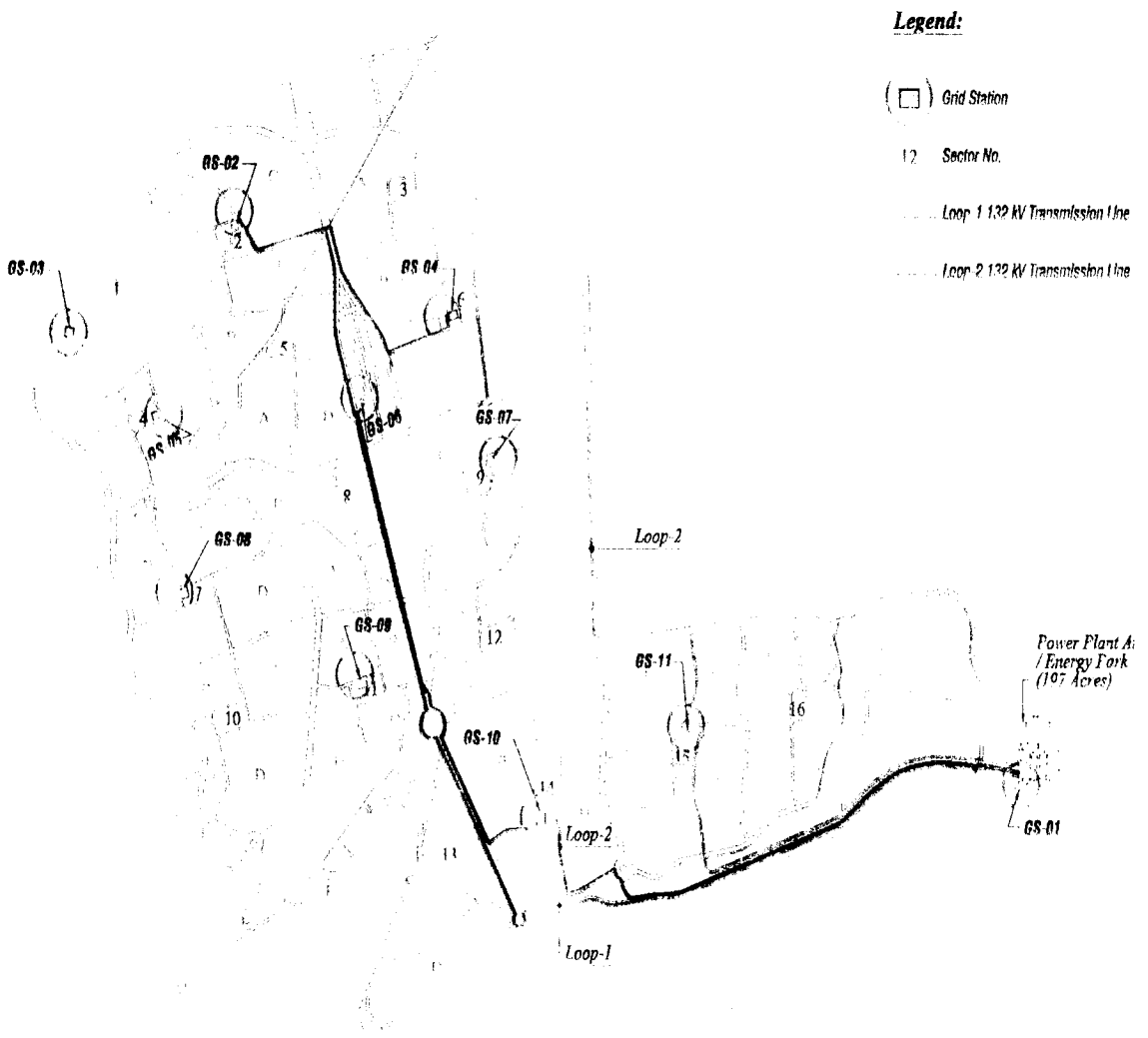
PAKISTAN DEFENCE OFFICERS' HOUSING AUTHORITY,
KARACHI

# APPLICATION FOR DISTRIBUTION LICENSE

## "DHA ENERGY SUPPLY COMPANY (PVT.) LTD."




MARCH 2017

DHA Energy Supply Company (Pvt) Ltd.
2/B, East Street, Phase-1, DHA Karachi, 75500
Ph: (+92-21) 111-589-589 Fax: (+92-21) 3588 8406

Date: June 16, 2017

**Registrar**
National Electric Power Regulatory Authority (**NEPRA**)
NEPRA Tower,
Ataturk Avenue (East)
G-5/1
Islamabad

Subject: **DHA Energy Supply Company (Private) Limited – Application for a Distribution License**

I, Lt Col (R) Javaid Iqbal (CNIC No. 37405-0281658-5), being the duly authorized representative of **DHA Energy Supply Company (Private) Limited** by virtue of board resolution dated 01.06.2017, hereby apply to the National Electric Power Regulatory Authority for the grant of a distribution licence to **DHA Energy Supply Company (Private) Limited** pursuant to section 20 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

I certify that the documents-in-support attached with this application are prepared and submitted in conformity with the provisions of the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, and undertake to abide by the terms and provisions of the above-said regulations. I further undertake and confirm that the information provided in the attached documents-in-support is true and correct to the best of my knowledge and belief.

Two pay orders for the total sum of **Rupees One Million Eight Hundred Seventy-Seven Thousand Four Hundred (Rs.1,877,400)** (one pay order for Rupees One Million Eight Hundred Fifty-One Thousand Three Hundred [Rs.1,851,300] and another pay order for Rupees Twenty-Six Thousand One Hundred [Rs.26,100]), being the non-refundable licence application fee calculated in accordance with Schedule II to the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, is also attached herewith.

Yours sincerely

For and on behalf of

**DHA ENERGY SUPPLY COMPANY (PRIVATE) LIMITED**

**Lt Col (R) Javaid Iqbal**
Authorised Representative

**BEFORE THE**
**NATIONAL ELECTRIC POWER REGULATORY AUTHORITY**

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# PETITION FOR THE GRANT OF DISTRIBUTION LICENSE

**ON BEHALF OF**
**DHA ENERGY SUPPLY COMPANY (PRIVATE) LIMITED**

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Dated: 20.06.2017

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Legal Consultants

**RIAA Barker Gillette**
68, Nazimuddin Road, F-8/4
Islamabad
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**PETITION:** **For the grant of Distribution License on behalf of DHA Energy Supply (Private) Limited (the "DESCO" or the "Petitioner")**

## 1 LEGAL REGIME

1.1 Under the Regulation of Generation, Transmission and Distribution of Electric Power Act (Act No. XL of) 1997 (the "**NEPRA Act**"), the Authority is mandated to, *inter alia*, grant licenses for generation, transmission and distribution of electric power and perform such functions which are consequential or incidental thereto.

1.2 The Petitioner has filed this petition for the grant of a distribution license (the "**DL Petition**") before the National Electric Power Regulatory Authority (the "**NEPRA**" or the "**Authority**") pursuant to Section 20 of the NEPRA Act, the NEPRA Licensing (Distribution) Rules 1999 (the "**Licensing Rules**") and other enabling provisions of NEPRA Rules, Regulations, Codes and Applicable Documents.

1.3 More specifically, the Petitioner's distribution network is intended to be located adjacent to the territories of K-Electric Limited ("**KE**") and Hyderabad Electricity Supply Company ("**HESCO**") (KE and HESCO together, the "**DISCOs**"). Pursuant to the distribution licenses granted to them by the Authority, KE and HESCO *"have the exclusive right to provide distribution service, make sales of electric power, make schemes and engage in incidental activities in [their territory]..."*.

1.4 However, the exclusivity granted to the DISCOs by the Authority is subject to a number of caveats. The right of monopoly is linked with certain critical obligations and, where the entity consistently fails to perform such obligations, the provisions of the relevant laws and the licence provide ample powers to the Authority to *inter alia* amend, suspend or revoke the licence.

1.5 **Firstly**, pursuant to Section 26 of the NEPRA Act, the Authority has the statutory power to **amend** any licence if it is of the opinion that it is in the **public interest** to do so. The language of Section 26 is reproduced below:

*"26. **Modifications.** — If the Authority is of the opinion that it is in the public interest, it may, with the consent of the licensee, amend or vary the conditions of any licence issued under this Act and in the absence of licensee's consent, the Authority shall conduct a public hearing on whether the proposed amendment or variance is in the public interest and shall make a determination consistent with the outcome to this hearing."*

The public interest aspect of this DL Petition is discussed in further detail in part 6 of this Petition.

1.6 **Secondly** and alternatively, the distribution licencees of the DISCOs are granted to them subject to their **compliance** with, and **performance** of their obligations under, the various laws

of the Authority and with the provisions of the licences themselves. Breach of such laws and/or provisions by the DISCOs can lead to the suspension and even revocation of their distribution licences.

1.7 **Thirdly** and alternatively, the exclusivity granted to the DISCOs is **not absolute but conditional** as it is subject to any and all second-tier supply authorisations that the Authority may grant pursuant to Rule 7(2) of the Licensing Rules.

1.8 **Fourthly** and alternatively, KE and HESCO's exclusivity is **also conditional** as their distribution licences provide that, where the DISCOs are unable to supply electric power under the Authority's approved terms and conditions within one year to in their respective Concession Territories (as defined in their respective distribution licences) despite the request of the owners/occupiers of any area within such Concession Territories, such area may be **excluded** from the respective distribution licence at the option of the owners/occupiers.

1.9 Furthermore, the Petitioner undertakes that it will be in compliance with the NEPRA (Supply of Electric Power) Regulations 2015, especially Regulation 4(3) thereof, as the load of the Petitioner's proposed distribution network shall not be less than 20 MW and shall have its own 132 kV grid station.

## 2 THE PETITIONER – DESCO

2.1 The Petitioner's sponsor, the Pakistan Defence Officers' Housing Authority (the "**DHA**"), is developing a large-scale residential project north-east of Karachi called the DHA City Karachi (the "**DCK**", brochure attached herewith). The DHA intends to develop the DCK as a completely sustainable and self-sufficient project. In order to achieve this aim and to ensure the reliable distribution of electricity, the DHA intends to develop its own power generation projects and its own electricity distribution network for the DCK.

2.2 In order to pursue the development of the distribution network, the DHA has incorporated the Petitioner on 02 March 2017, as a special purpose vehicle (SPV) in compliance with *inter alia* Section 24 of the NEPRA Act. Copies of the Certificate of Incorporation, the Memorandum of Association and Articles of Association of the Petitioner are appended as **Annex G**.

2.3 The objectives of the Petitioner will include *inter alia* engaging in the activities relating to the business of construction, ownership, management, control, operation and maintenance of the electricity distribution lines, electrical distribution facilities, electrical circuits, transformers and sub-stations as well as the movement and delivery of electric power on distribution lines, undertaking distribution activities and distribution business, interconnection services and facilities and the matters connected therewith and incidental thereto.

2.4 As the distribution of electric power in Pakistan is a regulated activity, the Petitioner requires permission from the Authority in the form of a Distribution Licence.

## 3 THE PETITIONER'S SPONSOR – DEFENCE HOUSING AUTHORITY (THE "DHA")

3.1 The DHA was established pursuant to the Pakistan Defence Housing Authority Order (President's Order No.7 of 1980) (attached herewith) with the objects of planning and developing housing schemes and projects for public purposes. The DHA has a success story spread over almost four decades. Today, the DHA continues to be engaged in the planning and development of well-known residential and commercial projects for public purposes.

3.2 Continuously striving for excellence, the DHA combines commitment with expertise to develop its core strengths, vision and mission. With the commitment and effort of its employees, professional management and the vision of its leaders and stakeholders, the DHA has achieved the standing of being one of the most progressive organisations in Pakistan.

3.3 Part of the DHA's future plans are strategically designed for further investment in the energy sector, focusing on green energy.

3.4 The commitment to social responsibility at the DHA is evident in a wide variety of areas including the environmental, health and safety initiatives and community relations schemes. The DHA assures that all its operations are managed in compliance with good ethics as defined through its policies.

3.5 Realizing its responsibilities as a statutory body, the DHA contributes substantially to the economic development of Pakistan through the development of residential and commercial areas and the provision of employment to the thousands of people associated with its operations, in various capacities.

## 4 PURPOSE OF THE DISTRIBUTION LICENCE

4.1 The DCK is being developed to be the first completely energy self-sufficient large-scale residential project in Pakistan.

4.2 As the DCK is a large-scale residential project of an unprecedented size for Pakistan, the reliable distribution and delivery of electric power is critical for the success of the project.

4.3 In pursuit of its objective of energy self-sufficiency and to meet its present electricity needs, the DCK has already developed a generation capacity of 1.5 MW using a combination of solar-powered PV cell units and diesel-powered generation units, which is being distributed amongst the DCK Directorate Offices. The DHA plans to procure and develop further generation capacity in order to meet its projected load growth from time to time. It is expected that the total load of the distribution capacity shall be 500 MW.

4.4 The Petitioner is in particular need of a distribution licence for the purpose of serving the public interest, as explained more comprehensively in part 6 of this Petition.

4.5 Needless to say, the provision of a reliable electricity supply is key to ensuring the viability of the DCK as a project. Moreover, the DCK's eventual energy self-sufficiency may serve to set a precedent for other projects, which in turn will serve to reduce the load on the overburdened national grid.

4.6 In light of the foregoing, the Petitioner requests the learned Authority to favourably consider this DL Petition for the grant of a distribution licence, which will enable the Petitioner to reliably distribute and deliver electric power to the consumers of the DCK. The grant of a distribution license to the Petitioner will pave the way towards energy sustainability and electrical reliability for other similar projects and the country.

4.7 The Petitioner has constituted a team of experts and consultants to undertake the proposed distribution activities. The profiles of the Petitioner's management staff is appended with this DL Petition, as per the requirement of the NEPRA, which include:

4.7.a the curriculum vitae of the Petitioner's senior management, technical and professional staff; and

4.7.b evidence of the availability of adequate technical resources to the Petitioner to carry out the distribution activities and such evidence consists of:

- employment records of engineering and technical staff of the Petitioner;
- profiles of sub-contractors; and
- verifiable references in respect of the experience of the applicant and its proposed sub-contractors.

## 5 DETAILS OF THE DISTRIBUTION LICENCE

5.1 The proposed distribution infrastructure and the line route to be constructed by the Petitioner are fully explained in **Annexes J.3 to J.29**, including [the Load Flow Study], etc.

5.2 The Petitioner seeks the distribution licence in order to construct, own and operate an LV/MV distribution network, consisting of 11 132kV grid-stations. More specifically the network will comprise of, *inter alia*, bays with associated control protection and metering system, transformer bays, power transformers, single busbar arrangement, incomers, SCADA System, power line carrier and telecommunication system, grid station AC/DC auxiliary supply, etc.

5.3 The majority of the distribution network will be underground and is designed to be a low loss system, offering improved distribution efficiencies.

5.4 All the material and equipment to be used and procured by the Petitioner will be in accordance with NEPRA-approved specifications, which are also being implemented by KE.

5.5 The land on which the distribution system is to be established is hard, solid ground, suitable for the construction of the distribution infrastructure and for the setting up of other ancillary equipment.

5.6 The Petitioner intends to produce all the energy required to meet its demands. In order to do so, the DHA has planned a number of wind, solar and conventional thermal power plants. Moreover, these will be augmented by rooftop solar panels mounted on houses and other buildings in the DCK. The DHA shall promulgate bye-laws for the installation and maintenance of rooftop solar panels, the draft of which is attached as **Annex J.30**. However, initially, the Petitioner may procure electricity from Fauji Fertiliser Bin Qasim Limited and Lucky Cement (Private) Limited (the "**Private Gencos**") for onwards distribution to the Petitioner's consumers. However, once the DHA's own power projects are commercially operational and viable, the electricity generated by them will incrementally replace the electricity provided by the Private Gencos.

## 6 PUBLIC INTEREST

6.1 Pursuant to Section 20 of the NEPRA Act, the Authority is mandated to grant distribution licences. Moreover, pursuant to Section 26 of the NEPRA Act, the Authority is also mandated to amend a distribution licence where doing so is demonstrated to be in the public's interest.

6.2 In order to determine whether a matter is in the **public's interest**, it is essential to identify the following **factors**[1]:

6.2.a the relevant public;

6.2.b the relevant public's needs;

6.2.c the constraints to such needs; and

6.2.d whether such needs will be met.

6.3 **The Relevant Public:** It is submitted that the relevant public in relation to the DL Petition comprises of:

6.3.a the residents of the DCK; and

6.3.b in general terms, the consumers whose interests the Authority is mandated to protect.

[1] Institute Chartered Accountant of England and Wales, 'Acting in the Public Interest: A Framework for Analysis' (July 2012) http://www.icaew.com/-/media/corporate/files/technical/ ethics/public-interest-summ-web.ashx?la=en> accessed on 10 May 2017

6.4 **The Relevant Public's Needs:** It is further submitted that the relevant public's needs can be identified as:

6.4.a for the residents of the DCK – the reliable and cost-effective distribution and delivery of electric power; and

6.4.b the general consumers – the development of a wider market for electricity distribution that encourages healthy competition and efficiency.

6.5 **The Constraints to the Relevant Public's Needs:** It is further submitted that the grant of a distribution licence to the Petitioner raises no material constraints to such needs, as aiming to meet the energy needs of the relevant public results in inherently positive objectives.

6.6 However, unless the Petitioner is granted a distribution licence, the residents of the DCK must rely on the distribution networks of KE and HESCO. Presently, these DISCOs are struggling to meet their existing demand, with their consumers consistently facing severe and prolonged predicaments, including *inter alia*:

6.6.a chronic load-shedding;

6.6.b unexpected power-cuts;

6.6.c excessive billing;

6.6.d frequent tariff hikes; and

6.6.e non-compliance with various laws.

6.7 In light of their present situation, when these DISCOs cannot provide reliable electricity for their existing consumer-base, it is evidently impossible for them to provide reliable electricity for the residents of the DCK.

6.8 The Authority itself has served on KE several explanations and show cause notices on account of countless consumer complaints and KE's numerous failures to perform its distribution licence obligations, some of which have even resulted in the deaths of its consumers.

6.9 Evidence of the DISCOs' failure to provide a satisfactory level of service to their consumers, including the DHA and the DCK, is attached herewith as **Annex I**.

6.10 **Whether the Needs of the Relevant Public can be Met:** It is further submitted that the relevant public's needs will be satisfied by the granting of a distribution licence to the Petitioner as:

6.10.a a distribution licence will allow the DCK to develop a comprehensive energy solution, comprising of the ability to generate electricity cheaply and reliably and to distribute

it efficiently. Ultimately, the residents of the DCK will benefit from cheap electricity that will be available reliably and around-the-clock; and

6.10.b the general consumers of the country will benefit from the precedent of self-sufficiency that will be established by the Petitioner.

6.11 As the DCK is designed to be one of Pakistan's first energy self-sufficient residential projects, the distribution of electricity by the Petitioner to consumers in the DCK will play a vital role in the growth of sustainable and reliable energy distribution in Pakistan.

6.12 The immediate beneficiaries of the Petitioner's distribution activities will include homeowners and businesses that are resident within the DCK and the overloaded national grid. On the other hand, indirect beneficiaries will include other large-scale housing projects, sustainable energy projects and other electricity distribution companies.

## 7 FINANCIAL STRENGTH

7.1 The DHA has demonstrably strong financial capabilities to fund the development of the Petitioner's distribution network. Evidence of the financial strength of the DHA is appended as **Annex H**.

## 8 DETAILS OF THE CONTRACTORS

8.1 The relevant details of the contractors are appended herewith as **Annexes J.1 and J.2**.

## 9 FEASIBILITY STUDY, SYSTEM STUDIES & SPECIFICATION OF EQUIPMENT

9.1 The Petitioner, in order to finalize the Feasibility Study and the System Studies, hired a reputable consultant to shortlist the most appropriate connectivity options for the distribution network. A summary Feasibility Study (including summary Load Flow Study) is appended herewith as **Annex M**.

9.2 The Petitioner has reviewed the relevant technical details of the distribution infrastructure to be established with necessary specifications including the control and protection system.

9.3 The distribution infrastructure established by the Petitioner will be compliant with the requirements of the applicable environmental laws and policy and the infrastructure and routing alternatives of the Petitioner will be based on such environmental considerations including construction activities, right-of-way clearing and impacts of construction and operation of towers, access roads, substations and related facilities.

9.4 The details and specifications of the distribution equipment form a part of the Feasibility Study.

## 10 ENVIRONMENTAL IMPACT ASSESSMENT (THE "EIA")

10.1 The approval of the Sindh Environmental Protection Agency (the "**SEPA**") for the EIA for the DCK is attached herewith as **Annex J.26** hereto.

## 11 METERING & TESTING FACILITIES

11.1 The details relating to metering and testing etc. constitute integral part of Load Flow Study and Operations and Maintenance Protocols which is appended with this DL Petition.

## 12 SCADA & COMMUNICATION

12.1 The SCADA System will be used to collect data from instruments and sensors located at remote sites and to transmit data at load dispatch centre (LDC) DCK City, Karachi for monitoring and controlling purpose. The collected data from sensors and instrument shall be viewed on one or more SCADA host computers HMIs that will be located at Load Dispatch Centre DCK City Karachi. Based on the information received from the remote stations, automated or operator-driven supervisory commands can be pushed to remote station control devices which are then referred to as Field device.

12.2 Further details relating to SCADA and communications etc. form a part of the Communication System information, which is appended with this DL Petition.

## 13 SAFETY

13.1 The Petitioner has developed protocols and procedures and adopted NEPRA-approved power safety codes to ensure that its networks are planned, developed, operated and maintained in an efficient and safe way without compromising on safety of the systems, personnel & others.

13.2 The Petitioner shall promote a healthy and safe culture and provide all employees, contractors and the people concerned and the public with a safe & healthy place to work. The Petitioner shall ensure that safe working is integrated into every aspect and area of business. Moreover, safety culture shall be based on personal leadership, collaboration and involvement.

13.3 The Petitioner shall adhere to the highest standards in all work practices. This includes high engineering and maintenance standards, so that the equipment is fit for purpose, prepared and documented standard operating procedures and training, involvement and other programs to help people contribute to safety, security, health and environment.

13.4 The copy of the Safety Protocols and SOPs is appended herewith as **Annex J.24** hereto.

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13.4 The copy of the Safety Protocols and SOPs is appended herewith as **Annex J.24** hereto.

## 14 O&M, Training & Development

14.1 The Petitioner shall implement the operation & maintenance, training and development programmes that meet the Authority's approved specifications. These programmes shall be developed before the commencements of operations of the Petitioner. The Petitioner plans to employ, *inter alia*, ex-personnel of the Military Engineering Services (MES) to carry out the operation and maintenance of the distribution system.

## 15 Additional Information

1S.1 The Petitioner shall provide NEPRA such further or additional information, clarification or explanation as it may require from time to time.

1S.2 It is respectfully submitted that the Petitioner also requests the Authority to allow it to supplement and submit such information and supporting material that it may deem appropriate.

## 16 PRAYER

16.1 In light of the forgoing, the Petitioner respectfully prays that the learned Authority kindly:

16.1.a accept the instant DL Petition and grant the distribution licence to the Petitioner for the purpose of undertaking distribution activities within the within the area of the DCK;

16.1.b allow the Petitioner to engage in the activities relating to the business of construction, ownership, management, control, operation and maintenance of the distribution network, including the distribution lines, electrical distribution facilities, electrical circuits, transformers and sub-stations, the movement and delivery of electric power, distribution activities and distribution business, interconnection services and facilities and the matters connected therewith and incidental thereto;

16.1.c allow such other reliefs which is just, fair, proper, better and necessary in these circumstances.

Dated: 20.06.2017

**PETITIONER**
DHA Energy Supply Company (Private) Limited

through

**RIAA Barker Gillette**
Advocates & Legal Consultants
68, Nazimuddin Road, F-8/4, Islamabad
Tel: (051) 111-LAWYER
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**EXTRACTS FROM**
**RESOLUTION PASSED BY THE BOARD OF DIRECTORS OF**
**DHA ENERGY SUPPLY COMPANY (PRIVATE) LIMITED**
**DATED 01 JUNE 2017**

**RESOLVED** that **DHA Energy Supply Company (Private) Limited**(the "**Company**") shall apply to National Electric Power Regulatory Authority (**NEPRA**) for a distribution licence in respect of the Company's distribution project as per master planning of DHA City Karachi, and in relation thereto, sign all requisite documentation, pay all applicable fees and undertake all other necessary and ancillary acts and deeds.

**RESOLVED FURTHER** that an application for a distribution licence be made to the NEPRA with regards to the Project (the "**Licence Application**").

**RESOLVED FURTHER** that Lt Col (R) Javaid Iqbal, bearing CNIC No. 37405-0281658-5 and Mr. Shahid Abbas S/O Sultan Muhammad, bearing CNIC No. 37405-6240030-9, be and are hereby singly authorized to sign the Licence Application and any documentation ancillary thereto, represent before and provide any information required by the NEPRA in relation to the Licence Application, do all lawful acts and deeds necessary and ancillary for the processing, completion and finalization of the Licence Application, and authorise legal advisors to represent the Company before the NEPRA in respect of the Licence Application.

**CERTIFIED TO BE TRUE COPY**

**Brig (Retired)**
**Muhammad Rafique, SI (M)**
**DIRECTOR**
**DHA Energy Supply Company (Private) Limited**

**CERTIFICATION**

**CERTIFIED**, that, the above resolution was duly passed by the Board of Directors of **DHA Energy Supply Company (Private) Limited** in their meeting held on 01 June 2017, for which the quorum of directors was present.

**FURTHER CERTIFIED**, that the said resolution has not been rescinded and is in operation and that this is a true copy thereof.

**Brig (Retired)**
**Muhammad Rafique, SI (M)**
**DIRECTOR**
**DHA Energy Supply Company (Private) Limited**

# VAKALATNAMA

I, Lt Col (R) Javaid Iqbal, bearing CNIC No. 37405-0281658-5, hereby appoint and constitute **MR. NADIR ALTAF, Mr. MUSTAFA MUNIR AHMED, MR. HASEEB RAO, MS. SAIRA KHALID** and **MS. MICHELLE SHAHID** of **M/S RIAA Barker Gillette** to appear and act for **DHA Energy Supply Company (Private) Limited**as our legal advisors in connection with preparation, filing and follow up of the application before the National Electric Power Regulatory Authority for a distribution licence in respect of the distribution project in DHA City Karachi and represent us in connection therewith.

The above mentioned legal advisors, or any of them, are also authorized to do all acts and things necessary for the processing, completion, acceptance and finalization of the application for distribution licence with the National Electric Power Regulatory Authority.

Dated: 06 June 2017

**(Lt Col (R) Javaid Iqbal)**
For and on behalf of
**DHA Energy Supply Company (Private) Limited**

**ACCEPTED**

**RIAA Barker Gillette**
68 NAZIMUDDIN ROAD, F-8/4
ISLAMABAD
UAN: 111-LAWYER

A026817

SECP

MISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE, KARACHI

CERTIFICATE OF INCORPORATION

[Under section 32 of the Companies Ordinance, 1984 (XLVII of 1984)]

Corporate Universal Identification No. 0196300

I hereby certify that DHA ENERGY SUPPLY COMPANY (PRIVATE) LIMITED is this day incorporated under the Companies Ordinance, 1984 (XLVII of 1984) and that the company is limited by shares.

Given under my hand at Karachi this Second day of March, Two Thousand and Seventeen.

Incorporation fee Rs. 420,500/= only

(Hanif Mahmood)
Deputy Registrar of Companies

Certified to be true copy

Asstt./Deputy Registrar of Companies

Registrar Office Karachi
Securities and Exchange Commission of Pakistan

THE COMPANIES ORDINANCE, 1984

(COMPANY LIMITED BY SHARES)

MEMORANDUM OF ASSOCIATION

OF

**DHA ENERGY SUPPLY COMPANY (PRIVATE) LIMITED**

I. The name of the company is 'DHA ENERGY SUPPLY COMPANY (PRIVATE) LIMITED' (the "Company").

II. The Registered Office of the Company will be situated in the Province of Sindh.

III. The objects for which the Company is established are all or any of the following:

1. To carry on all or any of the businesses of generation, transmission, distribution, purchase and sale of electricity and to deal in all goods derived from or relating to such business including but without limitation to, steam, fuel, lignite, coal, ash, conversion of ash into bricks and any other products derived from or connected with any other form of energy, including, but without limitation to conventional sources such as heat, thermal, hydel and/or from nonconventional sources such as tidal wave, wind, solar, geothermal, biological, biogas and coal bed methane.

2. To locate, finance, set-up, develop, own, acquire, establish, construct, design, equip, operate, use, manage, invest in and maintain power generation facilities / power plants (including power generation facilities / power plants utilizing wind, hydel, solar, thermal, tidal, coal, gas, diesel oil, and/or any other means of energy or fuel), jetties, power grid station, transforming, switching, conversion, and transmission facilities, distribution facilities, cables, overhead lines, sub-stations, switching stations, tunnels, cable bridges, link boxes, heat pumps, plant and equipment for combined heat and power schemes, offices, computer centers, shops, depots, factories, workshops, plants, warehouses and other storage facilities, together with all machinery, equipment, cables, wires, lines, accumulators, and works ancillary to the aforesaid anywhere in or outside Pakistan and to do all such acts, deeds and things, without limitation whatsoever, as may be necessary or desirable in that connection.

3. To buy, sell, hold, acquire or invest the capital and funds of the Company in securities and investments of every kind and description including but not limited to shares, stocks, fixed income securities, modaraba certificate, musharaka certificates, participation term certificates, term finance certificates, mutual fund certificates, units, certificates of investments, commercial papers, debentures, debenture stocks, bonds, obligations or securities issued or guaranteed in Pakistan or abroad by any company

Company Registration Office Karachi
Securities and Exchange Commission of Pakistan
SECP

incorporated or registered in Pakistan by the Government or public body or Authority both for short term or long term gains and to realize such gains.

4. To acquire or undertake the whole or any part of the business, goodwill, and assets of any person, firm, or company and as part of the consideration for such acquisition to undertake all or any of the liabilities of such person, firm or company, or to acquire an interest in, amalgamate with, or enter into partnership or into any arrangement for sharing profits, or for co-operation, or for mutual assistance with any such person, firm or company, or for subsiding or otherwise assisting any such person, firm or company, and to give or accept, by way of consideration for any of the acts or things aforesaid or property acquired, any shares, debentures, debenture stock or securities that may be agreed upon.

5. To carry out all types of services relating to development and operation of business of generation, purchase, sale, transmission and distribution of energy and to perform all other acts which are necessary or incidental to the business of electricity generation, supply, transmission, distribution and trading of energy.

6. To develop business plans, feasibility studies, carry out surveys, and do such other activities that are incidental and ancillary to the foregoing, pertaining to the business of power generation, transmission and distribution or such other business as considered appropriate by the directors of the Company from time to time.

7. To carry on all or any of the businesses of wholesalers, retailers, traders, importers, exporters, suppliers, distributors, designers, developers, manufacturer, installer, filters, testers, repairers, trainers, maintainers, contractors, constructors, operators, users, inspectors, re-conditioners, improvers, alterers, protectors, removers, hirers, replacers, importers and exporters of and dealers in, electrical appliances, systems, products and services used for energy conservation and generation, equipment, machinery, materials and installations, including but not limited to cables, wires, meters, tracks, rails, pipelines and any other plan, apparatus, equipment, systems and things incidental to the efficient generation, procurement, transformation, supply and distribution of electricity.

8. To construct, acquire and maintain roads, bridges, rail sidings, pipelines and storage facilities for water, petroleum products, natural gas, oil, coal and other substances, water desalination and treatment plants, and such other works as may be required for all or any of the above purposes.

9. To carry on the business of electrical engineers, electricians, engineers, consultants, agents, suppliers of services and manufacturers of electrical plant, machinery, and generally to install, acquire, execute, provide, operate and maintain all necessary plant, machinery, equipment, cables, wires, accumulators, lamps, exchanges, telephones, and apparatus and to provide any services related or incidental to the business of electricity generation, supply, transmission, distribution and trading of energy.

10. To import, export, buy, sell, hire or deal in plant, machinery, equipment, cables, wires, accumulators, lamps, exchanges, telephones, fixtures and fittings and apparatus of every kind with special reference to plant, machinery, equipment or apparatus connected with the producing, storing, supplying, distribution, transmission, using, regulating or measuring the supply or facilitating the use of electricity or electrical currents or force.

11. To buy, sell, import, export, hire, manufacture, deal in and turn to account plant, machinery, implements, conveniences, provisions, articles and products capable of being used in connection with the operations of or required by workmen and other employer by the Company or incidentally or conveniently connected with any such business as aforesaid.

12. To conduct, promote and commission research of all kinds and research and development activities of all kinds, whether related to the generation, transmission, distribution and supply of electricity or other forms of energy or otherwise, and to exploit and turn to account the results of any such research or research and development carried out by or for the Company.

13. To establish laboratories and to employ and promote scientific research and invention, patronize such invention and enter into manufacture in collaboration with outside parties for transfer of technology from abroad and to promote transfer of technology from Pakistan abroad and to carryon business in all other allied fields permissible by law.

14. To enter into, make, and perform contracts and arrangements of every kind and description that may be conducive to the Company's object or objects and for any lawful purpose, with the government or authority (public, supreme, municipal or otherwise), and with any firm, person, corporation or company without any limit as to amount, and to obtain from such government, authority, firm, company or persons any rights, privileges, contracts, concessions, charters, subsidies, loans, indemnities, grants, contracts, rights, powers, concessions, privileges or immunities which the Company may think desirable to obtain and to carry out, exercise and comply with any such arrangements, rights, privileges and concessions.

15. To sell, lease, improve, manage, develop, mortgage, exchange, turn to account or otherwise deal with, dispose of absolutely, conditionally, or for any limited interest, and grant any leave or license in respect of all or any of the property, rights or privileges of the Company, to improve, manage, develop, grant rights or privileges in respect of, or otherwise deal with all or any part of the property and rights of the Company, and to distribute in specie as dividend or bonus any money, shares, debentures, or debenture stock that may be accepted as consideration for any such sale, lease, exchange or other disposition.

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16. To pay for technical know-how, technical and engineering assistance and information and/or service rights or privileges acquired by the Company in a manner the Company deems appropriate, either by cash or through its shares.

17. To train personnel and workers both in Pakistan and abroad, to obtain technical proficiency in various specialties connected with the business of the Company.

18. To establish and support or aid in the establishment and support of associations, institutions, funds and conveniences calculated to benefit persons who are or have been directors of, or who have been employed by or who are serving or have served the Company or any other company which is a subsidiary or associate of the Company or the dependents of such persons and to grant pensions, gratuities, allowances, relief and payments in any other manner calculated to benefit the persons described herein.

19. To amalgamate, enter into partnership, or to make any arrangement for sharing profits, union of interests, co-operation, joint-venture, reciprocal concession or otherwise with any person, firm or company and to have foreign collaborations and to pay royalties/technical fees to collaborators subject to the applicable laws.

20. To purchase or otherwise acquire any patents, inventions, trademarks, licenses, concessions and the like conferring any exclusive or non-exclusive or limited right to use any invention which may seem capable of being used for any of the purposes of the Company or the acquisition of which may seem calculated directly or indirectly to benefit the Company, and to use, exercise, develop or grant licenses in respect of or otherwise turn to account, the property and rights so acquired.

21. To carry on any other trade or business whatever which, in the opinion of the directors of the Company, can be advantageously carried on independently or in connection with or ancillary to any of the above mentioned business or is calculated directly or indirectly to enhance the value of, or render profitable any of, the property or rights of the Company.

22. To purchase, take on lease, or in exchange, hire, apply for or otherwise acquire either solely or jointly and hold for any interest, any rights, privileges, lands, buildings, easements, machinery, plants, stock-in-trade and any movable and immovable property of any kind, necessary or convenient for the purposes of or in connection with the Company's business or any branch or department thereof and to use, exercise, develop, and grant licences in respect of or otherwise turn to account any property, rights and information so acquired, subject to any permission required under the law.

23. To establish, promote or assist in establishing or promoting, and subscribe to or become a member of any other company, association or club whose objects are similar or in part similar to the objects of this Company or the establishment or promotion of which may be beneficial to the Company as permissible under law.

24. To open accounts with any bank or banks and to draw, make, accept, endorse, execute, issue, negotiate and discount cheques, promissory notes, bills of exchange, bills of lading, warrants, deposit notes, debentures, letters of credit and other negotiable instruments and securities.

25. To borrow or raise money by means of local and foreign currency loans, Islamic financing or other legal arrangements from local and foreign banks, or other financial and non-financial institutions, for such purpose or in such manner as the Company may think fit and in particular by issue of debentures, sukuks, or term finance certificates and to provide any type of security to the lenders or investors including by way of hypothecation, charge, lien, pledge, mortgage or assignment.

26. To sell or otherwise dispose of the whole or any part of the undertaking of the Company, either together or in portions for such consideration as the Company may think fit and in particular, for shares, debenture-stock or securities of any company purchasing the same.

27. To issue all or any part of the original or enhanced share capital of the Company at par or at a premium or discount subject to any permission required by law.

28. To pay all costs, charges, and expenses preliminary or incidental, incurred in the formation or about the promotion and establishment of the Company and to remunerate any person, firm or company for services rendered or to be rendered in or about the formation or promotion of the Company or the conduct of its business.

29. To apply for and obtain necessary consents, permissions and licenses from any Government, State, Local and other Authorities for enabling the Company to carry on any of its objects into effect as and when required by law.

30. To pay for any property, rights or benefits acquired by the Company either in cash or in shares with such rights, in respect of dividend or otherwise, as may be deemed fit by the Company or by any securities which the Company has power to issue or partly in one mode and partly in another and generally on such terms as the Company may approve.

31. To distribute any of the Company's property and assets among the members in specie or in any other manner in case of winding up of the Company.

32. To guarantee the performance of contracts and obligations of the Company or any other person.

33. To take out any insurances that the Company deems necessary or appropriate and to pay the premium thereof.

34. To [illegible] and [illegible] [illegible] [illegible] branches or departments of the Company's business and to appropri[illegible] respectively any of the assets of the [illegible]

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24. To open accounts with any bank or banks and to draw, make, accept, endorse, execute, issue, negotiate and discount cheques, promissory notes, bills of exchange, bills of lading, warrants, deposit notes, debentures, letters of credit and other negotiable instruments and securities.

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28. To pay all costs, charges, and expenses preliminary or incidental, incurred in the formation or about the promotion and establishment of the Company and to remunerate any person, firm or company for services rendered or to be rendered in or about the formation or promotion of the Company or the conduct of its business.

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30. To pay for any property, rights or benefits acquired by the Company either in cash or in shares with such rights, in respect of dividend or otherwise, as may be deemed fit by the Company or by any securities which the Company has power to issue or partly in one mode and partly in another and generally on such terms as the Company may approve.

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34. To [illegible] and [illegible] [illegible] [illegible] branches or departments of the Company's business and to appropriate [illegible] respectively any of the assets of the

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Company and any of the capital, issued or to be issued, of the Company and from time to time to vary the constitution or regulations of any such subsidiaries, branches or departments or any such appropriations and if thought fit to amalgamate all or any of the said subsidiaries, branches or departments.

35. To procure the Company to be registered or recognized in any country or place outside Pakistan and to keep branch registers.

36. To institute and defend in any forum legal proceedings of every kind or description whatsoever, enter into arbitration agreements and refer disputes to arbitration, pay, satisfy or receive payments in respect thereof, or compound or compromise any claim, demand, action, suit or proceeding of any nature whatsoever made or brought by or against the Company.

37. To subscribe or guarantee money for any purpose which may be considered likely, directly or indirectly, to further the objects of the Company or for any national, charitable, benevolent, public, general or useful object or for any exhibition.

38. To draw, make, accept, discount, endorse and issue promissory notes, bills of exchange, bills of lading and other negotiable or transferrable securities and only in connection with the business of the Company, to advance, deposit with or lend money, securities or property to such governmental or other authority, person, firm or company and on such terms, with or without security, as the Company deems fit.

39. To do and perform all other acts as are incidental or conducive to the attainment of the above objects or any of them.

40. It is declared that notwithstanding anything contained in the foregoing object clauses of this Memorandum of Association, nothing contained therein shall be construed as empowering the Company to undertake or to indulge in the business of a banking company, forex, illegal brokerage, an investment company, a managing agency, an insurance business or a non-banking finance company, or in any unlawful business directly or indirectly, and the Company shall not launch multilevel marketing, pyramid and ponzi schemes.

41. Notwithstanding anything stated in any object clause, the Company shall obtain such other approval or licence from the competent authority as may be required under any law for the time being in force to undertake a particular business.

IV. The liability of the members is limited.

V. The authorized share capital of the Company is Rs. 100,000,000 (Rupees One Hundred Million Only) divided into 10,000,000 (Ten Million) Ordinary shares of the nominal value of Rs. 10 (Ten) each with the rights, privileges and conditions attached thereto as are provided for the time being with power to increase and reduce the capital of the Company and to divide the shares in the capital for the time being, into several classes.

We the several persons, whose names and addresses are subscribed, are desirous of being formed into a company, in pursuance of this Memorandum of Association and we respectively agree to take the number of shares in the capital of the Company set opposite to our names

| Name and Surname (Present & Former) in full (in Block Letters) | Father's/Husband's Name in Full | CNIC/ Passport No. | Nationality with any former Nationality | Occupation | Address | Number of Shares taken by each Subscriber | Signature |
|---|---|---|---|---|---|---|---|
| NAEEM AZHAR LONE | MUHAMMAD AZHAR LONE | 35201-9117920-1 | PAKISTANI | BUSINESS EXECUTIVE | 53/1-S, 7TH COMMERCIAL STREET, PHASE 4, DHA, KARACHI | ONE (1) | |
| MUHAMMAD RAFIQUE | MUHAMMAD YASIN KHAN | 34101-[illegible]5 | PAKISTANI | BUSINESS EXECUTIVE | HOUSE NO. SUH-443, STREET 5, ASKARI 5, MALIR CANTT, KARACHI | ONE (1) | |
| SYED JAMAL ULLAH MACDI | SYED SANA ULLAH MACDI | 42101-1936245-5 | PAKISTANI | BUSINESS EXECUTIVE | PLOT 6/B-3, D STREET, PHASE 5, DHA, KARACHI | ONE (1) | |
| DHA ENERGY AND SERVICES (PRIVATE) LIMITED<br><br>Through its authorized representative | N/A | N/A | PAKISTANI | N/A | 2/B, EAST STREET, PHASE-I, DHA, KARACHI, SINDH 75500 | NINE HUNDRED AND NINETY-NINE THOUSAND NINE HUNDRED AND NINETY-SEVEN (999,997) | |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MUHAMMAD RAFIQUE | MUHAMMAD YASIN KHAN | 34101-6241501-5 | PAKISTANI | BUSINESS EXECUTIVE | HOUSE NO. SUH-443, STREET 5, ASKARI 5, MALIR CANTT, KARACHI | | |
| | | | | | | ONE MILLION (1,000,000) | |

Dated 24 February 2017

Witness to the above signatures:
Name: NIFT (Pvt.) Limited
Address: 5th Floor, AWT Plaza, I.I. Chundrigar Road
Karachi- 74200, Pakistan

Certified to be True Copy
Asstt./Deputy Registrar of Companies

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THE COMPANIES ORDINANCE, 1984

(COMPANY LIMITED BY SHARES)

# ARTICLES OF ASSOCIATION

# OF

# DHA ENERGY SUPPLY COMPANY (PRIVATE) LIMITED

## 1. TABLE "A" NOT TO APPLY

The Regulations contained in the table marked "A" of the First Schedule to the Companies Ordinance, 1984, shall not apply to the Company except in so far as the same are repeated or expressly made applicable in these Articles.

## 2. Interpretation

In these Articles (if not inconsistent with the subject or context or expressly provided to the contrary below) the following words and expressions shall have the following meanings:

**"Board"** means the Directors collectively or the Directors present at a duly convened meeting of Directors at which a quorum is present, as the context requires.

**"Company"** means DHA Energy Supply Company (Private) Limited.

**"Directors"** mean the directors or the alternate director for the time being of the Company, as the case maybe.

**"month and year"** means the calendar month and the calendar year respectively.

**"Member"** means the member of the Company as defined in Section 2(1) (21) of the Ordinance.

**"Ordinance"** means the Companies Ordinance, 1984 (XLVII of 1984).

**"Ordinary Resolution"** means a resolution passed at a general meeting when the votes cast (whether on a show of hands or on a poll, as the case may be) in favour of the resolution (including the casting vote, if any, of the Chairman) by members who, being entitled to vote in person or by proxy, do so vote, exceed the votes, if any, cast against the resolution by members entitled to vote and voting thereon.

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**"Register"** means a Register of Members to be kept pursuant to Section 147 of the Ordinance.

**"Registrar"** means a Registrar, an Additional Registrar, a Joint Registrar a Deputy Registrar or an Assistant Registrar, responsible under the Ordinance for the registration of companies.

**"SECP"** means Securities and Exchange Commission of Pakistan.

**"Special Resolution"** means a special resolution of the Company as defined in Section 2(1)(36) of the Ordinance.

**"Seal"** means the common seal of the Company.

References to writing shall, unless the contrary intention appears, be construed as including reference to printing, lithography, photography & other modes of representing, transmitting or reproducing words in a legible & non-transitory form.

Words importing singular number only shall include the plural number and vice versa.

Save as aforesaid any words or expressions defined in the Ordinance shall if not inconsistent with the subject or context, bear the same meaning as in these Articles.

Any reference to statutory provi[illegible] shall include any statutory modification or re-enactment thereof.

## 3. PRIVATE LIMITED COMPANY

The Company is a private limited company within the meaning of Clause (28) of Section 2(1) of the Ordinance.

(1) No invitation shall be issued to the public to subscribe for any share of the Company.

(2) The number of the members of the Company shall be limited to fifty, provided that for the purpose of this provision, where two or more persons hold one or more shares in the company jointly, they shall be treated as single member, and

(3) The right to transfer shares of the Company is restricted in the manner and to the extent hereinafter appearing.

## 4. BUSINESS

The company is entitled to commence business from the date of its incorporation. The business of the company shall include all or any of the objects enumerated in the Memorandum of Association. The business of the company shall be carried out at such place or places anywhere in Pakistan or elsewhere as the Directors may deem proper or advisable from time to time.

# PART II - CAPITAL AND SHARES

## 5. AUTHORISED SHARE CAPITAL

The authorized capital of the Company is Rs. 100,000,000 (Rupees One Hundred Million) divided into 10,000,000 (Ten Million) Ordinary shares of the nominal value of Rs. Ten (10), each set out in that Clause with power to increase the capital and to consolidate or sub-divide the shares, issue shares of different kinds or classes therein of higher or lower denomination and to [illegible] such rights or conditions in such a manner as may be authorized by the regulations of the Company and subject to applicable laws.

## 6. ALLOTMENT OF SHARES

6.1 The shares shall be under the control of the Board, who may subject to applicable law allot or dispose of the same to such persons, firms, cooperation on such terms and conditions and at any such times as the Board shall think fit. Shares may also be allotted in consideration other than cash.

6.2 Shares may be registered in the name of any limited company or other corporate body but not in the name of minor or a firm. Not more than four persons shall be registered as joint holders of any shares.

6.3 Subject to the provisions of the Ordinance, the Companies (Issue of Capital) Rules 1996 and these Articles, the Directors may allot and issue shares in the capital of the Company as payment or part payment of any property sold or transferred, land, machinery, goods supplied or any services rendered to the Company in the conduct of its business and any shares which may be so allotted may be issued as fully paid up shares and if so issued, shall be deemed to be fully paid up shares.

6.4 The share capital of the Company shall comprise of ordinary shares, and subject as aforesaid the Company may issue shares of a single class or of different classes, but where ordinary shares of more than one class are issued the rights as between the various classes of such shares shall be strictly proportionate to the paid up value of the shares as regards voting, dividends and other benefits.

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## 7. RESTRICTION ON ALLOTMENT

The Board shall as regard any allotments of shares duly comply with such of the provisions of Sections 68 to Section 73 of the Ordinance as may be applicable thereto.

## 8. COMMISSION AND BROKERAGE

Subject to Section 82 and 83 of the Ordinance, the Company may at any time pay a commission to any person for subscribing or agreeing to subscribe whether absolutely or conditionally for any shares in, or debentures or other securities of the Company or procuring or agreeing to procure subscriptions whether absolute or conditional for any shares or debentures or other securities of the Company, provided that the conditions and requirements set out in the Ordinance shall be observed and complied with. Such commission may be satisfied by the payment of cash or the allotment of fully paid shares, or the issuance of securities or by any combination thereof. The rate of commission and brokerage shall not exceed the rate, if any, from time to time fixed by the SECP.

## 9. SHARES AT DISCOUNT

The Company may under a Special Resolution and with the consent of SECP and upon otherwise, complying with Section 84 of the Ordinance, the Board may issue shares at a discount.

## 10. TRUST NOT RECOGNIZED

No notice of any Trust expressed, implied or constructive shall be entered on the Register. The Company shall not, save as ordered by a court of competent jurisdiction, or as by statute required, be bound to recognize any benami, equitable, contingent, future, or partial interest in any share, or any other right in respect of a share, except an absolute right thereto in the person or persons from time [illegible] registered as the holder or holders thereof.

## 11. REGISTER

11.1 The Company shall keep a Register in accordance with Sections 147, 149 and 156 of the Ordinance.

11.2 The Register shall be prima facie evidence of any matters the Ordinance directs or authorizes to be inserted therein.

## PART III – CERTIFICATES

## 12. CERTIFICATES

The certificates of title of shares shall be issued under the Seal and signed by at least two Directors. Every share certificate shall specify the number and class and the distinguishing number (if any) of the shares to which it relates. A Director's signature on such certificates may be affixed or printed by any mechanical or electronic method. No share certificate shall represent shares of more than one class.

## 13. MEMBERS RIGHTS TO CERTIFICATES

Every person whose name is entered as a Member in the Register of Members shall, unless the conditions of issue of the shares otherwise provide, be entered without payment to receive within sixty (60) days after the allotment or within forty five (45) days of the application for the registration of the transfer of any shares of the Company, a certificate under the Seal specifying the shares held by him/her and the amount paid up thereon. If any Member shall require additional certificates he/she shall pay for each such certificate, a sum not exceeding Rs.10/- or otherwise as the Board may determine, provided that in respect of any share held jointly by several persons the Company shall not be bound to issue more than one certificate, and delivery of the certificate for a shares to one of the several joint holders shall be sufficient delivery to all.

## 14. ISSUE OF NEW CERTIFICATES

14.1 Subject to the provisions of Section 75 of the Ordinance, if a share certificate is defaced, lost or destroyed it may be renewed [illegible] such fee (if any) not exceeding Rs.10/- and on such terms (if any) as to evidence and indemnity and the payment of expenses incurred by the Company in investigating evidence, as the Board thinks fit.

14.2 Where some of the share comprised in a share certificate are transferred the old certificate shall be cancelled and a new certificate for the balance of such shares be issued without charge.

14.3 The shares are indivisible but more than one person may have a share in one share but shall be represented by one person towards the Company. The shares may not be represented by negotiable instruments.

# PART IV - TRANSFER AND TRANSMISSION OF SHARES

## 15. TRANSFER OF SHARES

15.1 Every transfer of shares must be in writing in the form specified in Article 16.2 herein or in any other form that the Board may approve and must be left at the office accompanied by the certificate or, if no such certificate is in existence the letter of allotment of the shares to be transferred and such other evidence, if any, as the Board may require to prove the title of the intending transferor of his/her right to transfer the shares.

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15.2 The shareholders and Directors of the Company have a right of priority in the event of one of the shareholders alienating some or all of his/her shares. But any transfer whether to the shareholders or to the Directors of the Company or to third parties must follow the provisions of the applicable law.

## 16. EXECUTION OF TRANSFER

16.1 The instrument of transfer of any share should be duly stamped and executed both by the transferor and the transferee and the transferor shall be deemed to remain the holder of such shares until the name of the transferee is entered in the Register of Members in respect thereof. Each signature of such transfer shall be duly attested by the signature of one witness who shall add his/her address and occupation.

16.2 Shares in the Company shall be transferred in the following form, or in any usual or common form which the Directors shall approve:

I..... of..... In consideration of the sum of Rupees..... paid to me by..... of..... (hereinafter called "the transferee") do hereby transfer to the said transferee.....share(s) numbered..... to..... inclusive, in **DHA ENERGY SUPPLY COMPANY (PRIVATE) LIMITED** to hold unto the said transferee, his/her executors, administrators and assigns, subject to the several conditions on which I held the same at the time of the execution hereof, and I, the said transferee, do hereby agree to take the said share(s) subject to the conditions aforesaid.

As witness our hand this .....Day of .....

| | |
|---|---|
| ..... | ..... |
| Signature Transferor | Signature Transferee |
| | Full Name |
| | Full Address |
| Witness | Fathers/Husband's name |
| | Nationality |
| | Occupation |
| Signature ..... | |
| Full Address ..... | |
| Signature..... | |
| Full Address ..... | |

## 17. CASES IN WHICH THE DIRECTORS SHALL REFUSE TO REGISTER TRANSFER

The Directors may refuse to register any transfer of any fully paid shares if:

(a) the transfer deed is for any reason defective or invalid, provided that the Company shall within thirty (30) days, from the date on which the instrument of transfer was lodged with it, notify the defect or invalidity to the transferee who shall after removal of such defect or invalidity be entitled to re-lodge the transfer deed with the Company; or

(b) the transfer is in breach of the provisions of Article 16;

If the Company refuses to register the transfer of any share for the reason specified in Article 16, the Company shall within thirty (30) days after the date on which the instrument of transfer was lodged with it, send to the transferee notice of the refusal indicating the reason for such refusal.

## 18. NO TRANSFER TO AN INSOLVENT OR PERSON OF UNSOUND MIND

No transfer shall be made to an insolvent or person of unsound mind.

## 19. TRANSMISSION OF REGISTERED SHARES

The executors, administrators, heirs or nominees, appointed under Section 30 of the Ordinance as the case may be, of a deceased Member not being one of several joint holders shall be the only persons recognized by the Company having any title to the shares registered in the name of such Member. In case of death of any one or more of the joint holders of any shares the survivor or survivors shall be the only persons recognized by the Company as having any title to or interest in such share. Before recognizing any executor, or administrator the Board may request him/her to obtain a grant of Probate or Letters of Administration, Successions Certificates or other legal representation(s) as the case may be from a competent court provided nevertheless that where the Board in its absolute discretion thinks fit it shall be lawful for the Board to dispense with the production of Probate or Letters of Administrator or Succession Certificates or such other legal representation(s) upon such terms as to indemnity or otherwise as the Board in its absolute discretion may consider necessary.

## 20. RIGHT OF PERSONS ENTITLED TO SHARES UNDER ARTICLE 19

A person so becoming entitled under Article 19 shall subject to the right of the Board to retain such dividends or monies as hereinafter provided have the right to receive and give a discharge for any dividend or other monies payable or other advantages arising in respect of the shares but he/she shall have no right to attend or vote at meetings of the Company or save as aforesaid to any of the rights or privileges of a Member in respect of the shares unless and until he/she shall be registered as the holder thereof.

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## 21. DIRECTOR MAY DECLINE TO REGISTER PERSONS ENTITLED BY TRANSMISSION

The Directors shall have the same right to refuse to register a person entitled by transmission to any shares or his/her nominee as if he/she were the transferee named in any ordinary transfer presented for registration.

## 22. CLOSURE OF REGISTER

The Company may on giving seven (7) days previous notice in the manner prescribed in the Ordinance, close the Register for any period not exceeding in the aggregate forty-five (45) days in each year but not exceeding thirty (30) days at any one time.

## 23. TRANSFER OF DEBENTURES

The provision relating to transfer of shares herein contained shall apply mutatis mutandis to transfer of debentures and other securities of the Company.

# PART V - ALTERATION OF CAPITAL

## 24. POWER TO INCREASE CAPITAL

The Company may, from time to time, increase its share capital in accordance with the provisions of the Ordinance.

## 25. SHARES TO BE OFFERED TO EXISTING MEMBERS

25.1 All new shares shall be offered in the first instance to the Members in proportion as nearly as the circumstances admit to the existing shares held by each Member and such offer shall be made by notice specifying the number to which the Member is entitled and limiting a time within which the offer if not accepted will be deemed to be declined.

25.2 After expiration of the time for acceptance of an offer of new shares specified in paragraph 25.1 of this Article or on receipt of an intimation from the Member to whom such notice is given that he/she declines to accept the shares offered, the Board may, subject to the provisions of Section 86 of the Ordinance, dispose of the same in such manner as they think most beneficial to the Company.

## 26. RANKING OF NEW SHARES WITH THE ORIGINAL CAPITAL

The new shares shall be subject to the same provisions with reference to transfer, transmission, and otherwise as the shares in the original share capital.

## 27. REDUCTION OF SHARE CAPITAL

The Company may, by Special Resolution, reduce its share capital, in any manner subject to the provisions of the Ordinance.

## 28. CONSOLIDATION AND SUB-DIVISION

Subject to the provisions of Section 92 of the Ordinance, the Company may, by Ordinary Resolution:

**(a)** Consolidate and divide the whole or any part of its share capital into shares of larger nominal value than its existing shares.

**(b)** Sub-divide its existing shares or any of them into shares of smaller amount than is fixed by the Company's Memorandum of Association, subject nevertheless, to the provisions of clause (d) of sub-Section (1) of Section 92.

**(c)** Cancel any shares which at the date of the passing of the Ordinary Resolution in that behalf have not been taken or agreed to be taken by any person.

# PART VI - GENERAL MEETINGS

## 29. ANNUAL GENERAL MEETINGS

The Company shall hold in addition to any other general meeting, a general meeting as its annual general meeting, within eighteen months from the date of its incorporation and thereafter at least once in every calendar year within a period of four months following the close of its financial year and not more than fifteen months after the holding of its last preceding annual general meeting.

## 30. EXTRAORDINARY GENERAL MEETING

All general meetings of the Company other than the annual general meeting shall be called extraordinary general meetings ("EGM"). The Board may whenever it thinks fit convene an EGM and an EGM shall also be convened on such requisition, or, in default may be convened by such requisitions, as provided by Section 159 of the Ordinance. An EGM may be held in such places as the Board may determine.

## 32. NOTICE OF MEETINGS

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All general meetings of the Company shall be called by not less than twenty-one clear days' notice in writing. The notice shall specify the place, the day and the hour of the meeting along with a statement of the business to be transacted at the general meeting and in case of special business, a the general nature of that business , shall be given in the manner provided by the Ordinance for the general meeting, to such persons as are, under the Ordinance or the regulations of the Company entitled to receive such notices from the Company; but the accidental omission to give notice to, or the non-receipt of notice by, any Member shall not invalidate the proceedings at any general meeting.

## 33. PROXIES

In every notice calling a meeting of the Company there shall appear with reasonable prominence a statement that a Member entitled to attend and vote is entitled to appoint a proxy to attend the vote in his/her stead and that a proxy need not be a Member.

## 34. ENTITLEMENT TO RECEIVE NOTICE AND ARRANGEMENT FOR MEETINGS

Subject to any restrictions contained in the Ordinance or in any of the Articles every Member shall be entitled to attend a general meeting in person or by proxy.

## 35. BUSINESS AT GENERAL MEETINGS

All business that is transacted at an EGM shall be deemed special, and also all that is transacted at an annual general meeting with the exception of declaring a dividend, the consideration of the accounts, balance sheet and the reports of the Directors and auditors, the election of Directors, the appointment of, and the fixing of the remuneration of the auditors.

## 36. QUORUM

No business shall be transacted at any general meeting unless quorum of Members is present at the time when the meeting proceeds to business, save as herein otherwise provided. At least 2 Members having not less than twenty-five percent (25%) of the voting power present in person or through proxy shall be the quorum at any general meeting of the Company.

## 37. EFFECT OF QUORUM NOT BEING PRESENT

If within half an hour from the time appointed for the meeting a quorum is not present, the meeting, if convened upon the requisition of Members, shall be dissolved, in any other case, it shall stand adjourned to the same day in the following week at the same time and place. The quorum for any such meeting shall remain as provided for in Article 36 above.

## 38. CHAIRMAN OF GENERAL MEETING

The Chairman, if any, elected under Article 58 shall preside as Chairman at every general meeting of the Company, but if there is no such Chairman or if at any general meeting the Chairman is not present within fifteen minutes after the time appointed for holding the meeting, or is unwilling to act as Chairman, the Members present whether in person or by the proxy shall choose one of their number to be Chairman of the meeting.

## 39. POWER TO ADJOURN GENERAL MEETING

39.1 The Chairman of a general meeting may at any time with the consent of the general meeting at which a quorum is present (and shall if so directed by the meeting) adjourn the meeting to another time or place. In addition the Chairman may at any time without the consent of the meeting adjourn the meeting to another time or indefinitely if it appears to the Chairman that:

(i) The number of persons wishing to attend cannot be conveniently accommodated in the place(s) appointed for the meeting;

(ii) The unruly behavior of any person attending the meeting prevents or is likely to prevent the orderly conduct of the business of the meeting; or

(iii) An adjournment is otherwise necessary so that business of the meeting may be properly conducted.

No business shall be transacted at any adjourned meeting other than business left unfinished at the meeting from which the adjournment took place.

39.2 When a meeting is adjourned for an indefinite period, the date, time and place of the adjourned meeting shall be fixed by the Board. When a meeting is adjourned for 60 days or more, notice of the adjourned meeting shall be given as in the case of the original meeting. When a meeting is adjourned for more than 14 days but less than 60 days (or for 14 days or less if the date of the adjourned meeting is fixed by the Board), notice of the day, time and place of the adjourned meeting shall be given in the same manner as in the case of an original meeting and notice of the business to be transacted at such an adjourned meeting shall not be required. Where a meeting is adjourned for 14 days or less, and the date of the adjourned meeting is fixed by the Chairman of the meeting, it shall not be necessary to give any notice of the adjourned meeting or of the business to be transacted at an adjourned meeting whatever the reason for the adjournment.

## 40. MODE OF DECIDING QUESTIONS AT MEETINGS

At any general meeting, a resolution put to the vote of the meeting shall, unless a poll is demanded, be decided on a show of hands unless a poll is (before or on the declaration of the result of the show of hands) demanded. Unless a poll is so demanded, a declaration by the Chairman that a resolution has, on a show of hands, been carried, or carried unanimously, or by a particular majority, or lost, and an entry to that effect in the book of the proceedings of the Company shall be conclusive evidence of the fact, without proof of the number or proportion of the votes recorded in favour of, or against, that resolution.

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## 41. POLL

41.1 A poll may be demanded only in accordance with the provisions of Section 167 of the Ordinance. If a poll is duly demanded, it shall be taken in accordance with the manner laid down in Section 168 of the Ordinance and the result of the poll shall be deemed to be the resolution of the meeting at which the poll was demanded.

41.2 A poll demanded on the election of the Chairman or on a question of adjournment shall be taken at once.

## 42. RIGHT OF DIRECTORS TO ATTEND GENERAL MEETINGS

Subject to Section 162 of the Ordinance every Director of the Company shall have the right to attend any general meeting of the Company and also to take part in the discussions thereat, but he/she shall not be entitled to cast a vote at a general meeting of the Company unless he/she is Member of the Company.

# PART VII - VOTES OF MEMBERS

## 43. VOTES OF MEMBERS

Subject to any rights or restrictions attached to any shares and to the provisions of these Articles, on a show of hands every Member who is present in person shall have one vote and on a poll every Member present in person or by a representative or proxy shall have one vote for each share held by him/her. Provided that, in case of election of Directors, the provisions of Article 53 shall apply.

## 44. REPRESENTATION OF COMPANIES OR CORPORATIONS AT GENERAL MEETING

Any company or corporation which is a Member of the Company may by resolution of its Board of directors or in such manner as may be permitted or required by its constitution, authorize, in writing, any person or persons to act as its representative at any general meeting of the Company or any class of Members in respect of its entire holding or any part thereof. A person so authorized shall be entitled to exercise the same powers on behalf of the company or corporation he/she represents as that company or corporation could exercise if it were an individual Member of the Company. A representative so appointed shall not be deemed to be a proxy.

## 45. JOINT HOLDERS

In the case of joint holders of a share the vote of the senior who tenders a vote, whether in person or by proxy, shall be accepted to the exclusion of the votes of the other joint holders and for this purpose seniority shall be determined by the order in which the names stand in the Register in respect of the shares.

## 46. THE INSTRUMENT OF PROXY

The instrument appointing a proxy shall be in writing and be signed by the appointer or his/her attorney duly authorized in writing or if the appointer or his/her attorney duly authorized in writing or if the appointer is a body corporate be under its seal or be signed by an officer or any attorney duly authorized. A proxy need not be a Member. A proxy who is appointed for a specified meeting only shall be called a Special Proxy. A special proxy shall be valid only for the meeting to which it relates and it shall not be used for more than one meeting. An instrument appointing a proxy may be in the following form or a form near thereto as may be approved by the Directors:

**DHA ENERGY SUPPLY COMPANY (PRIVATE) LIMITED**

I---------- ---------- ---- ------of ---- ----------being a member of DHA ENERG SUPPLY COMPANY (PRIVATE) LIMITED hereby appoint---------- ----------of----------as my proxy to vote for me and on my behalf at the annual/extraordinary general meeting of the Company to be held on the _____ day of_____, _____and at any adjournment thereof.

Dated: _____ Signed: ----------

## 47. INSTRUMENT APPOINTING A PROXY TO BE DEPOSITED AT THE OFFICE OF THE COMPANY

The instrument appointing a proxy and the power of attorney or other authority, if any under which it is signed or a notarized certified copy of that power or authority shall be deposited at the office of the Company not less than 48 hours before the time for holding the meeting or adjourned meeting at which the person named in the instrument proposed to vote and in default the instrument of proxy shall not be treated as valid. Delivery of an instrument appointing a proxy shall not preclude a Member from attending and voting in person at the meeting or poll concerned.

## 48. REVOCATION OF AUTHORITY

A vote given in accordance with the terms of an instrument appointing a proxy shall be valid notwithstanding the previous death or insanity of the Member or revocation of the proxy or of the authority under which the proxy was executed or the transfer of the shares

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in respect of which the proxy is given unless intimation in writing of the death, insanity, revocation or transfer shall have been received by the Company at least forty eight (48) hours before the commencement of the meeting or adjourned meeting at which the proxy is used. Provided nevertheless that the Chairman of any meeting shall be entitled to require such evidence as he/she may in his/her discretion think fit of the due execution of an instrument of proxy and that the same has not been revoked.

## 49. EQUALITY OF VOTES

In case of an equality of votes, whether on a show of hands or on a poll, the Chairman of the meeting at which the show of hands takes place, or at which the poll is demanded, shall have and exercise a second or casting vote.

## PART XIII - DIRECTORS

## 50. NUMBER OF DIRECTORS

a) The following shall be the first Directors of the Company:-

1. Naeem Azhar Lone
2. Muhammad Rafique
3. Syed Jamal Ullah Macdi

b) Save as provided in Section 187 of the Ordinance, no person shall be appointed as a Director unless he/she is a Member of the Company.

## 51. REMUNERATION OF DIRECTORS

The remuneration of the Directors shall from time to time be determined by the Company in general meeting subject to the provisions of the Ordinance.

## 52. DIRECTORS MAY CONTRACT WITH COMPANY

No Director or intending Director shall be disqualified by his/her office from entering into any contract, arrangement, transaction or proposal with the Company either acting in a professional capacity as a vendor, purchaser or otherwise, nor shall any contract, arrangement, transaction or proposal entered into by or on behalf of the Company in which any Director shall be so concerned or interested, be liable to account to the Company for any profit realized by any such contract, arrangement, transaction or proposal by reason of such Director holding that office or of the fiduciary relation thereby established provided that the nature of his/her interest has been disclosed by him/her at the time and in the manner specified in Section 214 of the Ordinance. Provided further that any such contract, arrangement, transaction or proposal as afore-mentioned shall not be entered into with the

Company by a Director or intending Director without the approval of the Board. In a Board meeting held for the purposes of granting such afore-said approval, the Director who is directly or indirectly interested or concerned in any way shall not take part in the discussion, nor vote in such meeting.

## PART IX - APPOINTMENT, ELECTION AND REMOVAL OF DIRECTORS

### 53. ELECTION OF DIRECTORS

53.1 At the first annual general meeting of the Company, all the Directors shall stand retired from office, and directors shall be elected in their place in accordance with Section 178 for a term of three years.

53.2 A retiring Director shall be eligible for re-election.

53.3 The Directors shall comply with the provisions of Sections 174 to 178 and Sections 180 and 184 relating to the election of Directors and matters ancillary thereto.

53.4 Subject to the provisions of the Ordinance, the Company may from time to time increase or decrease the number of Directors.

53.5 Any casual vacancy occurring on the Board of Directors may be filled up by the Directors, but the person so appointed shall be subject to retirement at the same time as if he/she had become a Director on the day on which the Director in whose place he/she is chosen was last elected as Director.

53.6 The Company may remove a Director in accordance with the provisions of the Ordinance

### 54. VACATION OF OFFICE OF DIRECTOR

The office of a Director shall be vacated if:

(a) He/she becomes ineligible to be appointed as a Director on any or more of the grounds enumerated in clause (a) to (h) of Section 187 of the Ordinance subject always to the proviso to such Section;

(b) He/she absents himself/herself from three consecutive meetings of the Board or from all meetings of the Board for a continuous period of three months whichever is the longer without leave of absence from the Board and the Board resolve that his/her office be vacated;

(c) He/she or any firm of which he/she is a partner or any private company of which he/she is a Director;

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(i) without the sanction of the Company in general meeting, accepts or holds any office of profit under the Company other than that of Chief Executive or a legal or technical advisor or a banker; or

(ii) accepts a loan or guarantee from the Company in contravention of Section 195 of the Ordinance.

(d) He/she fails to obtain the share qualification, if any necessary for his/her appointment, or ceases to hold share qualification necessary for his/her appointment.

## 55. ALTERNATE DIRECTORS

Subject to Section 192 of the Ordinance, a Director may with the approval of the Board, appoint any person to be his/her alternate Director during his/her absence, if not less than three months, from Pakistan and such appointment shall have effect and such appointee while he/ she holds office as an alternate director shall be entitled to notice of meetings of the Board and to attend and vote thereat accordingly and generally to exercise all the rights of such absent Director subject to any limitations in the instrument appointing him/her. Any appointment or removal under this Article shall be effected by notice in writing under the hand of the Director making the same.

# PART X - PROCEEDINGS OF DIRECTORS

## 56. MEETING OF DIRECTORS

The Board may meet together for the dispatch of business, adjourn, and otherwise regulate their meetings, as they think fit. Such meetings may be held in such places in or outside Pakistan as the Board may determine. The Board may invite such persons as they may deem fit to attend the meetings of the Board of Directors as observers. Meetings of the Board may be held by teleconference, video conference or other electronic media facilities enabling Directors to participate in meetings without being in the same physical location.

## 57. POWER OF DIRECTOR TO [illegible] MEETING

A meeting of the Board can be convened at any time on the requisition of a Director; provided that seven (7) clear days' notice of the meeting shall ordinarily be given to all Directors including those who were/are not for the time being resident in Pakistan. In case of urgent business a meeting of the Directors may be called at shorter notice provided that notice of such meeting is sent to all the Directors by facsimile at the facsimile numbers if any provided by the Directors or by any other expeditious means.

## 58. CHAIRMAN

The Board may from time to time appoint one or more of their body to be the holder of the office of Chairman and determine the period for which he/she is to hold office. The Chairman so elected shall preside over meetings of the Board.

## 59. QUORUM

The quorum for a meeting of the Board shall be a minimum of two (2) Directors.

## 60. EFFECT OF QUORUM

A meeting of the Directors for the time being at which a quorum is present shall be competent to exercise all or any of the authorities, powers and discretions by or under Articles of the Company for the time being vested in or exercisable by the Directors generally.

## 61. RESOLUTION WITHOUT A MEETING OF THE DIRECTORS

A resolution in writing signed by all Directors for the time being in office shall be valid and effectual as if it had been passed at a meeting of the Board duly called and constituted. For this [illegible] the text of the proposed resolution duly signed by the Chief Executive and obtain signatures of all the other Directors thereon.

## 62. DIRECTOR MAY ACT NOTWITHSTANDING ANY VACANCY

The continuing Directors may act notwithstanding any vacancy in their body, but if their number falls below the minimum fixed by or under these Articles the Directors shall not, except for the purpose of filling vacancies on the Board or summoning a general meeting, act so long as the number is below the minimum.

# PART XI - POWERS OF DIRECTORS

## 63. POWERS OF DIRECTORS

63.1 The business of the Company shall be managed by the Directors who may pay all expenses incurred in promoting and registering the Company and may exercise all such powers of the Company as are not by the Ordinance or these Articles required to be exercised by the Company in a general meeting, provided that no regulation made by the Company in general meeting shall invalidate any prior act of the Board which would have been valid if that regulation had not been made.

63.2 The Directors shall exercise all powers enumerated under Section 196 of the Ordinance, including issuance/execution of cheques, promissory notes, drafts, bills of exchange and other instruments whether negotiable or transferable or not, and all receipts for moneys paid to the Company, shall be signed, drawn, accepted, endorsed or otherwise executed, as the case may be, in such manner as the Board shall from time to time by resolution determine.

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63.3 The Board shall cause minutes to be made in books provided for the purpose:

(a) of all appointments of officers made by the Board;

(b) of the names of the Directors present at each meetings of the Directors and of any committee of the Board; and

(c) of all resolutions and proceedings at all meetings of the Company, and of the Directors, and of committees of the Board.

## PART XII - CHIEF EXECUTIVE

### 64. APPOINTMENT OF CHIEF EXECUTIVE

The Company shall have a Chief Executive appointed in accordance with the provisions of Section 198 and 199 of the Ordinance.

### 65. CHIEF EXECUTIVE DEEMED TO BE A DIRECTOR

The Chief Executive shall if he/she is not already a Director elected under Article 53 be deemed to be one and be entitled to all the rights and privileges and subject to all the liabilities of that office. Subject as aforesaid the terms and conditions of appointment of the Chief Executive shall be determined by the Board.

### 66. REMOVAL OF CHIEF EXECUTIVE

The Board by resolution by not less than three-fourths of their total number for the time being or the Company by a Special Resolution may remove a Chief Executive before the expiration of his/her term of office.

## PART XIII - THE SEAL

### 67. CUSTODY OF SEAL

67.1 The Board shall provide for the safe custody of the Seal and the Seal shall not be affixed to any instrument except by the authority of the Board or a committee authorized by the Board itself.

67.2 Every instrument to which the Seal shall be affixed shall be signed autographically in any of the following manners.

(i) By two Directors; or

(ii) By a person duly authorized by the Board either generally or in relation to specific instruments or instruments of specific descriptions.

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67.3 Notwithstanding the provisions of paragraph 67.2 of the Articles the Board may resolve to dispense with autographic signatures of all or any person referred to in that paragraph in relation to specific instruments or instruments of specified descriptions, and in substitution therefore to authorize signatures to be affixed by some method or system of mechanical signature approved by the Board.

## PART XIV – DIVIDENDS AND RESERVES

### 68. RESERVES

The Board may, before recommending any dividend, set aside out of the profits of the Company such sums as they think proper as a reserve or reserves which shall, at the discretion of the Board, be applicable for meeting contingencies or for equalizing dividends or for any other purpose to which the profits of the Company may be properly applied and pending such application may, at the like discretion, be employed in the business of the Company or be invested in such investments as the Directors may, subject to the provisions of the Ordinance, think fit.

### 69. DECLARATION OF DIVIDENDS

The Company in general meeting may declare dividends, but no dividends shall exceed the amount recommended by the Board.

### 70. PAYMENT OF DIVIDENDS

No dividend shall be paid otherwise than out of the profits of the Company.

### 71. INTERIM DIVIDENDS

The Board may from time to time declare and pay to the Members such interim dividends as appear to the Board to be justified by the profits and position of the Company.

### 72. TIME FOR PAYMENT OF DIVIDEND

Any dividend declared pursuant to Article 69 shall be paid within the period laid down in Section 251 of the Ordinance.

### 73. DIVIDEND TO JOINT HOLDERS

Any one of several persons who are registered as the joint holders of any shares may give effectual receipt for any dividend payable in respect of such shares.

### 74. EFFECT OF TRANSFER

A transfer of shares shall not pass the right to any dividend declared thereon before the registration of the transfer.

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## 75. RETENTION OF DIVIDEND

The Directors may retain the dividend payable upon shares in respect of which any person is under Article 20 entitled to become a Member or which any person under that Article is entitled to transfer until such person shall become a Member in respect thereof or shall duly transfer the same.

## 76. UNCLAIMED DIVIDENDS

Subject to the applicable provisions of the Ordinance, all dividends unclaimed after having been declared may be invested or otherwise made use of by the Board for the benefit of the Company until claimed.

## 77. DIVISION OF DIVIDEND

All dividends of the Company shall be apportioned and paid pro rata among the Members in proportion to the number of shares held by them respectively during any portion or portions of the period in respect of which the dividend is paid.

# PART XV – MINUTES AND BOOKS

## 78. MINUTES TO BE RECORDED

The Company shall cause a fair and accurate summary of all proceedings of general meetings and meetings of its Board and committees along with the name of those participating in such meetings to be entered in properly maintained books.

## 79. BOOKS OF ACCOUNTS TO BE KEPT

The Board shall cause to be kept proper books of accounts with respect to all sums of money received and expenditures incurred all sales and purchases of goods by the Company and all assets and liabilities of the Company.

## 80. BOOKS OF ACCOUNTS TO BE KEPT AT OFFICE OF THE COMPANY

The books of accounts shall be kept at the office of the Company or at such other place in Pakistan as the Board may decide and when the Board so decides the Company shall within seven (7) days of the decision, file with the Registrar a notice in writing giving the full address of that other place.

## 81. ANNUAL ACCOUNTS AND BALANCE SHEET

The Directors shall as required by Section 233 and 236 of the Ordinance cause to be prepared and to be laid before the Company in general meeting such profit and loss

accounts and balance sheets duly audited and reports as referred to in the above referred Sections.

## PART XVI – AUDIT

### 82. APPOINTMENT OF AUDITORS

Auditors shall be appointed and their duties regulated in accordance with Sections 252 to 255 of the Ordinance. The auditors shall be entitled to attend any general meeting of the Company and to receive all notices of and other communications relating to any general meeting which any Member is entitled to receive and be heard there at, on any part of the business of the meeting which concerns him/her as auditor.

## PART XVII – NOTICES

### 83. PROCEDURE FOR GIVING NOTICES

A notice may be given by the Company to any Member either personally or by sending it by post to him/her at his/her registered address or if he/she has no registered address in Pakistan, to the address, if any within or outside Pakistan, supplied by him/her to the Company for the giving of notices to him/her.

### 84. NOTICE SENT BY POST

Where a notice is sent by post, service of the notice shall be deemed to be effected by properly addressing, preparing and posting a letter containing the notice and, unless the contrary is proved, to have been effected at the time at which the letter would have been delivered in the ordinary course of post.

### 85. NOTICE TO JOINT HOLDERS

A notice may be given by the Company to the joint holders of a share by giving the notice to the joint holder named first in the Register in respect of the shares.

### 86. NOTICE TO PERSON ENTITLED BY TRANSMISSION

A notice may be given by the Company to the person entitled to a share in consequence of the death or insolvency of a Member by sending it through the post in a prepaid letter addressed to them by name or by the title of representatives of the deceased or assignees of the insolvent of by any like description at the address if any in Pakistan, supplied for the purpose by the persons claiming to be so entitled or until such an address has been so supplied by giving the notice in any manner in which the same might have been given if the death or insolvency had not occurred.

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## PART XVIII – SECRECY

### 87. SECRECY

Every Director, manager, advisor, auditor, member of a committee of the Board, officer, servant, agent, accountant or other person employed in the business of the Company shall, if so required by the Board, before entering upon his/her duties, sign a declaration pledging himself/herself to observe a strict secrecy respecting all transactions of the Company with its customers and the state of accounts with individuals and in matters relating thereto, and shall by such declaration pledge himself/herself not to reveal any of the matters which may come to his/her knowledge in the discharge of his/her duties except when required to do so by the Directors or by any applicable law or by any general meeting or by any court of law and except so for as may be necessary in order to comply with any of the provisions of these Articles.

## PART XIX – INDEMNITY

### 88. INDEMNITY

Every officer, Director or agent for the time being of the Company may be indemnified out of the assets of the Company against any liability incurred by him/her in defending any proceedings, whether civil or criminal arising out of his/her dealings in relation to the affairs of the Company whether the outcome of any such proceedings is in her/his favour or otherwise except those brought by the Company against him/her, or in connection with any application under Section 488 in which relief is granted to him/her by the Court.

## PART XX - WINDING UP

### 89. DISTRIBUTION OF ASSETS

89.1 If the Company is wound up, the liquidator may, with the sanction of a Special Resolution of the Company and any other sanction required by the Ordinance, divide amongst the Members, in specie or in kind, the whole or any part of the assets of the Company, whether they consist of property of the same kind or not.

89.2 For the purpose aforesaid, the liquidator may set such value as he/she deems fair upon any property to be divided as aforesaid and may determine how such division shall be carried out as between the Members or different classes of Members.

89.3 The liquidator may, with the like sanction, vest the whole or any part of such assets in trustees upon such trusts for the benefit of the contributories as the liquidator, with the like sanction, thinks fit, but so that no Member shall be compelled to accept any shares or other securities whereon there is any liability.

## PART XXI - DISPUTE RESOLUTION

### 90. DISPUTE RESOLUTION

**90.1** In the event that a dispute, claim or controversy arises between the Company, its management or its shareholders, or between the shareholders inter-se, or the directors inter-se, all steps shall be taken to settle the dispute and resolve the issue through mediation by an accredited mediator before taking recourse to formal dispute resolution such as arbitration or litigation. Notwithstanding [illegible], mediation shall not be a condition precedent for initiating proceedings before the court having jurisdiction to determine the dispute, claim or controversy.

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We the several persons, whose names and addresses are subscribed, are desirous of being formed into a company, in pursuance of these Articles of Association and we respectively agree to take the number of shares in the capital of the Company set opposite to our names:

| Name and Surname (Present & Former) in full (in Block Letters) | Father's/Husband's Name in Full | CNIC/ Passport No. | Nationality with any former Nationality | Occupation | Address | Number of Shares taken by each Subscriber | Signature |
|---|---|---|---|---|---|---|---|
| NAEEM AZHAR LONE | MUHAMMAD AZHAR LONE | 35201-9117920-1 | PAKISTANI | BUSINESS EXECUTIVE | 53/1-S, 7TH COMMERCIAL STREET, PHASE 4, DHA, KARACHI | ONE (1) | |
| MUHAMMAD RAFIQUE | MUHAMMAD YASIN KHAN | 34101-6241501-5 | PAKISTANI | BUSINESS EXECUTIVE | HOUSE NO. SUH-443, STREET 5, ASKARI 5, MALIR CANTT, KARACHI | ONE (1) | |
| SYED JAMAL ULLAH MACDI | SYED SANA ULLAH MACDI | 42101-1936245-5 | PAKISTANI | BUSINESS EXECUTIVE | PLOT 6/B-3, D STREET, PHASE 5, DHA, KARACHI | ONE (1) | |
| DHA ENERGY AND SERVICES (PRIVATE) LIMITED<br><br>Through its authorized representative | N/A | N/A | PAKISTANI | N/A | 2/B, EAST STREET, PHASE-I, DHA, KARACHI, SINDH 75500 | NINE HUNDRED AND NINETY-NINE THOUSAND NINE HUNDRED AND NINETY SEVEN (9999997) | |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MUHAMMAD RAFIQUE | MUHAMMAD YASIN KHAN | 34101-6241501-5 | PAKISTANI | BUSINESS EXECUTIVE | HOUSE NO. SUH-443, STREET 5, ASKARI 5, MALIR CANTT, KARACHI | | |
| | | | | | | ONE MILLION (1,000,000) | |

Dated 24 February 2017

Witness to the above signatures:

Name: NIFT (Pvt.) Limited
Address: 5th Floor, AWT Plaza, I.I. Chundrigar Road
Karachi- 74200, Pakistan

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Securities and Exchange Commission of Pakistan
SECP

Certified to be True Copy
Asstt./Deputy Registrar of Companies

# Part J.4

# The type, technology, model, technical details and design of the facilities proposed to be acquired, constructed developed or installed

**ITEM No. 04**

## The type, technology, model, technical details and design of the facilities proposed to be acquired, constructed developed or installed

1. **For Distribution Facility**

   Type, technology and technical details for Distribution System are given under item No.s 6, 7, 8, 9, & 11.

2. **For Generation Facility**

   Following are the various sources of Power Generation (currently under consideration):

   (i) Wind – 50 MW

   (ii) Solar – 50 to 60 MW

   (iii) Bio-mass – 40 MW

   (iv) Thermal (Conventional) – 350 MW

# Part J.5

# The type and details of the services proposed to be provided

ITEM No. 05

# The type and details of the services proposed to be provided

## The type and details of the services proposed to be provided

Services proposed to be provided shall include professionally handling of all issues relating to:

i. Un-interrupted power supply to DCK residents throughout the year.
ii. Maintaining Quality of Power with respect to voltage deviation, frequency variation, and Harmonics etc.
iii. Safety standards and its implementation.
iv. Operation of electrical system with high reliability & availability.
v. Maintenance of system with least power outages and durations.
vi. Customer services.
vii. Billing after providing power connections to consumers.
viii. Tariff structuring and management of other tariff related matters and dealing with NEPRA from time to time.
ix. Preparation of performance reports.
X. Maintenance of data and records in respect of provision of electrical power services.

# Part J.6

# Distribution system configuration, service territory, right of way, feeder maps (with Evidence of Commitment for Long-Term Lease Agreement for Land and NOC for Right of Way)

ITEM No. 06

## Distribution System Configuration, Service Territory, Right of way, Feeder Map

### General

The Defence Officers Housing Authority (DHA) has acquired new land for development of state of the art housing project known as DHA city, Karachi, located at 56 KM from Karachi on Super Highway.

Development of the area, spreading over 11,640 acres of land, with infrastructure is the responsibility of DCK and individual houses and commercial complexes shall be built by the residents who have purchased and leased the land in their name.

DCK comprises of 16 sectors, each sector has generally four sub sectors. Location plans is shown at Annex A. DCK layout plan with sectors is at Annex-B.

### Type of distribution system (configuration)

The Entire power demand of DCK is about 500MW, when it is fully developed. It is proposed to be fed through extra high tension underground 132kV transmission lines, four in numbers for serving nine/ten 132 kV GIS type grid stations.

The grid stations shall be established in different sectors as per development of DHA city (Annex C).

The grid station would step down power from 132 kV to 11kV through 40 MVA power transformer estimated to be about 23 in numbers for meeting the entire load of the area.

For distributing the power, about 200 numbers of 11 kV feeders shall be laid, feeding 11/0.4kV distribution transformers, about 1200 in numbers, when the entire area of DCK id fully developed.

ITEM No. 06

## Distribution System Configuration, Service Territory, Right of way, Feeder Map

Low tension underground distribution lines are planned which will emanate from distribution transformers for feeding the power demand of the consumers through feeder pillar boxes. Underground service cables shall be laid for the resident from the feeder pillar boxes to their premises.

The power requirement of DCK will grow as the population grows .DCK intend to have its own self generation, captive generation for which initially smaller units shall be suitable to match with the infrastructure development and population growth.

Initially 4x1.5 MW Diesel Engines running on RFO are proposed to be installed for meeting the initial load demand and from this diesel plant 11kV cables shall be laid up to the sub-stations for distribution of power.

In future, power plant of larger size shall be constructed for which an area has been designed in the south east of DCK land (Annex D).

### Service Territory

DHA city Karachi has land of 11,640 acres, located 56 KM from Karachi on Karachi Hyderabad Super Highway. (Service territory is shown at Annex B).

The territory is about 40 km from KE nearest grid station (KDA scheme 33 G/S) and lies in the concessional licensed area of KE and HESCO.

### Right of way

As the land belongs to DHA itself, the right of way available and utility corridors have been planned for 132 kV, 11 kV and 0.4 kV cables by the developers and planners.

Phones: 021-36470008
Fax: 021-36470007
Ext: 111-589-589-2254

**Pakistan Defence Officers Housing Authority**
2/B, East Street, Phase-1, DHA Karachi-75500, (PAKISTAN)

In reply, please quote:
DHA/DCK/E&M/2016/62

Date: 31 May 2017

To: DHA Energy Supply Company (Pvt.) Ltd
2/B East Street, Phase-1,
DHA Karachi-75500
Ph: (+92-21) 111-589-589
Fax: (+92-21) 35886406

Subject: **Defence Housing Authority (DHA) - DHA City Karachi - Commitment for Long-Term Lease Agreement for Distribution Network**

Dear Sir,

1. This is with reference to the electricity distribution network being developed, and to be maintained, by the Company for the DHA City Karachi.

2. Upon the issuance of a distribution licence to the Company for the aforementioned distribution network by the National Electric Power Regulatory Authority, we hereby undertake to enter into a long-term lease agreement with the Company for the land required to construct, operate and maintain the distribution system, and the term of such agreement shall correspond to the term of that distribution licence.

3. We also undertake to provide the Company with the requisite easements, rights-of-way and other permissions in order to facilitate the Company in the construction, operation and maintenance of the distribution system.

Yours faithfully

For and on behalf of

Defence Officers' Housing Authority Karachi

Lt Col
**Touqeer Mehmood (Retd)**
A/Dir A&C

# DHA Energy & Services (Pvt) Ltd.

[illegible] Street, Phase 1, DHA Karachi 75500
[illegible] Fax [illegible]

In reply, please quote:
DHA/DESL/2017/01

Date: 2 Jun 2017

To: Lt Col (R)
Touqeer Mehmood
Addl Dir A&C
DHA City Karachi

Subject: **Right of Way (ROW) for Laying of Electrical Distribution & Transmission Network in DHA City Karachi**

As you are aware that DHA Energy Supply Company (Pvt) Ltd is in process of applying of Distribution License to NEPRA. We request for provision of ROW for laying of Electrical Distribution and Transmission network within DHA City Karachi as per the master planning for a period of 25 years extendable for a further period as mutually agreed between both parties.

Lt Col (R)
**Javaid Iqbal, TI (M)**
For Director
DHA Energy & Services (Pvt.) Ltd

Phones: 021-36470008
Fax: 021-36470007
Ext: 111-589-589-2254

**"DHA City Karachi (DCK)"**

2/B, East Street, Phase-I DHA Karachi-75500, (PAKISTAN)

In reply, please quote:
DHA/DCK/E&M/2016/60

Date: 20 Jun 2017

To: DHA Energy & Services (Pvt.) Ltd

Subject: **Right of Way (ROW) for Laying of Electrical Distribution & Transmission Network in DHA City Karachi**

Reference: Your letter no. DHA/DESL/2017/01 dated 02 Jun 2017

This office has no objection in provision of ROW for laying of Electrical Distribution and Transmission network as req vide your letter under reference for a period of 25 years, which could be further extended for a specified period with mutual understanding. A formal agreement will be signed as desired by your office.

Lt Col (Retd)
**Touqeer Mehmood**
Acting Dir A&C
DHA City Karachi

**ITEM No. 06**

**Distribution System Configuration, Service Territory, Right of way, Feeder Map**

**Feeder Maps**

DHA City Karachi (DCK) comprises of 16 sectors. Each sector has generally four sub-sectors. The development works have started in sector 2 to 7 Out of 16 sectors. Feeder maps up to sectors 12 have been planned. (Annex D).

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# Part J.7
# Voltage levels, regulation

ITEM No. 07

# Voltage Levels, Regulation

## Voltage Levels, Regulations

The Voltage levels of medium voltage distribution lines shall be 11 kV with voltage regulation of ± 5% at the receiving end and single line contingency condition (N-1). The medium voltage distribution lines shall be under ground.

- The distribution system voltage level shall be as per NEPRA regulation and performance standards.
- The low voltage distribution lines shall be 0.4 kV with voltage regulation of ± 5% at the receiving end as per NEPRA regulation and performance standards.
- Voltage level of transmission lines shall be 132 kV with voltage regulation ± 5% at the receiving end and it shall be ± 10% under single outage contingency.

  (N-1 condition as per NEPRA regulation and performance standards.) (Annex-C).

# Part J.8
# Type of distribution system

ITEM No. 08

# Type of Distribution System

## Type of Distribution system

The distribution system shall comprise of voltage levels 132kV, 11kV and 0.4 kV. The distribution system shall be entirely underground. 132 kV transmission lines shall be laid under ground between the grid stations. The 132 kV cable shall be single core (XLPE type). The 132kV grid station shall be indoor GIS type. Medium voltage 11 kV distribution lines shall also be laid underground between the 11/0.4 kV substations. The 11 kV cable shall be XLPE type. The 11/0.4 kV substations shall be pre fabricated KIOSK type.

The low voltage cables emanating from the substation to the feeder pillar boxes shall be 0.4 kV aluminium conductors armored, 3 Phase four wire cable.

The feeder pillar boxes shall have provision of MCCB controlled outgoing service cables for the consumers. The service cables shall be underground.

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# Part J.9
# Line equipment characteristics

ITEM No. 09

# Line Equipment Data / Characteristics

**Line Equipment Data/ Characteristics**

All material and equipment supplied and installed shall be designed, manufactured and tested to meet the following system and climate conditions unless specifically stated otherwise for any material /equipment.

All system shall adopt following main standards, wherever applicable, and the design criteria shall meet the following.

**Design Codes and Standards**

All system shall adapt the following standards:

- European committee for standardization (CEN) and European committee for Electro technical standardization (CENELEC).
- International Electro technical Commission (IEC).
- Other standards and codes can be used in areas not covered by these standards. Other stands include:
- European Standards like EN, DN.
- British Standards like (BS).
- The electrical Products used , should be tested, approved to meet the applicable standards, by one of the test independent test laboratories, including following:

  i. KEMA

  ii. CESI

  iii. UL or other similar laboratories.

  iv. Rawaat laboratories Pakistan.

ITEM No. 09

# Line Equipment Data / Characteristics

## Design Criteria

The DCK Electrical Distribution shall meet the following requirements:

- High reliability
- Safe operation
- Route protection
- Redundancy
- Reliable technology
- Easy to maintain and troubleshoot
- Environmentally protected
- Cost effective
- Future proof

## System Conditions

| | | | | |
|---|---|---|---|---|
| Normal System Voltage | - | HV | 132,000 | Volts |
| | - | MV | 11,000 | Volts |
| | - | LV | 400 | Volts |
| Highest System Voltage | - | HV | 145,000 | Volts |
| | - | MV | 12,000 | Volts |
| | - | LV | 440 | Volts |

ITEM No. 09

## Line Equipment Data / Characteristics

| | | | | |
|---|---|---|---|---|
| Phases | - | MV | 3 | |
| | - | LV | 3 ( 4 wire) | |
| Frequency | - | HV/MV/LV | 50 | Hz |
| Rated short circuit current | - | HV | 40 | kA |
| | - | MV | 20 | kA |
| | - | LV | 46 | kA |

**BIL (Basic Impulse level)**

| | | | |
|---|---|---|---|
| Lightning Impulse withstand Voltage (132 kV) | - | 650 | kV |
| Lightning Impulse withstand Voltage (11kV) | - | 75 | kV |
| Power Frequency withstand Voltage (132kV) | - | 275 | kV |
| Power Frequency withstand Voltage (11kV) | - | 28 | kV |
| Power Frequency withstand Voltage (415V) | - | 3 | kV |

System Earthing -Neutral Grounded through resistor at Grid- Station to limit the earth fault current.

**Climate Conditions**

**ITEM No. 09**

## Line Equipment Data / Characteristics

| | | |
|---|---|---|
| Max Ambient Air temperature | - | 50 °C |
| Max Daily Average temperature | - | 40 °C |
| Min Ambient Air temperature | - | O °C |
| Max Ambient Air temperature on Exposed | | |
| Horizontal surface | - | 60 °C |
| Highest Radiation intensity | - | 1000 W/m$^2$ |
| Max relative humidity | - | 95% |
| Isokeraunic level | - | 9.7 Days / Annum |
| Altitude | - | Sea Level |
| Location | - | Semi desert |
| Pollution | - | Wind blown sand |

The line equipment characteristics shall be as follows.

## A. 132 kV Grid station Equipment

### 1. Power Transformer

| | | |
|---|---|---|
| i. | Rated | 40 MVA |
| ii. | Voltage ratio | 132/12 kV |
| iii. | Winding arrangement | Delta /Star |
| iv. | Tap position | Oil immersed |
| v. | Impedance at principal tap | 16 % |
| vi. | Vector group | YNyn0(d11) |

## Line Equipment Data / Characteristics

| | | |
|---|---|---|
| vii. | Tap change range | ±15 %, |
| viii. | Earthing method | Through NGR |

2. **GIS Switchgear**

| | | |
|---|---|---|
| i. | Rated Voltage | 145 kV |
| ii. | Operating Voltage | 132 kV |
| iii. | Rated 3 – Phase, Short circuit breaking current | 40 kA |
| iv. | Rated 3- Phase , Peak short circuit making current | 100 kA |
| v. | Rated bus bar current | 2500 A |

## B. 11 kV Switchgear

| | | |
|---|---|---|
| ii. | Rated Current | 630 A for incoming and outgoing panels<br>2500 A, for bus bars and bus coupler |
| iii. | Rated Voltage | 15kV |
| iv. | Rated Frequency | 50 Hz |
| v. | Rated short circuit breaking current | 20 kA for 1 Sec |
| vi. | Rated short circuit making current | 63 kA |
| vii. | Rated 1 minute power frequency withstand voltage | 28kV |
| viii. | Rated lighting impulse withstand voltage | 75 kV |
| ix. | Operating sequence | O-0.3 sec-CO-3Min-CO |
| x. | Operating times: | |
| | i. Closing time | Max 80 ms |
| | ii. Opening Time | Max 60 ms |

ITEM No. 09

## Line Equipment Data / Characteristics

### C. Kiosk Sub station

- The kiosk substation shall be compact and outdoor type design.
- The kiosk sub- station shall have four (04) compartments each one shall house the equipment as under.
    - i. MV VCB Switchgear panels- Three Numbers
    - ii. Oil filled distribution transformer-kVA Rating 1000/750/500
    - iii. LV panel
    - iv. Battery charger for 48 V DC battery systems
- The Kiosk shall be complete in all respect with inter connection between MV switchgear and MV distribution transformer and between LV side distribution transformer and LV panel.
- VCB Switchgear panel for distribution transformer shall be complete in all respect, shall be prewired and equipped with the following.
    - i. Dual ration dual core current transformer for metering and protection.
    - ii. Potential transformer
    - iii. Numeric over current and earth fault relay
    - iv. Electronic AMR Energy meter
    - v. Ammeter selector switch (ASS)
    - vi. Digital voltmeter

## Line Equipment Data / Characteristics

vii. Voltmeter selector switch

viii. Cable terminations

- The protection and metering equipment with Earth fault indicator (EFI) shall be smart and intelligent Electronic devices (IEDs) having provision for remote on-line two way data and fault indication communication and provision for integration with AMI and SCADA for distribution Automation ( DMS and EMS) to achieve smart grid concept.
- The metering compartment and instrument /relay compartment in MV panel shall have sufficient space to accommodate the devices like transducer, modem, and RTU etc necessary for remote data transmission and for control/ monitoring through SCADA.
- The VCB switch shall have at least 12 Numbers of normally open (NO) contacts for remote ON and OFF indication and control through SCADA.
- The Numeric relay shall have potential free NO and NC contacts for remote communication of status/ indication and control through SCADA.
- The metering compartment and instrument/relay compartment shall have sufficient number of various sizes/ capacity of spare terminals.

## D. Switching station

- The switching sub-station shall be outdoor type either of 3 way, 4 way MV switchgear panel arrangement as per design requirement.

ITEM No. 09

## Line Equipment Data / Characteristics

- The sub-station shall have MV switchgear panel with vacuum circuit breaker (VCB) to accommodate outside MV cable circuit designated as incoming and outgoing.
- The sub-station shall be mounted on RCC platform with provision for MV cables circuit entry and connections.
- VCB switchgear panel for connecting outside MV cable shall be complete in all respect shall be pre wired and equipped with the following
    - i. Single Ratio Dual core current transformer for protection
    - ii. Numeric over current and Earth Fault Relay.
    - iii. Digital Ammeter
    - iv. Ammeter selector switch ( ASS)
    - v. Earth fault indicator ( EFI)
    - vi. Earth switch to ground cable.
    - vii. Cable live indication.
    - viii. Cable termination arrangement.
- The protective equipment and EFI shall be smart and intelligent Electronic Devices (IEDs) having provision for remote on line two way data and fault indication communication and provision for integration with AMI and SCADA for distribution Automation ( DMS and EMS) to achieve smart grid concept.

ITEM No. 09

## Line Equipment Data / Characteristics

- The instrument /relay compartment in MV panel shall have sufficient space to accommodate the devices necessary for remote data transmission and for control/monitoring through SCADA.
- The VCB and earthing switch shall have potential free 12 NOs of Normally open and 12 Nos of normally closed (NC) contacts for ON and OFF indication and control through SCADA.
- The metering and Instrument relay compartment shall have sufficient of various size/capacity of spare terminals.

**MV cable and Straight through joint /Termination.**

- The cable shall be three core stranded aluminium conductor, XLPE insulated, triple extruded, PVC bedded, steel wire armored (SWA) and PVC sheath overall.
- The cable shall be laid in tranches complete with bricks sand cushion, warning tape, and marker.
- The cable trench shall be depth 1.0 m.
- The straight through joint for MV XLPE cable shall be of PVC consisting of mould, resin, and MV tape, semi–conducting tape, ferrules and earth wire.
- The danger sign for MV cable shall not be less than 250 x 125 mm enameled.

ITEM No. 09

## Line Equipment Data / Characteristics

### L.V cable

- The LV cable shall be stranded aluminium conductor, XLPE insulated, extruded PVC bedded, steel wire armored and PVC sheathed overall.
- The cable shall be laid in tranches complete with bricks, sand, warning tape with all accessories.
- The cable trench shall be of depth 0.9 Meter.
- The danger sign of LV cable shall not be less than 250x125 mm enameled.

### LV Feeder pillar

- The feeder pillar housing shall be floor mounted installed on RCC pad.
- The housing shall be of GRP, dust and weather proof, ingress protection to IP55 and weather proof and rigid construction suitable for outdoor use.
- The feeder pillar housing shall have front and rear compartment. A suitable sheet of insulating material shall be provided for separation between front and rear compartment.
- The rear compartment shall contain LV main 600 A TPN+E bus bar , MCCB, CT operated 3 phase ,4 wire electronic AMR Energy meter ,set of current transformers.

ITEM No. 09

## Line Equipment Data / Characteristics

- The front compartment shall contain LV distribution 300 A TPN+ E bus bar outgoing MCCBs for consumer feeders.
- Incoming MCCB shall be connected between main and distribution Bus bar and distribution bus bar onward shall feed the outgoing MCCBs for consumer feeders.
- The upper/top chamber shall be suitable to accommodate electronic AMR Energy meter with ring type CTs on each of LV incoming cable form KIOSK LV distribution panel.
- The feeder pillar shall have front and rear compartments. A suitable sheet of insulating material shall be provided for separation between front and rear compartment.
- The rear compartment shall contain LV main 600 A TPN + E bus bar, MCCB, CT operated 3 phase ,4 wire Electronic AMR energy meter, set of current transformers.
- The front compartment shall contain LV distribution 300A TPN + bus bar and outgoing MCCBs for consumer feeders.
- Incoming MCCBs shall be connected between main and distribution bus bar and distribution bus bar onward shall feed the outgoing MCCBs.

ITEM No. 09

## Line Equipment Data / Characteristics

- The upper/top chamber shall be suitable to accommodate electronic AMR Energy meter with ring type CTs on phase of LV incoming cable from KIOSK LV distribution panel.
- The feeder pillar shall have provision for incoming and outgoing cable entry.
- All incoming and outgoing cable entry points shall be provided cable glands.
- The middle chamber /housing shall have on the upper front door indication lamps for indication supply availability.

E. 132 kV Transmission Lines ( Underground cable )

| | | | |
|---|---|---|---|
| 1. | Rated Voltage | 145,000 | Volts |
| 2. | Operating Voltage | 132,000 | Volts |
| 3. | Type | (XLPE) Underground cable, Copper conductor | |
| 4. | Size | 800mm$^2$ | |

F. Distribution System ( 11 kV)

1. Transformer

| | | |
|---|---|---|
| I. | Rating | 500/750/1000 kVA |
| II. | Voltage ratio | 11000/400Volts |
| III. | Tap position | Principal Tap |
| IV. | Vector group | Dyn11 |
| V. | Impedance voltage (500kVA) | 4% (With IEC tolerance) |

ITEM No. 09

## Line Equipment Data / Characteristics

VI. Impedance voltage (750/1000kVA) 5%(With IEC tolerance)

2. **11 kV switch gear**

| | | |
|---|---|---|
| i. | Rated voltage | 15,000 Volts |
| ii. | Operating voltage | 11,000 Volts |
| iii. | Rated 3 phase short circuit current (1 sec) | 20 kA |
| iv. | Rated 3 phase short circuit making current | 63 kA |

3. **11 kV cable**

| | | |
|---|---|---|
| I. | Size | 300mm$^2$/400 mm$^2$ |
| II. | Type | Compacted round, stranded |
| III. | Rated Voltage | 15 kV |
| IV. | No of cores | 3 |

4. **LV cable**

| | | |
|---|---|---|
| I. | Size | 300/240/185/150/95/70 mm$^2$ |
| II. | Type | Annealed Aluminum Stranded |
| III. | Rated Voltage | 600/1000 Volts |
| IV. | Operating Voltage | 400 Volts |
| V. | No of cores | 4 |

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# Part J.10
# Power quality control

ITEM No. 10

# Power Quality Control

## Power Quality Control

- The Power quality will be maintained according to NEPRA codes.
- Harmonics and voltage deviations and frequency variation will be monitored automatically through SCADA.
- Loading of the equipment and terminal voltage shall be monitored.
- Connection points, heating points shall be monitored and maintained.
- Neutral earthing would be monitored and maintained.

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# Part J.11
# Back-up / express feeder provision

ITEM No. 11

# Back-up / Express Feeder Provision

## Back-up / Express Feeder Provision

Back up MV feeder provision is provided for each sub-station to provide backup in case of fault on service feeder.

Similarly 132 kV underground transmission line 800 $mm^2$ sizes consist of four (4) circuits to meet (n-1) criteria the other circuit shall be capable of taking peak load demand of DCK.

Earth fault indicators (EFI) shall be provided on medium voltage 11 kV distribution underground cable network.

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# Part J.12
# Accident protection / prevention procedures

ITEM No. 12

**Accident Protection and Prevention Procedures**

## Accident Prevention and Procedure

- Standard operating procedure (SOP) for operation and maintenance of all equipment will be prepared.
- Safety procedure will be developed considering the voltage levels.
- All operation and maintenance personal will be equipped with safety gears and personal safety gadgets.
- All equipment will be tagged properly to avoid any accident.
- The earthing of all equipment will be carried out as per IEC/IEEE codes and standards.
- The forms for handling over / taking over equipment of maintenance will be developed.
- SAP or any other equivalent software will be used for plant and equipment to keep a track of maintenance.
- Written communication will be done to take shut down, for maintenance of normal line/equipment.
- Proper Communication will be done to take shut down for maintenance of normal line element and thus also same for handling over for reenergizing of element after maintenance.
- All operation with time, and persons responsible, will be tagged properly, in registers at installation, to avoid any accident.
- The SOPs prepared will define, duties of personnel involved in operation and maintenance.

ITEM No. 12

## Accident Protection and Prevention Procedures

- The proper warning signs will always be in place.
- The equipments for maintenance will be not accessible to any unauthorized person.
- The fire extinguisher system will be placed, at necessary place, along with manual and automatic system for high voltage equipment like transformer and grid stations.
- The power transformer will have automatic fire protection system.
- The underground mesh will be installed to control step and touch voltages within limits.
- Fire fighting training will be given to operation and maintenance crew.
- The illumination level will be as such preventing any accident due to low light standards.
- All codes and standards will be as per NEPRA distribution codes.
- The health and safety protocols will be developed for employee.
- The equipment will be tested as per SOP to avoid accidents.
- All equipment installed will be made inaccessible by installing barriers and putting warning signs.

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# Part J.13
# Maintenance Plans and Procedures

ITEM No. 13

**Maintenance Plans and Procedures**

## Maintenance Plans and Procedures

- The grid station will be manned by switch board operators and therefore 24/7 monitoring will be in place.
- The daily monitoring of equipment will be carried out as per following sample:

  Hourly reading of Ammeter, Voltmeter and energy meters, Temperature, pressure etc will be carried out by Switch Board Operators (SBO)
- The SCADA system will also record all values necessary and transients to centralized Load Dispatch Centre (LDC).
- On the basis of monitoring by SBO and SCADA, maintenance will be carried out; however routine maintenance of all equipments will be carried out as per recommendations of manufacturer.
- For planned maintenance the weekly, monthly , quarteriy and annually maintenance schedule will be performed .The planned maintenance will be carried out in winter season (NOV-to-FEB) to avoid any load shedding.
- The distribution system design with ample capacity for load transfer and to take any element out of service due to planned and emergency maintenance conditions.
- Maintenance team will be available to take care of emergency and planned routine maintenance.

ITEM No. 13

**Maintenance Plans and Procedures**

- The testing relays will also be part of planned maintenance and schedule will be prepared as per recommendation of manufacturer.
- The standard operating procedure for maintenance will be prepared and will be implemented as per international codes and standards.

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Gillette

# Part J.14
# Fault location and trouble-shooting procedures

ITEM No. 14

# Fault Location and Troubleshooting Procedure

## Fault Location and Troubleshooting Procedure

- Teams will be deployed at fault location along with equipment.
- The latest equipment with facility of pin pointing underground cable fault will be available to minimize the maintenance time.
- Testing equipment for locating faults in CT, PT etc to check internal faults will be made available with qualified testing engineers.
- Team of engineers with different skills will be deployed for relay testing, breaker testing and Cable Testing.
- Automatic isolation of faulty portion will be done by relays and SCADA system.

# Part J.15
# Emergency Provisions

ITEM No. 15

# Emergency Provisions

## Emergency Provisions

- Fire Tenders with at least state of art equipment will be available.
- Automatic alarms will be initiated in any emergency conditions.
- SCADA will be used to cut off the lines or consumer supply from remote to minimize the affect of any fire etc.
- Ambulances with medical Aid will be available to help any medical emergency.
- The communication system will be designed to minimize reporting time to limit the loss.

# Part J.16
# Patrolling and Inspection Procedures

ITEM No. 16

# Patrolling and Inspection Procedure

## Patrolling and Inspection Procedure

- Routine day/Night patrolling of cable route and overhead lines route will be carried out with trained staff. (The inspection sheet will be available with these teams).
- The inspection teams/patrolling team will notify any emergency condition by mobile phones and/or UHF sets (if allowed by government) to dispatch maintenance crew.
- The team will also contact load dispatch centre and control room for any emergency shutdown.
- The patrolling team will also look for any encroachments on the route of cables and distribution lines.
- The standard operating procedure (SOP) will be prepared for patroiling teams.

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# Part J.17
# Customer Service Data / Manuals

ITEM No. 17

# Customer Service Data / Manual

## Customer Service Data / Manual

- The customer service data shall be computerized for each customer.
- Each transformer and feeder pillar box shall be marked for identification.
(For example transformer 5-2 means, Transformer No.2 of Sector No.5).
- Feeder Pillar 5-2/3 means, Feeder Pillar No. 3 fed through transformer No.2 of Sector No.5.
- Similarly out-going service cable and number shall be identification for each customer along with date of installation, connected load etc.
- Thus a customer data base shall be generated and maintained for ready reference.

RIAA
Barker
Gillette

# Part J.18
# Billing and Collection Procedures

ITEM No. 18

# Billing and Collection Procedures

## Billing and Collection Procedures

- Automatic Meter Reader (AMR) shall be introduces in DCK along with advance metering Infrastructure
- Automatic Meter Reading and computer generated bills shall be produced which will be payable in any bank branch including bank branches in DCK

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# Part J.19
# Protection, Control and Measuring Instruments

ITEM No. 19

# Protection, Control and Measuring Instruments

## Protection, Control and Measuring Instruments

Protection System shall be designed to protect all the essential equipment installed in the electrical network of DHA City, Karachi. The general aim of the protection equipment shall be to isolate every fault on the network with reliability, speed, selectivity and simplicity, avoiding unnecessary operation and in the minimum time possible. The protection system shall comprise state of the art, high speed, highly sensitive numerical relays and associated equipment. Relays shall have the provision for SCADA and telecom facilities. The protection system shall be designed in such a way that it shall facilitate easy maintenance and repair of the components. All components shall be suitable for the local climatic conditions.

## Transmission Lines Protection

Distance relays, in conjunction with tele-signalling, shall be used as primary protection for high speed fault clearance on transmission line with maximum sensitivity and selectivity. Over current relays for phase and earth faults shall be used as back-up protection. The pilot wire differential protection shall be provided for underground transmission feeders.

## 132/11 kV Power Transformers Protection

Differential protection shall act as the main protection for the 132/12 kV transformers. HV and LV Over-current and Earth Fault Relays shall be provided for transformer back-up Protection.

## 11 kV Feeder Protection

Protection of 11 kV feeders shall comprise over-current relays for phase and earth faults.

Effective grading between the over-current and earth fault relays of the outgoing feeders at grid stations and those relays at the downstream 11 kV network shall be ensured.

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## Protection, Control and Measuring Instruments

**Distribution Transformer Protection**

The distribution transformers shall step down the voltage from 11 kV to 415 Volts. Protection of these transformers shall comprise over-current and earth fault relays on HV side.

Energy measurement system shall be incorporated at suitable points in the network to measure energy exported to various feeders and circuits. The distribution losses will be monitored through smart metering/grid systems. All measuring instruments shall have the provision for connection to SCADA/HMI.

The controlling of high voltage elements will be through HMI. All control and measuring instruments will be according to IEC/IEEE standards.

# Part J.20
# Metering and Testing Facilities

ITEM No. 20

# Metering and Testing Facilities

## Metering and Testing Facilities

Energy measurement system is designed to calculate energy in and out from Power Transformer and energy exported to various Medium Voltage (11kV) feeders and 132kV transmission circuits.

All metering instruments, summation equipment and tele-metering instruments are designed to be of the smart IED/AMR type and are designed to communicate with the DISCO-SCADA system.

The energy meters shall be compliant to following standards:

- IEC 62052-11
- IEC 62053-21
- EN 50470-3
- IEC 62053-22
- IEC 62053-23

The metering devices shall allow to measure MWh or kWh and MVArh or kVArh and as an option measuring of import and export of active and reactive energy in the same instrument.

The combination meters (kWh/kVArh) shall be able to register the two rate MWh- or kWh-tariff (two registers) for one direction, or a single rate MWh- or kWh-tariff for two directions (import/export), a single rate MVArh or kVArh tariff for leading and lagging reactive energy (two registers).

ITEM No. 20

## Metering and Testing Facilities

The meter shall have two independent electronic output contacts (one for MWh or kWh and one for MVArh or kVArh) for re-transmitting to an external totalizer.

Two other independent output contacts for retransmitting to a tele-metering or supervisory control system are required. These potential free output contacts shall be mercury wetted and bounce free and equipped with a built-in contact protection.

A very long life time of about $25x10^{+9}$ pulses shall be guaranteed.

The MWh- or kWh-meters the accuracy shall be of class 0.2S according to IEC 62052-11 and IEC 62053-22, the MVArh- or kVArh-meters shall be of class 3.

The meters must be able to register very low initial reading, i.e. shall start at less than 0.05 % of the load.

On-site calibration facilities shall be provided to enable the service engineer to modify/offset the error curve with defined very small values/steps.

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# Part J.21
# Communication Systems

ITEM No. 21

# Communication System

## Communication System

### A) HMI/SCADA SYSTEM

SCADA System shall be used to collect data from instruments and sensors located at remote sites and to transmit data at load dispatch centre (LDC) DCK City, Karachi for monitoring and controlling purpose. The collected data from sensors and instrument shall be viewed on one or more SCADA host computers HMIs that will be locate d at Load Dispatch Centre DCK City Karachi. Based on the information received from the remote stations, automated or operator-driven supervisory commands can be pushed to remote station control devices which are then referred to as Field device.

**SCADA Layout at DCK City:**

**i) Outstation Process Scheme**

The process interfaces for acquisition of process information and control data output to the process in the outstations, Remote Terminal Units RTUs shall be installed at outstations (grids and generating stations) and master station (Load dispatch Centre).

**ii) Telecommunication Scheme**

Telecommunication network will be provisioned with a Fiber Optic FO main digital backbone ring of 16 single mode fibers and intermediate digital rings of power line carrier PLC and pilot cable PC links. Telecommunication equipment transmits data up to the LDC.

**iii) Tele-Control Interface Scheme**

The data communication between LDC and outstations will be performed on basis of an IEC Telecontrol Communication Protocol 60870-5-101 synchronized by GPS based clock system. Redundant TCI server scheme serves as an interface between outstation and master station.

ITEM No. 21

## Communication System

### B) HUMAN MACHINE INTERFACE (HMI)

The human machine interface (HMI) is the interface between the SCADA/EMS and the user. HMI shall provide interactive user-guide, fully mouse supported navigation and operation, automatic updating of linked data in network diagram and tables, Dynamic coloring in network diagrams depending on the status of the represented network segment (e.g. voltage level, source of energy, de-energized, grounded, etc.), support of multi-window operation with as a minimum 4 windows per screen for all video display units (VDUs). HMI shall support multi-screen operation using drag and drop, zooming, panning, and undo functionality. The HMI shall support the world map concept.

### C) RTU and Outstations Equipment/Services

RTU shall have 100% capacity for signals and 50% for additional load. Cabling works and data communication equipment to small RTU comprising RTU/SCADA Interface cabinet(s), etc required for a complete installation. This will be required for interfaces between HMI Automation systems to LDC DCK through SCADA RTU system.

**Modems**

The modems will be used to provide installed data transmission.

### Telecommunication Media

The telecommunication media shall provide the means for transportation of information from DCK Grid to various destinations.

ITEM No. 21

# Communication System

## Architecture of the Telecommunication Network

### Fiber Optic Link Equipment

The telecommunication network shall require the implementation of optical terminal equipment to establish complete fiber optic links.

### Optical Line Terminal Equipment (OLTE) Design

The OLTE shall be based on SDH hierarchy with transmission at the STM-1 level (155.52 Bit/s), with capability to be upgraded to higher transmission speeds of STM4, STM16, STM64.

### OLTE sizing

The STM-1 SDH equipment shall be equipped and wired to meet the project channel requirements

### Alarm and test functions

All of the important system parameters shall be continuously monitored and an alarm signal shall be initiated whenever any system parameter deviates from the set limits. Test function of alarm indicators to ensure workability of alarm indicators.

### Power supply

The equipment shall be powered from 48V DC (power supply voltage range shall be from 40 to 58V DC).

### Optical Distribution Frame (ODF) Design

An ODF shall be provided to act as an interface between the approach fiber optic cable and the optical line terminal equipment for performing optical isolation, which might be required either during testing/commissioning or during the routine maintenance.

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## Communication System

### Approach Fiber Optic Cable Design

The fiber optic cable shall be designed to withstand all prevalent environmental conditions including the effects of high electric and magnetic fields produced in proximity of live power cables.

### Cable type

The fiber optic cable shall be of the single mode type equipped with at least 16 fibers complying with ITU-T recommendation G.652 and shall be suitable for underground installation and laying in trenches/cable trays.

### Fiber optic cable requirements

The cable shall be fully moisture-resistant and meet the longitudinal water tightness test requirements. Considering there is a potential danger through fault or leakage currents, the cable must be non-metallic. The cable shall suitably withstand the mechanical radial stresses and shall be protected against rodents and termites. The crush resistance shall be at least 2kN/10cm. The operating temperature range shall be 0 to +70°C and the cable shall be suitable for operation in tropical climate with humidity approaching 100%.

### DIGITAL MULTIPLEXER EQUIPMENT

The equipment shall work as the access equipment for fiber optic, digital microwave and HDSL links. Multiplexer racks (separate from that used for OLTE/HDSL) shall be provided for connection to digital microwave radio.

### Multiplexer sizing

The digital multiplexer shall be equipped and wired to meet the project channel requirements

ITEM No. 21

## Communication System

and sized for the spare capacity:

**Equipment design**

The Multiplex Equipment shall be based on Pulse Code Modulation (PCM) techniques. The equipment shall be universal, software-controlled, through Windows based network management system (with direct and remote monitoring and management). It shall be equipped with various interface cards for connection to the facilities i.e. voice, protection signaling, data, alarms, etc. and multiplex them into the standard digital 2MBit/s stream.

**Protection Signaling**

Protection signaling shall be used for operating the distance relays in carrier aided schemes and for direct transfer trip functions in case of breaker failure contingencies.

**Equipment functions**

Two (2) command signals for 132kV network; one signal for operating the distance protection in any of the specified carrier aided schemes and the other for the direct trip function.

**Digital Protection Signaling Equipment**

Digital protection signaling equipment shall be provided for secure and dependable transmission of protection trip signals.

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# Part J.22
# Training and Development

ITEM No. 22

# Training and Development

## Training and Development

- In house training facilities will be available to train employee, skilled and professional and managers.
- Safety trainings will be conducted in routine.
- Specialized training for equipment will be given by manufacturers.
- On-job training shall be imparted during construction of the installations
- Maintenance and operation manuals shall be available to train engineers for following :

— Overall maintenance and monitoring of the grid station + distribution system.

— Circuit breakers, operating mechanism testing, routing maintenance.

— Monitoring and testing of power transformer, current and voltage transformer and routine maintenance.

— Protection relays.

— Operations indications, testing including control and indicating instruments.

— Distribution transformers switchgear and metering.

— MV feeders and distribution lines lying and maintenance.

— Earthing systems and its routine testing and measurement.

# Part J.23

# O&M Operators

ITEM No. 23

# O & M Operator

## O & M Operator

Operation and Maintenance of Distribution System shall be carried out by the proposed DISCO.

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# Part J.24
# Safety Protocols

## Safety Protocols & Standard Operating Procedure (SOP) For HT/LT Distribution System

**1.0 Objective**

1.1 To assure safe work place and environment for maintenance, operation at HT / LT distribution network and street lights.

1.2 Promote and facilitate continuous improvement of electrical safety policies and practices.

**2.0 Scope**

2.1 This SOP (Standard Operating Procedure) shall apply to all employees working on HT / LT lines, on-site contractors, subcontractors and any other related person, to prevent electrical and related hazards.

**3.0 Safety Tools (STs), Personal Protective Equipments (PPEs) for Supervisor (electrical) and Line Man**

3.1 Before starting any work at site, Personal Protective Equipments and special tools shall be provided to each Foreman / Sub-Engineer or as deemed necessary to concerned staff deputed to HT / LT mains and all related work at site.

| | | |
|---|---|---|
| 3.1.1 | Binoculars | 1 No |
| 3.1.2 | Tong Tester | 1 No |
| 3.1.3 | Stopwatch | 1 No |
| 3.1.4 | Magnifying glass | 1 No |
| 3.1.5 | Earth resistance Tester | 1 No |
| 3.1.6 | High Voltage Detector (Live Line Tester) (Handy type) | 1 No |
| 3.1.7 | Megger | 1 No |
| 3.1.8 | Measuring Tape | 1 No |

**3.2 Personal Protective Equipments (PPEs) and tools shall be provided to every HT / LT field staff as per nature of job**

3.2.1 PPEs shall be provided to every field staff as per nature of job. Following are the minimum requirement of safety devices and special tools;

3.2.1.1 Rubber Gloves, Gauntlets and Rubber Mats for HT/LT in addition to Rubber Sleeves.

3.2.1.2 Full body harness with front position Safety Belt.

3.2.1.3 Safety Boots.

3.2.1.4 Insulated Safety Caps with chin strap and face shield.

3.2.1.5 Leather Protective Gloves.

3.2.1.6 Safety Clothing.

3.2.1.7 Safety goggles / Face shields.

3.2.1.8 Vehicles (Trucks / Testing Van / Motorized Travelling Ladder (MTL).

3.2.1.9 Rain Coat

3.2.1.10 Gum Boot

3.2.1.11 Live Line Tester

3.2.1.12 Discharge Rods

3.2.1.13 Ground rod

3.2.1.14 First Aid Tool Box to be provided in each MTL /Trucks/Testing Van.

3.2.1.15 Warning tapes and cones

**3.3 Standard Tools / equipment**

| | | |
|---|---|---|
| 3.3.1 | Cutting pliers, 8 inches (insulated) | 1 No |
| 3.3.2 | Screw driver, 8 inches & 12 inches (insulated handle) | 1 No |
| 3.3.3 | Steel wire Brush | 1 No |
| 3.3.4 | Tool bag | 1 No |
| 3.3.5 | Pen knife | 1 No |
| 3.3.6 | Spanner set (12 pieces) | 1 Set |
| 3.3.7 | Hack saw blade with insulated frame | 1 Set |
| 3.3.8 | Test Lamp (single and double) | 1 Set each |
| 3.3.9 | Torch & battery cell | 1 No |
| 3.3.10 | Rubber Mat | 1 No |
| 3.3.11 | Gas Pliers (10 inches) | 1 No |
| 3.3.12 | Tester | 1 No |
| 3.3.13 | Fuse Puller | 1 No |

| | | |
|---|---|---|
| 3.3.14 | Canvas Bucket with land line 15 m | 1 No |
| 3.3.15 | Danger sign board / flag for placing at road | 1 No |
| 3.3.16 | Danger sign board / flag for fixing at pole | 1 No |
| 3.3.17 | Crimping tool (hand / foot operated). | 1 No |

**3.4 Movement of MTL and field staff at place of work**

In no case MTL driver will place the MTL near site of work unless directed by Site / Field In-charge i.e. AE / Supervisor / Lineman (L/M). This will only be done after the supervisor obtains prior clearance from AOC that correct feeder (s) has/have been shut down. To confirm, he will hand over the phone to L/M concerned to verify what has been told by SBO. All gang members should strictly comply with the instructions issued by Field In-charge from time to time.

**4.0 General instructions / safety rules and operation procedures**

In order to avoid accidents of personnel working on distribution network, following safety rules and standard operating procedure shall be ensured strictly.

**4.1 Disconnect**

4.1.1 Disconnect / isolate and dead (ground / earth) the particular portion of network on which shut down is to be arranged, for carrying out a specific work, by managing necessary sequence of operations, as per the area network position at that location.

**4.2 Test for absence of voltage / supply**

4.2.1 After disconnecting / isolating the specific portion of network through required sequence of operations, Supervisor (Electrical) should check & verify for dead / no supply status with Live Line Tester. Tester must be tested for healthiness on live line prior to checking for no voltage / dead.

**4.3 Discharge, short circuit and earth**

4.3.1 MTL's to be placed away from the system and not positioned at the work site till confirmation of feeder shut down.

4.3.2 To avoid distraction while working, no phone calls to be made to L/M after they have been dispatched, any emergency call may be made to accompanying Karkun (skilled helper) or supervisor.

4.3.3 Lineman will discharge all the three phases of the required portion of network with discharging rod / stick and then short & ground all three phase by connecting it to earth point.

4.3.4 Grounding of equipment must be checked for healthiness in the portion need to be shutdown, there must be at least one healthy point (where the portion of the network to be shutdown can be effectively grounded) ground terminal resistance must be less than or equal to 1Ω.

4.3.5 The short circuiting equipment must first be connected to the earth then short circuiting of the conductors/parts are carried out. At the time of normalizing the shutdown reversed procedure is to be adopted i.e. the short circuiting equipment would be disconnected first from the conductors / poles then from the earth /ground terminal.

**4.4 SAFETY PRECAUTIONS FOR EARTHING**

4.4.1 The precautions mentioned below should be adapted to the extent applicable and possible.

- Examine earthing devices periodically and always prior to their use.
- Use only earthing switches or any other special apparatus where provided for earthing.
- The earthing device when used shall be first connected to an effective earth. Then other end of the device shall then be connected to the conductors to be earthed.

Ground and short all three phases

- Earthing should be done in such a manner that the persons doing the job are protected by earth connections on both sides of their working zone.
- All the three phases should be effectively earthed and short circuited though work may be even proceeding on one phase only.

4.4.2 Short circuit and ground points should be well within the visual range of the place of work, otherwise, the nearest switching point must also be short circuited and grounded.

4.4.3 Overhead lines if any should additionally be short circuited and earthed at the switching points.

4.4.4 Before the start of work a final check must be made by the supervisor to ensure that proper short and earth have been provided.

**4.5 Guard and barrier to live parts**

4.5.1 To keep abreast / informed of every one about the work in progress, live parts and isolated / dead points must be segregated by using prominent warning / danger boards / signs by site supervisor.

4.5.2 Put warning sign / board as **"DO NOT TOUCH, EQUIPMENTS ARE ALIVE, WORK IN PROGRESS"** (Also in Urdu).

**4.6 Safety Procedural Precautions**

4.6.1 To avoid occurrence of accidents to the personnel / staff, working on distribution network, the sequence of following operations and the standard operating procedures, must be adopted by authorized employee of concerned Operation section being familiar with the network and not by any other person.

4.6.2 An electrical supervisor of operation section must be trained to carry out electrical work, and have received sufficient / detailed instructions as how to operate the VCB, he must be well aware of the dangers involved during operation of equipment as well as he is supposed to be familiar with all defined protective measures involved therein. After arranging the shutdown, all operations carried out must be recorded properly in a Log Book.

4.6.3 To avoid distraction while working, no phone calls to be made to L/M after they have been dispatched, any emergency call may be made to accompanying Karkun (skilled helper) or supervisor

4.6.4 The isolated equipment should be protected against being made live again inadvertently or otherwise, by keeping the operating levers and handles or hand operated mechanism in safe custody and place.

4.6.5 Underground cables must be isolated from both ends by identifying it's marking, with reference to the single line network / diagram and then by using an inductive cable locator, before cutting the cable, it must be ensured dead

**4.7 Shutdown request / availing procedures**

Department intend to avail shutdown being arranged on the request of other department must adopt the following procedure:

4.7.1 Availing department will send 'A' Form (duly filled) to the concerned operation section one week prior to the commencement date of shutdown, with purpose and portion of the network needs to be availed during shutdown.

4.7.2 The operation section will check the position of the network and if there would be any area affected due to the shutdown, inform the requesting section about the area affected and for the publication of the shut down through media and Newspapers.

4.7.3 The requesting department will send 'B' Form and the copy of the publication of the shutdown to operation section, at least 48 Hours prior to the shutdown.

4.7.4 The manager / shift engineer operation section will be responsible to mention the operations to be carried out for arrangement of shutdown, by filling up the portion of 'B' Form and will then responsible to send / communicate it to duty supervisor of concerned operation center for arrangement of shutdown.

4.7.5 The authorized supervisor of requesting / availing department will contact operation center with copy of 'B' Form duly signed by Manager (operation), supervisor (operation) center will arrange shut down and fill up the relevant portion of 'B' Form with operations carried out and will give written clearance to requesting / availing department's Supervisor for the commencement of work. After receiving written clearance on 'B' Form from the supervisor of requesting / availing departments, the operation supervisor will reverse the operations as per instruction of duty / shift engineer operation control.

4.7.6 After normalization of shut down, the operation center will send copy of 'B' Form to Manager (operation) for record purpose.

4.7.7 In case of considerable number of operations are required to be carried out for the arrangement of shutdown, such as shutdown of Grid Power Transformer a 'C' Form must be filled by the shift engineer (operation) & must be counter checked by senior engineer / Manager Operation. The 'C' Form will have all details and sequence of operations to be carried out for normalization of shutdown. The shift engineer will send this "C" Form to concerned operation center well before the date and time of shutdown. Supervisor operation centre will arrange shutdown for the date and time mentioned in accordance to the instructions of shift engineer (on duty).

4.7.8 Forced shut down will be arranged in case of area affected or in emergency for which a "B" form would have to be provided to operation section by the requesting section.

**5.0 Working on lines and equipment adjacent to live equipment or lines**

5.1 When working near live lines or apparatus, each man shall take extreme care in moving from one position to another.

5.2 Where impractical to erect barriers between men at work and live parts within reach of their hands and objects being handled, no work shall be carried out until & unless the live line is also made dead & grounded.

5.3 As each member of the gang is responsible for the safety of one another, in view of this "Karkun (skilled helper)" is held responsible for ensuring that Lineman;

- Lineman Wear Harness
- Usage of Live Line Tester by Supervisor for confirmation of absence of supply
- Mobile not used by Supervisor/ lineman while working
- Inspection of MTL ladder before climbing.
- In case, L/M or Supervisor does not listen to Karkun (K/K), when he raises any observation with respect to the above, the K/K should call the dispatch Supervisor /Manager.

**6.0 Arrangement of shut down to work on HT Bus-bar of a Feeder Sub-Station (S/S) [Sub-Station Maintenance (SSM) job]**

6.1 To avoid distraction while working, no phone calls to be made to Lineman / Fitter after they have been dispatched, any emergency call may be made to accompanying Karkun or supervisor.

6.2 For arranging a shutdown, either for attending HT Bus bar fault or for coupling/decoupling of a VBC/Isolator/PT by a SSM gang, in a S/S, where an 11-KV feeder is terminating from a G/S (Grid Station), the Supervisor; Area Operation Center, would arrange the shutdown of the bus bar as follows:

6.2.1 Get the feeder "OFF" with DB (Danger Board) and TFS (Trolley First Staged) from the Grid Station (G/S), through the duty shift Engineer Operation Control and in the S/S put the Incoming G/S side as under:

6.2.2 OFF trolley first staged (TFS) if VCB (Vacuum Circuit Breaker).

6.2.3 OFF and Earth if Isolator

6.2.4 If there are HT B/S (Bulk Supplies) from the S/S, get them isolated from the consumer end side then in the s/s the following operation should be done on the bulk supply Circuit Breaker:

6.2.5 OFF TFS if VCB.

6.2.6 Then all the HT linking cables terminating in the S/S must be isolated and made dead firstly from where the same are energized and then from the other end of the cables as follows:

6.2.7 OFF TFS if VCBs.

6.2.8 OFF and Earth if Isolators

6.2.9 OFF and Earth if PMU.

6.2.10 Leads open and short circuited and Earth if Transformer.

6.2.11 Leads open and short circuited and Earth if O/H or U/G (Under Ground).

6.2.12 Put the VCB of the Local Transformers OFF / TFS.

6.2.13 Put OFF the LT Breaker if exists

6.2.14 Ensure "absence of supply" on each of the LT bus bar of the LT panel, by using "Live Line Tester".

6.2.15 Short all the Phases and Neutral to Earth at the LT panels with an Earthing Rope/wire.

6.3 Give Clearance to work.

6.3.1 On completion of work and clearance by SSM Team, Removing of shorts and grounds, re-energization of the LT circuits and putting ON the LT Breaker will also be carried out by the Operation Supervisor himself.

**7.0 Arrangement of shut down of HT Bus-bar of a Non-Feeder S/S (SSM job)**

7.1 To avoid distraction while working, no phone calls to be made to Lineman / Fitter after they have been dispatched. Any emergency call may be made to accompanying Karkun or supervisor.

7.2 For arranging a shutdown, either for attending HT Bus bar fault or for coupling/decoupling of a VBC/Isolator/PT by a SSM gang, in a s/s, the Supervisor; Area Operation Center, would arrange the shutdown of the bus bar as follows,

7.3 If there are HT B/S (Bulk Supplies) from the S/S, get them isolated from the consumer end side then in the S/S, the following operation should be done on the bulk supply Circuit Breaker:

7.3.1 OFF TFS if VCB.

7.3.2 Then all the HT linking cables terminating in the S/S must be isolated and made dead firstly from where the same are energized and then from the other end of the cables as follows:

7.3.3 OFF TFS if VCBs.

7.3.4 OFF and Earth if Isolators.

7.3. 5 OFF and Earth if PMUs.

7.3.6 Leads open and short circuited and Earth if PMU.

7.3.7 Put the VCB of the Local Transformer OFF / TFS.

7.3.8 Put OFF the LT Breaker if Exists

7.3.9 Ensure "absence of supply" on each of the LT busbar of the LT panel, by using "Live Line Tester".

7.3.10 Short all the Phases and Neutral to Earth at the LT panels with an Earthing Rope/wire.

7.3.4 Give the Clearance to work.

7.4.1 On completion of work and clearance by SSM Team, Removing of shorts and grounds, re-energize and putting ON the LT Breaker will also be carried out by the Operation Supervisor himself.

**8.0 Arrangement of shut down of Local Transformer & its Panel for SSM:**

8.1 To avoid distraction while working, no phone calls to be made to Lineman /Fitter after they have been dispatched, any emergency call may be made to accompanying Karkun, supervisor.

8.2 For arranging a shutdown, either for Replacement of Local Transformer or working on Transformer Bushings, Bushings to LT Panel Leads and replacement of MCCBs a SSM gang, in a S/S, the Supervisor; Area Operation Center, would arrange the shutdown of the Local Transformer and LT Panel as follows;

8.3 Put the VCB of the Local Transformer OFF /TFS/Rack out.

8.4 Put OFF the LT Breaker if Exists.

8.5 Ensure "absence of supply" on each of the LT busbar of the LT panel, by using "Live Line Tester."

8.6 For Base & Grips / MCCB replacement, get all LT circuits be isolated, short and ground at the O/H and also get isolated from consumers side.

8.7 Short all the Phases and Neutral to Earth at the LT panels/Feeder Pillar Box with an Earthing Rope/wire.

8.8 Give Clearance to work.

8.8.1 On completion of work and clearance by SSM Team, the shorts and grounds will be removed by H.T Team while connecting and removing short & ground of the LT cable and putting ON the LT Breaker will be carried out by LT Team.

# Safety Protocols

**9.0 Arrangement of shut down of HT (feeder or linking) cable for UGM:**

9.1 For arranging a shutdown of the Main Feeder Cable for UGM Section for attending its fault or for a system augmentation, the Supervisor; Area Operation Center, would arrange the shutdown of the bus-bar as follows:

9.2 To avoid distraction while working, no phone calls to be made to Supervisor / Jointer after they have been dispatched, any emergency call may be made to accompanying Karkun.

9.3 Get the Feeder "OFF" with DB and TFS from the Grid Station (G/S), through the duty shift Engineer Operation Control and in the S/S put the Incoming G/S side as under:

9.3.1 OFF Trolley First Staged (TFS) if VCB (Vacuum Circuit Breaker).

9.3.2 OFF and Earth if Isolator.

9.4 If HT cable to be shut downed is between two sub-stations having VCBs/Isolators on either side, the cable must be made dead by carrying out the following operations in both the S/S:

9.4.1 OFF Trolley First Staged (TFS) if VCB (Vacuum Circuit Breaker).

9.4.2 OFF and Earth if Isolator.

9.4.3 If HT cable to be shut down is between two Sub-Stations having Circuit Breaker in supply delivering S/S and isolator in supply receiving S/S, then it is very necessary first to put OFF T/L in supply delivering S/S after that isolator in supply receiving S/S should be put "OFF" and "earthed" to make the said cable isolate and dead.

9.4.4 In case of LCF (Linking Cable Fault) the requirement of testing gang is to remove the ground at isolator /RMU/PMU end, otherwise testing would not be possible and it always shows the fault/error.

9.4.5 If HT cable to be shut down is between Two Sub-Stations and on both sides there are isolators then it is necessary to first put OFF both side isolators one by one, by putting OFF the source of supply from a far end s/s in the loop, otherwise, the feeder should be got put OFF with DB from the G/S (Grid Station) for carrying out operations on the isolators.

9.4.6 After that the isolators may be put at "Earth" position in order to isolate and make the said HT cable dead.

**9.5 LT Leads Repair/Replacement work from Distribution Transformer to LT Breaker/Distribution Box:**

9.5.1 To avoid distraction while working, no phone calls to be made to L/M or Fitter after they have been dispatched, any emergency call may be made to accompanying Karkun or supervisor.

9.5.2 Ensure that lineman to wear proper PPEs / SPEs; especially Rubber insulated gloves class'00' with leather protector gloves on both hands before start of work, and should fastened his full body safety harness with front position safety belt, and make sure that the safety belt is properly secured.

9.5.3 (a) Manager/Asst. Manager/Site Incharge of Operation shall be responsible to supervise all the activities at site, if lead replacement/repair is required at the incoming side of circuit breaker.

9.5.3 (b) Manager / Assistant Manager/Site In-charge /substation maintenance (SSM) / In-charge Operation shall be responsible to supervise all the activities at site, if lead replacement/repair is required at the LT bushings of Transformer.

9.5.4 After wearing HT Rubber Insulated gloves along with leather protector gloves on both hands & other PPE's, operation AE / site in charge/Lineman will Switch 'OFF' Transformer from HT side, and check for absence of HT Supply through HT Live Line Tester and isolate Transformer by dropping HT Fuse Link (D.O. Cutout) / Operating Circuit Breaker.

9.5.5 Switch 'OFF' LT Circuit Breaker to avoid any back feeding from LT circuit / Kunda. If no Circuit Breaker is installed, pull out the all three LT HRC Fuses from Distribution Box. Ensure absence of supply at outgoing terminals of circuit breakers/DB through test lamp. Short & ground on all LT circuits (all phases and neutral).

9.5.6 Short & ground HT & LT side of Transformer at bushing terminals.

9.5.7 It is to be ensured by the site in-charge that proper earthing / grounding is available at point of work, in case of non-provision/existence of appropriate grounding , temporary earthing should be used from the nearest available ground.

9.5.8 Now repair/replace the LT lead from Transformer LT Bushing to LT Circuit Breaker/Distribution Box / Panel.

9.5.9 Remove all short & ground from both HT & LT sides after completion of job.

9.5.10 Energize Transformer from HT after getting clearance of site in-charge & afterward switched 'ON' LT circuit breaker.

9.5.11 In case no Circuit Breaker is installed, first insert the LT HRC Fuses in Distribution Box/Panel and then get the Transformer energized from HT side.

9.5.12 As each member of the gang is responsible for the safety of one another, in view of this "Karkun" is held responsible for ensuring that:

- Lineman / Fitter Wear Harness.
- Usage of Live Line Tester by Supervisor for confirmation of absence of supply.
- Mobile not used by Supervisor/ lineman/Fitter while working.
- Inspection of MTL ladder before climbing.
- In case, L/M or Supervisor does not listen to K/K, when he raises any observation with respect to the above, the K/K should call the dispatch Supervisor /Manager.

**9.6 LT Lead Repair/Replacement work from LT Circuit Breaker to Distribution Box (DB) & DB to LT mains**

9.6.1 To avoid distraction while working, no phone calls to be made to L/M after they have been dispatched, any emergency call may be made to accompanying Karkun or supervisor.

9.6.2 Ensure that lineman to wear proper PPEs/SPEs, especially Rubber insulated gloves class'00' with leather protector gloves on both hands & safety shoes before start of work, and should

fastened his full body safety harness with front position safety belt, and make sure that the safety belt is properly secured.

9.6.3 In-charge Operations /Asst. Manager /A.E / Site In charge shall be responsible to supervise all the activities.

9.6.4 Put 'OFF' LT circuit breaker.

9.6.5 Verify that there is no voltage at the outgoing side of the circuit breaker.

9.6.6 Remove the LT fuses from DBs / Fuse Boxes connected with circuit breaker.

9.6.7 Short & ground all LT circuits (all phases and neutral) from outgoing side of DBs / Panels.

9.6.8 It is to be ensured by the site in-charge that proper earthing/grounding is available at point of work, in case of non-provision/existence of appropriate grounding, temporary earthing should be used from the nearest available ground. If temporary earthing is not possible then complete HT/LT isolation with shorts to be arranged.

9.6.9 After repair work ensure that all shorts and grounds have been removed, prior to clearance for switching "ON" the supply.

9.6.10 If circuit breaker is not installed / by passed, following shall be followed:

9.6.10.1 After wearing HT Rubber Insulated gloves along with leather protector gloves on both hands & other PPE's, operation AE / site in charge/Lineman will Switch 'OFF' Transformer from HT side, and check for absence of HT Supply through HT Live Line Tester and isolate Transformer by dropping HT Fuse Link (D.O. Cutout) / Circuit Breaker.

9.6.10.2 In-charge Operation /AE shall ensure absence of supply through test lamp at outgoing side of DB. Short & ground all LT circuits (Phase & neutral).

9.6.10.3 HT Operation Lineman shall short & ground (Phases & neutral) HT & LT side of Transformer at bushing terminals under the supervision of AE/Supervisor.

9.6.10.4 It is to be ensured by the site in-charge that proper earthing / grounding is available at point of work, in case of non-provision/existence of appropriate grounding, temporary earthing should be used from the nearest available ground. If no ground is available complete HT/LT isolation with shorts to be arranged.

9.6.10.5 Now repair/replace the LT lead from Transformer LT Bushing to LT Circuit Breaker/Distribution Box/ Panel.

9.6.10.6 Remove all short & ground from both HT & LT sides after completion of job.

9.6.10.7 After getting clearance from site in-charge, insert the LT Fuses in the Fuse Boxes / Panels and then get the Transformer energized from HT side.

9.6.10.8 As each member of the gang is responsible for the safety of one another, in view of this "Karkun" is held responsible for ensuring that:

- Lineman / Fitter Wear Harness.
- Usage of Live Line Tester by Supervisor for confirmation of absence of supply.

- Mobile not used by Supervisor/ lineman/Fitter while working.
- Inspection of MTL ladder before climbing.
- In case, L/M (Lineman) or Supervisor does not listen to Karkun (skilled helper), when he raises any observation with respect to the above, the Karkun should call the dispatch Supervisor /Manager.

**9.7 Replacement of faulty LT Circuit Breaker**

9.7.1 To avoid distraction while working, no phone calls to be made to L/M after they have been dispatched, any emergency call may be made to accompanying Karkun or supervisor.

9.7.2 Ensure that SSM Fitter to wear proper PPEs/SPEs, especially Rubber insulated gloves class'00' with leather protector gloves on both hands & safety shoes before start of work, and should fastened his full body safety harness with front position safety belt and make sure that the safety belt is properly secured. Transformer platform foundation must be assured for safe working of the staff.

9.7.3 Asst. Manager / A.E / Site Incharge substation manager (SSM) shall be responsible to supervise all the activities.

9.7.4 After wearing HT Rubber Insulated gloves along with leather protector gloves on both hands & other PPE's, operation AE / site in charge/Lineman will Switch 'OFF' Transformer from Transformer HT side, and check for absence of HT Supply through HT Live Line Tester and isolate PMU by dropping HT Fuse Link (D.O. Cutout) / Circuit Breaker.

9.7.5 Pull out the LT HRC Fuses from DBs / Panels. Ensure absence of supply at the outgoing side of BD/fuse box through test lamp. Short & ground all LT circuits (All phases and neutral). Short and ground all LT circuits by Operations Team.

9.7.6 Short & ground HT & LT side of Transformer at bushing terminals.

9.7.7 It is to be ensured by the site in-charge that proper earthing / grounding is available at point of work , in case of non-provision / existence of appropriate grounding , temporary earthing should be used from the nearest available ground. In other case, HT/LT to be isolated with shorts to be arranged.

9.7.8 As each member of the gang is responsible for the safety of one another, in view of this "Karkun" is held responsible for ensuring that;

- Lineman / Fitter Wear Harness.
- Usage of Live Line Tester by Supervisor for confirmation of absence of supply.
- Mobile not used by Supervisor/ lineman/Fitter while working.
- Inspection of MTL ladder before climbing.
- In case, L/M or Supervisor does not listen to K/K, when he raises any observation with respect to the above, the K/K should call the dispatch Supervisor /Manager.

9.7.9 Now replace the faulty circuit breaker.

9.7.10 Remove all short & ground from both HT & LT sides after completion of job.

9.7.11 Energize Transformer from HT after getting clearance from SSM team in-charge & afterward switched 'ON' LT circuit breaker to check it at 'NO' load.

9.7.12 Switch 'OFF' circuit breaker & check for no voltage at outgoing side of the circuit breaker.

9.7.13 Insert the LT HRC Fuses in the DBs / Panel and then put 'ON' the circuit breaker.

**9.8 Responsibilities of Supervisor (HT/LT)**

9.8.1 MTL's to be placed away from the system and not positioned at the work site till confirmation of feeder shut down given by supervisor.

9.8.2 To avoid distraction while working, no phone calls to be made to L/M after they have been dispatched, any emergency call may be made to accompanying Karkun or supervisor.

9.8.3 Supervisor shall brief the following to field staff before the commencement of work to be executed:

9.8.3.1 About description of job/activity to be performed or executed.

9.8.3.2 SOPs / work instruction for execution of job and also brief to perform assigned job as per company Standards / Specification / work practice.

9.8.3.3 The field staff for possible hazards & associate risks with the task / activity shall involve and discuss with the participants their feedback and invite suggestions for improvement of safety during performing of task/activity.

9.8.3.4 The mandatory use of PPE (Personal Protective Equipment) during the job.

9.8.3.5 Shall check & verify all mandatory tools / PPEs are available, appropriate & fit for purpose.

9.8.3.6 Shall ensure that all field workers are competent, aware of the task; understand their roles / responsibilities & familiar with the hazards & controls to be implemented.

9.8.3.7 Employee supervising or directing the work will be held responsible for enforcement & shall hold off part or all the work until the required PPE's are in place.

9.8.3.8 In no circumstances shall the lineman be allowed to work wearing only rubber or leather protector gloves. To attend any fault both Rubber insulated gloves and leather protector gloves shall be worn on both hands.

9.8.3.9 Karkun / helper shall not be allowed in any case to work as a line man.

9.8.3.10 HT & LT short & ground to be removed by HT & LT gangs respectively.

**9.9 Responsibilities of Karkun (skilled helper)**

9.9.1 As each member of the gang is responsible for the safety of one another, in view of this "Karkun" is held responsible for ensuring that;

- Lineman / Fitter Wear Harness.
- Usage of Live Line Tester by Supervisor for confirmation of absence of supply.

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## Safety Protocols

- Mobile not used by lineman while working.
- Inspection of MTL ladder before climbing.
- In case, L/M or Supervisor does not listen to K/K, when he raises any observation with respect to the above, the K/K should call the dispatch Supervisor /Manager.

# Part J.25
# Testing Protocols

Item No. 25

# Testing Protocols

## 1. HIGH VOLTAGE SWITCHGEAR & SWITCHGEAR COMPONENTS

All switchgear/switchgear components shall be tested in the Manufacture's work. The manufacturer may be required to carry out any one or all of the tests stated in this Protocol under witness of Employer/Engineer or his authorized representative(s).

Testing of the switchgear and its components shall be performed in line with this Protocol and in accordance with the relevant IEC Standards (as minimum requirement) and other Standards as may be approved by Employer/Engineer.

Acceptance by Employer/Engineer's representative of any unit shall not relieve the manufacturer from any of his performance guarantees or from any other obligations.

Test certificates for each unit shall be submitted along with Bidding Document.

Employer/Engineer reserves the right to perform checks during manufacturing process at any time or all the times. It shall be at the discretion of Employer/Engineer to witness tests on 100%, or any percentage quantity of each lot for routine tests, apart from the type tests, wherever called for.

### Factory Tests

### Type Tests

Evidence shall be given that the proposed switchgear/switchgear components to be supplied under this Contract have been subjected to all type tests at an internationally recognized testing station, like KEMA, PEHLA or equivalent.

An internationally recognized laboratory shall certify the type test reports.

The Manufacturer/Contractor shall submit certified copies of type test certificates covering the proposed switchgear components.

Type tests certificates/reports shall be considered acceptable if they are in compliance with the relevant Standards, acceptable/accredited labs such as KEMA, CESSI etc. with the following conditions:

Type Tests conducted at an internationally recognized laboratory acceptable to Employer/Engineer.

Type test conducted at the manufacture's laboratory and witnessed by representative from an internationally recognized independent laboratory acceptable to Employer/Engineer.

If the presented type test reports are not in accordance with the above requirements, Employer/Engineer may decide to ask for the type tests to be carried out in the manufacture's premises or other places subject to the approval of Employer/Engineer. These tests shall be performed in the presence of an internationally recognized laboratory, which should issue the relevant type test certificates upon successful test.

### Routine Tests

Switchgears and their components shall be subjected to routine tests as per the relevant IEC

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# Testing Protocols

Recommendations. Routine test certificates shall be submitted for Employer/Engineer's review and approval before shipment of the switchgear components.

Following tests shall be performed as routine tests in addition to the standard tests:

- At least one local control cubicle (LCC) shall be tested together with the equipment during factory acceptance tests.
- Speed and timing tests for circuit breakers shall be performed additionally at the factory
- Partial discharge measurements.
- Visual inspection of the switchgear, in order to ensure that all components are mechanically assembled and fixed properly and that there are no imperfections.

## Site Tests

For site tests, the following shall be performed in particular:

- Speed and timing tests for circuit breakers
- Timing tests for Disconnectors and earthing switches
- Humidity/dew point measurement tests of SF6 gas during commissioning three months after that, before issuance of Defects Liability Certificate (DLC), and at each refill operation. Critical dew points are subject to the approval of Employer/Engineer.
- Voltage drop tests during commissioning
- Function interlocking tests
- Power frequency voltage test for switchgear and auxiliary circuits. The power frequency test voltage shall be 65% of the rated voltage for existing busbar extensions (if applicable) and 80% of rated voltage for new GIS.
- Gas leakage test on each bay with hand held gas leakage detector on all seals.
- Partial discharge measurement for 132kV is mandatory.

If applicable, the Manufacturer/Contractor shall prove that the HV circuit breakers are capable of interrupting.

- The capacitive current, and
- The inductive current

For switching of capacitors/shunt reactors under site conditions, both by either performing the relevant tests or by submitting the relevant type test reports plus calculations; to the satisfaction of Employer/Engineer.

The Manufacturer/Contractor shall furthermore advise and guarantee the minimum number of switching operations for the conditions as mentioned above within the arrangement as designed by him.

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# Testing Protocols

## TRANSFORMER

Each of the transformers shall be subjected to inspections and witness tests to be performed at the manufacturer's premises and independent test facilities and at site as approved by the Engineer and Employer.
The Manufacturer/Contractor is obliged to submit a detailed test program including detailed test connections for all dielectric tests - for approval in due time, prior to the tests. Detailed test schedules separately for each unit showing working-day-wise when each of the witness tests will be carried out shall be submitted for approval along with the test program as above.

The tests shall be performed in accordance with the latest issues of the recommendations of the IEC-applicable standards. All tests will be carried out according to IEC- 60076.

### Tests

| | |
|---|---|
| Factory Tests | aaccrding to IEC 60076 |
| Routine Tests | aaccrding to IEC 60076 |
| **Type Tests** | **aaccrding to IEC 60076** |
| **Special Tests** | **aaccrding to IEC 60076** |

### Tests on Transformer Tank and Accessories

- Prior to the acceptance tests, the Manufacturer/Contractor shall submit the following test certificates as a minimum requirement:
- Vacuum test on tank and all other oil-filled compartments (to be applied at 1.5 mbar for at least 5 hours)
- Pressure test on tank and all oil-filled compartments at min. 1.0 bar measured on tank bottom for at least 24 hours
- Ultra-sonic tests on tank cover and self-supporting tank bottom
- Insulating oil used during factory tests and at site
- Bushings
- Current transformers
- Buchholz relays
- Tap changers and related equipment

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# Testing Protocols

## Pre commissioning tests at Site (Minimum Requirements)

The following precommissioining tests shall be performed at site after installation of transformer is complete, all parts are assembled, centrifuging of oil complete and any other work needed to make transformer ready for such tests. Below is minimum requirement:

Measurement of the excitation current with low voltage (AC, 3-phase) when the transformer is completely de-magnetized

- Oil tightness test on tank at 0.3 bar over oil level, 24 hours
- Measurement of voltage ratio at all tap positions
- Check of vector group by voltmeter method
- Measurement of winding resistances at all tap positions
- Measurement of the winding insulation resistances
- Measurement of the insulation resistance between the core and tank at Measurement of the insulation resistances on auxiliary wiring at 1000V, DC
- Measurement of the dielectric strength of the insulation oil
- Measurement of tan $\delta$ value of oil
- Dissolved gas-in-oil analysis
- Check of water content in ppm. for oil
- Re-calibration and current injection test on winding temperature indicators (45 min.)
- Functional test on cooling plant, including check of rotation direction of motors
- Functional tests on control and supervisory equipment
- Functional tests on OLTC equipment
- Visual checks.
- Any other test as required by Engineer and Employer before commissioning .

# Testing Protocols

## 3 AC & DC AUXILIARY SYSTEM

### TESTS

**Workshop Tests**

At least the following tests shall be performed in the manufacturer's workshop on the individual apparatus and on the complete installation, respectively, all in accordance with latest issue of IEC 60439-1/standards:

- Power frequency HV tests;
- Dielectric tests of the auxiliary circuits;
- Functional tests (to be repeated at site);
- Check of the operational sequences;
- Output voltage stability and ripple factor (for the batteries);
- Check of the denominations.

**Tests at Site**

The complete switchgear and, as far as reasonable, the individual apparatus shall be tested at site as follows:

- High voltage test;
- Visual inspection;
- Dielectric test;
- Functional test.

The Contractor shall submit at an early date proposals for site tests to the Engineer at Site accompanied by test sheets and details of test instruments to be used. All Site tests shall be agreed upon mutually and in particular tests also to be witnessed by the Employerer shall be organized well in advance.

# Testing Protocols

## 4. CABLE

### Tests

Tests shall be performed at independent institutes or at the Contractor's premises if approved by the Engineer, and at site (if applicable), in the presence of the Employer/Engineer.

The Contractor shall fabricate the cable lengths necessary for the tests, over and above those within the Scope of Supply, and to furnish them for the tests free of charge.

The Employer/Engineer is entitled hereby to specify in detail from which part of the total Scope the samples for testing shall be taken.

The Contractor shall furthermore forward copies of all original test lab readings to the Engineer, if so required.

Before energizing a cable circuit, including all accessories, tests shall be performed on the complete installation. The same tests, except the high voltage test, shall be repeated before issuance of the Defects Liability Certificate.

For the pressure tests of high voltage power cables at site, the Contractor shall make available a suitable DC cable testing set.

The tests shall be performed as follows:

Tests for the HV-XLPE Cables and their Accessories

**Type tests for cable outer covering:**

- Construction and dimensions (IEC 60811)
- Mechanical properties (IEC 60811)
- Carbon black content
- Water and saline absorption test (IEC 60229)
- Shrinkage test
- AC withstand voltage test (IEC 60229)

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- AC voltage test (10 kV/30 min and then increase in 10 kV steps of 10 min duration each up to min 95 kV)
- Impulse withstand voltage test (50 kV ± 10 Imp.) (IEC 60230)
- Impulse voltage test to breakdown (40 kV/-3 Imp. step)

Type test for cables and their accessories:

Generally, the standards of SS 4241417, IEC 60840 and IEEE 48 shall be applied.

In addition, the following shall be performed:

Water and saline absorption test of the insulation;

Shrinkage test of the insulation.

Special cable tests according to:

SS 4241417, VDE 0263, IEC 60840 and IEC 60811.

In addition, the following shall be performed:

Impulse test 1.54 x BIL at + 20°C, each 3 negative and positive impulses;

Dielectric test 3 x $U_0$ for 4 hours;

Measurement of metal sheath thickness (IEC 60141, 13.2), weights of copper, lead and steel per meter for adjustment of metal prices for final Contract Value.

Routine cable tests according to IEC 60840.

In addition, the following shall be performed:

Conductor resistance test (IEC 60228);

Capacitance test;

Dielectric loss angle test;

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Test on corrosion - resistant covering (IEC 60229).

Tests after installation including all accessories:

According to IEC 60840.

In addition, the following shall be performed:

DC conductor resistance test (IEC 60228);

Capacitance test;

DC sheath test (10 kV/1 minute) between metallic sheath/ screen/armouring including cross bonding system, etc. and ground;

Earthing measurements;

Visual and function test of cross bonding system and cable sheath temperature measurement system;

Positive/negative and zero sequence impedance measurements.

Subsequent repeat tests (after guarantee period).

DC sheath test (5 kV/1 minute) between metallic sheath/ screen/armouring including cross bonding system, etc. and ground;

Single type tests may be waived if satisfactory type test certificates are submitted before Contract signature.

**Tests for MV-XLPE Cables**

Type tests for cable outer covering:

- Construction and dimensions (IEC 60811)
- Mechanical properties (IEC 60811)
- Carbon black content
- Water and saline absorption test (IEC 60229)
- Shrinkage test
- AC withstand voltage test (IEC 60229)
- AC voltage test (10 kV/30 min and then increase in 10 kV steps of 10 min duration each up to min 95 kV)
- Impulse withstand voltage test (50 kV ± 10 Imp.) (IEC 60230)
- Impulse voltage test to breakdown (40 kV/-3 Imp. step)

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Type test for cables and their accessories:

Generally, the standards of SS 4241417, IEC 60502, 60840 and IEEE 48 shall be applied. In addition, the following shall be performed:

Water and saline absorption test of the insulation;

Shrinkage test of the insulation.

Special cable tests according to:

SS 4241417, VDE 0263, IEC 60502, 60840 and IEC 60811.

In addition, the following shall be performed:

Impulse test 1.54 x BIL at + 20°C, each 3 negative and positive impulses;

Dielectric test 3 x $U_0$ for 4 hours;

Measurement of metal sheath thickness (IEC 60141, 13.2), weights of copper, lead and steel per meter for adjustment of metal prices for final Contract Value;

Routine cable tests according to IEC 60502, 60840.

In addition, the following shall be performed:

Conductor resistance test (IEC 60228);

Capacitance test;

Insulation resistance test;

Test on corrosion - resistant covering (IEC 60229).

Tests after installation including all accessories:

According to IEC 60502, 60840.

In addition, the following shall be performed:

DC conductor resistance test (IEC 60228);

Capacitance test;

Insulation resistance test.

Subsequent repeat tests (after guarantee period).

DC sheath test (5 kV/1 minute) between metallic sheath/ screen/armouring and ground.

Single type tests may be waived if satisfactory type test certificates are submitted before Contract signature.

## 5. MV SWITCHGEAR

Complete switchgear with enclosure, current-transformers, voltage transformers, earthing switch etc, will be subjected to routine & type tests as per latest revision/edition of their relevant IEC Standards.

Type Tests may not be required if the Supplier can submit test reports verifying that relevant type tests have already been performed on essentially same equipment, at KEMA Holland or any other independent testing laboratory of international repute, acceptable to the.

If type tests are not already performed, then manufacture/supplier will arrange the performance of type tests on complete switchgears, at KEMA Holland or an independent testing laboratory acceptable to the Employer/Engineer/ and same shall be witnessed by Employer/Engineer/ representatives.

Routine Tests will be performed, on each equipment, at manufacture's works and will be witnessed by an Engineer nominated by Employer.

The Bidder will submit testing protocol, for type tests and routine tests, for approval of same before arranging any type testing and routine testing as described above.

**SWITCHGEAR AND CONTROL GEAR**

Reference should be made to latest edition/revision ofIEC-62271-102, IEC 62271-1 and other relevant applicable IEC standards

Routine Tests:

The routine tests shall be made with each transport unit and whenever practicable at the manufacturer's works.

a) Power frequency voltage dry tests of the main circuit.
b) Voltage tests on control and auxiliary circuits.
c) Measurement of the resistance of the main circuit.
d) Mechanical operation tests.
e) Tests of auxiliary electrical devices.
f) Verification of the correct wiring.

Type-Tests

a) Tests to verify the insulation level of the equipment, including tests at power-frequency Test voltages on auxiliary circuits.
b) Tests to prove the temperature rise of any part of the equipment and measurement of the resistance of the main circuit.
c) Tests to prove the capability of the main and earthing circuits to be subjected to the

rated peak and rated short-time withstand currents.

d) Tests to prove the making and breaking capacity of the included switching devices.
e) Tests to prove the satisfactory operation of the included switching devices and removable parts.
f) Tests to verify the protection of persons against approach to live parts and contact with moving parts.
g) Tests to verify the protection of persons against dangerous electrical effects.
h) Measurement of the resistance of the main circuit.
i) Radio interference voltage (R.I.V.) test
j) Tests on auxiliary and control circuits
k) Tightness tests

## 6. Current Transformers

Reference should be made to latest edition/revision of IEC-61869-1, 61869-2, and other relevant applicable IEC standards

Routine Tests

a) Power-frequency voltage withstand tests on primary terminals
b) Power-frequency voltage withstand tests between sections
c) Power-frequency voltage withstand tests on secondary terminals
d) Test for accuracy
e) Enclosure tightness test at ambient temperature
f) Pressure test for the enclosure
g) Verification of markings
h) Determination of the secondary loop time constant (Ts)
i) Test for rated knee point e.m.f. (Ek) and exciting current at Ek
j) Determination of the secondary winding resistance (Rct)
k) Inter-turn overvoltage test
l) Partial discharge measurement

Type Tests

a) Short time current test.
b) Temperature rise test.
c) Lightning impulse with stand voltage.
d) Type-test for accuracy.
e) Type test for composite error, current error and phase displacement measurement.
f) Knee point verification.
g) Polarity & ratio.

## 7. Voltage Transformers

Reference should be made to latest edition/revision ofIEC-61869-1, 61869-3, and other relevant applicable IEC standards.

Routine Tests

a) Verification of terminal markings

# Testing Protocols

b) Power-frequency withstand tests on primary and secondary windings
c) Partial discharge measurement
d) Determination of errors according to the requirements of accuracy class.
e) Enclosure tightness test at ambient temperature
f) Pressure Test for the enclosure
g) Physical check and verification of dimension
h) Ratio Test.

Type Tests

a) Temperature rise test.
b) Impulse voltage test.
c) Voltage error and phase displacement test.
d) Polarity & ratio.
e) Short-circuit withstand capability test
f) Electromagnetic Compatibility (EMC) tests

## 8. Post Insulator

Reference should be made to latest edition/revision of relevant applicable IEC standards including following tests to verify the principal characteristics.

Type-Tests.

a) Dry lightning impulse withstand voltage test.
b) Dry switching impulse withstand voltage test.
c) Dry power frequency withstand voltage test.
d) Tests for mechanical strength comprising bending test, torsion test, tensile test & compression test.

## 9. Protective Relays

Reference shall be made to latest edition/ revision of relevant IEC standards.
The type tests results in respect of the following tests are to be furnished.

a) Limits of error.
b) Temperature rise test.
c) Overload test.
d) Contact rating test.
e) Mechanical durability test.
f) Variation of characteristics with ambient condition.

# Part J.27

# Power off-take arrangement information & technical information relating to & power off-take arrangement

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# POWER OFF TAKE ARRANGEMENT INFO

# &

# Technical info relating to power off take arrangement

## POWER OFF TAKE ARRANGEMENT INFO:

For the reliability and availability of power supply, DCK plans to have its own electricity generation capacity of 250-500 MW. The power generation will be mix of conventional & Renewable. DHA has reserved land for establishing conventional & wind, solar, biomass energy power plants.

The energy demand will grow with population increase in DCK and it is expected to rise to 500 MW till year 2040 when it is fully populated. As per the master plan of DCK power generation shall be based on both conventional and Renewable energy sources. The anticipated energy mix of conventional and Renewable generation as foreseen for 500 MW of installed generation capacity is given in Table 1.

*Table 1: DCK Energy Generation Plan by Source*

| No. | GENERATION COMPANIES | SOURCE TYPE | CAPACITY (MW) |
|---|---|---|---|
| 1 | GENCO 1 | Wind Power Plant | 50 |
| 2 | GENCO 2 | HFO/RFO Power Plant | 6 |
| 3 | GENCO 3 | Solar Power Plant | 20-30 |
| 4 | GENCO 4 | LNG Based Power Plant | 125 |
| 5 | GENCO 5 | Solar Thermal Power Plant | 30 |
| 6 | GENCO 6 | Conventional Power Plant | 225 |
| 7 | GENCO 7 | Biomass Power Plant | 20-40 |

DCK is also looking into the possibility of interconnection of its distribution network with:

- K-Electric
- HESCO, Sindh Transmission and Dispatch Company (Pvt) Ltd (STDC).
- Any other bulk power producer, for purchase and selling of power.

Three different sources of power procurement off take for DCK have been identified and their location and routes to DCK have been shown in (Figure-1)

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## POWER OFF TAKE ARRANGEMENT INFO

## &

## Technical info relating to power off take arrangement

**Source-1:** Power supply through K-Electric Grid at KDA Scheme 33, having distance around 32Km to DCK site.

**Source -2:** Power supply through K-Electric Grid soon to be constructed at PirSirhandi having distance of around 25Km to DCK Site.

**Source -3:** Power supply through HESCO Grid/STDC/Lucky Cement having distance of around 8Km to DCK Site.

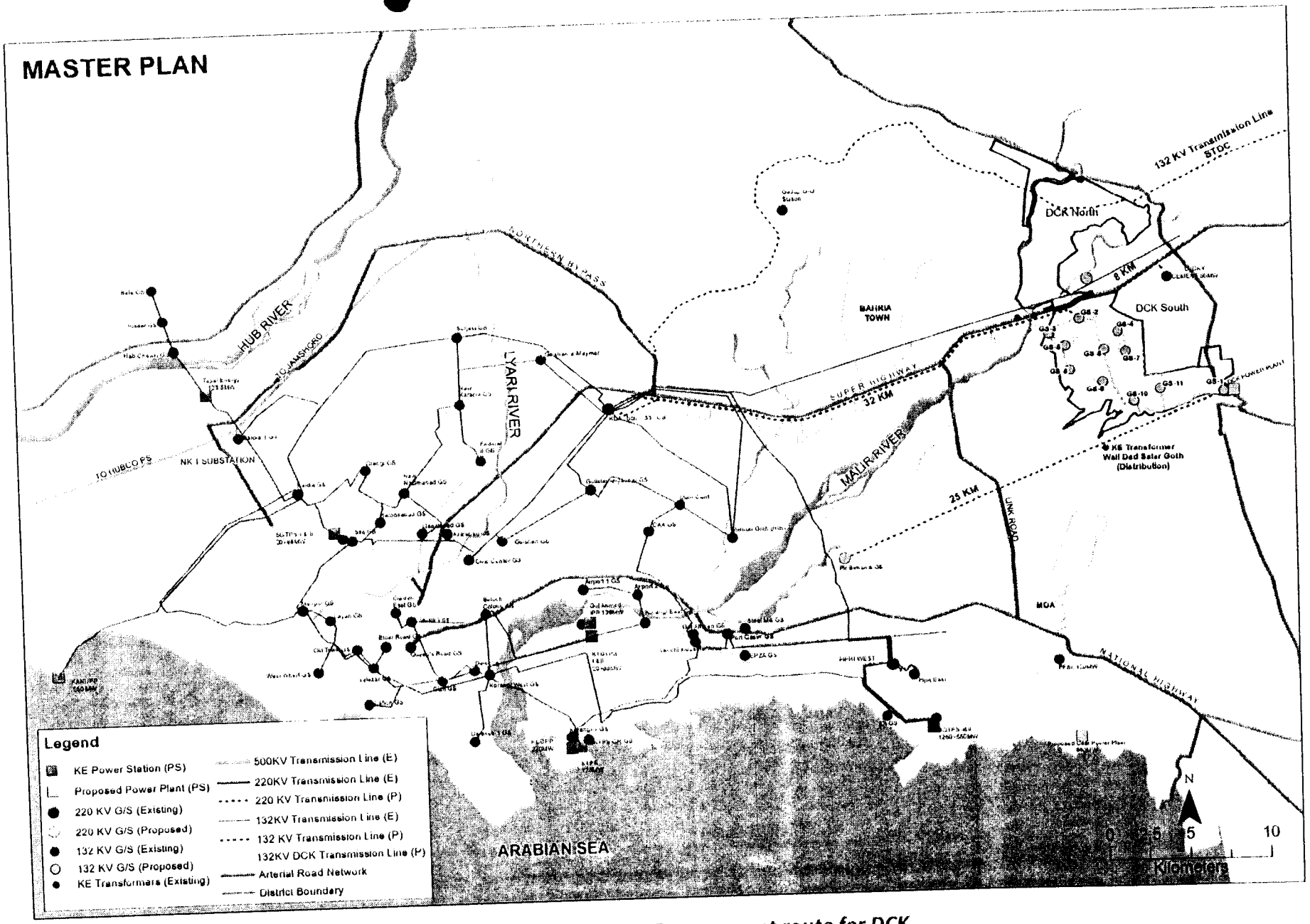


*Figure 1: External Power Procurement route for DCK*

Several options are under consideration to provide the total estimated load demand of 500MW of DHA City, once the city is populated as planned. These Options have been assesses based on bulk electricity import or energy generation by DCK or a combination of both. The Options are placed in Table 2.

***Table 2: Options for Provisioning of Ultimate Power Demand***

| | |
|---|---|
| **Option-1** | |
| **This option considers:** | 100% import (500 MW) |
| Sources of import are: | 1A- From New Port Qasim (Pir Sirhandi GS)<br>1B- From K-Electric KDA 33 GS. |
| **Option-2** | |
| **This option considers:** | 50% import (250 MW) and<br>50% self-Generation (250 MW) |
| Sources of import are: | 2A- From New Port Qasim (Pir Sirhandi GS)<br>2B- From New Port Qasim, Lucky Cement/STDC |
| Self-Generation (250MW): | Wind- 50MW<br>Solar- 60MW<br>Gas & Fossil Fuel- 150MW |
| **Option-3** | |
| **This option considers:** | 100% Self Generation (500 MW) |
| Self-Generation (500MW) Mix | - |
| Shall be: | **Renewable:**<br>Wind- 50MW<br>Solar- 60MW<br>Biomass- 40MW<br>Non Renewable<br>Gas & Fossil Fuel<br>Thermal Power Plant- 350MW |

# Part J.28

# Layout of Electrical Installation Metering & Construction Related Information

ITEM No. 29

## Layout of electric installation metering & construction related info

| S.No. | Dwg. No: | Title of the Drawing |
|---|---|---|
| 1. | 2400-E0, Rev. P0 | Typical Layout Plan 132/11kV GIS Grid Station |
| 2. | 2400-E113, Rev. T0 | Typical Construction Drawing PMU/F.P/MV & LV Cable Laying Details |

Item No. 29

# Layout of electric installation metering & construction related info

## LAYOUT OF ELECTRICAL INSTALLATION, METERING AND CONSTRUCTION – RELATED INFORMATION.

## 1. GIS EQUIPMENT

### 1.1 132 kV Circuit Breaker

Each bay will consist of 1 132kV circuit breaker with the degree of protection IP 54 minimum and highest rated voltage of 145kV. The rated continuous current capacity of the transmission line bays will be 1250A minimum at 50°C ambient temperature. The rated continuous current capacity of the circuit breaker on transmission bays will be 1250A minimum at ambient 50°C, while the continuous current rating of the bus coupler bay breaker will be 2500A minimum at ambient 50°C.

The rated short time making current is designed as 100kA. The breaker will be capable of breaking cable charging and capacitive switching. The duty cycle of the circuit breaker is selected as O - t′- CO-t″- CO - t″- CO , where t′ = 0.3s and t″= 3min

Breaker should be capable of operating according to IEC class M2. The circuit breaker will have SF6 barrier and maintenance will be possible without taking out SF6 gas from other equipment of bus bar.

The breaker will have sufficient number of N/O and N/C auxiliary voltage free contacts for signalling and control signals for local and remote operation. The breaker mechanism will be spring charged. For every close operation there should be enough charge in the spring to open the breaker. The rated short time withstand current will be 40 kA for 3 sec. This short circuit withstand value is selected on the basis of present fault current values keeping in view future expansions in generation and transmission network of K.E. The circuit breaker will be fully compatible for adapting the signals for HMI/SCADA system.

### 1.2 132 kV Disconnectors

Each bay shall have 3 numbers of 145kV motor operated disconnector namely 2 Number bus bar disconnector and 1 Number line/ transformer disconnector. The 2 Nos bus bar disconnector will provide flexibility in transferring the transmission lines of the power transformer from 1 bus to another. With these arrangements, the grid station can also be operated as split bus system to control the load flow in power system.

The provision of the disconnector on both sides of the circuit breaker will also enable in isolating the circuit breaker for maintenance purpose.

All the disconnector will have spring charged mechanism with the DC-motor or universal motor. The spring to operate the mechanism will be automatically charged after every operation. For every close operation there should be enough charge in the spring to open the disconnector while continuous current rating of the disconnector will be 2500A minimum at ambient 50°C.

The disconnector will have sufficient number of N/O and N/C auxiliary voltage free contacts for signaling and control signals for local and remote operation.

### 1.3 1 Earthing Switch

The transmission line bays will have 1 high speed earthing switch with the rated making current of 80kA. The current ratings are selected according to the values available from the short circuit and SCG (single line to ground) studies of the K.E network. The higher values are selected then the present fault current values keeping in view future expansions in generation and transmission.

Rated short time withstand current is recommended as 50kA for 3 sec. Each earthing isolator will have sufficient N/O and N/C. The earthing switch will have sufficient number of N/O and N/C auxiliary voltage free contacts for signalling and control signals for local and remote operation.

### 1.4 132 kV Bus Bar

Nominal system voltage is 132 kV, however equipment will be rated for maximum system kV. Rated short time withstand current will be 40 kA for 3 sec. This short circuit withstand value is selected on the basis of S.C values of the K.E system to which grid station will be connected. The basic impulse level is selected 650/750 kV. Insulation medium will be SF6 gas. Natural air flow will be maintained in design of civil works to provide natural ventilation and cooling of GIS equipment.

### 1.5 Power Transformers- 31.5/40 MVA, 132/12 kV

The power transformers with outdoor bushings are recommended although grid station is GIS type. The reason for such recommendation is that the maintenance requirement for the power transformer with gas filled bushing and connected through SF6 gas filled tubes to GIS is much higher than power transformer with open type bushings.

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## Layout of electric installation metering & construction related info

Each transformer will be designed to have capacity of 31.5 MVA with cooling system of air natural and oil natural (ONAN).

The cooling fans will be installed for enhancing the capacity of power transformer from 31.5 MVA to 40 MVA. The fans will be grouped to operate automatically according to the temperature rise of the transformer oil.

The impedance of the power transformer is recommended as 16% to minimize the short circuit level. The neutral ground resistor (NGR) are also recommended to control the ground fault current with the monitoring system for negative sequence current appearing in case of single phase medium voltage open circuits or uneven capacitors installed on the MV system.

The vector group of power transformer is selected as star connected primary with star connected secondary ($Yy_nd$). The tertiary winding will be designed at one-third rating of the power transformer. The tertiary winding will provide to contain the flow of zero sequence current in case of ground faults and blocking the appearance of zero sequence current in the extra high tension network.

The transformer core will be made of insulated high grade silicon to minimize the eddy current loss. The power transformer will be core types. Each transformer will be equipped with on load tap changer. The bushings on the primary and secondary sides will be outdoor type with creepage distance of 45mm /kV for the highest degree pollution. The power transformer will be equipped with all necessary measuring and protective devices including buchholz relay, pressure relief device, oil level indicator, breather, RTDS, tap changer, protective device ,oil and winding temperature indicators.

All devices shall have provision for signals for annunciator panels in the control room. The signals will be integrated in HMI/SCADA system. The oil of the transformer will meet all the safety standards .

### 1.6 House Transformer:

2 numbers of house transformers will be installed to supply 400/230 volts to Battery chargers, lighting system and other uses.

## 2. PROTECTION EQUIPMENT

Protection System is designed to protect all equipment installed in the grid stations. The state of the art ,high speed, highly sensitive and reliable protection system is recommended.

Some existing protection shall be modified, e.g. in order to coordinate with the new parts all the necessary auxiliary relays, boards, wiring terminals, etc., and shall change the corresponding drawings, erect the necessary equipment and perform the commissioning in accordance with the requirements.

The distance relays shall be numerical type, high-speed, non-switched relays suitable for short, heavily loaded, double or single circuit lines. The distance relays shall be capable of clearing all types of faults selectively.

The relays shall be built-up from plug-in modules and shall be dust-proof and solidly built. All parts shall be accessible for easy inspection and maintenance.
The distance relays shall have provision for operating in the following carrier aided and SDH modes of operation:

i) Permissive under-reach transfer tripping.
ii) Stage Acceleration.
iii) Permissive over-reach transfer tripping.
iv) Directional comparison blocking and un-blocking.

The characteristics of measuring elements for all types of faults shall be directional impedance and shall have Mho, quadrilateral, lenticular or other features to best suit various conditions when the line is subjected to single phase, two phase and three phase faults. The protection shall avoid undesired tripping due to current reversals during switching operations. Phase and ground fault compensation and mutual compensation for parallel lines features shall be incorporated to ensure accurate distance measurement.

The distance protection scheme shall be capable of functioning in conjunction with auto-reclosing relays for three phase tripping and auto-reclosing in case of single and multi-phase faults. Moreover, provisions shall be available to initiate three pole definitive tripping if tripping order is given after time delay. Provision shall also be available to ensure three phase tripping when either breaker at each end is closed manually onto fault on the protected line with the line previously de-energized. In this case the auto-reclose shall be blocked.

The relays shall operate with correct directional sense for zero voltage three phase faults, based on the normal voltage existing at the relay terminals prior to the faults by a

memory unit/module. Provision shall be available to prevent false operation of the unit for loss of voltage due to fault on the secondary side of the voltage transformers. The blocking of false operation shall be faster than minimum first zone operating time.

The distance protection shall be capable of differentiating between power swings and three phase faults and shall block tripping if so desired. It shall be possible to render the power swing blocking function out of service if required.

The scheme shall also be insensitive to the specified range of frequency changes and to the DC component in the fault current.

The distance scheme shall provide at least 3-zone directional detection of all multiphase faults and ground faults. The first zone of the relay shall normally be set to cover 85% of the line lengths and shall operate well within one cycle for all phase and ground faults respectively, within the first zone setting. Individually adjustable timing relays shall be provided for second and third time delayed tripping. Temporary reversal of the second or third directional time step shall be possible.

The starting shall be based on true impedance principle. The starting zone shall also act as a fourth zone with facility for operating in non-directional, directional or off-set modes.

The reach of each zone shall be individually and independently adjustable. Separate setting of the resistive-reach shall also be possible. Each step of operating time shall be sufficiently independent of the magnitude of fault current.

The relays shall have the required reach on each transmission line section, where these shall be applied, without load encroachment. The protection shall function correctly during low fault current.

The residual current compensation value must be adjustable vectorially and between a wide range.

Depending upon the star-point formation of the current transformers (bus side or feeder side) it shall be possible to adjust directional measurement with a switch on the relay without having to modify the wiring. Star-point of the current transformers shall be accessible.

The distance relays shall include fault locations, sequence of events recording, fault recording, stub protections, weak end infeed trip, VT/CCVT MCB failure, supervision feature etc.

Sufficient number of potential free contacts for implementing logical functions and remote signalling of indications and alarms shall be provided.

## 2.1 Earth Fault Relays for 132 kV Feeders

The feeder over-current protection shall consist of the following:

a) Three phase, non-directional, numerical over-current relays, with a variable definite time lag independent of current, for over-current and phase fault protection. The phase relays shall have an independent instantaneous over-current element with a separate trip output. It shall be possible to set the instantaneous element to infinity, to block it, if necessary.

   Setting range of the phase fault elements shall be variable between 50% to 200% continuously or in steps not exceeding 10%. Time setting shall be possible between 0 to 10 seconds continuously or in steps of 0.10 seconds or less. Instantaneous elements shall be adjustable from 100% to 3000% of the time delayed element setting.

b) Single phase, non-directional numerical definite minimum time relay with standard inverse-time characteristics, for ground faults. Earth fault elements shall have setting range adjustable between 10% to 80% continuously or in maximum 5% steps. Time multiplier setting shall be possible between 5% to 100% continuously or in maximum 5% steps. The IDMT relay shall contain instantaneous element adjustable between 100% to 3000% of the time delayed element setting. Infinity setting, shall also be possible to block the instantaneous element, if necessary. Instantaneous elements of the phase and earth fault relays shall have low transient overreach (90%) with a tripping time less than 25 milliseconds. Resetting time shall be less than 50 milliseconds and resetting current shall be greater than 95 percent of the operating current.

## 2.2 Auto-reclosing and Synchrocheck for 132 kV Transmission Feeders

The distance protection schemes shall be designed for automatic, three phase, synchro-checked, single-shot reclosure. The reclosing relays shall include features to operate in conjunction with line protection in any of the permissive under-reach and permissive over-reach transfer tripping, zone acceleration and directional comparison blocking carrier-aided schemes.

## 2.3 Fault Locator for 132 kV Feeders

Fault locators shall be provided at one of the terminal grid stations of each of the new 132 kV feeders.The fault locator operation shall be based on impedance to fault measurements.Fault locator shall function with line distance protection and over-current relays. The fault locator shall be suitable for feeders constructed of solely overhead conductors, partly overhead conductors and partly underground cables, or underground

cables only.The fault locator shall be of an adjustable type to be easily calibrated in kilometres, miles, or in percentage of line length.

## 2.4 132 kV BREAKER FAILURE PROTECTION

The breaker failure scheme shall comprise numerical, high speed relays and auxiliary equipment.Breaker failure shall be detected by sensing whether the fault current is interrupted within a specified time after any of the protective relays controlling the respective breaker has issued a tripping command. If fault current persists beyond the allowable time, local breaker(s) feeding the fault as well as the remote breaker(s) of the feeder whose local breaker has failed shall be tripped. The beaker failure protection shall take into account the position of the disconnecting switches to guarantee a selective protection of the bus-bar zones.

The breaker failure protection for each individual circuit breaker, separately for trip coils 1 and 2, shall be initiated by all other protection devices and also any remote tripping signal which initiates tripping of that breaker. The tripping of circuit breaker(s) through Breaker Failure Relay shall be through independent and separate auxiliary relays and shall not be mixed up with any other protection.

After a period of delay called T1 the breaker failure protection shall generally give a tripping command to both tripping coils of the respective circuit breaker. If this has no effect, the protection shall give a different tripping command after a second period of delay called T 2 to all circuit breakers of the busbar zone concerned in order to interrupt fault current infeed. Provisions for initiating tripping of the remote breaker associated with the failed breaker's feeder shall also be incorporated. The lock-out function of breaker self monitoring (SF 6, N 2, oil pressure etc.) shall effect tripping of the concerned bus zone and initiating of the remote C.B's tripping after the first time step. Tripping of the busbar protection shall also bridge the second time step to initiate tripping of the remote circuit breaker after the first time step.

In case of short circuit between an open circuit breaker and its associated current transformer, the scheme shall provide for operation of the protection system to trip the appropriate circuit breakers. The scheme shall be such that it does not operate incorrectly on un-balanced load current when one pole is open during single-pole auto-reclose cycle.

The breaker failure protection shall comprise three (3) single phase instantaneous over-current relays and an earth fault instantaneous over-current relay for use with external time delay relays. These relays shall have a fast operating time and very fast reset time.

Protection shall provide two stage tripping with an initial trip to its own breaker and time staged tripping to the adjacent breakers.

The phase and earth fault relays shall have adjustable setting range of 20-200% and 10-100% respectively. The measuring relays and timers shall be fast operate-fast reset type. Time delay on the timer relays shall be adjustable between 50 and 500 milliseconds continuously or in steps smaller than 10 milliseconds.

The breaker failure relays shall be furnished with test circuits to enable a check of all the logic circuits, start and tripping functions and contacts. Measures shall be taken to prevent any false tripping during operation and tests, e.g. tripping only if a start-input exists and testing only if the trip circuits are interrupted, etc.

Indicators shall be provided to show clearly which circuit breaker caused tripping and in which stage.

Extensions of the system shall easily be possible. The protection shall already be wired for the whole number of feeders required in the future. Thus later on the respective prints, modules or parts can easily be fitted to the protection system and no further cubicles shall be necessary. However, modules or prints for at least four additional feeders shall be provided.

Breaker failure scheme shall be wired to the protection signalling system for direct transfer tripping of remote circuit breakers.

## 2.5 132 kV BUSBAR PROTECTION

132 kV grid station all be equipped with busbar protection scheme.

The new busbar protection shall be numerical with a very low burden.

The bus differential relays shall be high speed and of low impedance type, as approved by the Employer, connected for protection of both phase and ground faults.

## 2.6 132/11 kV Power Transformer Protection

Percentage differential protection shall be the main protection for the 132/12 kV transformers. Connections of the transformer to the 132 kV and 12 kV switchgear shall be brought in the zone of this protection by utilizing the 132 kV and 12 kV CTs in the switchgear instead of connecting the differential relay to the bushing CTs.

Two sets of high impedance protections shall be employed to provide restricted earth fault protection. One set shall have the zone restricted between the 132 kV CTs and the

HV windings. The second protection shall cover the LV windings and the connection of the transformer to the 12 kV switchgear.

The following over-current (O/C) protection relays shall be installed for 40 MVA transformers.

HV-terminal side CT:

3 phase time delayed (inverse time) and instantaneous O/C relays

HV-neutral side CT:
neutral current time delayed (inverse) O/C relay

LV-terminal side CT:
3 phase time delayed (inverse) O/C relays

LV-neutral side CT:
neutral current time delayed (inverse) O/C relay

Resistor-grounding side CT:
neutral current time delayed (definitive time) O/C relay with two time steps

These CT's and O/C relays are to be provided separately from the CT's required for the restricted earth fault (REF) relays

Tertiary windings shall be protected against earth faults. For tertiary earth faults, one corner of delta shall be grounded through a CT which shall feed an IDMT/Definite Time over-current relay. Over-current relay(s) connected to bushing CTs of tertiary windings shall monitor and provide protection against circulating currents in tertiary windings due to prolonged system earth faults and also against faults in the tertiary windings.

## 2.7 Differential Protection

The differential relay shall be percentage differential type. The relay shall have harmonic restraint to prevent tripping by in-rush current.

The differential relays shall have built-in matching facilities for correcting phase shift if involved, difference in CT ratios on HV and LV sides, and for compensation of regulating range of power transformers.

The differential relay shall have suitable differential current to circulating current ratio for all types of faults under all conditions so that relay is sensitive enough to pick-up on faults under no-load conditions and on the other hand it shall not operate on through

faults, up to the maximum through fault current expected in the system . Bias ratio shall be variable and the range shall be such that with maximum mismatch between the HV and LV CTs due to tap-changing the relay will always securely restrain in the presence of maximum through fault current.

The operating time of the relay shall be less than two cycles for current greater than 5 times the relay setting.

The relay shall have safeguard against operation from harmonics as a result of over excitation, but have high sensitivity for internal faults. It shall also have unrestrained instantaneous unit for operation on severe internal faults.

Setting of bias and basic sensitivity must be adjustable in steps.

Trip and indication outputs shall meet the tripping and signaling requirements.

It shall be possible to measure the differential current at the relay and the current before and after each interposing current transformer.

## 2.8 Restricted Earth Fault Protection

Restricted earth fault protection for power transformers shall comprise the high impedance differential relays. The relays shall be voltage operated with setting in terms of rated secondary current.

This protection can be operated from a completely separate set of line current transformers.

A current transformer is required on the neutral to earth connection with the same magnetising characteristics as the other leg of this protection.

The aim of this protection is to cover a reasonable percentage of the winding with more efficiency than the differential relay so that it would need to be extremely sensitive. Therefore, all random restrictions, such as out of balance current due to tap changing, current transformers unit mismatching and power transformer magnetization, shall be considered on the setting and/or dimensioning of the current transformers.

Tripping of this protection as well as the DC in-feed shall be independent of the differential protection.

HV and LV Side Over-current and Earth Fault Relays for Transformer Back-up Protection (Transformer Feeder Protection)

This protection shall comprise three non-directional IDMT over-current relays for over-current and phase faults and one IDMT relay for earth fault. The relays shall operate with standard inverse characteristics. Over-current and earth fault relays shall be numerical type. Each phase and earth fault relay shall include instantaneous over-current element adjustable to infinity setting to block it, if necessary.

Current setting range of the phase over-current relays shall be adjustable between 50% to 200% continuously or in steps not exceeding 10% and time multiplier setting shall be adjustable between 5% to 100% continuously or in steps not exceeding 5%. Setting of the instantaneous elements shall be possible between 100% to 3000% of the time delayed element setting.

Earth fault relays shall have current settings adjustable between 10% to 80% continuously or in steps not exceeding 5% and time multiplier setting (TMS) adjustable in the range 5% to 100% continuously or in 5% steps. Setting range of the instantaneous elements shall be possible within 100% to 3000% of the time delayed element.

Instantaneous elements of the phase and earth fault relays shall have low transient overreach (90%) with a tripping time less than 25 milliseconds.

Resetting time shall be less than 50 milliseconds and resetting current shall be greater than 95% of the operating current.

Timer relays provided for the instantaneous elements of the phase relays at 11 kV side of the transformers shall be adjustable between 0s-1.0s continuously or in 0.05s steps.

## 2.9 Earth Fault Relay for Tertiary Protection

Setting range of the earth fault over-current relays shall be continuously variable from 10% to 80% or in steps of 5% or less and time multiplier setting shall be adjustable between 5% to 100% continuously or in steps not exceeding 5%.

The relays shall also be equipped with elements to operate the relays in definite time mode whenever so desired. Current setting ranges shall be same as specified for the IDMT elements. Time setting shall be possible between 0 to 10 seconds continuously or in steps not exceeding 0.10 seconds.

Instantaneous elements of earth fault relays shall be adjustable to infinity and shall have low transient overreach (90%) with a tripping time less than 25 milliseconds.

Resetting time shall be less than 50 milliseconds and resetting current shall be greater than 95% of the operating current.

HV and LV Neutral Over-current Protection

The neutral over-current relay shall be non-directional inverse definite minimum time type complete with an instantaneous over-current element.

The relay shall have current settings adjustable between 10% to 80% continuously or in maximum 5% steps and time multiplier setting (TMS) adjustable in the range 5% to 100% continuously or in maximum 5% steps. Setting range of the instantaneous elements shall be possible within 100% to 3000% of the current setting. Instantaneous elements shall also be adjustable to infinity.

Instantaneous elements of the phase and earth fault relays shall have low transient overreach (90%) with a tripping time less than 25 milliseconds.

Resetting time shall be less than 50 milliseconds and resetting current shall be greater than 95 percent of the operating current.

Additional time delay relays shall be provided for LV neutral over-current protection. Time setting shall be adjustable between 0 to 10 seconds continuously or in steps not exceeding 0.1 seconds.

## 2.10 Synchro-check Relays

The synchronism verifier relay shall check the conditions of synchronism existing between two system voltages and close any of the high voltage breakers when the voltages are within the set limits in phase and frequency. Also included shall be the feature that the relay will operate when one of the sources is de-energized. The operating time of the relay shall be adjustable. If the circuit is not in synchronism, then the closure shall be locked out. Provision shall be available to synchronize either manually or automatically the line/transformer feeder with the busbars. Bus-coupler shall also be supervised against un-synchronized closing. Separate synchro-check relays shall be provided for manual closing of breakers and for auto reclosing. Synchronizing schemes shall incorporate the image of disconnectors.

## 2.11 Lockout Relays

Lockout relays shall be high speed multi-contact type. These relays shall have the provision for hand reset or electrical reset from the remote location.

## 2.12 High Speed Tripping Relays

The breaker fail inter-trip, direct transfer trip receive and the breaker fail direct transfer trip transmit relays shall be high speed, self-reset type with manually reset targets.

The line main protection tripping relays and line back-up protection tripping relays shall be high speed self-reset type.

Auxiliary tripping relays shall have maximum operating and reset times less than 10 milliseconds.

Tripping relays shall have an operation indicator. These relays shall be guaranteed for operations down to 50% of rated DC voltage.

## 2.13 Panels and Cubicles

Protection panels shall be of vertical type of construction suitable for bolting on steel channel sills embedded in the floor. Panels shall be fabricated from sheet steel not less than 3 mm thick. The panels shall be so constructed that entry of dust and vermin is effectively blocked. Protection class shall be IP54 in view of the environmental conditions prevailing in the project area. The panels shall have front door with glass windows. Rear doors shall be double leaf type with pocket for internal drawings. Each panel shall have Provisions for interior door operated lighting, humidity control heaters Controlled with thermostats / humidistat.

## 2.14 Breaker Trip Coil Supervision

Supervision of trip coil(s) of the circuit breaker shall be a standard feature for switchgear of voltage level down to 11kV. Supervision device shall monitor the trip circuit right from the protection/control panels up to the trip coil(s).

Trip circuits shall be continuously supervised for breaker open and breaker close conditions. If a breaker is fitted with two trip coils, trip circuits connected to each trip coil shall be separately supervised.

## 2.15 Oscillographic

Fault recording and events recording functions built into the numerical protective devices shall be used. The numerical devices shall be equipped with their maximum

capacity of analogue channels and binary channels to enable coverage of the fault and events recording requirements of the respective grid station. Records of at least five past happenings disturbances / faults shall be available in the memory. All numerical devices shall be time synchronized to guarantee high precision time tagging of analogue and binary channels. Provision shall also be made for interface of the analogue and binary channels with future fault recorders/event recorders/ microprocessor technology based Substations Control and Monitoring System (SCMS).

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## Layout of electric installation metering & construction related info

### 3. METERING EQUIPMENT

Energy measurement system is designed to calculate energy in and out from Power Transformer and energy exported to various Medium Voltage (11kV) feeders and 132kV transmission circuits. The values will also be transmitted to HMI system and SCADA system.

All metering instruments, summation equipment and telemetering instruments is designed to be of the smart IED type and is designed to communicate with the SCADA system.

The energy meters shall be compliant to following standards:

- IEC 62052-11
- IEC 62053-21
- EN 50470-3
- IEC 62053-22
- IEC 62053-23

The metering devices shall allow to measure MWh or kWh and MVArh or kVArh and as an option measuring of import and export of active and reactive energy in the same instrument.

The combination meters (kWh/kVArh) shall be able to register the two rate MWh- or kWh-tariff (two registers) for one direction, or a single rate MWh- or kWh-tariff for two directions (import/export), a single rate MVArh or kVArh tariff for leading and lagging reactive energy (two registers).

The meter shall have two independent electronic output contacts (one for MWh or kWh and one for MVArh or kVArh) for re-transmitting to an external totalizer. Two other independent output contacts for retransmitting to a telemetering or supervisory control system are required. These potential free output contacts shall be mercury wetted and bounce free and equipped with a built-in contact protection.

The MWh- or kWh-meters the accuracy shall be of class 0.2S according to IEC 62052-11 and IEC 62053-22, the MVArh- or kVArh-meters shall be of class 3. The meters must be able to register very low initial reading, i.e. shall start at less than 0.05 % of the load.

On-site calibration facilities shall be provided to enable the service engineer to modify/offset the error curve with defined very small values/steps.

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### 4. MV SWITCHGEAR

Each power transformer will have 10 numbers of 11kV feeders for evacuating power to different areas and one each for house transformer and capacitor bank. The feeders will be controlled by medium voltage switchgear at the grid station.

The medium voltage system will be designed with the following values.

| | |
|---|---|
| a) Nominal system voltage | 11kV |
| b) Highest system voltage | 12 kV |
| c) Highest voltage for equipment | 15 kV |
| d) Phases | 3 |
| e) Frequency | 50 Hz |
| f) Lightening impulse withstand voltage (BIL) | 95 kV |
| g) System earthing: | Star-Star 132/11kV Power Transformer at Grids with neutral on 11KV either solidly grounded or through Neutral Grounding |

#### 4.1 General Requirements

The switchgear will be housed in metal clad and partitioned design (Class PM) with withdrawable circuit breakers. The switchgear is to be mounted on floor and shall be of free-standing, self-supporting, dead front design with all high voltage equipment installed inside metallic and earthed enclosures, suitably divided into individual compartments namely Busbar System, Circuit Breaker, Cable Connections, Low Voltage Compartment.

Minimum Degree of Ingress Protection requirement for every compartment will not be less than IP42.

The Vacuum type withdraw-able Circuit Breakers shall be fitted in outgoing panels, being operated by the 220V DC driven-stored-energy mechanism. The breaker shall have mechanical ON and OFF indications. All circuit breakers shall be provided with local as well as remote control from the Grid-station control room / LDC. The switchgear shall be HMI/SCADA compatible

*Circuit Breaker Characteristics and Rating*

The following values are recommended

| S. No. | Characteristics | Rating |
|---|---|---|
| 1. | Rated Current. | 1250 Amps. for outgoing panels.<br>2500 Amps. for incoming panels. |

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| | | |
|---|---|---|
| 2. | Rated Voltage. | 15 kV |
| 3. | Rated frequency | 50 Hz |
| 4. | Rated short circuit breaking current sym. | 25 kA |
| 5. | Rated short circuit making current. | 63 KA |
| 6. | Rated duration of Short circuit. | 3 Secs. |
| 7. | Rated 1 minute power frequency withstand Voltage. | 38 kV (rms) |
| 8. | Rated lightning impulse Withstand voltage. | 95 kV (peak) |
| 9. | Operating sequence. | 0-0.3 Sec.-CO-3 Min.-CO. |
| 10. | Operating Times: | |
| i) | Closing time. | Max. 80 ms. |
| ii) | Opening time. | Max. 60 ms. |
| 11. | Class of partitions and shutters | PM |
| 12. | Internal arc classification | IAC |

The bus-bar compartment will be necessary single bus-bar system but the bus bar shall be tin plated and covered with approved insulation material

The cable connection compartment will conveniently accommodate the necessary current and voltage transformers, the earthing switch and the cable and fittings including the required mountings. The voltage transformers will be provided in the incoming panel only but the fixing of C.T &V.T shall be arranged so that the same can be easily accessible for a wire man during maintenance and fault rectification.

Each incoming and outgoing panel shall have provision of dry terminals of cables as detailed below:

- For Incoming Panel, Cables 5x 630 mm2 - 15/8.7 KV, XLPE insulated single core copper cable per phase.
- For capacitor panels and auxiliary transformer panel suitable cable terminations will be provided.
- For outgoing panel, cables 1 x 400 mm2 - 15/8.7 KV, XLPE insulated three core aluminum cable per phase.

All panels shall have over current and earth fault relays. All incoming panels shall have provision for tripping on differential including Power Transformer's Protection Devices (Buchholz, High Temperature OLTC Diverter Switch & Pressure Relief).

The voltage transformer and current transformer shall be in accordance with IEC-61869 and shall be rated at 11/0.1 kV and 400/800/5A respectively

## 5. AUXILIARY EQUIPMENT

### 5.1 Station Supply - AC

These panels include one 3-phase 5-wire incoming unit each with a circuit breaker. The CB's is designed to be of the air-break type with a driving mechanism composed of a spring loaded, energy closing and tripping device. All electrical making devices will be suitable for operation at voltages between 110 % and 80 % of the rated control voltage. All electrical breaking devices shall be suitable for operation between 110 % and 50 % of the rated control voltage.

The LV/AC distribution is designed to have a feeder facility for the connection of an external mobile stand-by diesel generator unit with an approximate capacity of 250 kVA. An outdoor cable terminal box for the connection of the stand-by unit will be provided. The cable between the LV/AC distribution panel and this cable terminal box will have sufficient protection facilities at both ends.

### 5.2 Local Supply - AC

The distribution boards/busbars will comply to the specified transformer sizes and ratings and the infeed circuit breakers as well as the bus sectionalizing circuit breaker is designed be capable of switching the expected maximum busbar short circuit current. Under Condition of parallel transformers the size of the feeder's fused load break switches shall be designed to distribute 100 percent of the transformer's power ratings. The local supply room shall be fitted with lighting, earthing, air conditioning and fire fighting facilities.

Each transformer infeed to the local supply distribution panel is designed to be provided an indication Ammeter and a kWh meter.

### 5.3 Station Supply - DC

The entire system shall consist of:

- Two battery chargers;
- Two battery banks;
- Two voltage control units for regulating the DC output voltage at the 220 V main switchboard when the rectifiers/ chargers are in the float/trickle or boost charge mode;
- Two 220 V DC main switchboards for distributing power to the various loads.

For the battery design, special reference is made to the tripping features of busbar protection, i.e., all circuit breaker trip coils shall be initiated at once. Each battery charger, voltage control unit and battery will at least be capable of supplying the entire load of the DC main switchboard, in particular the emergency loads such as all

protection relays in addition to tripping of all feeders and subsequent restoration, all indicators, alarms, emergency lighting, firefighting equipment.

### 5.4 DC Distribution

The panels shall house all distribution necessary for the station DC circuits; they shall at least be of protection class IP42. The DC panels shall have an alarm tableaux (sub-panel) for alarm indications such as:

- Lamp test;
- DC circuit breaker trip (one per each breaker);
- DC feeder trip (one per each outgoing feeder);
- Supply infeed(s) off/bus coupler closed.

### 5.5 Chargers

The chargers shall each be housed in a separate cubicle of Protection Class IP42. Two electronically controlled battery charging devices shall be provided, each capable of 100 % load of the entire DC-busbar plus boost charge of one battery bank.

Each charger will be able to operate from a three-phase AC low voltage supply of given nominal voltage(s). Each charger/battery shall be connected via a voltage control system to one busbar of the DC main switchboard (VCU). Facilities will be provided to connect the outputs of the two chargers to enable the feeding of both batteries from one charger in case of any outage requirement.

Operational characteristic of the battery charger shall be in accordance with DIN 41772 and DIN 41773 for float/trickle, equalizing and boost charging.
Each battery charger shall be provided with at least:

- DC output voltmeter;
- DC output ammeter;
- A green lamp indicating that the charger is on duty;
- A red lamp indicating that the charger is on boost charge;
- Under-voltage relay with timer;
- AC supply failure relay;
- Battery charger failure;
- Earth fault relay with additional measurement instrument to detect the magnitude of the defect;
- Battery circuit supervision;
- Test push button for checking all lamps.

### 5.6 Batteries

Two separate battery systems shall be designed, one for each 220 V DC system, each rated to give 100 % of the entire DC load under the site environmental conditions, plus a 30 % spare outlet capacity in order to cater for aging of the battery. Batteries shall be of the Nickel-Cadmium pocket plate type.

Each battery system will be provided with the following accessories:

- Two syringe hydrometers;
- Two thermometers;
- One cell testing voltmeter, digital type, reading and accurate to 3 decimal digits;
- One plastic jug;
- One plastic funnel;
- One plastic storage tank for distilled water, of at least 60 Litre capacity;
- One maintenance tool box;
- One instruction card;
- One battery record book.
- Auxiliary devices and auxiliary flexible cables
- Six spare cells with sufficient electrolyte.

## 6. 132 kV, 11 kV & 0.4 kV POWER AND CONTROL CABLES

132 kV XLPE 300mm² cables will be used for interconnection between GIS Bay and Power Transformer together with the required type of Termination and Accessories where required. The 132 kV 800mm², copper conductor XLPE cable will be looped in & looped out of the grid station, connecting existing 132 kV underground Transmission lines to GIS with required laying, jointing, terminations & complete accessories. The transmission cable will be provided with the DTS equipment for continuous monitoring of the cable.

The 15/8.7 kV single core 630 sq.mm XLPE cable (5 for each phase) will serve as a medium for interconnection between MV Side of Power Transformer and 11 kV Incoming Panels.

In selecting control cable and wire sizes, due regard has been paid to the appropriate de-rating factors in relation to the climatic conditions at site. All control cables shall be of copper. The minimum cross-section of each control wire shall be at least as given below:

- 4.0 $mm^2$ for current transformer circuits and heavy power consumers up to 20 A
- 2.5 $mm^2$ for all power consumers such as motors, heaters, lighting, etc. up to 10 A

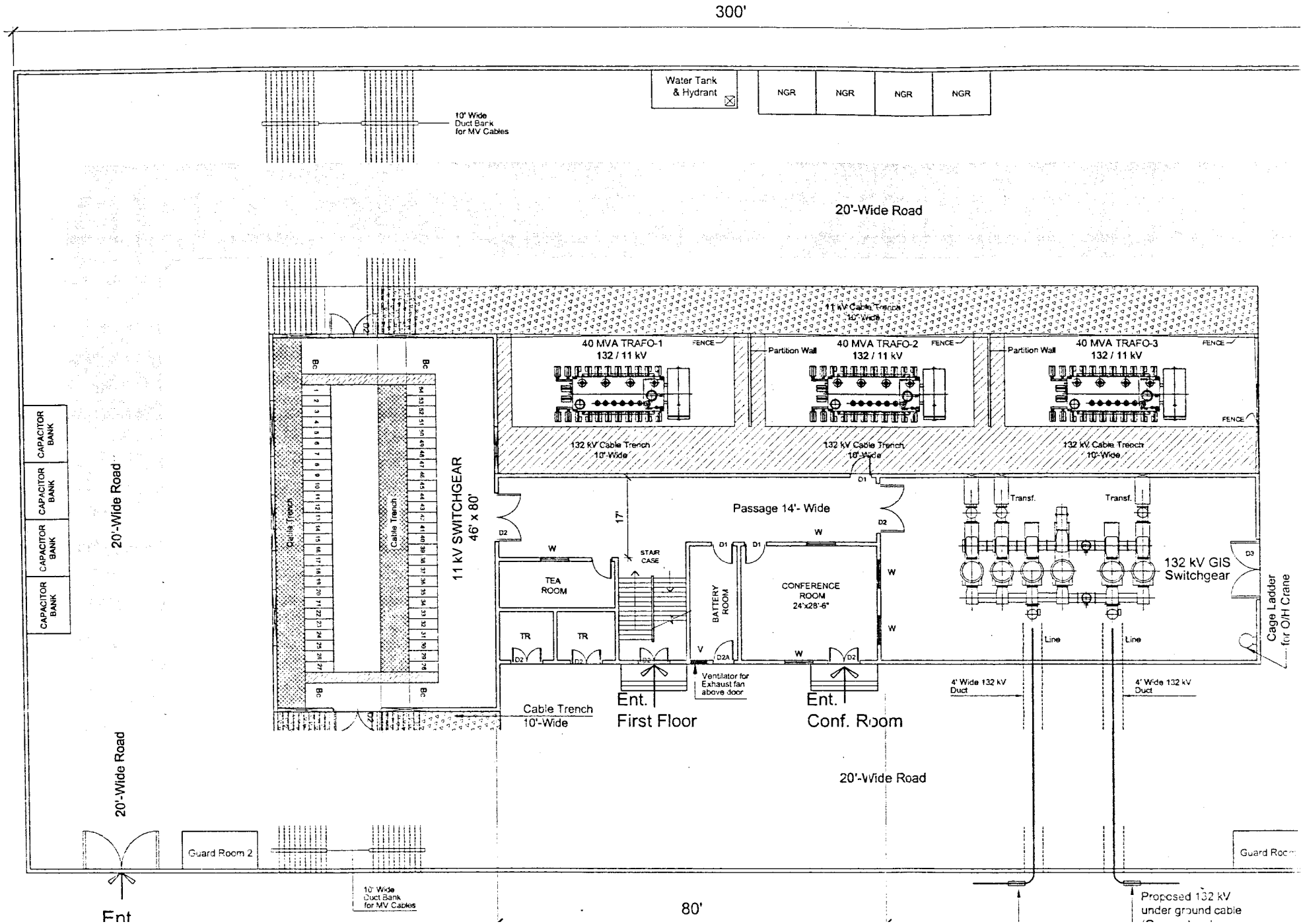
- 1.5 $mm^2$ for all instrument and control wiring, however, the maximum permissible voltage drop shall be less than 5 %.
- 0.6 $mm^2$ for all telephone wiring.

## 7. NITROGEN INJECTION EXPLOSION PREVENTION AND FIRE PROTECTION SYSTEM FOR POWER TRANSFORMERS

Explosion Prevention and Fire protection will be provided by means of a system comprising all necessary components, parts and appurtenances, including, but not limited to the following to make it a complete functional unit:-

- Rupture Disk.
- Transformer Depressurization Set and Explosive Gas Elimination Set
- Oil and Gas Separation Tank for storing drained oil and expelling flammable gases.
- Temperature/ fire sensors
- Control cabinet consisting of:
- Nitrogen injection
- Electrical actuator
- Pressure reducer
- Nitrogen injection valves.
- Conservator tank shutter valves.
- Electrical connections.

Explosion and fire prevention system will be designed to protect the transformer from blasting and catching fire on external surfaces/ accessories.


300'
Water Tank & Hydrant
NGR
NGR
NGR
NGR
10' Wide Duct Bank for MV Cables
20'-Wide Road
11 kV Cable Trench 10'-Wide
40 MVA TRAFO-1 132 / 11 kV
40 MVA TRAFO-2 132 / 11 kV
40 MVA TRAFO-3 132 / 11 kV
Partition Wall
Partition Wall
FENCE
132 kV Cable Trench 10'-Wide
132 kV Cable Trench 10'-Wide
132 kV Cable Trench 10'-Wide
CAPACITOR BANK
CAPACITOR BANK
CAPACITOR BANK
CAPACITOR BANK
20'-Wide Road
Cable Trench
Cable Trench
11 kV SWITCHGEAR 46' x 80'
Passage 14'- Wide
17'
STAIR CASE
TEA ROOM
TR
TR
BATTERY ROOM
CONFERENCE ROOM 24'x28'-6"
Transf.
Transf.
132 kV GIS Switchgear
Line
Line
Cage Ladder for O/H Crane
Ventilator for Exhaust fan above door
Ent. First Floor
Ent. Conf. Room
Cable Trench 10'-Wide
4' Wide 132 kV Duct
4' Wide 132 kV Duct
20'-Wide Road
20'-Wide Road
Guard Room 2
Guard Room
10' Wide Duct Bank for MV Cables
Ent
80'
Proposed 132 kV under ground cable

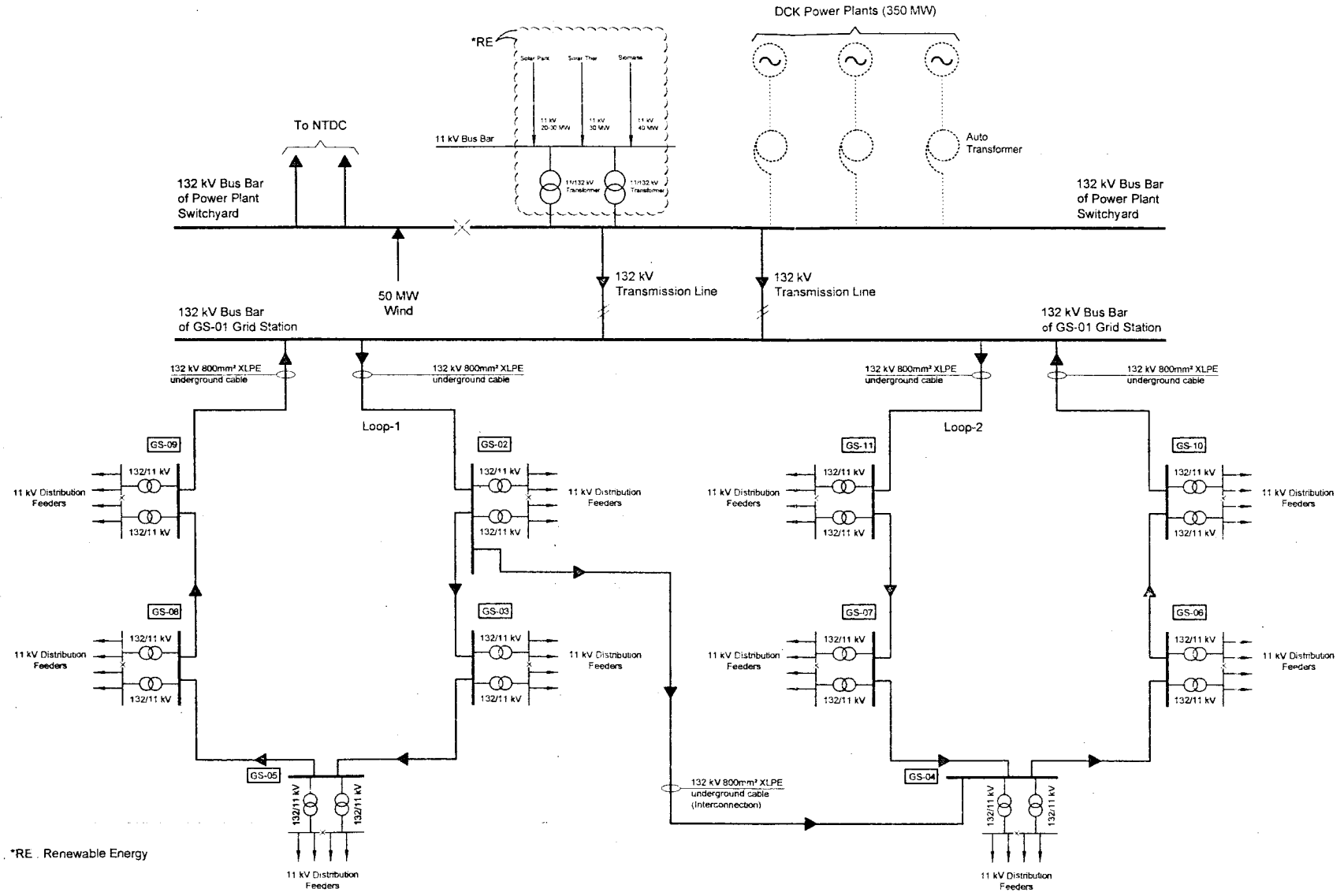
# Part J.29

# Line Diagram & Line Map / Route

ITEM No. 31 & 32

## Line Diagram & Line Map / Route

| S.No. | Dwg. No: | Title of the Drawing |
|---|---|---|
| 1. | 2400-E01, Rev. P0 | Power Generation, Grid Distribution Network in DCK |
| 2. | 2400-E02, Rev. P0 | Map Showing Location of Grid Stations & 132kV Transmission Line Loops in DCK |
| 3. | 2400-E113, Rev. P0 | Typical Single Line Diagram MV Network of a Sub-Sector |

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**Note:**

1. *This drawing is not to be used for construction or for ordering material.*

| Issued | Date | Revisions | Drawn | Checked |
|---|---|---|---|---|

Project: DHA CITY KARACHI

Client: PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY, KARACHI

Project Consultant: OSMANI
Engineering - Architecture - Planning - Mapping - Technology
245/2-K, Block 6, PCHS, Karachi-75400, Pakistan.
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E-mail: ghosh@osmani.com, URL: www.osmani.com

Status of Drawing: DETAIL DRAWING

Drawing Discipline: ELECTRICAL

Drawing Title: POWER GENERATION, GRID DISTRIBUTION NETWORK IN DCK

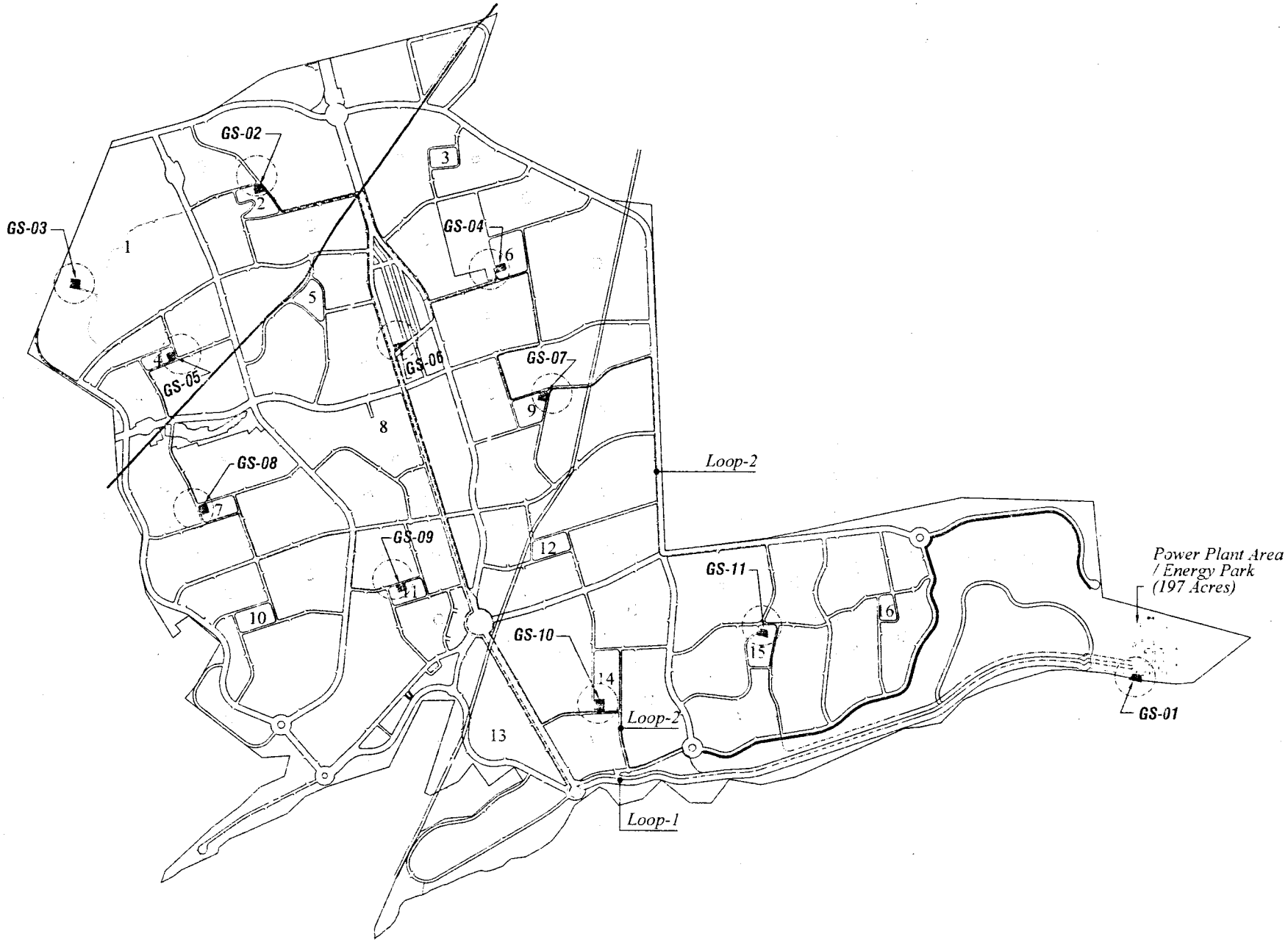
Location Description: DCK - SINGLE LINE DIAGRAM

Drawn by | Designed by | Checked by | Supervised by | Approved by

Scale | CTB File Name | Dated | Project No | Sheet No

Drawing No: 2400-E01 | Rev No: P0

File Name: DCK

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**Note:**

1. This drawing is not to be used for construction or for ordering material.

Grid Station

12 Sector No.

Loop-1 132 kV Transmission Line

Loop-2 132 kV Transmission Line

| No. | Date | Revisions | Chkd. | Recom. |
|---|---|---|---|---|

Project: DHA CITY KARACHI

Client: PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY, KARACHI

Project Consultant: OSMANI
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Status of Drawing: PRELIMINARY DRAWING

Drawing Discipline: ELECTRICAL

Drawing Title: MAP SHOWING LOCATION OF GRID STATIONS AND 132 KV TRANSMISSION LINE LOOPS IN DCK

Location Description: DCK - GRID

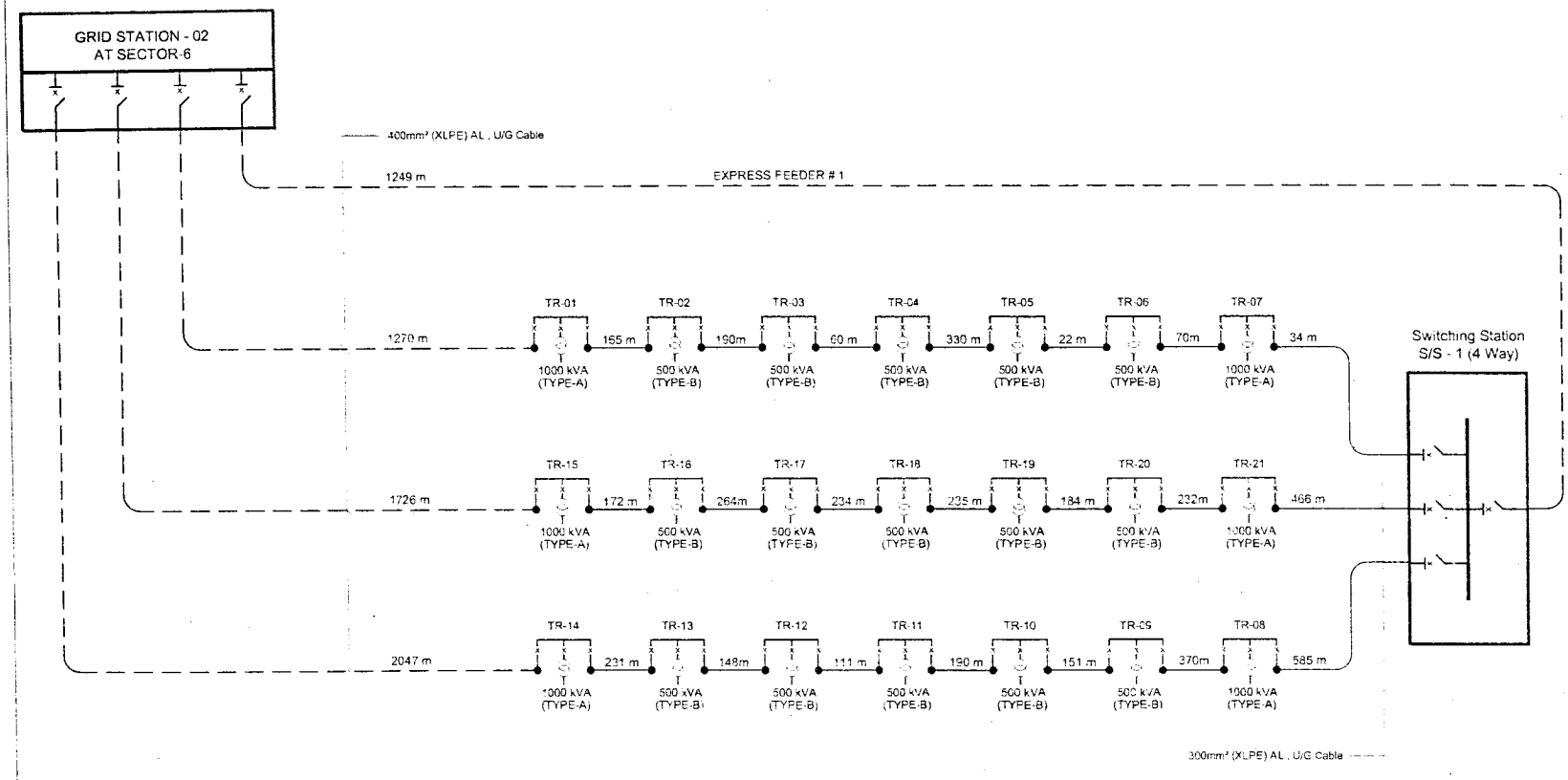
| Drawn By | Designed By | Checked By | Coordinated By | Approved By |
|---|---|---|---|---|
| ARK | ARK, SM, ATFA | SAA | - | - |

| Date | Scale | Date | Sheet No | Total No |
|---|---|---|---|---|
| 25-5-2017 | S=200 | FEB 2017 | 24/30 | - |

Dwg. No: 2400-EOC

Drawing Name: TRANSM-LINE LOOPS

Rev. No: FO




## LEGEND

| SYMBOL | DESCRIPTION |
|---|---|
| | PAD MOUNTED UNIT (PMU) |
| | VACUUM CIRCUIT BREAKER |
| | SWITCHING STATION |
| ——— | 300mm² (XLPE) AL , U/G Cable |
| - - - - | 400mm² (XLPE) AL , U/G Cable |

| No. | Date | Revisions | Drawn | Checked |
|---|---|---|---|---|

Project: DHA CITY KARACHI

Client: PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY, KARACHI

Project Consultant: OSMANI
Engineering - Architecture - Planning - Mapping - Technology

Status of Drawing: PRELIMINARY DRAWINGS

Drawing Discipline: ELECTRICAL

Drawing Title: TYPICAL SINGLE LINE DIAGRAM MV NETWORK OF A SUB-SECTOR

Location Description: SECTOR-6 (PACKAGE-1)

Drawn By: SAHIR | Designed by: KAMRAN | Checked By: ASIF | Engineer By: - | Approved By: -

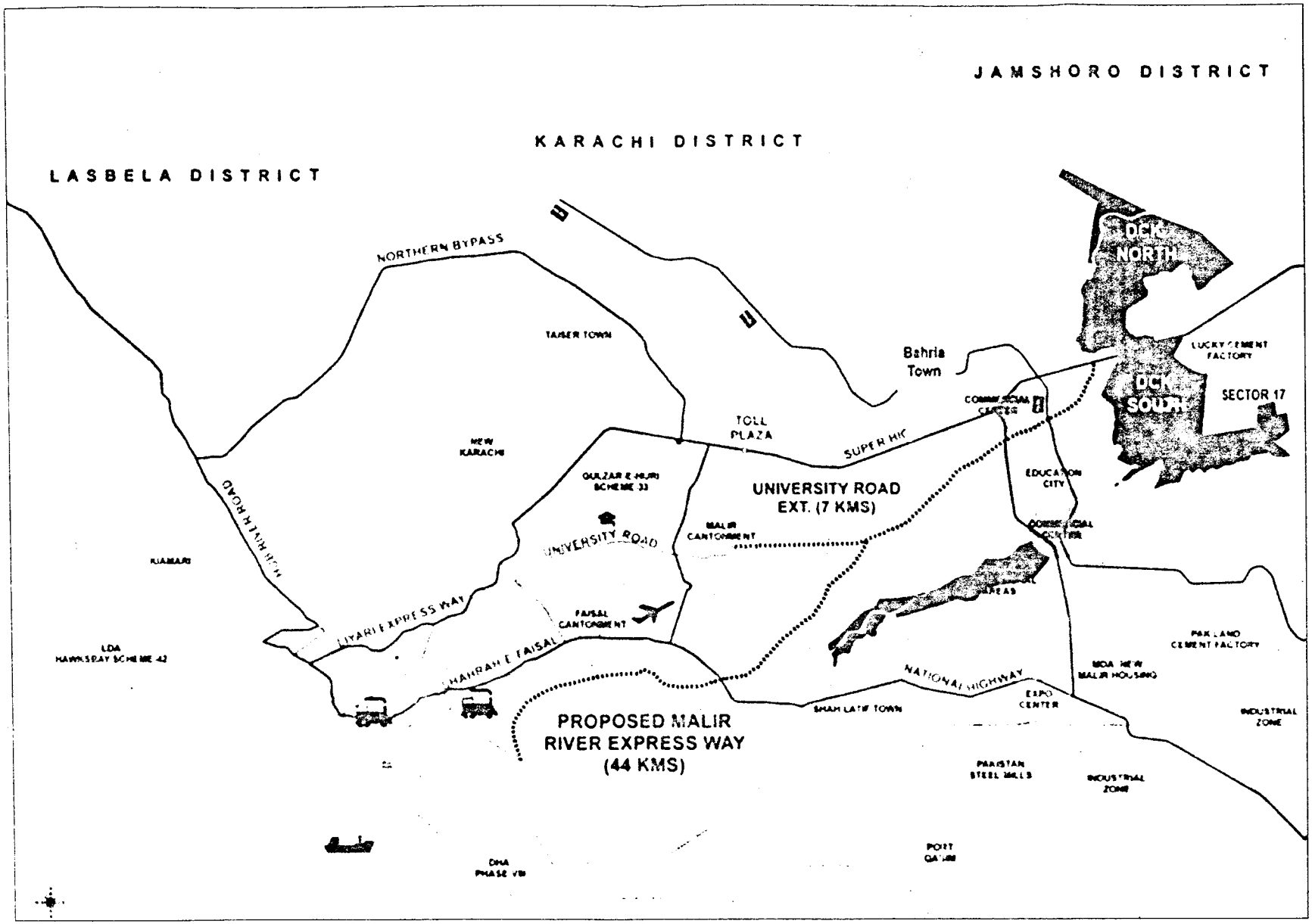
Scale: NTS | CAD File name: 2400-E113 | Dated: MAR-2016 | Project No: 2400 | Sheet No: 1

Drawing No: 2400-E113 | Rev No: 0

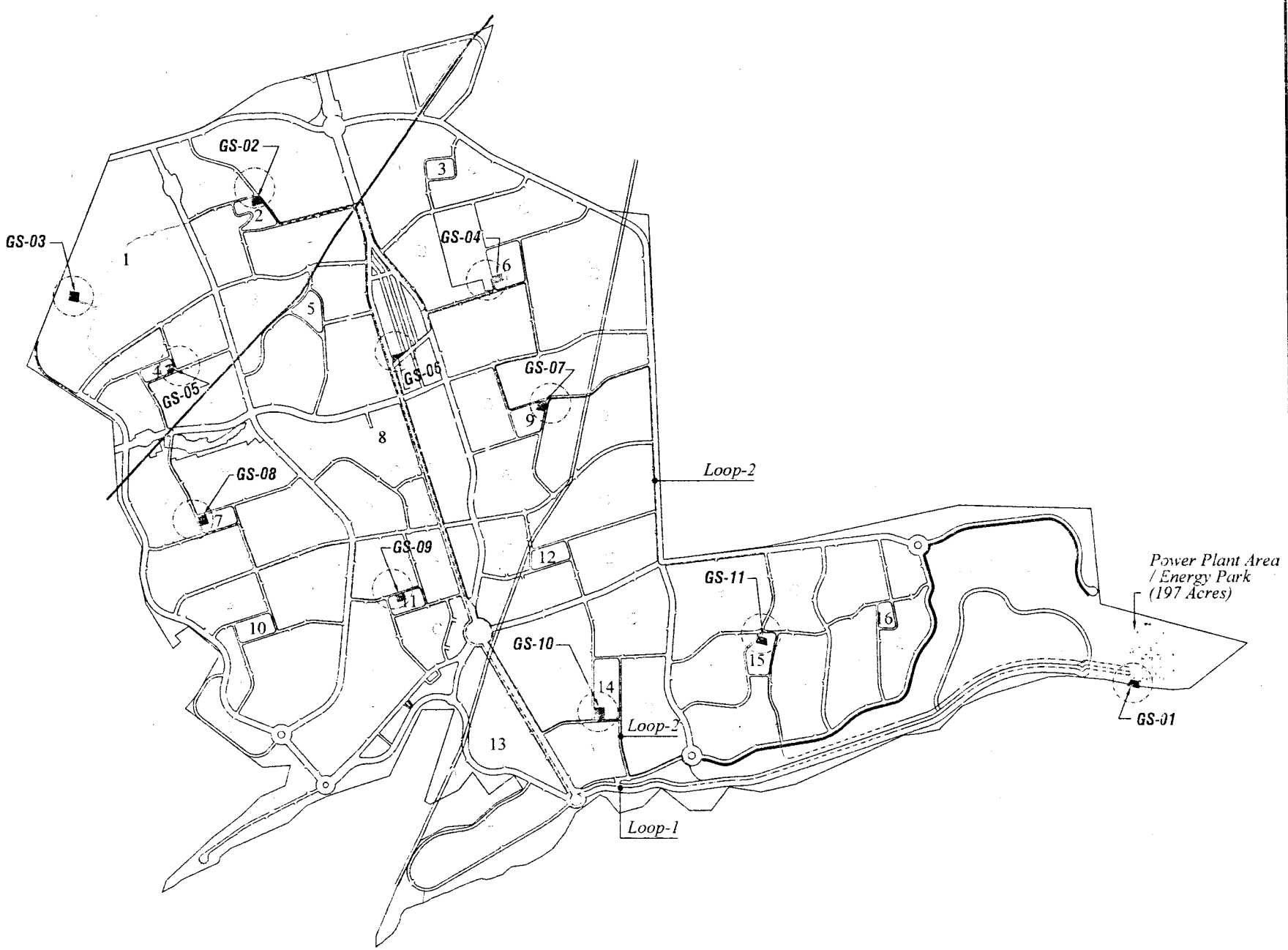
# DHA Energy Supply Company (Private) Limited

# Distribution Licence

# Feasibility Study




Location of Defence City Karachi (DCK)

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**Note:**

1. This drawing is not to be used for construction or for ordering material.

Grid Station

12 Sector No.

Loop-1 132 kV Transmission Line

Loop-2 132 kV Transmission Line

| No. | Date | Revisions | Drawn | Checked |
|---|---|---|---|---|

Project: DHA CITY KARACHI

Client: PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY, KARACHI

Project Consultant: OSMANI
Engineering - Architecture - Planning - Mapping - Technology

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Status of Drawing: PRELIMINARY DRAWING

Drawing Discipline: ELECTRICAL

Drawing Title: MAP SHOWING LOCATION OF GRID STATIONS AND 132 kV TRANSMISSION LINE LOOPS IN DCK

Location Description: DCK - GRID

| Drawn By | Designed By | Checked By | Coordinated By | Approved By |
|---|---|---|---|---|
| ARK | ADR/SMJ/ATIFA | SKA | – | – |
| Scale | Date | Project No. | Sheet No. |
| 1:200 | FEB 2017 | 2400 | – |

Drg. No. 2400-E-12 Sh. No. PG

Drawing Name: TRANSM-LINE LOOPS

PAKISTAN DEFENCE OFFICERS
HOUSING AUTHORITY
KARACHI

# ELECTRICAL WORKS FOR SECTOR-01 FARMHOUSE DISTRICT DHA CITY KARACHI

# DETAILED DESIGN REPORT

## SECTOR-01

*Submitted by*


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September 2016

# PLANNING & DESIGNING OF ELECTRICAL DISTRIBUTION SYSTEM OF DHA CITY, KARACHI SECTOR-01 (PACKAGE-01)

## DETAIL DESIGN REPORT

# DEFENCE HOUSING AUTHORITY
# KARACHI

## SHORT-TERM PLAN ENERGY SECTOR – 01 (Package-01)
## DHA CITY KARACHI

# DETAIL DESIGN REPORT

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- Topography
- Population and Development
- Overview of DCK Network Design Plan
- Design Codes & Standards
- User Requirements
- Network Design Criteria
- Design Consideration
- Smart Grid

**2) K – ELECTRIC LOAD ASSESSMENT CRITERIA**

**3) DESIGN LOAD CALCULATIONS OF SECTOR – 01 (Package-01)**

**4) DESIGN DRAWINGS**

**5) ROUGH ESTIMATE**

# 1

## DESIGN BRIEF & DESIGN CRITERIA

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-01 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

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# 1 EXECUTIVE SUMMARY

For tendering purpose, Sector - 01 short term development plan has been divided into two packages. Package – 01 and 02 of Sector - 01 comprises the following:

**A. MV Distribution Network comprising of:**

**1. MV Cables:**

| | |
|---|---|
| • 3 core 300 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable | 9,000 m |
| • 3 core 400 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable | 5,200 m |

**2. Switching Stations:**

| | |
|---|---|
| • 3-way | 7 Nos. |
| • 4-Way | 7 Nos. |
| • 5-way | 1 Nos. |

**3. Pad Mounted Unit**

| | |
|---|---|
| • PMU Sub Station 500 kVA (Type A) Transformer 11/0.42 kV Oil filled | 4 Nos. |
| • PMU Sub Station 500 kVA (Type B) Transformer 11/0.42 kV Oil filled | 13 Nos. |

**B. LV Distribution Network comprising of:**

**1. LV Cables:**

| | |
|---|---|
| • 4 core 300 mm² AL, XLPE/PVC/SWA/PVC cable | 1,300m |
| • 4 core 240 mm² AL, XLPE/PVC/SWA/PVC cable | 1,800m |
| • 4 core 185 mm² AL, XLPE/PVC/SWA/PVC cable | 950 m |
| • 4 core 150 mm² AL, XLPE/PVC/SWA/PVC cable | 1,900 m |
| • 4 core 120 mm² AL, XLPE/PVC/SWA/PVC cable | 1,055 m |
| • 4 core 70 mm² AL, XLPE/PVC/SWA/PVC cable | 100 m |

## 2. Feeder Pillars:

| | |
|---|---|
| 8-way (Type A) | 07 Nos. |
| 8-way (Type B) | 02 Nos. |
| 6-way (Type A) | 38 Nos. |
| 6-way (Type B) | 02 Nos. |
| 4-way (Type A) | 08 Nos. |

# 2 GENERAL FEATURES

## 2.1 INTRODUCTION

Pakistan Defence Officers Housing Authority (DHA) has commissioned M/s Omani and Company (Pvt.) Ltd. to provide consultancy services for Development of DHA City Karachi (DCK) in August 2010. DHA City is spread over an area of 11,640 acres with numerous ridges and nalas following a rolling / mountainous terrain. DHA City is planned and divided into 16 sectors as listed below in Table 2-1.

**Table 2-1: Area of Sectors**

| S.NO. | LOCATION | AREA (acres) | S.NO. | LOCATION | AREA (acres) |
|---|---|---|---|---|---|
| 1 | SECTOR 1 | 513 | 9 | SECTOR 9 | 604 |
| 2 | SECTOR 2 | 595 | 10 | SECTOR 10 | 541 |
| 3 | SECTOR 3 | 310 | 11 | SECTOR 11 | 627 |
| 4 | SECTOR 4 | 360 | 12 | SECTOR 12 | 503 |
| 5 | SECTOR 5 | 483 | 13 | SECTOR 13 | 448 |
| 6 | SECTOR 6 | 822 | 14 | SECTOR 14 | 655 |
| 7 | SECTOR 7 | 627 | 15 | SECTOR 15 | 696 |
| 8 | SECTOR 8 | 262 | 16 | SECTOR 16 | 383 |
| GRAND TOTAL | | | | | 8,437 |

Sector development works are to be carried out with respect to development strategy, which has been divided into 3 phases;

- Short Term Development Plan (2015 – 2018)
- Mid Term Development Plan (2018 – 2021)
- Long Term Development Plan (2021 – 2030)

The following ***Figure 2-1*** shows the location of various sub-sectors planned.

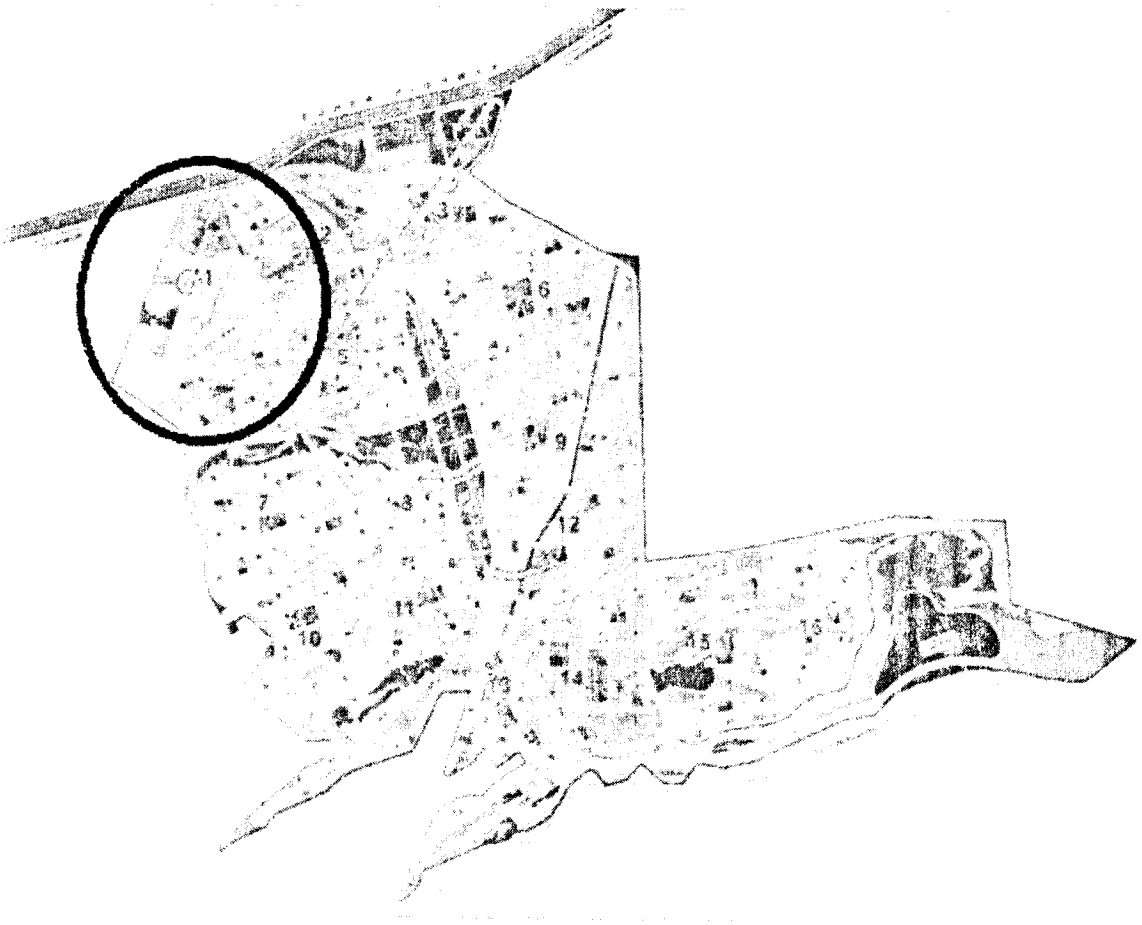

**Figure 2-1: Sectors under Short Term Development Plan**

Sectors are generally divided into two sub-sectors as per the design criteria of 'Ekistics' for ease of communication of urban city. Acreage of each sub sector is given in Table 2-1. Whereas, Error! Reference source not found. illustrates the areas of the sectors/sub-sectors in Short Term Development Plan. Sector - 01 has a total developed area of 513 acres as given in Table 2-1.

## 2.2 SCOPE OF THE REPORT

- The main objective of this report is to explain the Detail design of Energy Distribution Network for DCK Sector - 01. The other main objectives of this Detail Design Report (PDR) are the following:
- Present the Detail design of Sector - 01 to enable client review prior to progression to the detailed design stage.
- Provide details of how the design has been developed since the submission of the Energy Distribution Inception Report.
- Provide an updated description of the works.
- Confirm the design criteria and parameters used for the design of Electrical Distribution System. Provide a rough cost estimate for the project component.
- Provide details of any information obtained; and information still required to complete the project and highlight any potential difficulties in obtaining such information. This report will cover Detail design of Sector - 01 as encircled in Figure 2-1 and highlighted in Table 2-1.

## 2.3 BACKGROUND

Sector – 01 is planned on 513 acres area. For tendering purpose, sector – 01 is divided into 02 packages i.e. Package – 01 and 02. Package - 01 contains farm houses with an approx. area of 207 acres, package – 02 contains mixed use building and army houses with an approx. area of 306 acres, these 2 packages are Short Term Plan (STP). Figure 2-2 shows the boundaries and area of sector – 02.

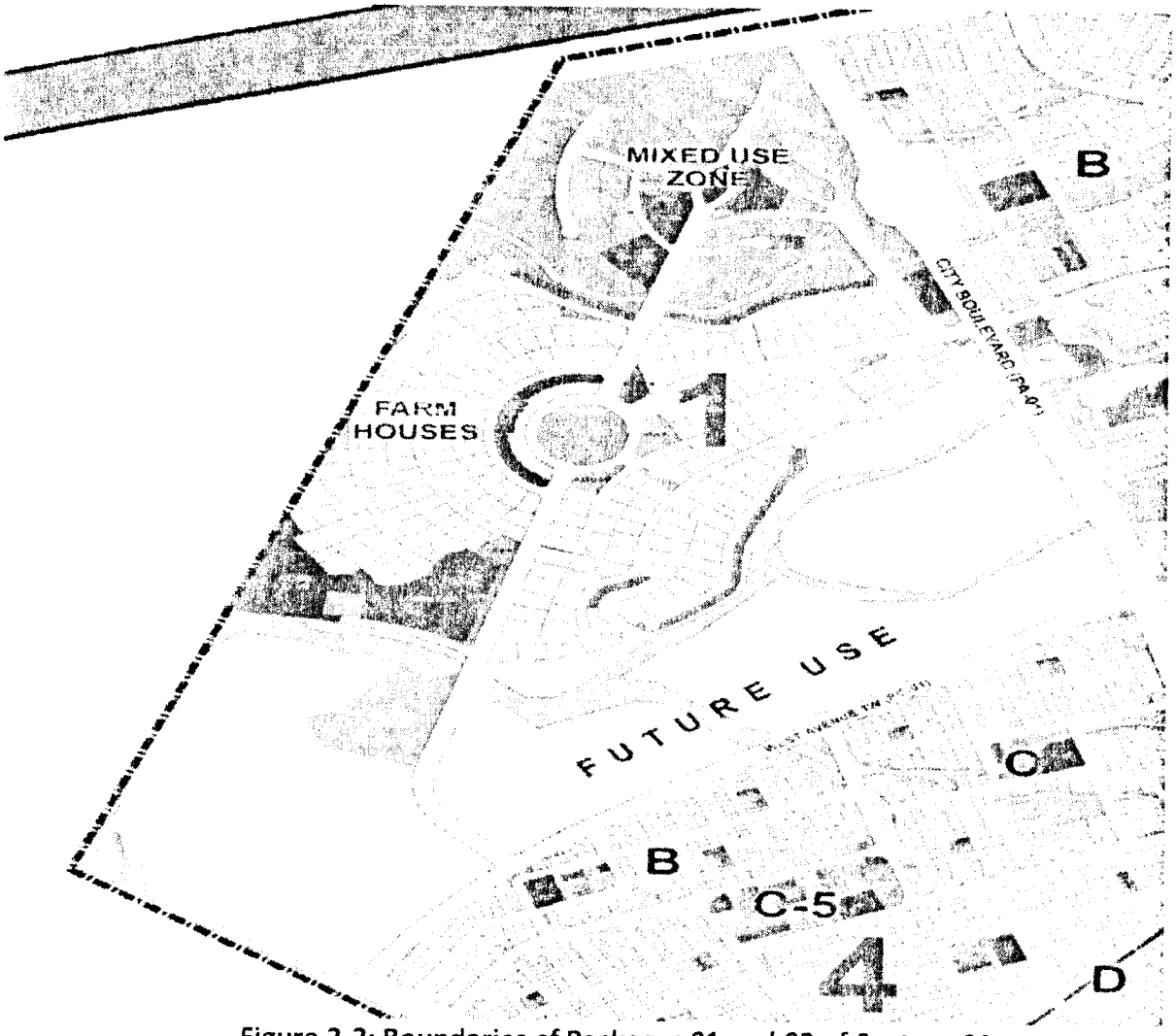


**Figure 2-2: Boundaries of Packages 01 and 02 of Sector - 01**

## 2.4 TOPOGRAPHY

DHA City Karachi (DCK) is towards the North East of Karachi and is accessed by Karachi Hyderabad Motorway (the Super Highway) having a distance of approximately 54 km. It has an uneven rocky terrain in the southwest (SW) and northwest (NW) regions whereas northeast (NE) has a ridge running from North to South and southeast (SE) is mostly rocky region. Figure 2-3 shows that the highest elevation is 657.5 ft and the lowest is 436.9 ft with a difference of 220.6 ft.

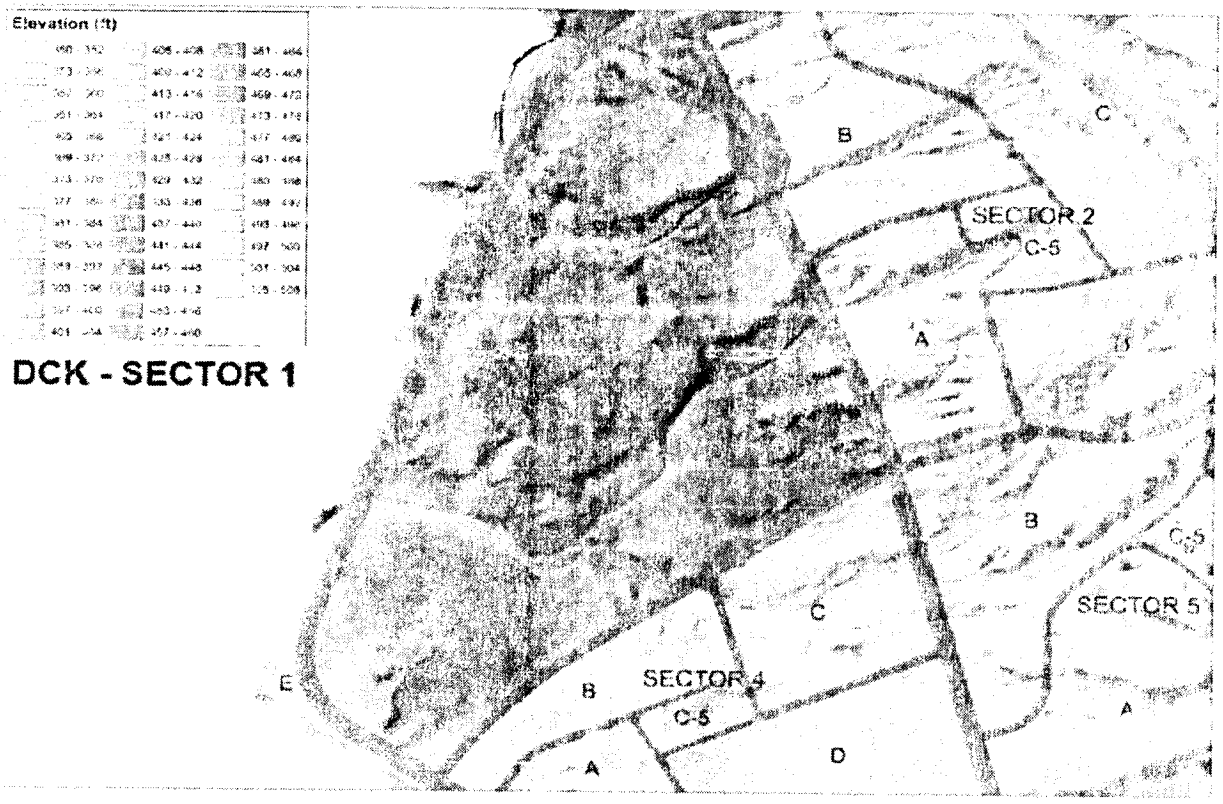


**Figure 2-3: Topography of Sector – 01**

## 2.5 POPULATION AND DEVELOPMENT

The DCK will be developed in stages aiming to reach eventually more than 600,000 people. The overall planning of DCK is based on ekistics, about half of the area of sector - 01 is utilized for farm houses. Farm houses area has different plot categories from 2,000 square yards to 3,000 square yards. Other facilities include commercial areas, amenities, drive in cinema, horse riding etc facilities.

**Table 2-2: Sector – 02: Plots Summary**

| DCK - SECTOR-01 PLOTS SUMMARY | | |
|---|---|---|
| S# | Description | Qty |
| 1 | Commercial Building 2000yards | 1 |
| 2 | Water Work | 1 |
| 3 | Masjid | 1 |
| 4 | Chalets 12.26kW @ 60% load Factor | 94 |
| 5 | Farm House 30kW @ 60% load Factor | 224 |
| 6 | Drive in Cinema | 1 |
| 7 | Riding Club | 1 |
| 8 | Mini Zoo | 1 |
| 9 | Commercial Building Shops | 1 |
| 10 | Cineplex | 1 |
| 11 | Gas Station | 1 |
| 12 | Club | 1 |

## 2.6 OVERVIEW OF DCK ELECTRICAL DISTRIBUTION DESIGN

Design of the Electrical Distribution Network for DHA City Karachi (DCK) is a very important task of the project. Analysis of the latest technologies, current industry standards, local field practices and availability of skilled Human Resource (HR) have been done with a view of current and future requirements of DCK residential and commercial users. Electrical network design layout of DCK is based on the geographic and sector wise distribution.

The DCK is a vision to build an urban city with adaption of new technologies. Distinctly it has to be a part of global smart cities family, which integrates various technical trends into a single place to facilitate best options to the local residents as well as business community. Any urban society can't be accomplished without proper plan so decision for

opting of a reliable electrical distribution system for DCK will really need a higher priority at early stage.

Thus it is proposed to design and construct an electrical network that will be capable to deliver electrical services within DCK. In order to enable the level of operational efficiencies needed for a project of this kind, the use of 'smart building technologies' is the basis of this design to fulfil DCK requirement for provisioning of electrical services. The aim is to provide a network with reliable electricity supply to the residents and stakeholders.

PMU substations can only be the favourable medium for smart distribution in DCK, which can provide the monitoring and control required. We believe that key for reliable electricity is a reliable distribution system with few faults and their fast location and removal. In this regard best efforts are being made to make DCK a prosperous place in current and future scenarios. This will enable DCK to append and merge forthcoming technologies without modifying its existing infrastructure system. The description of various kiosks Sub-Stations used is given below.

**PMU Sub-Station Type-A** (500 kVA) Oil filled Transformer 11/0.42 kV, with incoming & out going VCBs on MV side.

**PMU Sub-Station Type-B** (500 kVA) Oil filled Transformer 11/0.42 kV, with incoming and outgoing SF6 load break switches with fuses on MV side.

# 3 DESIGN CRITERIA

## 3.1 DESIGN CODES & STANDARDS

All systems shall adapt the following main standards, wherever applicable:

- European Committee for Standardization (CEN) and European Committee for Electro technical Standardization (CENELEC)
- International Electro technical Commission (IEC)
- International Organization for Standardization (ISO)
- Other Standards and Codes can be used in areas not covered by these standards. Other standards include:
- European Standards like EN, DIN
- British Standards (BS)

The Electrical products used, should be tested and approved to meet the applicable standards by one of the independent test laboratories including following:

- KEMA
- CESI
- UL or other similar laboratories

## 3.2 USER REQUIREMENTS

The user requirements for DCK that are given by the DHA include the followings:

a. Completely underground distribution system.
b. Use of aluminium conductor cables for cost saving.
c. Use of Kiosk type substations for space saving and faster installation.
d. Smart Metering Technologies.
e. Remote monitoring and control.

## 3.3 DESIGN CRITERIA

The DCK Electrical Distribution must meet following requirements:

- High reliability
- Safe Operation
- Route Protection
- Redundancy
- Reliable Technology
- Easy to maintain and troubleshoot
- Environmentally Protected
- Cost Effective
- Future Proof

## 3.4 DESIGN CONSIDERATIONS

- Underground distribution for reliable power supply.
- MV ring distribution for fast restoration of power in case of fault.
- Use of MV express feeder to provide backup in case of simultaneous fault on two feeders.
- Use of Kiosk type substation for space saving and faster installation.
- Use of VCB type Ring Main Units (RMUs) for reliable maintenance free switching.
- Fibre Optic cable network for remote monitoring and control.
- Use of Smart Meters in residences, offices & commercial premises for two way flow of power, thus encouraging use of renewable energy by consumers.
- Remote monitoring and control of MV and LV distribution system and automatic meter reading and billing.
- Use of cost saving aluminium conductor for MV and LV cables.

# 4 SMART GRID

## 4.1 GENERAL

Traditional Electric Power Systems have been designed through deploying large central generation units built away from cities and residential areas, while electricity has been delivered to consumers through interlinked transmission lines and grid stations. Each individual generation unit, whether it is powered by fossil fuels or hydro, may be rated of up to hundreds of Megawatts (MWs). Transmission line distance also varies up to hundreds of kilometres and Electricity is then transferred to end-users through distribution transformers. The distribution system is very extensive but is almost entirely passive with *little communication* and only limited local controls. There is no *real-time monitoring* hence there is very little interaction between the loads and the power system.

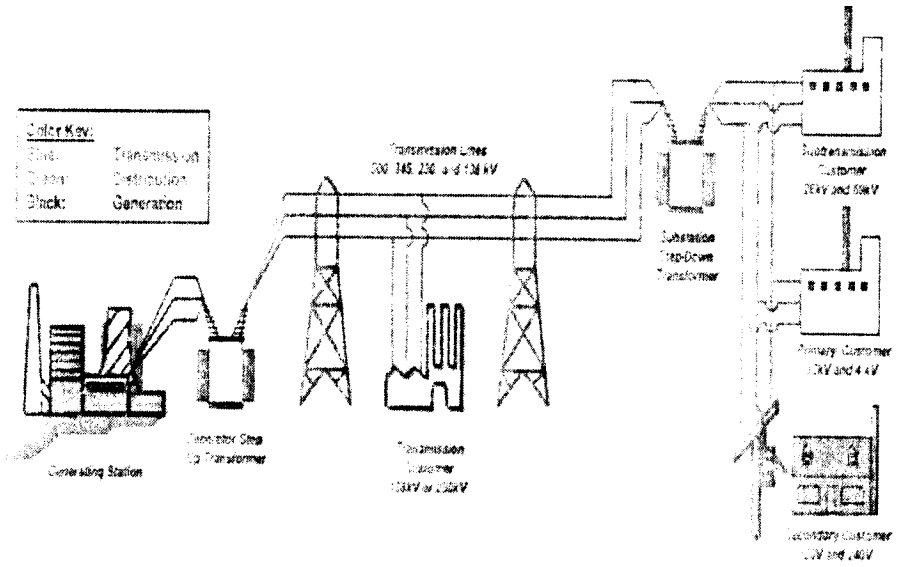


**Figure 4-1: Existing Power System Infrastructure**

The present advances in communication systems, particularly high speed networks, offer the possibility of much greater monitoring and control throughout the power system and hence more effective, flexible and lower cost operations.

Today, design concept of power system has changed and it does not required to be isolated from cities by using large scale generators. Instead large numbers of small scale generation units located at various places are being combined together to deliver electricity to local city residents. Using ICT services at smaller scale is very feasible as well as cost effective. This concept of intelligent delivery of electricity is known as ***Smart Grid***.

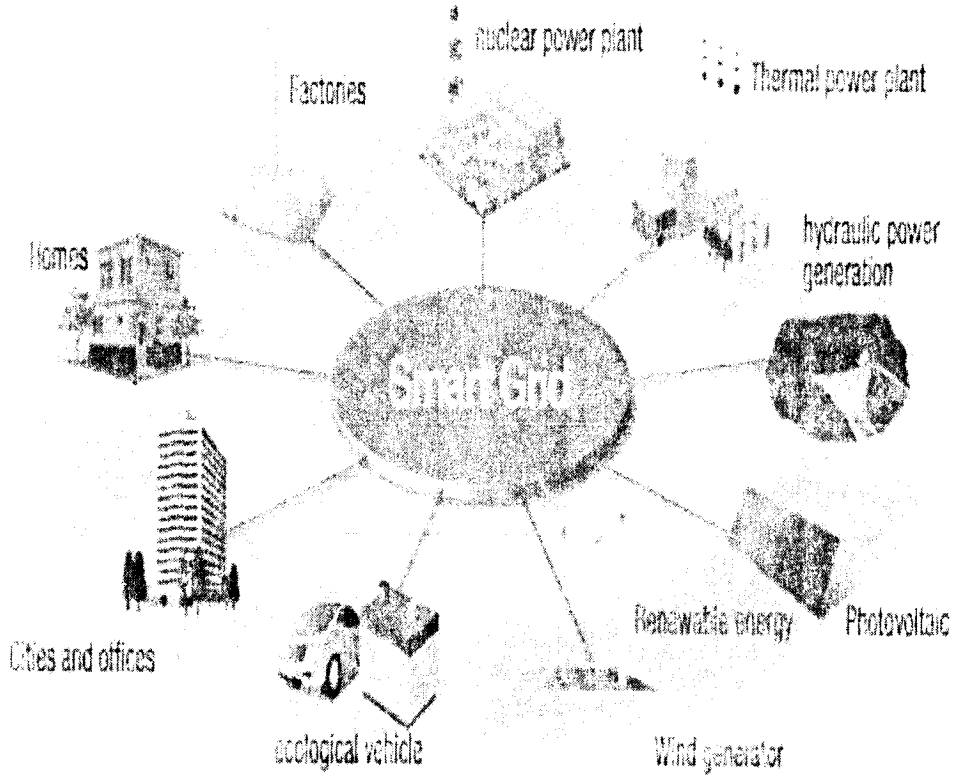


**Figure 4-2: A Smart Grid Infrastructure**

One of the best features of DHA City Karachi (DCK) is the introduction of Smart Grid Technology which will help in managing and protecting the resources of DCK electricity network. Electrical components will be 'network' enabled which will help to monitor the electricity consumption by DCK Power Operators remotely at Network Control Centre (NCC). Real-time Electricity database will then be used to optimize power generation and distribution.

Not only this, but real-time monitoring and control will enable to avoid any unwanted circumstance such as blackout due to heavy short circuits within network and brownout due to unplanned heavy loads. These cases not only affect the power quality but also damage costly power equipment such as power transformers and bus bars at Sub-Stations/grid stations. This technology will enable the DCK consumers to see how much Electricity is being consumed and can also see utility bills any time online at their homes through smart meters.

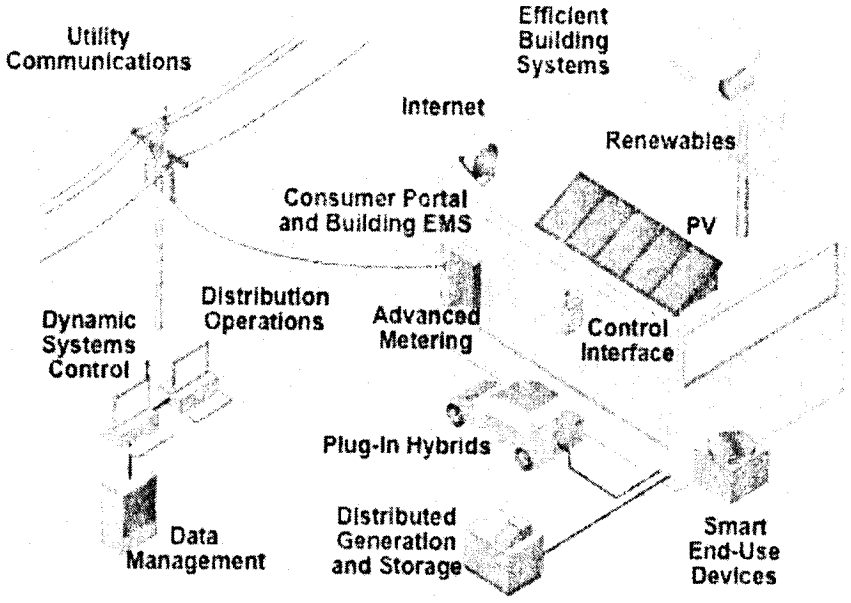


**Figure 4-3: Latest Electrical Network Infrastructure**

The design of power transmission and distribution system of DCK has also been done with a consideration of futuristic demands of any urban city. The design is aligned with the requirements of latest Codes and Standards defined for a Smart Grid and assures modular deployment of any future elements whenever required.

## 4.2 ACCOMMODATION OF RENEWABLE ENERGY INTO EXISTING GRIDS

The global concern for the environment and the need to counteract the effects that lead to global warming are the most important drivers for an improved electrical energy system. Along with establishing a common understanding of man-made changes in the global climate, scenarios have been presented, showing how future carbon emissions might be limited, or even reduced. The major proposals in these scenarios is the introduction of renewable energy sources to replace the traditional fossil based power generation with higher priority as we have a very limited fossil-fuel in future.

## 4.3 DIFFERENCE BETWEEN CONVENTIONAL AND SMART GRIDS

Following table shows a brief difference between a conventional and a Smart Grid.

**Table 2-2: Difference between a Conventional & Smart Grid**

| CHARACTERISTIC | EXISTING GRID | SMART GRID |
|---|---|---|
| Enables active participation by consumers | Consumers are uninformed and non-participative with power system | Informed, involved, and active consumers - demand response and distributed energy resources. |
| Accommodates all generation and storage options | Dominated by central generation- many obstacles exist for distributed energy resources interconnection | Many distributed energy resources with plug-and-play convenience focus on renewable |
| Enables new products, services and markets | Limited wholesale markets, not well integrated - limited opportunities for consumers | Mature, well-integrated wholesale markets, growth of new electricity markets for consumers |
| Provides power quality for the digital economy | Focus on outages - slow response to power quality issues | Power quality is a priority with a variety of quality/ price options - rapid resolution of issues |
| Optimizes assets & operates efficiently | Little integration of operational data with asset management - business process silos | Greatly expanded data acquisition of grid parameters - focus on prevention, minimizing impact to consumers |
| Anticipates and responds to system disturbances (self-heals) | Responds to prevent further damage- focus is on protecting assets following fault | Automatically detects and responds to problems - focus on prevention, minimizing impact to consumer |
| Operates resiliently against attack and natural disaster | Vulnerable to malicious acts of terror and natural disasters | Resilient to attack and natural disasters with rapid restoration capabilities |

## 4.4 USER REQUIREMENTS

- Demand & Supply Balancing
- Optimized and cost-effective Power Generation
- Consumer-Interacted Advance Metering Technology
- Remote Monitoring & Control
- High level protection of EHV, HV, MV and LV equipments
- Accommodation of Generation from Renewable Energy
- Resiliently to Disturbances, Attacks, & Natural Disasters
- High Speed Communication medium throughout the Transmission & Distribution Network
- Power Quality
- Accuracy in load prediction
- Reliability
- Future Proof Technology

## 4.5 NEED OF SMART GRID INFRASTRUCTURE

Today, existing grids are under pressure to deliver the growing demand for power, as well as provide a stable and sustainable supply of electricity. These complex challenges are driving the evolution of smart grid technologies. Smart grid is specifically designed to meet the increasing global demand for electricity, by providing sufficient capacity, as well as reliability, efficiency and sustainability.

## 4.6 ADVANCED METERING INFRASTRUCTURE

Advance Metering Infrastructure (AMI) systems that support two-way communications with customers while allowing secure and reliable system-wide communication for distribution automation are the enabling foundation for the Smart Grid. Advanced Metering Infrastructure will give consumers the consumption and pricing information they need to enable them to more effectively participate in peak load reduction and energy conservation.

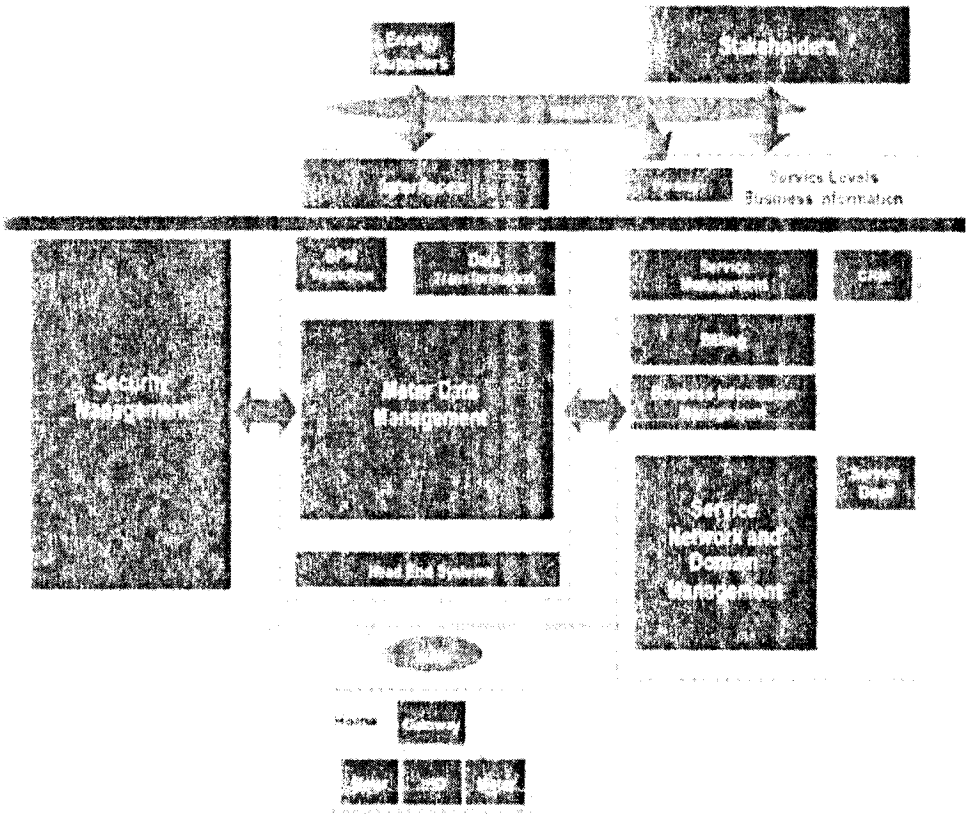


**Figure 4-4: Advance Metering Infrastructure System**

AMI consists of the communications hardware and software, and the associated system and data management software, that together create a two-way network between advanced meters and utility business systems, enabling collection and distribution of information to customers and other parties, such as the competitive retail supplier or the utility itself. Generally AMI have following functionalities:

- Two way communications
- Interval measurement and storage of consumption data
- Display of consumption data to consumer
- Remote connection/disconnection
- Support for variable energy tariffs
- Demand control

## 4.7 DISTRIBUTION AND OUTAGE MANAGEMENT

Distribution and Outage Management Systems (DMS/OMS) provide real-time response to adverse or unstable conditions. It saves money and improves customer service. Through the consolidation of both real-time OMS and DMS functionality, telemetry, and integrated security, smart distribution systems will be poised to become truly self-healing.

## 4.8 DISTRIBUTION AND SUBSTATION AUTOMATION

A Smart Grid requires control centre supervision, area-wide solutions and visualization with centralized modelling. Implementations should leverage installed infrastructure and use a model-based, scalable approach. This practical, cost-effective method ensures that current technology eventually gives way to reactive, software-driven intelligence.

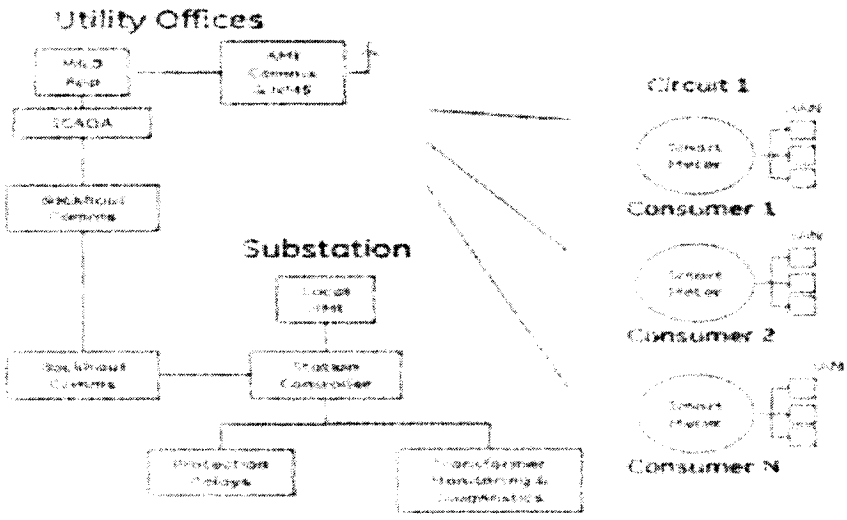


**Figure 4-5: Distribution Automation System**

The architecture shown above uses a centralized distribution automation system with the addition of communication to smart metering. The algorithm can utilize the information from the smart meters to assist in detecting outages outside of the monitored range of the automated devices. This includes fuses or other non-automated fault interrupters. The meters can detect and report an outage and can report successful restoration. Using the restoration detection, the system can determine customers have been properly restored as expected.

## 4.9 PERFORMANCE

Smart Grids will make use of new design concepts and advanced materials in system components like transformers and circuit breakers to improve efficiency, safety and operational performance. Widespread use of power electronic devices will help maximize performance of existing assets and make the grid more resilient in the event of disruptions.

## 4.10 SECURITY & SAFETY

Improvements in security increase the robustness and resiliency of the grid from a physical perspective and a cyber perspective, thereby reducing the probability and consequences of man-made attacks and natural disasters. In addition, reductions in oil imports made possible by the Smart Grid enhance national security.

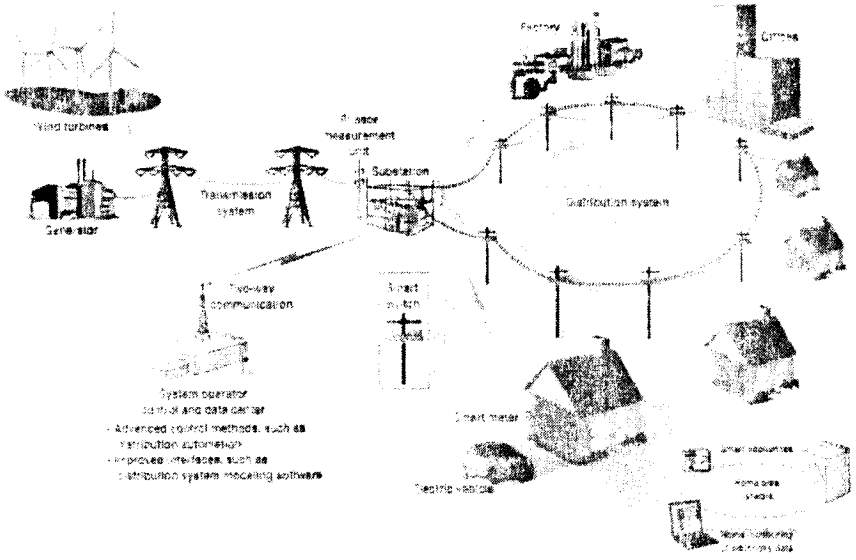


**Figure 4-6: A Secure Smart Grid System**

Improvements in safety reduce the hazards inherent in an energized electric system as well as the time of exposure to those hazards. Generally Smart Grid Infrastructure will help through followings:

- Reduction in the probability that a deliberate man-made cyber or physical attack could occur and a reduction in the consequences of any that are not detected or prevented
- Improved restoration times following storms and other natural events
- Reduction in theft and vandalism of property due to increased detection capability
- Reduction in injuries and deaths of employees due to reduction in time spent in hazardous situations and the availability of more intelligent systems that support worker safety

These benefits will decrease the probability that extended outages impacting the security of customers will occur by reducing the threat, vulnerability, and consequences of man-made attacks. The increased reliance on digital Smart Grid technologies will require the deployment of new systems to address cyber security ensuring this critical infrastructure is as "hack proof" as possible. The increased robustness and resilience of the smart grid will also reduce the impact of many natural events that today result in extended outages.

# 5 BENEFITS OF SMART GRID ELEMENTS

A modernized electrical grid has following features:

- Improves power reliability and quality
- Optimizes facility utilization and averts construction of backup (peak load) power plants
- Enhances capacity and efficiency of existing electric power networks
- Improves resilience to disruption
- Enables predictive maintenance and "self-healing" responses to system disturbances
- Facilitates expanded deployment of renewable energy sources
- Accommodates distributed power sources
- Automates maintenance and operation
- Reduces greenhouse gas emissions by enabling electric vehicles and new power sources
- Reduces oil consumption by reducing the need for inefficient generation during peak usage periods
- Presents opportunities to improve grid security
- Enables transition to plug-in electric vehicles and new energy storage options
- Increases consumer choice
- Enables new products, services, and markets and consumer access to them
- Improved distribution system efficiency
- Reduced distribution line losses
- Improved voltage profile along feeder
- Improved system stability and capacity
- Deferred capital upgrades
- Reduced energy demand
- Reduction of environmentally harmful emissions

# 3

## DESIGN LOAD SHEET SECTOR-01 (PACKAGE-1)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-01 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


Engineering - Architecture - Planning - Management - Technology

**OSMANI & COMPANY (PVT.) LTD.**

**Consulting Engineers – Architects – Planners**

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# DESIGN LOAD SHEET

**DCK - SECTOR-01**
**ELECTRICAL LOAD CALCULATIONS**
**LOAD AS PER K-ELECTRIC & STANDARDS**

## Load Summary

| S# | Description | Load (kW) | Load (MW) |
|---|---|---|---|
| 1 | Farm Houses & Chalets | 4723 | 4.723 |
| 2 | Commercial Buildings,Gas Station & Entertainment Area | 7204 | 7.204 |
| 3 | Amenities | 281 | 0.281 |
| | **Total Load** | **12208** | **12.21** |

| DCK - SECTOR-01<br>ELECTRICAL LOAD CALCULATIONS<br>LOAD AS PER K-ELECTRIC & STANDARDS | | | |
|---|---|---|---|
| **Load Summary** | | | |
| **S#** | **Description** | **Connected Load (kW)** | **Connected Load (MW)** |
| | **Farm House** | | |
| 1 | 2000Yards- Farm House | 2484 | |
| 2 | 2500Yards- Farm House | 900 | |
| 3 | 3000Yards- Farm House | 648 | |
| 4 | 300Yards Chalets | 691 | |
| | **TCL** | 4723 | 4.72 |
| | **Amenities** | | |
| 1 | Water Works | 153 | |
| 2 | Masjid | 128 | |
| | **TCL** | 281 | 0.281 |
| | **Commercial** | | |
| 1 | Commercial Building 2000yards (4Nos.) | 1152 | |
| 2 | Commercial Building for Shop 800yards (12Nos.) | 1521 | |
| 3 | Cineplex Complex | 1755 | |
| 4 | Gas Station | 320 | |
| 5 | Club | 602 | |
| 6 | Mini Zoo | 303 | |
| 7 | Riding Club | 1341 | |
| 8 | Drive In Cinema | 210 | |
| | **TCL** | 7204 | 7.204 |
| | **Grand Total Connected Load** | | **12.208** |

## DCK - SECTOR-01
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER K-ELECTRIC & STANDARDS

**Farm House**

| S. # | Plot Area (Sq.yds) | | Net Connected Load (kW) | Group Connected Diversity Factor @ 60% kW | Total No of Plots | Gross Load (kW) |
|---|---|---|---|---|---|---|
| 1 | Farm House | 2000 | 30 | 18 | 138 | 2484 |
| 2 | Farm House | 2500 | 30 | 18 | 50 | 900 |
| 3 | Farm House | 3000 | 30 | 18 | 36 | 648 |
| 4 | Chalets | 300 | 12 | 7.4 | 94 | 691 |
| | | | | | **Total Connected Load (kW)** | **4723.5** |

## DCK - SECTOR-01
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER K-ELECTRIC & STANDARDS

Amenities Load

| S# | Type | Type of Plot | Plot Area (Sq.yds) | Covered Area as per DCK Bye Laws | | | | | Load Criteria | | General Connected Load (kW) | A/C Connected Load (kW) | NCL kW | Conn Load @ 80% D.F (kW) | Total No of Plots | Gross Conn Load (kw) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | % | Covered Area (Sq.yds) | Covered Area (Sq.ft) | No of Floor | Total Sq.ft | General Load (W/sft) | A/C load W/Sq.ft | | | | | | |
| 1 | Amenities | Water Works Motor Load | | | | | | | | | | | 100 | _ | 100 | 100.00 |
| | | Water Works External | 8630 | 100% | 8630 | 77670 | 1 | 77670 | 0.55 | 0 | 42.7 | 0 | 43 | 42.7 | 1 | 42.72 |
| | | Water Works Office | 238 | 100% | 238 | 2142 | 1 | 2142 | 5 | | 10.7 | 0 | 11 | 10.7 | 1 | 10.71 |
| 2 | Amenities | Masjid Internal | 1349 | 100% | 1349 | 12141 | 1 | 12141 | 12 | | 145.7 | 0 | 146 | 116.6 | 1 | 116.55 |
| | | Masjid External | 2881 | 100% | 2881 | 25929 | 1 | 25929 | 0.55 | 0 | 14.3 | 0 | 14 | 11.4 | 1 | 11.41 |
| | | | | | | | | | | | | | TCL (kW) | | | 281.4 |

**DCK - SECTOR-01**
**ELECTRICAL LOAD CALCULATIONS**
**LOAD AS PER K-ELECTRIC & STANDARDS**

**Commercial Load**

| S# | Type | Type of Plot | Plot Area (Sq.yds) | Covered Area as per DCK Bye Laws | | | | | K-E & other Load Criteria | | General Con. Load (kW) | A/C Con. Load (kW) | NCL (kW) | Con Load @ 80% D.F (kW) | Total No of Plots | Gross Con. Load (kw) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | % | Covered Area (Sq.yds) | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C Load (W/sft) | | | | | | |
| 1 | Commercial Building for Shop - 800 yards | G.F | 800 | 80% | 640 | 5760 | 1 | 15840 | 10 | | 158.4 | | 158 | 126.7 | 12 | 1521 |
| | | Remaining Floor | 800 | 70% | 560 | 5040 | 2 | | | | | | | | | |
| 2 | Ceniplex (Already designed by Architect) | Basement-1 (Parking) | 4220 | 65% | 2743 | 24688 | 1 | 24688 | 0.75 | | 18.5 | | 19 | 15 | 1 | 1755 |
| | | Basement-2 (Parking) | 4220 | 65% | 2743 | 24688 | 1 | 24688 | 0.75 | | 18.5 | | 19 | 15 | 1 | |
| | | G.F (Shopping Mall) | 4220 | 70% | 2954 | 26587 | 1 | 26587 | 15 | | 399 | | 399 | 319 | 1 | |
| | | 1st.F (Shopping Mall) | 4220 | 65% | 2743 | 24688 | 1 | 24688 | 15 | | 370 | | 370 | 296 | 1 | |
| | | 2nd.F (Shopping Mall) | 4220 | 65% | 2743 | 24688 | 1 | 24688 | 15 | | 370 | | 370 | 296 | 1 | |
| | | 3rd.F (Shopping Mall) | 4220 | 65% | 2743 | 24688 | 1 | 24688 | 15 | | 370 | | 370 | 296 | 1 | |
| | | 4th.F (Food Court) | 4220 | 65% | 2743 | 24688 | 1 | 24688 | 3 | 8 | 74.1 | 198 | 272 | 217 | 1 | |
| | | 5th.F (Cineplex) | 4220 | 65% | 2743 | 24688 | 1 | 24688 | 5 | 10 | 123.4 | 247 | 370 | 296 | 1 | |
| | | Roof (Covered Area) | 170 | 65% | 111 | 995 | 1 | 995 | 5 | | 5.0 | | 5 | 4 | 1 | |
| 3 | Gas Station | G.F | | | | | | | | | | | 320 | _ | 320 | 320 |
| 4 | Club (Already designed by Architect) | Basement (Parking) | 2713 | 65% | 1763 | 15871 | 1 | 15871 | 0.75 | | 11.9 | | 12 | 9.5 | 1 | 602 |
| | | G.F (Café/Rest) | 1762 | 70% | 1233 | 11101 | 1 | 11101 | 5 | 8 | 55.5 | 89 | 144 | 115.4 | 1 | |
| | | M.F (Café/Rest) | 1983 | 65% | 1289 | 11601 | 1 | 11601 | 5 | 8 | 58.0 | 93 | 151 | 120.6 | 1 | |
| | | F.F (Gym) | 2160 | 65% | 1404 | 12636 | 1 | 12636 | 8 | 8 | 101.1 | 101 | 202 | 161.7 | 1 | |
| | | S.F (Indoor games) | 2160 | 65% | 1404 | 12636 | 1 | 12636 | 5 | 8 | 63.2 | 101 | 164 | 131.4 | 1 | |
| | | Roof (open food court) | 2713 | 65% | 1763 | 15871 | 1 | 15871 | 5 | | 79.4 | | 79 | 63.5 | 1 | |
| | | | | | | | | | | | | | | | Total Connected Load (kW) | 4198 |
| | | | | | | | | | | | | | | | Total MW for Feeder | 4.20 |

## DCK - SECTOR-01
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER K-ELECTRIC STANDARDS

**Commercial Load**

| S# | Type | Type of Plot | Plot Area (Sq.yds) | Covered Area as per DCK Bye Laws | | | | | K-E & other Load Criteria | | General Con. Load (kW) | A/C Con. Load (kW) | NCL (kW) | Con Load @ 80% D.F (kW) | Total No of Plots | Gross Con. Load (kw) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | % | Covered Area (Sq.yds) | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C Load (W/sft) | | | | | | |
| 1 | Commercial Building 2000 yards | G.F | 2000 | 70% | 1400 | 12600 | 1 | 36000 | 10 | | 360.0 | 0 | 360 | 288.0 | 4 | 1152 |
| | | Remaining Floor | 2000 | 65% | 1300 | 11700 | 2 | | | | | | | | | |
| 2 | Drive in Cinema | Staff Room | 125 | 100% | 125 | 1125 | 1 | 1125 | 4 | 4 | 4.5 | 5 | 9 | 7.2 | 1 | 210 |
| | | Stand Snacks | 283 | 90% | 255 | 2292 | 1 | 2292 | 6 | 2 | 13.8 | 5 | 18 | 14.7 | 1 | |
| | | Parking | 2476 | 100% | 2476 | 22284 | 1 | 22284 | 0.75 | 0 | 16.7 | 0 | 17 | 13.4 | 1 | |
| | | Projector + Sound System | | | | | | | | | | | 10 | 10.0 | 1 | |
| | | Projection Area | 41919 | 70% | 29343 | 264090 | 1 | 264090 | 0.75 | 0 | 198.1 | 0 | 198 | 158.5 | 1 | |
| | | Landscape | 1491 | 75% | 1118 | 10064 | 1 | 10064 | 0.75 | 0 | 7.5 | 0 | 8 | 6.0 | 1 | |
| 3 | Mini Zoo | Floor | 50136 | 70% | 35095 | 315857 | 1 | 315857 | 1.2 | | 379.0 | 0 | 379 | 303.2 | 1 | 303 |
| 4 | Riding | Club | 800 | 80% | 640 | 5760 | 3 | 17280 | 12 | | 207.4 | 0 | 207 | 165.9 | 1 | 1341 |
| | | Office | 800 | 80% | 640 | 5760 | 3 | 17280 | 10 | | 172.8 | 0 | 173 | 138.2 | 1 | |
| | | Cafteriea | 800 | 80% | 640 | 5760 | 2 | 11520 | 12 | | 138.2 | 0 | 138 | 110.6 | 1 | |
| | | Stables | 800 | 80% | 640 | 5760 | 1 | 5760 | 10 | | 57.6 | 0 | 58 | 46.1 | 1 | |
| | | Staff Accomodation | 520 | 85% | 442 | 3978 | 3 | 11934 | 8 | | 95.5 | 0 | 95 | 76.4 | 1 | |
| | | Service Building | 2118 | 70% | 1483 | 13343 | 3 | 40030 | 10 | | 400.3 | 0 | 400 | 320.2 | 1 | |
| | | Labour Accomodation | 510 | 85% | 434 | 3902 | 3 | 11705 | 6 | | 70.2 | 0 | 70 | 56.2 | 1 | |
| | | PADDocks | 1055 | 75% | 791 | 7121 | 1 | 7121 | 2 | 0 | 14.2 | 0 | 14 | 11.4 | 1 | |
| | | Hurdle | 1729 | 75% | 1297 | 11671 | 1 | 11671 | 2 | 0 | 23.3 | 0 | 23 | 18.7 | 1 | |
| | | Breeding Barn | 2118 | 70% | 1483 | 13343 | 1 | 13343 | 2 | 0 | 26.7 | 0 | 27 | 21.3 | 1 | |
| | | Riding Arena (Open) | 25531 | 70% | 17872 | 160845 | 1 | 160845 | 2 | 0 | 321.7 | 0 | 322 | 257.4 | 1 | |
| | | Riding Arena (covered) | 2240 | 70% | 1568 | 14112 | 1 | 14112 | 2 | 5 | 28.2 | 71 | 99 | 79.0 | 1 | |
| | | Car Parking | 2216 | 70% | 1551 | 13961 | 1 | 13961 | 0.75 | 0 | 10.5 | 0 | 10 | 8.4 | 1 | |
| | | Green Area + | 8208 | 70% | 5746 | 51710 | 1 | 51710 | 0.75 | 0 | 38.8 | 0 | 39 | 31.0 | 1 | |
| | | | | | | | | | | | Total Connected Load (kW) | | | | | 3006 |
| | | | | | | | | | | | Total MW for Feeder | | | | | 3.01 |

# 4

## FEEDER SIZING
## SECTOR-01 (PACKAGE-1)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-01 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
**Consulting Engineers – Architects – Planners**
245/2-K, Block-6, PECHS, Karachi-75400, Pakistan
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# FEEDER SIZING

**DCK - SECTOR-01**
**ELECTRICAL LOAD CALCULATIONS**
**LOAD AS PER K-ELECTRIC & STANDARDS**

| | **Feeder -1 Load** | **Commercial + Farm House + Chalets** | | |
|---|---|---|---|---|
| S# | Description | Load (kW) | Qty | Total Load kW |
| 1 | Commercial Building 2000yards | 1152 | 1 | 1152 |
| 2 | Water Work | 153 | 1 | 153 |
| 3 | Masjid | 128 | 1 | 128 |
| 4 | Chalets 12.26kW @ 60% load Factor | 7.5 | 74 | 555 |
| 5 | Farm House 30kW @ 60% load Factor | 18 | 121 | 2178 |
| | | | TCL (kW) | 4166 |
| | | | TCL (MW) | **4.17** |
| | | | | |

| | **Feeder -2 Load** | **Commercial + Farm House + Chalets** | | |
|---|---|---|---|---|
| S# | Description | Load (kW) | Qty | Total Load kW |
| 1 | Drive in Cinema | 210 | 1 | 210 |
| 2 | Riding Club | 1341 | 1 | 1341 |
| [illegible] | Mini Zoo | 303 | 1 | 303 |
| 4 | Farm House 30kW @ 60% load Factor | 18 | 103 | 1854 |
| 5 | Chalets 12.26kW @ 60% load Factor | 7.5 | 20 | 150 |
| | | | TCL (kW) | 3858 |
| | | | TCL (MW) | **3.86** |

| | Feeder -3 Load | Pure Commercial | | |
|---|---|---|---|---|
| S# | Description | Load (kW) | Qty | Total Load kW |
| 1 | Commercial Building Shops | 1521 | 1 | 1521 |
| 2 | Cineplex | 1755 | 1 | 1755 |
| 3 | Gas Station | 320 | 1 | 320 |
| 4 | Club | 602 | 1 | 602 |
| | | | TCL (kW) | 4198 |
| | | | TCL (MW) | **4.20** |
| | | | GCL (MW) | **12.22** |

# 5

## LV- VOLTAGE DROP
## SECTOR-01 (PACKAGE-1)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-01 (PACKAGE-1)
.DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


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**D.H.A CITY**
**SECTOR-01 (Farm House)**
**VOLTAGE DROP CALCULATIONS (LV)**

| | Service Name | Feeder Route | | Power Cable Length | Load kW on Feeder Piller | | | | Ampere | | Cable Sizing | | | | | Voltage Drop | Total Length Rm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | From | To | Rm | Con Load kW | Qty | TCL kW | factor @ 80% Load kW | TCL Amp | C.B @ 100% | Cable Sq.mm | Actual Amp rating | After D.F Amp | Cable Qty | Max Amp Draw | V.D % | |
| | 0 | 1 | 2 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 17 | 18 | 19 | 20 | 21 | 24 | 25 |
| 1 | Chalets | TR-1 - 1 | FP 1 -1/1 | 84 | 13 | 5 | 65 | 52 | 94 | 250 | 70 | 130 | 125 | 1 | 125 | 1.91 | 84 |
| 2 | Chalets | TR-1 - 1 | FP 1 -1/2 | 177 | 13 | 5 | 65 | 52 | 94 | 250 | 120 | 174 | 167 | 1 | 167 | 2.40 | 177 |
| 3 | Farm House | TR-1 - 1 | FP 1 -1/3 | 128 | 30 | 5 | 150 | 120 | 214 | 250 | 240 | 253 | 244 | 1 | 244 | 2.12 | 128 |
| 4 | Farm House | TR-1 - 1 | FP 1 -1/4 | 182 | 30 | 5 | 150 | 120 | 216 | 250 | 300 | 286 | 275 | 1 | 275 | 2.56 | 182 |
| 5 | Farm House | TR-1 - 2 | FP 1 - 2/1 | 125 | 30 | 5 | 150 | 120 | 214 | 250 | 240 | 253 | 244 | 1 | 244 | 2.07 | 125 |
| 6 | Farm House | TR-1 - 2 | FP 1 - 2/2 | 69 | 30 | 5 | 150 | 120 | 214 | 250 | 240 | 253 | 244 | 1 | 244 | 1.14 | 69 |
| 7 | Chalets | TR-1 - 2 | FP 1 - 2/3 | 59 | 13 | **5** | **169** | 135 | 242 | 250 | 300 | 286 | 275 | 1 | 275 | 0.93 | 59 |
| 8 | Chalets | **FP 2 - 2/3** | **FP 1 - 2/4** | 91 | 13 | **8** | **104** | 83 | 150 | 250 | 150 | 197 | 190 | 1 | 190 | 1.60 | 91 |
| 9 | Chalets | TR-1 - 2 | FP 1 - 2/5 | 105 | 13 | 8 | 104 | 83 | 150 | 250 | 150 | 197 | 190 | 1 | 190 | 1.85 | 105 |
| 10 | Chalets | TR-1 - 3 | FP 1 -3/1 | 8 | 13 | 8 | 104 | 83 | 150 | 250 | 150 | 197 | 190 | 1 | 190 | 0.14 | 8 |
| 11 | Chalets | TR [illegible] | FP 1 -3/2 | 58 | 13 | **3** | **143** | 114 | 206 | 250 | 240 | 253 | 244 | 1 | 244 | 0.93 | 58 |
| 12 | Chalets | **FP 1 - 3/2** | **FP 1 -3/3** | 89 | 13 | **8** | **104** | 83 | 150 | 250 | 150 | 197 | 190 | 1 | 190 | 1.57 | 89 |
| 13 | Farm House | TR-1 - 3 | FP 1 -3/4 | 148 | 30 | 4 | 120 | 96 | 173 | 250 | 185 | 220 | 212 | 1 | 212 | 2.49 | 148 |
| 14 | Farm House | TR-1 - 3 | FP 1 -3/5 | 112 | 30 | 4 | 120 | 96 | 173 | 250 | 185 | 220 | 212 | 1 | 212 | 1.89 | 112 |
| 15 | Farm House | TR-1 [illegible] | FP 1 -4/2 | 35 | 30 | 4 | 120 | 96 | 173 | 250 | 185 | 220 | 212 | 1 | 212 | 0.59 | 35 |
| 16 | Farm House | TR [illegible] | FP 1 -4/3 | 191 | 30 | 4 | 120 | 96 | 173 | 250 | 240 | 253 | 244 | 1 | 244 | 2.56 | 191 |
| 17 | Water Work | TR 1 - 4 | Directly Feed | 74 | 146 | 1 | 146 | 117 | 210 | 250 | 240 | 253 | 244 | 1 | 244 | 1.21 | 74 |
| 18 | Farm House | TR-1 - 7 | FP 1 - 7/1 | 107 | 30 | 5 | 150 | 120 | 214 | 250 | 240 | 253 | 244 | 1 | 244 | 1.77 | 107 |
| 19 | Chalets | TR-1 - 7 | FP 1 - 7/2 | 174 | 13 | 8 | 104 | 83 | 150 | 250 | 185 | 220 | 212 | 1 | 212 | 2.54 | 174 |
| 20 | Farm House | TR-1 - 7 | FP 1 - 7/3 | 181 | 30 | 5 | 150 | 120 | 216 | 250 | 300 | 286 | 275 | 1 | 275 | 2.54 | 181 |

| | Name | From | To | Rm | Con Load kW | Qty | TCL kW | factor @ 80% Load kW | TCL Amp | C.B @ 100% | Cable Sq.mm | Actual Amp rating | After D.F Amp | Cable Qty | Max Amp Draw | V.D % | Rm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 17 | 18 | 19 | 20 | 21 | 24 | 25 |
| 21 | Farm House | TR-1 - 8 | FP 1 - 8/1 | 9 | 30 | 4 | 120 | 96 | 166 | 250 | 150 | 197 | 190 | 1 | 190 | 0.18 | 9 |
| 22 | Farm House | TR-1 - 8 | FP 1 - 8/2 | 182 | 30 | 5 | 150 | 120 | 216 | 250 | 300 | 286 | 275 | 1 | 275 | 2.56 | 182 |
| 23 | Chalets | TR-1 - 8 | FP 1 - 8/3 | 48 | 13 | 8 | 104 | 83 | 150 | 250 | 150 | 197 | 190 | 1 | 190 | 0.84 | 48 |
| 24 | Chalets | TR-1 - 8 | FP 1 - 8/4 | 195 | 13 | 8 | 104 | 83 | 150 | 250 | 240 | 253 | 244 | 1 | 244 | 2.26 | 195 |
| 25 | Farm House | TR-1 - 9 | FP 1 - 9/1 | 164 | 30 | 4 | 120 | 96 | 173 | 250 | 240 | 253 | 244 | 1 | 244 | 2.20 | 164 |
| 26 | Farm House | TR-1 - 9 | FP 1 - 9/2 | 13 | 30 | 5 | 150 | 120 | 214 | 250 | 240 | 253 | 244 | 1 | 244 | 0.22 | 13 |
| 27 | Farm House | TR-1 - 9 | FP 1 - 9/3 | 182 | 30 | 5 | 150 | 120 | 216 | 250 | 300 | 286 | 275 | 1 | 275 | 2.56 | 182 |
| 28 | Farm House | TR-1 - 9 | FP 1 - 9/4 | 98 | 30 | 5 | 150 | 120 | 214 | 250 | 240 | 253 | 244 | 1 | 244 | 1.63 | 98 |
| 29 | Farm House | TR-1 - 10 | FP 1 - 10/1 | 158 | 30 | 6 | 180 | 144 | 259 | 250 | 150 | 197 | 190 | 2 | 379 | 2.41 | 316 |
| 30 | Farm House | TR-1 - 10 | FP 1 - 10/2 | 179 | 30 | 5 | 150 | 120 | 216 | 250 | 300 | 286 | 275 | 1 | 275 | 2.51 | 179 |
| 31 | Farm House | TR-1 - 10 | FP 1 - 10/3 | 118 | 30 | 6 | 180 | 144 | 259 | 250 | 120 | 174 | 167 | 2 | 335 | 2.22 | 236 |
| 32 | Farm House | TR-1 - 11 | FP 1 -11/1 | 197 | 30 | 6 | 180 | 144 | 259 | 250 | 185 | 220 | 212 | 2 | 424 | 2.49 | 394 |
| 33 | Farm House | TR-1 - 11 | FP 1 -11/2 | 168 | 30 | 6 | 180 | 144 | 259 | 250 | 150 | 197 | 190 | 2 | 379 | 2.56 | 336 |
| 34 | Farm House | TR-1 - 11 | FP 1 -11/3 | 164 | 30 | 6 | 180 | 144 | 259 | 250 | 150 | 197 | 190 | 2 | 379 | 2.50 | 328 |
| 35 | Farm House | TR-1 -12 | FP 1 - 12/1 | 100 | 30 | 5 | 150 | 120 | 214 | 250 | 240 | 253 | 244 | 1 | 244 | 1.66 | 100 |
| 36 | Farm House | TR-1 -12 | FP 1 - 12/3 | 136 | 30 | 6 | 180 | 144 | 259 | 250 | 120 | 174 | 167 | 2 | 335 | 2.56 | 272 |
| 37 | Masjid | TR-1 -12 | Directly Feed | 185 | 137 | 1 | 137 | 110 | 197 | 250 | 300 | 286 | 275 | 1 | 275 | 2.37 | 185 |
| 38 | Farm House | TR-1 -18 | FP 1 - 18/1 | 64 | 30 | 4 | 120 | 96 | 166 | 250 | 150 | 197 | 190 | 1 | 190 | 1.25 | 64 |
| 39 | Farm House | TR-1 -18 | FP 1 - 18/2 | 57 | 30 | 6 | 180 | 144 | 259 | 250 | 120 | 174 | 167 | 2 | 335 | 1.07 | 114 |
| 40 | Farm House | TR-1 -18 | FP 1 - 18/3 | 98 | 30 | 6 | 180 | 144 | 259 | 250 | 120 | 174 | 167 | 2 | 335 | 1.84 | 196 |
| 41 | Farm House | TR-1 -19 | FP 1 - 19/1 | 177 | 30 | 5 | 150 | 120 | 216 | 250 | 300 | 286 | 275 | 1 | 275 | 2.49 | 177 |
| 42 | Farm House | TR-1 -19 | FP 1 - 19/2 | 168 | 30 | 6 | 180 | 144 | 259 | 250 | 150 | 197 | 190 | 2 | 379 | 2.56 | 336 |
| 43 | Farm House | TR-1 -19 | FP 1 - 19/3 | 168 | 30 | 6 | 180 | 144 | 259 | 250 | 150 | 197 | 190 | 2 | 379 | 2.56 | 336 |
| 44 | Farm House | TR-1 -20 | FP 1 - 20/1 | 97 | 30 | 5 | 150 | 120 | 214 | 250 | 240 | 253 | 244 | 1 | 244 | 1.61 | 97 |
| 45 | Farm House | TR-1 -20 | FP 1 - 20/2 | 124 | 30 | 6 | 180 | 144 | 259 | 250 | 120 | 174 | 167 | 2 | 335 | 2.33 | 248 |
| 46 | Farm House | TR-1 -20 | FP 1 - 20/3 | 168 | 30 | 6 | 180 | 144 | 259 | 250 | 150 | 197 | 190 | 2 | 379 | 2.56 | 336 |
| 47 | Farm House | TR-1 -21 | FP 1 - 21/1 | 168 | 30 | 6 | 180 | 144 | 259 | 250 | 150 | 197 | 190 | 2 | 379 | 2.56 | 336 |

| | Name | From | To | Rm | Con Load kW | Qty | TCL kW | factor @ 80% Load kW | TCL Amp | C.B @ 100% | Cable Sq.mm | Actual Amp rating | After D.F Amp | Cable Qty | Max Amp Draw | V.D % | Rm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 17 | 18 | 19 | 20 | 21 | 24 | 25 |
| 48 | Farm House | TR-1 -21 | FP 1 - 21/2 | 25 | 30 | 6 | 180 | 144 | 259 | 250 | 120 | 174 | 167 | 2 | 335 | 0.47 | 50 |
| 49 | Farm House | TR-1 -21 | FP 1 - 21/3 | 167 | 30 | 6 | 180 | 144 | 259 | 250 | 150 | 197 | 190 | 2 | 379 | 2.54 | 334 |
| 50 | Farm House | TR-1 -22 | FP 1 - 22/1 | 49 | 30 | 5 | 150 | 120 | 214 | 250 | 240 | 253 | 244 | 1 | 244 | 0.81 | 49 |
| 51 | Farm House | TR-1 -22 | FP 1 - 22/2 | 142 | 30 | 5 | 150 | 120 | 214 | 250 | 240 | 253 | 244 | 1 | 244 | 2.36 | 142 |
| 52 | Farm House | TR-1 -22 | FP 1 - 22/3 | 168 | 30 | 6 | 180 | 144 | 259 | 250 | 150 | 197 | 190 | 2 | 379 | 2.56 | 336 |
| 53 | Farm House | TR-1 -23 | FP 1 - 23/1 | 77 | 30 | 4 | 120 | 96 | 173 | 250 | 185 | 220 | 212 | 1 | 212 | 1.30 | 77 |
| 54 | Farm House | TR-1 -23 | FP 1 - 23/2 | 144 | 30 | 5 | 150 | 120 | 214 | 250 | 240 | 253 | 244 | 1 | 244 | 2.39 | 144 |
| 55 | Farm House | TR-1 -23 | FP 1 - 23/3 | 80 | 30 | 5 | 150 | 120 | 214 | 250 | 240 | 253 | 244 | 1 | 244 | 1.33 | 80 |
| 56 | Farm House | TR-1 -24 | FP 1 - 24/1 | 64 | 30 | 6 | 180 | 144 | 259 | 250 | 120 | 174 | 167 | 2 | 335 | 1.20 | 128 |
| 57 | Chalets | TR-1 -24 | FP 1 - 24/2 | 6 | 13 | 8 | 104 | 83 | 150 | 250 | 150 | 197 | 190 | 1 | 190 | 0.11 | 6 |
| 58 | Chalets | TR-1 -24 | FP 1 - 24/3 | 81 | 13 | 7 | 91 | 73 | 131 | 250 | 120 | 174 | 167 | 1 | 167 | 1.54 | 81 |
| 59 | Chalets | TR-1 -24 | FP 1 - 24/4 | 175 | 13 | 5 | 65 | 52 | 94 | 250 | 120 | 174 | 167 | 1 | 167 | 2.38 | 175 |

# 6

## LOADING OF TRANSFORMERS IN SECTOR-01 (PACKAGE-1)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-01 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


**OSMANI & COMPANY (PVT.) LTD**
Consulting Engineers – Architects – Planners
245/2-K, Block-6, PECHS, Karachi-75400, Pakistan
Tel: +92-21-34536007 / 08, 34546541/42
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Web: www.osmani.com

| InHouse Working Sheet (DCK - SECTOR-01)<br>Transformer Loading Capacity<br>AS PER K-ELECTRIC STANDARDS | | | |
|---|---|---|---|
| S# | Trafo | kVA | Trafo Loading Capacity % |
| **Feeder-1** | | | |
| 1 | Trafo-1 | 500 | 64% |
| 2 | Trafo-2 | 500 | 84% |
| 3 | Trafo-3 | 500 | 72% |
| 4 | Trafo-4 | 500 | 73% |
| 5 | Trafo-5 | 1000 | 2000Yards Bldg > Commercial Load |
| 6 | Trafo-6 | 1000 | 2000Yards Bldg > Commercial Load |
| 7 | Trafo-7 | 500 | 60% |
| 8 | Trafo-8 | 500 | 71% |
| 9 | Trafo-9 | 500 | 86% |
| 10 | Trafo-10 | 500 | 77% |
| 11 | Trafo-11 | 500 | 81% |
| 12 | Trafo-12 | 500 | 84% |
| **Feeder-2** | | | |
| 13 | Trafo-13 | 500 | Mini-Zoo > Commercial Load |
| 14 | Trafo-14 | 1000 | Riding Club > Commercial Load |
| 15 | Trafo-15 | 1000 | Riding Club > Commercial Load |
| 16 | Trafo-16 | 500 | Drive in Cinema > Commercial Load |
| 17 | Trafo-17 | 500 | Drive in Cinema > Commercial Load |
| 18 | Trafo-18 | 500 | 72% |
| 19 | Trafo-19 | 500 | 77% |
| 20 | Trafo-20 | 500 | 77% |
| 21 | Trafo-21 | 500 | 81% |
| 22 | Trafo-22 | 500 | 72% |
| 23 | Trafo-23 | 500 | 63% |
| 24 | Trafo-24 | 500 | 65% |
| **Feeder-3** | | | |

| | | | |
|---|---|---|---|
| 25 | Trafo-25 | 500 | 800YardsShop > Commercial Load |
| 26 | Trafo-26 | 500 | 800YardsShop > Commercial Load |
| 27 | Trafo-27 | 1000 | CinePlex > Commercial Load |
| 28 | Trafo-28 | 1000 | CinePlex > Commercial Load |
| 29 | Trafo-29 | 500 | 800YardsShop > Commercial Load |
| 30 | Trafo-30 | 500 | 800YardsShop > Commercial Load |
| 31 | Trafo-31 | 500 | Gas Station > Commercial Load |
| 32 | Trafo-32 | 1000 | Club > Commercial Load |

# 8

## BoQ

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-01 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
**Consulting Engineers – Architects – Planners**
245/2-K, Block-6, PECHS, Karachi-75400, Pakistan
Tel: +92-21-34536007 / 08, 34546541/42
Fax: +92-21-34534691
Email: ocl-khi@osmani.com,
Web: www.osmani.

# Bill of Quantities

## GRAND SUMMARY

Client / Owner : Pakistan Defence Officers Housing Authority, Karachi
Name of Project : Electrical Works in Sector-01 (Package-1) at DHA City, Karachi
Bid Reference No. : DCK-ELEC-

| Sub-Head | Name of Work | Amount (PKR) |
|---|---|---|
| A | ONLY SUPPLY WORKS MV/LV DISTRIBUTION | 0 |
| B | INSTALLATION, TESTING AND COMMISSIONING WORKS MV/LV DISTRIBUTION | 0 |
| C | ICT Works | 0 |
| | Total (Million PKR) | 0 |

(Rupees. )

**CONTRACTOR** **FOR DEFENCE OFFICERS' HOUSING AUTHORITY**

# Bill of Quantities

ent / Owner : Pakistan Defence Officers Housing Authority, Karachi
me of Project : Electrical Works in Sector-01 (Package-1) at DHA City, Karachi
l Reference No. : DCK-ELEC-_____

| ·. | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| | **Note:**<br>**i) Supplying of the following items of work including all duties and Texes to DHA designated store with supporting invoice and documentation, drawings and Specification.**<br><br>**ii) Following Items are to be supplied by Contractor as per rates quoted below, However, DHA reserve the right to place the Contract either on installation, Testing and Commissioning basis or Supply and Installation Testing and Commissioning basis.** | | | | |
| | **MV CABLE** | | | | |
| 1 | **Supply of MV cable, 3 core 400 mm²** AL, XLPE / PVC / SWA / PVC 15 kV, Triple Extruded PVC bedded, steel wire armoured and PVC sheathed as per specifications. | 2,500 | m | | 0 |
| 2 | For Interconnection Cable between Sector-01 (Package-01) to Sector-02 From S/S 1-3 to S/S 2-B/1 and For Interconnection Cable between Sector-02 to Sector-02 From S/S 2B/1 to S/S 2-D/1 | 1,500 | m | | 0 |
| | **Supply of straight through HeatShrink joint for 3 core 400 mm² XLPE Almunium Conductor, 15kV**, semi conducting tape, ferrules and earth wire, including all accessories as per specifications and approval of Engineer. | 15 | Set | | 0 |
| 3 | **Supply of Termination Kit for 3 core 400 mm² XLPE Almunium Conductor, 15 kV** including all accessories as per specifications and approval of Engineer. | 12 | Set | | 0 |

| r. | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| 4 | **Supply, laying and testing of MV cable, 3 core 300 mm²** AL, XLPE / PVC / SWA / PVC 15 kV, Triple Extruded PVC bedded, steel wire armoured and PVC sheathed as per specifications. | 9,000 | m | | 0 |
| 5 | **Supply of straight through HeatShrink joint for 3 core 300 mm² XLPE Almunium Conductor, 15kV**, semi conducting tape, ferrules and earth wire, including all accessories as per specifications and approval of Engineer. | 35 | Set | | 0 |
| 6 | **Supply of Termination Kit for 3 core 300 mm²XLPE Almunium Conductor, 15 kV** with all installation as per specifications and approval of Engineer. | 69 | Set | | 0 |
| | **SWITCHING STATION** | | | | |
| | **PAD MOUNTED SWITCHING STATION (5-Way)** | | | | |
| | Supply of outdoor PMU type switching station. It shall have **5-way MV Distribution arrangement**, as defined/detailed in drawing and specification, Each MV switchgear Panel in switching-station shall have extendable, 15 kV Vaccum circuit breaker (VCB), fixed type or with drawable Cassette type, 20kA/1 sec. 630A, with protection through dual powered relay through CT 400/5/5 A. The switchgear panel shall be out door type with protection class IP42. The enclosure shall be IP54. Switching station shall be mounted on RCC plat form. EFI shall be installed on each panel. The relay shall have additional potential free contacts for SCADA. SCADA provision, each VCB and earthing switch shall have potential free "NO" & "NC" contacts for status monitoring and control locally as well as from remote control room through SCADA. Foundation design & drawings shall be provided by the contractor for Engineer's approval. | 1 | Each | | 0 |

| Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|
| ***NOTE***<br><br>*Switching Stations shall have provisions for present or future integration with smart grid through SCADA control.*<br><br>*The Modem shall be capable of connectivity with optical fibre network.*<br>*RTUs, Modem, Battery & Chargers (UPS) shall be part of VCBs panel or in a separate enclosure next to it.*<br><br>*The enclosure of switching station shall be IP-54 and shall be capable of performing at its best at temperatures that can be reached inside a enclosure exposed to the sun at the hottest possible ambient temperature of 50°C.* | | | | |
| **PAD MOUNTED SWITCHING STATION (4-Way)**<br><br>Supply of outdoor PMU type switching station. It shall have **4-way MV Distribution arrangement**, as defined/detailed in drawing and specification, Each MV switchgear Panel in switching-station shall have extendable, 15 kV Vaccum circuit breaker (VCB), fixed type or with drawable Cassette type, 20kA/1 sec. 630A, with protection through dual powered relay through CT 400/5/5 A. The switchgear panel shall be out door type with protection class IP42. The enclosure shall be IP54. Switching station shall be mounted on RCC plat form. EFI shall be installed on each panel. The relay shall have additional potential free contacts for SCADA. SCADA provision, each VCB and earthing switch shall have potential free "NO" & "NC" contacts for status monitoring and control locally as well as from remote control room through SCADA. Foundation design & drawings shall be provided by the contractor for Engineer's approval. | 7 | Each | | 0 |

| Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|
| ***NOTE***<br><br>*Switching Stations shall have provisions for present or future integration with smart grid through SCADA control.*<br><br>*The Modem shall be capable of connectivity with optical fibre network.*<br>*RTUs, Modem, Battery & Chargers (UPS) shall be part of VCBs panel or in a separate enclosure next to it.*<br><br>*The enclosure of switching station shall be IP-54 and shall be capable of performing at its best at temperatures that can be reached inside a enclosure exposed to the sun at the hottest possible ambient temperature of 50°C.* | | | | |
| **PAD MOUNTED SWITCHING STATION (3-Way)**<br><br>Supply of outdoor PMU type switching station. It shall have **3-way MV Distribution arrangement**, as defined/detailed in drawing and specification, Each MV switchgear Panel in switching-station shall have extendable, 15 kV Vaccum circuit breaker (VCB), fixed type or with drawable Cassette type, 20kA/1 sec. 630A, with protection through dual powered relay through CT 400/5/5 A. The switchgear panel shall be out door type with protection class IP42. The enclosure shall be IP54. Switching station shall be mounted on RCC plat form. EFI shall be installed on each panel. The relay shall have additional potential free contacts for SCADA. SCADA provision, each VCB and earthing switch shall have potential free "NO" & "NC" contacts for status monitoring and control locally as well as from remote control room through SCADA. Foundation design & drawings shall be provided by the contractor for Engineer's approval. | 5 | Each | | 0 |
| ***NOTE*** | | | | |

| | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| | *Switching Stations shall have provisions for present or future integration with smart grid through SCADA control.* | | | | |
| | *The Modem shall be capable of connectivity with optical fibre network.* | | | | |
| | *RTUs, Modem, Battery & Chargers (UPS) shall be part of VCBs panel or in a separate enclosure next to it.* | | | | |
| | *The enclosure of switching station shall be IP-54 and shall be capable of performing at its best at temperatures that can be reached inside a enclosure exposed to the sun at the hottest possible ambient temperature of 50°C.* | | | | |

| | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| | **PMU-SUB-STATION** | | | | |
| | **PAD MOUNTED unit (500 kVA- TYPE-A))** | | | | |
| | Supply of Pad mounted unit Sub Station **(Type-A)** with 15 kV, 800 Amp, 20kA/1 sec, extensible, fixed type or with drawable Cassette type, with VCB panels type-I & type-II as defined in detail drawing and specification. The switchgear panel shall be out door type with protection class IP42.The enclosure shall be IP54.<br>Type-I (With metering & with protection)<br>Type-II (Without metering & with protection).<br>The CTs shall be 400/5/5 A with a burden / accuracy class of 10VA/0.5M5 for metering and 15VA/5P20 for protection core for incomming and outgoing feeders.<br>Three Single Core Voltage Transformers shall be provided with ratio of 11000/110 volts having burden of 100 VA and accuracy class of 0.5.<br>Ammeters and Voltmeters with their Selector Switches, Presence of Voltage through Indicators also to be provided.<br>On / Off indications of CB / Switches with Mimic Diagram shall be provided.<br>Electronic Smart AMR Energy Meters shall be provided for remote monitoring. It shall need prior approval by the DHA / Engineer.<br>**500 kVA Oil filled Transformer 11/0.42 kV** with incoming, out going and Tee-Off VCBs on MV side.<br>The Tee-off VCB panel having CTs of 50/5/5 A, shall have protection through dual powered relay, with auxiliary voltage source with battery & charger.<br>EFI shall be installed on each panel except transformer panel.<br>In LV Distribution Board Air Circuit Breaker of 800 Amp with provision of remote data transmission and outgoing 4 Nos MCCB of 250 Amp adjustable shall be as specified in the specification,<br>PMU SUB STATION shall be installed on RCC foundation pad & other accessories including transformer neutral & substation earthing system.<br>Foundation design & drawings shall be provided by the contractor for Engineer's approval.<br>All LV Board and Transformers shall be of outdoor type. | 4 | Each | | |

| S. | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| | ***NOTE:***<br><br>*All Switching Stations, Pad Mounted Unit Substations (both Type-A & Type-B) shall have provisions for present or future integration with smart grid through SCADA control.The Modem shall be capable of connectivity with optical fibre network RTUs, Modem, Battery & Chargers (UPS) shall be part of VCBs panel or in a separate enclosure next to it. The enclosure of PMU shall be IP54 and shall be capable of performing at its best temperatures that can be reached inside a enclosure exposed to the sun at the hottest possible ambient temperature of 50 $^{o}$C.* | | | | |

| | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| | **PAD MOUNTED unit (500 kVA- TYPE-B)**<br><br>Supply of Pad mounted unit Sub Station **(Type-B)** with 15 kV, 800 Amp, 20kA/1 sec, extensible, fixed type or with drawable Cassette type, with VCB panels type-I & type-III as defined in detail drawing and specification. The switchgear panel shall be out door type with protection class IP42.The enclosure shall be IP54.<br>Type-I (With metering & with protection)<br>Type-III (Without metering & without protection).<br>The CTs shall be 400/5/5 A with a burden / accuracy class of 10VA/0.5M5 for metering and 15VA/5P20 for protection core for incomming and outgoing feeders.<br>Three Single Core Voltage Transformers shall be provided with ratio of 11000/110 volts having burden of 100 VA and accuracy class of 0.5.<br>Ammeters and Voltmeters with their Selector Switches, Presence of Voltage through Indicators also to be provided.<br>On / Off indications of CB / Switches with Mimic Diagram shall be provided.<br>Electronic Smart AMR Energy Meters shall be provided for remote monitoring. It shall need prior approval by the DHA / Engineer.<br>**500 kVA Oil filled Transformer 11/0.42 kV** with incoming, out going and Tee-Off VCBs on MV side.<br>The Tee-off VCB panel having CTs of 50/5/5 A, shall have protection through dual powered relay, with auxiliary voltage source with battery & charger.<br>EFI shall be installed on each panel except transformer panel.<br>In LV Distribution Board Air Circuit Breaker of 800 Amp with provision of remote data transmission and outgoing 4 Nos MCCB of 250 Amp adjustable shall be as specified in the specification,<br>PMU SUB STATION shall be installed on RCC foundation pad & other accessories including transformer neutral & substation earthing system.<br>Foundation design & drawings shall be provided by the contractor for Engineer's approval.<br>All LV Board and Transformers shall be of outdoor type. | 10 | Each | | |

| | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| | ***NOTE:*** *All Switching Stations, Pad Mounted Unit Substations (both Type-A & Type-B) shall have provisions for present or future integration with smart grid through SCADA control.The Modem shall be capable of connectivity with optical fibre network. RTUs, Modem, Battery & Chargers (UPS) shall be part of VCBs panel or in a separate enclosure next to it. The enclosure of PMU shall be IP54 and shall be capable of performing at its best temperatures that can be reached inside a enclosure exposed to the sun at the hottest possible ambient temperature of 50°C.* | | | | |
| | **LV CABLE** | | | | |
| | Supply of LV cable 600/1000V stranded aluminum conductor, XLPE insulated, Extruded PVC bedded, steel wire armored and PVC sheathed overall as per Specification. | | | | |
| 1 | 4 core 300mm² AL / XLPE / PVC / SWA / PVC | 1,300 | m | | 0 |
| 2 | 4 core 240mm² AL / XLPE / PVC / SWA / PVC | 1,800 | m | | 0 |
| 3 | 4 core 185mm² AL / XLPE / PVC / SWA / PVC | 950 | m | | 0 |
| 4 | 4 core 150mm² AL / XLPE / PVC / SWA / PVC | 1,900 | m | | 0 |
| 5 | 4 core 120mm² AL / XLPE / PVC / SWA / PVC | 1,055 | m | | 0 |
| 6 | 4 core 70mm² AL / XLPE / PVC / SWA / PVC | 100 | m | | 0 |
| | Supply of straight through HeatShrink joint for following XLPE Almunium Conductor 400V cable, semi conducting tape, ferrules and earth wire, including all accessories as per specifications and approval of Engineer. | | | | |
| 1 | 4 core 300mm² AL / XLPE / PVC / SWA / PVC | 4 | Each | | 0 |
| 2 | 4 core 240mm² AL / XLPE / PVC / SWA / PVC | 6 | Each | | 0 |
| 3 | 4 core 185mm² AL / XLPE / PVC / SWA / PVC | 3 | Each | | 0 |
| 4 | 4 core 150mm² AL / XLPE / PVC / SWA / PVC | 6 | Each | | 0 |

| . | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| 5 | 4 core 120mm² AL / XLPE / PVC / SWA / PVC | 4 | Each | | 0 |
| 6 | 4 core 70mm² AL / XLPE / PVC / SWA / PVC | 3 | Each | | 0 |
| | Supply of Termination Kit for following XLPE Almunium Conductor 400V cable, including all accessories as per specifications and approval of Engineer. | | | | |
| 1 | 4 core 300mm² AL / XLPE / PVC / SWA / PVC | 16 | Each | | 0 |
| 2 | 4 core 240mm² AL / XLPE / PVC / SWA / PVC | 34 | Each | | 0 |
| 3 | 4 core 185mm² AL / XLPE / PVC / SWA / PVC | 12 | Each | | 0 |
| 4 | 4 core 150mm² AL / XLPE / PVC / SWA / PVC | 34 | Each | | 0 |
| 5 | 4 core 120mm² AL / XLPE / PVC / SWA / PVC | 20 | Each | | 0 |
| 6 | 4 core 70 mm² AL / XLPE / PVC / SWA / PVC | 2 | Each | | 0 |
| | **Feeder Pillar**<br>Supply of floor mounted Feeder pillar in Glass Reinforced Polyester (GRP) enclosure with front and rear compartments. Ingress Protection to IP55 and weather proof and rigid construction as defined / detailed in drawing and specification. Both compartments shall have hinged door/lock, padlocking arrangement. The rear compartment shall be suitable for 3 phase, 400 V Main TPN+E Aluminum Bus bar with support insulators, Main Incoming MCCB. Space shall be provided for one Electronic Smart AMR Energy Meter (meter not part of this Tender). The front compartment shall be suitable for 3 phase, 400 V Distribution TPN+E Aluminum bus bars with Insulators for distribution of out going / service connection MCCBs. The Feeder Pillars shall be Installed on RCC pad foundation, its design & drawings shall be provided by the contractor for Engineer's approval. The job shall also include the cost of RCC foundation with complete accessories. | | | | |

| . | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| 1 | **Feeder Pillar (8-WAY, TYPE-A)**<br><br>1No. 250A TP MCCB (Adj.) 35KA (Main I/C Breaker)<br><br>1No. 250A TP MCCB (Adj.) 25KA (I/C Breaker for Distribution Bus bar)<br><br>1No. 300A TPN+E Aluminum Main Bus bar with insulators for I/C & O/G circuits<br><br>1No. 300A TPN+E Aluminum Distribution Bus bar with insulators for out going service connection MCCBs<br><br>Suitable cable gland<br><br>3-Indication lamps<br><br><u>Service connection MCCBs.</u><br><br>8Nos. 60A TP MCCB (Adj.) 15KA<br><br>2Nos. 60A TP MCCB Spaces only | 7 | Each | | 0 |
| 2 | **Feeder Pillar (6-WAY, TYPE-A)**<br><br>1No. 250A TP MCCB (Adj.) 35KA (Main I/C Breaker)<br><br>1No. 250A TP MCCB (Adj.) 25KA (I/C Breaker for Distribution Bus bar)<br><br>1No. 300A TPN+E Aluminum Main Bus bar with insulators for I/C & O/G circuits<br><br>1No. 300A TPN+E Aluminum Distribution Bus bar with insulators for out going service connection MCCBs<br><br>Suitable cable gland<br><br>3-Indication lamps<br><br><u>Service connection MCCBs.</u><br><br>6Nos. 60A TP MCCB (Adj.) 15KA<br><br>2Nos. 60A TP MCCB Spaces only | 25 | Each | | 0 |

| r. | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| | Note: Please refere the Dwg #<br>2400-01-03-01-55-02-03-E700 Sheet-2<br>2400-01-03-01-55-02-03-E301 | | | | |

| ?. | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| 3 | **Feeder Pillar (4-WAY,TYPE-A)**<br><br>1No. 250A TP MCCB (Adj.) 35KA (Main I/C Breaker)<br><br>1No. 250A TP MCCB (Adj.) 25KA (I/C Breaker for Distribution Bus bar)<br><br>1No. 300A TPN+E Aluminum Main Bus bar with insulators for I/C & O/G circuits<br><br>1No. 300A TPN+E Aluminum Distribution Bus bar with insulators for out going service connection MCCBs<br><br>Suitable cable gland<br><br>3-Indication lamps<br><br><u>Service connection MCCBs.</u><br><br>4Nos. 60A TP MCCB (Adj.) 15KA<br><br>2Nos. 60A TP MCCB Spaces only | 8 | Each | | 0 |
| 4 | **Feeder Pillar (6-Way,TYPE-B)**<br><br>1No. 250A TP MCCB (Adj.) 25KA (Main I/C Breaker)<br><br>1No. 100A TP MCCB (Adj.) 25KA (I/C Breaker for Distribution Bus bar)<br><br>1No. 200A TP MCCB (Adj.) 25KA (O/G Breaker for Next Feeder Pillar)<br><br>1No. 300A TPN+E Aluminum Main Bus bar with insulators for I/C & O/G circuits<br><br>1No. 150A TPN+E Aluminum Distribution Bus bar with insulators for out going service connection MCCBs<br><br>Suitable cable gland<br><br>3-Indication lamps<br><br><u>Service connection MCCBs.</u><br><br>6Nos. 80A TP MCCB (Adj.) 15KA<br><br>2Nos. 80A TP MCCB Spaces only | 2 | Each | | 0 |

| S. | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| 5 | **Feeder Pillar (8-Way, TYPE-B)** | 2 | Each | | 0 |
| | 1No. 200A TP MCCB (Adj.) 35KA (Main I/C Breaker) | | | | |
| | 1No. 250A TPN+E Aluminum Main Bus bar with insulators for I/C & O/G circuits | | | | |
| | Suitable cable gland | | | | |
| | 3-Indication lamps | | | | |
| | Service connection MCCBs. | | | | |
| | 8Nos. 80A TP MCCB (Adj.) 15KA | | | | |
| | 2Nos. 80A TP MCCB Spaces only | | | | |
| | | | | **Total of Rs.** | **0** |

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In Words

**ONTRACTOR** **FOR DEFENCE OFFICERS' HOUSING AUTHORI**

# Bill of Quantities

**Installation, Testing, Commissioning and handingover of the Equipment material issued from DHA Stores.**

Defence Officers Housing Authority, Karachi
Name of Project : Electrical Works in Sector-01 (Package-1) at DHA City, Karachi
Bid Reference No. : DCK-ELEC-_____

| Sr. # | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| **1 - ELECTRICAL WORKS MV DISTRIBUTION** | | | | | |
| | **Notes**<br><br>**i) Installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labor, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.**<br><br>**ii) Contractor shall submit drawings as per specifications for approval of engineer.** | | | | |
| 1 | **MV CABLE** | | | | |
| 1.1 | **Laying and testing of MV cable, 3 core 400 mm²**<br>AL, XLPE / PVC / SWA / PVC 15 kV, Triple Extruded PVC bedded, steel wire armoured and PVC sheathed as per specifications, already excavated in trenches covered with bricks, sand, warning tape as per drawings.<br>Transportation of cables from DHA stores to assigned locations including Insurance of Cables to safeguard against theft and damages during transportation.<br>Note: The Bidder/contractor shall take extreme care in cutting of cables before laying to minimize the wastage. | 2,500 | m | | 0 |
| 1.2 | For Interconnection Cable between Sector-01 (Package-01) to Sector-02 From S/S 1-3 to S/S 2-B/1 and For Interconnection Cable between Sector-02 to Sector-02 From S/S 2B/1 to S/S 2-D/1<br>Transportation of cables from DHA stores to assigned locations including Insurance of Cables to safeguard against theft and damages during transportation.<br>Note: The Bidder/contractor shall take extreme care in cutting of cables before laying to minimize the wastage. | 1,500 | m | | 0 |

| Sr. # | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| a | **Fixing of straight through HeatShrink joint for 3 core 400 mm² XLPE Almunium Conductor, 15kV**, semi conducting tape, ferrules and earth wire, including all accessories as per specifications and approval of Engineer.<br>Transportation of Cable Joint from DHA stores to assigned locations including Insurance of Cable Joints to safeguard against theft and damages during transportation. | 15 | Set | | 0 |
| 1.3 | **Fixing of Termination Kit for 3 core 400 mm²XLPE Almunium Conductor, 15 kV** including all accessories as per specifications and approval of Engineer.<br>Transportation of Cable Termination Kits from DHA stores to assigned locations including Insurance of Cable Termination Kits to safeguard against theft and damages during transportation. | 12 | Set | | 0 |
| 1.4 | **Laying and testing of MV cable, 3 core 300 mm²** AL, XLPE / PVC / SWA / PVC 15 kV, Triple Extruded PVC bedded, steel wire armoured and PVC sheathed as per specifications, already excavated in trenches covered with bricks, sand, warning tape as per drawings.<br>Transportation of cables from DHA stores to assigned locations including Insurance of Cables to safeguard against theft and damages during transportation.<br>Note: The Bidder/contractor shall take extreme care in cutting of cables before laying to minimize the wastage. | 9,000 | m | | 0 |
| 1.5 | **Fixing of straight through HeatShrink joint for 3 core 300 mm² XLPE Almunium Conductor, 15kV**, semi conducting tape, ferrules and earth wire, including all accessories as per specifications and approval of Engineer.<br>Transportation of Cable Joint from DHA stores to assigned locations including Insurance of Cable Joints to safeguard against theft and damages during transportation | 35 | Set | | 0 |
| 1.6 | **Fixing of Termination Kit for 3 core 300 mm²XLPE Almunium Conductor, 15 kV** with all installation as per specifications and approval of Engineer.<br>Transportation of Cable Termination Kits from DHA stores to assigned locations including Insurance of Cable Termination Kits to safeguard against theft and damages during transportation. | 69 | Set | | 0 |

| Sr. # | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| 1.7 | **Supply and Fixing of 11 kV MV cable route marker** through out the cable route as shown on the Drawing as per specifications. | 87 | Each | | 0 |
| 2 | **SWITCHING STATION** | | | | |
| a | **PAD MOUNTED SWITCHING STATION (5-Way)** | | | | |
| | Installation, connecting, testing and commissioning of outdoor PMU type switching station. It shall have **5-way MV Distribution arrangement**, as defined/detailed in drawing and specification, Each MV switchgear Panel in switching-station shall have extendable, 15 kV Vaccum circuit breaker (VCB), fixed type or with drawable Cassette type, 20kA/1 sec. 630A, with protection through dual powered relay through CT 400/5/5 A. The switchgear panel shall be out door type with protection class IP42. The enclosure shall be IP54. Switching station shall be mounted on RCC plat form. EFI shall be installed on each panel. The relay shall have additional potential free contacts for SCADA. SCADA provision, each VCB and earthing switch shall have potential free "NO" & "NC" contacts for status monitoring and control locally as well as from remote control room through SCADA. Foundation design & drawings shall be provided by the contractor for Engineer's approval.<br><br>Contractor will be also responsible for;<br>(a) Transportation of Switching Stations from DHA stores to assigned locations including Insurance of equipment to safeguard against theft and damages during transportation.<br>(b) Co-ordination with and obtaining the SOPs from the original suppliers of Switching Stations during installation, testing and commissioning and to keep the original warranties intact.<br>(c) Construction of foundations for Switching Stations as per equipment drawings and in co-ordination with the original suppliers.<br>(d) Placement of Switching Stations on foundations at assigned locations | 1 | Each | | 0 |

| Sr. # | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| | *NOTE*<br>*Switching Stations shall have provisions for present or future integration with smart grid through SCADA control.*<br><br>*The Modem shall be capable of connectivity with optical fibre network.*<br>*RTUs, Modem, Battery & Chargers (UPS) shall be part of VCBs panel or in a separate enclosure next to it.*<br><br>*The enclosure of switching station shall be IP-54 and shall be capable of performing at its best at temperatures that can be reached inside a enclosure exposed to the sun at the hottest possible ambient temperature of 50°C.* | | | | |
| b | **PAD MOUNTED SWITCHING STATION (4-Way)** | | | | |
| | Installation, connecting, testing and commissioning of outdoor PMU type switching station. It shall have **4-way MV Distribution arrangement**, as defined/detailed in drawing and specification, Each MV switchgear Panel in switching-station shall have extendable, 15 kV Vaccum circuit breaker (VCB), fixed type or with drawable Cassette type, 20kA/1 sec. 630A, with protection through dual powered relay through CT 400/5/5 A. The switchgear panel shall be out door type with protection class IP42. The enclosure shall be IP54. Switching station shall be mounted on RCC plat form. EFI shall be installed on each panel. The relay shall have additional potential free contacts for SCADA. SCADA provision, each VCB and earthing switch shall have potential free "NO" & "NC" contacts for status monitoring and control locally as well as from remote control room through SCADA. Foundation design & drawings shall be provided by the contractor for Engineer's approval.<br><br>Contractor will be also responsible for;<br>(a) Transportation of Switching Stations from DHA stores to assigned locations including Insurance of equipment to safeguard against theft and damages during transportation.<br>(b) Co-ordination with and obtaining the SOPs from the original suppliers of Switching Stations during installation, testing and commissioning and to keep the original warranties intact.<br>(c) Construction of foundations for Switching Stations as per equipment drawings and in co-ordination with the original suppliers.<br>(d) Placement of Switching Stations on foundations at assigned locations. | 7 | Each | | 0 |

| Sr. # | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| | *NOTE*<br><br>*Switching Stations shall have provisions for present or future integration with smart grid through SCADA control.*<br><br>*The Modem shall be capable of connectivity with optical fibre network.*<br>*RTUs, Modem. Battery & Chargers (UPS) shall be part of VCBs panel or in a separate enclosure next to it.*<br><br>*The enclosure of switching station shall be IP-54 and shall be capable of performing at its best at temperatures that can be reached inside a enclosure exposed to the sun at the hottest possible ambient temperature of 50°C.* | | | | |
| c | **PAD MOUNTED SWITCHING STATION (3-Way)** | | | | |
| | Installation, Connecting, testing and commissioning of outdoor PMU type switching station. It shall have **3-way MV Distribution arrangement**, as defined/detailed in drawing and specification, Each MV switchgear Panel in switching-station shall have extendable, 15 kV Vaccum circuit breaker (VCB), fixed type or with drawable Cassette type, 20kA/1 sec. 630A, with protection through dual powered relay through CT 400/5/5 A. The switchgear panel shall be out door type with protection class IP42. The enclosure shall be IP54. Switching station shall be mounted on RCC plat form. EFI shall be installed on each panel. The relay shall have additional potential free contacts for SCADA. SCADA provision, each VCB and earthing switch shall have potential free "NO" & "NC" contacts for status monitoring and control locally as well as from remote control room through SCADA. Foundation design & drawings shall be provided by the contractor for Engineer's approval.<br><br>Contractor will be also responsible for;<br>(a) Transportation of Switching Stations from DHA stores to assigned locations including Insurance of equipment to safeguard against theft and damages during transportation.<br>(b) Co-ordination with and obtaining the SOPs from the original suppliers of Switching Stations during installation, testing and commissioning and to keep the original warranties intact.<br>(c) Construction of foundations for Switching Stations as per equipment drawings and in co-ordination with the original suppliers.<br>(d) Placement of Switching Stations on foundations at | 5 | Each | | 0 |

| Sr. # | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| | *NOTE*<br><br>*Switching Stations shall have provisions for present or future integration with smart grid through SCADA control.*<br><br>*The Modem shall be capable of connectivity with optical fibre network.*<br>*RTUs, Modem, Battery & Chargers (UPS) shall be part of VCBs panel or in a separate enclosure next to it.*<br><br>*The enclosure of switching station shall be IP-54 and shall be capable of performing at its best at temperatures that can be reached inside a enclosure exposed to the sun at the hottest* | | | | |
| 3 | **PMU-SUB-STATION** | | | | |
| a | **PAD MOUNTED UNIT (500 kVA- TYPE-A))** | | | | |
| | Installing, conecting, testing and Commissioning of Pad mounted unit Sub Station **(Type-A)** with 15 kV, 800 Amp, 20kA/1 sec, extensible. fixed type or with drawable Cassette type, with VCB panels type-I & type-II as defined in detail drawing and specification.<br>The switchgear panel shall be out door type with protection class IP42.The enclosure shall be IP54.<br>Type-I (With metering & with protection)<br>Type-II (Without metering & with protection).<br>The CTs shall be 400/5/5 A with a burden / accuracy class of 10VA/0.5M5 for metering and 15VA/5P20 for protection core for incomming and outgoing feeders.<br>Three Single Core Voltage Transformers shall be provided with ratio of 11000/110 volts having burden of 100 VA and accuracy class of 0.5.<br>Ammeters and Voltmeters with their Selector Switches, Presence of Voltage through Indicators also to be provided.<br>On / Off indications of CB / Switches with Mimic Diagram shall be provided.<br>Electronic Smart AMR Energy Meters shall be provided for remote monitoring. It shall need prior approval by the DHA / Engineer.<br>**500 kVA Oil filled Transformer 11/0.42 kV** with incoming, out going and Tee-Off VCBs on MV side.<br>The Tee-off VCB panel having CTs of 50/5/5 A, shall have protection through dual powered relay, with auxiliary voltage source with battery & charger. | 4 | Each | | - |

| Sr. # | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| | EFI shall be installed on each panel except transformer panel.<br>In LV Distribution Board Air Circuit Breaker of 800 Amp with provision of remote data transmission and outgoing 4 Nos MCCB of 250 Amp adjustable shall be as specified in the specification,<br>PMU SUB STATION shall be installed on RCC foundation pad & other accessories including transformer neutral & substation earthing system.<br>Foundation design & drawings shall be provided by the contractor for Engineer's approval.<br>All LV Board and Transformers shall be of outdoor type.<br><br>Contractor will be also responsible for;<br>(a) Transportation of PMU from DHA stores to assigned locations including Insurance of equipment to safeguard against theft and damages during transportation.<br>(b) Co-ordination with and obtaining the SOPs from the original suppliers of PMU during installation, testing and commissioning and to keep the original warranties intact.<br>(c) Construction of foundations for PMU as per equipment drawings and in co-ordination with the original suppliers.<br>(d) Placement of PMU on foundations at assigned locations.<br><br>***NOTE:***<br><br>*All Switching Stations, Pad Mounted Unit Substations (both Type-A & Type-B) shall have provisions for present or future integration with smart grid through SCADA control.The Modem shall be capable of connectivity with optical fibre network RTUs, Modem, Battery & Chargers (UPS) shall be part of VCBs panel or in a separate enclosure next to it. The enclosure of PMU shall be IP54 and shall be capable of performing at its best temperatures that can be reached inside a enclosure exposed to the sun at the hottest possible ambient temperature of 50 $^{0}$C.* | | | | |

| Sr. # | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| b | **PAD MOUNTED unit (500 kVA- TYPE-B)** | | | | |
| | Installing, conecting, testing and Commissioning of Pad mounted unit Sub Station **(Type-B)** with 15 kV, 800 Amp, 20kA/1 sec, extensible, fixed type or with drawable Cassette type, with VCB panels type-I & type-III as defined in detail drawing and specification. The switchgear panel shall be out door type with protection class IP42.The enclosure shall be IP54. Type-I (With metering & with protection) Type-III (Without metering & without protection). The CTs shall be 400/5/5 A with a burden / accuracy class of 10VA/0.5M5 for metering and 15VA/5P20 for protection core for incomming and outgoing feeders. Three Single Core Voltage Transformers shall be provided with ratio of 11000/110 volts having burden of 100 VA and accuracy class of 0.5. Ammeters and Voltmeters with their Selector Switches, Presence of Voltage through Indicators also to be provided. On / Off indications of CB / Switches with Mimic Diagram shall be provided. Electronic Smart AMR Energy Meters shall be provided for remote monitoring. It shall need prior approval by the DHA / Engineer. **500 kVA Oil filled Transformer 11/0.42 kV** with incoming, out going and Tee-Off VCBs on MV side. The Tee-off VCB panel having CTs of 50/5/5 A, shall have protection through dual powered relay, with auxiliary voltage source with battery & charger. | 10 | Each | | - |

| Sr. # | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| | EFI shall be installed on each panel except transformer panel.<br>In LV Distribution Board Air Circuit Breaker of 800 Amp with provision of remote data transmission and outgoing 4 Nos MCCB of 250 Amp adjustable shall be as specified in the specification,<br>PMU SUB STATION shall be installed on RCC foundation pad & other accessories including transformer neutral & substation earthing system.<br>Foundation design & drawings shall be provided by the contractor for Engineer's approval.<br>All LV Board and Transformers shall be of outdoor type.<br><br>Contractor will be also responsible for;<br>(a) Transportation of PMU from DHA stores to assigned locations including Insurance of equipment to safeguard against theft and damages during transportation.<br>(b) Co-ordination with and obtaining the SOPs from the original suppliers of PMU during installation, testing and commissioning and to keep the original warranties intact.<br>(c) Construction of foundations for PMU as per equipment drawings and in co-ordination with the original suppliers.<br>(d) Placement of PMU on foundations at assigned locations.<br><br>*All Switching Stations, Pad Mounted Unit Substations (both Type-A & Type-B) shall have provisions for present or future integration with smart grid through SCADA control.The Modem shall be capable of connectivity with optical fibre network. RTUs, Modem, Battery & Chargers (UPS) shall be part of VCBs panel or in a separate enclosure next to it. The enclosure of PMU shall be IP54 and shall be capable of performing at its best temperatures that* | | | | |

| Sr. # | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| **RKS LV DISTRIBUTION** | | | | | |
| **4** | **EXCAVATION** | | | | |
| 4.1 | Excavation for foundation trenches, drain & other structure work in common soil with 1/4 Cubic meter, or less rocks (including but not limited to ordinary Soil, Gravel, morum etc. but excluding rock) backfilling the suitable excavated material in foundation, plinth or under floor including braking clodos, watering, consolidation by ramming in layer not exceeding inches (229 mm) in depth to full compaction and removal of surplus material at direction of the Engineer. | 14,304 | cu m | | 0 |
| 4.2 | Excavation for foundation trenches, drain & other structure work in al kind of rocks including hard rocks by manual or any mechanical means including stacking of suitable and unsuitable material seprately, using suitable material for backfilling of trenches / under floor dressing watering consolidation by ramming in layer not excluding 9 inches (229 mm ) in depth to full compaction and disposal of material surplus excavated stuff to designated area as directed by the Engineer including all read and lift | 6,130 | cu m | | 0 |
| **5** | **LV CABLE**<br>Laying, testing and Termination of LV cable 600/1000V stranded aluminum conductor, XLPE insulated, Extruded PVC bedded, steel wire armored and PVC sheathed overall, laid in trenches complete with bricks, sand, warning tape with all accessories as approved by the Engineer. The cable size as under. (Exclusive cost of excavation item no. 1 as above). Transportation of cables from DHA stores to assigned locations including Insurance of Cables to safeguard against theft and damages during transportation. Note: The Bidder/contractor shall take extreme care in cutting of cables before laying to minimize the wastage. | | | | |

| Sr. # | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| 5.1 | 4 core 300mm² AL / XLPE / PVC / SWA / PVC | 1,300 | m | | 0 |
| 5.2 | 4 core 240mm² AL / XLPE / PVC / SWA / PVC | 1,800 | m | | 0 |
| 5.3 | 4 core 185mm² AL / XLPE / PVC / SWA / PVC | 950 | m | | 0 |
| 5.4 | 4 core 150mm² AL / XLPE / PVC / SWA / PVC | 1,900 | m | | 0 |
| 5.5 | 4 core 120mm² AL / XLPE / PVC / SWA / PVC | 1,055 | m | | 0 |
| 5.6 | 4 core 70mm² AL / XLPE / PVC / SWA / PVC | 100 | m | | 0 |
| **6** | Properly Fixing of straight through HeatShrink joint for following XLPE Almunium Conductor 400V cable, semi conducting tape, ferrules and earth wire, including all accessories as per specifications and approval of Engineer.<br>Transportation of Cable Joint from DHA stores to assigned locations including Insurance of Cable Joints to safeguard against theft and damages during transportation | | | | |
| 6.1 | 4 core 300mm² AL / XLPE / PVC / SWA / PVC | 4 | Each | | 0 |
| 6.2 | 4 core 240mm² AL / XLPE / PVC / SWA / PVC | 6 | Each | | 0 |
| 6.3 | 4 core 185mm² AL / XLPE / PVC / SWA / PVC | 3 | Each | | 0 |
| 6.4 | 4 core 150mm² AL / XLPE / PVC / SWA / PVC | 6 | Each | | 0 |
| 6.5 | 4 core 120mm² AL / XLPE / PVC / SWA / PVC | 4 | Each | | 0 |
| 6.6 | 4 core 70mm² AL / XLPE / PVC / SWA / PVC | 3 | Each | | 0 |
| **7** | Properly Fixing of Termination Kit for following XLPE Almunium Conductor 400V cable, including all accessories as per specifications and approval of Engineer.<br>Transportation of Cable Termination Kits from DHA stores to assigned locations including Insurance of Cable Termination Kits to safeguard against theft and damages during transportation. | | | | |
| 7.1 | 4 core 300mm² AL / XLPE / PVC / SWA / PVC | 16 | Each | | 0 |
| 7.2 | 4 core 240mm² AL / XLPE / PVC / SWA / PVC | 34 | Each | | 0 |
| 7.3 | 4 core 185mm² AL / XLPE / PVC / SWA / PVC | 12 | Each | | 0 |
| 7.4 | 4 core 150mm² AL / XLPE / PVC / SWA / PVC | 34 | Each | | 0 |
| 7.5 | 4 core 120mm² AL / XLPE / PVC / SWA / PVC | 20 | Each | | 0 |
| 7.6 | 4 core 70 mm² AL / XLPE / PVC / SWA / PVC | 2 | Each | | 0 |

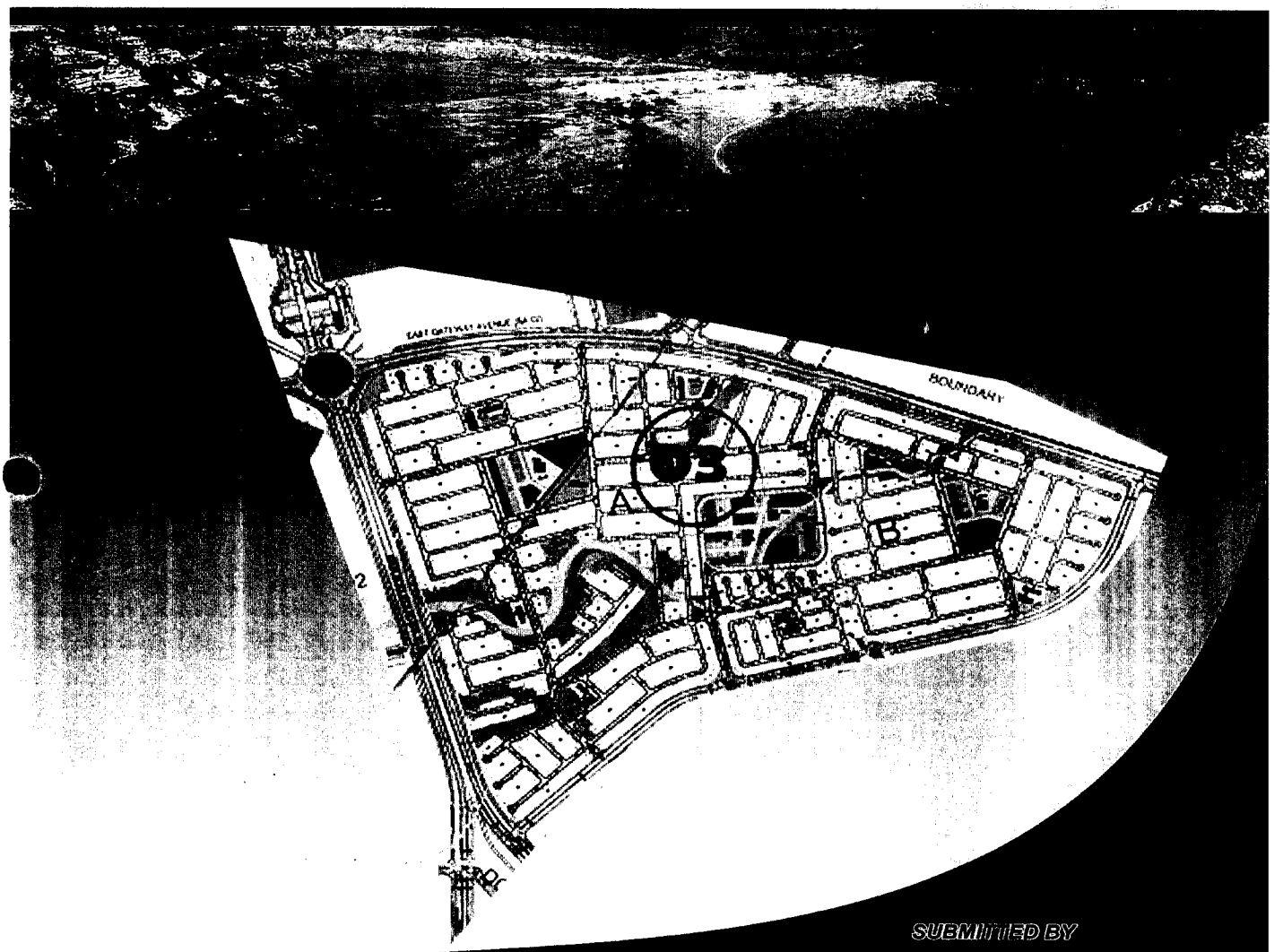
| Sr. # | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| 8 | **Feeder Pillar**<br>Installation, Connecting, Testing and commissioning of floor mounted Feeder pillar in Glass Reinforced Polyester (GRP) enclosure with front and rear compartments. Ingress Protection to IP55 and weather proof and rigid construction as defined / detailed in drawing and specification. Both compartments shall have hinged door/lock, padlocking arrangement. The rear compartment shall be suitable for 3 phase, 400 V Main TPN+E Aluminum Bus bar with support insulators, Main Incoming MCCB. Space shall be provided for one Electronic Smart AMR Energy Meter (meter not part of this Tender). The front compartment shall be suitable for 3 phase, 400 V Distribution TPN+E Aluminum bus bars with Insulators for distribution of out going / service connection MCCBs. The Feeder Pillars shall be Installed on RCC pad foundation, its design & drawings shall be provided by the contractor for Engineer's approval. The job shall also include the cost of RCC foundation with complete accessories.<br><br>Contractor will be also responsible for;<br>(a) Transportation of Feeder Pillars from DHA stores to assigned locations including Insurance of equipment to safeguard against theft and damages during transportation.<br>(b) Co-ordination with and obtaining the SOPs from the original suppliers of Feeder Pillars during installation, testing and commissioning and to keep the original warranties intact.<br>(c) Construction of foundations for Feeder Pillars as per equipment drawings and in co-ordination with the original suppliers.<br>(d) Placement of Feeder Pillars on foundations at assigned locations. | | | | |

| Sr. # | Particulars | Qty. | Unit | Rate | Amount (PKR.) |
|---|---|---|---|---|---|
| 8.1 | **Feeder Pillar (8-WAY, TYPE-A)** | 7 | Each | | 0 |
| | 1No. 250A TP MCCB (Adj.) 35KA (Main I/C Breaker) | | | | |
| | 1No. 250A TP MCCB (Adj.) 25KA (I/C Breaker for Distribution Bus bar) | | | | |
| | 1No. 300A TPN+E Aluminum Main Bus bar with insulators for I/C & O/G circuits | | | | |
| | 1No. 300A TPN+E Aluminum Distribution Bus bar with insulators for out going service connection MCCBs | | | | |
| | Suitable cable gland | | | | |
| | 3-Indication lamps | | | | |
| | Service connection MCCBs. | | | | |
| | 8Nos. 60A TP MCCB (Adj.) 15KA | | | | |
| | 2Nos. 60A TP MCCB Spaces only | | | | |
| 8.2 | **Feeder Pillar (6-WAY, TYPE-A)** | 25 | Each | | 0 |
| | 1No. 250A TP MCCB (Adj.) 35KA (Main I/C Breaker) | | | | |
| | 1No. 250A TP MCCB (Adj.) 25KA (I/C Breaker for Distribution Bus bar) | | | | |
| | 1No. 300A TPN+E Aluminum Main Bus bar with insulators for I/C & O/G circuits | | | | |
| | 1No. 300A TPN+E Aluminum Distribution Bus bar with insulators for out going service connection MCCBs | | | | |
| | Suitable cable gland | | | | |
| | 3-Indication lamps | | | | |
| | Service connection MCCBs. | | | | |
| | 6Nos. 60A TP MCCB (Adj.) 15KA | | | | |
| | 2Nos. 60A TP MCCB Spaces only | | | | |
| | Note: Please refere the Dwg # 2400-01-03-01-55-02-03-E700 Sheet-2 2400-01-03-01-55-02-03-E301 | | | | |

PAKISTAN DEFENCE OFFICERS
HOUSING AUTHORITY
KARACHI

# PLANNING AND DESIGNING OF ELECTRICAL DISTRIBUTION SYSTEM OF DHA CITY KARACHI SECTOR - 3A ( PACKAGE - 1 )

# DETAILED DESIGN REPORT

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DECEMBER 2012

# PLANNING & DESIGNING OF ELECTRICAL DISTRIBUTION SYSTEM OF DHA CITY, KARACHI SECTOR-03 (PACKAGE-01)

## DETAIL DESIGN REPORT

**DEFENCE HOUSING AUTHORITY**
**KARACHI**

SHORT-TERM PLAN ENERGY SECTOR – 03 (Package-01)
DHA CITY KARACHI

# DETAILED DESIGN REPORT

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**4) DESIGN DRAWINGS**

**5) ROUGH ESTIMATE**

# 1

## DESIGN BRIEF & DESIGN CRITERIA

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-03 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


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# 1. EXECUTIVE SUMMARY

For tendering purpose, Sector-03 short term development plan has been divided into two packages. Package-01 of Sector-03 comprises the following:

**A) MV Distribution Network comprising of:**

**1) MV Cables:**

- 3 core 300 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable — 7,266 m
- 3 core 400 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable — 10,782 m

**2) Switching Stations:**

**4-way** — 1 Nos.

**Kiosk Sub Station:**

- Kiosk Sub Station 1000 kVA (Type A) Transformer 11/0.42 kV Oil filled — 4 Nos.
- Kiosk Sub Station 1000 kVA (Type B) Transformer 11/0.42 kV Oil filled — 3 Nos.
- Kiosk Sub Station 500 kVA (Type A) Transformer 11/0.42 kV Oil filled — 3 Nos.
- Kiosk Sub Station 500 kVA (Type B) Transformer 11/0.42 kV Oil filled — 20 Nos.

**B) LV Distribution Network comprising of:**

**1) LV Cables:**

| | | | |
|---|---|---|---|
| a) | 4 core 300 mm² AL, XLPE/PVC/SWA/PVC cable | 620 | m |
| b) | 4 core 240 mm² AL, XLPE/PVC/SWA/PVC cable | 919 | m |
| c) | 4 core 185 mm² AL, XLPE/PVC/SWA/PVC cable | 809 | m |
| d) | 4 core 150 mm² AL, XLPE/PVC/SWA/PVC cable | 4[illegible]7 | m |
| e) | 4 core 120 mm² AL, XLPE/PVC/SWA/PVC cable | 617 | m |
| f) | 4 core 95 mm² AL, XLPE/PVC/SWA/PVC cable | 1589 | m |
| g) | 4 core 70 mm² AL, XLPE/PVC/SWA/PVC cable | 2236 | m |
| h) | 4 core 50 mm² AL, XLPE/PVC/SWA/PVC cable | 770 | m |
| i) | 4 core 35 mm² AL, XLPE/PVC/SWA/PVC cable | 666 | m |
| j) | 4 core 25 mm² AL, XLPE/PVC/SWA/PVC cable | 33 | m |
| k) | 4 core 16 mm² AL, XLPE/PVC/SWA/PVC cable | 69 | m |

2) **Feeder Pillars**

| | |
|---|---|
| **10-way FP** | **25 Nos.** |
| **9-way FP** | **12 Nos.** |
| **8-way FP** | **44 Nos.** |
| **7-way FP** | **19 Nos.** |
| **6-way FP** | **26 Nos.** |
| **5-way FP** | **7 Nos.** |
| **4-way FP** | **4 Nos.** |
| **2- way FP** | **5 Nos.** |

**C) Smart Grid ICT Network / pipe sleeves comprising:**

1) HDPE Pipe 2" dia. (2 Nos.) for MV/LV cables 26,500 m

2) RCC hand hole with cover (L=5', W=3', D=3') 275 Nos.

# 2. GENERAL FEATURES

## 2.1 INTRODUCTION

Pakistan Defence Officers Housing Authority (DHA) has commissioned M/s Osmani and Company (Pvt.) Ltd. to provide consultancy services for Development of DHA City Karachi (DCK) in August 2010. DHA City is spread over an area of 11,640 acres with numerous ridges and nalas following a rolling / mountainous terrain. DHA City is planned and divided into 16 sectors as listed below in Table 2-1

**Table 2-1: Area of Sectors**

| S.NO. | LOCATION | AREA (acres) | S.NO. | LOCATION | AREA (ACRES) |
|---|---|---|---|---|---|
| 1 | SECTOR 1 | 525 | 9 | SECTOR 9 | 604 |
| 2 | SECTOR 2 | 600 | 10 | SECTOR 10 | 541 |
| **3** | **SECTOR 3** | **311** | 11 | SECTOR 11 | 663 |
| 4 | SECTOR 4 | 337 | 12 | SECTOR 12 | 504 |
| 5 | SECTOR 5 | 483 | 13 | SECTOR 13 | 575 |
| 6 | SECTOR 6 | 823 | 14 | SECTOR 14 | 655 |
| 7 | SECTOR 7 | 631 | 15 | SECTOR 15 | 697 |
| 8 | SECTOR 8 | 339 | 16 | SECTOR 16 | 383 |
| **GRAND TOTAL** | | | | | **8,671** |

Sector development works are to be carried out with respect to development strategy, which has been divided into 3 phases;

- Short Term Development Plan (2015 – 2018)
- Mid Term Development Plan (2018 – 2021)
- Long Term Development Plan (2021 – 2030)

The following ***Figure 2-1*** shows the location of various sub-sectors planned under short term, medium term and long term development.

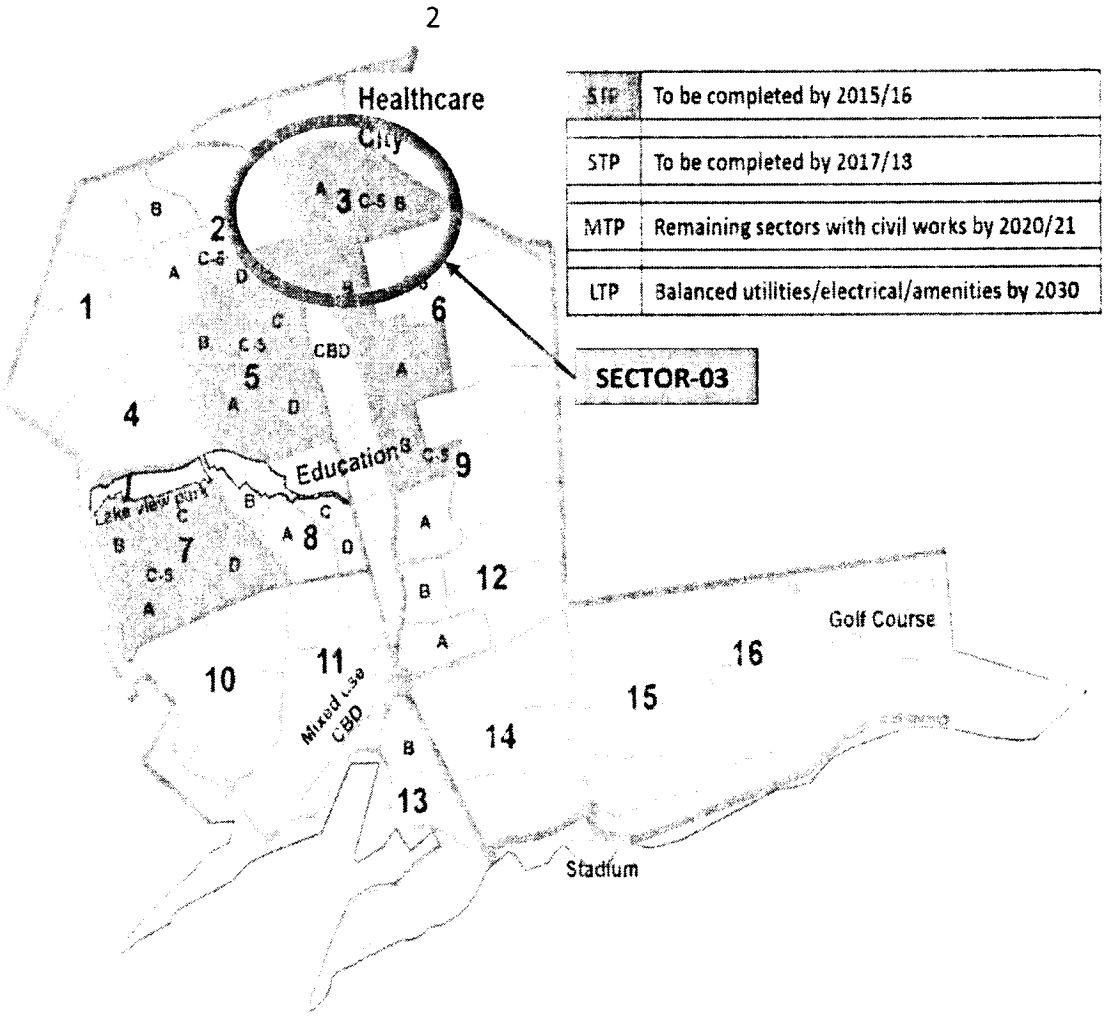


**Figure 2-1: Sectors under Short Term Development Plan**

Sectors are generally divided into four sub sectors as per the design criteria of 'Ekistics' for ease of communication of urban city. Acreage of each sub sector is given in Table 2-1 of Short Term Development Plan. Sector-03 has a total developed area of 311 acres.

***Table 2-2*** shows the areas of various sectors under short term development plan:

**Table 2-2: Areas of Sectors under Short Term Plan**

| Areas in acres | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sector | Sub-Sector | | | | | Other than Sub Sector | Total |
| | A | B | C | C-5 | D | | |
| 2 | | | | | 141 | | 141 |
| **3** | **212** | **77** | | **13** | | **9** | **311** |
| 5 | 136 | 108 | 63 | 18 | 136 | | 483 |
| 6 | 167 | 97 | 112 | 40 | | | 416 |
| 7 | 136 | 129 | 198 | 19 | 149 | | 631 |
| 9 | | 89 | | | | | 89 |
| CBD | | | | | | 104 | 104 |
| **Total** | **662** | **506** | **377** | **97** | **433** | **113** | **2,175** |

## 2.2 SCOPE OF THE REPORT

The main objective of this report is to explain the Detail Design of Energy Distribution Network for DCK Sector-03. The other main objectives of this Detailed Design Report (DDR) are the following:

- Present the Detailed Design of Sub-Sector-3A to enable client review prior to progression to the detailed design stage.
- Provide details of how the design has been developed since the submission of the Energy Distribution Inception Report.
- Provide an updated description of the works.
- Confirm the design criteria and parameters used for the design of Electrical Distribution System. Provide a rough cost estimate for the project component.
- Provide details of any information obtained; and information still required to complete the project and highlight any potential difficulties in obtaining such information.
- This report will cover detail design of Sector-3A as encircled in Figure 2-1 and highlighted in Table 2-1

## 2.3 BACKGROUND

Sector-03 was planned on 311 acres area, with Main Boulevard (PA 02B) to the west, East Gateway Avenue (SA-02) to the east side and East Avenue 1E (PC-02) on the south.

For tendering purpose, Sector-03 is divided in to 2 packages i.e. 1 and 2. Package 1 contains sub-sector A with an approx. area of 212.47 acres, package 2 contains sub-sector B and commercial centre C5 with an approx. area of 90 acres. **Figure 2-2** shows the boundaries and areas of packages 1, 2 and C-5 of sector-03.

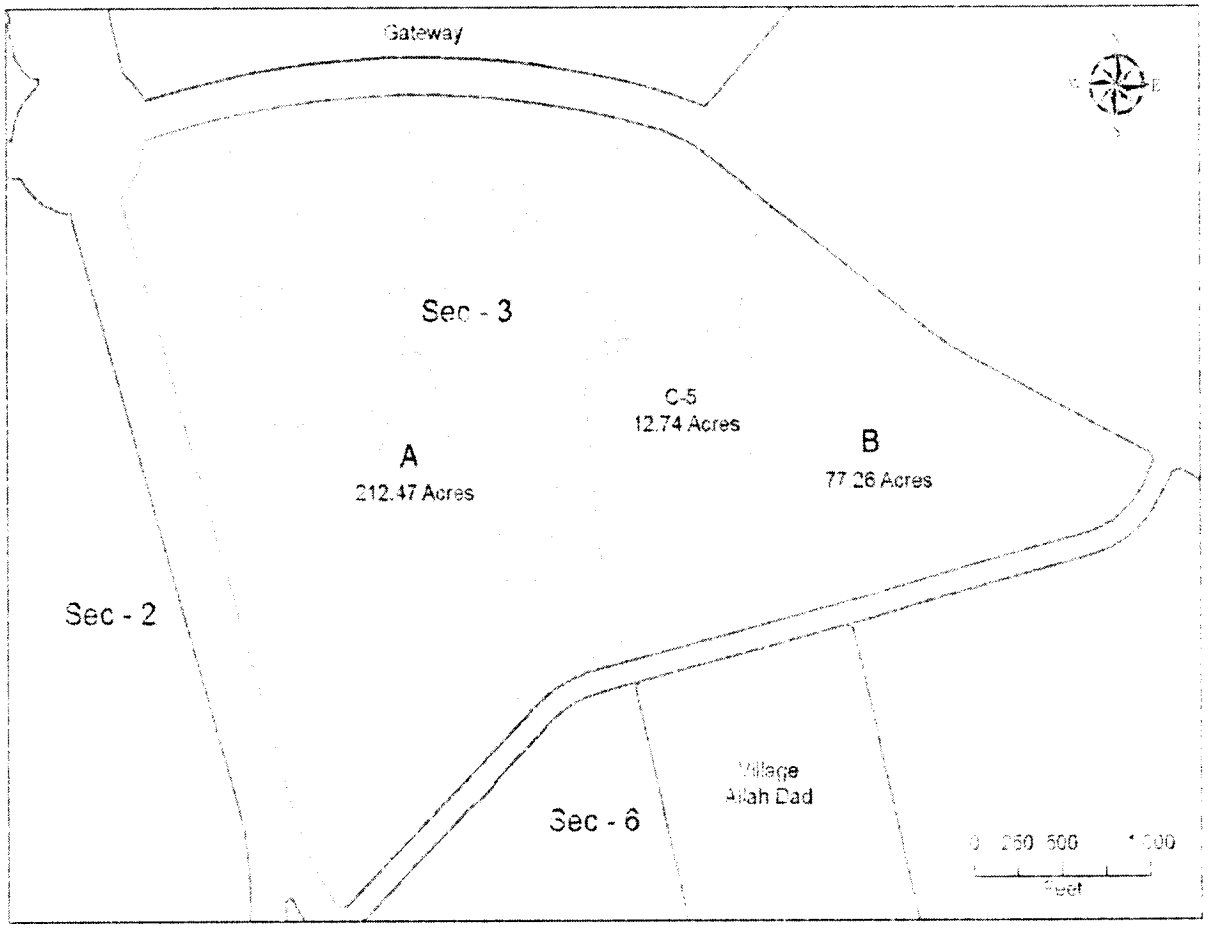


**Figure 2-2: Boundaries of Packages 1, 2 and C-5 of Sector-03**

## 2.4 TOPOGRAPHY

Sub-Sector 3-A has an uneven rocky terrain in the North. A nalla runs from the East to the Southwest creating valleys and ridges. South is mostly hilly. Figure 2-3 shows that the highest elevation is of 634 ft and lowest is 511 ft with a difference of 123 ft.

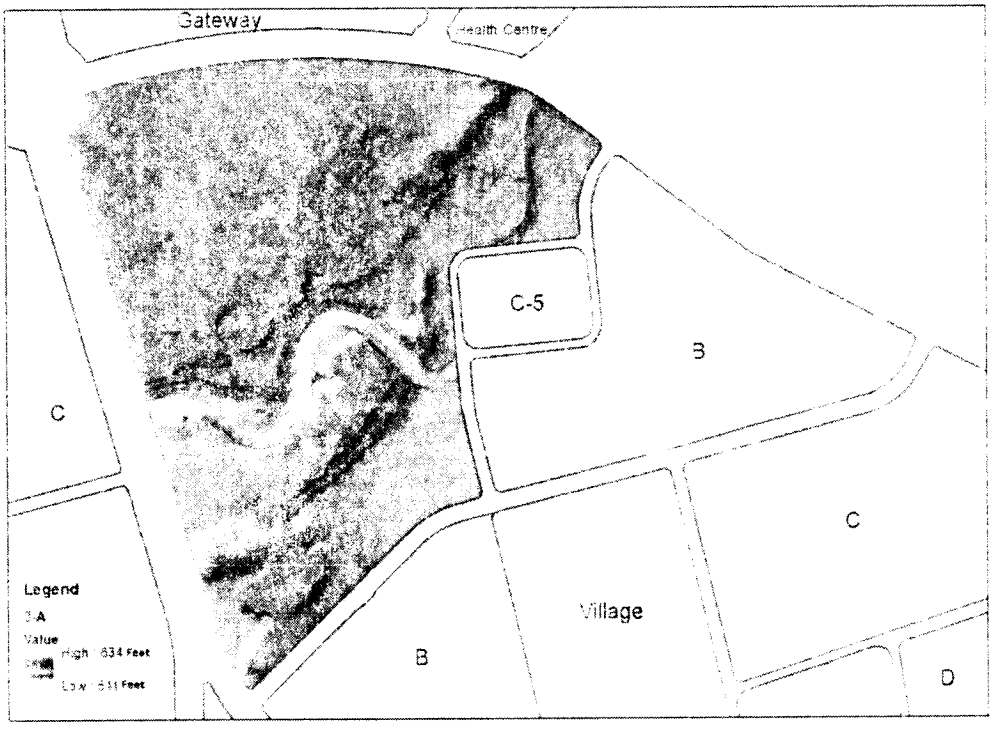


**Figure 2-3: Topography of Sub-Sector 3-A**

## 2.5 POPULATION AND DEVELOPMENT

The DCK will be developed in stages aiming to reach eventually more than 600,000 people. The overall planning of DCK is based on ekistics, leading to sectors of 20-40,000 people each. The Table 2-3 describes the land use in sector-03. About 2/3 of the area of sector 3 is utilized for residential purposes. Residential area has different plot categories from 100 square yards to 2,000 square yards. Other facilities include commercial areas, amenities, educational institutions, graveyard, healthcare facilities and green space areas.

**Table 2-3: Sector-03: Land Use Statistics**

| SECTOR-03 LAND USE STATISTICS | | | |
|---|---|---|---|
| **Zonal Land use** | **Categories** | **Area (acres)** | **Total Area (acres)** |
| Agriculture and Pre-served Open Spaces | Nallah | 8.97 | 37.59 |
| | Oil Pipe Line | 1.72 | |
| | Open & Green Space | 26.9 | |
| Amenities | Cemetery | 0.32 | 9.14 |
| | College/ A-Level/ Professional (CA/ ACCA etc.) | 1.28 | |
| | Community Hall | 1.15 | |
| | Dispensary | 0.19 | |
| | Health Centre | 0.47 | |
| | Kindergarten | 1.45 | |
| | Marriage Hall | 0.25 | |
| | Masjid | 0.66 | |
| | PS/ SS/ O-Level | 3.14 | |
| | Public Service (Club) | 0.23 | |
| Commercial | - | - | 3.62 |
| Mixed use | - | - | 2.32 |
| Recreation | Nursery | 0.2 | 6.91 |
| | Parks and Playground | 6.71 | |
| Residential | - | - | 149.44 |
| Transportation | Commercial Collector Roads (60' Row) | 4.3 | 100.51 |
| | Parking | 2.98 | |
| | Pedestrian way | 1.56 | |
| | Piazza | 7.16 | |
| | Residential Collector Roads (90' ROW) | 3.56 | |
| | Streets | 80.96 | |
| Utilities | Electric Installation | | 0.79 |
| | ICT and Security | 0.18 | |
| | Sewage Treatment Plant | - | |
| | Tube well | - | |
| | Unclassified Utility | 0.61 | |
| **Grand Total** | | | 3[illegible].2 |

## 2.6 CONTRACT PACKAGES

Sector-03 consists of 2 contract packages. Refer Figure 2-2 for location and boundary of various packages. The key layout plans showing overall MV & LV network of contract package-01 is also attached in Detail Design Drawings of the report. The statistical description of package-01 is given below:

- **Package-01**

This package comprises of sub-sector 3A which has an area of 212 acres as given in Table 2-2 and consists of an approx. road network of 70,026.93 ft (21.34 Km)Table 2-4 shows it has 28 C2s.

Table 2-4 shows the Plots Summary of sub-sectors-3A under categories of Residential, Commercial & Mix Use.

**Table 2-4: Sub-Sector-3A: Plots Summary**

**SUB-SECTOR-3A**
**PLOTS SUMMARY**

| Residential Plots | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | R1 | R2 | R2.5 | R3 | R5 | R10 | R20 | Total |
| **Sector-03** | | | | 11 | 1,297 | 18 | 1 | 1,327 |
| Sub-Sector A | | | | | 1010 | 10 | | 1020 |

| Commercial Plots | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | C1 | C2 | C2.5 | C3 | C5 | C10 | C20 | Total |
| **Sector-03** | | 42 | | 15 | | 3 | | 60 |
| Sub-Sector A | | 28 | | | | | | 28 |

| Mix Use (Residential + Commercial) Plots | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | M1 | M2 | M2.5 | M3 | M5 | M10 | M20 | Total |
| **Sector-03** | | 13 | | 22 | 4 | | | 39 |
| Sub-Sector A | | | | 12 | | | | 12 |

## 2.7 OVERVIEW OF DCK ELECTRICAL DISTRIBUTION DESIGN

Design of the Electrical Distribution Network for DHA City Karachi (DCK) is a very important task of the project. Analysis of the latest technologies, current industry standards, local field practices and availability of skilled Human Resource (HR) have been done with a view of current and future requirements of DCK residential and commercial users. Electrical network design layout of DCK is based on the geographic and sector wise distribution.

The DCK is a vision to build an urban city with adaption of new technologies. Distinctly it has to be a part of global smart cities family, which integrates various technical trends into a single place to facilitate best options to the local residents as well as business community. Any urban society can't be accomplished without proper plan so decision for opting of a reliable electrical distribution system for DCK will really need a higher priority at early stage.

Thus it is proposed to design and construct an electrical network that will be capable to deliver electrical services within DCK. In order to enable the level of operational efficiencies needed for a project of this kind, the use of 'smart building technologies' is the basis of this design to fulfil DCK requirement for provisioning of electrical services. The aim is to provide a network with reliable electricity supply to the residents and stakeholders.

Kiosk type substations can only be the favourable medium for smart distribution in DCK, which can provide the monitoring and control required. We believe that key for reliable electricity is a reliable distribution system with few faults and their fast location and removal. In this regard best efforts are being made to

make DCK a prosperous place in current and future scenarios. This will enable DCK to append and merge forthcoming technologies without modifying its existing infrastructure system. The description of various kiosks Sub-Stations used is given below.

- **Kiosk Sub-Station Type-A** (1000 kVA, 630 kVA, 500 kVA) Oil filled Transformer 11/0.42 kV, with incoming & out going VCBs on MV side.

- **Kiosk Sub-Station Type-B** (1000 kVA, 630 kVA, 500 kVA) Oil filled Transformer 11/0.42 kV, with incoming and outgoing SF6 load break switches with fuses on MV side.

# 3. DESIGN CRITERIA

## 3.1 DESIGN CODES & STANDARDS

All systems shall adapt the following main standards, wherever applicable:

- European Committee for Standardization (CEN) and European Committee for Electro technical Standardization (CENELEC)
- International Electro technical Commission (IEC)
- International Organization for Standardization (ISO)
- Other Standards and Codes can be used in areas not covered by these standards. Other standards include:
- European Standards like EN, DIN
- British Standards (BS)

The Electrical products used, should be tested and approved to meet the applicable standards by one of the independent test laboratories including following:

- KEMA
- CESI
- UL or other similar laboratories

## 3.2 USER REQUIREMENTS

The user requirements for DCK that are given by the DHA include the followings:

a) Completely underground distribution system.

b) Use of aluminium conductor cables for cost saving.

c) Use of Kiosk type substations for space saving and faster installation.

d) Smart Metering Technologies.

e) Remote monitoring and control.

## 3.3 DESIGN CRITERIA

The DCK Electrical Distribution must meet following requirements:

- High reliability
- Safe Operation
- Route Protection
- Redundancy
- Reliable Technology
- Easy to maintain and troubleshoot
- Environmentally Protected
- Cost Effective
- Future Proof

## 3.4 DESIGN CONSIDERATIONS

- Underground distribution for reliable power supply.
- MV ring distribution for fast restoration of power in case of fault.
- Use of MV express feeder to provide backup in case of simultaneous fault on two feeders.
- Use of Kiosk type substation for space saving and faster installation.
- Use of VCB type Ring Main Units (RMUs) for reliable maintenance free switching.
- Fibre Optic cable network for remote monitoring and control.
- Use of Smart Meters in residences, offices & commercial premises for two way flow of power, thus encouraging use of renewable energy by consumers.
- Remote monitoring and control of MV and LV distribution system and automatic meter reading and billing.
- Use of cost saving aluminium conductor for MV and LV cables.

# 4. SMART GRID

## 4.1 GENERAL

Traditional Electric Power Systems have been designed through deploying large central generation units built away from cities and residential areas, while electricity has been delivered to consumers through interlinked transmission lines and grid stations. Each individual generation unit, whether it is powered by fossil fuels or hydro, may be rated of up to hundreds of Megawatts (MWs). Transmission line distance also varies up to hundreds of kilometres and Electricity is then transferred to end-users through distribution transformers. The distribution system is very extensive but is almost entirely passive with *little communication* and only limited local controls. There is no *real-time monitoring* hence there is very little interaction between the loads and the power system.

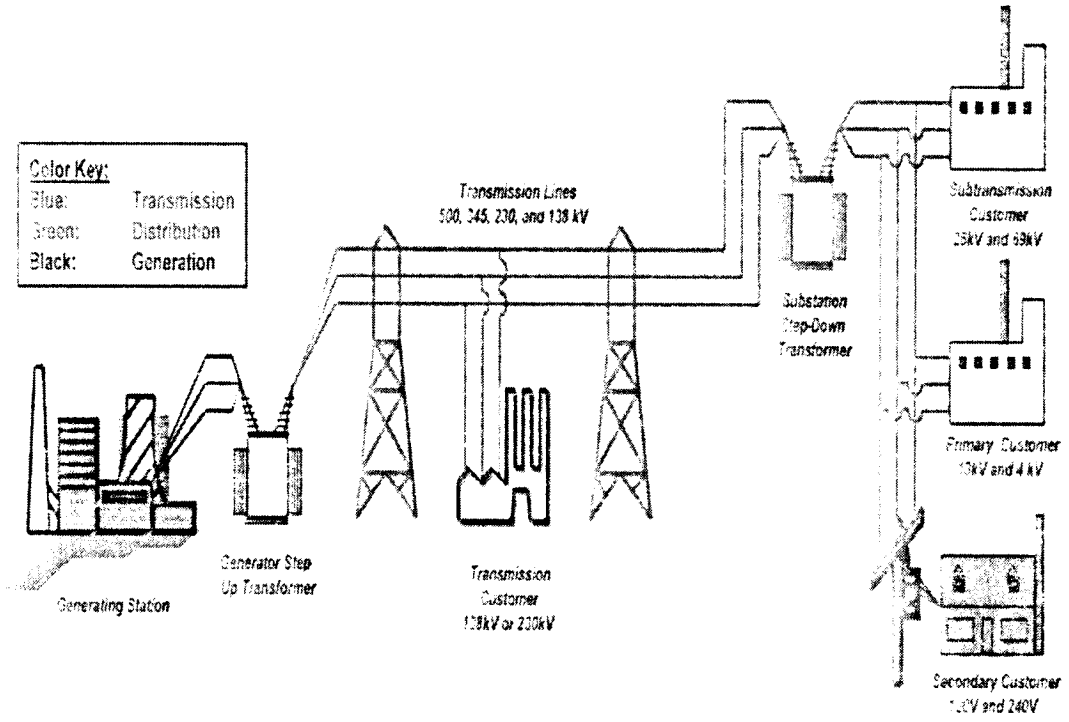


**Figure 4-1: Existing Power System Infrastructure**

The present advances in communication systems, particularly high speed networks, offer the possibility of much greater monitoring and control throughout the power system and hence more effective, flexible and lower cost operations.

Today, design concept of power system has changed and it does not required to be isolated from cities by using large scale generators. Instead large numbers of small scale generation units located at various places are being combined together to deliver electricity to local city residents. Using ICT services at smaller scale is very feasible as well as cost effective. This concept of intelligent delivery of electricity is known as ***Smart Grid***.

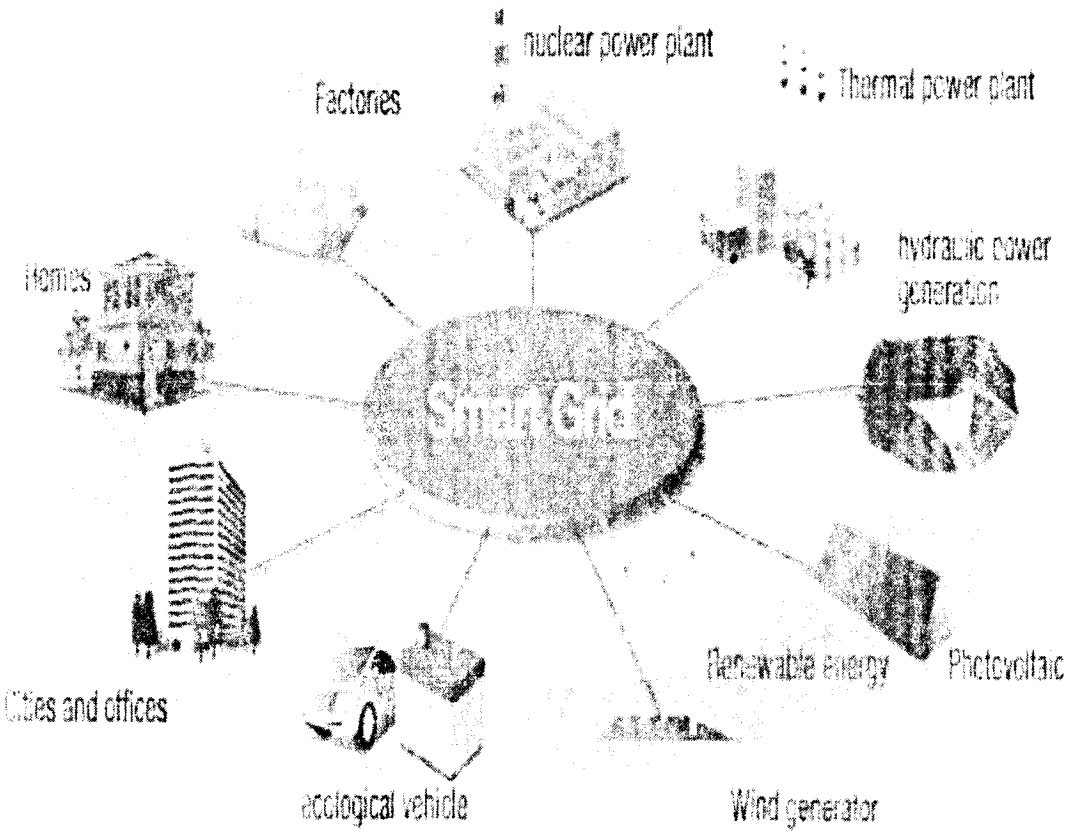


**Figure 4-2: A Smart Grid Infrastructure**

One of the best features of DHA City Karachi (DCK) is the introduction of Smart Grid Technology which will help in managing and protecting the resources of DCK electricity network. Electrical components will be 'network' enabled which will help to monitor the electricity consumption by DCK Power Operators remotely at Network Control Centre (NCC). Real-time Electricity database will then be used to optimize power generation and distribution.

Not only this, but real-time monitoring and control will enable to avoid any unwanted circumstance such as blackout due to heavy short circuits within network and brownout due to unplanned heavy loads. These cases not only affect the power quality but also damage costly power equipment such as power transformers and bus bars at Sub-Stations/grid stations. This technology will enable the DCK consumers to see how much Electricity is being consumed and can also see utility bills any time online at their homes through smart meters.

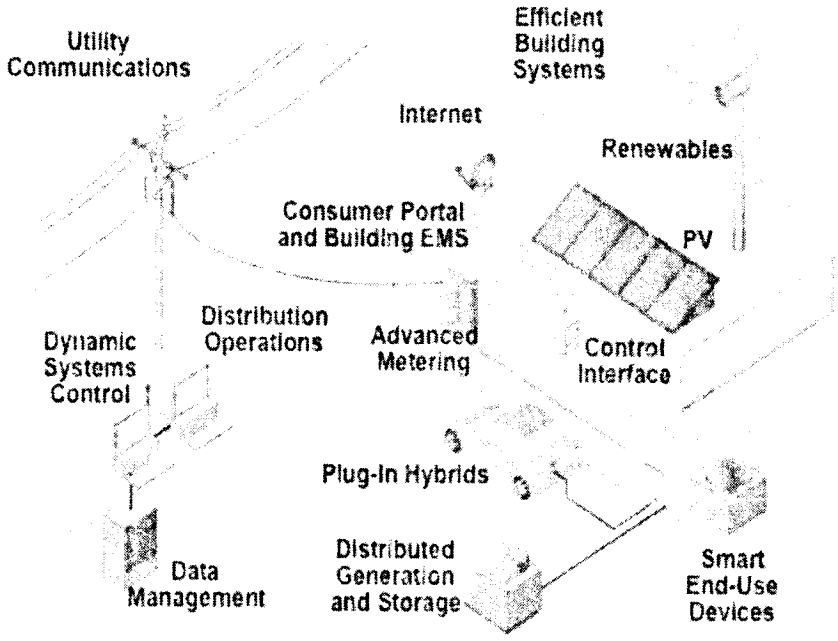


**Figure 4-3: Latest Electrical Network Infrastructure**

The design of power transmission and distribution system of DCK has also been done with a consideration of futuristic demands of any urban city. The design is aligned with the requirements of latest Codes and Standards defined for a Smart Grid and assures modular deployment of any future elements whenever required.

## 4.2 ACCOMMODATION OF RENEWABLE ENERGY INTO EXISTING GRIDS

The global concern for the environment and the need to counteract the effects that lead to global warming are the most important drivers for an improved electrical energy system. Along with establishing a common understanding of man-made changes in the global climate, scenarios have been presented, showing how future carbon emissions might be limited, or even reduced. The major proposals in these scenarios is the introduction of renewable energy sources to replace the traditional fossil based power generation with higher priority as we have a very limited fossil-fuel in future.

## 4.3 DIFFERENCE BETWEEN CONVENTIONAL AND SMART GRIDS

Following table shows a brief difference between a conventional and a Smart Grid.

**Table 4-1: Difference between a Conventional & Smart Grid**

| CHARACTERISTIC | EXISTING GRID | SMART GRID |
|---|---|---|
| Enables active participation by consumers | Consumers are uninformed and non-participative with power system | Informed, involved, and active consumers - demand response and distributed energy resources. |
| Accommodates all generation and storage options | Dominated by central generation- many obstacles exist for distributed energy resources interconnection | Many distributed energy resources with plug-and-play convenience focus on renewable |
| Enables new products, services and markets | Limited wholesale markets, not well integrated - limited opportunities for consumers | Mature, well-integrated wholesale markets, growth of new electricity markets for consumers |
| Provides power quality for the digital economy | Focus on outages - slow response to power quality issues | Power quality is a priority with a variety of quality/ price options - rapid resolution of issues |
| Optimizes assets & operates efficiently | Little integration of operational data with asset management - business process silos | Greatly expanded data acquisition of grid parameters - focus on prevention, minimizing impact to consumers |
| Anticipates and responds to system disturbances (self-heals) | Responds to prevent further damage- focus is on protecting assets following fault | Automatically detects and responds to problems - focus on prevention, minimizing impact to consumer |
| Operates resiliently against attack and natural disaster | Vulnerable to malicious acts of terror and natural disasters | Resilient to attack and natural disasters with rapid restoration capabilities |

## 4.4 USER REQUIREMENTS

- Demand & Supply Balancing
- Optimized and cost-effective Power Generation
- Consumer-Interacted Advance Metering Technology
- Remote Monitoring & Control
- High level protection of EHV, HV, MV and LV equipments
- Accommodation of Generation from Renewable Energy
- Resiliently to Disturbances, Attacks, & Natural Disasters
- High Speed Communication medium throughout the Transmission & Distribution Network
- Power Quality
- Accuracy in load prediction
- Reliability
- Future Proof Technology

## 4.5 NEED OF SMART GRID INFRASTRUCTURE

Today, existing grids are under pressure to deliver the growing demand for power, as well as provide a stable and sustainable supply of electricity. These complex challenges are driving the evolution of smart grid technologies. Smart grid is specifically designed to meet the increasing global demand for electricity, by providing sufficient capacity, as well as reliability, efficiency and sustainability.

## 4.6 ADVANCED METERING INFRASTRUCTURE

Advance Metering Infrastructure (AMI) systems that support two-way communications with customers while allowing secure and reliable system-wide communication for distribution automation are the enabling foundation for the Smart Grid. Advanced Metering Infrastructure will give consumers the consumption and pricing information they need to enable them to more effectively participate in peak load reduction and energy conservation.

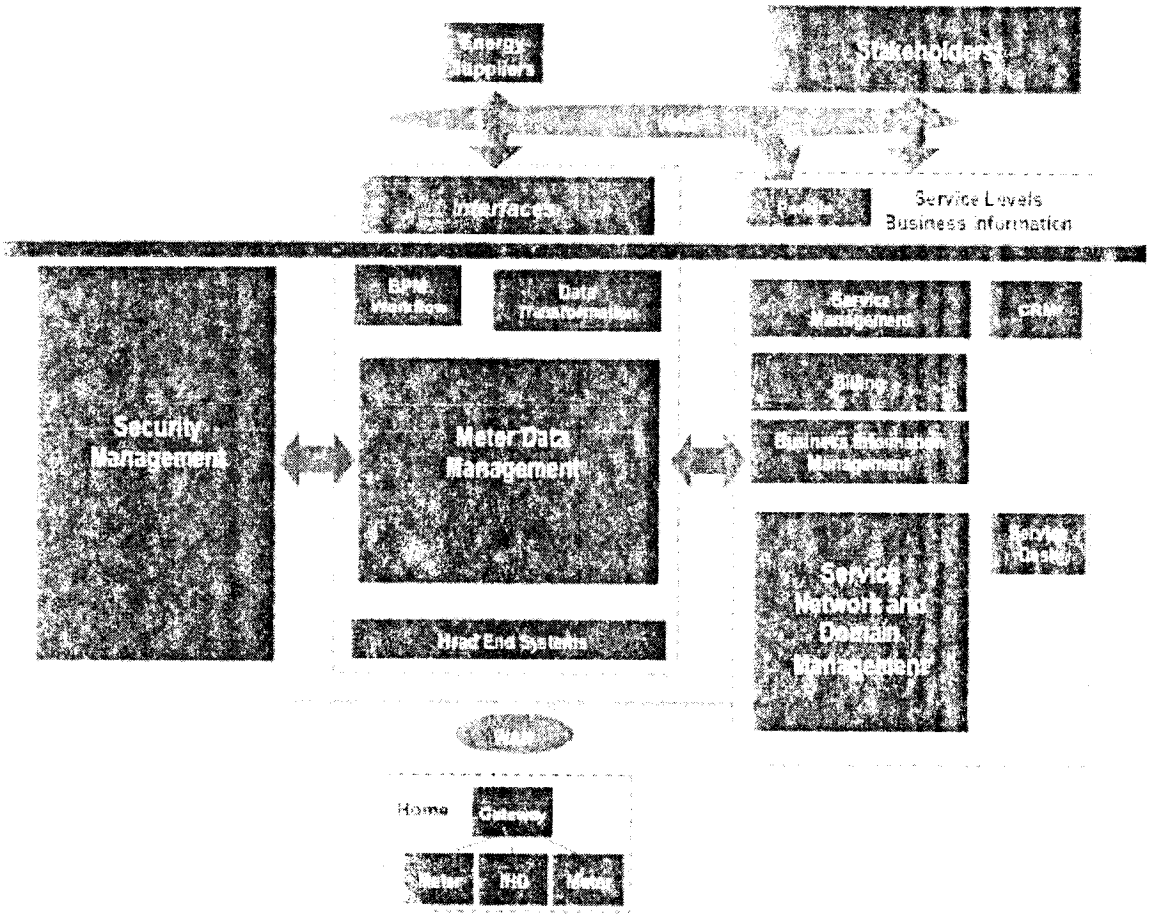


**Figure 4-4: Advance Metering Infrastructure System**

AMI consists of the communications hardware and software, and the associated system and data management software, that together create a two-way network between advanced meters and utility business systems, enabling collection and distribution of information to customers and other parties, such as the competitive retail supplier or the utility itself. Generally AMI have following functionalities:

- Two way communications
- Interval measurement and storage of consumption data
- Display of consumption data to consumer
- Remote connection/disconnection
- Support for variable energy tariffs
- Demand control

## 4.7 DISTRIBUTION AND OUTAGE MANAGEMENT

Distribution and Outage Management Systems (DMS/OMS) provide real-time response to adverse or unstable conditions. It saves money and improves customer service. Through the consolidation of both real-time OMS and DMS functionality, telemetry, and integrated security, smart distribution systems will be poised to become truly self-healing.

## 4.8 DISTRIBUTION AND SUBSTATION AUTOMATION

A Smart Grid requires control centre supervision, area-wide solutions and visualization with centralized modelling. Implementations should leverage installed infrastructure and use a model-based, scalable approach. This practical, cost-effective method ensures that current technology eventually gives way to reactive, software-driven intelligence.

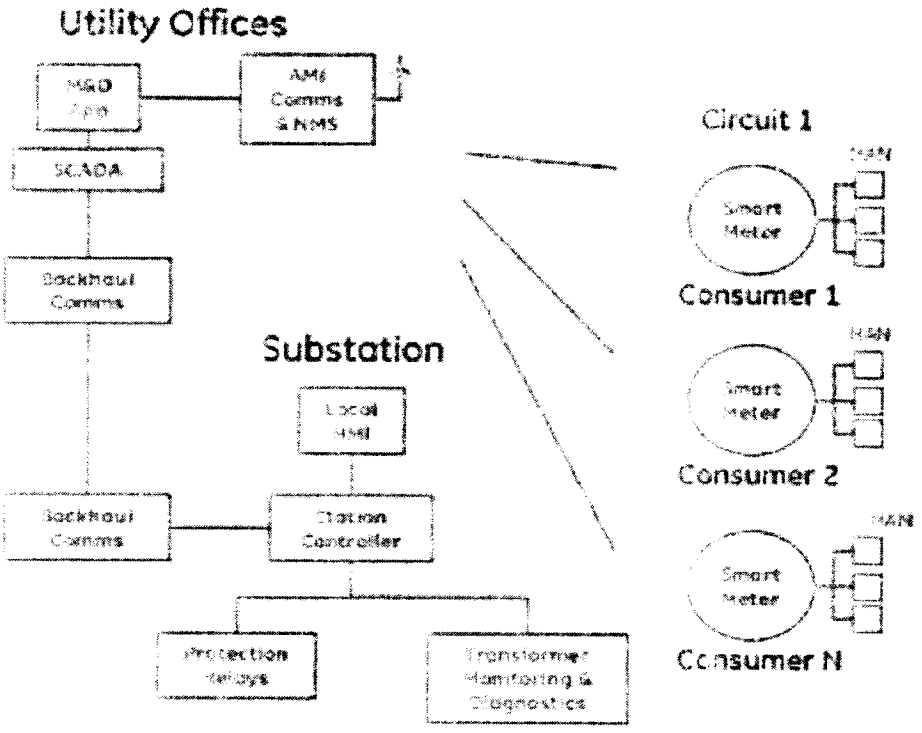


**Figure 4-5: Distribution Automation System**

The architecture shown above uses a centralized distribution automation system with the addition of communication to smart metering. The algorithm can utilize the information from the smart meters to assist in detecting outages outside of the monitored range of the automated devices. This includes fuses or other non-automated fault interrupters. The meters can detect and report an outage and can report successful restoration. Using the restoration detection, the system can determine customers have been properly restored as expected.

## 4.9 PERFORMANCE

Smart Grids will make use of new design concepts and advanced materials in system components like transformers and circuit breakers to improve efficiency, safety and operational performance. Widespread use of power electronic devices will help maximize performance of existing assets and make the grid more resilient in the event of disruptions.

## 4.10 SECURITY & SAFETY

Improvements in security increase the robustness and resiliency of the grid from a physical perspective and a cyber perspective, thereby reducing the probability and consequences of man-made attacks and natural disasters. In addition, reductions in oil imports made possible by the Smart Grid enhance national security.

Improvements in safety reduce the hazards inherent in an energized electric system as well as the time of exposure to those hazards. Generally Smart Grid Infrastructure will help through followings:

- Reduction in the probability that a deliberate man-made cyber or physical attack could occur and a reduction in the consequences of any that are not detected or prevented
- Improved restoration times following storms and other natural events
- Reduction in theft and vandalism of property due to increased detection capability
- Reduction in injuries and deaths of employees due to reduction in time spent in hazardous situations and the availability of more intelligent systems that support worker safety

These benefits will decrease the probability that extended outages impacting the security of customers will occur by reducing the threat, vulnerability, and consequences of man-made attacks. The increased reliance on digital Smart Grid technologies will require the deployment of new systems to address cyber security ensuring this critical infrastructure is as "hack proof" as possible. The increased robustness and resilience of the smart grid will also reduce the impact of many natural events that today result in extended outages.

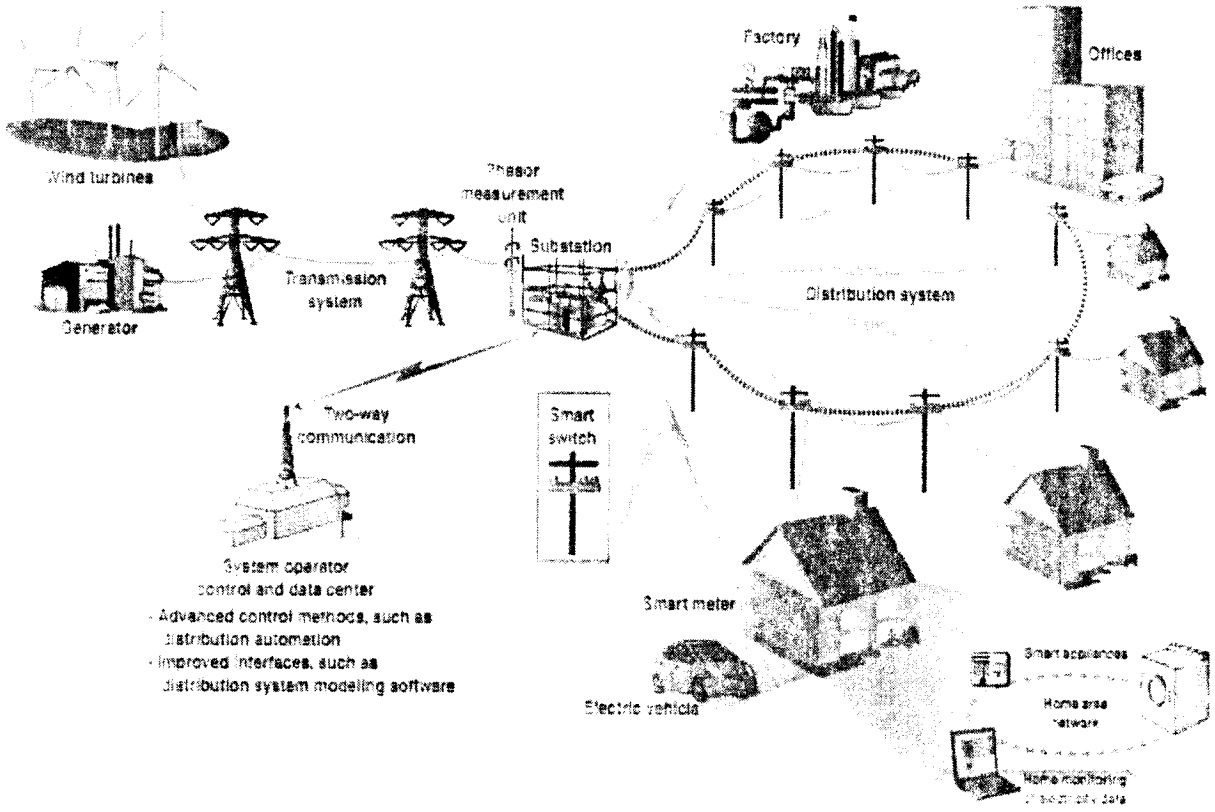


**Figure 4-6: A Secure Smart Grid System**

## 5. BENEFITS OF SMART GRID ELEMENTS

A modernized electrical grid has following features:

- Improves power reliability and quality
- Optimizes facility utilization and averts construction of backup (peak load) power plants
- Enhances capacity and efficiency of existing electric power networks
- Improves resilience to disruption
- Enables predictive maintenance and "self-healing" responses to system disturbances
- Facilitates expanded deployment of renewable energy sources
- Accommodates distributed power sources
- Automates maintenance and operation

- Reduces greenhouse gas emissions by enabling electric vehicles and new power sources
- Reduces oil consumption by reducing the need for inefficient generation during peak usage periods
- Presents opportunities to improve grid security
- Enables transition to plug-in electric vehicles and new energy storage options
- Increases consumer choice
- Enables new products, services, and markets and consumer access to them
- Improved distribution system efficiency
- Reduced distribution line losses
- Improved voltage profile along feeder
- Improved system stability and capacity
- Deferred capital upgrades
- Reduced energy demand
- Reduction of environmentally harmful emissions

# 3

## DESIGN LOAD SHEET SECTOR-03 (PACKAGE-1)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-03 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
Consulting Engineers – Architects – Planners
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Tel: +92-21-34536007 / 08, 34546541/42
Fax: +92-21-34534691
Email: ocl-khi@osmani.com,
Web: www.osmani.com

## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

| Type of Plot | Covered Area as per DCK Bye Laws | | | | | KESC Load Criteria | | General Load | A/C Load | Water Pump Load (W) | Max. Connected Load (W) | Group Div. Factor 80% (W) | TOTAL NO OF PLOTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | Covered Area (Sq.yds) | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | |
| CIVIC CENTRE | 60% | 1385.4 | 12468.6 | 1 | 12468.6 | 2.5 | 1 | 31171.5 | 2000 | 3729 | 36901.5 | 29521.2 | 1 |
| MASJID | 80% | 983.2 | 8848.8 | 2 | 17697.6 | 1.5 | 0 | 26546.4 | 0 | 3729 | 30275.4 | 24220.32 | 1 |
| EDUCATION | 40% | 495.6 | 4460.4 | 3 | 13381.2 | 2.5 | 4 | 33453 | 24000 | 3729 | 61186 | 48948.8 | 2 |
| EDUCATION | 40% | 330 | 2970 | 3 | 8910 | 2.5 | 3 | 22275 | 18000 | 3729 | 44007 | 35205.6 | 1 |
| EDUCATION | 40% | 2932.8 | 26395.2 | 3 | 79185.6 | 2.5 | 4 | 197964 | 24000 | 3729 | 225697 | 180557.6 | 1 |
| EDUCATION | 40% | 500.4 | 4503.6 | 3 | 13510.8 | 2.5 | 4 | 33777 | 24000 | 3729 | 61510 | 49208 | 1 |
| NURSERY | 100% | - | - | 1 | - | 4.9kW fixed for any area | 0 | 4900 | 0 | | 4900 | 3920 | 1 |
| PARK & PG | 100% | 6097 | 54873 | 1 | 54873 | 1.5 | 0 | 82309.5 | 0 | | 82309.5 | 65847.6 | 1 |
| PARK & PG | 100% | 5047 | 45423 | 1 | 45423 | 1.5 | 0 | 68134.5 | 0 | | 68134.5 | 54507.6 | 1 |
| PARK & PG | 100% | 9130 | 82170 | 1 | 82170 | 1.5 | 0 | 123255 | 0 | | 123255 | 98604 | 1 |
| PARK & PG | 100% | 36952 | 332568 | 1 | 332568 | 1.5 | 0 | 498852 | 0 | | 498852 | 399081.6 | 1 |
| PARK & PG | 100% | 5749 | 51741 | 1 | 51741 | 1.5 | 0 | 77611.5 | 0 | | 77611.5 | 62089.2 | 1 |
| PARK & PG | 100% | 15306 | 137754 | 1 | 137754 | 1.5 | 0 | 206631 | 0 | | 206631 | 165304.8 | 1 |
| PARK & PG | 100% | 4202 | 37818 | 1 | 37818 | 1.5 | 0 | 56727 | 0 | | 56727 | 45381.6 | 2 |
| PARK & PG | 100% | 11131 | 100179 | 1 | 100179 | 1.5 | 0 | 150268.5 | 0 | | 150268.5 | 120214.8 | 1 |
| PARK & PG | 100% | 1953 | 17577 | 1 | 17577 | 1.5 | 0 | 26365.5 | 0 | | 26365.5 | 21092.4 | 3 |
| PARK & PG | 100% | 7490 | 67410 | 1 | 67410 | 1.5 | 0 | 101115 | 0 | | 101115 | 80892 | 1 |
| DISPENSARY | 80% | 150.4 | 1353.6 | 1 | 1353.6 | 5 | 0 | 6768 | 0 | | 6768 | 5414.4 | 1 |
| DISPENSARY | 80% | 260 | 2340 | 1 | 2340 | 5 | 0 | 11700 | 0 | | 11700 | 9360 | 1 |
| UTILITY | 100% | 473 | 4257 | 1 | 4257 | 10 | 0 | 42570 | 0 | | 42570 | 34056 | 1 |

| Type of Plot | Covered Area as per DCK Bye Laws | | | | | KESC Load Criteria | | General Load | /C Load | Water Pump Load (W) | Max. Connected Load (W) | Group Div. Factor 80% (W) | TOTAL NO OF PLOTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | Covered Area (Sq.yds) | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | |
| UTILITY | 100% | 640 | 5760 | 1 | 5760 | 10 | 0 | 57600 | 0 | | 57600 | 46080 | 1 |
| UTILITY | 100% | 462 | 4158 | 1 | 4160 | 10 | 0 | 41600 | 0 | | 41600 | 33280 | 1 |
| PARKING | 100% | 186 | 1674 | 1 | 1674 | 0.75 | 0 | 1255.5 | 0 | | 1255.5 | 1004.4 | 1 |
| PARKING | 100% | 721 | 6489 | 1 | 6489 | 0.75 | 0 | 4866.75 | 0 | | 4866.75 | 3893.4 | 4 |
| PARKING | 100% | 534 | 4806 | 1 | 4806 | 0.75 | 0 | 3604.5 | 0 | | 3604.5 | 2883.6 | 3 |
| PARKING | 100% | 2270 | 20430 | 1 | 20430 | 0.75 | 0 | 15322.5 | 0 | | 15322.5 | 12258 | 1 |
| PARKING | 100% | 334 | 3006 | 1 | 3006 | 0.75 | 0 | 2254.5 | 0 | | 2254.5 | 1803.6 | 1 |
| PIAZZA | 100% | 924 | 8316 | 1 | 8316 | 0.5 | 0 | 4158 | 0 | | 4158 | 3326.4 | 1 |
| PIAZZA | 100% | 150 | 1350 | 1 | 1350 | 0.5 | 0 | 675 | 0 | | 675 | 540 | 3 |
| PIAZZA | 100% | 2670 | 24030 | 1 | 24030 | 0.5 | 0 | 12015 | 0 | | 12015 | 9612 | 1 |
| PIAZZA | 100% | 1378 | 12402 | 1 | 12402 | 0.5 | 0 | 6201 | 0 | | 6201 | 4960.8 | 1 |
| PIAZZA | 100% | 11690 | 105210 | 1 | 105210 | 0.5 | 0 | 52605 | 0 | | 52605 | 42084 | 1 |
| | | | | | | | | | | | TOTAL (kW) | | |

## DCK - SECTOR-03 (PACKAGE-1)

## ELECTRICAL LOAD CALCULATIONS

## LOAD AS PER KESC STANDARDS

| ype of lot | Covered Area as per DCK Bye Laws | | | | | KESC Load Criteria | | General Load | A/C Load | Lift Load (W) | Water Pump Load (W) | Max. Connected Load (W) | Group Div. Factor 80% (W) | TOTAL N OF PLO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | Covered Area (Sq.yds) | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | |
| C2 | 100% | 200 | 1800 | 6 | 10800 | 10 | 0 | 108000 | 0 | 8952 | 3729 | 120681 | 96544.8 | 28 |
| M3 | 90% | 270 | 2430 | 6 | 14580 | 10-GF 1.75 UP | 1 | 45562.5 | 10000 | 8952 | 3729 | 68243.5 | 54594.8 | 12 |
| | | | | | | | | | | | | TOTAL (kW) | | |

# DCK - SECTOR-03 (PACKAGE-1)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

| Type of Plot | Covered Area as per DCK Bye Laws | | | | | KESC Load Criteria | | General Load | A/C Load | Max. Connected Load (W) | Connected Load at 40% DF (W) | Group Div. Factor 80% (W) | TOTAL NO OF PLOTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | Covered Area (Sq.yds) | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | |
| R5 | 60% | 300 | 2700 | 3 | 8100 | 1.75 | 1 | 14175 | 6000 | 20175 | 8070 | 6456 | 1011 |
| R10 | 50% | 500 | 4500 | 3 | 13500 | 1.75 | 2 | 23625 | 12000 | 35625 | 14250 | 11400 | 10 |
| | | | | | | | | | | | | **TOTAL (kW)** | **1021** |

**DCK - SECTOR-03 (PACKAGE-1)**

**ELECTRICAL LOAD CALCULATIONS**

**LOAD AS PER KESC STANDARDS**

| SCRIPTION | TOTAL NO. OF PLOTS | TOTAL RESIDENTIAL LOAD (kW) | TOTAL AMENITIES LOAD (kW) | TOTAL COMMERCIAL LOAD (kW) | TOTAL (kW) |
|---|---|---|---|---|---|
| | 1,021 | | | | |
| oad | | 6,641.02 | | | |
| oad | | | 1,850.20 | | 11,849.60 |
| Load | | | | 3,358.39 | |
| **oad (MW)** | | **6.64** | **1.85** | **3.36** | **11.85** |

# 4

## FEEDER SIZING
## SECTOR-03 (PACKAGE-1)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-03 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


OSMANI

Engineering - Architecture - Planning - Mapping - Technology

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Web: www.osmani.com

# D.H.A CITY
# SECTOR-02 (PACKAGE 1)
# RING MAIN VOLTAGE DROPS (CALCULATIONS)

## RING MAIN NO.1 (FEEDER NO. 1)

| | |
|---|---|
| **Ring Main No. 1 (Feeder No. 1) Load** | **= 3.64 MW** |
| a) Length of 3 core 400 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from 1st transformer to grid station | = 2160 m |
| Approximate AC impedance of conductor at 90°C | = 0.135 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 439A |
| Voltage Drop = Vd = IZ<br>= Vd = 439 x 2.160 x 0.135 | = 128.01 Volts |
| b) Length of 3 core 300 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from last transformer to switching station | = 292 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.292 x 0.158 | = 17.86 Volts |
| c) Length of 3 core 300 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from transformer to transformer | = 2474 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 2.474 x 0.158 | = 151.29 Volts |
| Total voltage drop for ring main no.1 = 128.01 + 17.86 + 151.29 | = 297.16 Volts |
| % Voltage drop = 297.16 x 100 / 11000 | = 2.7 % |

## RING MAIN NO.2 (FEEDER NO. 2)

| | |
|---|---|
| **Ring Main No. 2 (Feeder No. 2) Load** | **= 3.57 MW** |
| a) Length of 3 core 400 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from 1st transformer to grid station | = 2480 m |
| Approximate AC impedance of conductor at 90°C | = 0.135 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 439A |
| Voltage Drop = Vd = IZ<br>= Vd = 439 x 2.480 x 0.135 | = 146.98 Volts |
| b) Length of 3 core 300 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from last transformer to switching station | = 685 m |
| Approximate AC impedance of conductor at 90°C ohm/km | = 0.158 |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.685 x 0.158 | = 41.89 Volts |
| c) Length of 3 core 300 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from transformer to transformer | = 2173 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 2.173 x 0.158 | = 132.89 Volts |
| Total voltage drop for Ring Main No.2 = 146.98 + 41.89 + 132.89 | = 321.76 Volts |
| % Voltage drop = 321.76 x 100 / 11000 | = 2.92 % |

## RING MAIN NO.3 (FEEDER NO. 3)

| | |
|---|---|
| **Ring Main No. 3 (Feeder No. 3) Load** | **= 3.71 MW** |
| d) Length of 3 core 400 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from 1st transformer to grid station | = 2811 m |
| Approximate AC impedance of conductor at 90°C | = 0.135 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 439A |
| Voltage Drop = Vd = IZ<br>= Vd = 439 x 2.811 x 0.135 | = 166.59 Volts |
| e) Length of 3 core 300 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from last transformer to switching station | = 338 m |
| Approximate AC impedance of conductor at 90°C ohm/km | = 0.158 |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.338 x 0.158 | = 20.67 Volts |
| f) Length of 3 core 300 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from transformer to transformer | = 1304 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 1.304 x 0.158 | = 79.74 Volts |
| Total voltage drop for Ring Main No.3 = 166.59 + 20.67 + 79.74 | = 267 Volts |
| % Voltage drop = 267 x 100 / 11000 | = 2.42 % |

## EXPRESS FEEDER # 1

| | |
|---|---|
| g) Length of 3 core 400 mm2 AL, XLP/,PVC/SWA/PVC 15 KV cable from grid station to switching station | = 3331 m |
| Approximate AC impedance of conductor at 90°C | = 0.135 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 439A |
| Voltage Drop = Vd = IZ<br>= Vd = 439 x 3.331 x 0.135 | = 197.41 Volts |
| % Voltage drop = 197.41 x 100 / 11000 | = 1.79 % |

# 5

## LV- VOLTAGE DROP
## SECTOR-03 (PACKAGE-1)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-03 (PACKAGE-1)
.DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
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| - | FEEDER LENGTH | LOAD ON FEEDER | | INCOMING (TP MCCB) | OUTGOING (TP MCCB) | Method of Installation | DERATING FACTORS | | | | Required Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| PARK | | 120.00 | 259 | Feed From Trafo-1 | | | | | | | | | | | |
| FP 1/1 | 49 | 121.90 | 263 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 274 | | 300 | 286 | 263 |
| FP 1/2 | 9 | 56.9 | 123 | (150A) TP | (7 x 15A) + (30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 128 | | 70 | 130 | 123 |
| FP 1/3 | 16 | 58.50 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 131 | | 95 | 154 | 126 |
| FP 1/4 | 49 | 123.50 | 267 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 277 | | 300 | 286 | 267 |
| FP 1/5 | 42 | 58.50 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 131 | | 95 | 154 | 126 |
| FP 1/6 | 45 | 97.50 | 211 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 219 | | 185 | 220 | 211 |
| FP 1/7 | 41 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 1/8 | 136 | 84.00 | 181 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 188 | | 150 | 197 | 181 |
| FP 1/9 | 41 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 |
| PARK | | 65.85 | 142 | Feed From Trafo-2 | | | | | | | | | | | |
| FP 2/1 | 85 | 45.50 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 |
| FP 2/2 | 117 | 45.50 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 |
| FP 2/3 | 10 | 95.30 | 206 | (125A) TP | (7 x 15A) + (10A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 214 | | 185 | 220 | 206 |
| FP 2/4 | 57 | 143.78 | 311 | (200A) TP | (8 x 15A) + (80A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 323 | 2 | 120 | 174 | 155 |
| FP 2/5 | 34 | 58.50 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 131 | | 95 | 154 | 126 |
| C-2 | | 96.54 | 209 | Feed From Trafo-3 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-3 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-3 | | | | | | | | | | | |
| FP 3/1 | 57 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| C-4 | | 96.54 | 209 | Feed From Trafo-1 | | | | | | | | | | | |

| | FEEDER LENGTH | LOAD ON FEEDER | | INCOMING (TP MCCB) | OUTGOING (TP MCCB) | Method of Installation | DERATING FACTORS | | | | Required Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| FP 4/4 | 26 | 97.50 | 211 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 219 | | 185 | 220 | 211 |
| PARK | | 62.09 | 134 | Feed From Trafo-5 | | | | | | | | | | | |
| FP 5/1 | 33 | 78.00 | 168 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 175 | | 150 | 197 | 168 |
| FP 5/2 | 34 | 91.00 | 197 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 204 | | 185 | 220 | 197 |
| FP 5/3 | 57 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 5/4 | 42 | 45.50 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 |
| FP 5/5 | 53 | 97.50 | 211 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 219 | | 185 | 220 | 211 |
| FP 5/6 | 83 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 |
| PARK | | 98.60 | 213 | Feed From Trafo-6 | | | | | | | | | | | |
| FP 6/1 | 75 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 6/2 | 18 | 91.00 | 197 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 204 | | 185 | 220 | 197 |
| FP 6/3 | 81 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 |
| FP 6/4 | 12 | 45.50 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 |
| FP 6/5 | 85 | 97.50 | 211 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 219 | | 185 | 220 | 211 |
| FP 7/1 | 125 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| FP 7/2 | 35 | 117.00 | 253 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 263 | | 300 | 286 | 253 |
| FP 7/3 | 84 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 7/4 | 93 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 7/5 | 20 | 104.00 | 225 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 233 | | 240 | 253 | 225 |

| | FEEDER LENGTH | LOAD ON FEEDER | | INCOMING (TP MCCB) | OUTGOI[illegible] (TP MCCB) | [illegible] of Installatio n | DERATING FACTORS | | | | Req[illegible] Current Carrying[illegible] Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| FP 8/3 | 42 | 143.00 | 309 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 321 | 2 | 120 | 174 | 154 |
| FP 8/4 | 94 | 91.00 | 197 | (60A) TP | (4 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 204 | | 185 | 220 | 197 |
| FP 8/5 | 55 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| FP 8/6 | 72 | 58.50 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 131 | | 95 | 154 | 126 |
| PARK | | 84.22 | 182 | Feed From Trafo-9 | | | | | | | | | | | 182 |
| FP 9/1 | 53 | 109.18 | 236 | (250A) TP | (2 x 125A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 245 | | 240 | 253 | 236 |
| FP 9/2 | 19 | 109.18 | 236 | (250A) TP | (2 x 125A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 245 | | 240 | 253 | 236 |
| FP 9/3 | 20 | 109.18 | 236 | (250A) TP | (2 x 125A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 245 | | 240 | 253 | 236 |
| FP 9/4 | 66 | 109.18 | 236 | (250A) TP | (2 x 125A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 245 | | 240 | 253 | 236 |
| [illegible] P 9/5 | 25 | 126.43 | 273 | (250A) TP | (100A) + (80A) + (60A) + (50A) + (30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 284 | | 300 | 286 | 273 |
| PARK | | 320.00 | 691 | Feed From Trafo-10 | | | | | | | | | | | |
| P 10/1 | 66 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| [illegible] 10/2 | 30 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 |
| P 10/3 | 65 | 45.50 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 |
| P 10/4 | 114 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 50 | 90 | 84 |
| P 10/5 | 41 | 130.00 | [illegible] | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 292 | 2 | 95 | 154 | 140 |

| | FEEDER LENGTH | LOAD ON FEEDER | | INCOMING (TP MCCB) | OUTGOI[illegible] (TP MCCB) | [illegible] of Installatio n | DERATING FACTORS | | | | Re[illegible] Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| FP 11/2 | 33 | 45.50 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 |
| FP 11/3 | 54 | 58.50 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 131 | | 95 | 154 | 126 |
| FP 11/4 | 172 | 119.00 | 257 | (150A) TP | (9 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 267 | | 300 | 286 | 257 |
| FP 12/1 | 82 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| FP 12/2 | 52 | 78.00 | 168 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 175 | | 150 | 197 | 168 |
| FP 12/3 | 44 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 |
| FP 12/4 | 135 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 12/5 | 15 | 130.00 | 281 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 292 | 2 | 95 | 154 | 140 |
| FP 12/6 | 65 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| FP 13/1 | 84 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 13/2 | 14 | 104.00 | 225 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 233 | | 240 | 254 | 225 |
| FP 13/3 | 100 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 13/4 | 158 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 70 | 130 | 84 |
| FP 13/5 | 65 | 104.00 | 225 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 233 | | 240 | 254 | 225 |
| FP 13/6 | 35 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| FP 13/7 | 47 | 97.50 | 211 | (1[illegible]) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 219 | | 185 | 220 | 211 |
| FP 14/1 | 11[illegible] | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| FP 14/2 | 42 | [illegible] | [illegible] | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |

| | FEEDER LENGTH | LOAD ON FEEDER | | INCOMING (TP MCCB) | OUTGOING (TP MCCB) | Method of Installation | DERATING FACTORS | | | | Required Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| FP 14/6 | 12 | 119.00 | 257 | (125A) TP | (8 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 267 | | 300 | 286 | 257 |
| FP 15/1 | 22 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| FP 15/2 | 10 | 82.00 | 177 | (150A) TP | (7 x 15A) + (30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 184 | | 150 | 197 | 177 |
| FP 15/3 | 51 | 26.00 | 56 | (60A) TP | (4 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 58 | | 16 | 59 | 56 |
| FP 15/4 | 71 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| FP 15/5 | 142 | 113.80 | 246 | (125A) TP | (6 x 15A) + (2 x 30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 255 | | 300 | 286 | 246 |
| [illegible]/6 | 9 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| PARK | | 165.30 | 357 | Feed From Trafo-16 | | | | | | | | | | | |
| UTILITY | | 46.08 | 100 | Feed From Trafo-16 | | | | | | | | | | | |
| FP 16/1 | 19 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| FP 16/2 | 71 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 17/1 | 36 | 32.50 | 70 | (80A) TP | (5 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 73 | | 35 | 90 | 70 |
| FP 17/2 | 14 | 71.50 | 154 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 160 | | 120 | 174 | 154 |
| FP 17/3 | 14 | 71.50 | 154 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 160 | | 120 | 174 | 154 |
| FP 17/4 | 26 | 32.50 | 70 | (80A) TP | (5 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 73 | | 25 | 75 | 70 |
| FP 17/5 | 47 | 71.50 | 154 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 160 | | 120 | 174 | 154 |
| FP 17/6 | 38 | 32.50 | 70 | (80A) TP | (5 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 73 | | 35 | 90 | 70 |

| E | FEEDER LENGTH | LOAD ON FEEDER | | INCOMING (TP MCCB) | OUTGOI[illegible] (TP MCCB) | Method of Installation | DERATING FACTORS | | | | Re[illegible] Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| FP 17/7 | 77 | 104.00 | 225 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 233 | | 240 | 254 | 225 |
| FP 17/8 | 38 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| C-2 | | 96.54 | 209 | Feed From Trafo-18 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-18 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-18 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-18 | | | | | | | | | | | |
| P 18/1 | 23 | 123.04 | 266 | (200A) TP | (3 x 10A) + (125A) + (50A) + (15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 276 | | 300 | 286 | 266 |
| FP 18/2 | 30 | 37.40 | 81 | (100A) TP | (4 x 15A) + (30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 84 | | 35 | 90 | 81 |
| FP 18/3 | 78 | 117.00 | 253 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 263 | | 300 | 286 | 253 |
| FP 18/4 | 43 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| EDUCATION | | 180.56 | 390 | Feed From Trafo-19 | | | | | | | | | | | |
| FP 19/1 | 27 | 42.30 | 91 | (100A) TP | (3 x 15A) + (2 x 30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 95 | | 50 | 106 | 91 |
| FP 19/2 | 147 | 87.80 | 190 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 197 | | 185 | 220 | 190 |
| FP 19/3 | 88 | 108.32 | 234 | (125A) TP | (6 x 15A) + (30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 243 | | 240 | 254 | 234 |
| FP 19/4 | 63 | 57.92 | 125 | (150A) TP | (8 x 15A) + (2 x 10A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 130 | | 70 | 130 | 125 |
| FP 19/5 | 25 | 86.06 | 186 | (200A) TP | (8 x 15A) + (80A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 193 | | 150 | 197 | 186 |

| | FEEDER LENGTH | LOAD ON FEEDER | | INCOMING (TP MCCB) | OUTGOI[illegible] (TP MCCB) | Method of Installation | DERATING FACTORS | | | | Req[illegible] Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| FP 19/7 | 52 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 |
| FP 19/8 | 74 | 82.90 | 179 | (100A) TP | (5 x 15A) + (30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 186 | | 150 | 197 | 179 |
| P 19/9 | 29 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 |
| C-2 | | 96.54 | 209 | Feed From Trafo-20 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-20 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-20 | | | | | | | | | | | |
| FP 20/1 | 40 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| EDUCATION | | 48.90 | 106 | Feed From Trafo-21 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-21 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-21 | | | | | | | | | | | |
| FP 21/1 | 7 | 30.85 | 67 | (80A) TP | (3 x 10A) + (50A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 69 | | 25 | 75 | 67 |
| FP 22/1 | 47 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 22/2 | 69 | 130.00 | 281 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 292 | 2 | 95 | 154 | 140 |
| FP 22/3 | 99 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| FP 22/4 | 108 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 22/5 | 31 | 104.00 | 225 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 233 | | 240 | 254 | 225 |
| FP 22/6 | 67 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 23/1 | 57 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| FP 23/2 | 57 | 149.32 | 323 | (200A) TP | (6 x 15A) + (125A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 335 | 2 | 120 | 174 | 161 |
| FP 23/3 | 42 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |

| | FEEDER LENGTH | LOAD ON FEEDER | | INCOMING (TP MCCB) | OUTGOI[illegible] (TP MCCB) | Method of Installation | DERATING FACTORS | | | | Req[illegible] Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| P 24/2 | 64 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| P 24/3 | 206 | 104.00 | 225 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 233 | | 240 | 254 | 225 |
| P 24/4 | 24 | 78.00 | 168 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 175 | | 150 | 197 | 168 |
| P 24/5 | 41 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 |
| FP 24/6 | 81 | 91.00 | 197 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 204 | | 185 | 220 | 197 |
| FP 24/7 | 9 | 45.50 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 |
| M-3 | | 57.39 | 124 | Feed From Trafo-25 | | | | | | | | | | | |
| M-3 | | 54.59 | 118 | Feed From Trafo-25 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-25 | | | | | | | | | | | |
| FP 25/1 | 25 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 25/2 | 35 | 117.00 | 253 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 263 | | 300 | 286 | 253 |
| M-3 | | 54.59 | 118 | Feed From Trafo-26 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-26 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-26 | | | | | | | | | | | |
| FP 26/1 | 18 | 21.62 | 47 | (50A) TP | (2 x 30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 49 | | 16 | 59 | 47 |
| C-2 | | 96.54 | 209 | Feed From Trafo-27 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-27 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-27 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-28 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-28 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-28 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-28 | | | | | | | | | | | |

| | FEEDER LENGTH | LOAD ON FEEDER | | INCOMING (TP MCCB) | OUTGOI[illegible] (TP MCCB) | [illegible] of Installatio n | DERATING FACTORS | | | | Re[illegible] Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| TR-10(B) & TR-11(B) are coming from Sector-3 (Package-2) | | | | | | | | | | | | | | | |
| [illegible] 10/1 | 106 | 43.60 | 94 | (100A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 98 | | 50 | 106 | 94 |
| FP 10/2 | 48 | 102.10 | 221 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 229 | | 240 | 245 | 221 |
| FP 10/3 | 52 | 95.60 | 206 | (100A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 215 | | 185 | 220 | 206 |
| FP 10/4 | 83 | 52.80 | 114 | (125A) TP | (8 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 118 | | 70 | 130 | 114 |
| FP 10/5 | 13 | 97.50 | 211 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 219 | | 185 | 220 | 211 |
| FP 10/6 | 83 | 45.50 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 |
| FP 10/7 | 110 | 139.65 | 302 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 313 | 2 | 120 | 174 | 151 |
| FP 10/8 | 41 | 94.15 | 203 | (225A) TP | (3A) + (80A) + (125A) + (10A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 211 | | 185 | 220 | 203 |
| FP 10/9 | 49 | 110.50 | 239 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 248 | | 240 | 254 | 239 |
| P 10/10 | 77 | 45.50 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 |
| P 10/11 | 7 | 91.00 | 197 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 204 | | 185 | 220 | 197 |
| P 10/12 | 222 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 70 | 130 | 84 |
| FP 11/1 | 57 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 |
| C-2 | | 96.54 | 209 | Feed From Trafo-11 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-11 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-11 | | | | | | | | | | | |

B = Clipped on wall

REF:

# 6

## LOADING OF TRANSFORMERS IN SECTOR-03 (PACKAGE-1)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-03 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
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Fax: +92-21-34534691
Email: ocl-khi@osmani.com,
Web: www.osmani.com

# D.H.A CITY
## SECTOR-03 (PACKAGE-1)

| FEEDER | | TRANSFORMERS |
|---|---|---|
| Feeder No: | 1 | 1000 kVA(TYPE-A) =1 b) 1000 kVA(TYPE-B)=1 |
| Feeder Load: | 3.64 MW | 500 kVA(TYPE-A) =1 b) 500 kVA(TYPE-B) =6 |

| S. No. | TRANSFORMER | | | | |
|---|---|---|---|---|---|
| | TR-No. | Rating kVA | Rating kW | Connected Load kW | Loading Efficiency % |
| 1 | 1 | 1000 | 800 | 605.9 | 75.74% |
| 2 | 2 | 500 | 400 | 350.43 | 87.61% |
| 3 | 3 | 500 | 400 | 341.62 | 85.41% |
| 4 | 4 | 500 | 400 | 340.75 | 85.19% |
| 5 | 5 | 500 | 400 | 328.59 | 82.15% |
| 6 | 6 | 500 | 400 | 339.1 | 84.78% |
| 7 | 7 | 500 | 400 | 338 | 84.50% |
| 8 | 8 | 500 | 400 | 347.09 | 86.77% |
| 9 | 9 | 1000 | 800 | 647.37 | 80.92% |

| FEEDER | | TRANSFORMERS |
|---|---|---|
| Feeder No: | 2 | 1000 kVA(TYPE-A) =1 b) 1000 kVA(TYPE-B)=1 |
| Feeder Load: | 3.57 MW | 500 kVA(TYPE-A) =1 b) 500 kVA(TYPE-B) =6 |

| S. No. | TRANSFORMER | | | | |
|---|---|---|---|---|---|
| | TR-No. | Rating kVA | Rating kW | Connected Load kW | Loading Efficiency % |
| 1 | 10 | 1000 | 800 | 638.5 | 79.81% |
| 2 | 11 | 500 | 400 | 322.3 | 80.58% |
| 3 | 12 | 500 | 400 | 325 | 81.25% |
| 4 | 13 | 500 | 400 | 344.5 | 86.13% |
| 5 | 14 | 500 | 400 | 340 | 85.00% |
| 6 | 15 | 500 | 400 | 326.7 | 81.68% |
| 7 | 16 | 500 | 400 | 328.38 | 82.10% |
| 8 | 17 | 500 | 400 | 318.5 | 79.63% |
| 9 | 18 | 1000 | 800 | 626.2 | 78.28% |

| FEEDER | | TRANSFORMERS | |
|---|---|---|---|
| Feeder No: | 3 | 1000 kVA(TYPE-A) =1 | b) 1000 kVA(TYPE-B)=1 |
| Feeder Load: | 3.71 MW | 500 kVA(TYPE-A) =1 | b) 500 kVA(TYPE-B) =7 |

| S. No. | TRANSFORMER | | | | |
|---|---|---|---|---|---|
| | TR-No. | Rating kVA | Rating kW | Connected Load kW | Loading Efficiency % |
| 1 | 19 | 1000 | 800 | 641.54 | 80.19% |
| 2 | 20 | 500 | 400 | 341.62 | 85.41% |
| 3 | 21 | 500 | 400 | 272.83 | 68.21% |
| 4 | 22 | 500 | 400 | 338 | 84.50% |
| 5 | 23 | 500 | 400 | 333.32 | 83.33% |
| 6 | 24 | 500 | 400 | 325 | 81.25% |
| 7 | 25 | 500 | 400 | 325.52 | 81.38% |
| 8 | 26 | 500 | 400 | 269.29 | 67.32% |
| 9 | 27 | 500 | 400 | 286.92 | 71.73% |
| 10 | 28 | 1000 | 800 | 579.24 | 72.41% |

# 8

## BoQ

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-03 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
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Tel: +92-21-34536007 / 08, 34546541/42
Fax: +92-21-34534691
Email: ocl-khi@osmani.com,
Web: www.osmani.

**CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI**
**NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS**
**LOCATION : DHA CITY SECTOR '03' (PACKAGE-1)**
**SUB-HEAD : ELECTRICAL WORKS LV DISTRIBUTION**

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| 1 | **EXCAVATION**<br>Excavation and back filling as in hard/sofft or any soil upto 1.0m depth and 0.9m wide for MV/LV/ITC cable and pipe trenches complete as directed by the Engineer.(Excluding cost of cable & pipe) | 10,100 | Cum | 900 | 9,090,000 |
| 1.1 | Excavation and back filling as in hard/sofft or any soil upto 1.0m depth and 0.6m wide for LV/ITC cable and pipe trenches complete as directed by the Engineer.(Excluding cost of cable & pipe) | 2,950 | Cum | 900 | 2,655,000 |
| 2 | **LV CABLE**<br>Supply, laying , conecting and testing Cable electric LV 600/1000V stranded aluminium conductor, XLPE insulated, Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, sand,warning tap with all accessories as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| 2.1) | 4 core 300mm² AL, XLPE,PVC / SWA / PVC | 620 | m | 5,600 | 3,472,000 |
| 2.2) | 4 core 240mm² AL, XLPE,PVC / SWA / PVC | 919 | m | 4,500 | 4,135,500 |
| 2.3) | 4 core 185mm² AL, XLPE,PVC / SWA / PVC | 809 | m | 3,500 | 2,831,500 |
| 2.4) | 4 core 150mm² AL, XLPE,PVC / SWA / PVC | 437 | m | 2,800 | 1,223,600 |
| 2.5) | 4 core 120mm² AL, XLPE,PVC / SWA / PVC | 617 | Mtr | 2,500 | 1,542,500 |
| 2.6) | 4 core 95mm² AL, XLPE,PVC / SWA / PVC | 1,589 | m | 2,000 | 3,178,000 |
| 2.7) | 4 core 70mm² AL, XLPE,PVC / SWA / PVC | 2,236 | m | 1,750 | 3,913,000 |
| 2.8) | 4 core 50mm² AL, XLPE,PVC / SWA / PVC | 770 | m | 1,200 | 924,000 |
| 2.9) | 4 core 35mm² AL, XLPE,PVC / SWA / PVC | 666 | m | 950 | 632,700 |
| 2.10) | 4 core 25mm² AL, XLPE,PVC / SWA / PVC | 33 | Mtr | 750 | 24,750 |
| 2.11) | 4 core 16mm² AL, XLPE,PVC / SWA / PVC | 69 | m | 630 | 43,470 |
| 3 | Danger sign for MV & LV not less than 250 X 125 mm enameled as required, supply and fixing. | 200 | Each | 2,000 | 400,000 |
| 4 | **Feeder pillar**<br>Providing, installing, testing and commissioning of floor mounted Feeder pillar in 16 SWG sheet steel housing, dust, weather proof IP-54 paint, hinged double lock, suitable for 3 phase neutral and earth strip 400 volts, Almunium busbars & Insulators for distribution to out going breakers.Seperate Almunium busbars chamber in locking arrangement. Installed on RCC pad, including cost of RCC foundation, complete as per Drawings and accessories as Directed by the engineer. | | | | |

| Sr. No. | Particulars | Qty. | Unit | Rs. | Rs. |
|---|---|---|---|---|---|
| 4.1) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>10-10A to 60A TP MCCB 16KA | 25 | Each | 255,000 | 6,375,000 |
| 4.2) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>9-10A to 60A TP MCCB 16KA<br>10-10A to 60A TP MCCB 16KA | 10 | Each | 245,000 | 2,450,000 |
| 4.2) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>8-10A to 60A TP MCCB 16KA<br>1-80A TP MCCB 25KA<br>10-10A to 60A TP MCCB 16KA | 2 | Each | 250,000 | 500,000 |
| 4.3) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>8-10A to 60A TP MCCB 16KA<br>2-TP MCCB Space only | 44 | Each | 235,000 | 10,340,000 |
| 4.4) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>7-10A to 60A TP MCCB 16KA<br>3-TP MCCB Space only | 18 | Each | 225,000 | 4,050,000 |

| Sr. # | Particulars | Qty. | Unit | Rs. | Rs. |
|---|---|---|---|---|---|
| 4.4) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>6-10A to 60A TP MCCB 16KA<br>1-125A TP MCCB 25KA<br>3-TP MCCB Space only | 1 | Each | 230,000 | 230,000 |
| 4.5) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>6-10A to 60A TP MCCB 16KA<br>4-TP MCCB Space only | 25 | Each | 205,000 | 5,125,000 |
| 4.5) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>5-10A to 60A TP MCCB 16KA<br>1-125A TP MCCB 25KA<br>4-TP MCCB Space only | 1 | Each | 215,000 | 215,000 |
| 4.6) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>5-10A to 60A TP MCCB 16KA<br>5-TP MCCB Space only | 2 | Each | 195,000 | 390,000 |
| 4.6) b) | **Incoming**<br>1-80A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>5-10A to 60A TP MCCB 16KA<br>5-TP MCCB Space only | 4 | Each | 200,000 | 800,000 |

| Sr. # | Particulars | Qty. | Unit | Rs. | Rs. |
|---|---|---|---|---|---|
| 4.6) c) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>3-10A to 60A TP MCCB 16KA<br>1-100A TP MCCB 25KA<br>1-80A TP MCCB 25KA<br>5-TP MCCB Space only | 1 | Each | 200,000 | 200,000 |
| 4.7) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>2-10A to 60A TP MCCB 16KA<br>1-120A TP MCCB 25KA<br>1-80A TP MCCB 25KA<br>6-TP MCCB Space only | 1 | Each | 190,000 | 190,000 |
| 4.7) b) | **Incoming**<br>1-80A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>4-10A to 60A TP MCCB 16KA<br>6-TP MCCB Space only | 1 | Each | 190,000 | 190,000 |
| 4.7) c) | **Incoming**<br>1-60A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>4-10A to 60A TP MCCB 16KA<br>6-TP MCCB Space only | 2 | Each | 190,000 | 380,000 |
| 4.8) a) | **Incoming**<br>1-50A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>2-10A to 60A TP MCCB 16KA<br>8-TP MCCB Space only | 1 | Each | 160,000 | 160,000 |

| Sr. # | Particulars | Qty. | Unit | Rs. | Rs. |
|---|---|---|---|---|---|
| 4.8) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>2-125A TP MCCB 25KA<br>8-TP MCCB Space only | 4 | Each | 160,000 | 640,000 |
| 5 | **Earthing Electrodes**<br>Supply, installation, connection & testing of copper earth electrodes, 20mm dia, 3000mm in length, driven vertically in ground, including cost of Test pit 300x300x300mm, internal plaster, 100mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 145 | Job | 45,000 | 6,525,000 |
| 6 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Feeder Pillars as shown on the drawing. or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 1,450 | m | 500 | 725,000 |
| | | | | **Total of Rs.** | **73,551,0** |

# ENGINEER'S ESTIMATE

CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI
NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS
LOCATION : DHA CITY SECTOR '03' (PACKAGE-1)
SUB-HEAD : ELECTRICAL WORKS MV DISTRIBUTION. (Feeders & Express feec

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| 1 | **MV CABLE**<br>Supply,laying and conecting, Cable electric MV 15-kV stranded aluminium conductor, XLPE insulated,Triple Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, soft sand coushion, warning tape, Marker as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| | **FEEDER No 1.** | | | | |
| 1.1) | 3 core 400 mm² AL, XLPE / PVC / SWA / PVC 15 kV from grid station to TR-1 as shown on the drawings. | 2,160 | m | 11,500 | 24,840,00 |
| 1.2) | 3 core 300 mm² AL, XLPE / PVC / SWA / PVC 15 kV from transformar to transformer as shown on the drawings. | 2,474 | m | 7,600 | 18,802,40 |
| 1.3) | 3 core 300 mm² AL, XLPE / PVC / SWA / PVC 15 kV from TR-9 to Switch station-1 as shown on the drawings. | 292 | m | 7,600 | 2,219,20( |
| | **FEEDER No 2.** | | | | |
| 1.4) | 3 core 400 mm² AL, XLPE / PVC / SWA / PVC 15 kV from grid station to TR-10 as shown on the drawings. | 2,480 | m | 11,500 | 28,520,00 |
| 1.5) | 3 core 300 mm² AL, XLPE / PVC / SWA / PVC 15 kV from transformar to transformer as shown on the drawings. | 2,173 | m | 7,600 | 16,514,80 |
| 1.6) | 3 core 300 mm² AL, XLPE / PVC / SWA / PVC 15 kV from TR-18 to Switch station-1 as shown on the drawings. | 685 | m | 7,600 | 5,206,00( |
| | **FEEDER No 3.** | | | | |
| 1.7) | 3 core 400 mm² AL, XLPE / PVC / SWA / PVC 15 kV from grid station to TR-28 as shown on the drawings. | 2,811 | m | 11,500 | 32,326.50 |
| 1.8) | 3 core 300 mm² AL, XLPE / PVC / SWA / PVC 15 kV from transformar to transformer as shown on the drawings. | 1,304 | m | 7,600 | 9,910 4 |
| 1.9) | 3 core 300 mm² AL, XLPE / PVC / SWA / PVC 15 kV from TR-19 to Switch station-1 as shown on the drawings. | 338 | m | 7,600 | 2,568,8 |
| | **EXPRESS FEEDER-1** | | | | |
| 1.10) | 3 core 400 mm² AL, XLPE / PVC / SWA / PVC 15 kV from Grid station to Switch station-1 as shown on the drawings. | 3,331 | m | 11,500 | 38,306.50 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 2 | PVC straight joint, MV 15 kV, for XLPE cable consisting of mould, resin, MV tape, semi conducting tape, ferrules and earth wire etc. suitable for MV cables, 3 core 300 mm², supply and fixing complete with all installation accessories as per KESC standard. | | | | |
| | **FEEDER No 1.** | | | | |
| 2.1) | From grid station to TR-1 | 22 | Each | 80,000 | 1,760,000 |
| 2.2) | From TR-9 to Switching station. | 3 | Each | 80,000 | 240,000 |
| | **FEEDER No 2.** | | | | |
| 2.3) | From grid station to TR-10 | 25 | Each | 80,000 | 2,000,000 |
| 2.4) | From TR-18 to Switching station. | 7 | Each | 80,000 | 560,000 |
| | **FEEDER No 3.** | | | | |
| 2.5) | From grid station to TR-28 | 30 | Each | 80,000 | 2,400,000 |
| 2.6) | From TR-19 to Switching station. | 4 | Each | 80,000 | 320,000 |
| | **EXPRESS FEEDER No 1.** | | | | |
| 2.7) | From Switching station No-1 to grid station. | 35 | Each | 80,000 | 2,800,000 |
| | **SWITCHING STATION NO-1** | | | | |
| 3 | Supply Installation, testing and commissioning outdoor type of Switching station.Substation will have **1-incoming & 3-outgoing 17.5 kV** Vaccum circuit breaker (VCB), **350 MVA, 630A**, with protection devices housed in metalic frame **IP 54**. Switching station will be mounted on RCC plateform circuit breaker (CB) will be trolley raised type to avoid floor unevenness if any. The male & female contacts shall be rod & Tulip type with vertical arrangement. EFI will be installed on each cable. The breaker shall be provided with bimetalic lugs to accomodate 2-Almunium cable connection with copper bus bars. C.T & P.T will be installed on each breaker. C.T ratio **1200/600/1/1** P.T ratio **11 kV/110 V**. Each VCB shall have earthing switch to ground cable. Earthing switch shall have inter-lock with "ON" Mechanism. Digital type Relays on each VCB shall be over current **2Nos**; Earth Fault one No with series/shunt trip prorivions. The relay shall have additional potential free contacts for SCADA. Relays shall have self supervision provision. SCADA provision- each VCB will have potential **"NO" & "NC"** contact for status monitoring locally as well as at remote control room through SCADA. Switching Station (SS) housing shall be designed for safe operation by operator locally. No arc should comeout in any case. As per spacification installed on RCC pad, including the cost of RCC foundation pad complete with all civil and other installation accessories as shown on the drawing or as directed by the Engineers'. | 1 | Job | 7,800,000 | 7,800 |
| | **NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided. | | | | |

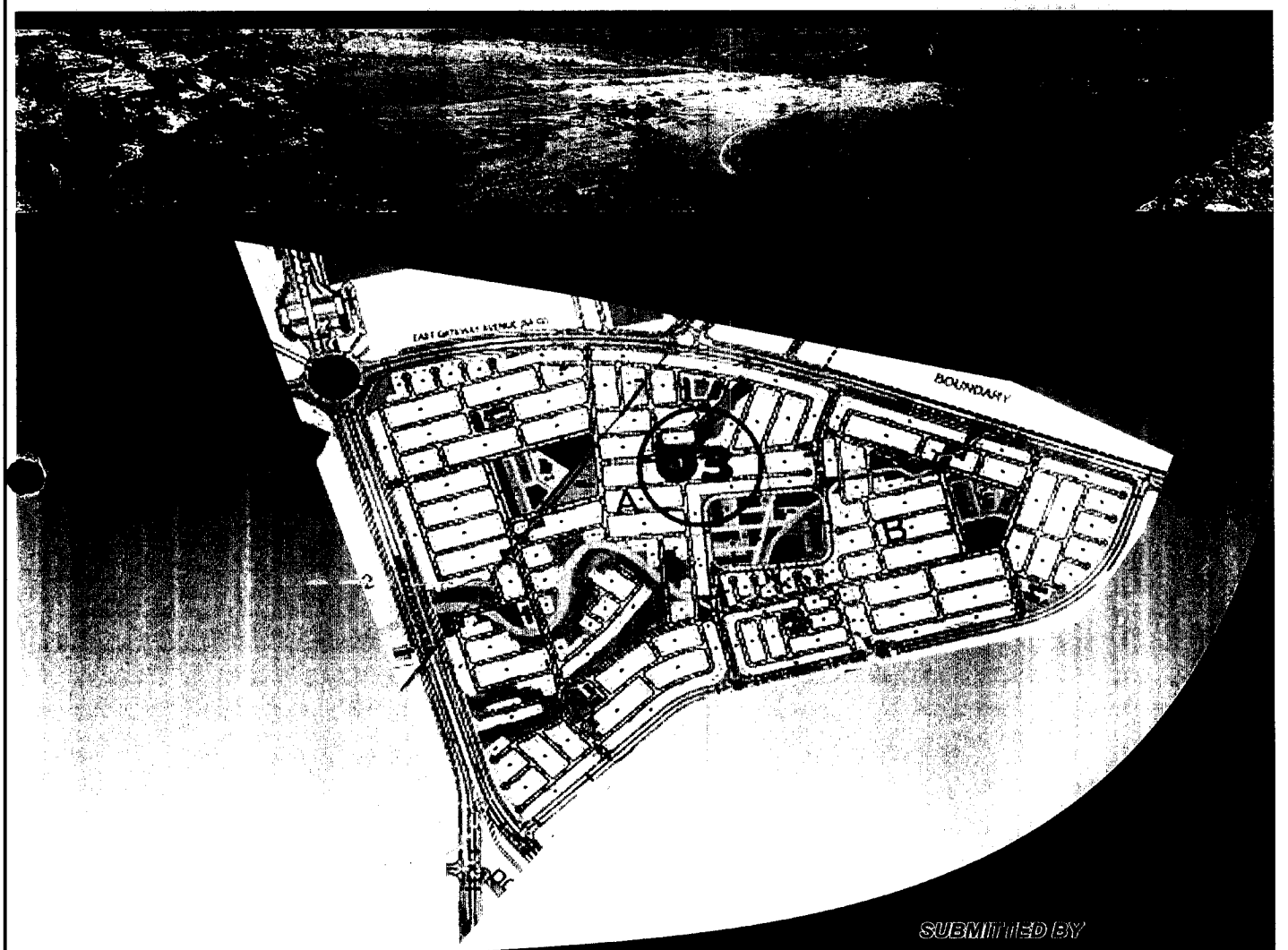
| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-A)** with **630 Amp**. VCB **17.5 kV**, **350 MVA**, **1000 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going VCBs on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos MCCB** of **400 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided. | 4 | Each | 7,050,000 | 28,200,00 |
| 5 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amp**. VCB **17.5 kV**, **350 MVA**, **1000 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going load break switches with SF6 Fuses on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos** MCCB of **400 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided. | 3 | Each | 6,000,000 | 18,000,00 |
| 6 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-A)** with **630 Amp**. VCB **17.5 kV**, **350 MVA**, **500 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going VCBs on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos MCCB** of **300 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided. | 3 | Each | 5,300,000 | 15,900,00 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **KIOSK SUBSTATIONS** | | | | |
| 7 | Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amp**. VCB **17.5 kV**, **350 MVA**, **500 kVA** Oil filled Transformer **11/0.42** kV with incoming & out going load break switches with SF6 Fuses on MV side. Air Circuit Breaker of **1600 Amp** outgoing 6 Nos MCCB of **300 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer. | 20 | Each | 4,300,000 | 86,000,00 |
| | **NOTE** | | | | |
| | KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided. | | | | |
| | **Earthing Electrodes** | | | | |
| 8 | Supply, installation, connection & testing of copper earth electrodes, 20 mm dia, 3000 mm in length, driven vertically in ground, including cost of Test pit 300x300x300 mm, internal plaster, 100 mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 35 | Job | 45,000 | 1,575,00( |
| 9 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Switching Station & Transformer as shown on the drawing. or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 350 | m | 500 | 175,000 |
| | | | | **Total of Rs.** | **346,944,6(** |

**PAKISTAN DEFENCE OFFICERS**
**HOUSING AUTHORITY**
**KARACHI**

# PLANNING AND DESIGNING OF ELECTRICAL DISTRIBUTION SYSTEM OF DHA CITY KARACHI SECTOR - 3B ( PACKAGE - 2 )

# DETAILED DESIGN REPORT

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DECEMBER 2012

# PLANNING & DESIGNING OF ELECTRICAL DISTRIBUTION SYSTEM OF DHA CITY, KARACHI SECTOR-03 (PACKAGE-02)

## DETAIL DESIGN REPORT

# DEFENCE HOUSING AUTHORITY
# KARACHI

SHORT-TERM PLAN ENERGY SECTOR – 03 (Package-02)
DHA CITY KARACHI

# DETAILED DESIGN REPORT

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# 1

## DESIGN BRIEF & DESIGN CRITERIA

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-03 (PACKAGE-2)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


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# 1. EXECUTIVE SUMMARY

For tendering purpose, Sector-03 short term development plan has been divided into two packages. Package-02 of Sector-03 comprises the following:

**A) MV Distribution Network comprising of:**

**1) MV Cables:**

- 3 core 300 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable — 4,761 m
- 3 core 400 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable — 8,139 m

**2) Switching Stations:**

**4-way** — 1 No.

**3) Kiosk Sub Station:**

- Kiosk Sub Station 1000 kVA (Type A) Transformer 11/0.42 kV Oil filled — 2 Nos.
- Kiosk Sub Station 1000 kVA (Type B) Transformer 11/0.42 kV Oil filled — 3 Nos.
- Kiosk Sub Station 630 kVA (Type A) Transformer 11/0.42 kV Oil filled — 1 Nos.
- Kiosk Sub Station 630 kVA (Type B) Transformer 11/0.42 kV Oil filled — 2 Nos.
- Kiosk Sub Station 500 kVA (Type A) Transformer 11/0.42 kV Oil filled — 2 Nos.
- Kiosk Sub Station 500 kVA (Type B) Transformer 11/0.42 kV Oil filled — 14 Nos.

**B) LV Distribution Network comprising of:**

**1) LV Cables:**

| | | | |
|---|---|---|---|
| a) | 4 core 300 mm² AL, XLPE/PVC/SWA/PVC cable | 164 | m |
| b) | 4 core 240 mm² AL, XLPE/PVC/SWA/PVC cable | 871 | m |
| c) | 4 core 185 mm² AL, XLPE/PVC/SWA/PVC cable | 560 | m |
| d) | 4 core 150 mm² AL, XLPE/PVC/SWA/PVC cable | 1,029 | m |
| e) | 4 core 120 mm² AL, XLPE/PVC/SWA/PVC cable | 357 | m |
| f) | 4 core 95 mm² AL, XLPE/PVC/SWA/PVC cable | 912 | m |
| g) | 4 core 70 mm² AL, XLPE/PVC/SWA/PVC cable | 818 | m |
| h) | 4 core 50 mm² AL, XLPE/PVC/SWA/PVC cable | 725 | m |
| i) | 4 core 35 mm² AL, XLPE/PVC/SWA/PVC cable | 194 | m |
| j) | 4 core 25 mm² AL, XLPE/PVC/SWA/PVC cable | 300 | m |
| k) | 4 core 16 mm² AL, XLPE/PVC/SWA/PVC cable | 254 | m |

**2) Feeder Pillars:**

| | |
|---|---|
| **10-way FP** | **17 Nos.** |
| **9-way FP** | **3 Nos.** |
| **8-way FP** | **15 Nos.** |
| **7-way FP** | **19 Nos.** |
| **6-way FP** | **16 Nos.** |
| **5-way FP** | **3 Nos.** |
| **4-way FP** | **2 Nos.** |
| **3- way FP** | **3 Nos.** |
| **2- way FP** | **6 Nos.** |

**C) Smart Grid ICT Network / pipe sleeves comprising:**

| | | |
|---|---|---|
| 1) | HDPE Pipe 2" dia. (2 Nos.) for MV/LV cables | 13,000 m |
| 2) | RCC hand hole with cover (L=5', W=3', D=3') | 135 Nos. |

# 2. FEATURES

## 2.1 INTRODUCTION

Pakistan Defence Officers Housing Authority (DHA) has commissioned M/s Osmani and Company (Pvt.) Ltd. to provide consultancy services for Development of DHA City Karachi (DCK) in August 2010. DHA City is spread over an area of 11,640 acres with numerous ridges and nalas following a rolling / mountainous terrain. DHA City is planned and divided into 16 sectors as listed below in Table 2-1

**Table 2-1: Area of Sectors**

| S.NO. | LOCATION | AREA (acres) | S.NO. | LOCATION | AREA (acres) |
|---|---|---|---|---|---|
| 1 | SECTOR 1 | 525 | 9 | SECTOR 9 | 604 |
| 2 | SECTOR 2 | 600 | 10 | SECTOR 10 | 541 |
| 3 | SECTOR 3 | 311 | 11 | SECTOR 11 | 663 |
| 4 | SECTOR 4 | 337 | 12 | SECTOR 12 | 504 |
| 5 | SECTOR 5 | 483 | 13 | SECTOR 13 | 575 |
| 6 | SECTOR 6 | 823 | 14 | SECTOR 14 | 655 |
| 7 | SECTOR 7 | 631 | 15 | SECTOR 15 | 697 |
| 8 | SECTOR 8 | 339 | 16 | SECTOR 16 | 383 |
| **GRAND TOTAL** | | | | | **8,671** |

Sector development works are to be carried out with respect to development strategy, which has been divided into 3 phases;

- Short Term Development Plan (2015 – 2018)
- Mid Term Development Plan (2018 – 2021)
- Long Term Development Plan (2021 – 2030)

The following ***Figure 2-1*** shows the location of various sub-sectors planned under short term, medium term and long term development.

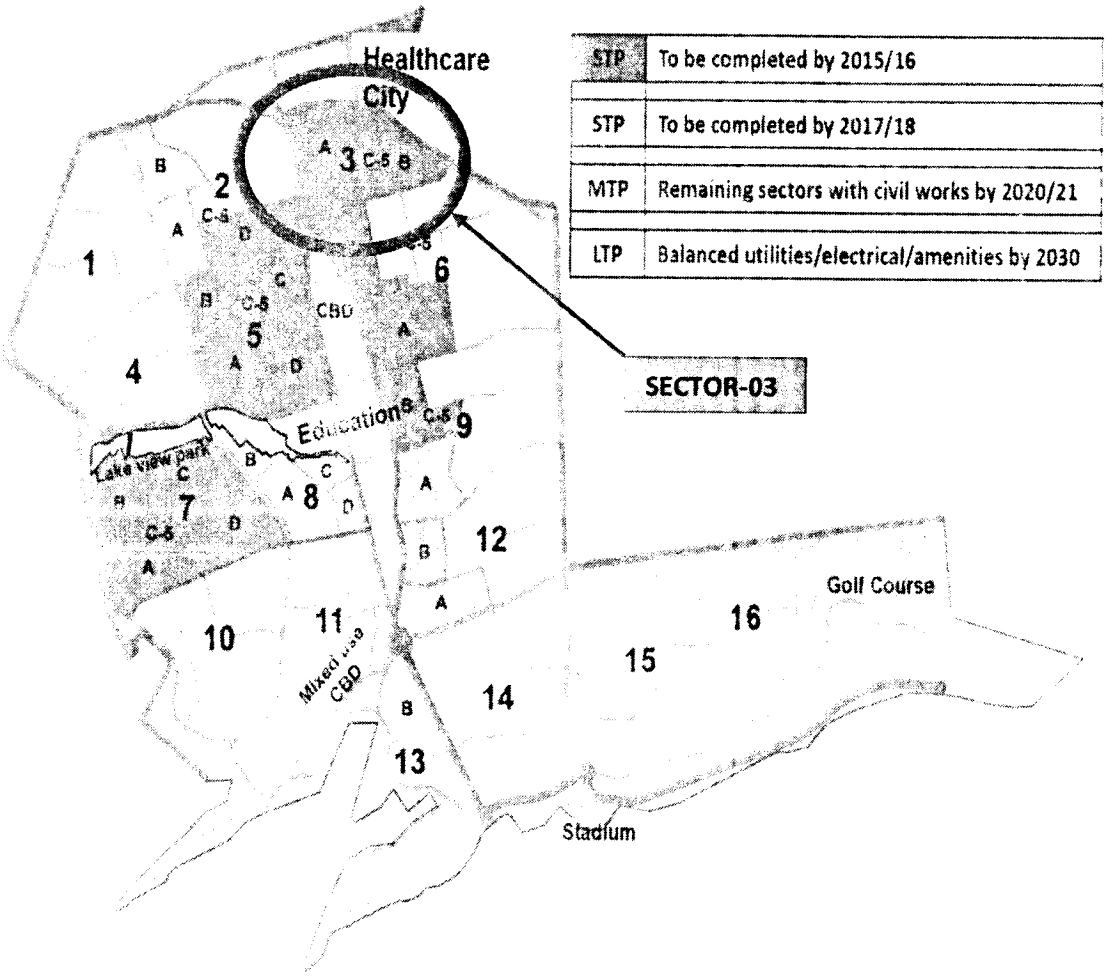


**Figure 2-1: Sectors under Short Term Development Plan**

Sectors are generally divided into four sub sectors as per the design criteria of 'Ekistics' for ease of communication of urban city. Acreage of each sub sector is given in Table 2-1 of Short Term Development Plan. Sector-03 has a total developed area of 311 acres.

*Table 2-2* shows the areas of various sectors under short term development plan:

**Table 2-2: Areas of Sectors under Short Term Plan**

| Areas in acres | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sector | Sub-Sector | | | | | Other than Sub Sector | Total |
| | A | B | C | C-5 | D | | |
| 2 | | | | | 141 | | 141 |
| 3 | 212 | 77 | | 13 | | 9 | 311 |
| 5 | 136 | 108 | 63 | 18 | 136 | | 483 |
| 6 | 167 | 97 | 112 | 40 | | | 416 |
| 7 | 136 | 129 | 198 | 19 | 149 | | 631 |
| 9 | | 89 | | | | | 89 |
| CBD | | | | | | 104 | 104 |
| **Total** | **662** | **506** | **377** | **97** | **433** | **113** | **2,175** |

## 2.2 SCOPE OF THE REPORT

The main objective of this report is to explain the Detail Design of Energy Distribution Network for DCK Sector-03. The other main objectives of this Detailed Design Report (DDR) are the following:

- Present the Detailed Design of Sub-Sector-3B to enable client review prior to progression to the detailed design stage.
- Provide details of how the design has been developed since the submission of the Energy Distribution Inception Report.
- Provide an updated description of the works.
- Confirm the design criteria and parameters used for the design of Electrical Distribution System. Provide a rough cost estimate for the project component.
- Provide details of any information obtained; and information still required to complete the project and highlight any potential difficulties in obtaining such information.

- This report will cover detail design of Sub-Sector-3B as encircled in Figure 2-1 and highlighted in Table 2-1

## 2.3 BACKGROUND

Sector-03 was planned on 302.47 acres area, with Main Boulevard (PA 02B) to the west, East Gateway Avenue (SA-02) to the east side and East Avenue 1E (PC-02) on the south.

For tendering purpose, Sector-03 is divided in to 2 packages i.e. 1 and 2. Package 1 contains sub-sector A with an approx. area of 212.47 acres, package 2 contains sub-sector B and commercial centre C5 with an approx. area of 90 acres. Figure 2-2 shows the boundaries and areas of packages 1, 2 and C-5 of Sector-03.

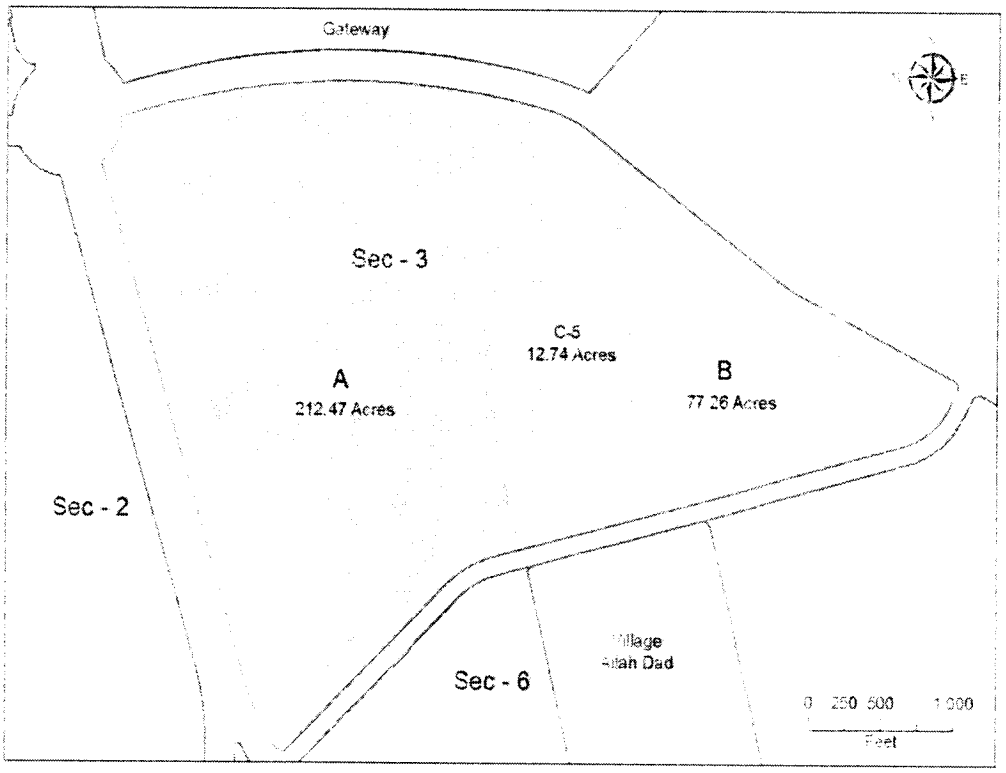


**Figure 2-2: Boundaries of Packages 1 and 2 of Sector-03**

## 2.4 TOPOGRAPHY OF SUB-SECTOR 3-B

The whole eastern part of sub-sector 3-B is plain rocky surface. The north and west have a nalla. The south and west are uneven with ridges. Figure 2-3 shows that the highest elevation is 570.56 ft and the lowest is 0.16 ft with a difference of 570.4 ft. The nalla also runs through C-5 which creates a valley with rocky high ground on both sides.

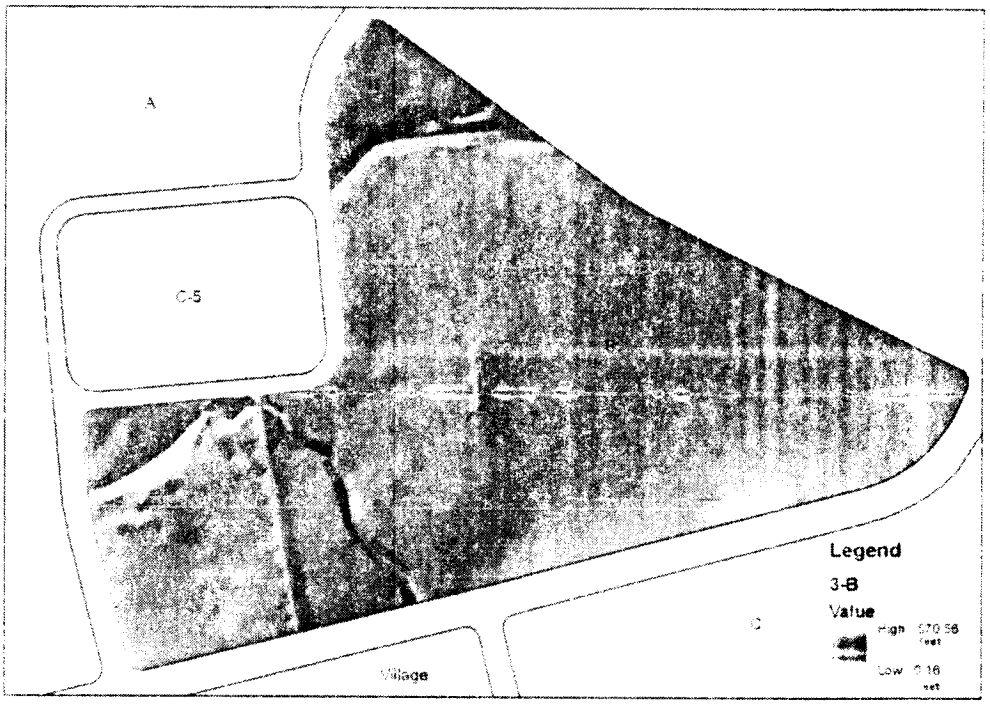


**Figure 2-3: Topography of sub-sector 3-B**

## 2.5 POPULATION AND DEVELOPMENT

The DCK will be developed in stages aiming to reach eventually more than 600,000 people. The overall planning of DCK is based on ekistics, leading to sectors of 20-40,000 people each. The Table 2-3 describes the land use in sector 3. About 2/3 of the area of sector 3 is utilized for residential purposes. Residential area has different plot categories from 100 square yards to 2,000 square yards. Other facilities include commercial areas, amenities, educational institutions, graveyard, healthcare facilities and green space areas.

**Table 2-3: Sector-03: Land Use Statistics**

| SECTOR-03 LAND USE STATISTICS | | | |
|---|---|---|---|
| **Zonal Land use** | **Categories** | **Area (acres)** | **Total Area (acres)** |
| Agriculture and Pre-served Open Spaces | Nallah | 8.97 | 37.59 |
| | Oil Pipe Line | 1.72 | |
| | Open & Green Space | 26.9 | |
| Amenities | Cemetery | 0.32 | 9.14 |
| | College/ A-Level/ Professional (CA/ ACCA etc.) | 1.28 | |
| | Community Hall | 1.15 | |
| | Dispensary | 0.19 | |
| | Health Centre | 0.47 | |
| | Kindergarten | 1.45 | |
| | Marriage Hall | 0.25 | |
| | Masjid | 0.66 | |
| | PS/ SS/ O-Level | 3.14 | |
| | Public Service (Club) | 0.23 | |
| Commercial | - | - | 3.62 |
| Mixed use | - | - | 2.32 |
| Recreation | Nursery | 0.2 | 6.91 |
| | Parks and Playground | 6.71 | |
| Residential | - | - | 149.44 |
| Transportation | Commercial Collector Roads (60' Row) | 4.3 | 100.51 |
| | Parking | 2.98 | |
| | Pedestrian way | 1.56 | |
| | Piazza | 7.16 | |
| | Residential Collector Roads (90' ROW) | 3.56 | |
| | Streets | 80.96 | |
| Utilities | Electric Installation | | 0.79 |
| | ICT and Security | 0.18 | |
| | Sewage Treatment Plant | - | |
| | Tube well | - | |
| | Unclassified Utility | 0.61 | |
| **Grand Total** | | | **310.32** |

## 2.6 CONTRACT PACKAGES

Sector-03 consists of 2 contract packages. Refer Figure 2-2 for location and boundary of various packages. The key layout plans showing overall MV & LV network of contract package-02 is also attached in Detailed Design Drawings of the report. The statistical description of package-02 is given below:

- **Package-02**

This package comprises of sub-sector B which has commercial C-5 also having an area of 90 acres as given in Table 2-2. It has 14 C2s as shown in Table 2-4 and consists of an approx. road network of 30,237 ft (9.216 Km).
Table 2-4 shows the Plots Summary of Sub-Sector-3B under categories of Residential, Commercial & Mix Use.

**Table 2-4: Sub-Sector-3B: Plots Summary**

**SUB-SECTOR-3B PLOTS SUMMARY**

**Residential Plots**

| | R1 | R2 | R2.5 | R3 | R5 | R10 | R20 | Total |
|---|---|---|---|---|---|---|---|---|
| **Sector-03** | | | | **11** | **1,297** | **18** | **1** | **1,327** |
| Sub-Sector B | | 218 | | 11 | 287 | 8 | 1 | **525** |

**Commercial Plots**

| | C1 | C2 | C2.5 | C3 | C5 | C10 | C20 | Total |
|---|---|---|---|---|---|---|---|---|
| **Sector-03** | | **42** | | **15** | | **3** | | **60** |
| Sub-Sector B | | 9 | | | | | | 9 |
| C-5 | | 5 | | 15 | | 3 | | 23 |

**Mix Use (Residential + Commercial) Plots**

| | M1 | M2 | M2.5 | M3 | M5 | M10 | M20 | Total |
|---|---|---|---|---|---|---|---|---|
| **Sector-03** | | **13** | | **22** | **4** | | | **39** |
| Sub-Sector B | | 7 | | | | | | **7** |
| C-5 | | 6 | | 10 | 4 | | | **20** |

## 2.7 OVERVIEW OF DCK ELECTRICAL DISTRIBUTION DESIGN

Design of the Electrical Distribution Network for DHA City Karachi (DCK) is a very important task of the project. Analysis of the latest technologies, current industry standards, local field practices and availability of skilled Human Resource (HR) have been done with a view of current and future requirements of DCK residential and commercial users. Electrical network design layout of DCK is based on the geographic and sector wise distribution.

The DCK is a vision to build an urban city with adaption of new technologies. Distinctly it has to be a part of global smart cities family, which integrates various technical trends into a single place to facilitate best options to the local residents as well as business community. Any urban society can't be accomplished without proper plan so decision for opting of a reliable electrical distribution system for DCK will really need a higher priority at early stage.

Thus it is proposed to design and construct an electrical network that will be capable to deliver electrical services within DCK. In order to enable the level of operational efficiencies needed for a project of this kind, the use of 'smart building technologies' is the basis of this design to fulfil DCK requirement for provisioning of electrical services. The aim is to provide a network with reliable electricity supply to the residents and stakeholders.

Kiosk type substations can only be the favourable medium for smart distribution in DCK, which can provide the monitoring and control required. We believe that key for reliable electricity is a reliable distribution system with few faults and their fast location and removal. In this regard best efforts are being made to

make DCK a prosperous place in current and future scenarios. This will enable DCK to append and merge forthcoming technologies without modifying its existing infrastructure system. The description of various kiosks Sub-Stations used is given below.

- **Kiosk Sub-Station Type-A** (1000 kVA, 630 kVA, 500 kVA) Oil filled Transformer 11/0.42 kV, with incoming & out going VCBs on MV side.

- **Kiosk Sub-Station Type-B** (1000 kVA, 630 kVA, 500 kVA) Oil filled Transformer 11/0.42 kV, with incoming and outgoing SF6 load break switches with fuses on MV side.

# 3. DESIGN CRITERIA

## 3.1 DESIGN CODES & STANDARDS

All systems shall adapt the following main standards, wherever applicable:

- European Committee for Standardization (CEN) and European Committee for Electro technical Standardization (CENELEC)
- International Electro technical Commission (IEC)
- International Organization for Standardization (ISO)
- Other Standards and Codes can be used in areas not covered by these standards. Other standards include:
- European Standards like EN, DIN
- British Standards (BS)

The Electrical products used, should be tested and approved to meet the applicable standards by one of the independent test laboratories including following:

- KEMA
- CESI
- UL or other similar laboratories

## 3.2 USER REQUIREMENTS

The user requirements for DCK that are given by the DHA include the followings:

a) Completely underground distribution system.

b) Use of aluminium conductor cables for cost saving.

c) Use of Kiosk type substations for space saving and faster installation.

d) Smart Metering Technologies.

e) Remote monitoring and control.

## 3.3 DESIGN CRITERIA

The DCK Electrical Distribution must meet following requirements:

- High reliability
- Safe Operation
- Route Protection
- Redundancy
- Reliable Technology
- Easy to maintain and troubleshoot
- Environmentally Protected
- Cost Effective
- Future Proof

## 3.4 DESIGN CONSIDERATIONS

- Underground distribution for reliable power supply.
- MV ring distribution for fast restoration of power in case of fault.
- Use of MV express feeder to provide backup in case of simultaneous fault on two feeders.
- Use of Kiosk type substation for space saving and faster installation.
- Use of VCB type Ring Main Units (RMUs) for reliable maintenance free switching.
- Fibre Optic cable network for remote monitoring and control.
- Use of Smart Meters in residences, offices & commercial premises for two way flow of power, thus encouraging use of renewable energy by consumers.
- Remote monitoring and control of MV and LV distribution system and automatic meter reading and billing.
- Use of cost saving aluminium conductor for MV and LV cables.

# 4. SMART GRID

## 4.1 GENERAL

Traditional Electric Power Systems have been designed through deploying large central generation units built away from cities and residential areas, while electricity has been delivered to consumers through interlinked transmission lines and grid stations. Each individual generation unit, whether it is powered by fossil fuels or hydro, may be rated of up to hundreds of Megawatts (MWs). Transmission line distance also varies up to hundreds of kilometres and Electricity is then transferred to end-users through distribution transformers. The distribution system is very extensive but is almost entirely passive with *little communication* and only limited local controls. There is no *real-time monitoring* hence there is very little interaction between the loads and the power system.

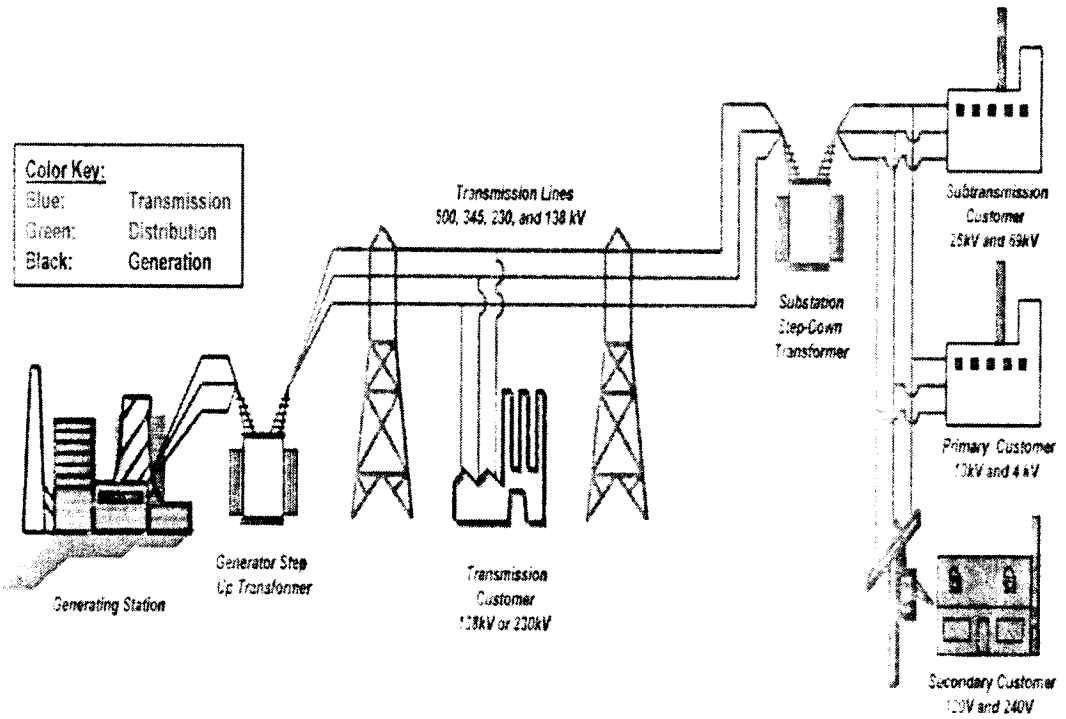


**Figure 4-1: Existing Power System Infrastructure**

The present advances in communication systems, particularly high speed networks, offer the possibility of much greater monitoring and control throughout the power system and hence more effective, flexible and lower cost operations.

Today, design concept of power system has changed and it does not required to be isolated from cities by using large scale generators. Instead large numbers of small scale generation units located at various places are being combined together to deliver electricity to local city residents. Using ICT services at smaller scale is very feasible as well as cost effective. This concept of intelligent delivery of electricity is known as ***Smart Grid***.

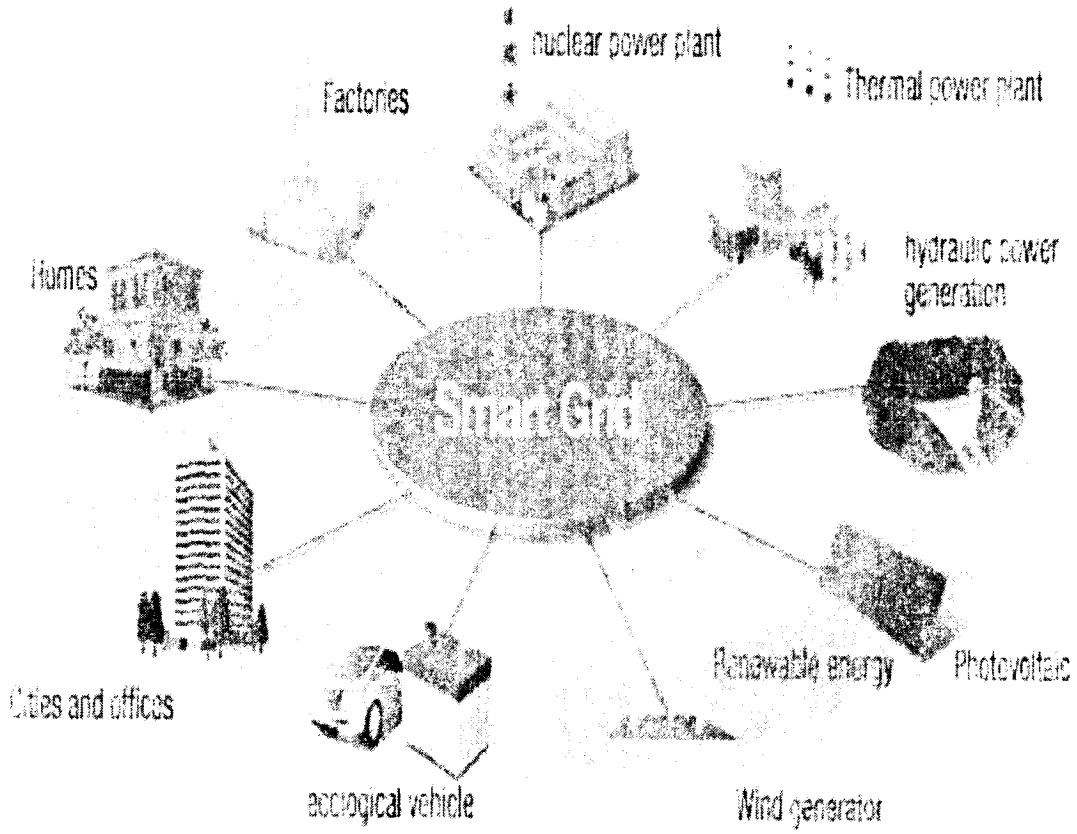


**Figure 4-2: A Smart Grid Infrastructure**

One of the best features of DHA City Karachi (DCK) is the introduction of Smart Grid Technology which will help in managing and protecting the resources of DCK electricity network. Electrical components will be 'network' enabled which will help to monitor the electricity consumption by DCK Power Operators remotely at Network Control Centre (NCC). Real-time Electricity database will then be used to optimize power generation and distribution.

Not only this, but real-time monitoring and control will enable to avoid any unwanted circumstance such as blackout due to heavy short circuits within network and brownout due to unplanned heavy loads. These cases not only affect the power quality but also damage costly power equipment such as power transformers and bus bars at Sub-Stations/grid stations. This technology will enable the DCK consumers to see how much Electricity is being consumed and can also see utility bills any time online at their homes through smart meters.

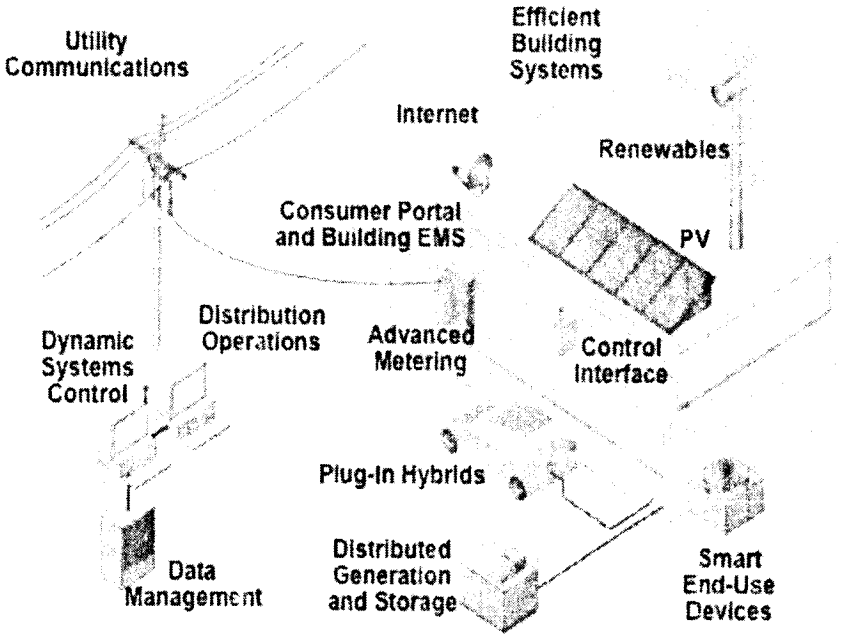


**Figure 4-3: Latest Electrical Network Infrastructure**

The design of power transmission and distribution system of DCK has also been done with a consideration of futuristic demands of any urban city. The design is aligned with the requirements of latest Codes and Standards defined for a Smart Grid and assures modular deployment of any future elements whenever required.

## 4.2 ACCOMMODATION OF RENEWABLE ENERGY INTO EXISTING GRIDS

The global concern for the environment and the need to counteract the effects that lead to global warming are the most important drivers for an improved electrical energy system. Along with establishing a common understanding of man-made changes in the global climate, scenarios have been presented, showing how future carbon emissions might be limited, or even reduced. The major proposals in these scenarios is the introduction of renewable energy sources to replace the traditional fossil based power generation with higher priority as we have a very limited fossil-fuel in future.

## 4.3 DIFFERENCE BETWEEN CONVENTIONAL AND SMART GRIDS

Following table shows a brief difference between a conventional and a Smart Grid.

**Table 4-1: Difference between a Conventional & Smart Grid**

| CHARACTERISTIC | EXISTING GRID | SMART GRID |
|---|---|---|
| Enables active participation by consumers | Consumers are uninformed and non-participative with power system | Informed, involved, and active consumers - demand response and distributed energy resources. |
| Accommodates all generation and storage options | Dominated by central generation- many obstacles exist for distributed energy resources interconnection | Many distributed energy resources with plug-and-play convenience focus on renewable |
| Enables new products, services and markets | Limited wholesale markets, not well integrated - limited opportunities for consumers | Mature, well-integrated wholesale markets, growth of new electricity markets for consumers |
| Provides power quality for the digital economy | Focus on outages - slow response to power quality issues | Power quality is a priority with a variety of quality/ price options - rapid resolution of issues |
| Optimizes assets & operates efficiently | Little integration of operational data with asset management - business process silos | Greatly expanded data acquisition of grid parameters - focus on prevention, minimizing impact to consumers |
| Anticipates and responds to system disturbances (self-heals) | Responds to prevent further damage- focus is on protecting assets following fault | Automatically detects and responds to problems - focus on prevention, minimizing impact to consumer |
| Operates resiliently against attack and natural disaster | Vulnerable to malicious acts of terror and natural disasters | Resilient to attack and natural disasters with rapid restoration capabilities |

## 4.4 USER REQUIREMENTS

- Demand & Supply Balancing
- Optimized and cost-effective Power Generation
- Consumer-Interacted Advance Metering Technology
- Remote Monitoring & Control
- High level protection of EHV, HV, MV and LV equipments
- Accommodation of Generation from Renewable Energy
- Resiliently to Disturbances, Attacks, & Natural Disasters
- High Speed Communication medium throughout the Transmission & Distribution Network
- Power Quality
- Accuracy in load prediction
- Reliability
- Future Proof Technology

## 4.5 NEED OF SMART GRID INFRASTRUCTURE

Today, existing grids are under pressure to deliver the growing demand for power, as well as provide a stable and sustainable supply of electricity. These complex challenges are driving the evolution of smart grid technologies. Smart grid is specifically designed to meet the increasing global demand for electricity, by providing sufficient capacity, as well as reliability, efficiency and sustainability.

## 4.6 ADVANCED METERING INFRASTRUCTURE

Advance Metering Infrastructure (AMI) systems that support two-way communications with customers while allowing secure and reliable system-wide communication for distribution automation are the enabling foundation for the Smart Grid. Advanced Metering Infrastructure will give consumers the consumption and pricing information they need to enable them to more effectively participate in peak load reduction and energy conservation.

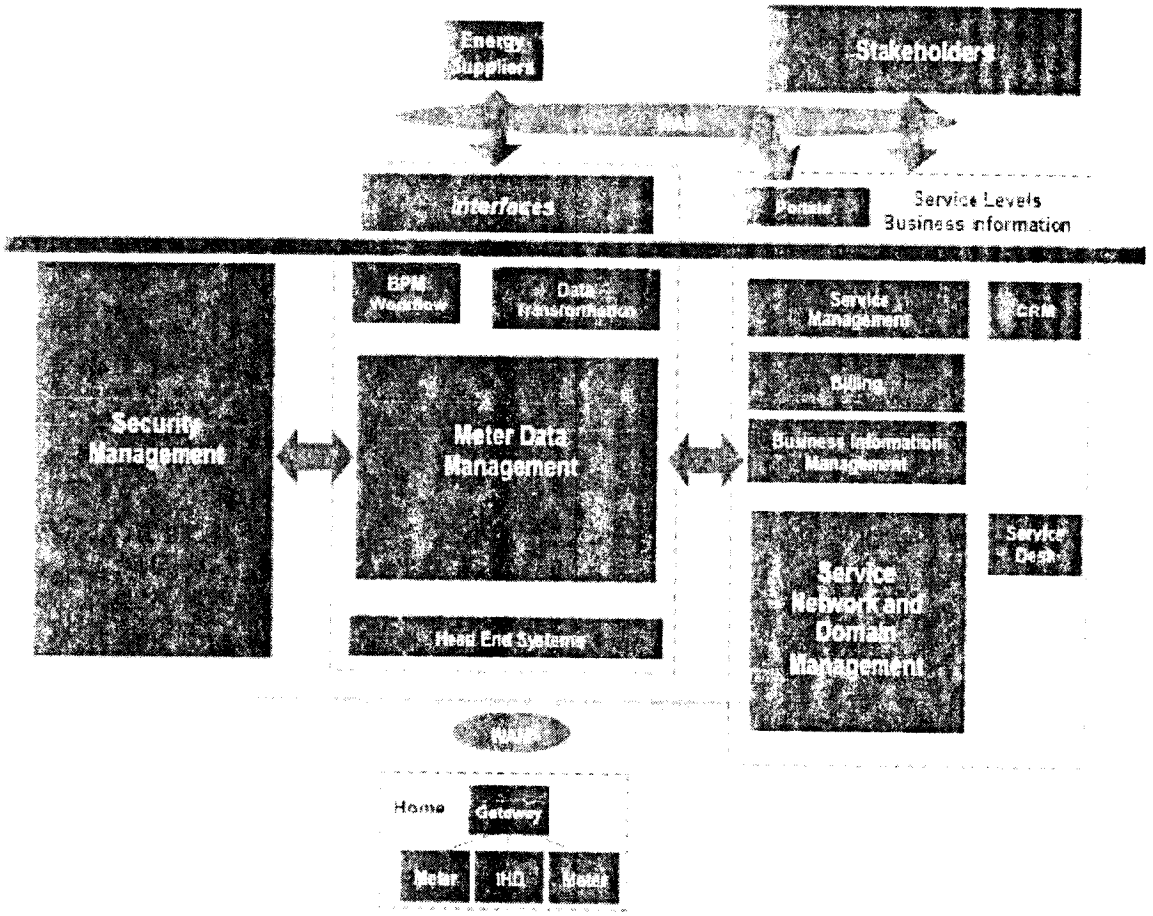


**Figure 4-4: Advance Metering Infrastructure System**

AMI consists of the communications hardware and software, and the associated system and data management software, that together create a two-way network between advanced meters and utility business systems, enabling collection and distribution of information to customers and other parties, such as the competitive retail supplier or the utility itself. Generally AMI have following functionalities:

- Two way communications
- Interval measurement and storage of consumption data
- Display of consumption data to consumer
- Remote connection/disconnection
- Support for variable energy tariffs
- Demand control

## 4.7 DISTRIBUTION AND OUTAGE MANAGEMENT

Distribution and Outage Management Systems (DMS/OMS) provide real-time response to adverse or unstable conditions. It saves money and improves customer service. Through the consolidation of both real-time OMS and DMS functionality, telemetry, and integrated security, smart distribution systems will be poised to become truly self-healing.

## 4.8 DISTRIBUTION AND SUBSTATION AUTOMATION

A Smart Grid requires control centre supervision, area-wide solutions and visualization with centralized modelling. Implementations should leverage installed infrastructure and use a model-based, scalable approach. This practical, cost-effective method ensures that current technology eventually gives way to reactive, software-driven intelligence.

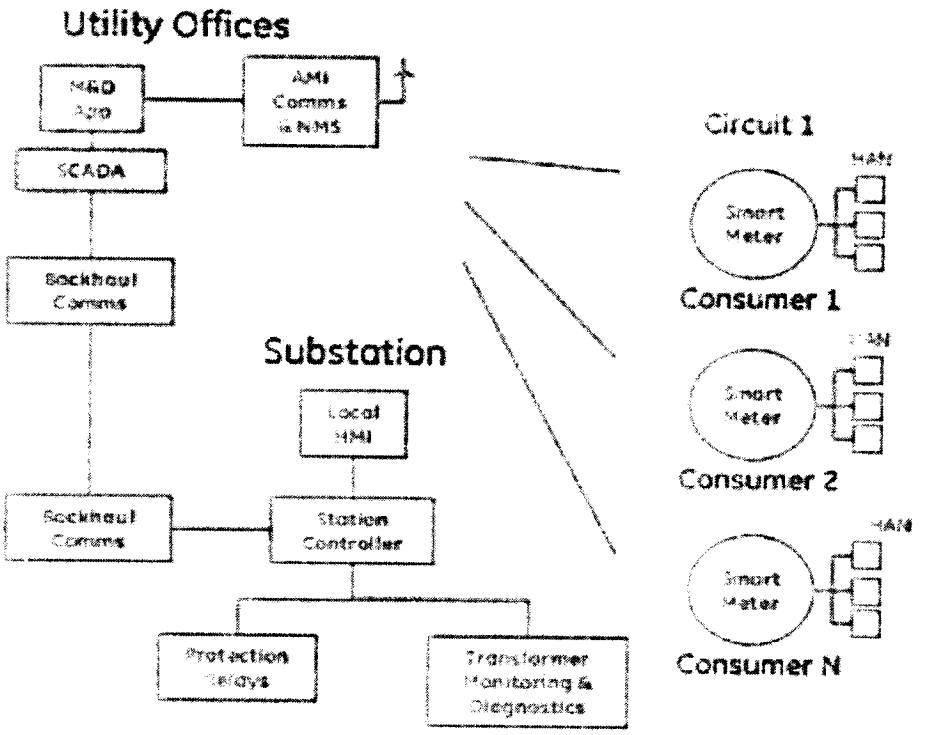


**Figure 4-5: Distribution Automation System**

The architecture shown above uses a centralized distribution automation system with the addition of communication to smart metering. The algorithm can utilize the information from the smart meters to assist in detecting outages outside of the monitored range of the automated devices. This includes fuses or other non-automated fault interrupters. The meters can detect and report an outage and can report successful restoration. Using the restoration detection, the system can determine customers have been properly restored as expected.

## 4.9 PERFORMANCE

Smart Grids will make use of new design concepts and advanced materials in system components like transformers and circuit breakers to improve efficiency, safety and operational performance. Widespread use of power electronic devices will help maximize performance of existing assets and make the grid more resilient in the event of disruptions.

## 4.10 SECURITY & SAFETY

Improvements in security increase the robustness and resiliency of the grid from a physical perspective and a cyber perspective, thereby reducing the probability and consequences of man-made attacks and natural disasters. In addition, reductions in oil imports made possible by the Smart Grid enhance national security.

Improvements in safety reduce the hazards inherent in an energized electric system as well as the time of exposure to those hazards. Generally Smart Grid Infrastructure will help through followings:

- Reduction in the probability that a deliberate man-made cyber or physical attack could occur and a reduction in the consequences of any that are not detected or prevented
- Improved restoration times following storms and other natural events
- Reduction in theft and vandalism of property due to increased detection capability
- Reduction in injuries and deaths of employees due to reduction in time spent in hazardous situations and the availability of more intelligent systems that support worker safety

These benefits will decrease the probability that extended outages impacting the security of customers will occur by reducing the threat, vulnerability, and consequences of man-made attacks. The increased reliance on digital Smart Grid technologies will require the deployment of new systems to address cyber security ensuring this critical infrastructure is as "hack proof" as possible. The increased robustness and resilience of the smart grid will also reduce the impact of many natural events that today result in extended outages.

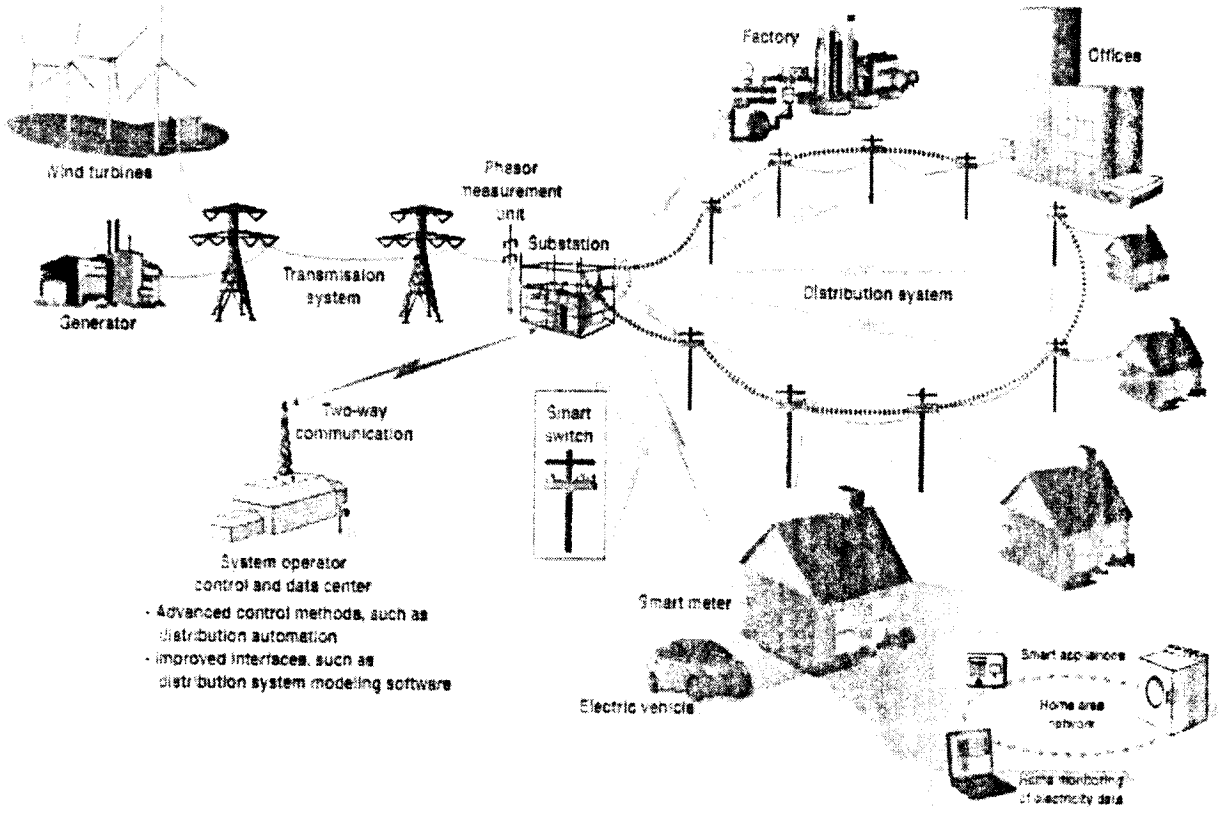


**Figure 4-6: A Secure Smart Grid System**

## 5. BENEFITS OF SMART GRID ELEMENTS

A modernized electrical grid has following features:

- Improves power reliability and quality
- Optimizes facility utilization and averts construction of backup (peak load) power plants
- Enhances capacity and efficiency of existing electric power networks
- Improves resilience to disruption
- Enables predictive maintenance and "self-healing" responses to system disturbances
- Facilitates expanded deployment of renewable energy sources
- Accommodates distributed power sources
- Automates maintenance and operation

- Reduces greenhouse gas emissions by enabling electric vehicles and new power sources
- Reduces oil consumption by reducing the need for inefficient generation during peak usage periods
- Presents opportunities to improve grid security
- Enables transition to plug-in electric vehicles and new energy storage options
- Increases consumer choice
- Enables new products, services, and markets and consumer access to them
- Improved distribution system efficiency
- Reduced distribution line losses
- Improved voltage profile along feeder
- Improved system stability and capacity
- Deferred capital upgrades
- Reduced energy demand
- Reduction of environmentally harmful emissions

# 2

## K-ELECTRIC LOAD ASSESMENT CRITERIA

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-03 (PACKAGE-2)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
Consulting Engineers – Architects – Planners
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Fax: +92-21-34534691
Email: ocl-khi@osmani.com,
Web: www.osmani.com

| | Covered Area as per DCR Bye Laws | | | Resc Load Criteria | | General Load | A/C Load | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| of Plot | % | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | Water Pump Load (W) | Max. Demand Load (W) | Group div: factor 80% (W) | Group div: factor 80% (kW) | TOTAL NO. OF PLOTS | Loa (kW |
| MMINITY CENTER | 60% | 1 | 4811.4 | 2.5 | 1 | 12028.5 | 2000 | | 14029.5 | 11223.6 | 11.2236 | 2 | 28.( |
| MMINITY CENTER | 60% | 1 | 8051.4 | 2.5 | 1 | 20128.5 | 2000 | | 22129.5 | 17703.6 | 17.7036 | 1 | 22.: |
| IOSQUE | 80% | 2 | 8596.8 | 1.5 | 0 | 12895.2 | 0 | | 12895.2 | 10316.16 | 10.31616 | 1 | 12.9 |
| UCATION | 40% | 3 | 8586 | 2.5 | 2 | 21465 | 12000 | | 33467 | 26773.6 | 26.7736 | 2 | 66.9 |
| UCATION | 40% | 3 | 14061.6 | 2.5 | 2 | 35154 | 12000 | | 47156 | 37724.8 | 37.7248 | 1 | 47.: |
| UCATION | 40% | 3 | 66787.2 | 2.5 | 2 | 166968 | 12000 | | 178970 | 143176 | 143.176 | 1 | 178. |
| RIMARY UCATION | 40% | 3 | 38102.4 | 2.5 | 3 | 95256 | 18000 | | 113259 | 90607.2 | 90.6072 | 1 | 113. |
| CONDARY UCATION | 40% | 3 | 46980 | 2.5 | 3 | 117450 | 18000 | | 135453 | 108362.4 | 108.3624 | 1 | 135. |
| RK & PG | 100% | 1 | 7200 | 1.5 | 0 | 10800 | 0 | | 10800 | 8640 | 8.64 | 2 | 21.( |
| RK & PG | 100% | 1 | 6588 | 1.5 | 0 | 9882 | 0 | | 9882 | 7905.6 | 7.9056 | 2 | 19.7 |
| RK & PG | 100% | 1 | 10926 | 1.5 | 0 | 16389 | 0 | | 16389 | 13111.2 | 13.1112 | 1 | 16.3 |
| RK & PG | 100% | 1 | 29466 | 1.5 | 0 | 44199 | 0 | | 44199 | 35359.2 | 35.3592 | 1 | 44.: |
| RK & PG | 100% | 1 | 33840 | 1.5 | 0 | 50760 | 0 | | 50760 | 40608 | 40.608 | 1 | 50.7 |
| PENSARY | 80% | 1 | 1555.2 | 5 | 0 | 7776 | 0 | | 7776 | 6220.8 | 6.2208 | 1 | 7.7 |
| TILITY | 100% | 1 | 7110 | 10 | 0 | 71100 | 0 | | 71100 | 56880 | 56.88 | 1 | 71.: |
| RKING | 100% | 1 | 3996 | 0.75 | 0 | 2997 | 0 | | 2997 | 2397.6 | 2.3976 | 6 | 17.9 |
| RKING | 100% | 1 | 6588 | 0.75 | 0 | 4941 | 0 | | 4941 | 3952.8 | 3.9528 | 1 | 4.9 |
| RKING | 100% | 1 | 3591 | 0.75 | 0 | 2693.25 | 0 | | 2693.25 | 2154.6 | 2.1546 | 1 | 2.6 |
| RKING | 100% | 1 | 5049 | 0.75 | 0 | 3786.75 | 0 | | 3786.75 | 3029.4 | 3.0294 | 1 | 3.7 |
| AZZA | 100% | 1 | 3636 | 0.5 | 0 | 1818 | 0 | | 1818 | 1454.4 | 1.4544 | 2 | 3.6 |
| AZZA | 100% | 1 | 4986 | 0.5 | 0 | 2493 | 0 | | 2493 | 1994.4 | 1.9944 | 2 | 4.9 |
| AZZA | 100% | 1 | 5670 | 0.5 | 0 | 2835 | 0 | | 2835 | 2268 | 2.268 | 1 | 2.8 |
| AZZA | 100% | 1 | 31986 | 0.5 | 0 | 15993 | 0 | | 15993 | 12794.4 | 12.7944 | 1 | 15.9 |
| | | | | | | | | | | | | TOTAL (kW) | 89 |

| of Plot | Covered Area as per DCK Bye Laws | | | KESC Load Criteria | | General Load | A/C Load | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | Lift Load (W) | Water Pump Load (W) | Max. Demand Load (W) | Group div: factor 80% (W) | Group div: factor 80% (kW) | TOTAL NO. OF PLOTS | |
| C2 | 100% | 6 | 10800 | 10 | 0 | 108000 | 0 | 8952 | 3729 | 120681 | 96544.8 | 96.5448 | 9 | 1 |
| 2 (C+R) | 100% | 6 | 10800 | 10-GF 1.75 UP | 1 | 33750 | 10000 | 8952 | 3729 | 56431 | 45144.8 | 45.1448 | 7 | 3 |
| MK | 100% | 1 | 3096 | 10 | 0 | 30960 | 0 | | | 30960 | 24768 | 24.768 | 1 | |
| | | | | | | | | | | | | | TOTAL (kW) | 1 |

## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

DENTIAL

| Plot Area (Sq.yds) | Type of Plot | Covered Area as per DHA Bye Laws | | | KESC Load Criteria | | General Load | A/C Load | Max. Demand Load (W) | Group div: factor 40% (W) | Group div: factor 80% (W) | TOTAL NO. OF PLOTS | Loa (kW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | |
| 200 | R2 | 90% | 2 | 3240 | 1.75 | 1 | 5670 | 4000 | 9670 | 3868 | 3094.4 | 218 | 674. |
| 300 | R3 | 75% | 3 | 6075 | 1.75 | 1 | 10631.25 | 6000 | 16631.25 | 6652.5 | 5322 | 11 | 58.5 |
| 500 | R5 | 60% | 3 | 8100 | 1.75 | 1 | 14175 | 6000 | 20175 | 8070 | 6456 | 287 | 1852. |
| 1000 | R10 | 50% | 3 | 13500 | 1.75 | 2 | 23625 | 12000 | 35625 | 14250 | 11400 | 8 | 91.2 |
| 1820 | R20 | 40% | 3 | 19656 | 1.75 | 2 | 34398 | 12000 | 46398 | 18559.2 | 14847.36 | 1 | 14.8 |
| | | | | | | | | | | | TOTAL | 525 | 2692. |

| of Plot | Covered Area as per DCK Bye Laws | | | KESC Loa[illegible] Criteria | | General Load | A/C Load | [illegible] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | Lift Load (W) | Water Pump Load (W) | Max. Demand Load (W) | Group div: factor 80% (W) | Group div: factor 80% (kW) | TOTAL NO. OF PLOTS | |
| C2 | 100% | 6 | 10800 | 10 | 0 | 108000 | 0 | 8952 | 3729 | 120681 | 96544.8 | 96.5448 | 9 | 1 |
| 2 (C+R) | 100% | 6 | 10800 | 10-GF 1.75 UP | 1 | 33750 | 10000 | 8952 | 3729 | 56431 | 45144.8 | 45.1448 | 7 | 3 |
| MK | 100% | 1 | 3096 | 10 | 0 | 30960 | 0 | | | 30960 | 24768 | 24.768 | 1 | |
| | | | | | | | | | | | | | TOTAL (kW) | 1 |

# 4

## FEEDER SIZING
## SECTOR-03 (PACKAGE-2)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-03 (PACKAGE-2)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


OSMANI
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# D.H.A CITY
# SECTOR-03 (PACKAGE-2 )
# RING MAIN VOLTAGE DROPS
# (CALCULATIONS)

## RING MAIN NO.1 (FEEDER NO. 1)

| | |
|---|---|
| **Ring Main No. 1 (Feeder No. 1) Load** | **= 3.61 MW** |
| a) Length of 3 core 400 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from 1st transformer to grid station | = 1446 m |
| Approximate AC impedance of conductor at 90°C | = 0.135 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 439A |
| Voltage Drop = Vd = IZ<br>= Vd = 439 x 1.446 x 0.135 | = 85.70 Volts |
| b) Length of 3 core 300 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from last transformer to switching station | = 454 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.454 x 0.158 | = 27.76 Volts |
| c) Length of 3 core 300 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from transformer to transformer | = 1149 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 1.149 x 0.158 | = 70.26 Volts |
| Total voltage drop for ring main no.1 = 85.70 + 27.76 + 70.26 | = 183.72 Volts |
| % Voltage drop = 183.72 x 100 / 11000 | = 1.67 % |

## RING MAIN NO.2 (FEEDER NO. 2)

| | |
|---|---|
| **Ring Main No. 2 (Feeder No. 2) Load** | **= 3.63 MW** |
| a) Length of 3 core 400 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from 1st transformer to grid station | = 2264 m |
| Approximate AC impedance of conductor at 90°C | = 0.135 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 439A |
| Voltage Drop = Vd = IZ<br>= Vd = 439 x 2.264 x 0.135 | = 134.18 Volts |
| b) Length of 3 core 300 mm2 AL, XLPE/PVC/SWA/PVC 15KV cable from last transformer to switching station | = 450 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.450 x 0.158 | = 27.52 Volts |
| c) Length of 3 core 300 mm2 AL, XLPE/PVC/SWA/PVC 15KV cable from transformer to transformer | = 1884 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 1.884 x 0.158 | = 115.21 Volts |
| Total voltage drop for Ring Main No.2 = 134.18 + 27.52 + 115.21 | = 276.90 Volts |
| % Voltage drop = 276.90 x 100 / 11000 | = 2.51 % |

## RING MAIN NO.3 (FEEDER NO. 3)

| | |
|---|---|
| **Ring Main No. 3 (Feeder No. 3) Load** | **= 3.39 MW** |
| d) Length of 3 core 400 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from 1st transformer to grid station | = 1978 m |
| Approximate AC impedance of conductor at 90°C | = 0.135 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 439A |
| Voltage Drop = Vd = IZ<br>= Vd = 439 x 1.978 x 0.135 | = 117.23 Volts |
| e) Length of 3 core 300mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from last transformer to switching station | = 49 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.049 x 0.158 | = 3.00 Volts |
| f) Length of 3 core 300 mm2 AL, XLPE/PVC/SWA/PVC 15 KV cable from transformer to transformer | = 775 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.775 x 0.158 | = 47.39 Volts |
| Total voltage drop for Ring Main No.3 = 117.23 + 3.0 + 47.39 | = 167.62 Volts |
| % Voltage drop = 167.62 x 100 / 11000 | = 1.52 % |

## EXPRESS FEEDER # 1

| | |
|---|---|
| g) Length of 3 core 400 mm2 AL, XLPE/PVC/SWA/PVC 15KV cable from grid station to switching station | = 2451 m |
| Approximate AC impedance of conductor at 90°C | = 0.135 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 439A |
| Voltage Drop = Vd = IZ<br>= Vd = 439 x 2.451 x 0.135 | = 145.26 Volts% |
| Voltage drop = 145.26 x 100 / 11000 | = 1.32 % |

# 5

## LV- VOLTAGE DROP
## SECTOR-03 (PACKAGE-2)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-03 (PACKAGE-2)
.DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


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Web: www.osmani.com

| | LENGTH | FEEDER | | (TP MCCB) | (TP MC[illegible] | Installation | DERATING FACTORS | | | | Carrying Capacity for Cable In/ODF | | Size & Numbers | Capacity as per IEE Regulations | per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| FP 1/1 | 22 | 102.38 | 221 | (250 A)TP | (7 x 15A) TP + (150A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 230 | | 240 | 253 | 221 |
| FP 1/2 | 64 | 177.1 | 383 | (200 A)TP | (80A) TP + (60A) TP + (30A) TP + (20A) TP + (10A) TP + (5A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 397 | 2 | 185 | 220 | 191 |
| FP 1/3 | 33 | 58.50 | 126 | (150 A)TP | (9 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 131 | | 95 | 154 | 126 |
| FP 1/4 | 24 | 97.50 | 211 | (100 A)TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 219 | | 185 | 220 | 211 |
| FP 1/5 | 44 | 156.00 | 337 | (100 A)TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 350 | 2 | 120 | 174 | 168 |
| FP 1/6 | 9 | 91.00 | 197 | (125 A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 204 | | 185 | 220 | 197 |
| FP 1/7 | 127 | 45.50 | 98 | (125 A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 |
| FP 1/8 | 60 | 105.80 | 229 | (125 A)TP | (6 x 15A) TP + (40A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 237 | | 240 | 253 | 229 |
| FP 1/9 | 34 | 52.00 | 112 | (125 A)TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| P 1/10 | 191 | 50.40 | 109 | (125 A)TP | (6 x 15A) TP + (30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 113 | | 95 | 154 | 109 |
| P 1/11 | 155 | 110.50 | 239 | (125 A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 248 | | 240 | 253 | 239 |
| P 1/12 | 158 | 65.00 | 140 | (150 A)TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |

| | LENGTH | FEEDER | | (TP MCCB) | (TP MC[illegible] | Installation | DERATING FACTORS | | | | Carrying Capacity for Cable In/ODF | | Size & Numbers | Capacity as per IEE Regulations | per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| FP 2/2 | 9 | 45.50 | 98 | (125 A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 |
| FP 2/3 | 227 | 99.50 | 215 | (125 A)TP | (8 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 223 | | 240 | 253 | 215 |
| FP 2/4 | 44 | 91.00 | 197 | (125 A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 204 | | 185 | 220 | 197 |
| FP 2/5 | 22 | 45.50 | 98 | (125 A)TP | (5 x 15A) TP + (20A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 |
| FP 2/6 | 41 | 91.00 | 197 | (125 A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 204 | | 185 | 220 | 197 |
| FP 2/7 | 27 | 45.50 | 98 | (125 A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 |
| SECONDARY | | 108.36 | 234 | Feed From Trafo-3 | | | | | | | | | | | |
| FP 3/1 | 95 | 55.17 | 119 | (125 A)TP | (20A) TP + (40A) TP + (2 x 30A) TP + (2 x 10A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 124 | | 70 | 130 | 119 |
| FP 3/2 | 64 | 52.00 | 112 | (125 A)TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| FP 3/3 | 38 | 104.00 | 225 | (125 A)TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 233 | | 240 | 253 | 225 |
| FP 3/4 | 66 | 65.00 | 140 | (150 A)TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| FP 4/1 | 100 | 52.00 | 112 | (125 A)TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 |
| P 4/2 | 40 | 104.00 | 225 | (125 A)TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 233 | | 240 | 253 | 225 |
| P 4/3 | 13 | 127.62 | 276 | (125 A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 286 | | 300 | 286 | 276 |

| | LENGTH | FEEDER | | (TP MCCB) | (TP MC[illegible] | Installation | DERATING FACTORS | | | | Carrying Capacity for Cable In/ODF | | Size & Numbers | Capacity as per IEE Regulations | per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| FP 4/5 | 220 | 78.00 | 168 | (100 A)TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 175 | | 150 | 197 | 168 |
| FP 4/6 | 256 | 34.70 | 75 | (100 A)TP | (5 x 15A) TP + (10A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 78 | | 70 | 130 | 75 |
| FP 4/7 | 100 | 39.00 | 84 | (100 A)TP | (6 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 |
| C-2 | | 96.54 | 209 | Feed From Trafo-5 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-5 | | | | | | | | | | | |
| FP 5/1 | 6 | 58.50 | 126 | (150 A)TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 131 | | 95 | 154 | 126 |
| FP 5/2 | 17 | 78.00 | 168 | (100 A)TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 175 | | 150 | 197 | 168 |
| FP 5/3 | 69 | 39.00 | 84 | (100 A)TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 |
| C-2 | | 96.54 | 209 | Feed From Trafo-6 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-6 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-6 | | | | | | | | | | | |
| FP 6/1 | 5 | 47.24 | 102 | (125 A)TP | (125A) TP + (10A)TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 106 | | 50 | 106 | 102 |
| C-2 | | 96.54 | 209 | Feed From Trafo-7 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-7 | | | | | | | | | | | |
| M-2 | | 45.14 | 98 | Feed From Trafo-7 | | | | | | | | | | | |
| TP 7/1 | 6 | 90.29 | 195 | (225 A)TP | (2 x 125 A)TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 203 | | 185 | 220 | 195 |
| M-2 | | 45.14 | 98 | Feed From Trafo-8 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-8 | | | | | | | | | | | |
| PRIMARY | | 96.61 | 209 | Feed From Trafo-8 | | | | | | | | | | | |
| TP 8/1 | 38 | 92.39 | 200 | (225 A)TP | (2 x 125 A)TP + (10A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 207 | | 185 | 220 | 200 |
| C-2 | | 96.54 | 209 | Feed From Trafo-9 | | | | | | | | | | | 209 |
| FP 9/1 | 139 | 39.00 | 84 | (100 A)TP | (6 x 15A) TP | D | [illegible] | 1.15 | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] |

| | LENGTH | FEEDER | | (TP MCCB) | (TP MC[illegible]) | Installation | DERATING FACTORS | | | | Carrying Capacity for Cable In/ODF | | Size & Numbers | Capacity as per IEE Regulations | per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| FP 9/4 | 31 | 91.00 | 197 | (125 A)TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 204 | | 185 | 220 | 197 |
| FP 9/5 | 8 | 39.00 | 84 | (100 A)TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 |
| FP 9/6 | 159 | 110.50 | 239 | (125 A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 248 | | 240 | 253 | 239 |
| FP 9/7 | 12 | 65.00 | 140 | (150 A)TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| FP 9/8 | 244 | 130.00 | 281 | (150 A)TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 292 | 2 | 150 | 197 | 140 |
| FP 9/9 | 39 | 65.00 | 140 | (150 A)TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 |
| P 9/10 | 53 | 47.64 | 103 | (125 A)TP | (6 x 15A) TP + (20A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 107 | | 70 | 130 | 103 |
| P 9/11 | 119 | 86.64 | 187 | (100 A)TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 194 | | 150 | 197 | 187 |
| | | TR-10 & TR-11 ARE IN SECTOR-3(PACKAGE-1) | | | | | | | | | | | | | |
| P 12/1 | 4 | 30.90 | 67 | (80 A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 69 | | 25 | 75 | 67 |
| P 12/2 | 82 | 61.80 | 133 | (80 A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 139 | | 95 | 154 | 133 |
| P 12/3 | 23 | 61.80 | 133 | (80 A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 139 | | 95 | 154 | 133 |
| P 12/4 | 98 | 30.90 | 67 | (80 A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0 90 | 0.96 | 69 | | 25 | 75 | 67 |
| P 12/5 | 82 | 18.54 | 40 | (50 A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 42 | | 16 | 59 | 40 |
| P 12/6 | 72 | 89.52 | 193 | (60 A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 201 | | 185 | 220 | 193 |
| P 12/7 | 30 | 43.26 | 93 | (60 A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 97 | | 50 | 106 | 93 |

| | LENGTH | FEEDER | | (TP MCCB) | (TP MC[illegible]) | Installation | DERATING FACTORS | | | | Carrying Capacity for Cable In/ODF | | Size & Numbers | Capacity as per IEE Regulations | per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| P 12/11 | 33 | 74.71 | 161 | (200 A) TP | (80A) TP+ (60A) TP + (30A) TP + (20A) TP + (2 x 10A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 168 | | 120 | 174 | 161 |
| FP 13/1 | 62 | 52.53 | 113 | (50 A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 118 | | 70 | 130 | 113 |
| FP 13/2 | 138 | 74.46 | 161 | (50 A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 167 | | 120 | 174 | 161 |
| P 13/3 | 43 | 30.90 | 67 | (80 A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 69 | | 25 | 75 | 67 |
| P 13/4 | 72 | 92.70 | 200 | (80 A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 208 | | 185 | 220 | 200 |
| P 13/5 | 100 | 30.90 | 67 | (80 A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 69 | | 25 | 75 | 67 |
| FP 13/6 | 117 | 61.80 | 133 | (80 A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 139 | | 95 | 154 | 133 |
| FP 13/7 | 4 | 30.90 | 67 | (80 A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 69 | | 25 | 75 | 67 |
| FP 13/8 | 12 | 80.34 | 174 | (60 A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 180 | | 150 | 197 | 174 |
| FP 13/9 | 100 | 55.63 | 120 | (60 A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 125 | | 70 | 130 | 120 |
| P 13/10 | 12 | 66.17 | 143 | (60 A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 148 | | 95 | 154 | 143 |
| P 13/11 | 20 | 90.89 | 196 | (60 A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 204 | | 185 | 220 | 196 |
| P 13/12 | 105 | 41.45 | 90 | (100 A) TP | (4 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 93 | | 50 | 106 | 90 |
| C-2 | | 96.54 | 209 | Feed From Trafo-14 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-14 | | | | | | | | | | | |
| FP 14/1 | 51 | 30.90 | 67 | (80 A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 69 | | 25 | 75 | 67 |

| | LENGTH | FEEDER | | (TP MCCB) | (TP MC[illegible]) | Installation | DERATING FACTORS | | | | Carrying Capacity for Cable In/ODF | | Size & Numbers | Capacity as per IEE Regulations | per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| FP 14/5 | 36 | 74.15 | 160 | (50 A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 166 | | 120 | 174 | 160 |
| FP 14/6 | 54 | 52.83 | 114 | (80 A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 119 | | 70 | 130 | 114 |
| FP 14/7 | 21 | 21.63 | 47 | (50 A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 49 | | 16 | 59 | 47 |
| C-2 | | 96.54 | 209 | Feed From Trafo-15 | | | | | | | | | | | |
| C-2 | | 96.54 | 209 | Feed From Trafo-15 | | | | | | | | | | | |
| M-2 | | 45.14 | 98 | Feed From Trafo-15 | | | | | | | | | | | |
| FP 15/1 | 75 | 90.29 | 195 | (225 A) TP | (2 x 125A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 203 | | 185 | 220 | 195 |
| C-2 | | 96.54 | 209 | Feed From Trafo-16 | | | | | | | | | | | |
| M-2 | | 45.14 | 98 | Feed From Trafo-16 | | | | | | | | | | | |
| M-3 | | 54.59 | 118 | Feed From Trafo-16 | | | | | | | | | | | |
| P 16/1 | 41 | 109.75 | 237 | (250 A) TP | (2 x 125A) TP+ (15A) TP + (30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 246 | | 240 | 253 | 237 |
| C-3 | | 126.78 | 274 | Feed From Trafo-17 | | | | | | | | | | | |
| M-3 | | 54.59 | 118 | Feed From Trafo-17 | | | | | | | | | | | |
| M-3 | | 54.59 | 118 | Feed From Trafo-17 | | | | | | | | | | | |
| FP 17/1 | 6 | 109.18 | 236 | (250 A) TP | (2 x 125 A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 245 | | 240 | 253 | 236 |
| C-3 | | 126.78 | 274 | Feed From Trafo-18 | | | | | | | | | | | |
| C-3 | | 126.78 | 274 | Feed From Trafo-18 | | | | | | | | | | | |
| C-3 | | 126.78 | 274 | Feed From Trafo-18 | | | | | | | | | | | |
| C-3 | | 126.78 | 274 | Feed From Trafo-18 | | | | | | | | | | | |
| M-5 | | 85.64 | 185 | Feed From Trafo-18 | | | | | | | | | | | |
| [illegible] | 62 | [illegible] | [illegible] | (160 A) TP | (150A) TP + | D | 0.93 | 1.15 | 0.90 | 0.96 | 158 | | [illegible] | [illegible] | [illegible] |

| | LENGTH | FEEDER | | (TP MCCB) | (TP MC[illegible]) | Installation | DERATING FACTORS | | | | Carrying Capacity for Cable In/ODF | | Size & Numbers | Capacity as per IEE Regulations | per Parallel Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| M-5 | | 85.64 | 185 | Feed From Trafo-19 | | | | | | | | | | | |
| M-5 | | 85.64 | 185 | Feed From Trafo-19 | | | | | | | | | | | |
| C-3 | | 96.54 | 209 | Feed From Trafo-20 | | | | | | | | | | | |
| M-5 | | 96.54 | 209 | Feed From Trafo-20 | | | | | | | | | | | |
| FP 20/1 | 133 | 114.14 | 247 | (300 A) TP | (60A) TP + (150A) TP + (15A) TP + (50A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 256 | | 300 | 286 | 247 |
| C-10 | | 391.00 | 845 | Feed From Trafo-21 | | | | | | | | | | | |
| C-10 | | 391.00 | 845 | Feed From Trafo-22 | | | | | | | | | | | |
| C-10 | | 391.00 | 845 | Feed From Trafo-23 | | | | | | | | | | | |
| EDUCATON | | 145.76 | 315 | Feed From Trafo-24 | | | | | | | | | | | |
| GAS STATION | | 88.62 | 191 | Feed From Trafo-24 | | | | | | | | | | | |
| FP 24/1 | 125 | 36.57 | 79 | (100 A) TP | (15A) TP + (60A) TP + (20A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 82 | | 50 | 106 | 79 |
| C-3 | | 126.78 | 274 | Feed From Trafo-25 | | | | | | | | | | | |
| FP 25/1 | 45 | 109.18 | 236 | (250 A) TP | (2 x 125A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 245 | | 240 | 253 | 236 |
| FP 25/2 | 78 | 109.18 | 236 | (250 A) TP | (2 x 125A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 245 | | 240 | 253 | 236 |
| C-3 | | 126.78 | 274 | Feed From Trafo-26 | | | | | | | | | | | |
| C-3 | | 126.78 | 274 | Feed From Trafo-26 | | | | | | | | | | | |
| C-3 | | 126.78 | 274 | Feed From Trafo-26 | | | | | | | | | | | |
| C-3 | | 126.78 | 274 | Feed From Trafo-26 | | | | | | | | | | | |
| M-3 | | 54.59 | 118 | Feed From Trafo-26 | | | | | | | | | | | |
| PARK | | 28.98 | 63 | Feed From Trafo-26 | | | | | | | | | | | |

# 6

## LOADING OF TRANSFORMERS IN SECTOR-03 (PACKAGE-2)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-03 (PACKAGE-2)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
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Web: www.osmani.com

# D.H.A CITY
## SECTOR-03 (PACKAGE 2)
## Transformer Load Sheet

| Sr. # | Sub-Sector | Traformer No. | Transformer Rating kVA | Transformer Rating kW | Connected Load kW | Transformer Loading |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1 | B | TR.1 | 1000 | 800 | 673.29 | 84% |
| 2 | B | TR.2 | 500 | 400 | 327 | 82% |
| 3 | B | TR.3 | 500 | 400 | 332.53 | 83% |
| 4 | B | TR.4 | 500 | 400 | 346.32 | 87% |
| 5 | B | TR.5 | 500 | 400 | 329.58 | 82% |
| 6 | B | TR.6 | 500 | 400 | 336.86 | 84% |
| 7 | B | TR.7 | 500 | 400 | 328.51 | 82% |
| 8 | B | TR.8 | 500 | 400 | 324.68 | 81% |
| 9 | B | TR.9 | 1000 | 800 | 618.68 | 77% |
| 10 | B | TR.10 | 1000 | 800 | 636.65 | 80% |
| 11 | B | TR.11 | 500 | 400 | 328.62 | 82% |
| 12 | B | TR.12 | 500 | 400 | 334.27 | 84% |
| 13 | B | TR.13 | 500 | 400 | 338.09 | 85% |
| 14 | B | TR.14 | 500 | 400 | 352.67 | 88% |
| 15 | B | TR.15 | 500 | 400 | 328.51 | 82% |

| Sr. # | Sub-Sector | Traformer No. | Transformer Rating kVA | Transformer Rating kW | Connected Load kW | Transformer Loading |
|---|---|---|---|---|---|---|
| 16 | B | TR.16 | 500 | 400 | 310.53 | 78% |
| 17 | B | TR.17 | 500 | 400 | 345.14 | 86% |
| 18 | B | TR.18 | 1000 | 800 | 663.1 | 83% |
| 19 | B | TR.19 | 1000 | 800 | 678.4 | 85% |
| 20 | B | TR.20 | 500 | 400 | 326.56 | 82% |
| 21 | B | TR.21 | 630 | 504 | 391 | 78% |
| 22 | B | TR.22 | 630 | 504 | 391 | 78% |
| 23 | B | TR.23 | 630 | 504 | 391 | 78% |
| 24 | B | TR.24 | 500 | 400 | 268.36 | 67% |
| 25 | B | TR.25 | 500 | 400 | 345.14 | 86% |
| 26 | B | TR.26 | 1000 | 800 | 596.69 | 75% |

# 8

## BoQ

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-03 (PACKAGE-2)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
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Email: ocl-khi@osmani.com,
Web: www.osmani.

**CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI**
**NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS**
**LOCATION : DHA CITY SECTOR '03' (PACKAGE-2)**
**SUB-HEAD : ELECTRICAL WORKS LV DISTRIBUTION**

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| 1 | **EXCAVATION**<br>Excavation and back filling as in hard/sofft or any soil upto 1.0m depth and 0.9m wide for MV/LV/ITC cable and pipe trenches complete as directed by the Engineer.(Excluding cost of cable & pipe) | 5,888 | Cum | 900 | 5,299,200 |
| 1.1 | Excavation and back filling as in hard/sofft or any soil upto 1.0m depth and 0.6m wide for LV/ITC cable and pipe trenches complete as directed by the Engineer.(Excluding cost of cable & pipe) | 3,149 | Cum | 900 | 2,834,100 |
| 2 | **LV CABLE**<br>Supply, laying , conecting and testing Cable electric LV 600/1000V stranded aluminium conductor, XLPE insulated, Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, sand,warning tap with all accessories as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| 2.1) | 4 core 300mm² AL, XLPE,PVC / SWA / PVC | 164 | m | 5,600 | 918,400 |
| 2.2) | 4 core 240mm² AL, XLPE,PVC / SWA / PVC | 871 | m | 4,500 | 3,919,500 |
| 2.3) | 4 core 185mm² AL, XLPE,PVC / SWA / PVC | 560 | m | 3,500 | 1,960,000 |
| 2.4) | 4 core 150mm² AL, XLPE,PVC / SWA / PVC | 1,029 | m | 2,800 | 2,881,200 |
| 2.5) | 4 core 120mm² AL, XLPE,PVC / SWA / PVC | 357 | m | 2,500 | 892,500 |
| 2.6) | 4 core 95mm² AL, XLPE,PVC / SWA / PVC | 912 | m | 2,000 | 1,824,000 |
| 2.7) | 4 core 70mm² AL, XLPE,PVC / SWA / PVC | 818 | m | 1,750 | 1,431,500 |
| 2.8) | 4 core 50mm² AL, XLPE,PVC / SWA / PVC | 725 | m | 1,200 | 870,000 |
| 2.9) | 4 core 35mm² AL, XLPE,PVC / SWA / PVC | 194 | m | 950 | 184,300 |
| 2.10) | 4 core 25mm² AL, XLPE,PVC / SWA / PVC | 300 | m | 750 | 225,000 |
| 2.11) | 4 core 16mm² AL, XLPE,PVC / SWA / PVC | 185 | m | 630 | 116,550 |
| 3 | Danger sign for MV & LV not less than 250 X 125 mm enameled as required, supply and fixing. | 110 | Each | 2,000 | 220,000 |
| 4 | **Feeder pillar**<br>Providing, installing, testing and commissioning of floor mounted Feeder pillar in 16 SWG sheet steel housing, dust, weather proof IP-54 paint, hinged door/lock, suitable for 3 phase neutral and earth strip 400 volts, Almunium busbars & Insulators for distribution to out going breakers.Seperate Almunium busbars chamber in locking arrangement. Installed on RCC pad, including cost of RCC foundation, complete as per Drawings and accessories as Directed by the engineer. | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 4.1) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>10-10A to 60A TP MCCB 16KA | 6 | Each | 255,000 | 1,530,000 |
| 4.1) b) | **Incoming**<br>1-80A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>10-10A to 60A TP MCCB 16KA | 11 | Each | 260,000 | 2,860,000 |
| 4.2) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>9-10A to 60A TP MCCB 16KA<br>10-10A to 60A TP MCCB 16KA | 3 | Each | 245,000 | 735,000 |
| 4.3) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>8-10A to 60A TP MCCB 16KA<br>2-TP MCCB Space only | 6 | Each | 235,000 | 1,410,000 |
| 4.3) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>7-10A to 60A TP MCCB 16KA<br>1-150A TP MCCB 25KA<br>2-TP MCCB Space only | 1 | Each | 240,000 | 240,000 |
| 4.3) c) | **Incoming**<br>1-60A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>8-10A to 60A TP MCCB 16KA<br>2-TP MCCB Space only | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | | 8 | Each | 240,000 | 1,920,000 |
| 4.4) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>7-10A to 60A TP MCCB 16KA<br>3-TP MCCB Space only | 14 | Each | 225,000 | 3,150,000 |
| 4.4) b) | **Incoming**<br>1-50A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>7-10A to 60A TP MCCB 16KA<br>3-TP MCCB Space only | 5 | Each | 230,000 | 1,150,000 |
| 4.5) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>6-10A to 60A TP MCCB 16KA<br>4-TP MCCB Space only | 11 | Each | 205,000 | 2,255,000 |
| 4.5) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>5-10A to 60A TP MCCB 16KA<br>1-80A TP MCCB 25KA<br>4-TP MCCB Space only | 2 | Each | 215,000 | 430,000 |
| 4.5) c) | **Incoming**<br>1-50A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>6-10A to 60A TP MCCB 16KA<br>4-TP MCCB Space only | 3 | Each | 215,000 | 645,000 |

| | | | | | |
|---|---|---|---|---|---|
| 4.6) a) | **Incoming**<br>1-80A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>5-10A to 60A TP MCCB 16KA<br>5-TP MCCB Space only | 2 | Each | 200,000 | 400,000 |
| 4.6) b) | **Incoming**<br>1-30A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>5-10A to 60A TP MCCB 16KA<br>5-TP MCCB Space only | 1 | Each | 200,000 | 200,000 |
| 4.7) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>2-10A to 60A TP MCCB 16KA<br>2-125A TP MCCB 25KA<br>6-TP MCCB Space only | 1 | Each | 190,000 | 190,000 |
| 4.7) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>3-10A to 60A TP MCCB 16KA<br>1-150A TP MCCB 25KA<br>6-TP MCCB Space only | 1 | Each | 190,000 | 190,000 |
| 4.8) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>1-10A to 60A TP MCCB 16KA<br>2-100A TP MCCB 25KA<br>7-TP MCCB Space only | 1 | Each | 170,000 | 170,000 |

| | | | | | |
|---|---|---|---|---|---|
| 4.8) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>1-10A to 60A TP MCCB 16KA<br>2-125A TP MCCB 25KA<br>7-TP MCCB Space only | 1 | Each | 170,000 | 170,000 |
| 4.8) c) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>3-10A to 60A TP MCCB 16KA<br>7-TP MCCB Space only | 1 | Each | 170,000 | 170,000 |
| 4.9) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>2-125A TP MCCB 25KA<br>8-TP MCCB Space only | 4 | Each | 160,000 | 640,000 |
| 4.9) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>1-10A to 60A TP MCCB 16KA<br>1-150A TP MCCB 25KA<br>8-TP MCCB Space only | 1 | Each | 160,000 | 160,000 |
| 4.9) c) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>1-10A to 60A TP MCCB 16KA<br>1-125A TP MCCB 25KA<br>8-TP MCCB Space only | 1 | Each | 160,000 | 160,000 |

| | | | | | |
|---|---|---|---|---|---|
| 5 | **Earthing Electrodes**<br>Supply, installation, connection & testing of copper earth electrodes, 20mm dia, 3000mm in length, driven vertically in ground, including cost of Test pit 300x300x300mm, internal plaster, 100mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 85 | Job | 45,000 | 3,825,000 |
| 6 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Feeder Pillars as shown on the drawing. or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 850 | m | 500 | 425,000 |
| | | | | **Total of Rs.** | **46,601,2** |

CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI
NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS
LOCATION : DHA CITY SECTOR '03' (PACKAGE-2)
SUB-HEAD : ELECTRICAL WORKS MV DISTRIBUTION. (Feeders & Express fee

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| 1 | **MV CABLE**<br>Supply,laying and conecting, Cable electric MV 15-kV stranded aluminium conductor, XLPE insulated,Triple Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, soft sand coushion, warning tape, Marker as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| | **FEEDER No 1.** | | | | |
| 1.1) | 3 core 400 mm² AL, XLPE / PVC / SWA / PVC 15 kV from grid station to TR-1 as shown on the drawings. | 1,446 | m | 11,500 | 16,629,0 |
| 1.2) | 3 core 300 mm² AL, XLPE / PVC / SWA / PVC 15 kV from transformar to transformer as shown on the drawings. | 1,149 | m | 7,600 | 8,732,4 |
| 1.3) | 3 core 300 mm² AL, XLPE / PVC / SWA / PVC 15 kV from TR-9 to Switch station-1 as shown on the drawings. | 454 | m | 7,600 | 3,450,40 |
| | **FEEDER No 2.** | | | | |
| 1.4) | 3 core 400 mm² AL, XLPE / PVC / SWA / PVC 15 kV from grid station to TR-10 as shown on the drawings. | 2,264 | m | 11,500 | 26,036,0 |
| 1.5) | 3 core 300 mm² AL, XLPE / PVC / SWA / PVC 15 kV from transformar to transformer as shown on the drawings. | 1,884 | m | 7,600 | 14,318,40 |
| 1.6) | 3 core 300 mm² AL, XLPE / PVC / SWA / PVC 15 kV from TR-18 to Switch station-1 as shown on the drawings. | 450 | m | 7,600 | 3,420,00 |
| | **FEEDER No 3.** | | | | |
| 1.7) | 3 core 400 mm² AL, XLPE / PVC / SWA / PVC 15 kV from grid station to TR-19 as shown on the drawings. | 1,978 | m | 11,500 | 22,747,00 |
| 1.8) | 3 core 300 mm² AL, XLPE / PVC / SWA / PVC 15 kV from transformar to transformer as shown on the drawings. | 775 | m | 7,600 | 5,890,00 |
| 1.9) | 3 core 300 mm² AL, XLPE / PVC / SWA / PVC 15 kV from TR-26 to Switch station-1 as shown on the drawings. | 49 | m | 7,600 | 372,400 |
| | **EXPRESS FEEDER-1** | | | | |
| 1.10) | 3 core 400 mm² AL, XLPE / PVC / SWA / PVC 15 kV from Grid station to Switch station-1 as shown on the drawings. | 2,451 | m | 11,500 | 28,186,5 |

| | | | | | |
|---|---|---|---|---|---|
| 2 | PVC straight joint, MV 15 kV, for XLPE cable consisting of mould, resin, MV tape, semi conducting tape, ferrules and earth wire etc. suitable for MV cables, 3 core 300 mm², supply and fixing complete with all installation accessories as per KESC standard. | | | | |
| | **FEEDER No 1.** | | | | |
| 2.1) | From grid station to TR-1 | 15 | Each | 80,000 | 1,200,00( |
| 2.2) | From TR-9 to Switching station. | 5 | Each | 80,000 | 400,000 |
| | **FEEDER No 2.** | | | | |
| 2.3) | From grid station to TR-10 | 23 | Each | 80,000 | 1,840,00( |
| 2.4) | From TR-18 to Switching station. | 5 | Each | 80,000 | 400,000 |
| | **FEEDER No 3.** | | | | |
| 2.5) | From grid station to TR-19 | 20 | Each | 80,000 | 1,600,00( |
| 2.6) | From TR-26 to Switching station. | 5 | Each | 80,000 | 400,000 |
| | **EXPRESS FEEDER No 1.** | | | | |
| 2.7) | From Switching station No-1 to grid station. | 25 | Each | 80,000 | 2,000,00( |
| | **SWITCHING STATION NO-1** | | | | |
| 3 | Supply Installation, testing and commissioning outdoor type of Switching station.Substation will have **1-incoming & 3-outgoing 17.5 kV** Vaccum circuit breaker (VCB), **350 MVA**, **630A**, with protection devices housed in metalic frame **IP 54**. Switching station will be mounted on RCC plateform circuit breaker (CB) will be trolley raised type to avoid floor unevenness if any. The male & female contacts shall be rod & Tulip type with vertical arrangement. EFI will be installed on each cable. The breaker shall be provided with bimetalic lugs to accomodate 2-Almunium cable connection with copper bus-bars. C.T & P.T will be installed on each breaker. C.T ratio **1200/600/1/1** P.T ratio **11 kV/110 V**. Each VCB shall have earthing switch to ground cable. Earthing switch shall have inter-lock with "ON" Mechanism. Digital type Relays on each VCB shall be over current **2Nos**; Earth Fault one No with series/shunt trip prorivions. The relay shall have additional potential free contacts for SCADA. Relays shall have self supervision provision. SCADA provision- each VCB will have potential **"NO" & "NC"** contact for status monitoring locally as well as at remote control room through SCADA. Switching Station (SS) housing shall be designed for safe operation by operator locally. No arc should comeout in any case. As per spacification installed on RCC pad, including the cost of RCC foundation pad complete with all civil and other installation accessories as shown on the drawing or as directed by the Engineers'. | 1 | Job | 7,800,000 | 7,800,00( |
| | **NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-A)** with **630 Amp**. VCB **17.5 kV**, **350 MVA**, **1000 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going VCBs on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos MCCB** of **400 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br><br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | 7,050,000 | 14,100,00 |
| 5 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amp**. VCB **17.5 kV**, **350 MVA**, **1000 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going load break switches with SF6 Fuses on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos** MCCB of **400 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br><br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 3 | Each | 6,000,000 | 18,000,00 |
| 6 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-A)** with **630 Amp**. VCB **17.5 kV**, **350 MVA**, **630 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going VCBs on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos MCCB** of **400 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br><br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 1 | Each | 5,800,000 | 5,800,00( |

| | | | | | |
|---|---|---|---|---|---|
| 7 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amp**. VCB **17.5 kV**, **350 MVA**, **630 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going load break switches with SF6 Fuses on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos** MCCB of **400 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br><br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | 5,600,000 | 11,200,00 |
| 8 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-A)** with **630 Amp**. VCB **17.5 kV**, **350 MVA**, **500 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going VCBs on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos MCCB** of **300 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br><br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | 5,300,000 | 10,600.00 |
| 9 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amp**. VCB **17.5 kV**, **350 MVA**, **500 kVA** Oil filled Transformer **11/0.42** kV with incoming & out going load break switches with SF6 Fuses on MV side. Air Circuit Breaker of **1600 Amp** outgoing 6 Nos MCCB of **300 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br><br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 14 | Each | 4,300,000 | 60,200,00 |

| | | | | | |
|---|---|---|---|---|---|
| | **Earthing Electrodes** | | | | |
| 10 | Supply, installation, connection & testing of copper earth electrodes, 20 mm dia, 3000 mm in length, driven vertically in ground, including cost of Test pit 300x300x300 mm, internal plaster, 100 mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 25 | Job | 45,000 | 1,125,00( |
| 11 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Switching Station & Transformer as shown on the drawing. or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 250 | m | 500 | 125,000 |
| | | | | **Total of Rs.** | **266,572,1(** |

# PAKISTAN DEFENCE OFFICERS' HOUSING AUTHORITY KARACHI

# PLANNING AND DESIGNING OF ELECTRICAL DISTRIBUTION SYSTEM OF DHA CITY KARACHI SECTOR - 5 ( PACKAGE - 01 )

# DETAILED DESIGN REPORT

SUBMITTED BY


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FEBRUARY 2013

# PLANNING & DESIGNING OF ELECTRICAL DISTRIBUTION SYSTEM OF DHA CITY, KARACHI
# SECTOR-05
# (PACKAGE-1)

## DETAILED DESIGN & DRAWINGS

# DEFENCE HOUSING AUTHORITY
# KARACHI

## SHORT-TERM PLAN ENERGY SECTOR – 05 (Package-01)
## DHA CITY KARACHI

# DETAILED DESIGN REPORT

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**5) ROUGH ESTIMATE**

# 1

## DESIGN BRIEF & DESIGN CRITERIA

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


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# 1. EXECUTIVE SUMMARY

Main components of Energy Design for Sector-5A, Short Term Development Plan comprises of the following:

**A) MV Distribution Network comprising of:**

**1) MV Cables:**

- 3 core 300 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable — 4,154 m
- 3 core 400 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable — 9,985 m

**2) Switching Stations:**

a) 3-way — 1 Nos.

**3) Kiosk Sub Station:**

- Kiosk Sub Station 1000 kVA (Type A) Transformer 11/0.42 kV Oil filled — 3 Nos.
- Kiosk Sub Station 1000 kVA (Type B) Transformer 11/0.42 kV Oil filled — 2 Nos.
- Kiosk Sub Station 500 kVA (Type A) Transformer 11/0.42 kV Oil filled — 2 Nos.
- Kiosk Sub Station 500 kVA (Type B) Transformer 11/0.42 kV Oil filled — 15 Nos.

**B) LV Distribution Network comprising of:**

**1) LV Cables:**

| | | | |
|---|---|---|---|
| a) | 4 core 300 mm² AL, XLPE/PVC/SWA/PVC cable | 477 | m |
| b) | 4 core 240 mm² AL, XLPE/PVC/SWA/PVC cable | 409 | m |
| c) | 4 core 185 mm² AL, XLPE/PVC/SWA/PVC cable | 274 | m |
| d) | 4 core 150 mm² AL, XLPE/PVC/SWA/PVC cable | 57 | m |
| e) | 4 core 95 mm² AL, XLPE/PVC/SWA/PVC cable | 2197 | m |
| f) | 4 core 70 mm² AL, XLPE/PVC/SWA/PVC cable | 556 | m |
| g) | 4 core 50 mm² AL, XLPE/PVC/SWA/PVC cable | 381 | m |

h) 4 core 35 mm² AL, XLPE/PVC/SWA/PVC cable 141 m
i) 4 core 16 mm² AL, XLPE/PVC/SWA/PVC cable 14 m

| | |
|---|---|
| **10-way FP** | **35 Nos** |
| **9-way FP** | **9 Nos** |
| **8-way FP** | **12 Nos** |
| **7-way FP** | **8 Nos** |
| **6-way FP** | **3 Nos** |
| **5-way FP** | **2 Nos** |
| **4-way FP** | **1 No** |
| **3-way FP** | **1 No** |
| **2- way FP** | **10 Nos** |

**2) Feeder Pillars:**

**C) Smart Grid ICT Network / pipe sleeves comprising:**

1) HDPE pipe 2" dia. (2 Nos.) for MV/LV cables 35,000 m

2) RCC hand hole with cover (L=5', W=3', D=3') 140 Nos.

# 2. GENERAL FEATURES

## 2.1 INTRODUCTION

Pakistan Defence Officers Housing Authority (DHA) has commissioned M/s Osmani and Company (Pvt.) Ltd. to provide consultancy services for Development of DHA City Karachi (DCK) in August 2010. DHA City is spread over an area of 11,640 acres with numerous ridges and nallas following a rolling / mountainous terrain. DHA City is planned and divided into 16 sectors as listed below in Table 2-1.

**Table 2-1: Area of Sectors**

| S.NO. | LOCATION | AREA (acres) | S.NO. | LOCATION | AREA (acres) |
|---|---|---|---|---|---|
| 1 | SECTOR 1 | 525 | 9 | SECTOR 9 | 604 |
| 2 | SECTOR 2 | 600 | 10 | SECTOR 10 | 541 |
| 3 | SECTOR 3 | 311 | 11 | SECTOR 11 | 663 |
| 4 | SECTOR 4 | 337 | 12 | SECTOR 12 | 504 |
| **5** | **SECTOR 5** | **483** | 13 | SECTOR 13 | 575 |
| 6 | SECTOR 6 | 823 | 14 | SECTOR 14 | 655 |

| | | | | | |
|---|---|---|---|---|---|
| 7 | SECTOR 7 | 631 | 15 | SECTOR 15 | 697 |
| 8 | SECTOR 8 | 339 | 16 | SECTOR 16 | 383 |
| **GRAND TOTAL** | | | | | **8,675** |

Sector development works are to be carried out with respect to development strategy, which has been divided into 3 phases;

- Short Term Development Plan (2015 – 2018)
- Mid Term Development Plan (2018 – 2021)
- Long Term Development Plan (2021 – 2030)

The following ***Figure 2-1*** shows the location of various sub-sectors planned under short term development.

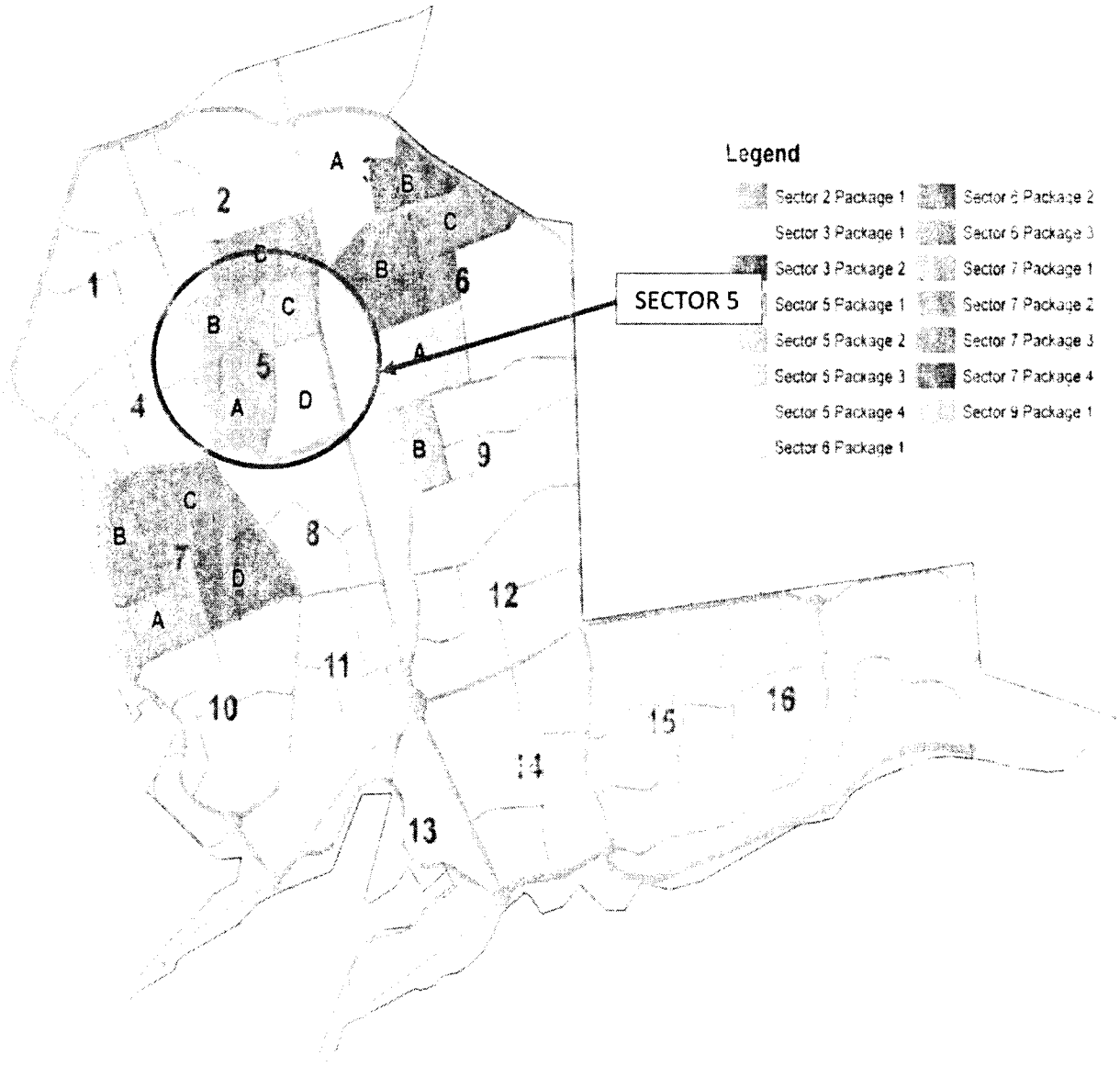


**Figure 2-1: Sectors under Short Term Development Plan**

Sectors are generally divided into four sub sectors as per the design criteria of 'Ekistics' for ease of communication of urban city. Acreage of each sub sector is given in Table 2-1 of Short Term Development Plan. Sector 5 has a total developed area of 2,335,734 square yards or 483 acres, excluding road network. About 2/3 of the area of sector 5 is utilized for residential purposes.

***Table 2-2*** shows the areas of various sectors under short term development plan:

**Table 2-2: Areas of Sectors under Short Term Plan**

| Areas in acres | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sector | Sub-Sector | | | | | Other than Sub Sector | Total |
| | A | B | C | C-5 | D | | |
| 2 | | | | | 141 | | 141 |
| 3 | 215 | 81 | | 15 | | | 311 |
| **5** | **136** | **108** | **63** | **18** | **136** | **22** | **483** |
| 6 | 167 | 97 | 112 | 40 | | | 416 |
| 7 | 136 | 129 | 198 | 19 | 149 | | 631 |
| 9 | | 89 | | | | | 89 |
| CBD | | | | | | 104 | 104 |
| **Total** | **654** | **504** | **373** | **92** | **426** | **126** | **2,175** |

Sector 5 is one of the model sectors being developed under Short Term Plan. This sector has plots of different sizes ranges from R3-S to R20-S. Majority of plots are of size R5 and R10.

## 2.2 SCOPE OF THE REPORT

The main objective of this report is to explain the Detailed Design for Energy Distribution Network of DCK. The main objectives of this Detailed Design Report (DDR) are the following:

- Present the Detailed Design of Sector 5A to enable client review prior to progression to the bidding stage.
- Provide details of how the design has been developed since the submission of the Preliminary Design Energy Distribution Report.
- Provide an updated description of the works.
- Confirm the design criteria and parameters used for the design of Electrical Distribution System. Provide a rough cost estimate for the project component.
- Provide details of any information obtained; and information still required to complete the project and highlight any potential difficulties in obtaining such information.

- This report will cover Detailed Design of Sector-5A as encircled in Figure 2-1 and highlighted in Table 2-1

## 2.3 BACKGROUND

Sector 5 was planned on 483 acres area, with City Boulevard (PA 01) to the west, Main Boulevard West (PA 02D) to the east, West Avenue 1W (PC 01) to the north and West Avenue 2W (PA 04) on the south. For tendering purpose, Sector 5 is divided in to 4 packages i.e. 1, 2, 3 and 4. Package 1 contains sub-sector A with an approx. area of 136 acres, package 2 contains sub-sector B with an approx. area of 108 acres, package 3 contains sub-sector C and commercial centre C5 with an approx. area of 81 acres and lastly package 4 contains sub-sector D with an approx. area of 136 acres.

Figure 2-2: Boundaries of Packages 1 to 4 of Sector 5 shows the boundaries of packages 1 to 4 of sector 5.

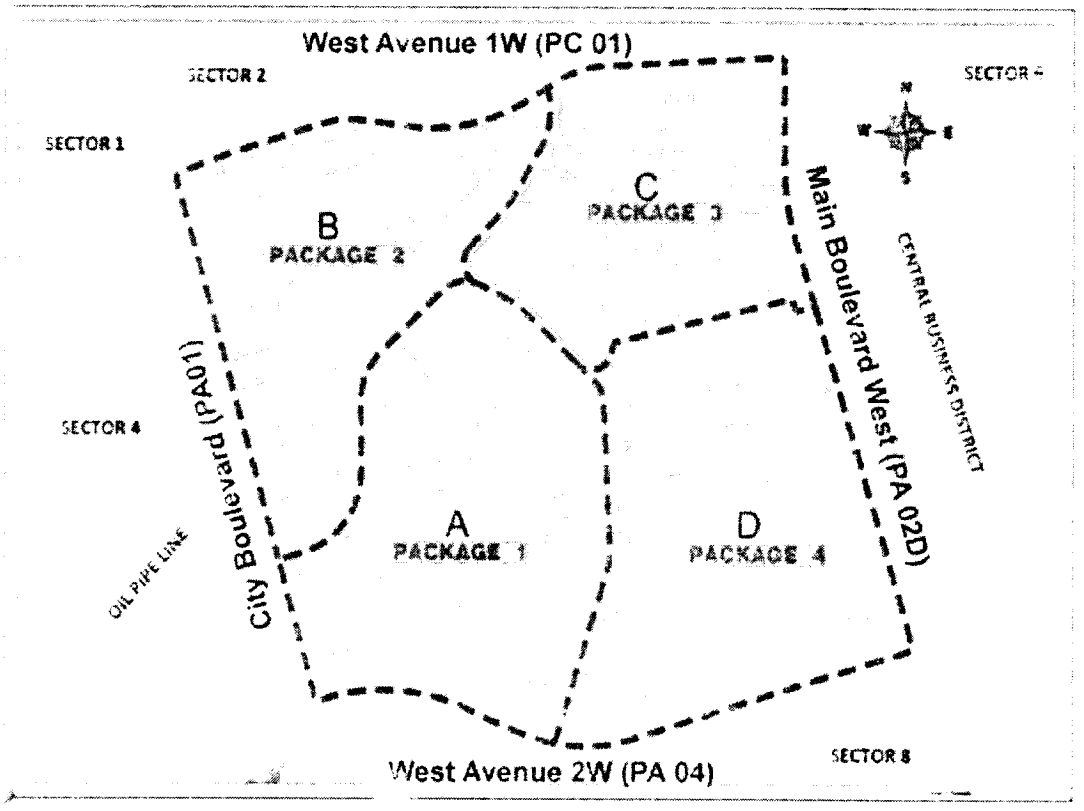


**Figure 2-2: Boundaries of Packages 1 to 4 of Sector 5**

## 2.4 TOPOGRAPHY OF SUB-SECTOR 5-A

Sub-sector 5-A is mostly hilly having ridges in northern and southern regions. Figure 2-3 shows that it has the highest elevation of 566.148 ft and lowest elevation of 440.5 ft, with a difference of 125.648 ft.

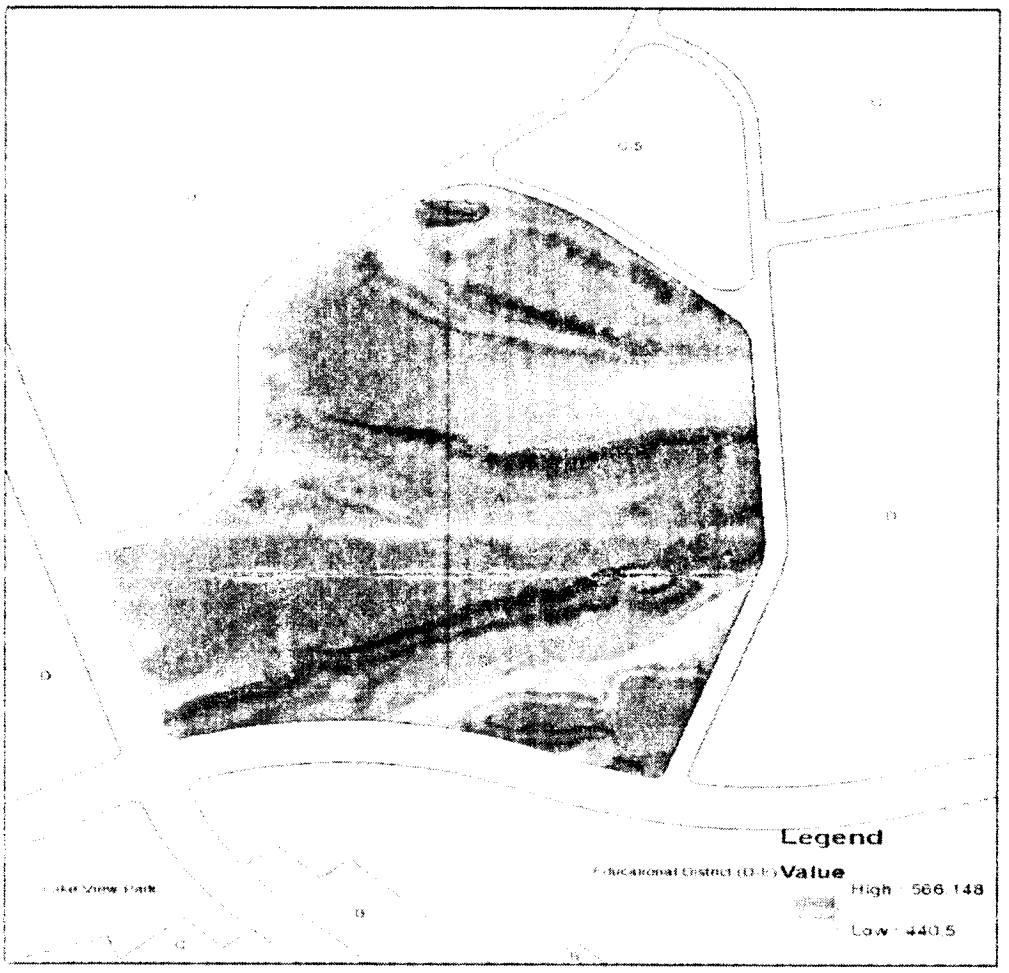


**Figure 2-3: Topography of sub-sector 5-A**

## 2.5 POPULATION AND DEVELOPMENT

The DCK will be developed in stages aiming to reach eventually more than 600,000 people. The overall planning of DCK is based on ekistics, leading to sectors of 20-40,000 people each. Sector 5 has a total developed area of 2,335,734 square yards, excluding road network. The table below describes the land use in sector 5. About 2/3 of the area of sector 5 is utilized for residential purposes. Residential area has different plot categories from 100 square yards to 2,000

square yards. Other facilities include commercial areas, amenities, educational institutions, graveyard, healthcare facilities and green space areas.

**Table 2-3: Sector 5: Land Use Statistics**

| SECTOR 5 LAND USE STATISTICS | | | |
|---|---|---|---|
| **Zonal Land use** | **Categories** | **Area (sq.yards)** | **Total Area (sq.yards)** |
| Agriculture and Preserved Open Spaces | Nallah | 38738.43 | **269616.5** |
| | Oil Pipe Line | 10986.53 | |
| | Open & Green Space | 219891.6 | |
| Amenities | Cemetery | 5039.94 | **63286.45** |
| | College/ A-Level/ Professional (CA/ ACCA etc.) | 6947.61 | |
| | Community Hall | 5260.62 | |
| | Dispensary | 756.46 | |
| | Health Centre | 3033.58 | |
| | Kindergarten | 7225.15 | |
| | Marriage Hall | 1555.55 | |
| | Masjid | 4510.28 | |
| | PS/ SS/ O-Level | 26977.56 | |
| | Public Service (Club) | 1979.7 | |
| Commercial | - | - | **36622.17** |
| Mixed use | - | - | **11279.09** |
| Recreation | Nursery | 53830.99 | **114651.8** |
| | Parks and Playground | 60820.86 | |
| Residential | - | - | **1100971** |
| Transportation | Commercial Collector Roads (120' ROW) | 21000.71 | **721689.8** |
| | Commercial Collector Roads (60' Row) | 28936.15 | |
| | Parking | 17406.59 | |
| | Pedestrian way | 9979.16 | |
| | Piazza | 53540.53 | |
| | Residential Collector Roads (90' ROW) | 63726.05 | |
| | Streets | 527100.6 | |
| Utilities | ICT and Security | 1183.57 | **17616.83** |
| | Overhead Reservoir | 2288.72 | |
| | Sewage Treatment Plant | 5218.79 | |
| | Unclassified Utility | 8925.74 | |
| **Grand Total** | | | **2,335,734** |

## 2.6 CONTRACT PACKAGES

Sector 5 consists of 4 contract packages. Refer Figure 2-2 for location and boundary of various packages. The detailed layout plans showing detailed MV & LV network is also attached in Detailed Design Drawings of the report. The statistical description of package 1 is given below:

- **Package 1**

This package comprises of sub-sector A which has an area of 136 acres as given in **Error! Reference source not found.** and consists of an approx. road network of 26,400 ft (8.05 km) Table 2-4:4 shows it has 24 C2s.

Table 2-4: 4 shows the Plots Summary of sub-sector-A under categories of Residential, Commercial & Mix Use.

**Table 2-4: Plots Summary- Sub-Sector 5-A**

| SECTOR 5-A PLOTS SUMMARY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Residential Plots** | | | | | | | | |
| | R1 | R2 | R2.5 | R3 | R5 | R10 | R20 | Total |
| Sector 5 | | | | 3 | 1,369 | 396 | 5 | 1,773 |
| Sub-Sector 5-A | | | | 1 | 595 | 8 | | 604 |
| **Commercial Plots** | | | | | | | | |
| | C1 | C2 | C2.5 | C3 | C5 | C10 | C20 | Total |
| Sector 5 | | 66 | 5 | 17 | 16 | 2 | | 106 |
| Sub-Sector 5-A | | 24 | | | | | | 24 |
| **Mix Use (Residential + Commercial) Plots** | | | | | | | | |
| | M1 | M2 | M2.5 | M3 | M5 | M10 | M20 | Total |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sector 5 | | 49 | 1 | 3 | | | | 53 |
| Sub-Sector 5-A | | 14 | | | | | | 14 |

## 2.7 OVERVIEW OF DCK ELECTRICAL DISTRIBUTION DESIGN

Design of the Electrical Distribution Network for DHA City Karachi (DCK) is a very important task of the project. Analysis of the latest technologies, current industry standards, local field practices and availability of skilled Human Resource (HR) have been done with a view of current and future requirements of DCK residential and commercial users. Electrical network design layout of DCK is based on the geographic and sector wise distribution.

The DCK is a vision to build an urban city with adaption of new technologies. Distinctly it has to be a part of global smart cities family, which integrates various technical trends into a single place to facilitate best options to the local residents as well as business community. Any urban society can't be accomplished without proper plan so decision for opting of a reliable electrical distribution system for DCK will really need a higher priority at early stage.

Thus it is proposed to design and construct an electrical network that will be capable to deliver electrical services within DCK. In order to enable the level of operational efficiencies needed for a project of this kind, the use of 'smart building technologies' is the basis of this design to fulfil DCK requirement for provisioning of electrical services. The aim is to provide a network with reliable electricity supply to the residents and stakeholders.

Kiosk type substations can only be the favourable medium for smart distribution in DCK, which can provide the monitoring and control required. We believe that

key for reliable electricity is a reliable distribution system with few faults and their fast location and removal. In this regard best efforts are being made to make DCK a prosperous place in current and future scenarios. This will enable DCK to append and merge forthcoming technologies without modifying its existing infrastructure system. The description of various kiosks Sub-Stations used is given below.

- **Kiosk Sub-Station Type-A** (1000 kVA, 630 kVA, 500 kVA) Oil filled Transformer 11/0.42 kV, with incoming & out going VCBs on MV side.

- **Kiosk Sub-Station Type-B** (1000 kVA, 630 kVA, 500 kVA) Oil filled Transformer 11/0.42 kV, with incoming and outgoing SF6 load break switches with fuses on MV side.

# 3. DESIGN CRITERIA

## 3.1 DESIGN CODES & STANDARDS

All systems shall adapt the following main standards, wherever applicable:

- European Committee for Standardization (CEN) and European Committee for Electro technical Standardization (CENELEC)
- International Electro technical Commission (IEC)
- International Organization for Standardization (ISO)
- Other Standards and Codes can be used in areas not covered by these standards. Other standards include:
- European Standards like EN, DIN
- British Standards (BS)

The Electrical products used, should be tested and approved to meet the applicable standards by one of the independent test laboratories including following:

- KEMA
- CESI
- UL or other similar laboratories

## 3.2 USER REQUIREMENTS

The user requirements for DCK that are given by the DHA include the followings:

a) Completely underground distribution system.

b) Use of aluminium conductor cables for cost saving.

c) Use of Kiosk type substations for space saving and faster installation.

d) Smart Metering Technologies.

e) Remote monitoring and control.

## 3.3 DESIGN CRITERIA

The DCK Electrical Distribution must meet following requirements:

- High reliability
- Safe Operation
- Route Protection
- Redundancy
- Reliable Technology
- Easy to maintain and troubleshoot
- Environmentally Protected
- Cost Effective
- Future Proof

## 3.4 DESIGN CONSIDERATIONS

- Underground distribution for reliable power supply.
- MV ring distribution for fast restoration of power in case of fault.
- Use of MV express feeder to provide backup in case of simultaneous fault on two feeders.
- Use of Kiosk type substation for space saving and faster installation.
- Use of VCB type Ring Main Units (RMUs) for reliable maintenance free switching.
- Fibre Optic cable network for remote monitoring and control.
- Use of Smart Meters in residences, offices & commercial premises for two way flow of power, thus encouraging use of renewable energy by consumers.

- Remote monitoring and control of MV and LV distribution system and automatic meter reading and billing.
- Use of cost saving aluminium conductor for MV and LV cables.

# 4. SMART GRID

## 4.1 GENERAL

Traditional Electric Power Systems have been designed through deploying large central generation units built away from cities and residential areas, while electricity has been delivered to consumers through interlinked transmission lines and grid stations. Each individual generation unit, whether it is powered by fossil fuels or hydro, may be rated of up to hundreds of Megawatts (MWs). Transmission line distance also varies up to hundreds of kilometres and Electricity is then transferred to end-users through distribution transformers. The distribution system is very extensive but is almost entirely passive with *little communication* and only limited local controls. There is no *real-time monitoring* hence there is very little interaction between the loads and the power system.

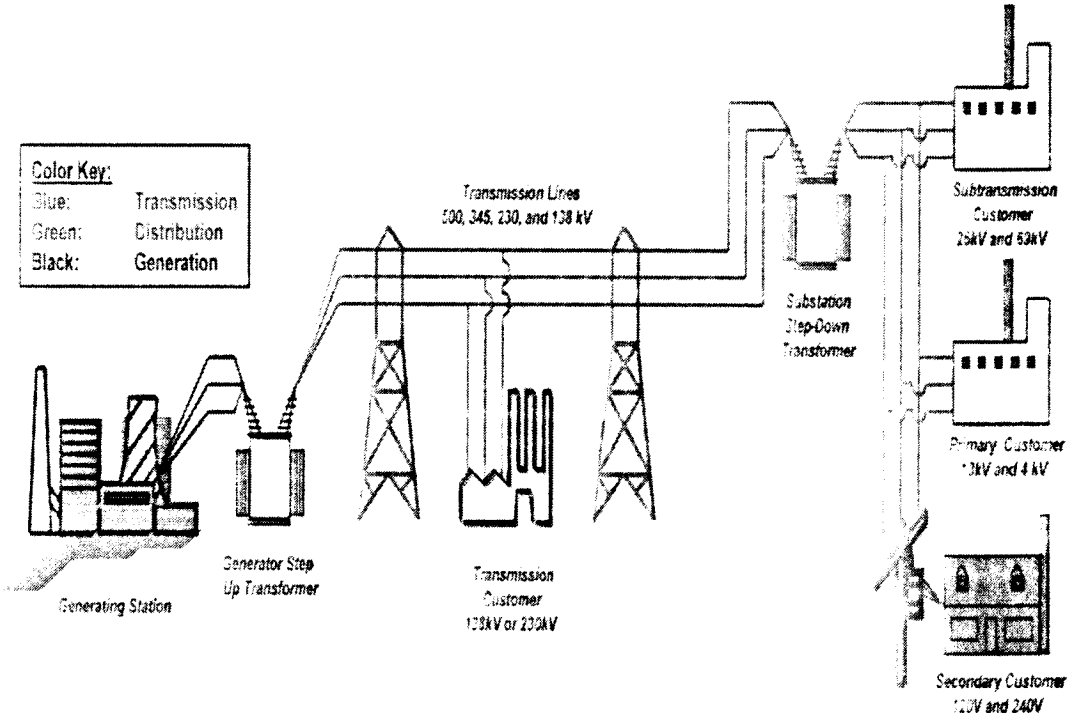

**Figure 4-1: Existing Power System Infrastructure**

The present advances in communication systems, particularly high speed networks, offer the possibility of much greater monitoring and control throughout the power system and hence more effective, flexible and lower cost operations.

Today, design concept of power system has changed and it does not required to be isolated from cities by using large scale generators. Instead large numbers of small scale generation units located at various places are being combined together to deliver electricity to local city residents. Using ICT services at smaller scale is very feasible as well as cost effective. This concept of intelligent delivery of electricity is known as ***Smart Grid***.

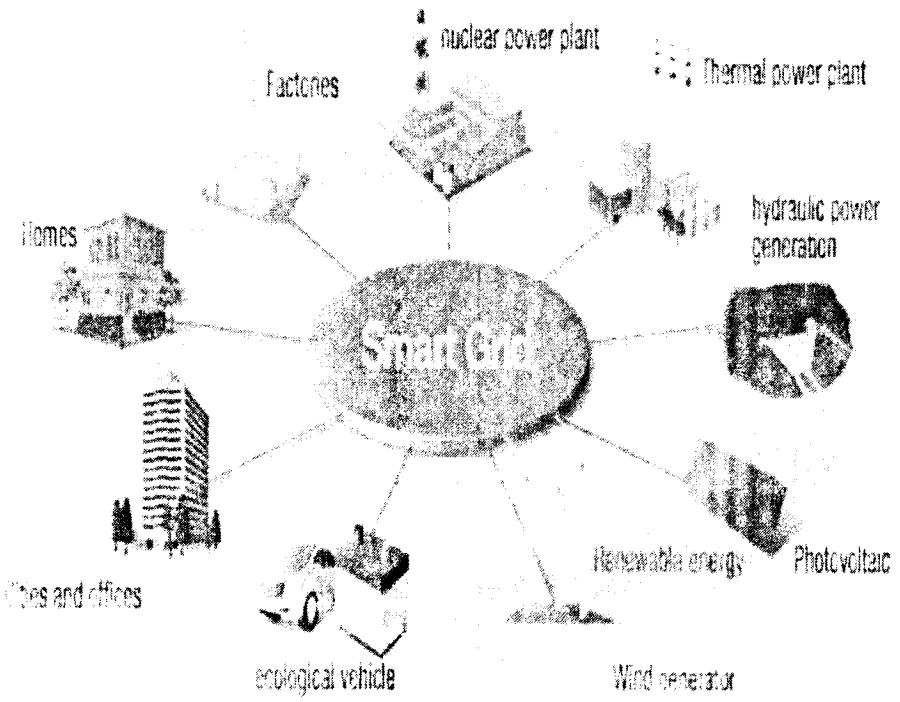


**Figure 4-2: A Smart Grid Infrastructure**

One of the best features of DHA City Karachi (DCK) is the introduction of Smart Grid Technology which will help in managing and protecting the resources of DCK electricity network. Electrical components will be 'network' enabled which will

help to monitor the electricity consumption by DCK Power Operators remotely at Network Control Centre (NCC). Real-time Electricity database will then be used to optimize power generation and distribution.

Not only this, but real-time monitoring and control will enable to avoid any unwanted circumstance such as blackout due to heavy short circuits within network and brownout due to unplanned heavy loads. These cases not only affect the power quality but also damage costly power equipment such as power transformers and bus bars at Sub-Stations/grid stations. This technology will enable the DCK consumers to see how much Electricity is being consumed and can also see utility bills any time online at their homes through smart meters.

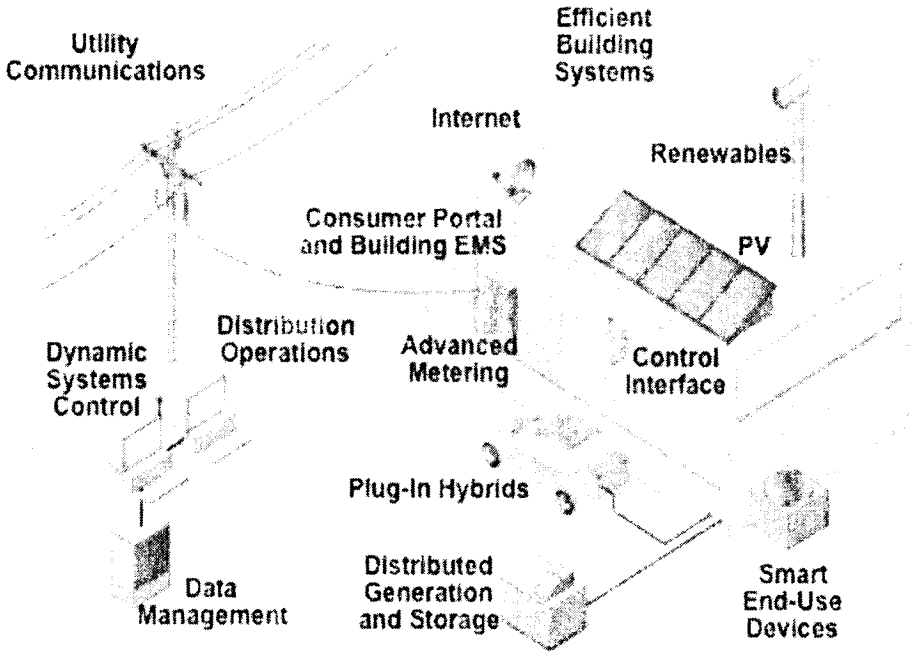


**Figure 4-3: Latest Electrical Network Infrastructure**

The design of power transmission and distribution system of DCK has also been done with a consideration of futuristic demands of any urban city. The design is aligned with the requirements of latest Codes and Standards defined for a Smart Grid and assures modular deployment of any future elements whenever required.

## 4.2 ACCOMMODATION OF RENEWABLE ENERGY INTO EXISTING GRIDS

The global concern for the environment and the need to counteract the effects that lead to global warming are the most important drivers for an improved electrical energy system. Along with establishing a common understanding of man-made changes in the global climate, scenarios have been presented, showing how future carbon emissions might be limited, or even reduced. The major proposals in these scenarios is the introduction of renewable energy sources to replace the traditional fossil based power generation with higher priority as we have a very limited fossil-fuel in future.

## 4.3 DIFFERENCE BETWEEN CONVENTIONAL AND SMART GRIDS

Following table shows a brief difference between a conventional and a Smart Grid.

**Table 4-1: Difference between a Conventional & Smart Grid**

| CHARACTERISTIC | EXISTING GRID | SMART GRID |
|---|---|---|
| Enables active participation by consumers | Consumers are uninformed and non-participative with power system | Informed, involved, and active consumers - demand response and distributed energy resources. |
| Accommodates all generation and storage options | Dominated by central generation- many obstacles exist for distributed energy resources interconnection | Many distributed energy resources with plug-and-play convenience focus on renewable |
| Enables new products, services and markets | Limited wholesale markets, not well integrated - limited opportunities for consumers | Mature, well-integrated wholesale markets, growth of new electricity markets for consumers |
| Provides power quality for the digital economy | Focus on outages - slow response to power quality issues | Power quality is a priority with a variety of quality/ price options - rapid resolution of issues |
| Optimizes assets & operates efficiently | Little integration of operational data with asset management - business process silos | Greatly expanded data acquisition of grid parameters - focus on prevention, minimizing impact to consumers |
| Anticipates and responds to system disturbances (self-heals) | Responds to prevent further damage- focus is on protecting assets following fault | Automatically detects and responds to problems - focus on prevention, minimizing impact |

| | | |
|---|---|---|
| | | to consumer |
| Operates resiliently against attack and natural disaster | Vulnerable to malicious acts of terror and natural disasters | Resilient to attack and natural disasters with rapid restoration capabilities |

## 4.4 USER REQUIREMENTS

- Demand & Supply Balancing
- Optimized and cost-effective Power Generation
- Consumer-Interacted Advance Metering Technology
- Remote Monitoring & Control
- High level protection of EHV, HV, MV and LV equipments
- Accommodation of Generation from Renewable Energy
- Resiliently to Disturbances, Attacks, & Natural Disasters
- High Speed Communication medium throughout the Transmission & Distribution Network
- Power Quality
- Accuracy in load prediction
- Reliability
- Future Proof Technology

## 4.5 NEED OF SMART GRID INFRASTRUCTURE

Today, existing grids are under pressure to deliver the growing demand for power, as well as provide a stable and sustainable supply of electricity. These complex challenges are driving the evolution of smart grid technologies. Smart grid is specifically designed to meet the increasing global demand for electricity, by providing sufficient capacity, as well as reliability, efficiency and sustainability.

## 4.6 ADVANCED METERING INFRASTRUCTURE

Advance Metering Infrastructure (AMI) systems that support two-way communications with customers while allowing secure and reliable system-wide communication for distribution automation are the enabling foundation for the Smart Grid. Advanced Metering Infrastructure will give consumers the consumption and pricing information they need to enable them to more effectively participate in peak load reduction and energy conservation.

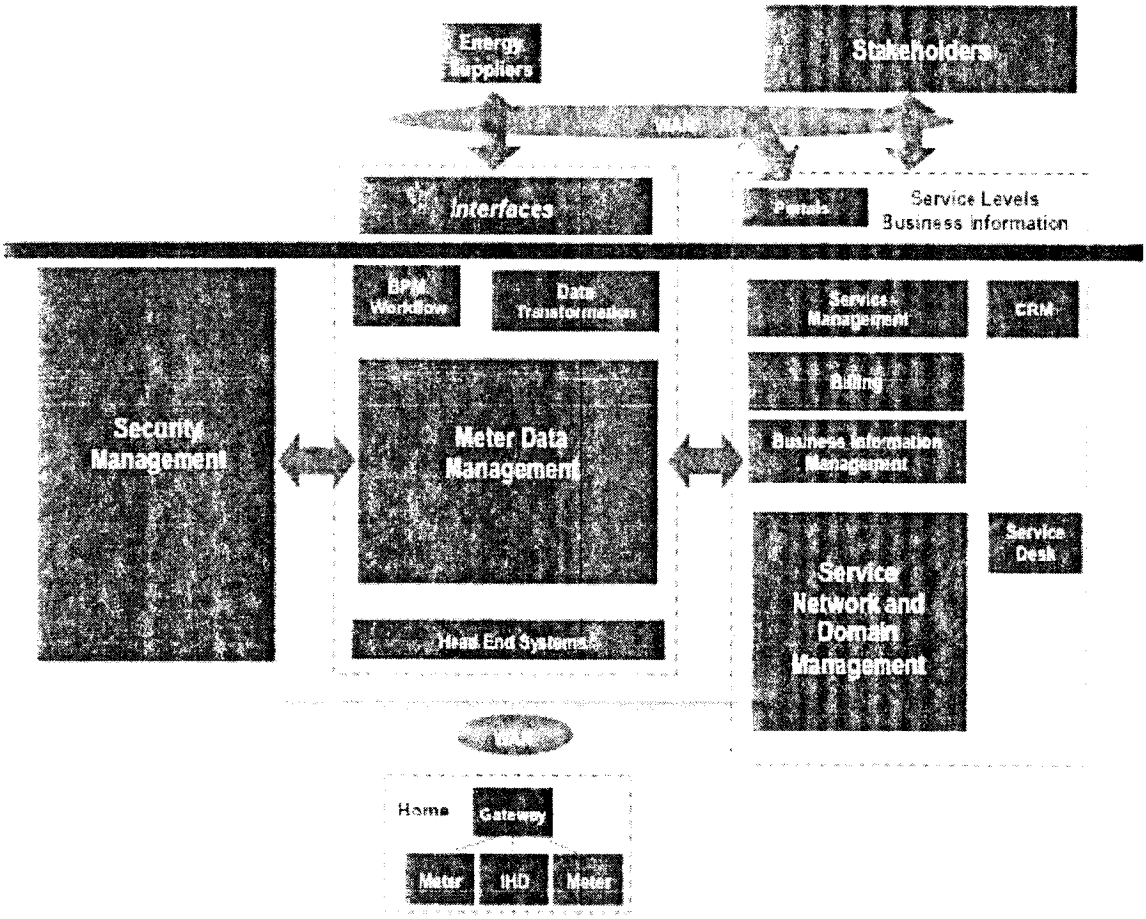


**Figure 4-4: Advance Metering Infrastructure System**

AMI consists of the communications hardware and software, and the associated system and data management software, that together create a two-way network between advanced meters and utility business systems, enabling collection and distribution of information to customers and other parties, such as the competitive retail supplier or the utility itself. Generally AMI have following functionalities:

- Two way communications
- Interval measurement and storage of consumption data
- Display of consumption data to consumer
- Remote connection/disconnection
- Support for variable energy tariffs
- Demand control

## 4.7 DISTRIBUTION AND OUTAGE MANAGEMENT

Distribution and Outage Management Systems (DMS/OMS) provide real-time response to adverse or unstable conditions. It saves money and improves customer service. Through the consolidation of both real-time OMS and DMS functionality, telemetry, and integrated security, smart distribution systems will be poised to become truly self-healing.

## 4.8 DISTRIBUTION AND SUBSTATION AUTOMATION

A Smart Grid requires control centre supervision, area-wide solutions and visualization with centralized modelling. Implementations should leverage installed infrastructure and use a model-based, scalable approach. This practical, cost-effective method ensures that current technology eventually gives way to reactive, software-driven intelligence.

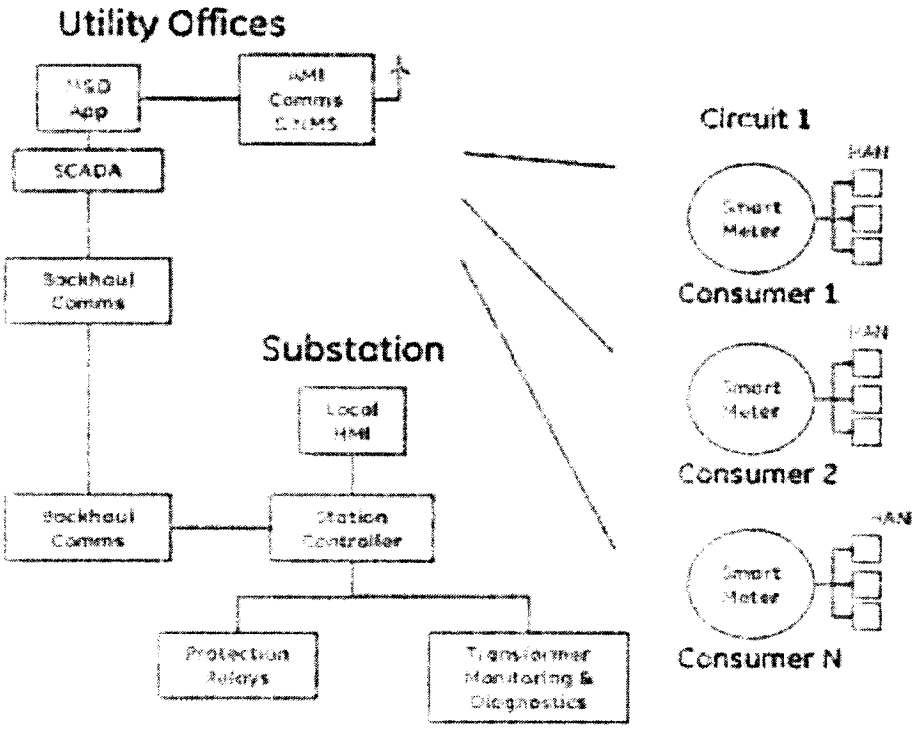


**Figure4-5: Distribution Automation System**

The architecture shown above uses a centralized distribution automation system with the addition of communication to smart metering. The algorithm can utilize the information from the smart meters to assist in detecting outages outside of the monitored range of the automated devices. This includes fuses or other non-automated fault interrupters. The meters can detect and report an outage and can report successful restoration. Using the restoration detection, the system can determine customers have been properly restored as expected.

## 4.9 PERFORMANCE

Smart Grids will make use of new design concepts and advanced materials in system components like transformers and circuit breakers to improve efficiency, safety and operational performance. Widespread use of power electronic devices will help maximize performance of existing assets and make the grid more resilient in the event of disruptions.

## 4.10 SECURITY & SAFETY

Improvements in security increase the robustness and resiliency of the grid from a physical perspective and a cyber perspective, thereby reducing the probability and consequences of man-made attacks and natural disasters. In addition, reductions in oil imports made possible by the Smart Grid enhance national security.

Improvements in safety reduce the hazards inherent in an energized electric system as well as the time of exposure to those hazards. Generally Smart Grid Infrastructure will help through followings:

- Reduction in the probability that a deliberate man-made cyber or physical attack could occur and a reduction in the consequences of any that are not detected or prevented
- Improved restoration times following storms and other natural events
- Reduction in theft and vandalism of property due to increased detection capability
- Reduction in injuries and deaths of employees due to reduction in time spent in hazardous situations and the availability of more intelligent systems that support worker safety

These benefits will decrease the probability that extended outages impacting the security of customers will occur by reducing the threat, vulnerability, and consequences of man-made attacks. The increased reliance on digital Smart Grid technologies will require the deployment of new systems to address cyber security ensuring this critical infrastructure is as "hack proof" as possible. The increased robustness and resilience of the smart grid will also reduce the impact of many natural events that today result in extended outages.

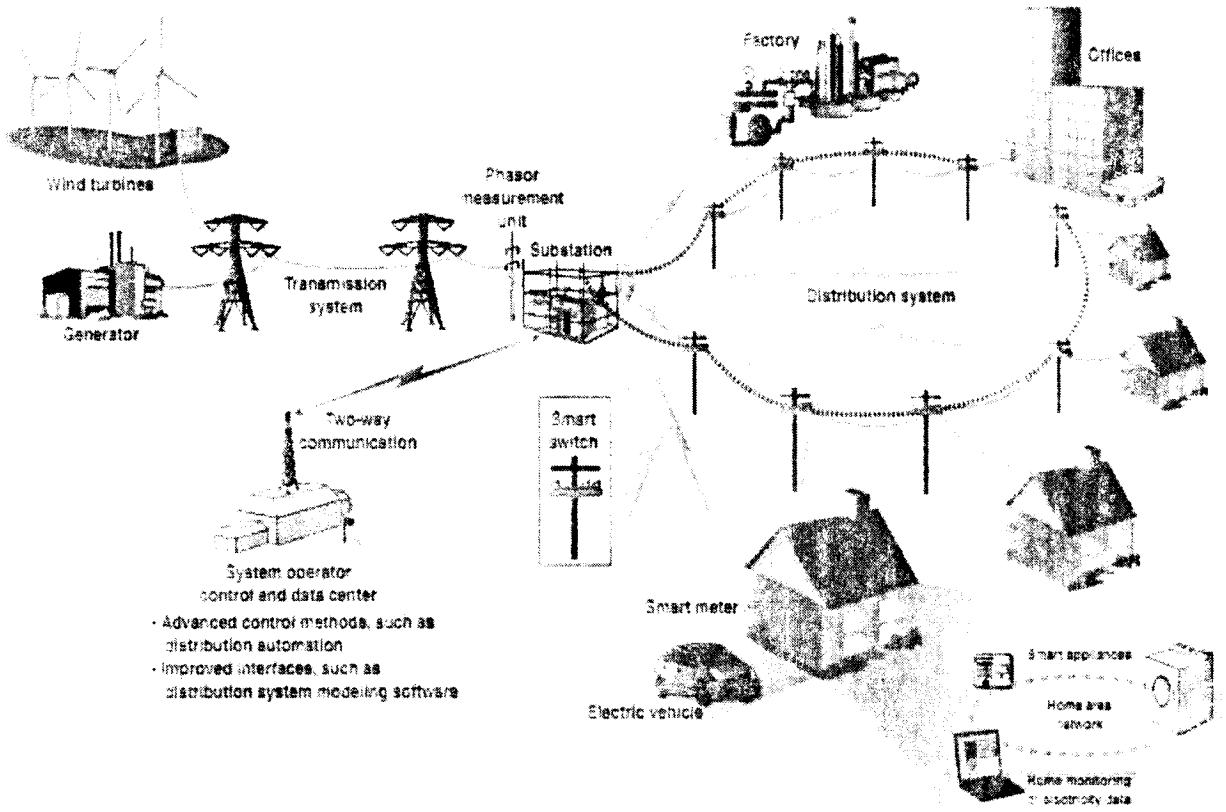


**Figure 4-6: A Secure Smart Grid System**

## 5. BENEFITS OF SMART GRID ELEMENTS

A modernized electrical grid has following features:

- Improves power reliability and quality
- Optimizes facility utilization and averts construction of backup (peak load) power plants
- Enhances capacity and efficiency of existing electric power networks
- Improves resilience to disruption
- Enables predictive maintenance and "self-healing" responses to system disturbances
- Facilitates expanded deployment of renewable energy sources
- Accommodates distributed power sources
- Automates maintenance and operation

- Reduces greenhouse gas emissions by enabling electric vehicles and new power sources
- Reduces oil consumption by reducing the need for inefficient generation during peak usage periods
- Presents opportunities to improve grid security
- Enables transition to plug-in electric vehicles and new energy storage options
- Increases consumer choice
- Enables new products, services, and markets and consumer access to them
- Improved distribution system efficiency
- Reduced distribution line losses
- Improved voltage profile along feeder
- Improved system stability and capacity
- Deferred capital upgrades
- Reduced energy demand
- Reduction of environmentally harmful emissions

# 3

## DESIGN LOAD SHEET SECTOR-05 (PACKAGE-1)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


OSMANI

Engineering - Architecture - Planning - Management - Technology

**OSMANI & COMPANY (PVT.) LTD.**

**Consulting Engineers – Architects – Planners**

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Tel: +92-21-34536007 / 08, 34546541/42
Fax: +92-21-34534691
Email: ocl-khi@osmani.com,
Web: www.osmani.com

**DCK - SECTOR-05 (PACKAGE-1)**
**ELECTRICAL LOAD CALCULATIONS**
**LOAD AS PER KESC STANDARDS**

**COMMERCIAL**

| S. No. | Plot Area (Sq.yds) | Type of Plot | Covered Area as per DCK Bye Laws | | | | KESC Load Criteria | | General Load | A/C Load | Lift Load (W) | Water Pump Load (W) | Max. Connected Load (W) | Group Div. Factor 80% (W) | TOTAL NO. OF PLOTS | Total Load (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | | |
| 1 | 200 | C2 | 100% | 1800 | 6 | 10800 | 10 | 0 | 108000 | 0 | 8952 | 3729 | 120681 | 96544.8 | 24 | 2317.08 |
| 2 | 200 | M2 (C+R) | 100% | 1800 | 6 | 10800 | 10-GF 1.75 UP | 1 | 33750 | 10000 | 8952 | 3729 | 56431 | 45144.8 | 14 | 632.03 |
| 3 | 403 | MK | 100% | 3627 | 1 | 3627 | 10 | 0 | 36270 | 0 | | | 36270 | 29016 | 1 | 29.02 |
| 4 | 413 | MK | 100% | 3717 | 1 | 3717 | 10 | 0 | 37170 | 0 | | | 37170 | 29736 | 1 | 29.74 |
| | | | | | | | | | | | | | | | **TOTAL (kW)** | **3007.85** |

## DCK - SECTOR-05 (PACKAGE-1)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

| DESCRIPTION | TOTAL NO. OF PLOTS | TOTAL RESIDENTIAL LOAD (kW) | TOTAL AMENITIES LOAD (kW) | TOTAL COMMERCIAL LOAD (kW) | TOTAL (kW) |
|---|---|---|---|---|---|
| No. of Plots | 604 | | | | 8,531.48 |
| Residential Load | | 3,937.84 | | | |
| Amenities Load | | | 1,585.78 | | |
| Commercial Load | | | | 3,007.85 | |
| **Total Load (MW)** | | **3.94** | **1.59** | **3.01** | **8.53** |

## DCK - SECTOR-05 (PACKAGE-1)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

**RESIDENTIAL**

| S. No. | Plot Area (sq. yds) | Type of Plot | Covered Area as per DCK Bye Laws | | | | KESC Load Criteria | | General Load | A/C Load | Max. Connected Load (W) | Connected Load at 40% DF (W) | Group Div. Factor 80% (W) | Total No. of Plots | Total Load (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | Covered Area (sq. ft) | No. of Floors | Total sq. ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | |
| 1 | 300 | R3 | 75% | 2025 | 3 | 6075 | 1.75 | 1 | 10,631 | 6,000 | 16,631 | 6652.5 | 5322 | 1 | 5.32 |
| 2 | 500 | R5 | 60% | 2700 | 3 | 8100 | 1.75 | 1 | 14,175 | 6,000 | 20,175 | 8070 | 6456 | 595 | 3841.32 |
| 3 | 1000 | R10 | 50% | 4500 | 3 | 13500 | 1.75 | 2 | 23,625 | 12,000 | 35,625 | 14250 | 11400 | 8 | 91.20 |
| | | | | | | | | | | | | | TOTAL | 604 | 3937.84 |

## DCK - SECTOR-05 (PACKAGE-1)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

**AMENITIES**

| S. No. | Plot Area (sq.yds) | Type of Plot | Covered Area as per DCK Bye Laws | | | | KESC Load Criteria | | General Load | A/C Load | Water Pump Load (W) | Max. Connected Load (W) | Group Div. Factor 80% (W) | Total No. of Plots | Total Load (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | Covered Area (sq. ft) | No. of Floors | Total sq. ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | |
| 1 | 4,221.3 | COMMUNITY CENTRE | 60% | 22795.128 | 1 | 22,795.13 | 2.50 | 1 | 56,988 | 2,000 | | 58,989 | 47191.056 | 1 | 47.2 |
| 2 | 1,883.6 | MASJID | 80% | 13561.92 | 2 | 27,123.84 | 1.50 | 0 | 40,686 | 0 | | 40,686 | 32548.608 | 1 | 32.5 |
| 3 | 944.0 | KINDER GARTEN | 100% | 8496 | 1 | 8,496.00 | 1.50 | 1 | 12,744 | 2,000 | | 14,745 | 11796 | 1 | 11.8 |
| 4 | 1,064.0 | KINDER GARTEN | 100% | 9576 | 1 | 9,576.00 | 1.50 | 1 | 14,364 | 2,000 | | 16,365 | 13092 | 1 | 13.1 |
| 5 | 6,413.0 | PRIMARY EDUCATION | 40% | 23086.8 | 3 | 69,260.40 | 2.50 | 3 | 173,151 | 18,000 | | 191,154 | 152923.2 | 1 | 152.9 |
| 6 | 9,412.0 | SECONDARY EDUCATION | 40% | 33883.056 | 3 | 101,649.17 | 2.50 | 4 | 254,123 | 24,000 | | 278,127 | 222501.536 | 1 | 222.5 |
| 7 | 6,807.0 | NURSERY | 100% | 61263 | 1 | - | 4.9kW fixed for any area | 0 | 4,900 | 0 | | 4,900 | 3920 | 1 | 3.9 |
| 8 | 439.0 | PARK & PG | 100% | 3951 | 1 | 3,951.00 | 1.50 | 0 | 5,927 | 0 | | 5,927 | 4741.2 | 1 | 4.7 |
| 9 | 486.0 | PARK & PG | 100% | 4374 | 1 | 4,374.00 | 1.50 | 0 | 6,561 | 0 | | 6,561 | 5248.8 | 1 | 5.2 |
| 10 | 880.0 | PARK & PG | 100% | 7920 | 1 | 7,920.00 | 1.50 | 0 | 11,880 | 0 | | 11,880 | 9504 | 1 | 9.5 |
| 11 | 1,327.0 | PARK & PG | 100% | 11943 | 1 | 11,943.00 | 1.50 | 0 | 17,915 | 0 | | 17,915 | 14331.6 | 1 | 14.3 |
| 12 | 5,798.0 | PARK & PG | 100% | 52182 | 1 | 52,182.00 | 1.50 | 0 | 78,273 | 0 | | 78,273 | 62618.4 | 1 | 62.6 |
| 13 | 14,872.0 | PARK & PG | 100% | 133848 | 1 | 133,848.00 | 1.50 | 0 | 200,772 | 0 | | 200,772 | 160617.6 | 1 | 160.6 |
| 14 | 11,481.2 | PARK & PG | 100% | 103331 | 1 | 103,330.62 | 1.50 | 0 | 154,996 | 0 | | 154,996 | 123996.744 | 2 | 248.0 |
| 15 | 25,685.0 | PARK & PG | 100% | 231165 | 1 | 231,165.00 | 1.50 | 0 | 346,748 | 0 | | 346,748 | 277398 | 1 | 277.4 |
| 16 | 16,447.0 | PARK & PG | 100% | 148023 | 1 | 148,023.00 | 1.50 | 0 | 222,035 | 0 | | 222,035 | 177627.6 | 1 | 177.6 |
| 17 | 478.7 | DISPENSARY | 80% | 3446.784 | 1 | 3,446.78 | 5.00 | 0 | 17,234 | 0 | | 17,234 | 13787.136 | 1 | 13.8 |
| 18 | 1,017.5 | UTILITY | 100% | 9157.5 | 1 | 9,157.50 | 10.00 | 0 | 91,575 | 0 | | 91,575 | 73260 | 1 | 73.3 |
| 19 | 319.0 | PARKING | 100% | 2871 | 1 | 2,871.00 | 0.75 | 0 | 2,153 | 0 | | 2,153 | 1722.6 | 1 | 1.7 |
| 20 | 248.5 | PARKING | 100% | 2236.23 | 1 | 2,236.23 | 0.75 | 0 | 1,677 | 0 | | 1,677 | 1341.738 | 1 | 1.3 |
| 21 | 250.0 | PARKING | 100% | 2250 | 1 | 2,250.00 | 0.75 | 0 | 1,688 | 0 | | 1,688 | 1350 | 1 | 1.4 |
| 22 | 270.0 | PARKING | 100% | 2430 | 1 | 2,430.00 | 0.75 | 0 | 1,823 | 0 | | 1,823 | 1458 | 1 | 1.5 |
| 23 | 1,070.0 | PARKING | 100% | 9630 | 1 | 9,630.00 | 0.75 | 0 | 7,223 | 0 | | 7,223 | 5778 | 2 | 11.6 |
| 24 | 1,328.0 | PIAZZA | 100% | 11952 | 1 | 11,952.00 | 0.50 | 0 | 5,976 | 0 | | 5,976 | 4780.8 | 1 | 4.8 |
| 25 | 1,694.0 | PIAZZA | 100% | 15246 | 1 | 15,246.00 | 0.50 | 0 | 7,623 | 0 | | 7,623 | 6098.4 | 1 | 6.1 |
| 26 | 7,326.0 | PIAZZA | 100% | 65934 | 1 | 65,934.00 | 0.50 | 0 | 32,967 | 0 | | 32,967 | 26373.6 | 1 | 26.4 |
| | | | | | | | | | | | | | **TOTAL (kW)** | | **1,585.8** |

# 4

## FEEDER SIZING
## SECTOR-05 (PACKAGE-1)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
**Consulting Engineers – Architects – Planners**
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Fax: +92-21-34534691
Email: ocl-khi@osmani.com.
Web: www.osmani.com

# D.H.A CITY
# SECTOR-05 (PACKAGE 1)
# RING MAIN VOLTAGE DROPS (CALCULATIONS)

## RING MAIN NO.1 (FEEDER NO. 1)

| | |
|---|---|
| **Ring Main No. 1 (Feeder No. 1) Load** | **= 3.78 MW** |
| a) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from 1st transformer to grid station | = 3351 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 3.351 x 0.158 | = 204.91 Volts |
| b) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from last transformer to switching station | = 288 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.288 x 0.158 | = 17.61 Volts |
| c) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from transformer to transformer | = 2018 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 2.018 x 0.158 | = 123.4 Volts |
| Total voltage drop for ring main no.1 = 204.91 + 17.61 + 123.4 | = 345.92 Volts |
| % Voltage drop = 345.92 x 100 / 11000 | = 3.15 % |

## RING MAIN NO.2 (FEEDER NO. 2)

| | |
|---|---|
| **Ring Main No. 2 (Feeder No. 2) Load** | **= 3.76 MW** |
| a) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from 1st transformer to grid station | = 2921 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 2.291 x 0.158 | = 140.1 Volts |
| b) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from last transformer to switching station | = 304 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.304 x 0.158 | = 18.59 Volts |
| c) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from transformer to transformer | = 1544 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 1.544 x 0.158 | = 94.42 Volts |
| Total voltage drop for Ring Main No.2 = 140.1 + 18.59 + 94.42 | = 253.11 Volts |
| % Voltage drop = 253.11 x 100 / 11000 | = 2.30 % |

## EXPRESS FEEDER # 1

| | |
|---|---|
| d) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from grid station to switching station | = 3713 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 3.713 x 0.158 | = 227 Volts |
| % Voltage drop = 227 x 100 / 11000 | = 2.1 % |

# 5

## LV- VOLTAGE DROP
## SECTOR-05 (PACKAGE-1)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-1)
.DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
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# D.H.A CITY
## SECTOR-05 (PACKAGE-1)
## DESIGN CALCULATIONS

| S. No. | FEEDER ROUTE | | FEEDER LENGTH | LOAD ON FEEDER | | FEEDER PILLAR | | CABLE SIZE CALCULATIONS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | INCOMING (TP MCCB) | OUTGOING (TP MCCB) | Method of Installation | DERATING FACTORS | | | | Reqd Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable | Type of Cable | Cable Voltage Drop | Actual VD in Cable Vd |
| | From | To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | | mV/A/ | Volts |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 1 | FP 1/2 | FP 1/1 | 45 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 | A | 0.97 | 4.90 |
| 2 | TRAFO-1 (1000 kVA) | FP 1/2 | 129 | 117.0 | 253 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 263 | | 300 | 286 | 253 | A | 0.26 | 8.48 |
| 3 | TRAFO-1 (1000 kVA) | FP 1/3 | 67 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 6.77 |
| 4 | FP 1/5 | FP 1/4 | 64 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 6.43 |
| 5 | TRAFO-1 (1000 kVA) | FP 1/5 | 51 | 117.00 | 253 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 263 | | 300 | 286 | 253 | A | 0.26 | 3.34 |
| 6 | FP 1/7 | FP 1/6 | 107 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 10.80 |
| 7 | TRAFO-1 (1000 kVA) | FP 1/7 | 41 | 130.00 | 281 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 292 | 2 | 95 | 154 | 140 | A | 0.72 | 4.18 |
| 8 | TRAFO-1 (1000 kVA) | FP 1/8 | 79 | 119.00 | 257 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 267 | | 300 | 286 | 257 | A | 0.26 | 5.28 |
| 9 | FP 1/8 | FP 1/9 | 32 | 54.00 | 117 | (125A) TP | (8 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 121 | | 70 | 130 | 117 | A | 0.97 | 3.64 |
| 10 | TRAFO-1 (1000 kVA) | FP 1/10 | 121 | 110.50 | 239 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 248 | | 240 | 253 | 239 | A | 0.31 | 8.96 |
| 11 | FP 1/10 | FP 1/11 | 18 | 45.50 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 | A | 1.45 | 2.61 |
| 7 | FP 2/2 | FP 2/1 | 20 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 2.07 |
| 8 | TRAFO-2 (500 kVA) | FP 2/2 | 159 | 123.50 | 267 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 277 | | 300 | 286 | 267 | A | 0.26 | 11.04 |
| 9 | TRAFO-2 (500 kVA) | FP 2/3 | 68 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 6.84 |
| 10 | TRAFO-2 (500 kVA) | FP 2/4 | 111 | 97.00 | 210 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 218 | | 185 | 220 | 210 | A | 0.39 | 9.09 |
| 11 | FP 2/4 | FP 2/5 | 9 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 | A | 0.97 | 0.96 |
| 12 | TRAFO-2 (500 kVA) | FP 2/6 | 172 | 32.50 | 70 | (80A) TP | (5 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 73 | | 70 | 130 | 70 | A | 0.97 | 11.71 |
| 9 | TRAFO-3 (500 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-3 | | | | | | | | | | | | | | |
| 9 | TRAFO-3 (500 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-3 | | | | | | | | | | | | | | |
| 10 | TRAFO-3 (500 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-3 | | | | | | | | | | | | | | |
| 11 | TRAFO-3 (500 kVA) | MK | | 29.02 | 63 | Feed From Trafo-3 | | | | | | | | | | | | | | |
| 11 | TRAFO-4 (500 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-4 | | | | | | | | | | | | | | |
| 11 | TRAFO-4 (500 kVA) | C2-S | | 96.54 | 209 | Feed From Trafo-4 | | | | | | | | | | | | | | |

# D.H.A CITY
## SECTOR-05 (PACKAGE-1)
## DESIGN CALCULATIONS

| S. No. | FEEDER ROUTE | | FEEDER LENGTH | LOAD ON FEEDER | | FEEDER PILLAR | | CABLE SIZE CALCULATIONS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | INCOMING (TP MCCB) | OUTGOING (TP MCCB) | Method of Installation | DERATING FACTORS | | | | Reqd Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable | Type of Cable | Cable Voltage Drop | Actual VD in Cable Vd |
| | From | To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | | mV/A/ | Volts |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 7 | FP 4/2 | FP 4/1 | 58 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 5.88 |
| 8 | TRAFO-4 (500 kVA) | FP 4/2 | 59 | 120.90 | 261 | (125A) TP | (8 x 15A) + (10A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 271 | | 300 | 286 | 261 | A | 0.26 | 3.97 |
| 9 | TRAFO-4 (500 kVA) | FP 4/3 | 14 | 14.50 | 31 | (50A) TP | (30A + 5A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 33 | | 16 | 59 | 31 | A | 4.2 | 1.83 |
| 11 | TRAFO-5 (500 kVA) | PARK | | 175.00 | 378 | Feed From Trafo-5 | | | | | | | | | | | | | | |
| 7 | TRAFO-5 (500 kVA) | FP 5/1 | 41 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 4.14 |
| 8 | TRAFO-5 (500 kVA) | FP 5/2 | 129 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 13.01 |
| 9 | TRAFO-5 (500 kVA) | FP 5/3 | 42 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 | A | 1.95 | 6.91 |
| 11 | TRAFO-6 (500 kVA) | PARK | | 160.60 | 347 | Feed From Trafo-6 | | | | | | | | | | | | | | |
| 7 | TRAFO-6 (500 kVA) | FP 6/1 | 32 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 | A | 0.97 | 3.47 |
| 7 | TRAFO-6 (500 kVA) | FP 6/2 | 16 | 58.50 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 131 | | 95 | 154 | 126 | A | 0.72 | 1.50 |
| 7 | TRAFO-6 (500 kVA) | FP 6/3 | 38 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 3.81 |
| 26 | TRAFO-7 (500 kVA) | FP 7/1 | 15 | 41.00 | 89 | (100A) TP | (6 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 92 | | 50 | 106 | 89 | A | 1.45 | 1.93 |
| 27 | TRAFO-7 (500 kVA) | FP 7/2 | 26 | 58.50 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 131 | | 95 | 154 | 126 | A | 0.72 | 2.40 |
| 28 | TRAFO-7 (500 kVA) | FP 7/3 | 57 | 79.30 | 171 | (200A) TP | (2 x 5A) + (40A) + (150A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 178 | | 150 | 197 | 171 | A | 0.47 | 4.56 |
| 29 | TRAFO-7 (500 kVA) | FP 7/4 | 97 | 130.00 | 281 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 292 | 2 | 95 | 154 | 140 | A | 0.72 | 9.80 |
| 30 | FP 7/4 | FP 7/5 | 9 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 0.89 |
| 31 | TRAFO-8 (500 kVA) | FP 8/1 | 131 | 45.50 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 102 | | 50 | 106 | 98 | A | 1.45 | 18.61 |
| 32 | TRAFO-8 (500 kVA) | FP 8/2 | 42 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 4.22 |
| 33 | TRAFO-8 (500 kVA) | FP 8/3 | 7 | 58.50 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 131 | | 95 | 154 | 126 | A | 0.72 | 0.60 |
| 34 | TRAFO-8 (500 kVA) | FP 8/4 | 79 | 130.00 | 281 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 292 | 2 | 95 | 154 | 140 | A | 0.72 | 7.99 |

# D.H.A CITY
## SECTOR-05 (PACKAGE-1)
## DESIGN CALCULATIONS

| S. No. | FEEDER ROUTE | | FEEDER LENGTH | LOAD ON FEEDER | | FEEDER PILLAR | | CABLE SIZE CALCULATIONS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | INCOMING (TP MCCB) | OUTGOING (TP MCCB) | Method of Installation | DERATING FACTORS | | | | Reqd Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable | Type of Cable | Cable Voltage Drop | Actual VD in Cable Vd |
| | From | To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | | mV/A/ | Volts |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 35 | FP 8/4 | FP 8/5 | 23 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 2.37 |
| 37 | TRAFO-9 (1000 kVA) | FP 9/1 | 13 | 102.27 | 221 | (250A) TP | (225A + 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 229 | | 240 | 253 | 221 | A | 0.31 | 0.90 |
| 9 | TRAFO-9 (500 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-9 | | | | | | | | | | | | | | |
| 9 | TRAFO-9 (500 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-9 | | | | | | | | | | | | | | |
| 9 | TRAFO-10 (1000 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-10 | | | | | | | | | | | | | | |
| 9 | TRAFO-10 (1000 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-10 | | | | | | | | | | | | | | |
| 9 | TRAFO-10 (1000 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-10 | | | | | | | | | | | | | | |
| 9 | TRAFO-10 (1000 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-10 | | | | | | | | | | | | | | |
| 9 | TRAFO-10 (1000 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-10 | | | | | | | | | | | | | | |
| 9 | TRAFO-10 (1000 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-10 | | | | | | | | | | | | | | |
| 11 | TRAFO-11 (1000 kVA) | PARK | | 277.40 | 599 | Feed From Trafo-11 | | | | | | | | | | | | | | |
| 45 | FP 11/2 | FP 11/1 | 23 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 2.37 |
| 46 | TRAFO-11 (1000 kVA) | FP 11/2 | 41 | 130.00 | 281 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 292 | 2 | 95 | 154 | 140 | A | 0.72 | 4.18 |
| 47 | TRAFO-11 (1000 kVA) | FP 11/3 | 23 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 | A | 0.97 | 2.51 |
| 48 | TRAFO-11 (1000 kVA) | FP 11/4 | 112 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 11.31 |
| 49 | TRAFO-11 (1000 kVA) | FP 11/5 | 61 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 | A | 0.97 | 6.69 |
| 50 | TRAFO-11 (1000 kVA) | FP 11/6 | 50 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 5.07 |
| 9 | TRAFO-12 (500 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-12 | | | | | | | | | | | | | | |
| 9 | TRAFO-12 (500 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-12 | | | | | | | | | | | | | | |
| 9 | TRAFO-12 (500 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-12 | | | | | | | | | | | | | | |
| 9 | TRAFO-12 (500 kVA) | KINDER GARTEN | | 11.80 | 25 | Feed From Trafo-12 | | | | | | | | | | | | | | |
| 9 | TRAFO-13 (500 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-13 | | | | | | | | | | | | | | |

# D.H.A CITY
## SECTOR-05 (PACKAGE-1)
## DESIGN CALCULATIONS

| S. No. | FEEDER ROUTE | | FEEDER LENGTH | LOAD ON FEEDER | | FEEDER PILLAR | | CABLE SIZE CALCULATIONS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | INCOMING (TP MCCB) | OUTGOING (TP MCCB) | Method of Installation | DERATING FACTORS | | | | Reqd Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable | Type of Cable | Cable Voltage Drop | Actual VD in Cable Vd |
| | From | To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | | mV/A/ | Volts |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 54 | TRAFO-13 (500 kVA) | FP 13/1 | 51 | 39.20 | 85 | (100A) TP | (30A + 80A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 85 | A | 1.95 | 8.39 |
| 55 | TRAFO-13 (500 kVA) | FP 13/2 | 23 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 | A | 1.95 | 3.79 |
| 56 | TRAFO-13 (500 kVA) | FP 13/3 | 18 | 58.50 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 131 | | 95 | 154 | 126 | A | 0.72 | 1.66 |
| 57 | TRAFO-13 (500 kVA) | FP 13/4 | 79 | 104.00 | 225 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 233 | | 240 | 253 | 225 | A | 0.31 | 5.50 |
| 58 | FP 13/4 | FP 13/5 | 42 | 58.50 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 131 | | 95 | 154 | 126 | A | 0.72 | 3.79 |
| 59 | FP 14/2 | FP 14/1 | 17 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 1.74 |
| 60 | TRAFO-14 (500 kVA) | FP 14/2 | 31 | 130.00 | 281 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 292 | 2 | 95 | 154 | 140 | A | 0.72 | 3.11 |
| 61 | TRAFO-14 (500 kVA) | FP 14/3 | 31 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 3.11 |
| 62 | TRAFO-14 (500 kVA) | FP 14/4 | 47 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 4.73 |
| 63 | TRAFO-14 (500 kVA) | FP 14/5 | 86 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 8.73 |
| 67 | FP 15/2 | FP 15/1 | 17 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 1.74 |
| 68 | TRAFO-15 (500 kVA) | FP 15/2 | 30 | 130.00 | 281 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 292 | 2 | 95 | 154 | 140 | A | 0.72 | 3.03 |
| 69 | TRAFO-15 (500 kVA) | FP 15/3 | 17 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 70 | A | 0.72 | 0.85 |
| 70 | TRAFO-15 (500 kVA) | FP 15/4 | 45 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 4.55 |
| 71 | TRAFO-15 (500 kVA) | FP 15/5 | 82 | 61.80 | 133 | (150A) TP | (7 x 15A) + (40A) + (5A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 139 | | 95 | 154 | 133 | A | 0.72 | 7.87 |
| 73 | TRAFO-16 (500 kVA) | FP 16/1 | 97 | 99.30 | 214 | (225A) TP | (4 x 15A) + (200A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 223 | | 240 | 253 | 214 | A | 0.31 | 6.42 |
| 74 | TRAFO-16 (500 kVA) | FP 16/2 | 11 | 61.80 | 133 | (150A) TP | (6 x 15A) + (2 x 30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 139 | | 95 | 154 | 133 | A | | 0.00 |

# D.H.A CITY
## SECTOR-05 (PACKAGE-1)
## DESIGN CALCULATIONS

| S. No. | FEEDER ROUTE | | FEEDER LENGTH | LOAD ON FEEDER | | FEEDER PILLAR | | CABLE SIZE CALCULATIONS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | INCOMING (TP MCCB) | OUTGOING (TP MCCB) | Method of Installation | DERATING FACTORS | | | | Reqd Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable | Type of Cable | Cable Voltage Drop | Actual VD in Cable Vd |
| | From | To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_t$ | $S_t$ | $G_t$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | | mV/A/ | Volts |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 75 | TRAFO-16 (500 kVA) | FP 16/3 | 15 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 117 | | 70 | 130 | 112 | A | 0.97 | 1.63 |
| 76 | TRAFO-16 (500 kVA) | FP 16/4 | 54 | 107.30 | 232 | (125A) TP | (6 x 15A) + (30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 241 | | 240 | 253 | 232 | A | 0.31 | 3.92 |
| 77 | FP 16/4 | FP 16/5 | 40 | 56.90 | 123 | (150A) TP | (7 x 15A) + (30A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 128 | | 70 | 130 | 123 | A | 0.97 | 4.80 |
| 11 | TRAFO-17 (500 kVA) | PARK | | 123.90 | 268 | Feed From Trafo-17 | | | | | | | | | | | | | | |
| 11 | TRAFO-17 (500 kVA) | COMMUNITY | | 47.20 | 102 | Feed From Trafo-17 | | | | | | | | | | | | | | |
| 77 | TRAFO-17 (500 kVA) | FP 17/1 | 15 | 104.00 | 225 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 233 | | 240 | 253 | 225 | A | 0.31 | 1.04 |
| 78 | FP 17/1 | FP 17/2 | 25 | 39.00 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 88 | | 35 | 90 | 84 | A | 1.95 | 4.09 |
| 79 | TRAFO-17 (500 kVA) | FP 17/3 | 68 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 6.91 |
| 11 | TRAFO-18 (500 kVA) | MASJID | | 32.50 | 70 | Feed From Trafo-18 | | | | | | | | | | | | | | |
| 81 | TRAFO-18 (500 kVA) | FP 18/1 | 5 | 90.28 | 195 | (225A) TP | (2 x 125A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 203 | | 185 | 220 | 98 | A | 0.39 | 0.21 |
| 82 | TRAFO-18 (500 kVA) | FP 18/2 | 7 | 90.28 | 195 | (225A) TP | (2 x 125A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 203 | | 185 | 220 | 195 | A | 0.39 | 0.56 |
| 83 | TRAFO-18 (500 kVA) | FP 18/3 | 31 | 90.28 | 195 | (225A) TP | (2 x 125A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 203 | | 185 | 220 | 195 | A | 0.39 | 2.34 |
| 11 | TRAFO-19 (500 kVA) | PRIMARY | | 152.90 | 330 | Feed From Trafo-19 | | | | | | | | | | | | | | |
| 11 | TRAFO-19 (500 kVA) | M2 | | 45.14 | 98 | Feed From Trafo-19 | | | | | | | | | | | | | | |
| 11 | TRAFO-19 (500 kVA) | M2 | | 45.14 | 98 | Feed From Trafo-19 | | | | | | | | | | | | | | |
| 90 | TRAFO-19 (500 kVA) | FP 19/1 | 5 | 40.70 | 88 | (100A) TP | (40A + 60A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 91 | | 50 | 106 | 88 | A | 1.45 | 0.65 |
| 9 | TRAFO-20 (1000 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-20 | | | | | | | | | | | | | | |
| 9 | TRAFO-20 (1000 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-20 | | | | | | | | | | | | | | |
| 9 | TRAFO-20 (1000 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-20 | | | | | | | | | | | | | | |
| 9 | TRAFO-20 (1000 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-20 | | | | | | | | | | | | | | |
| 9 | TRAFO-20 (1000 kVA) | C-2 | | 96.54 | 209 | Feed From Trafo-20 | | | | | | | | | | | | | | |
| 83 | TRAFO-20 (1000 kVA) | FP 20/1 | 7 | 102.31 | 221 | (250A) TP | (250A + 15A) TP | D | 0.93 | 1.15 | 0.90 | 0.96 | 230 | | 240 | 253 | 221 | A | 0.31 | 0.45 |

# D.H.A CITY
## SECTOR-05 (PACKAGE-1)
## DESIGN CALCULATIONS

| S. No. | FEEDER ROUTE | | FEEDER LENGTH | LOAD ON FEEDER | | FEEDER PILLAR | | CABLE SIZE CALCULATIONS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | INCOMING (TP MCCB) | OUTGOING (TP MCCB) | Method of Installation | DERATING FACTORS | | | | Reqd Current Carrying Capacity for Cable In/ODF | | Selected Size & Numbers | Current Carrying Capacity as per IEE Regulations | Load Current per Parallel Cable | Type of Cable | Cable Voltage Drop | Actual VD in Cable Vd |
| | From | To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | | mV/A/ | Volts |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | | TRAFO-1 & TRAFO-2 ARE COMING FROM SECTOR-5 (PACKAGE-2) | | | | | | | | | | | | | | | | | | |
| 1 | TRAFO-1 (1000 kVA) | FP 1/1 | 72 | 90.2 | 195 | (225A) TP | (2 x 125A) | D | 0.93 | 1.15 | 0.9 | 0.96 | 202 | | 185 | 220 | 195 | A | 0.39 | 5.45 |
| 2 | TRAFO-1 (1000 kVA) | FP 1/2 | 41 | 90.2 | 195 | (225A) TP | (2 x 125A) | D | 0.93 | 1.15 | 0.9 | 0.96 | 202 | | 185 | 220 | 195 | A | 0.39 | 3.11 |
| 3 | TRAFO-1 (1000 kVA) | FP 1/3 | 7 | 91.9 | 199 | (225A) TP | (2 x 125A) + (5A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 206 | | 185 | 220 | 199 | A | 0.39 | 0.57 |
| 4 | TRAFO-1 (1000 kVA) | FP 1/4 | 92 | 56.9 | 123 | (150A) TP | (7 x 15A) + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 128 | | 70 | 130 | 123 | A | 0.97 | 10.94 |
| 5 | TRAFO-1 (1000 kVA) | FP 1/5 | 153 | 45.5 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 102 | | 50 | 106 | 49 | A | 1.45 | 10.92 |
| 45 | TRAFO-1 (1000 kVA) | SECONDARY | | 222.5 | 481 | Feed From Trafo-1 | | | 0.93 | 1.15 | 0.9 | 0.96 | | | | | | | | |
| 11 | FP 2/2 | FP 2/1 | 59 | 44.3 | 96 | (100A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 99 | | 50 | 106 | 96 | A | 1.45 | 8.17 |
| 12 | TRAFO-2 (500 kVA) | FP 2/2 | 23 | 106.1 | 229 | (150A) TP | (6 x 15A) + (2 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 238 | | 240 | 253 | 229 | A | 0.31 | 1.66 |
| 13 | TRAFO-2 (500 kVA) | FP 2/3 | 35 | 56.9 | 123 | (150A) TP | (7 x 15A) + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 128 | | 70 | 130 | 123 | A | 0.97 | 4.19 |
| 14 | TRAFO-2 (500 kVA) | FP 2/4 | 58 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | A | 0.72 | 5.84 |
| 15 | TRAFO-2 (500 kVA) | FP 2/5 | 120 | 60.5 | 131 | (150A) TP | (9 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 136 | | 95 | 154 | 131 | A | 0.72 | 11.32 |
| 45 | TRAFO-2 (500 kVA) | PARK | | 96.3 | 208 | Feed From Trafo-2 | | | 0.93 | 1.15 | 0.9 | 0.96 | | | | | | | | |

**Factor will applied**

*a) Ground Temperature factor($T_f$) at 25$^0$ C=0.93*
*b) Grouping factor($G_f$) =0.90*
*a) Soil Resistivity Factor (Sc) @ 1.2 K.m/w = 1.15*
*c) Overall Derating factor(odf) =TfxGf*
*d) design current ($I_b$)*
*e) Current setting of device($I_n$)*
*e) Tabulated Current Rating ($I_t$)*
*f) Current carrying capacity of cable for continuous service(IZ= It x odf)*

***NOTE:ALL the above calculation refer to IEE 17th edition chapter 05***

**METHOD OF INSTALLATION**

A = Conduit in thermally insulated wall conduit
B = Clipped on wall
C = Direct in masonry
D = Buried in ground
E or F = On cable trays

**Maximum Voltage Drop 5% Allowed**
400 V = 20 V
**REF:**
NEPRA DISTRIBUTION CODE= DPC-11.(b) Page No.55

**TYPE OF CABLE**

A- AL, xLPE,PVC /SWA /PVC

# 6

## LOADING OF TRANSFORMERS IN SECTOR-05 (PACKAGE-1)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
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Web: www.osmani.com

# D.H.A CITY
# SECTOR-05 (PACKAGE-1)

| FEEDER | | TRANSFORMERS |
|---|---|---|
| Feeder No: | 1 | 1000 kVA(TYPE-A) =1 b) 1000 kVA(TYPE-B)=1 |
| Feeder Load: | 3.78 MW | 500 kVA(TYPE-A) =1 b) 500 kVA(TYPE-B) =7 |

| S. No. | TRANSFORMER | | | | |
|---|---|---|---|---|---|
| | TR-No. | Rating kVA | Rating kW | Connected Load kW | Loading Efficiency % |
| 1 | 1 | 1000 | 800 | 658.5 | 82.31% |
| 2 | 2 | 500 | 400 | 318.5 | 79.63% |
| 3 | 3 | 500 | 400 | 318.6 | 79.65% |
| 4 | 4 | 500 | 400 | 324.6 | 81.15% |
| 5 | 5 | 500 | 400 | 344 | 86.00% |
| 6 | 6 | 500 | 400 | 336.1 | 84.03% |
| 7 | 7 | 500 | 400 | 308.8 | 77.20% |
| 8 | 8 | 500 | 400 | 299 | 74.75% |
| 9 | 9 | 500 | 400 | 295.39 | 73.85% |
| 10 | 10 | 1000 | 800 | 579.24 | 72.41% |

| FEEDER | | TRANSFORMERS |
|---|---|---|
| Feeder No: | 2 | 1000 kVA(TYPE-A) =1 b) 1000 kVA(TYPE-B)=1 |
| Feeder Load: | 3.76 MW | 500 kVA(TYPE-A) =1 b) 500 kVA(TYPE-B) =7 |

| S. No. | TRANSFORMER | | | | |
|---|---|---|---|---|---|
| | TR-No. | Rating kVA | Rating kW | Connected Load kW | Loading Efficiency % |
| 1 | 11 | 1000 | 800 | 641.4 | 80.18% |
| 2 | 12 | 500 | 400 | 301.42 | 75.36% |
| 3 | 13 | 500 | 400 | 337.28 | 84.32% |
| 4 | 14 | 500 | 400 | 325 | 81.25% |
| 5 | 15 | 500 | 400 | 321.2 | 80.30% |
| 6 | 16 | 500 | 400 | 320.4 | 80.10% |
| 7 | 17 | 500 | 400 | 340.1 | 85.03% |
| 8 | 18 | 500 | 400 | 303.4 | 75.85% |
| 9 | 19 | 500 | 400 | 283.89 | 70.97% |
| 10 | 20 | 1000 | 800 | 585 | 73.13% |

# 8

## BoQ

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-1)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
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# ENGINEER'S ESTIMATE

**CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI**
**NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS**
**LOCATION : DHA CITY SECTOR '05' (PACKAGE-1)**
**SUB-HEAD : ELECTRICAL WORKS LV DISTRIBUTION**

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| 1 | **EXCAVATION**<br>Excavation and back filling as in hard/sofft or any soil upto 1.0m depth and 0.9m wide for MV/LV/ITC cable and pipe trenches complete as directed by the Engineer.(Excluding cost of cable & pipe) | 4,425 | Cum | 900 | 3,982,500 |
| 1.1 | Excavation and back filling as in hard/sofft or any soil upto 1.0m depth and 0.6m wide for LV/ITC cable and pipe trenches complete as directed by the Engineer.(Excluding cost of cable & pipe) | 1,500 | Cum | 900 | 1,350,000 |
| 2 | **LV CABLE**<br>Supply, laying , conecting and testing Cable electric LV 600/1000V stranded aluminium conductor, XLPE insulated, Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, sand,warning tap with all accessories as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| 2.1) | 4 core 300mm² AL, XLPE,PVC / SWA / PVC | 477 | m | 5,600 | 2,671,200 |
| 2.2) | 4 core 240mm² AL, XLPE,PVC / SWA / PVC | 409 | m | 4,500 | 1,840,500 |
| 2.3) | 4 core 185mm² AL, XLPE,PVC / SWA / PVC | 274 | m | 3,500 | 959,000 |
| 2.4) | 4 core 150mm² AL, XLPE,PVC / SWA / PVC | 57 | m | 2,800 | 159,600 |
| 2.6) | 4 core 95mm² AL, XLPE,PVC / SWA / PVC | 2,197 | m | 2,000 | 4,394,000 |
| 2.7) | 4 core 70mm² AL, XLPE,PVC / SWA / PVC | 556 | m | 1,750 | 973,000 |
| 2.8) | 4 core 50mm² AL, XLPE,PVC / SWA / PVC | 381 | m | 1,200 | 457,200 |
| 2.9) | 4 core 35mm² AL, XLPE,PVC / SWA / PVC | 141 | m | 950 | 133,950 |
| 2.10) | 4 core 16mm² AL, XLPE,PVC / SWA / PVC | 14<br>4,506 | m | 630 | 8,820 |
| 3 | Danger sign for MV & LV not less than 250 X 125 mm enameled as required, supply and fixing. | 110 | Each | 2,000 | 220,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4 | **Feeder pillar**<br>Providing, installing, testing and commissioning of floor mounted Feeder pillar in 16 SWG sheet steel housing, dust, weather proof IP-54 paint, hinged door/lock, suitable for 3 phase neutral and earth strip 400 volts, Almunium busbars & Insulators for distribution to out going breakers.Seperate Almunium busbars chamber in locking arrangement. Installed on RCC pad, including cost of RCC foundation, complete as per Drawings and accessories as Directed by the engineer. | | | | |
| 4.1) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>10-10A to 60A TP MCCB 16KA | 35 | Each | 255,000 | 8.925,000 |
| 4.2) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>9-10A to 60A TP MCCB 16KA<br>1-TP MCCB Space only | 9 | Each | 245.000 | 2,205,000 |
| 4.3) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>8-10A to 60A TP MCCB 16KA<br>2-TP MCCB Space only | 12 | Each | 235,000 | 2,820,000 |
| 4.4) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>7-10A to 60A TP MCCB 16KA<br>3-TP MCCB Space only | 8 | Each | 225,000 | 1,800.000 |
| 4.5) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>6-10A to 60A TP MCCB 16KA<br>4-TP MCCB Space only | 3 | Each | 205,000 | 615,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4.6) a) | **Incoming**<br>1-80A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br><br>**Outgoing**<br>5-10A to 60A TP MCCB 16KA<br>5-TP MCCB Space only | 1 | Each | 200,000 | 200,000 |
| 4.6) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>4-10A to 60A TP MCCB 16KA<br>1-200A TP MCCB 25KA<br>5-TP MCCB Space only | 1 | Each | 200,000 | 200,000 |
| 4.7) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>3-10A to 60A TP MCCB 16KA<br>1-150A TP MCCB 25KA<br>6-TP MCCB Space only | 1 | Each | 190,000 | 190,000 |
| 4.7) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>1-10A to 60A TP MCCB 16KA<br>2-125A TP MCCB 25KA<br>7-TP MCCB Space only | 1 | Each | 170,000 | 170,000 |
| 4.8) a) | **Incoming**<br>1-50A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>2-10A to 60A TP MCCB 16KA<br>8-TP MCCB Space only | 1 | Each | 160,000 | 160,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4.8) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>1-10A to 60A TP MCCB 16KA<br>1-80A TP MCCB 25KA<br>8-TP MCCB Space only | 1 | Each | 160,000 | 160,000 |
| 4.8) c) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>2-10A to 60A TP MCCB 16KA<br>8-TP MCCB Space only | 1 | Each | 155,000 | 155,000 |
| 4.8) d) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>1-10A to 60A TP MCCB 16KA<br>1-225A TP MCCB 25KA<br>8-TP MCCB Space only | 2 | Each | 160,000 | 320,000 |
| 4.8) e) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>2-125A TP MCCB 25KA<br>8-TP MCCB Space only | 5 | Each | 160,000 | 800,000 |
| 5 | **Earthing Electrodes**<br>Supply, installation, connection & testing of copper earth electrodes, 20mm dia, 3000mm in length, driven vertically in ground, including cost of Test pit 300x300x300mm, internal plaster, 100mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 85 | Job | 45,000 | 3,825,000 |
| 6 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Feeder Pillars as shown on the drawing. or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 850 | m | 500 | 425,000 |
| | | | | **Total of Rs.** | **40,119,770** |

# ENGINEER'S ESTIMATE

**CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI**
**NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS**
**LOCATION : DHA CITY SECTOR '05' (PACKAGE-1)**
**SUB-HEAD : ELECTRICAL WORKS MV DISTRIBUTION.** **(Feeders & Express feeder)**

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| 1 | **MV CABLE**<br>Supply,laying and conecting, Cable electric MV 15-kV stranded aluminium conductor, XLPE insulated,Triple Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, soft sand coushion, warning tape, Marker as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| | **FEEDER No 1.** | | | | |
| 1.1) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-1 as shown on the drawings. | 3,351 | m | 7,600 | 25,467,600 |
| 1.2) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 2,018 | m | 7,600 | 15,336,800 |
| 1.3) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-10 to Switch station-1 as shown on the drawings. | 288 | m | 7,600 | 2,188,800 |
| | **FEEDER No 2.** | | | | |
| 1.4) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-11 as shown on the drawings. | 2,921 | m | 7,600 | 22,199,600 |
| 1.5) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 1,544 | m | 7,600 | 11,734,400 |
| 1.6) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-20 to Switch station-1 as shown on the drawings. | 304 | m | 7,600 | 2,310,400 |
| | **EXPRESS FEEDER-1** | | | | |
| 1.7) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from Grid station to Switch station-1 as shown on the drawings. | 3,713 | m | 7,600 | 28,218,800 |
| 2 | PVC straight joint, MV 15kV, for XLPE cable consisting of mould, resin, MV tape, semi conducting tape, ferrules and earth wire etc. suitable for MV cables, 3 core 300mm², supply and fixing complete with all installation accessories as per KESC standard. | | | | |
| | **FEEDER No 1.** | | | | |
| 2.1) | From grid station to TR-1 | 35 | Each | 80,000 | 2,800,000 |
| 2.3) | From TR-10 to Switching station. | 5 | Each | 80,000 | 400,000 |
| | **FEEDER No 2.** | | | | |
| 2.2) | From grid station to TR-11 | 30 | Each | 80,000 | 2,400,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 2.3) | From TR-20 to Switching station. | 5 | Each | 80,000 | 400,000 |
| | **EXPRESS FEEDER No 1.** | | | | |
| 2.4) | From Switching station No-1 to grid station. | 40 | Each | 80,000 | 3,200,000 |
| | **SWITCHING STATION NO-1** | | | | |
| 3 | Supply Installation, testing and commissioning outdoor type of Switching station.Substation will have **1-incoming & 2-outgoing 17.5kV** Vaccum circuit breaker (VCB), **350MVA**, **630A**, with protection devices housed in metalic frame **IP 54**. Switching station will be mounted on RCC plateform circuit breaker (CB) will be trolley raised type to avoid floor unevenness if any. The male & female contacts shall be rod & Tulip type with vertical arrangement. EFI will be installed on each cable. The breaker shall be provided with bimetalic lugs to accomodate 2-Almunium cable connection with copper bus-bars. C.T & P.T will be installed on each breaker. C.T ratio **1200/600/1/1** P.T ratio **11kV/110V**. Each VCB shall have earthing switch to ground cable. Earthing switch shall have inter-lock with "ON" Mechanism. Digital type Relays on each VCB shall be over current **2Nos**; Earth Fault one No with series/shunt trip prorivions. The relay shall have additional potential free contacts for SCADA. Relays shall have self supervision provision. SCADA provision- each VCB will have potential **"NO" & "NC"** contact for status monitoring locally as well as at remote control room through SCADA. Switching Station (SS) housing shall be designed for safe operation by operator locally. No arc should comeout in any case. As per spacification installed on RCC pad, including the cost of RCC foundation pad complete with all civil and other installation accessories as shown on the drawing or as directed by the Engineers'. | 1 | Job | 5,800,000 | 5,800,000 |
| | **NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | | | | |
| | **KIOSK SUBSTATIONS** | | | | |
| 4 | Supply, installing, conecting and testing Kiosk Sub Station **(Type-A)** with **630 Amp**. VCB **17.5 kV**, **350MVA**, **1000 kVA** Oil filled Transformer 11/0.42 kV with incoming & out going VCBs on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos MCCB** of **400 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer. | 3 | Each | 7,050,000 | 21,150,000 |
| | **NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | | | | |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amp**. VCB **17.5kV**, **350MVA**, **1000 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going load break switches with SF6 Fuses on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos** MCCB of **400 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | 6,000,000 | 12,000,000 |
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-A)** with **630 Amp**. VCB **17.5kV**, **350MVA**, **500 kVA** Oil filled Transformer **11/0.42** kV with incoming & out going VCBs on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos MCCB** of **300 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | 5,300,000 | 10,600,000 |
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amp**. VCB **17.5kV**, **350MVA**, **500 kVA** Oil filled Transformer **11/0.42** kV with incoming & out going load break switches with SF6 Fuses on MV side. Air Circuit Breaker of **1600 Amp** outgoing 6 Nos MCCB of **300 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 15 | Each | 4,300,000 | 64,500,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Earthing Electrodes** | | | | |
| 6 | Supply, installation, connection & testing of copper earth electrodes, 20mm dia, 3000mm in length, driven vertically in ground, including cost of Test pit 300x300x300mm, internal plaster, 100mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 25 | Job | 45,000 | 1,125,000 |
| 7 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Switching Station & Transformer as shown on the drawing. or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 250 | m | 500 | 125,000 |
| | | | | **Total of Rs.** | **231,956,400** |

# ENGINEER'S ESTIMATE

**CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI**
**NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS**
**LOCATION : DHA CITY SECTOR '05' (PACKAGE-1)**
**SUB-HEAD : ELECTRICAL WORKS MV DISTRIBUTION.** **(Feeders & Express feeder)**

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| 1 | **MV CABLE**<br>Supply,laying and conecting, Cable electric MV 15-kV stranded aluminium conductor, XLPE insulated,Triple Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, soft sand coushion, warning tape, Marker as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| | **FEEDER No 1.** | | | | |
| 1.1) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-1 as shown on the drawings. | 3,351 | m | 7,600 | 25,467,600 |
| 1.2) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 2,018 | m | 7,600 | 15,336,800 |
| 1.3) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-10 to Switch station-1 as shown on the drawings. | 288 | m | 7,600 | 2,188,800 |
| | **FEEDER No 2.** | | | | |
| 1.4) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-11 as shown on the drawings. | 2,921 | m | 7,600 | 22,199,600 |
| 1.5) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 1,544 | m | 7,600 | 11,734,400 |
| 1.6) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-20 to Switch station-1 as shown on the drawings. | 304 | m | 7,600 | 2,310,400 |
| | **EXPRESS FEEDER-1** | | | | |
| 1.7) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from Grid station to Switch station-1 as shown on the drawings. | 3,713 | m | 7,600 | 28,218,800 |
| 2 | PVC straight joint, MV 15kV, for XLPE cable consisting of mould, resin, MV tape, semi conducting tape, ferrules and earth wire etc. suitable for MV cables, 3 core 300mm², supply and fixing complete with all installation accessories as per KESC standard. | | | | |
| | **FEEDER No 1.** | | | | |
| 2.1) | From grid station to TR-1 | 35 | Each | 80,000 | 2,800,000 |
| 2.3) | From TR-10 to Switching station. | 5 | Each | 80,000 | 400,000 |
| | **FEEDER No 2.** | | | | |
| 2.2) | From grid station to TR-11 | 30 | Each | 80,000 | 2,400,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 2.3) | From TR-20 to Switching station. | 5 | Each | 80,000 | 400,000 |
| | **EXPRESS FEEDER No 1.** | | | | |
| 2.4) | From Switching station No-1 to grid station. | 40 | Each | 80,000 | 3,200,000 |
| | **SWITCHING STATION NO-1** | | | | |
| 3 | Supply Installation, testing and commissioning outdoor type of Switching station.Substation will have **1-incoming & 2-outgoing 17.5kV** Vaccum circuit breaker (VCB), **350MVA**, **630A**, with protection devices housed in metalic frame **IP 54**. Switching station will be mounted on RCC plateform circuit breaker (CB) will be trolley raised type to avoid floor unevenness if any. The male & female contacts shall be rod & Tulip type with vertical arrangement. EFI will be installed on each cable. The breaker shall be provided with bimetalic lugs to accomodate 2-Almunium cable connection with copper bus-bars. C.T & P.T will be installed on each breaker. C.T ratio **1200/600/1/1** P.T ratio **11kV/110V**. Each VCB shall have earthing switch to ground cable. Earthing switch shall have inter-lock with "ON" Mechanism. Digital type Relays on each VCB shall be over current **2Nos**; Earth Fault one No with series/shunt trip prorivions. The relay shall have additional potential free contacts for SCADA. Relays shall have self supervision provision. SCADA provision- each VCB will have potential **"NO" & "NC"** contact for status monitoring locally as well as at remote control room through SCADA. Switching Station (SS) housing shall be designed for safe operation by operator locally. No arc should comeout in any case. As per spacification installed on RCC pad, including the cost of RCC foundation pad complete with all civil and other installation accessories as shown on the drawing or as directed by the Engineers'. | 1 | Job | 5,800,000 | 5,800,000 |
| | **NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | | | | |
| | **KIOSK SUBSTATIONS** | | | | |
| 4 | Supply, installing, conecting and testing Kiosk Sub Station **(Type-A)** with **630 Amp**. VCB **17.5 kV**, **350MVA**, **1000 kVA** Oil filled Transformer 11/0.42 kV with incoming & out going VCBs on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos MCCB** of **400 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer. | 3 | Each | 7,050,000 | 21,150,000 |
| | **NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | | | | |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amp**. VCB **17.5kV**, **350MVA**, **1000 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going load break switches with SF6 Fuses on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos** MCCB of **400 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | 6,000,000 | 12,000,000 |
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-A)** with **630 Amp**. VCB **17.5kV**, **350MVA**, **500 kVA** Oil filled Transformer **11/0.42** kV with incoming & out going VCBs on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos MCCB** of **300 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | 5,300,000 | 10,600,000 |
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amp**. VCB **17.5kV**, **350MVA**, **500 kVA** Oil filled Transformer **11/0.42** kV with incoming & out going load break switches with SF6 Fuses on MV side. Air Circuit Breaker of **1600 Amp** outgoing 6 Nos MCCB of **300 Amp** according to KESC / WAPDA standard specifications. smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 15 | Each | 4,300,000 | 64,500,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Earthing Electrodes** | | | | |
| 6 | Supply, installation, connection & testing of copper earth electrodes, 20mm dia, 3000mm in length, driven vertically in ground, including cost of Test pit 300x300x300mm, internal plaster, 100mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 25 | Job | 45,000 | 1,125,000 |
| 7 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Switching Station & Transformer as shown on the drawing. or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 250 | m | 500 | 125,000 |
| | | | | **Total of Rs.** | **231,956,400** |

# BILL OF QUANTITIES

**CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI**
**NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS**
**LOCATION : DHA CITY SECTOR '05' (PACKAGE-1)**
**SUB-HEAD : ELECTRICAL WORKS MV DISTRIBUTION. (Feeders & Express feeder)**

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| 1 | **MV CABLE**<br>Supply,laying and conecting, Cable electric MV 15-kV stranded aluminium conductor, XLPE insulated,Triple Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, soft sand coushion, warning tape, Marker as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| | **FEEDER No 1.** | | | | |
| 1.1) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-1 as shown on the drawings. | 3,351 | m | | |
| 1.2) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 2,018 | m | | |
| 1.3) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-10 to Switch station-1 as shown on the drawings. | 288 | m | | |
| | **FEEDER No 2.** | | | | |
| 1.4) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-11 as shown on the drawings. | 2,921 | m | | |
| 1.5) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 1,544 | m | | |
| 1.6) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-20 to Switch station-1 as shown on the drawings. | 304 | m | | |
| | **EXPRESS FEEDER-1** | | | | |
| 1.7) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from Grid station to Switch station-1 as shown on the drawings. | 3,713 | m | | |
| 2 | PVC straight joint, MV 15kV, for XLPE cable consisting of mould, resin, MV tape, semi conducting tape, ferrules and earth wire etc. suitable for MV cables, 3 core 300mm², supply and fixing complete with all installation accessories as per KESC standard. | | | | |
| | **FEEDER No 1.** | | | | |
| 2.1) | From grid station to TR-1 | 35 | Each | | |
| 2.3) | From TR-10 to Switching station. | 5 | Each | | |
| | **FEEDER No 2.** | | | | |
| 2.2) | From grid station to TR-11 | 30 | Each | | |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 2.3) | From TR-20 to Switching station. | 5 | Each | | |
| | **EXPRESS FEEDER No 1.** | | | | |
| 2.4) | From Switching station No-1 to grid station. | 40 | Each | | |
| | **SWITCHING STATION NO-1** | | | | |
| 3 | Supply Installation, testing and commissioning outdoor type of Switching station.Substation will have **1-incoming & 2-outgoing 17.5kV** Vaccum circuit breaker (VCB), **350MVA**, **630A**, with protection devices housed in metalic frame **IP 54**. Switching station will be mounted on RCC plateform circuit breaker (CB) will be trolley raised type to avoid floor unevenness if any. The male & female contacts shall be rod & Tulip type with vertical arrangement. EFI will be installed on each cable. The breaker shall be provided with bimetalic lugs to accomodate 2-Almunium cable connection with copper bus bars. C.T & P.T will be installed on each breaker. C.T ratio **1200/600/1/1** P.T ratio **11kV/110V**. Each VCB shall have earthing switch to ground cable. Earthing switch shall have inter-lock with "ON" Mechanism. Digital type Relays on each VCB shall be over current **2Nos**; Earth Fault one No with series/shunt trip prorivions. The relay shall have additional potential free contacts for SCADA. Relays shall have self supervision provision. SCADA provision- each VCB will have potential **"NO" & "NC"** contact for status monitoring locally as well as at remote control room through SCADA. Switching Station (SS) housing shall be designed for safe operation by operator locally. No arc should comeout in any case. As per spacification installed on RCC pad, including the cost of RCC foundation pad complete with all civil and other installation accessories as shown on the drawing or as directed by the Engineers'. | 1 | Job | | |
| | **NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | | | | |
| | **KIOSK SUBSTATIONS** | | | | |
| 4 | Supply, installing, conecting and testing Kiosk Sub Station **(Type-A)** with **630 Amp**. VCB **17.5 kV**, **350MVA**, **1000 kVA** Oil filled Transformer 11/0.42 kV with incoming & out going VCBs on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos MCCB** of **400 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer. | 3 | Each | | |
| | **NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | | | | |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amp**. VCB **17.5kV**, **350MVA**, **1000 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going load break switches with SF6 Fuses on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos** MCCB of **400 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | | |
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-A)** with **630 Amp**. VCB **17.5kV**, **350MVA**, **500 kVA** Oil filled Transformer **11/0.42** kV with incoming & out going VCBs on MV side. Air Circuit Breaker of **1600 Amp** outgoing **6 Nos MCCB** of **300 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | | |
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amp**. VCB **17.5kV**, **350MVA**, **500 kVA** Oil filled Transformer **11/0.42** kV with incoming & out going load break switches with SF6 Fuses on MV side. Air Circuit Breaker of **1600 Amp** outgoing 6 Nos MCCB of **300 Amp** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 15 | Each | | |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Earthing Electrodes** | | | | |
| 6 | Supply, installation, connection & testing of copper earth electrodes, 20mm dia, 3000mm in length, driven vertically in ground, including cost of Test pit 300x300x300mm, internal plaster, 100mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 25 | Job | | |
| 7 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Switching Station & Transformer as shown on the drawing, or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 300 | m | | |
| | | | | | |

# PAKISTAN DEFENCE OFFICERS' HOUSING AUTHORITY KARACHI

# PLANNING AND DESIGNING OF ELECTRICAL DISTRIBUTION SYSTEM OF DHA CITY KARACHI SECTOR - 5 ( PACKAGE - 02 )

# DETAILED DESIGN REPORT

SUBMITTED BY


عثمانی OSMANI

Engineering - Architecture - Planning - Mapping - Technology

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FEBRUARY 2013

# PLANNING & DESIGNING OF ELECTRICAL DISTRIBUTION SYSTEM OF DHA CITY, KARACHI
# SECTOR-05
# (PACKAGE-2)

## DETAILED DESIGN & DRAWINGS

# DEFENCE HOUSING AUTHORITY
# KARACHI

SHORT-TERM PLAN ENERGY SECTOR – 05 (Package-02)
DHA CITY KARACHI

# DETAILED DESIGN REPORT

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## DESIGN BRIEF & DESIGN CRITERIA

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-2)
DHA CITY KARACHI

DETAIL DESIGN REPORT

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# 1. EXECUTIVE SUMMARY

Main components of Energy Design for Sector-5B, Short Term Development Plan comprises of the following:

## A) MV Distribution Network comprising of:

### 1) MV Cables:

- 3 core 300 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable — 4,621 m
- 3 core 400 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable — 8,097 m

### 2) Switching Stations:

a) 3-way — 1 Nos.

### 3) Kiosk Sub Station:

- Kiosk Sub Station 1000 kVA (Type A) Transformer 11/0.42 kV Oil filled — 1 No.
- Kiosk Sub Station 1000 kVA (Type B) Transformer 11/0.42 kV Oil filled — 2 Nos.
- Kiosk Sub Station 500 kVA (Type A) Transformer 11/0.42 kV Oil filled — 2 Nos.
- Kiosk Sub Station 500 kVA (Type B) Transformer 11/0.42 kV Oil filled — 10 Nos.

## B) LV Distribution Network comprising of:

### 1) LV Cables:

| | | | |
|---|---|---|---|
| a) | 4 core 300 mm² AL, XLPE/PVC/SWA/PVC cable | 220 | m |
| b) | 4 core 240 mm² AL, XLPE/PVC/SWA/PVC cable | 48 | m |
| c) | 4 core 185 mm² AL, XLPE/PVC/SWA/PVC cable | 94 | m |
| d) | 4 core 150 mm² AL, XLPE/PVC/SWA/PVC cable | 564 | m |
| e) | 4 core 95 mm² AL, XLPE/PVC/SWA/PVC cable | 2204 | m |
| f) | 4 core 70 mm² AL, XLPE/PVC/SWA/PVC cable | 637 | m |
| g) | 4 core 50 mm² AL, XLPE/PVC/SWA/PVC cable | 329 | m |
| h) | 4 core 35 mm² AL, XLPE/PVC/SWA/PVC cable | 54 | m |
| i) | 4 core 25 mm² AL, XLPE/PVC/SWA/PVC cable | 68 | m |

| | |
|---|---|
| **10-way FP** | 22 Nos. |
| **9-way FP** | 12 Nos. |
| **8-way FP** | 12 Nos. |
| **7-way FP** | 3 Nos. |
| **6-way FP** | 3 Nos. |
| **5-way FP** | 4 Nos. |
| **4-way FP** | 1 Nos. |

**2) Feeder Pillars:**

**C) Smart Grid ICT Network / pipe sleeves comprising:**

1) HDPE pipe 2" dia. (2 Nos.) for MV/LV cables 42,000 m

2) RCC hand hole with cover (L=5', W=3', D=3') 180 Nos.

# 2. GENERAL FEATURES

## 2.1 INTRODUCTION

Pakistan Defence Officers Housing Authority (DHA) has commissioned M/s Osmani and Company (Pvt.) Ltd. to provide consultancy services for Development of DHA City Karachi (DCK) in August 2010. DHA City is spread over an area of 11,640 acres with numerous ridges and nalas following a rolling / mountainous terrain. DHA City is planned and divided into 16 sectors as listed below in Table 2-1

**Table 2-1: Area of Sectors**

| S.NO. | LOCATION | AREA (acres) | S.NO. | LOCATION | AREA (acres) |
|---|---|---|---|---|---|
| 1 | SECTOR 1 | 525 | 9 | SECTOR 9 | 604 |
| 2 | SECTOR 2 | 600 | 10 | SECTOR 10 | 541 |
| 3 | SECTOR 3 | 311 | 11 | SECTOR 11 | 663 |
| 4 | SECTOR 4 | 337 | 12 | SECTOR 12 | 504 |
| 5 | SECTOR 5 | 483 | 13 | SECTOR 13 | 575 |
| 6 | SECTOR 6 | 823 | 14 | SECTOR 14 | 655 |
| 7 | SECTOR 7 | 631 | 15 | SECTOR 15 | 697 |
| 8 | SECTOR 8 | 339 | 16 | SECTOR 16 | 383 |
| GRAND TOTAL | | | | | 8,675 |

Sector development works are to be carried out with respect to development strategy, which has been divided into 3 phases;

- Short Term Development Plan (2015 – 2018)
- Mid Term Development Plan (2018 – 2021)
- Long Term Development Plan (2021 – 2030)

The following ***Figure 2-1*** shows the location of various sub-sectors planned under short term development.

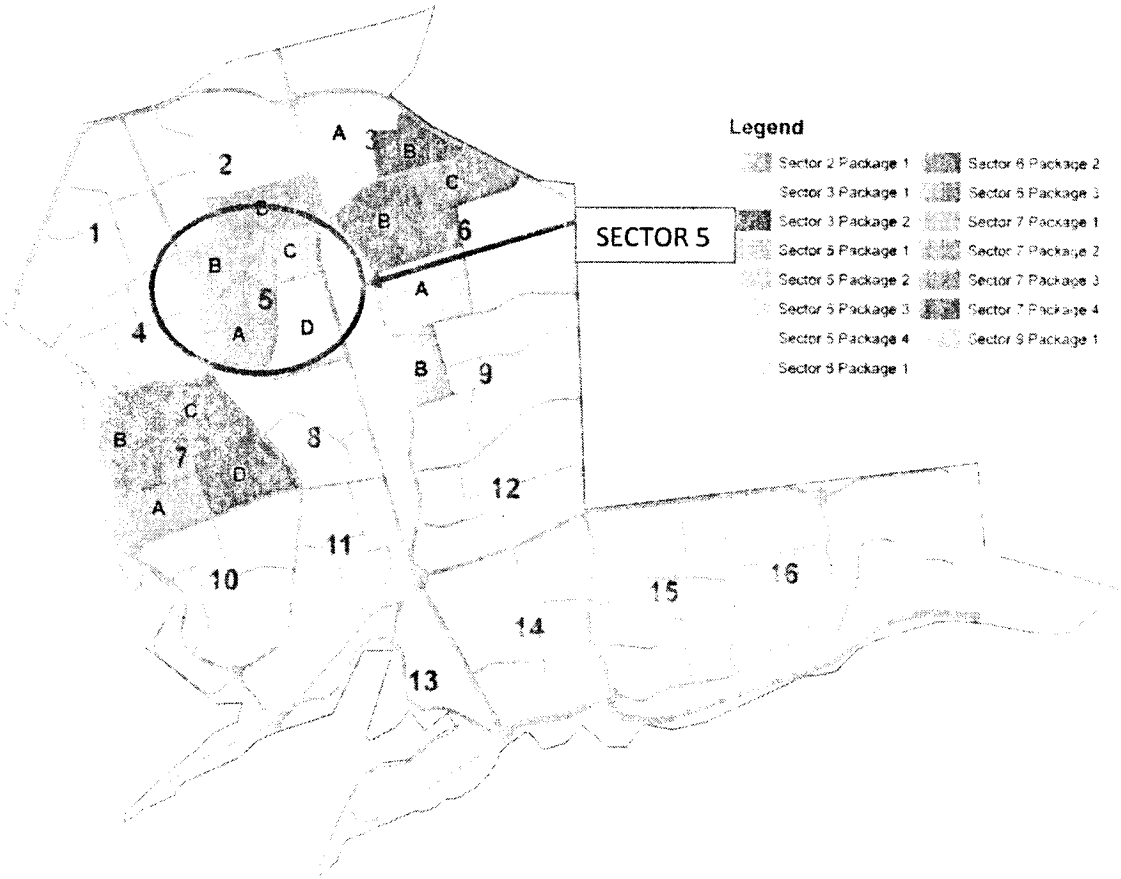


**Figure 2-1: Sectors under Short Term Development Plan**

Sectors are generally divided into four sub sectors as per the design criteria of 'Ekistics' for ease of communication of urban city. Acreage of each sub sector is given in Table 2-1 of Short Term Development Plan. Sector 5 has a total developed area of 2,335,734 square yards or 483 acres, excluding road network. About 2/3 of the area of sector 5 is utilized for residential purposes.

***Table 2-2*** shows the areas of various sectors under short term development plan:

**Table 2-2: Areas of Sectors under Short Term Plan**

| Areas in acres | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sector | Sub-Sector | | | | | Other than Sub Sector | Total |
| | A | B | C | C-5 | D | | |
| 2 | | | | | 141 | | 141 |
| 3 | 215 | 81 | | 15 | | | 311 |
| **5** | **136** | **108** | **63** | **18** | **136** | **22** | **483** |
| 6 | 167 | 97 | 112 | 40 | | | 416 |
| 7 | 136 | 129 | 198 | 19 | 149 | | 631 |
| 9 | | 89 | | | | | 89 |
| CBD | | | | | | 104 | 104 |
| **Total** | **654** | **504** | **373** | **92** | **426** | **126** | **2,175** |

Sector 5 is one of the model sectors being developed under Short Term Plan. This sector has plots of different sizes ranges from R3-S to R20-S. Majority of plots are of size R5 and R10.

## 2.2 SCOPE OF THE REPORT

The main objective of this report is to explain the Detailed Design for Energy Distribution Network of DCK. The main objectives of this Detailed Design Report (DDR) are the following:

- Present the Detailed Design of Sector 5B to enable client review prior to progression to the bidding stage.
- Provide details of how the design has been developed since the submission of the Preliminary Design Energy Distribution Report.
- Provide an updated description of the works.
- Confirm the design criteria and parameters used for the design of Electrical Distribution System. Provide a rough cost estimate for the project component.

- Provide details of any information obtained; and information still required to complete the project and highlight any potential difficulties in obtaining such information.

This report will cover Detailed Design of Sector-5B as encircled in Figure 2-1 and highlighted in Table 2-1

## 2.3 BACKGROUND

Sector 5 was planned on 483 acres area, with City Boulevard (PA 01) to the west, Main Boulevard West (PA 02D) to the east, West Avenue 1W (PC 01) to the north and West Avenue 2W (PA 04) on the south.

For tendering purpose, Sector 5 is divided in to 4 packages i.e. 1, 2, 3 and 4. Package 1 contains sub-sector A with an approx. area of 136 acres, package 2 contains sub-sector B with an approx. area of 108 acres, package 3 contains sub-sector C and commercial centre C5 with an approx. area of 81 acres and lastly package 4 contains sub-sector D with an approx. area of 136 acres. Figure 2-2: Boundaries of Packages 1 to 4 of Sector 5 shows the boundaries of packages 1 to 4 of sector 5.

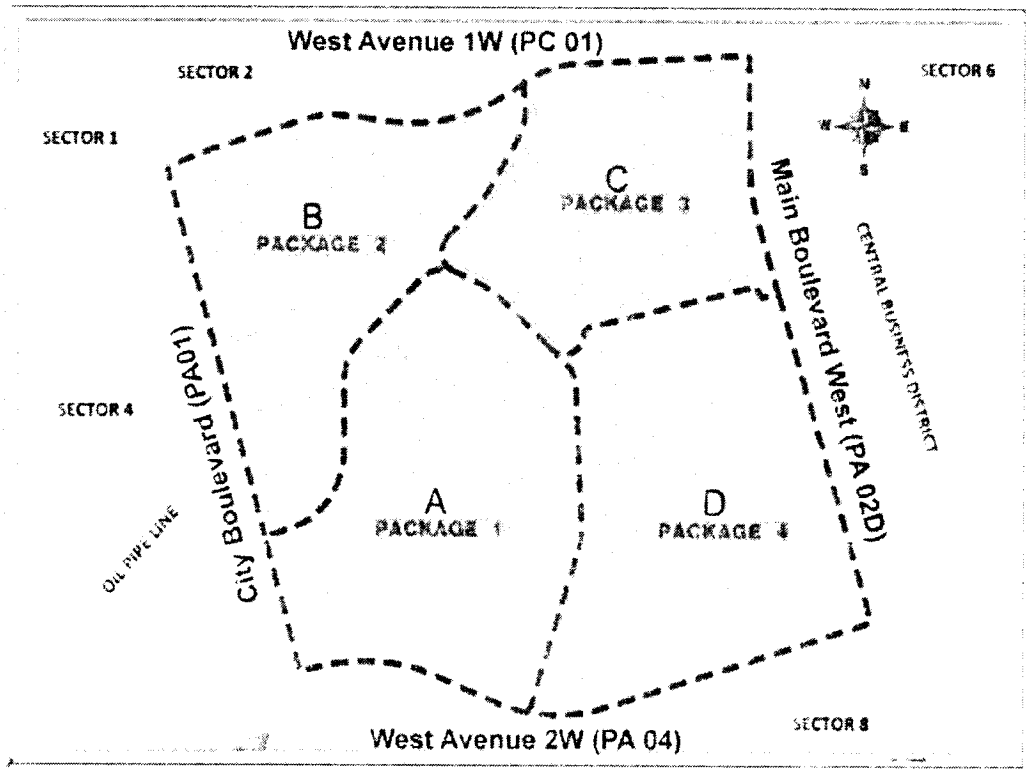


**Figure 2-2: Boundaries of Packages 1 to 4 of Sector 5**

## 2.4 TOPOGRAPHY OF SUB-SECTOR 5-B

Sub-Sector 5-B has a nalla and lots of slopes and hills. Figure 2-3 shows that it has the highest elevation of 542.915 ft and lowest elevation of 437.618 ft, with a difference of 105.297 ft.

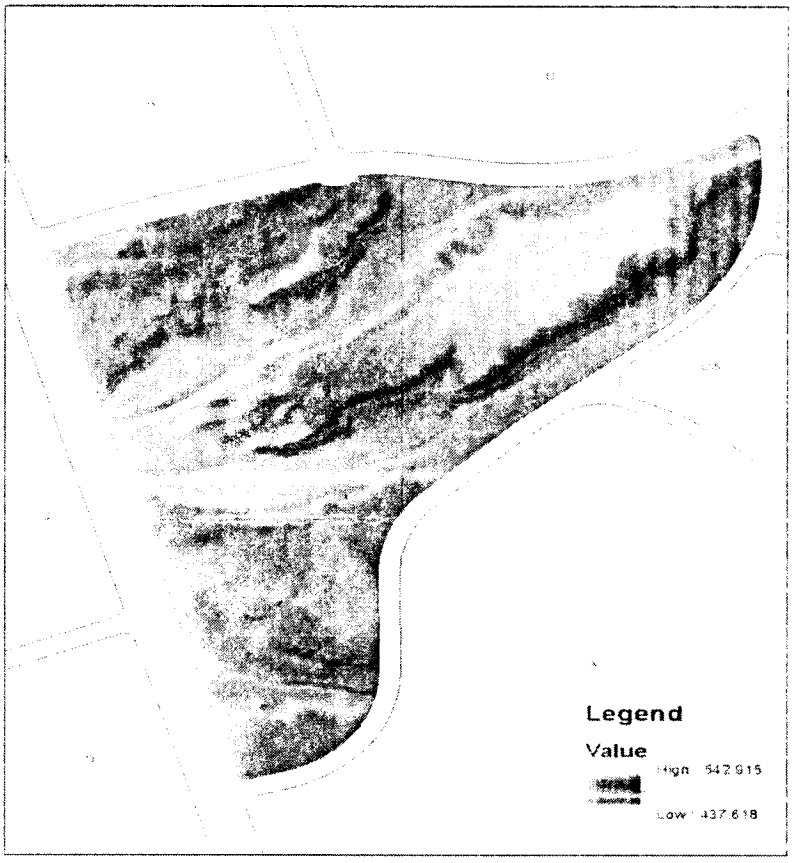


**Figure 2-3: Topography of Sub-Sector 5-B**

## 2.5 POPULATION AND DEVELOPMENT

The DCK will be developed in stages aiming to reach eventually more than 600,000 people. The overall planning of DCK is based on ekistics, leading to sectors of 20-40,000 people each. Sector 5 has a total developed area of 2,335,734 square yards, excluding road network. The table below describes the land use in sector 5. About 2/3 of the area of sector 5 is utilized for residential purposes. Residential area has different plot categories from 100 square yards to 2,000

square yards. Other facilities include commercial areas, amenities, educational institutions, graveyard, healthcare facilities and green space areas.

**Table 2-3: Sector 5: Land Use Statistics**

| SECTOR 5 LAND USE STATISTICS | | | |
|---|---|---|---|
| **Zonal Land use** | **Categories** | **Area (sq.yards)** | **Total Area (sq.yards)** |
| Agriculture and Preserved Open Spaces | Nallah | 38738.43 | **269616.5** |
| | Oil Pipe Line | 10986.53 | |
| | Open & Green Space | 219891.6 | |
| Amenities | Cemetery | 5039.94 | **63286.45** |
| | College/ A-Level/ Professional (CA/ ACCA etc.) | 6947.61 | |
| | Community Hall | 5260.62 | |
| | Dispensary | 756.46 | |
| | Health Centre | 3033.58 | |
| | Kindergarten | 7225.15 | |
| | Marriage Hall | 1555.55 | |
| | Masjid | 4510.28 | |
| | PS/ SS/ O-Level | 26977.56 | |
| | Public Service (Club) | 1979.7 | |
| Commercial | - | - | **36622.17** |
| Mixed use | - | - | **11279.09** |
| Recreation | Nursery | 53830.99 | **114651.8** |
| | Parks and Playground | 60820.86 | |
| Residential | - | - | **1100971** |
| Transportation | Commercial Collector Roads (120' ROW) | 21000.71 | **721689.8** |
| | Commercial Collector Roads (60' Row) | 28936.15 | |
| | Parking | 17406.59 | |
| | Pedestrian way | 9979.16 | |
| | Piazza | 53540.53 | |
| | Residential Collector Roads (90' ROW) | 63726.05 | |
| | Streets | 527100.6 | |
| Utilities | ICT and Security | 1183.57 | **17616.83** |
| | Overhead Reservoir | 2288.72 | |
| | Sewage Treatment Plant | 5218.79 | |
| | Unclassified Utility | 8925.74 | |
| **Grand Total** | | | **2,335,734** |

## 2.6 CONTRACT PACKAGES

Sector 5 consists of 4 contract packages. Refer Figure 2-2 for location and boundary of various packages. The detailed layout plans showing detailed MV & LV network is also attached Detailed Design Drawings of the report. The statistical description of package 2 is given below:

- **Package 2**

This package comprises of sub-sector B which has an area of 108 acres Table 2-2 and consists of an approx. road network of 23,927 ft (7.30 Km) **Error! Reference source not found.**. It has 10 C2s.Table 2-4 shows the Plots Summary of Sub-sector 5-B under categories of Residential, Commercial & Mix Use.

**Table 2-4: Plots Summary –Sub-Sector 5-B**

| SUB-SECTOR 5-B PLOTS SUMMARY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Residential Plots** | | | | | | | | |
| | **R1** | **R2** | **R2.5** | **R3** | **R5** | **R10** | **R20** | **Total** |
| **Sector 5** | | | | **3** | **1,369** | **396** | **5** | **1,773** |
| Sub-Sector 5-B | | | | 1 | 467 | 2 | | **470** |
| **Commercial Plots** | | | | | | | | |
| | **C1** | **C2** | **C2.5** | **C3** | **C5** | **C10** | **C20** | **Total** |
| **Sector 5** | | **66** | **5** | **17** | **16** | **2** | | **106** |
| Sub-Sector 5-B | | 10 | | | | | | **10** |
| **Mix Use (Residential + Commercial) Plots** | | | | | | | | |
| | **M1** | **M2** | **M2.5** | **M3** | **M5** | **M10** | **M20** | **Total** |
| **Sector 5** | | **49** | **1** | **3** | | | | **53** |
| Sub-Sector 5-B | | | | | | | | |

## 2.7 OVERVIEW OF DCK ELECTRICAL DISTRIBUTION DESIGN

Design of the Electrical Distribution Network for DHA City Karachi (DCK) is a very important task of the project. Analysis of the latest technologies, current industry standards, local field practices and availability of skilled Human Resource (HR) have been done with a view of current and future requirements of DCK residential and commercial users. Electrical network design layout of DCK is based on the geographic and sector wise distribution.

The DCK is a vision to build an urban city with adaption of new technologies. Distinctly it has to be a part of global smart cities family, which integrates various technical trends into a single place to facilitate best options to the local residents as well as business community. Any urban society can't be accomplished without proper plan so decision for opting of a reliable electrical distribution system for DCK will really need a higher priority at early stage.

Thus it is proposed to design and construct an electrical network that will be capable to deliver electrical services within DCK. In order to enable the level of operational efficiencies needed for a project of this kind, the use of 'smart building technologies' is the basis of this design to fulfil DCK requirement for provisioning of electrical services. The aim is to provide a network with reliable electricity supply to the residents and stakeholders.

Kiosk type substations can only be the favourable medium for smart distribution in DCK, which can provide the monitoring and control required. We believe that key for reliable electricity is a reliable distribution system with few faults and their fast location and removal. In this regard best efforts are being made to

make DCK a prosperous place in current and future scenarios. This will enable DCK to append and merge forthcoming technologies without modifying its existing infrastructure system. The description of various kiosks Sub-Stations used is given below.

- **Kiosk Sub-Station Type-A** (1000 kVA, 630 kVA, 500 kVA) Oil filled Transformer 11/0.42 kV, with incoming & out going VCBs on MV side.

- **Kiosk Sub-Station Type-B** (1000 kVA, 630 kVA, 500 kVA) Oil filled Transformer 11/0.42 kV, with incoming and outgoing SF6 load break switches with fuses on MV side.

# 3. DESIGN CRITERIA

## 3.1 DESIGN CODES & STANDARDS

All systems shall adapt the following main standards, wherever applicable:

- European Committee for Standardization (CEN) and European Committee for Electro technical Standardization (CENELEC)
- International Electro technical Commission (IEC)
- International Organization for Standardization (ISO)
- Other Standards and Codes can be used in areas not covered by these standards. Other standards include:
- European Standards like EN, DIN
- British Standards (BS)

The Electrical products used, should be tested and approved to meet the applicable standards by one of the independent test laboratories including following:

- KEMA
- CESI
- UL or other similar laboratories

## 3.2 USER REQUIREMENTS

The user requirements for DCK that are given by the DHA include the followings:

a) Completely underground distribution system.

b) Use of aluminium conductor cables for cost saving.

c) Use of Kiosk type substations for space saving and faster installation.

d) Smart Metering Technologies.

e) Remote monitoring and control.

## 3.3 DESIGN CRITERIA

The DCK Electrical Distribution must meet following requirements:

- High reliability
- Safe Operation
- Route Protection
- Redundancy
- Reliable Technology
- Easy to maintain and troubleshoot
- Environmentally Protected
- Cost Effective
- Future Proof

## 3.4 DESIGN CONSIDERATIONS

- Underground distribution for reliable power supply.
- MV ring distribution for fast restoration of power in case of fault.
- Use of MV express feeder to provide backup in case of simultaneous fault on two feeders.
- Use of Kiosk type substation for space saving and faster installation.
- Use of VCB type Ring Main Units (RMUs) for reliable maintenance free switching.
- Fibre Optic cable network for remote monitoring and control.
- Use of Smart Meters in residences, offices & commercial premises for two way flow of power, thus encouraging use of renewable energy by consumers.
- Remote monitoring and control of MV and LV distribution system and automatic meter reading and billing.
- Use of cost saving aluminium conductor for MV and LV cables.

# 4. SMART GRID

## 4.1 GENERAL

Traditional Electric Power Systems have been designed through deploying large central generation units built away from cities and residential areas, while electricity has been delivered to consumers through interlinked transmission lines and grid stations. Each individual generation unit, whether it is powered by fossil fuels or hydro, may be rated of up to hundreds of Megawatts (MWs). Transmission line distance also varies up to hundreds of kilometres and Electricity is then transferred to end-users through distribution transformers. The distribution system is very extensive but is almost entirely passive with *little communication* and only limited local controls. There is no *real-time monitoring* hence there is very little interaction between the loads and the power system.

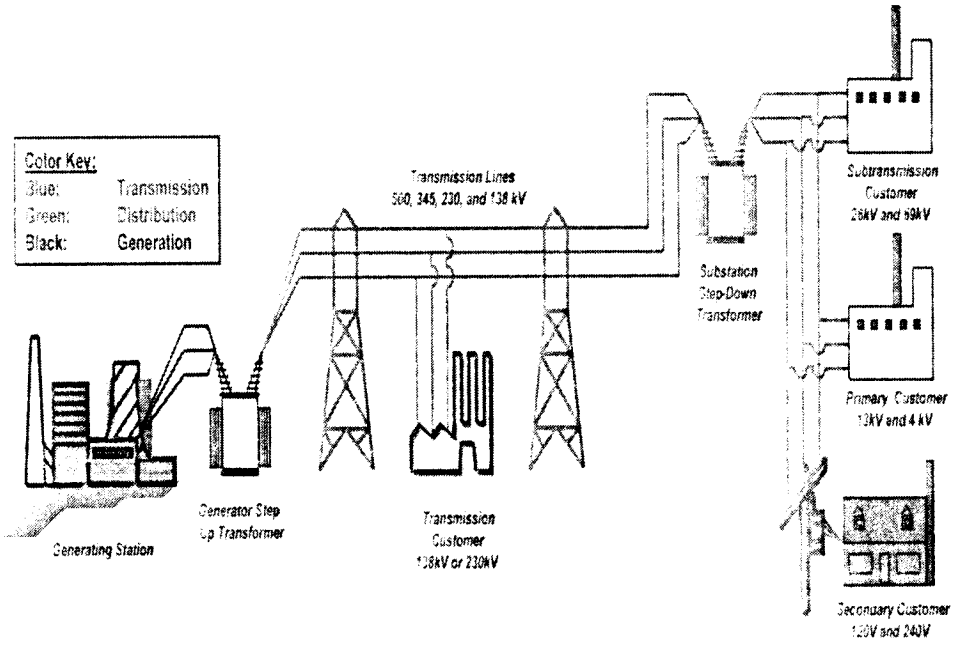


**Figure 4-1: Existing Power System Infrastructure**

The present advances in communication systems, particularly high speed networks, offer the possibility of much greater monitoring and control throughout the power system and hence more effective, flexible and lower cost operations.

Today, design concept of power system has changed and it does not required to be isolated from cities by using large scale generators. Instead large numbers of small scale generation units located at various places are being combined together to deliver electricity to local city residents. Using ICT services at smaller scale is very feasible as well as cost effective. This concept of intelligent delivery of electricity is known as ***Smart Grid***.

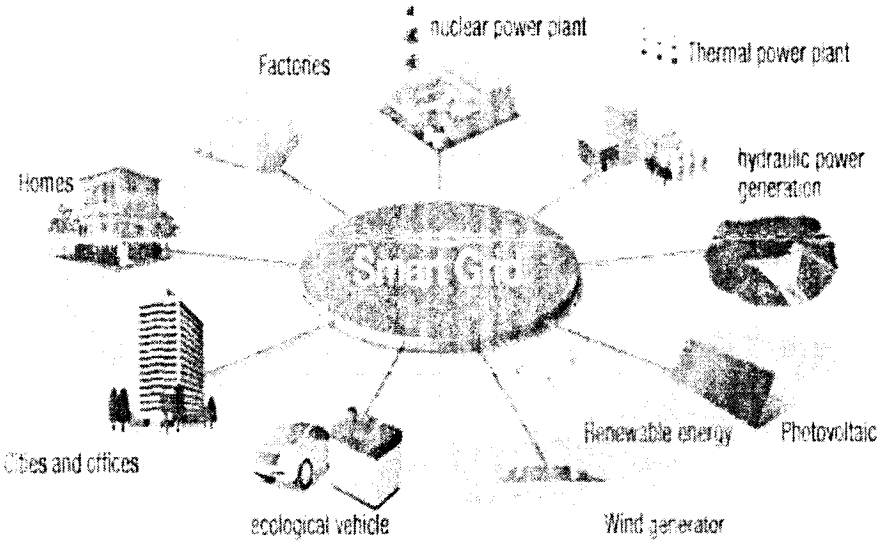


**Figure 4-2: A Smart Grid Infrastructure**

One of the best features of DHA City Karachi (DCK) is the introduction of Smart Grid Technology which will help in managing and protecting the resources of DCK electricity network. Electrical components will be 'network' enabled which will help to monitor the electricity consumption by DCK Power Operators remotely at Network Control Centre (NCC). Real-time Electricity database will then be used to optimize power generation and distribution.

Not only this, but real-time monitoring and control will enable to avoid any unwanted circumstance such as blackout due to heavy short circuits within network and brownout due to unplanned heavy loads. These cases not only affect the power quality but also damage costly power equipment such as power trans-

formers and bus bars at Sub-Stations/grid stations. This technology will enable the DCK consumers to see how much Electricity is being consumed and can also see utility bills any time online at their homes through smart meters.

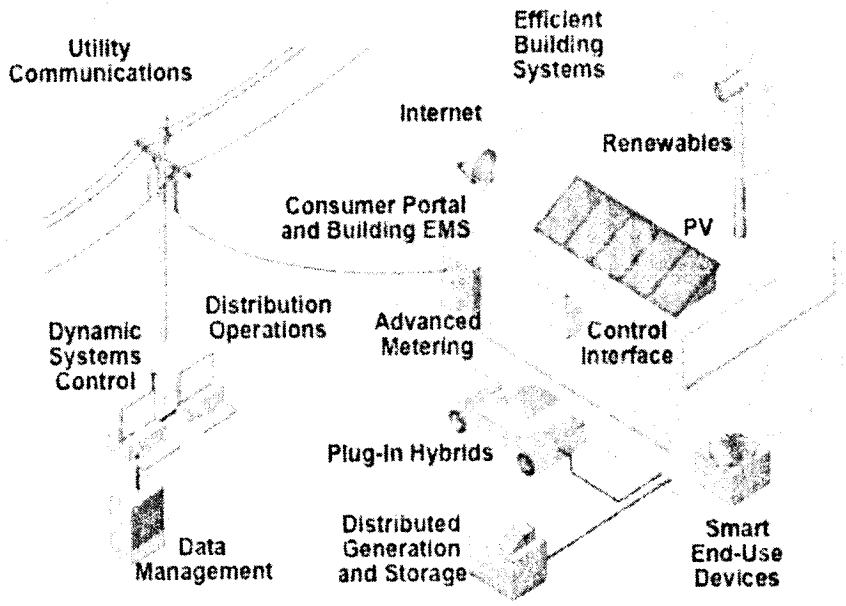


**Figure 4-3: Latest Electrical Network Infrastructure**

The design of power transmission and distribution system of DCK has also been done with a consideration of futuristic demands of any urban city. The design is aligned with the requirements of latest Codes and Standards defined for a Smart Grid and assures modular deployment of any future elements whenever required.

## 4.2 ACCOMMODATION OF RENEWABLE ENERGY INTO EXISTING GRIDS

The global concern for the environment and the need to counteract the effects that lead to global warming are the most important drivers for an improved electrical energy system. Along with establishing a common understanding of man-made changes in the global climate, scenarios have been presented, showing how future carbon emissions might be limited, or even reduced. The major proposals in these scenarios is the introduction of renewable energy sources to replace the traditional fossil based power generation with higher priority as we have a very limited fossil-fuel in future.

## 4.3 DIFFERENCE BETWEEN CONVENTIONAL AND SMART GRIDS

Following table shows a brief difference between a conventional and a Smart Grid.

**Table 4-4-1: Difference between a Conventional & Smart Grid**

| CHARACTERISTIC | EXISTING GRID | SMART GRID |
|---|---|---|
| Enables active participation by consumers | Consumers are uninformed and non-participative with power system | Informed, involved, and active consumers - demand response and distributed energy resources. |
| Accommodates all generation and storage options | Dominated by central generation- many obstacles exist for distributed energy resources interconnection | Many distributed energy resources with plug-and-play convenience focus on renewable |
| Enables new products, services and markets | Limited wholesale markets, not well integrated - limited opportunities for consumers | Mature, well-integrated wholesale markets, growth of new electricity markets for consumers |
| Provides power quality for the digital economy | Focus on outages - slow response to power quality issues | Power quality is a priority with a variety of quality/ price options - rapid resolution of issues |
| Optimizes assets & operates efficiently | Little integration of operational data with asset management - business process silos | Greatly expanded data acquisition of grid parameters - focus on prevention, minimizing impact to consumers |
| Anticipates and responds to system disturbances (self-heals) | Responds to prevent further damage- focus is on protecting assets following fault | Automatically detects and responds to problems - focus on prevention, minimizing impact to consumer |
| Operates resiliently against attack and natural disaster | Vulnerable to malicious acts of terror and natural disasters | Resilient to attack and natural disasters with rapid restoration capabilities |

## 4.4 USER REQUIREMENTS

- Demand & Supply Balancing
- Optimized and cost-effective Power Generation
- Consumer-Interacted Advance Metering Technology
- Remote Monitoring & Control
- High level protection of EHV, HV, MV and LV equipments
- Accommodation of Generation from Renewable Energy
- Resiliently to Disturbances, Attacks, & Natural Disasters
- High Speed Communication medium throughout the Transmission & Distribution Network
- Power Quality
- Accuracy in load prediction
- Reliability
- Future Proof Technology

## 4.5 NEED OF SMART GRID INFRASTRUCTURE

Today, existing grids are under pressure to deliver the growing demand for power, as well as provide a stable and sustainable supply of electricity. These complex challenges are driving the evolution of smart grid technologies. Smart grid is specifically designed to meet the increasing global demand for electricity, by providing sufficient capacity, as well as reliability, efficiency and sustainability.

## 4.6 ADVANCED METERING INFRASTRUCTURE

Advance Metering Infrastructure (AMI) systems that support two-way communications with customers while allowing secure and reliable system-wide communication for distribution automation are the enabling foundation for the Smart Grid. Advanced Metering Infrastructure will give consumers the consumption and pricing information they need to enable them to more effectively participate in peak load reduction and energy conservation.

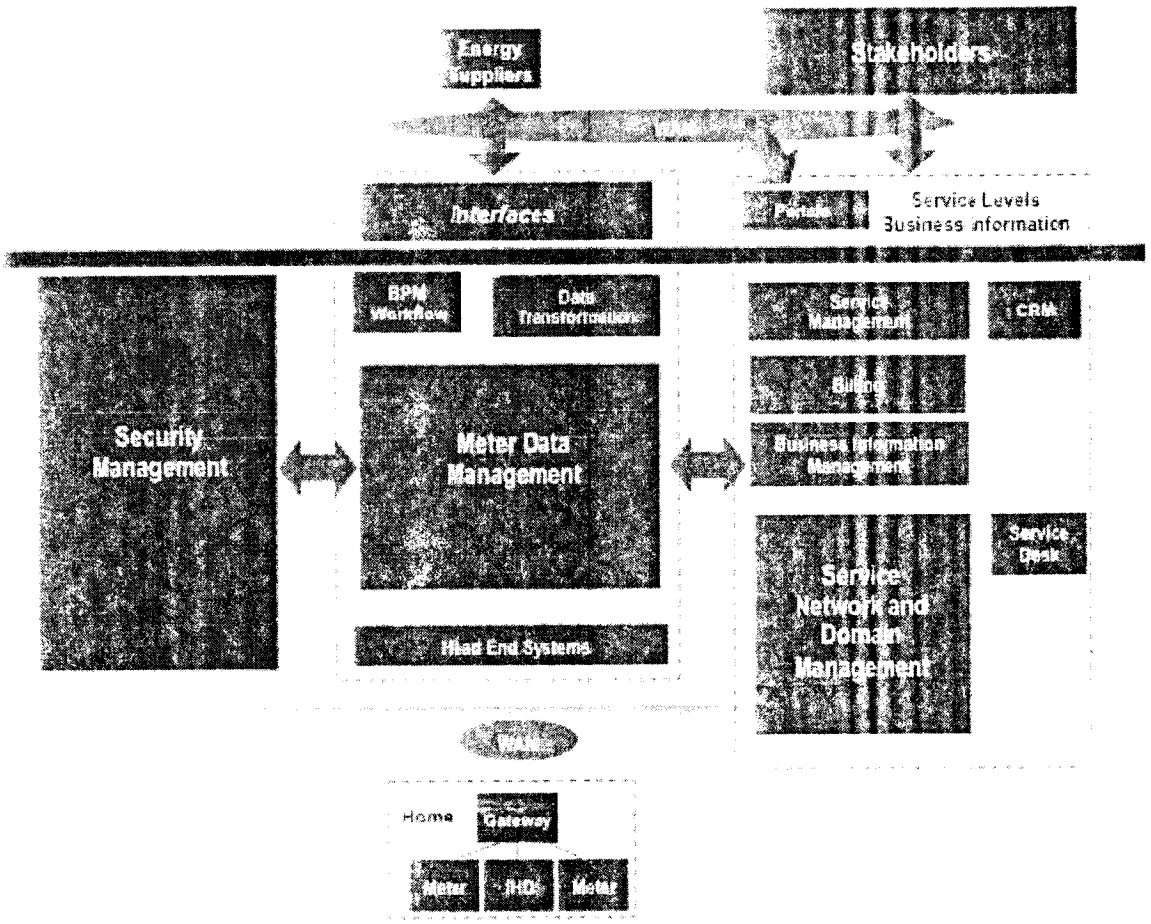


**Figure 4-4: Advance Metering Infrastructure System**

AMI consists of the communications hardware and software, and the associated system and data management software, that together create a two-way network between advanced meters and utility business systems, enabling collection and distribution of information to customers and other parties, such as the competitive retail supplier or the utility itself. Generally AMI have following functionalities:

- Two way communications
- Interval measurement and storage of consumption data
- Display of consumption data to consumer
- Remote connection/disconnection
- Support for variable energy tariffs
- Demand control

## 4.7 DISTRIBUTION AND OUTAGE MANAGEMENT

Distribution and Outage Management Systems (DMS/OMS) provide real-time response to adverse or unstable conditions. It saves money and improves customer service. Through the consolidation of both real-time OMS and DMS functionality, telemetry, and integrated security, smart distribution systems will be poised to become truly self-healing.

## 4.8 DISTRIBUTION AND SUBSTATION AUTOMATION

A Smart Grid requires control centre supervision, area-wide solutions and visualization with centralized modelling. Implementations should leverage installed infrastructure and use a model-based, scalable approach. This practical, cost-effective method ensures that current technology eventually gives way to reactive, software-driven intelligence.

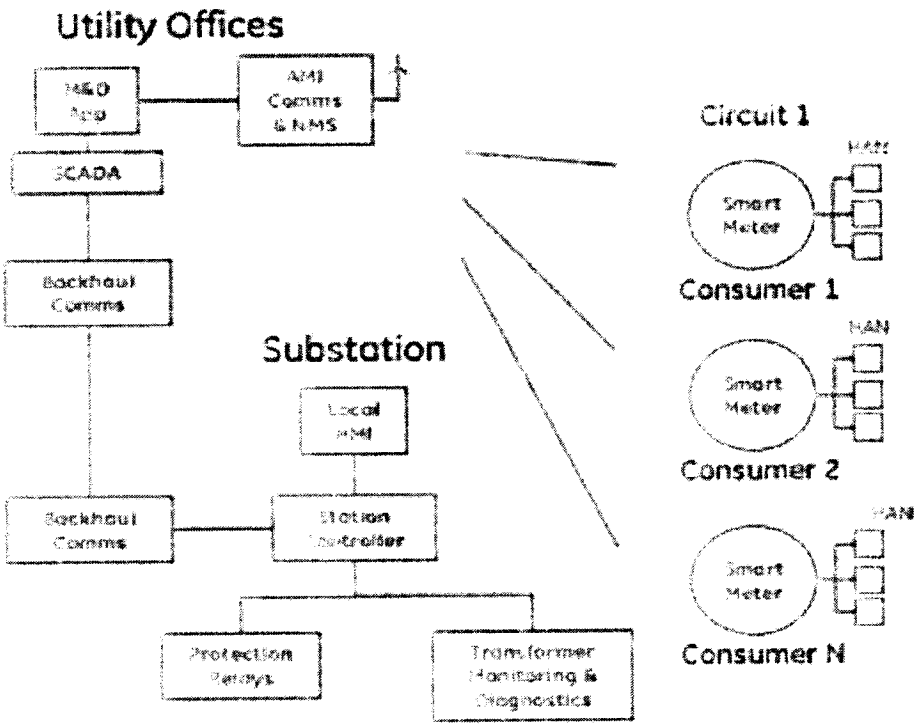


**Figure 4-5: Distribution Automation System**

The architecture shown above uses a centralized distribution automation system with the addition of communication to smart metering. The algorithm can utilize the information from the smart meters to assist in detecting outages outside of the monitored range of the automated devices. This includes fuses or other non-automated fault interrupters. The meters can detect and report an outage and can report successful restoration. Using the restoration detection, the system can determine customers have been properly restored as expected.

## 4.9 PERFORMANCE

Smart Grids will make use of new design concepts and advanced materials in system components like transformers and circuit breakers to improve efficiency, safety and operational performance. Widespread use of power electronic devices will help maximize performance of existing assets and make the grid more resilient in the event of disruptions.

## 4.10 SECURITY & SAFETY

Improvements in security increase the robustness and resiliency of the grid from a physical perspective and a cyber perspective, thereby reducing the probability and consequences of man-made attacks and natural disasters. In addition, reductions in oil imports made possible by the Smart Grid enhance national security.

Improvements in safety reduce the hazards inherent in an energized electric system as well as the time of exposure to those hazards. Generally Smart Grid Infrastructure will help through followings:

- Reduction in the probability that a deliberate man-made cyber or physical attack could occur and a reduction in the consequences of any that are not detected or prevented
- Improved restoration times following storms and other natural events
- Reduction in theft and vandalism of property due to increased detection capability
- Reduction in injuries and deaths of employees due to reduction in time spent in hazardous situations and the availability of more intelligent systems that support worker safety

These benefits will decrease the probability that extended outages impacting the security of customers will occur by reducing the threat, vulnerability, and consequences of man-made attacks. The increased reliance on digital Smart Grid technologies will require the deployment of new systems to address cyber security ensuring this critical infrastructure is as "hack proof" as possible. The increased robustness and resilience of the smart grid will also reduce the impact of many natural events that today result in extended outages.

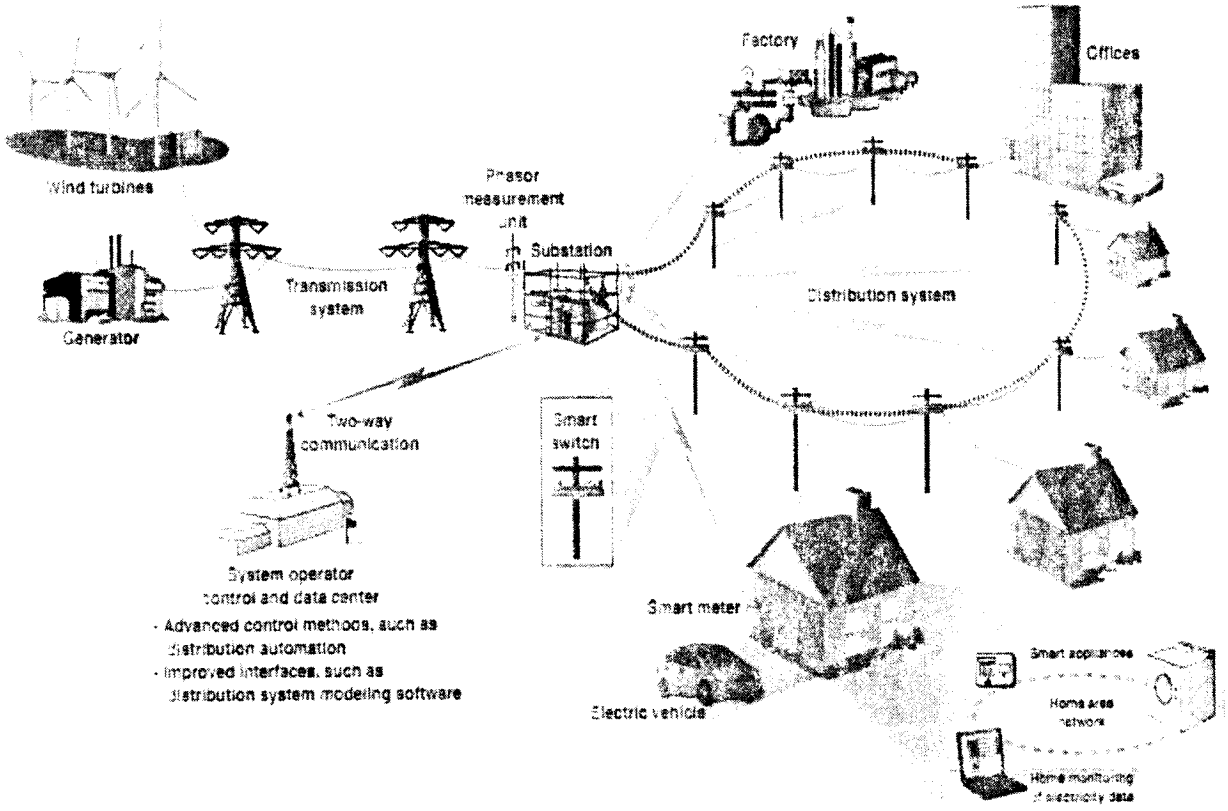


**Figure 4-6: A Secure Smart Grid System**

## 5. BENEFITS OF SMART GRID ELEMENTS

A modernized electrical grid has following features:

- Improves power reliability and quality
- Optimizes facility utilization and averts construction of backup (peak load) power plants
- Enhances capacity and efficiency of existing electric power networks
- Improves resilience to disruption
- Enables predictive maintenance and "self-healing" responses to system disturbances
- Facilitates expanded deployment of renewable energy sources
- Accommodates distributed power sources
- Automates maintenance and operation

- Reduces greenhouse gas emissions by enabling electric vehicles and new power sources
- Reduces oil consumption by reducing the need for inefficient generation during peak usage periods
- Presents opportunities to improve grid security
- Enables transition to plug-in electric vehicles and new energy storage options
- Increases consumer choice
- Enables new products, services, and markets and consumer access to them
- Improved distribution system efficiency
- Reduced distribution line losses
- Improved voltage profile along feeder
- Improved system stability and capacity
- Deferred capital upgrades
- Reduced energy demand
- Reduction of environmentally harmful emissions

# 3

## DESIGN LOAD SHEET SECTOR-05 (PACKAGE-2)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-2)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


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# DCK - SECTOR-05 (PACKAGE-2)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

**AMENITIES**

| S. No. | Plot Area (Sq.yds) | Type of Plot | Covered Area as per DCK Bye Laws | | | | KESC Load Criteria | | General Load | A/C Load | Water Pump Load (W) | Max. Connected Load (W) | Group Div. Factor 80% (W) | TOTAL NO. OF PLOTS | Total Load (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | |
| 1 | 825 | KINDER GARTEN | 100% | 7425 | 1 | 7425 | 1.5 | 1 | 11137.5 | 2000 | | 13138.5 | 10510.8 | 1 | 10.51 |
| 2 | 840 | KINDER GARTEN | 100% | 7560 | 1 | 7560 | 1.5 | 1 | 11340 | 2000 | | 13341 | 10672.8 | 1 | 10.67 |
| 3 | 1042 | KINDER GARTEN | 100% | 9378 | 1 | 9378 | 1.5 | 1 | 14067 | 2000 | | 16068 | 12854.4 | 1 | 12.85 |
| 4 | 830 3519 | NURSERY | 100% | - | 1 | - | 4.9kW fixed for any area | 0 | 4900 | 0 | | 4900 | 3920 | 2 | 7.84 |
| 5 | 188 | PARK & PG | 100% | 1692 | 1 | 1,692 | 1.5 | 0 | 2538 | 0 | | 2538 | 2030.4 | 1 | 2.03 |
| 6 | 435 | PARK & PG | 100% | 3915 | 1 | 3,915 | 1.5 | 0 | 5872.5 | 0 | | 5872.5 | 4698 | 1 | 4.70 |
| 7 | 550 | PARK & PG | 100% | 4950 | 1 | 4,950 | 1.5 | 0 | 7425 | 0 | | 7425 | 5940 | 1 | 5.94 |
| 8 | 718 | PARK & PG | 100% | 6462 | 1 | 6,462 | 1.5 | 0 | 9693 | 0 | | 9693 | 7754.4 | 1 | 7.75 |
| 9 | 24815 | PARK & PG | 100% | 223335 | 1 | 223,335 | 1.5 | 0 | 335002.5 | 0 | | 335002.5 | 268002 | 1 | 268.00 |
| 10 | 5374 | PARK & PG | 100% | 48366 | 1 | 48,366 | 1.5 | 0 | 72549 | 0 | | 72549 | 58039.2 | 1 | 58.04 |
| 11 | 6903 | PARK & PG | 100% | 62127 | 1 | 62,127 | 1.5 | 0 | 93190.5 | 0 | | 93190.5 | 74552.4 | 1 | 74.55 |
| 12 | 8519 | PARK & PG | 100% | 76671 | 1 | 76,671 | 1.5 | 0 | 115006.5 | 0 | | 115006.5 | 92005.2 | 1 | 92.01 |
| 13 | 8889 | PARK & PG | 100% | 80001 | 1 | 80,001 | 1.5 | 0 | 120001.5 | 0 | | 120001.5 | 96001.2 | 1 | 96.00 |
| 14 | 8930 | PARK & PG | 100% | 80370 | 1 | 80,370 | 1.5 | 0 | 120555 | 0 | | 120555 | 96444 | 1 | 96.44 |
| 15 | 12828 | PARK & PG | 100% | 115452 | 1 | 115,452 | 1.5 | 0 | 173178 | 0 | | 173178 | 138542.4 | 1 | 138.54 |
| 16 | 14815 | PARK & PG | 100% | 133335 | 1 | 133,335 | 1.5 | 0 | 200002.5 | 0 | | 200002.5 | 160002 | 1 | 160.00 |
| 17 | 290 | PARKING | 100% | 2610 | 1 | 2610 | 0.75 | 0 | 1957.5 | 0 | | 1957.5 | 1566 | 2 | 3.13 |
| 18 | 1295 | PIAZZA | 100% | 11655 | 1 | 11655 | 0.5 | 0 | 5827.5 | 0 | | 5827.5 | 4662 | 1 | 4.66 |
| 19 | 1436 | PIAZZA | 100% | 12924 | 1 | 12924 | 0.5 | 0 | 6462 | 0 | | 6462 | 5169.6 | 1 | 5.17 |
| 20 | 1442 | PIAZZA | 100% | 12978 | 1 | 12978 | 0.5 | 0 | 6489 | 0 | | 6489 | 5191.2 | 1 | 5.19 |
| 21 | 5219 | STP-06 | 100% | 46971 | 1 | 46971 | | | 400000 | 0 | | 400000 | 320000 | 1 | 320.00 |
| | | | | | | | | | | | | | | TOTAL (kW) | 1,384.0 |

## DCK - SECTOR-05 (PACKAGE-2)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

**COMMERCIAL**

| S. No. | Plot Area (Sq.yds) | Type of Plot | Covered Area as per DCK Bye Laws | | | | KESC Load Criteria | | General Load | A/C Load | Lift Load (W) | Water Pump Load (W) | Max. Connected Load (W) | Group Div. Factor 80% (W) | TOTAL NO. OF PLOTS | Total Load (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | | |
| 1 | 200 | C2 | 100% | 1800 | 6 | 10800 | 10 | 0 | 108000 | 0 | 8952 | 3729 | 120681 | 96544.8 | 10 | 965.45 |
| 2 | 400 | MK | 100% | 3600 | 1 | 3600 | 10 | 0 | 36000 | 0 | | | 36000 | 28800 | 3 | 86.40 |
| | | | | | | | | | | | | | | | TOTAL (kW) | 1051.85 |

## DCK - SECTOR-05 (PACKAGE-2)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

RESIDENTIAL

| S. No. | Plot Area (Sq.yds) | Type of Plot | Covered Area as per DHA Bye Laws | | | KESC Load Criteria | | General Load | A/C Load | Max. Connected Load (W) | Connected Load at 40% DF (W) | Group Div. Factor 80% (W) | TOTAL NO. OF PLOTS | Load (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | |
| 1 | 300 | R3 | 75% | 3 | 6075 | 1.75 | 1 | 10631.25 | 6000 | 16,631 | 6652.5 | 5322 | 1 | 5.32 |
| 2 | 500 | R5 | 60% | 3 | 8100 | 1.75 | 1 | 14175 | 6000 | 20,175 | 8070 | 6456 | 467 | 3014.95 |
| 3 | 1000 | R10 | 50% | 3 | 13500 | 1.75 | 2 | 23625 | 12000 | 35,625 | 14250 | 11400 | 2 | 22.80 |
| | | | | | | | | | | | | TOTAL | 470 | 3043.07 |

| DCK - SECTOR-05 (PACKAGE-2)<br>ELECTRICAL LOAD CALCULATIONS<br>LOAD AS PER KESC STANDARDS | | | | | |
|---|---|---|---|---|---|
| **DESCRIPTION** | **TOTAL NO. OF PLOTS** | **TOTAL RESIDENTIAL LOAD (kW)** | **TOTAL AMENITIES LOAD (kW)** | **TOTAL COMMERCIAL LOAD (kW)** | **TOTAL (kW)** |
| No. of Plots | 470 | | | | 5,478.97 |
| Residential Load | | 3,043.07 | | | |
| Amenities Load | | | 1,384.04 | | |
| Commercial Load | | | | 1,051.85 | |
| **Total Load (MW)** | **470** | **3.04** | **1.38** | **1.05** | **5.48** |

# 4

## FEEDER SIZING
## SECTOR-05 (PACKAGE-2)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-2)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


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Web: www.osmani.com

# D.H.A CITY
# SECTOR-05 (PACKAGE 2)
# RING MAIN VOLTAGE DROPS
# (CALCULATIONS)

## RING MAIN NO.1 (FEEDER NO. 1)

| | |
|---|---|
| **Ring Main No. 1 (Feeder No. 1) Load** | **= 3.29 MW** |
| a) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from 1st transformer to grid station | = 3307 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 3.307 x 0.158 | = 202.22 Volts |
| b) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from last transformer to switching station | = 544 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.544 x 0.158 | = 33.27 Volts |
| c) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from transformer to transformer | = 1672 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 1.672 x 0.158 | = 102.24 Volts |
| Total voltage drop for ring main no.1 = 202.22 + 33.27 + 102.24 | = 337.73 Volts |
| % Voltage drop = 337.73 x 100 / 11000 | = 3.07 % |

## RING MAIN NO.2 (FEEDER NO. 2)

| | |
|---|---|
| **Ring Main No. 2 (Feeder No. 2) Load** | **= 3.08 MW** |
| a) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from 1st transformer to grid station | = 2600 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 2.600 x 0.158 | = 158.99 Volts |
| b) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from last transformer to switching station | = 80 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.08 x 0.158 | = 4.89 Volts |
| c) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from transformer to transformer | = 2325 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 2.325 x 0.158 | = 142.17 Volts |
| Total voltage drop for Ring Main No.2 = 158.99 + 4.89 + 142.17 | = 306.05 Volts |
| % Voltage drop = 306.05 x 100 / 11000 | = 2.78 % |

## EXPRESS FEEDER # 1

| | |
|---|---|
| d) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from grid station to switching station | = 2190 m |
| Approximate AC impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 2.190 x 0.158 | = 133.92 Volts |
| % Voltage drop = 133.92 x 100 / 11000 | = 1.22 % |

# 5

## LV- VOLTAGE DROP
## SECTOR-05 (PACKAGE-2)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-2)
.DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


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Email: ocl-khi@osmani.com,
Web: www.osmani.com

| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | Installation | $T_f$ | $S_f$ | $G_f$ | ODF | for Cable In/ODF A[illegible] | NO. | Numbers mm² | IEE Regulations $I_t$ (Amp) | Cable Amps | C[illegible] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | |
| FP 1/1 | 72 | 90.2 | 195 | (225A) TP | (2 x 125A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 202 | | 185 | 220 | 195 | |
| FP 1/2 | 41 | 90.2 | 195 | (225A) TP | (2 x 125A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 202 | | 185 | 220 | 195 | |
| FP 1/3 | 7 | 91.9 | 199 | (225A) TP | (2 x 125A) + (5A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 206 | | 185 | 220 | 199 | |
| FP 1/4 | 92 | 56.9 | 123 | (150A) TP | (7 x 15A) + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 128 | | 70 | 130 | 123 | |
| FP 1/5 | 153 | 45.5 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 102 | | 50 | 106 | 49 | |
| SECONDARY SCHOOL | | 222.5 | 481 | Feed From Trafo-1 | | | 0.93 | 1.15 | 0.9 | 0.96 | | | | | | |
| FP 2/1 | 59 | 44.3 | 96 | (100A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 99 | | 50 | 106 | 96 | |
| FP 2/2 | 23 | 106.1 | 229 | (150A) TP | (6 x 15A) + (2 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 238 | | 240 | 253 | 229 | |
| FP 2/3 | 35 | 56.9 | 123 | (150A) TP | (7 x 15A) + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 128 | | 70 | 130 | 123 | |
| FP 2/4 | 58 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| FP 2/5 | 120 | 60.5 | 131 | (150A) TP | (9 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 136 | | 95 | 154 | 131 | |
| PARK | | 96.3 | 208 | Feed From Trafo-2 | | | 0.93 | 1.15 | 0.9 | 0.96 | | | | | | |
| FP 3/1 | 22 | 45.5 | 98 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 102 | | 50 | 106 | 98 | |
| FP 3/2 | 34 | 52.0 | 112 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 117 | | 70 | 130 | 112 | |
| FP 3/3 | 7 | 52.0 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 117 | | 70 | 130 | 112 | |
| FP 3/4 | 52 | 96.4 | 208 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 216 | | 185 | 220 | 208 | |
| FP 4/1 | 50 | 27.1 | 59 | (80A) TP | (2 x 15A) + (5A) + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 61 | | 25 | 75 | 59 | |
| C2-S | | 96.5 | 209 | Feed From Trafo-4 | | | | | | | | | | | | |
| C2 | | 96.5 | 209 | Feed From Trafo-4 | | | | | | | | | | | | |
| C2 | | 96.5 | 209 | Feed From Trafo-4 | | | | | | | | | | | | |
| FP 5/1 | 51 | 54.0 | 117 | (125A) TP | (8 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 121 | | 70 | 130 | 117 | |
| FP 5/2 | 35 | 119.0 | 257 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 267 | | 300 | 286 | 257 | |
| FP 5/3 | 54 | 39.0 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 88 | | 35 | 90 | 84 | |
| FP 5/4 | 40 | 84.0 | 182 | (200A) TP | (4 x 15A) + (150A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 189 | | 150 | 197 | 182 | |
| MK | | 28.8 | 62 | Feed From Trafo-5 | | | 0.93 | 1.15 | 0.9 | 0.96 | | | | | | |
| STP-06 | | 320.0 | 691 | Feed From Trafo-6 | | | 0.93 | 1.15 | 0.9 | 0.96 | | | | | | |
| FP 7/1 | 18 | 32.5 | 70 | (80A) TP | (5 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 73 | | 25 | 75 | 70 | |
| FP 7/2 | 35 | 52.0 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 117 | | 70 | 130 | 112 | |
| FP 7/3 | 79 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| PARK | | 160.0 | 346 | Feed From Trafo-7 | | | 0.93 | 1.15 | 0.9 | 0.96 | | | | | | |
| FP 8/1 | 34 | 110.5 | 239 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 248 | | 240 | 253 | 239 | |
| FP 8/2 | 117 | 58.5 | 126 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 131 | | 95 | 154 | 126 | |
| FP 8/3 | 137 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| FP 8/4 | 261 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 150 | 197 | 140 | |
| FP 8/5 | 61 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| C2-S | | 96.5 | 209 | Feed From Trafo-9 | | | | | | | | | | | | |

| | | | | | | Installation | | | | | for Cable in/ODF | | Numbers | IEE Regulations | Cable | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | A[redacted] | NO. | mm² | $I_t$ (Amp) | Amps | |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | |
| FP 9/1 | 161 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| FP 9/2 | 93 | 130.0 | 281 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 292 | 2 | 95 | 154 | 140 | |
| FP 9/3 | 91 | 52.0 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 117 | | 70 | 130 | 112 | |
| FP 9/4 | 24 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| FP 9/5 | 38 | 115.9 | 250 | (125A) TP | (25A) + (5A) + (2 x 15A) + (80A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 260 | | 300 | 286 | 250 | |
| ) PARK | | 268.0 | 579 | Feed From Trafo-10 | | | 0.93 | 1.15 | 0.9 | 0.96 | | | | | | |
| ) PARK | | 96.0 | 207 | Feed From Trafo-10 | | | 0.93 | 1.15 | 0.9 | 0.96 | | | | | | |
| FP 10/1 | 129 | 39.0 | 84 | (100A) TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 88 | | 50 | 106 | 84 | |
| FP 10/2 | 326 | 34.5 | 75 | (80A) TP | (5 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 77 | | 95 | 154 | 75 | |
| FP 10/3 | 120 | 52.0 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 117 | | 70 | 130 | 112 | |
| FP 10/4 | 263 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 150 | 197 | 140 | |
| FP 11/1 | 99 | 54.0 | 117 | (125A) TP | (8 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 121 | | 70 | 130 | 117 | |
| FP 11/2 | 7 | 110.5 | 239 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 248 | | 240 | 253 | 239 | |
| FP 11/3 | 126 | 66.3 | 143 | (150A) TP | (9 x 15A) + (20A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 149 | | 95 | 154 | 143 | |
| FP 11/4 | 110 | 45.5 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 102 | | 50 | 106 | 98 | |
| FP 11/5 | 52 | 47.5 | 103 | (125A) TP | (7 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 107 | | 70 | 130 | 103 | |
| FP 12/1 | 63 | 130.0 | 281 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 292 | 2 | 95 | 154 | 140 | |
| FP 12/2 | 92 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| FP 12/3 | 7 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| FP 12/4 | 72 | 68.3 | 148 | (160A) TP | (7 x 15A) + (2 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 153 | | 95 | 154 | 148 | |
| FP 12/5 | 51 | 60.5 | 131 | (150A) TP | (9 x 15A) + (5A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 136 | | 95 | 154 | 131 | |
| PARK | | 92.1 | 199 | Feed From Trafo-13 | | | | | | | | | | | | |
| PARK | | 138.5 | 299 | Feed From Trafo-13 | | | | | | | | | | | | |
| FP 13/1 | 34 | 58.5 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 131 | | 95 | 154 | 126 | |
| FP 13/2 | 18 | 58.5 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 131 | | 95 | 154 | 126 | |
| FP 14/1 | 34 | 58.5 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 131 | | 95 | 154 | 126 | |
| FP 14/2 | 21 | 117.0 | 253 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 263 | | 300 | 286 | 253 | |
| FP 14/3 | 40 | 58.5 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 131 | | 95 | 154 | 126 | |
| FP 14/4 | 77 | 58.5 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 131 | | 95 | 154 | 126 | |
| PARK | | 74.6 | 161 | Feed From Trafo-14 | | | | | | | | | | | | |
| FP 15/1 | 68 | 45.5 | 98 | (125A) TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 102 | | 50 | 106 | 98 | |
| FP 15/2 | 42 | 97.5 | 211 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 219 | | 185 | 220 | 211 | |
| FP 15/3 | 23 | 117.0 | 253 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 263 | | 300 | 286 | 253 | |

| | To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | Installation | $T_f$ | $S_f$ | $G_f$ | ODF | for Cable In/ODF A[illegible]s | NO. | Numbers mm² | IEE Regulations $I_t$ (Amp) | Cable Amps | C: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | |
| | FP 15/4 | 42 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| | FP 15/5 | 79 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| | FP 15/6 | 61 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| ) | C2 | | 96.5 | 208 | Feed From Trafo-16 | | | | | | | | | | | | |
| ) | C2 | | 96.5 | 209 | Feed From Trafo-16 | | | | | | | | | | | | |
| ) | C2 | | 96.5 | 209 | Feed From Trafo-16 | | | | | | | | | | | | |
| : | C2 | | 96.5 | 209 | Feed From Trafo-17 | | | | | | | | | | | | |
| ) | FP 17/1 | 106 | 55.4 | 120 | (125A) TP | (10A) + (15A) + (80A) + (20A) + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 124 | | 70 | 130 | 120 | |
| | FP 17/2 | 42 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| ) | FP 17/3 | 7 | 123.5 | 267 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 277 | | 300 | 286 | 267 | |
| ) | FP 17/4 | 7 | 104.0 | 225 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 233 | | 240 | 253 | 225 | |
| | FP 17/5 | 42 | 52.0 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 117 | | 70 | 130 | 112 | |
| ) | FP 17/6 | 96 | 123.5 | 267 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 277 | | 300 | 286 | 267 | |
| | FP 17/7 | 75 | 58.5 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 131 | | 95 | 154 | 126 | |
| | FP 17/8 | 9 | 65.0 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| ) | FP 17/9 | 64 | 130.0 | 281 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 292 | 2 | 95 | 154 | 140 | |

*) at 25⁰ C=0.93*

*1.2 K.m/w = 1.15*
*/xGf*

**METHOD OF INSTALLATION**

A = Conduit in thermally insulated wall conduit
B = Clipped on wall
C = Direct in masonry
D = Buried in ground
E or F = On cable trays

**Maximum Voltage Drop 5% Allowed**

400 V = 20 V

**REF:**

NEPRA DISTRIBUTION CODE= DF

**TYPE OF CABLE**

A- AL, xLPE,PVC /SWA /PVC

*ie for continuous service(IZ= It x odf)*

***ion refer to IEE 17th edition chapter 05***

# 6

## LOADING OF TRANSFORMERS IN SECTOR-05 (PACKAGE-2)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-2)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
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Web: www.osmani.com

# D.H.A CITY

## SECTOR-05 (PACKAGE-2)

| FEEDER | | TRANSFORMERS |
|---|---|---|
| Feeder No: | 1 | 1000 kVA(TYPE-A) = 1 b) 1000 kVA(TYPE-B)=1 |
| Feeder Load: | 3.29 MW | 500 kVA(TYPE-A) =1 b) 500 kVA(TYPE-B) =6 |

| S. No. | TRANSFORMER | | | | |
|---|---|---|---|---|---|
| | TR-No. | Rating kVA | Rating kW | Connected Load kW | Loading Efficiency % |
| 1 | 1 | 1000 | 800 | 597.4 | 74.68% |
| 2 | 2 | 500 | 400 | 288.5 | 72.13% |
| 3 | 3 | 500 | 400 | 296.74 | 74.19% |
| 4 | 4 | 500 | 400 | 316.59 | 79.15% |
| 5 | 5 | 500 | 400 | 270.8 | 67.70% |
| 6 | 6 | 500 | 400 | 320 | 80.00% |
| 7 | 7 | 500 | 400 | 309.5 | 77.38% |
| 8 | 8 | 500 | 400 | 305.5 | 76.38% |
| 9 | 9 | 1000 | 800 | 587.36 | 73.42% |

| FEEDER | | TRANSFORMERS | |
|---|---|---|---|
| Feeder No: | 2 | 1000 kVA(TYPE-A) =1 | b) 1000 kVA(TYPE-B)=1 |
| Feeder Load: | 3.08 MW | 500 kVA(TYPE-A) =1 | b) 500 kVA(TYPE-B) =5 |

| S. No. | TRANSFORMER | | | | |
|---|---|---|---|---|---|
| | TR-No. | Rating kVA | Rating kW | Connected Load kW | Loading Efficiency % |
| 1 | 10 | 1000 | 800 | 554.5 | 69.31% |
| 2 | 11 | 500 | 400 | 278.37 | 69.59% |
| 3 | 12 | 500 | 400 | 323.8 | 80.95% |
| 4 | 13 | 500 | 400 | 347.64 | 86.91% |
| 5 | 14 | 500 | 400 | 308.55 | 77.14% |
| 6 | 15 | 500 | 400 | 344.5 | 86.13% |
| 7 | 16 | 500 | 400 | 289.62 | 72.41% |
| 8 | 17 | 1000 | 800 | 632.88 | 79.11% |

# 8

## BoQ

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-2)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
**Consulting Engineers – Architects – Planners**
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Email: ocl-khi@osmani.com,
Web: www.osmani.

# ENGINEER'S ESTIMATE

**CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI**
**NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS**
**LOCATION : DHA CITY SECTOR '5' (PACKAGE-2)**
**SUB-HEAD : ELECTRICAL WORKS LV DISTRIBUTION**

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| | **EXCAVATION** | | | | |
| 1 | Excavation and back filling as in hard/sofft or any soil upto 1.0m depth and 0.9m wide for MV/LV/ITC cable and pipe trenches complete as directed by the Engineer.(Excluding cost of cable & pipe) | 4,910 | Cum | 900 | 4,419,000 |
| 1.1 | Excavation and back filling as in hard/sofft or any soil upto 1.0m depth and 0.6m wide for LV/ITC cable and pipe trenches complete as directed by the Engineer.(Excluding cost of cable & pipe) | 1,335 | Cum | 900 | 1,201,500 |
| | **LV CABLE** | | | | |
| 2 | Supply, laying , conecting and testing Cable electric LV 600/1000V stranded aluminium conductor, XLPE insulated, Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, sand.warning tap with all accessories as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| 2.1) | 4 core 300mm² AL, XLPE,PVC / SWA / PVC | 220 | m | 5,600 | 1,232,000 |
| 2.2) | 4 core 240mm² AL, XLPE,PVC / SWA / PVC | 48 | m | 4,500 | 216,000 |
| 2.3) | 4 core 185mm² AL, XLPE,PVC / SWA / PVC | 94 | m | 3,500 | 329,000 |
| 2.4) | 4 core 150mm² AL, XLPE,PVC / SWA / PVC | 564 | m | 2,800 | 1,579,200 |
| 2.5) | 4 core 95mm² AL, XLPE,PVC / SWA / PVC | 2,204 | m | 2,000 | 4,408,000 |
| 2.6) | 4 core 70mm² AL, XLPE,PVC / SWA / PVC | 637 | m | 1,750 | 1,114,750 |
| 2.7) | 4 core 50mm² AL, XLPE,PVC / SWA / PVC | 329 | m | 1,200 | 394,800 |
| 2.8) | 4 core 35mm² AL, XLPE,PVC / SWA / PVC | 54 | m | 950 | 51,300 |
| 2.9) | 4 core 25mm² AL, XLPE,PVC / SWA / PVC | 68 | m | 750 | 51,000 |
| 3 | Danger sign for MV & LV not less than 250 X 125 mm enameled as required, supply and fixing. | 75 | Each | 2,000 | 150,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Feeder pillar** | | | | |
| 4 | Providing, installing, testing and commissioning of floor mounted Feeder pillar in 16 SWG sheet steel housing, dust, weather proof IP-54 paint, hinged door/lock, suitable for 3 phase neutral and earth strip 400 volts, Almunium busbars & Insulators for distribution to out going breakers.Seperate Almunium busbars chamber in locking arrangement. Installed on RCC pad, including cost of RCC foundation, complete as per Drawings and accessories as Directed by | | | | |
| 4.1) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>10-10A to 60A TP MCCB 16KA | 22 | Each | 255,000 | 5,610,000 |
| 4.2) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>9-10A to 60A TP MCCB 16KA<br>1-TP MCCB Space only | 12 | Each | 245,000 | 2,940,000 |
| 4.3) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>8-10A to 60A TP MCCB 16KA<br>2-TP MCCB Space only | 12 | Each | 240,000 | 2,880,000 |
| 4.4) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>7-10A to 60A TP MCCB 16KA<br>3-TP MCCB Space only | 3 | Each | 225,000 | 675,000 |
| 4.5)<br>a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>6-30A to 60A TP MCCB 16KA<br>4-TP MCCB Space only | 2 | Each | 215,000 | 430,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4.5) b) | **Incoming**<br>1-80A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>6-30A to 60A TP MCCB 16KA<br>4-TP MCCB Space only | 1 | Each | 205,000 | 205,000 |
| 4.6) a) | **Incoming**<br>1-80A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>5-10A to 60A TP MCCB 16KA<br>5-TP MCCB Space only | 1 | Each | 195,000 | 195,000 |
| 4.6) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>4-10A to 60A TP MCCB 16KA<br>1-150A TP MCCB 25KA<br>5-TP MCCB Space only | 1 | Each | 195,000 | 195,000 |
| 4.6) c) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>4-10A to 60A TP MCCB 16KA<br>1-80A TP MCCB 25KA<br>5-TP MCCB Space only | 2 | Each | 195,000 | 390,000 |
| 4.7) | **Incoming**<br>1-80A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>4-10A to 60A TP MCCB 16KA<br>6-TP MCCB Space only | 1 | Each | 190,000 | 190,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Earthing Electrodes** | | | | |
| 5 | Supply, installation, connection & testing of copper earth electrodes, 20mm dia, 3000mm in length, driven vertically in ground, including cost of Test pit 300x300x300mm, internal plaster, 100mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 60 | Job | 45,000 | 2,700,000 |
| 6 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Feeder Pillars as shown on the drawing. or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 600 | m | 500 | 300,000 |
| | | | | **Total of Rs.** | **31,856,550** |

# ENGINEER'S ESTIMATE

**CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI**
**NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS**
**LOCATION : DHA CITY SECTOR `5` (PACKAGE-2)**
**SUB-HEAD : ELECTRICAL WORKS MV DISTRIBUTION.** **(Feeders & Express feeder)**

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| 1 | **MV CABLE**<br>Supply,laying and conecting, Cable electric MV 15-kV stranded aluminium conductor, XLPE insulated,Triple Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, soft sand coushion, warning tape, Marker as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| | **FEEDER No 1.** | | | | |
| 1.1) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-1 as shown on the drawings. | 3,307 | m | 7,600 | 25,133,200 |
| 1.2) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 1,672 | m | 7,600 | 12,707,200 |
| 1.3) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-9 to Switch station-1 as shown on the drawings. | 544 | m | 7,600 | 4,134,400 |
| | **FEEDER No 2.** | | | | |
| 1.4) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-17 as shown on the drawings. | 2,600 | m | 7,600 | 19,760,000 |
| 1.5) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 2,325 | m | 7,600 | 17,670,000 |
| 1.6) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-10 to Switch station-1 as shown on the drawings. | 80 | m | 7,600 | 608,000 |
| | **EXPRESS FEEDER-1** | | | | |
| 1.7) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from Grid station to Switch station-1 as shown on the drawings. | 2,190 | m | 7,600 | 16,644,000 |
| 2 | PVC straight joint, MV 15kV, for XLPE cable consisting of mould, resin, MV tape, semi conducting tape, ferrules and earth wire etc. suitable for MV cables, 3 core 300mm², supply and fixing complete with all installation accessories as per KESC standard. | | | | |
| | **FEEDER No 1.** | | | | |
| 2.1) | From grid station to TR-1 | 33 | Each | 80,000 | 2,640,000 |
| 2.1) | From TR-9 to Switching station | 6 | Each | 80,000 | 480,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **FEEDER No 2.** | | | | |
| 2.2) | From grid station to TR-17 | 30 | Each | 80,000 | 2,400,000 |
| 2.3) | From TR-10 to Switching station. | 2 | Each | 80,000 | 160,000 |
| | **EXPRESS FEEDER No 1.** | | | | |
| 2.4) | From Switching station No-1 to grid station. | 25 | Each | 80,000 | 2,000,000 |
| 3 | **SWITCHING STATION NO-1**<br>Supply Installation, testing and commissioning outdoor type of Switching station.Substation will have **1-incoming & 2-outgoing 17.5kV** Vaccum circuit breaker **(VCB), 350MVA, 630A,** with protection devices housed in metalic frame **IP 54**. Switching station will be mounted on RCC plateform circuit breaker (CB) will be trolley raised type to avoid floor unevenness if any. The male & female contacts shall be rod & Tulip type with vertical arrangement. EFI will be installed on each cable. The breaker shall be provided with bimetalic lugs to accomodate 2-Almunium cable connection with copper bus-bars. C.T & P.T will be installed on each breaker. C.T ratio **1200/600/1/1** P.T ratio **11kV/110V**. Each VCB shall have earthing switch to ground cable. Earthing switch shall have inter-lock with **"ON"** Mechanism. Digital type Relays on each VCB shall be over current 2Nos; Earth Fault one No with series/shunt trip prorivions. The relay shall have additional potential free contacts for SCADA. Relays shall have self supervision provision. SCADA provision- each VCB will have potential **"NO" & "NC"** contact for status monitoring locally as well as at remote control room through SCADA. Switching Station (SS) housing shall be designed for safe operation by operator locally. No arc should comeout in any case. As per spacification installed on RCC pad, including the cost of RCC foundation pad complete with all civil and other installation accessories as shown on the drawing or as directed by the Engineers'.<br><br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 1 | Job | 5,800,000 | 5,800,000 |
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing **Kiosk Sub Station (Type-A) with 630 Amp. VCB 17.5 kV, 350MVA, 1000 kVA** Oil filled **Transformer 11/0.42 kV** with incoming & out going VCBs on MV side. Air Circuit Breaker of 1600 Amp outgoing 6 Nos MCCB of 400 Amp according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br><br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 1 | Each | 7,050,000 | 7,050,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 5 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing **Kiosk Sub Station (Type-B) with 630 Amp. VCB 17.5kV, 350MVA, 1000 kVA** Oil filled **Transformer 11/0.42 kV** with incoming & out going load break switches with SF6 Fuses on MV side. Air Circuit Breaker of 1600 Amp outgoing 6 Nos MCCB of 400 Amp according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | 6,000,000 | 12,000,000 |
| 6 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing **Kiosk Sub Station (Type-A) with 630 Amp. VCB 17.5kV, 350MVA, 500 kVA** Oil filled **Transformer 11/0.42 kV** with incoming & out going VCBs on MV side. Air Circuit Breaker of 1600 Amp outgoing 6 Nos MCCB of 300 Amp according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | 5,300,000 | 10,600,000 |
| 7 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing **Kiosk Sub Station (Type-B) with 630 Amp. VCB 17.5kV, 350MVA, 500 kVA** Oil filled **Transformer 11/0.42 kV** with incoming & out going load break switches with SF6 Fuses on MV side. Air Circuit Breaker of 1600 Amp outgoing 6 Nos MCCB of 300 Amp according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 10 | Each | 4,300,000 | 43,000,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 8 | **Earthing Electrodes**<br>Supply, installation, connection & testing of copper earth electrodes, 20mm dia, 3000mm in length, driven vertically in ground, including cost of Test pit 300x300x300mm, internal plaster, 100mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 20 | Job | 45,000 | 900,000 |
| 9 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Switching Station&Transformers as shown on the drawing. or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 200 | m | 500 | 100,000 |
| | | | | **Total of Rs.** | **183,786,800** |

# PAKISTAN DEFENCE OFFICERS' HOUSING AUTHORITY KARACHI

# PLANNING AND DESIGNING OF ELECTRICAL DISTRIBUTION SYSTEM OF DHA CITY KARACHI SECTOR - 5 ( PACKAGE - 03 )

# DETAILED DESIGN REPORT

SUBMITTED BY


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FEBRUARY 2013

# PLANNING & DESIGNING OF ELECTRICAL DISTRIBUTION SYSTEM OF DHA CITY, KARACHI
# SECTOR-05
# (PACKAGE-3)

## DETAILED DESIGN & DRAWINGS

# DEFENCE HOUSING AUTHORITY
# KARACHI

## SHORT-TERM PLAN ENERGY SECTOR – 05 (Package-03)
## DHA CITY KARACHI

# DETAILED DESIGN REPORT

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# 1

## DESIGN BRIEF & DESIGN CRITERIA

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-3)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


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# 1. EXECUTIVE SUMMARY

Main components of Energy Design for Sector-5C, Short Term Development Plan comprises of the following:

**A) MV Distribution Network comprising of:**

**1) MV Cables:**

- 3 core 300 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable — 4,809 m
- 3 core 400 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable — 14,686 m

**2) Switching Stations:**

a) 5-way — 1 Nos.

**3) Kiosk Sub Station:**

- Kiosk Sub Station 1000 kVA (Type A) Transformer 11/0.42 kV Oil filled — 4 Nos.
- Kiosk Sub Station 1000 kVA (Type B) Transformer 11/0.42 kV Oil filled — 5 Nos.
- Kiosk Sub Station 630 kVA (Type B) Transformer 11/0.42 kV Oil filled — 2 Nos.
- Kiosk Sub Station 500 kVA (Type A) Transformer 11/0.42 kV Oil filled — 4 Nos.
- Kiosk Sub Station 500 kVA (Type B) Transformer 11/0.42 kV Oil filled — 17 Nos.

**B) LV Distribution Network comprising of:**

**1) LV Cables:**

| | | |
|---|---|---|
| a) | 4 core 300 mm² AL, XLPE/PVC/SWA/PVC cable | 233 m |
| b) | 4 core 240 mm² AL, XLPE/PVC/SWA/PVC cable | 42 m |
| c) | 4 core 185 mm² AL, XLPE/PVC/SWA/PVC cable | 424 m |
| d) | 4 core 150 mm² AL, XLPE/PVC/SWA/PVC cable | 469 m |
| e) | 4 core 120 mm² AL, XLPE/PVC/SWA/PVC cable | 531 m |
| f) | 4 core 95 mm² AL, XLPE/PVC/SWA/PVC cable | 840 m |
| g) | 4 core 70 mm² AL, XLPE/PVC/SWA/PVC cable | 403 m |
| h) | 4 core 50 mm² AL, XLPE/PVC/SWA/PVC cable | 447 m |
| i) | 4 core 35 mm² AL, XLPE/PVC/SWA/PVC cable | 80 m |
| j) | 4 core 16 mm² AL, XLPE/PVC/SWA/PVC cable | 23 m |

4) **Feeder Pillars:**

| | |
|---|---|
| **10-way FP** | **8 Nos** |
| **9-way FP** | **7 Nos** |
| **8-way FP** | **8 Nos** |
| **7-way FP** | **13 Nos** |
| **6-way FP** | **3 Nos** |
| **5-way FP** | **3 Nos** |
| **4-way FP** | **1 No** |
| **3-way FP** | **5 Nos** |
| **2- way FP** | **6 Nos** |

**C) Smart Grid ICT Network / pipe sleeves comprising:**

1) HDPE Pipe 2" dia. (2 Nos.) for MV/LV cables 28,000 m

2) RCC hand hole with cover (L=5', W=3', D=3') 165 Nos.

# 2. GENERAL FEATURES

## 2.1 INTRODUCTION

Pakistan Defence Officers Housing Authority (DHA) has commissioned M/s Osmani and Company (Pvt.) Ltd. to provide consultancy services for Development of DHA City Karachi (DCK) in August 2010. DHA City is spread over an area of 11,640 acres with numerous ridges and nalas following a rolling / mountainous terrain. DHA City is planned and divided into 16 sectors as listed below in Table 2-1

**Table 2-1: Area of Sectors**

| S.NO. | LOCATION | AREA (acres) | S.NO. | LOCATION | AREA (acres) |
|---|---|---|---|---|---|
| 1 | SECTOR 1 | 525 | 9 | SECTOR 9 | 604 |
| 2 | SECTOR 2 | 600 | 10 | SECTOR 10 | 541 |
| 3 | SECTOR 3 | 311 | 11 | SECTOR 11 | 663 |
| 4 | SECTOR 4 | 337 | 12 | SECTOR 12 | 504 |
| **5** | **SECTOR 5** | **483** | 13 | SECTOR 13 | 575 |
| 6 | SECTOR 6 | 823 | 14 | SECTOR 14 | 655 |
| 7 | SECTOR 7 | 631 | 15 | SECTOR 15 | 697 |
| 8 | SECTOR 8 | 339 | 16 | SECTOR 16 | 383 |
| **GRAND TOTAL** | | | | | **8,671** |

Sector development works are to be carried out with respect to development strategy, which has been divided into 3 phases;

- Short Term Development Plan (2015 – 2018)
- Mid Term Development Plan (2018 – 2021)
- Long Term Development Plan (2021 – 2030)

The following ***Figure 2-1*** shows the location of various sub-sectors planned under short term development.

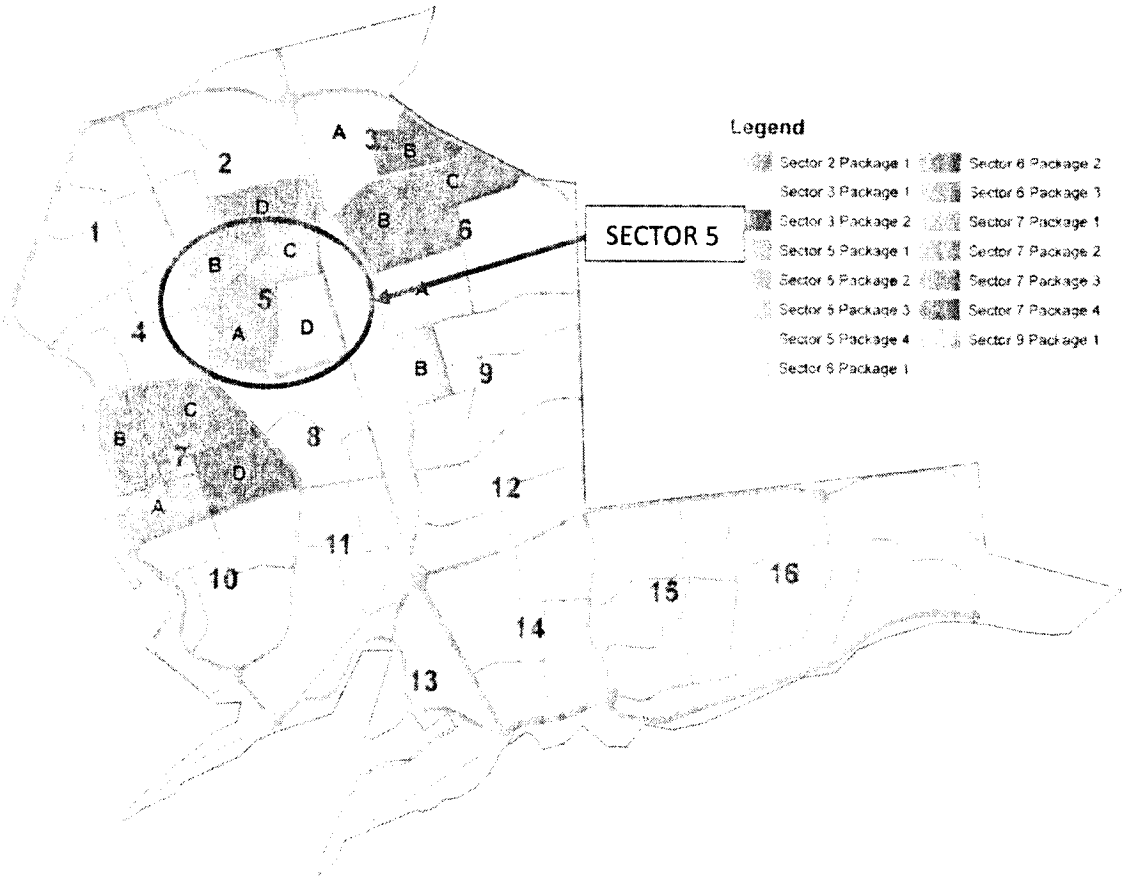


**Figure 2-1: Sectors under Short Term Development Plan**

Sectors are generally divided into four sub sectors as per the design criteria of 'Ekistics' for ease of communication of urban city. Acreage of each sub sector is given in Table 2-1 of Short Term Development Plan. Sector 5 has a total developed area of 2,335,734 square yards or 483 acres, excluding road network. About 2/3 of the area of sector 5 is utilized for residential purposes.

***Table 2-2*** shows the areas of various sectors under short term development plan:

**Table 2-2: Areas of Sectors under Short Term Plan**

| Areas in acres | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sector | Sub-Sector | | | | | Other than Sub Sector | Total |
| | A | B | C | C-5 | D | | |
| 2 | | | | | 141 | | 141 |
| 3 | 215 | 81 | | 15 | | | 311 |
| **5** | **136** | **108** | **63** | **18** | **136** | **22** | **483** |
| 6 | 167 | 97 | 112 | 40 | | | 416 |
| 7 | 136 | 129 | 198 | 19 | 149 | | 631 |
| 9 | | 89 | | | | | 89 |
| CBD | | | | | | 104 | 104 |
| **Total** | **654** | **504** | **373** | **92** | **426** | **126** | **2,175** |

Sector 5 is one of the model sectors being developed under Short Term Plan. This sector has plots of different sizes ranges from R3-S to R20-S. Majority of plots are of size R5 and R10.

## 2.2 SCOPE OF THE REPORT

The main objective of this report is to explain the Detailed Design for Energy Distribution Network of DCK. The main objectives of this Detailed Design Report (DDR) are the following:

- Present the Detailed Design of Sector 5C to enable client review prior to progression to the bidding stage.
- Provide details of how the design has been developed since the submission of the Preliminary Design Energy Distribution Report.
- Provide an updated description of the works.

- Confirm the design criteria and parameters used for the design of Electrical Distribution System. Provide a rough cost estimate for the project component.

- Provide details of any information obtained; and information still required to complete the project and highlight any potential difficulties in obtaining such information.

- This report will cover Detailed Design of Sector-5C as encircled in Figure 2-1 and highlighted in Table 2-1

## 2.3 BACKGROUND

Sector 5 was planned on 487 acres area, with City Boulevard (PA 01) to the west, Main Boulevard West (PA 02D) to the east, West Avenue 1W (PC 01) to the north and West Avenue 2W (PA 04) on the south. For tendering purpose, Sector 5 is divided in to 4 packages i.e. 1, 2, 3 and 4. Package 1 contains sub-sector A with an approx. area of 136 acres, package 2 contains sub-sector B with an approx. area of 108 acres, package 3 contains sub-sector C and commercial centre C5 with an approx. area of 81 acres and lastly package 4 contains sub-sector D with an approx. area of 136 acres.

Figure 2-2: Boundaries of Packages 1 to 4 of Sector 5 shows the boundaries of packages 1 to 4 of sector 5.

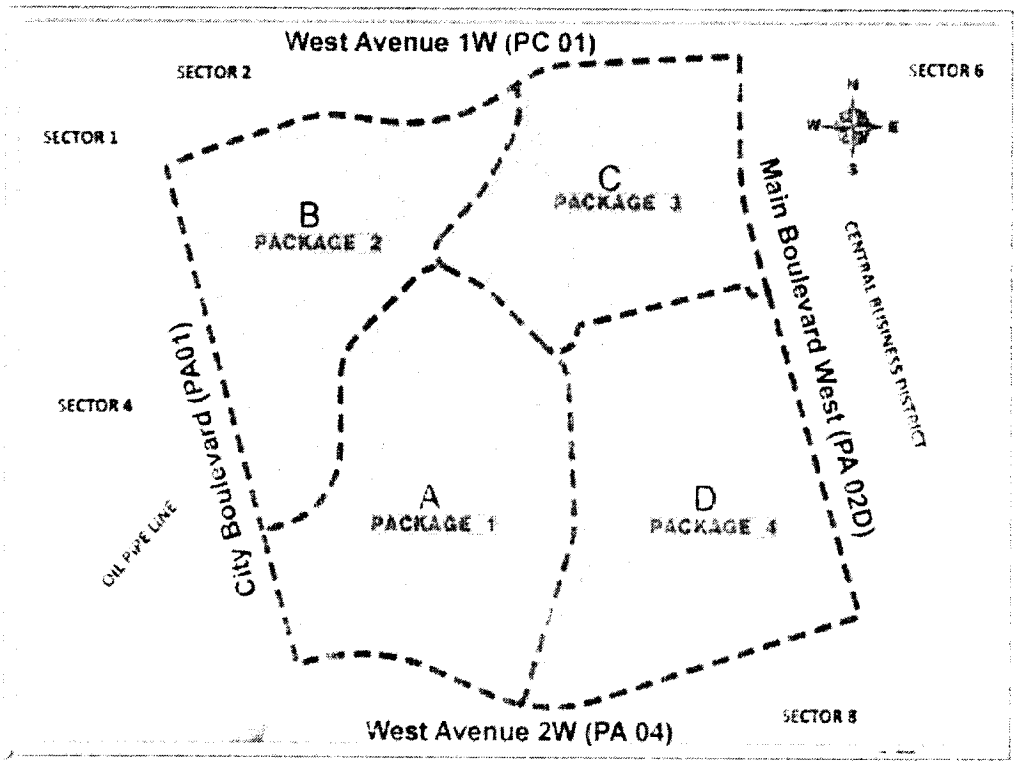

**Figure 2-2: Boundaries of Packages 1 to 4 of Sector 5**

## 2.4 TOPOGRAPHY OF SUB-SECTOR 5-C

Sub-Sector 5-C is relatively hilly as compared to other sub-sectors. Figure 2-3 shows that it has the highest elevation of 590.535 ft and lowest elevation of 494.661 ft, with a difference of 95.87 ft. There is a valley in the northern portion which extends from the west to the east.

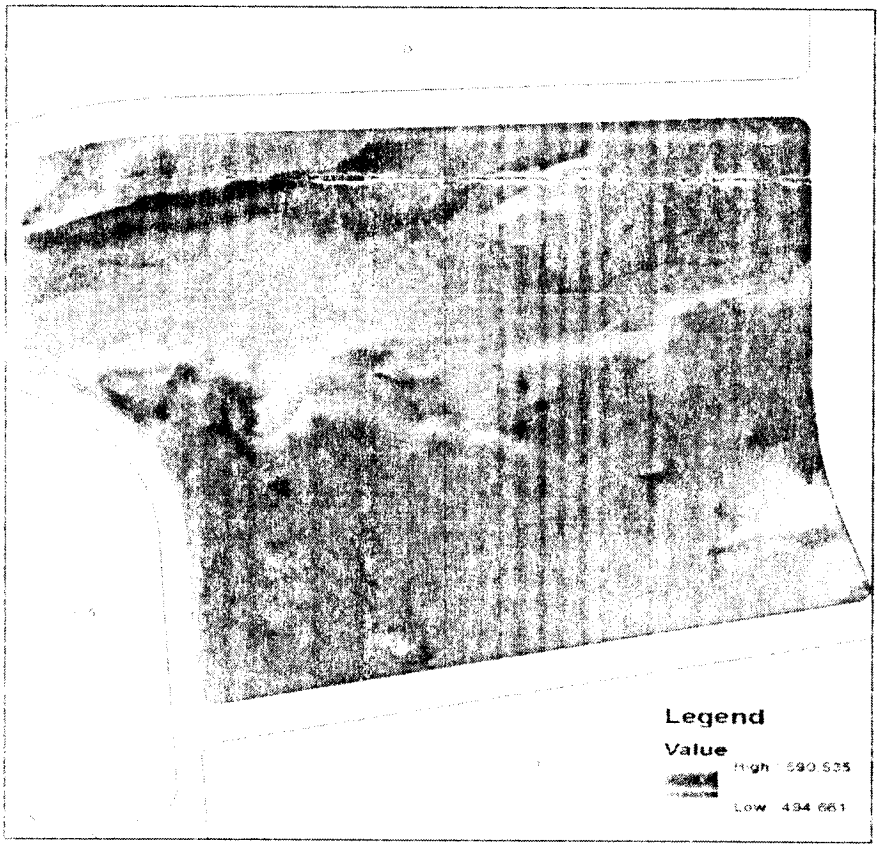


**Figure 2-3: Topography of Sub-Sector 5-C**

## 2.5 POPULATION AND DEVELOPMENT

The DCK will be developed in stages aiming to reach eventually more than 600,000 people. The overall planning of DCK is based on ekistics, leading to sectors of 20-40,000 people each. Sector 5 has a total developed area of 2,335,734 square yards, excluding road network. The table below describes the land use in sector 5. About 2/3 of the area of sector 5 is utilized for residential purposes. Residential area has different plot categories from 100 square yards to 2,000 square yards. Other facilities include commercial areas, amenities, educational institutions, graveyard, healthcare facilities and green space areas.

**Table 2-3: Sector 5: Land Use Statistics**

| SECTOR 5 LAND USE STATISTICS | | | |
|---|---|---|---|
| **Zonal Land use** | **Categories** | **Area (Sq.yards)** | **Total Area (Sq.yards)** |
| Agriculture and Preserved Open Spaces | Nallah | 38738.43 | **269616.5** |
| | Oil Pipe Line | 10986.53 | |
| | Open & Green Space | 219891.6 | |
| Amenities | Cemetery | 5039.94 | **63286.45** |
| | College/ A-Level/ Professional (CA/ ACCA etc.) | 6947.61 | |
| | Community Hall | 5260.62 | |
| | Dispensary | 756.46 | |
| | Health Centre | 3033.58 | |
| | Kindergarten | 7225.15 | |
| | Marriage Hall | 1555.55 | |
| | Masjid | 4510.28 | |
| | PS/ SS/ O-Level | 26977.56 | |
| | Public Service (Club) | 1979.7 | |
| Commercial | - | - | **36622.17** |
| Mixed use | - | - | **11279.09** |
| Recreation | Nursery | 53830.99 | **114651.8** |
| | Parks and Playground | 60820.86 | |
| Residential | - | - | **1100971** |
| Transportation | Commercial Collector Roads (120' ROW) | 21000.71 | **721689.8** |
| | Commercial Collector Roads (60' Row) | 28936.15 | |
| | Parking | 17406.59 | |
| | Pedestrian way | 9979.16 | |
| | Piazza | 53540.53 | |
| | Residential Collector Roads (90' ROW) | 63726.05 | |
| | Streets | 527100.6 | |
| Utilities | ICT and Security | 1183.57 | **17616.83** |

| | | | |
|---|---|---|---|
| | Overhead Reservoir | 2288.72 | |
| | Sewage Treatment Plant | 5218.79 | |
| | Unclassified Utility | 8925.74 | |
| **Grand Total** | | | **2,335,734** |

## 2.6 CONTRACT PACKAGES

Sector 5 consists of 4 contract packages. Refer **Figure 2-2** for location and boundary of various packages. The detailed layout plans showing detailed MV & LV network of contract package 5-C is also attached in Detailed Design Drawings of the report. The statistical description of package 3 is given below:

- **Package-03**

  This package comprises of sub-sector C and Commercial Centre C5 which has an area of 90 acres Table 2-2: Areas of Sectors under Short Term Plan and consists of an approx. road network of 25,082 ft (7.65 Km) Table 2-44 shows it has 9 C3s.

Table 2-4 shows the Plots Summary of Sub-sector 5-C under categories of Residential, Commercial & Mix Use.

**Table 2-4: Plots Summary – Sub-Sector 5-C**

**SUB-SECTOR 5-C**
**PLOTS SUMMARY**

**Residential Plots**

| | R1 | R2 | R2.5 | R3 | R5 | R10 | R20 | Total |
|---|---|---|---|---|---|---|---|---|
| **Sector 5** | | | | **3** | **1,369** | **396** | **5** | **1,773** |
| Sub-Sector 5- C | | | | 1 | 306 | 10 | | **317** |

**Commercial Plots**

| | C1 | C2 | C2.5 | C3 | C5 | C10 | C20 | Total |
|---|---|---|---|---|---|---|---|---|
| **Sector 5** | | **66** | **5** | **17** | **16** | **2** | | **106** |
| Sub-Sector | | 2 | 2 | 9 | 7 | | | **20** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5- C | | | | | | | | |

| Mix Use (Residential + Commercial) Plots | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | M1 | M2 | M2.5 | M3 | M5 | M10 | M20 | Total |
| Sector 5 | | 49 | 1 | 3 | | | | 53 |
| Sub-Sector 5- C | | 7 | | 3 | | | | 10 |

## 2.7 OVERVIEW OF DCK ELECTRICAL DISTRIBUTION DESIGN

Design of the Electrical Distribution Network for DHA City Karachi (DCK) is a very important task of the project. Analysis of the latest technologies, current industry standards, local field practices and availability of skilled Human Resource (HR) have been done with a view of current and future requirements of DCK residential and commercial users. Electrical network design layout of DCK is based on the geographic and sector wise distribution.

The DCK is a vision to build an urban city with adaption of new technologies. Distinctly it has to be a part of global smart cities family, which integrates various technical trends into a single place to facilitate best options to the local residents as well as business community. Any urban society can't be accomplished without proper plan so decision for opting of a reliable electrical distribution system for DCK will really need a higher priority at early stage.

Thus it is proposed to design and construct an electrical network that will be capable to deliver electrical services within DCK. In order to enable the level of operational efficiencies needed for a project of this kind, the use of 'smart building technologies' is the basis of this design to fulfil DCK requirement for

provisioning of electrical services. The aim is to provide a network with reliable electricity supply to the residents and stakeholders.

Kiosk type substations can only be the favourable medium for smart distribution in DCK, which can provide the monitoring and control required. We believe that key for reliable electricity is a reliable distribution system with few faults and their fast location and removal. In this regard best efforts are being made to make DCK a prosperous place in current and future scenarios. This will enable DCK to append and merge forthcoming technologies without modifying its existing infrastructure system. The description of various kiosks Sub-Stations used is given below.

- **Kiosk Sub-Station Type-A** (1000 kVA, 630 kVA, 500 kVA) Oil filled Transformer 11/0.42 kV, with incoming & outgoing VCBs on MV side.

- **Kiosk Sub-Station Type-B** (1000 kVA, 630 kVA, 500 kVA) Oil filled Transformer 11/0.42 kV, with incoming and outgoing SF6 load break switches with fuses on MV side.

# 3. DESIGN CRITERIA

## 3.1 DESIGN CODES & STANDARDS

All systems shall adapt the following main standards, wherever applicable:

- European Committee for Standardization (CEN) and European Committee for Electro technical Standardization (CENELEC)
- International Electro technical Commission (IEC)
- International Organization for Standardization (ISO)
- Other Standards and Codes can be used in areas not covered by these standards. Other standards include:
- European Standards like EN, DIN
- British Standards (BS)

The Electrical products used, should be tested and approved to meet the applicable standards by one of the independent test laboratories including following:

- KEMA
- CESI
- UL or other similar laboratories

## 3.2 USER REQUIREMENTS

The user requirements for DCK that are given by the DHA include the followings:

a) Completely underground distribution system.

b) Use of aluminium conductor cables for cost saving.

c) Use of Kiosk type substations for space saving and faster installation.

d) Smart Metering Technologies.

e) Remote monitoring and control.

## 3.3 DESIGN CRITERIA

The DCK Electrical Distribution must meet following requirements:

- High reliability
- Safe Operation
- Route Protection
- Redundancy
- Reliable Technology
- Easy to maintain and troubleshoot
- Environmentally Protected
- Cost Effective
- Future Proof

## 3.4 DESIGN CONSIDERATIONS

- Underground distribution for reliable power supply.
- MV ring distribution for fast restoration of power in case of fault.
- Use of MV express feeder to provide backup in case of simultaneous fault on two feeders.
- Use of Kiosk type substation for space saving and faster installation.
- Use of VCB type Ring Main Units (RMUs) for reliable maintenance free switching.

- Fibre Optic cable network for remote monitoring and control.
- Use of Smart Meters in residences, offices & commercial premises for two way flow of power, thus encouraging use of renewable energy by consumers.
- Remote monitoring and control of MV and LV distribution system and automatic meter reading and billing.
- Use of cost saving aluminium conductor for MV and LV cables.

# 4. SMART GRID

## 4.1 GENERAL

Traditional Electric Power Systems have been designed through deploying large central generation units built away from cities and residential areas, while electricity has been delivered to consumers through interlinked transmission lines and grid stations. Each individual generation unit, whether it is powered by fossil fuels or hydro, may be rated of up to hundreds of Megawatts (MWs). Transmission line distance also varies up to hundreds of kilometres and Electricity is then transferred to end-users through distribution transformers. The distribution system is very extensive but is almost entirely passive with *little communication* and only limited local controls. There is no *real-time monitoring* hence there is very little interaction between the loads and the power system.

DCK – Short Term Plan
Detailed Design Report - Energy Sector-6C

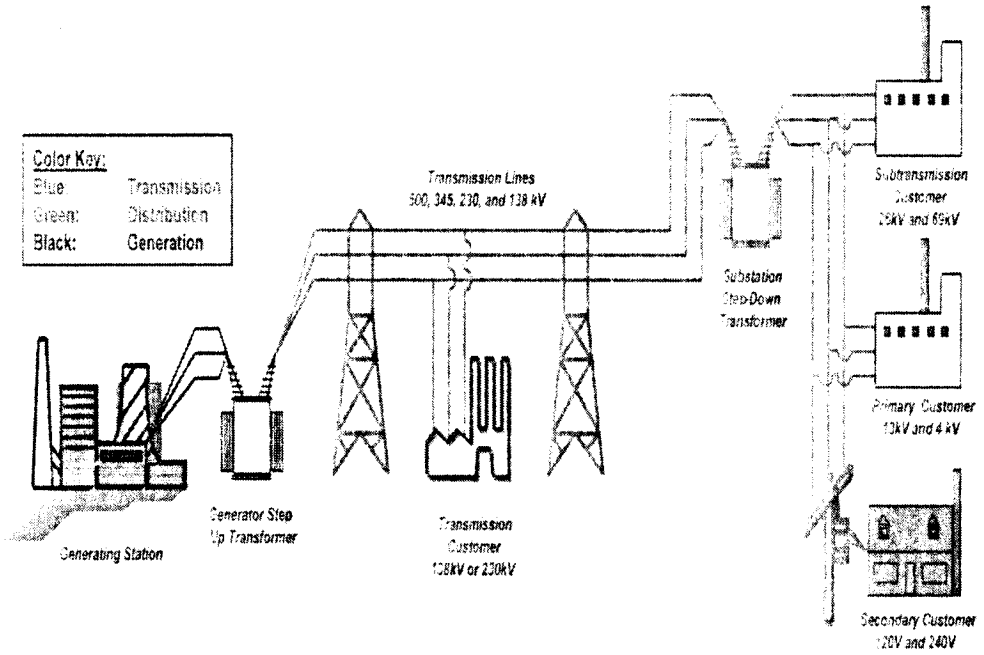
Color Key:
Blue: Transmission
Green: Distribution
Black: Generation
Transmission Lines
500, 345, 230, and 138 kV
Substation
Step-Down
Transformer
Subtransmission
Customer
69kV and 69kV
Primary Customer
10kV and 4 kV
Secondary Customer
120V and 240V
Generating Station
Generator Step
Up Transformer
Transmission
Customer
138kV or 230kV

**Figure 4-1: Existing Power System Infrastructure**

The present advances in communication systems, particularly high speed networks, offer the possibility of much greater monitoring and control throughout the power system and hence more effective, flexible and lower cost operations.

Today, design concept of power system has changed and it does not required to be isolated from cities by using large scale generators. Instead large numbers of small scale generation units located at various places are being combined together to deliver electricity to local city residents. Using ICT services at smaller scale is very feasible as well as cost effective. This concept of intelligent delivery of electricity is known as ***Smart Grid***.

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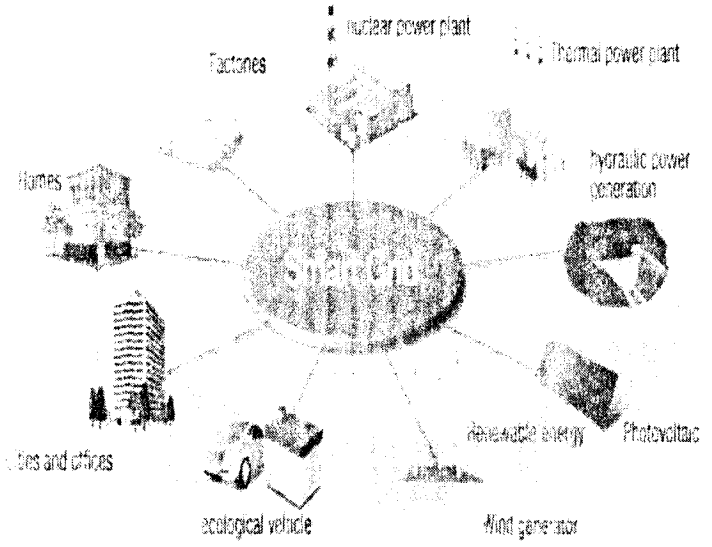


**Figure 4-2: A Smart Grid Infrastructure**

One of the best features of DHA City Karachi (DCK) is the introduction of Smart Grid Technology which will help in managing and protecting the resources of DCK electricity network. Electrical components wili be 'network' enabled which will help to monitor the electricity consumption by DCK Power Operators remotely at Network Control Centre (NCC). Real-time Electricity database will then be used to optimize power generation and distribution.

Not only this, but real-time monitoring and control will enable to avoid any un-wanted circumstance such as blackout due to heavy short circuits within network and brownout due to unplanned heavy loads. These cases not only affect the power quality but also damage costly power equipment such as power trans-formers and bus bars at Sub-Stations/grid stations. This technology will enable the DCK consumers to see how much Electricity is being consumed and can also see utility bills any time online at their homes through smart meters.

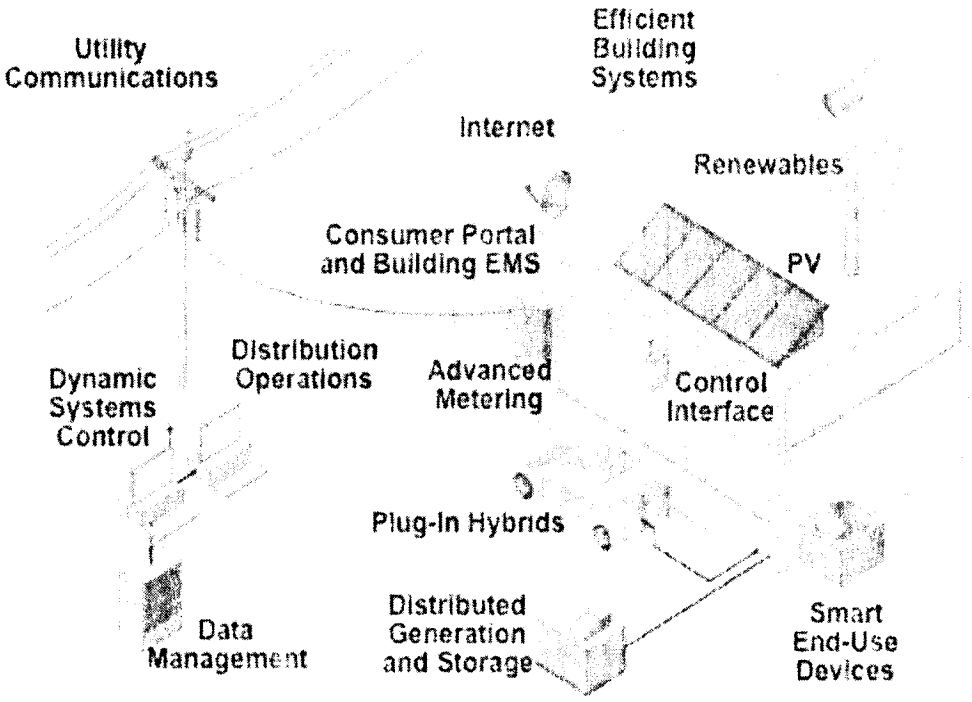


**Figure 4-3: Latest Electrical Network Infrastructure**

The design of power transmission and distribution system of DCK has also been done with a consideration of futuristic demands of any urban city. The design is aligned with the requirements of latest Codes and Standards defined for a Smart Grid and assures modular deployment of any future elements whenever required.

## 4.2 ACCOMMODATION OF RENEWABLE ENERGY INTO EXISTING GRIDS

The global concern for the environment and the need to counteract the effects that lead to global warming are the most important drivers for an improved electrical energy system. Along with establishing a common understanding of man-made changes in the global climate, scenarios have been presented, showing how future carbon emissions might be limited, or even reduced. The major proposals in these scenarios is the introduction of renewable energy sources to replace the traditional fossil based power generation with higher priority as we have a very limited fossil-fuel in future.

## 4.3 DIFFERENCE BETWEEN CONVENTIONAL AND SMART GRIDS

Following table shows a brief difference between a conventional and a Smart Grid.

**Table 4-1: Difference between a Conventional & Smart Grid**

| CHARACTERISTIC | EXISTING GRID | SMART GRID |
|---|---|---|
| Enables active participation by consumers | Consumers are uninformed and non-participative with power system | Informed, involved, and active consumers - demand response and distributed energy resources. |
| Accommodates all generation and storage options | Dominated by central generation- many obstacles exist for distributed energy resources interconnection | Many distributed energy resources with plug-and-play convenience focus on renewable |
| Enables new products, services and markets | Limited wholesale markets, not well integrated - limited opportunities for consumers | Mature, well-integrated wholesale markets, growth of new electricity markets for consumers |
| Provides power quality for the digital economy | Focus on outages - slow response to power quality issues | Power quality is a priority with a variety of quality/ price options - rapid resolution of issues |
| Optimizes assets & operates efficiently | Little integration of operational data with asset management - business process silos | Greatly expanded data acquisition of grid parameters - focus on prevention, minimizing impact to consumers |
| Anticipates and responds to system disturbances (self-heals) | Responds to prevent further damage- focus is on protecting assets following fault | Automatically detects and responds to problems - focus on prevention, minimizing impact to consumer |
| Operates resiliently against attack and natural disaster | Vulnerable to malicious acts of terror and natural disasters | Resilient to attack and natural disasters with rapid restoration capabilities |

## 4.4 USER REQUIREMENTS

- Demand & Supply Balancing
- Optimized and cost-effective Power Generation
- Consumer-Interacted Advance Metering Technology
- Remote Monitoring & Control
- High level protection of EHV, HV, MV and LV equipments
- Accommodation of Generation from Renewable Energy
- Resiliently to Disturbances, Attacks, & Natural Disasters
- High Speed Communication medium throughout the Transmission & Distribution Network
- Power Quality
- Accuracy in load prediction
- Reliability
- Future Proof Technology

## 4.5 NEED OF SMART GRID INFRASTRUCTURE

Today, existing grids are under pressure to deliver the growing demand for power, as well as provide a stable and sustainable supply of electricity. These complex challenges are driving the evolution of smart grid technologies. Smart grid is specifically designed to meet the increasing global demand for electricity, by providing sufficient capacity, as well as reliability, efficiency and sustainability.

## 4.6 ADVANCED METERING INFRASTRUCTURE

Advance Metering Infrastructure (AMI) systems that support two-way communications with customers while allowing secure and reliable system-wide communication for distribution automation are the enabling foundation for the Smart Grid. Advanced Metering Infrastructure will give consumers the consumption and pricing information they need to enable them to more effectively participate in peak load reduction and energy conservation.

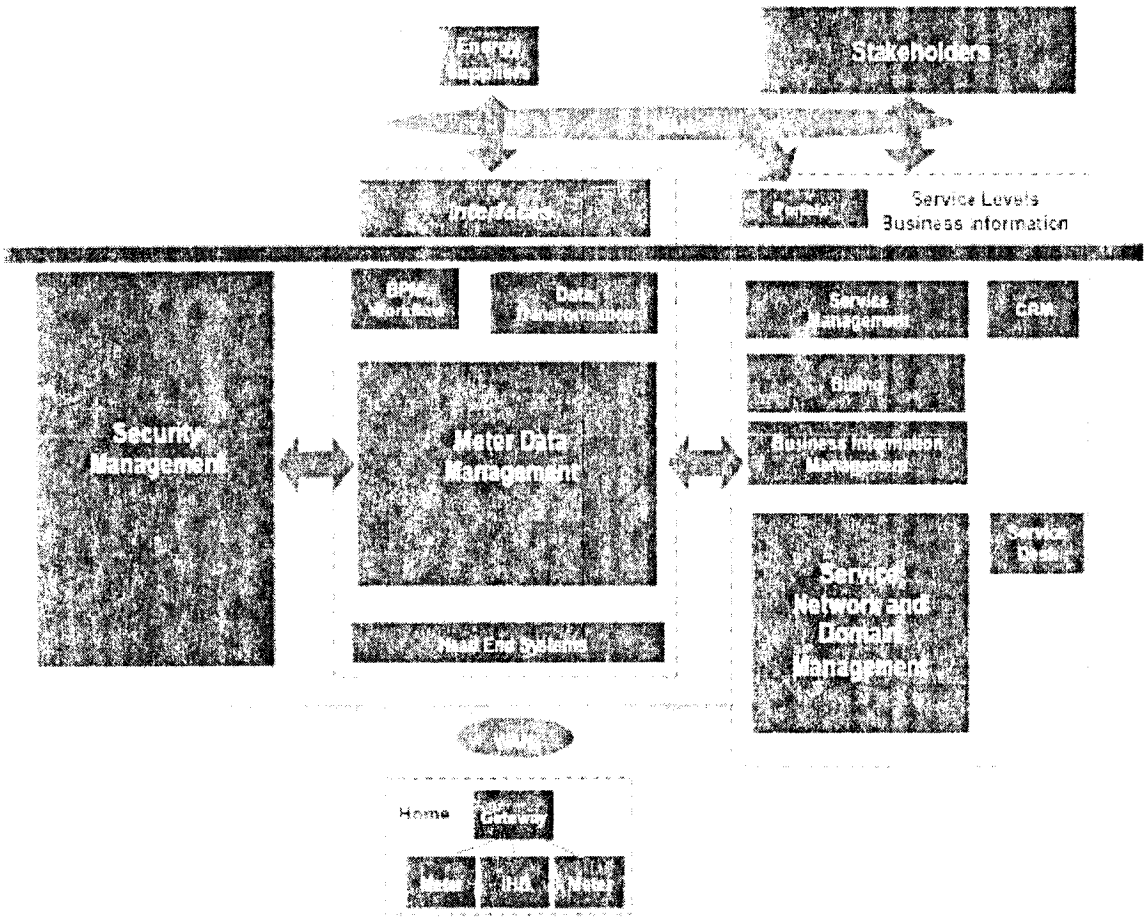


**Figure 4-4: Advance Metering Infrastructure System**

AMI consists of the communications hardware and software, and the associated system and data management software, that together create a two-way network between advanced meters and utility business systems, enabling collection and distribution of information to customers and other parties, such as the competitive retail supplier or the utility itself. Generally AMI have following functionalities:

- Two way communications
- Interval measurement and storage of consumption data
- Display of consumption data to consumer
- Remote connection/disconnection
- Support for variable energy tariffs
- Demand control

## 4.7 DISTRIBUTION AND OUTAGE MANAGEMENT

Distribution and Outage Management Systems (DMS/OMS) provide real-time response to adverse or unstable conditions. It saves money and improves customer service. Through the consolidation of both real-time OMS and DMS functionality, telemetry, and integrated security, smart distribution systems will be poised to become truly self-healing.

## 4.8 DISTRIBUTION AND SUBSTATION AUTOMATION

A Smart Grid requires control centre supervision, area-wide solutions and visualization with centralized modelling. Implementations should leverage installed infrastructure and use a model-based, scalable approach. This practical, cost-effective method ensures that current technology eventually gives way to reactive, software-driven intelligence.

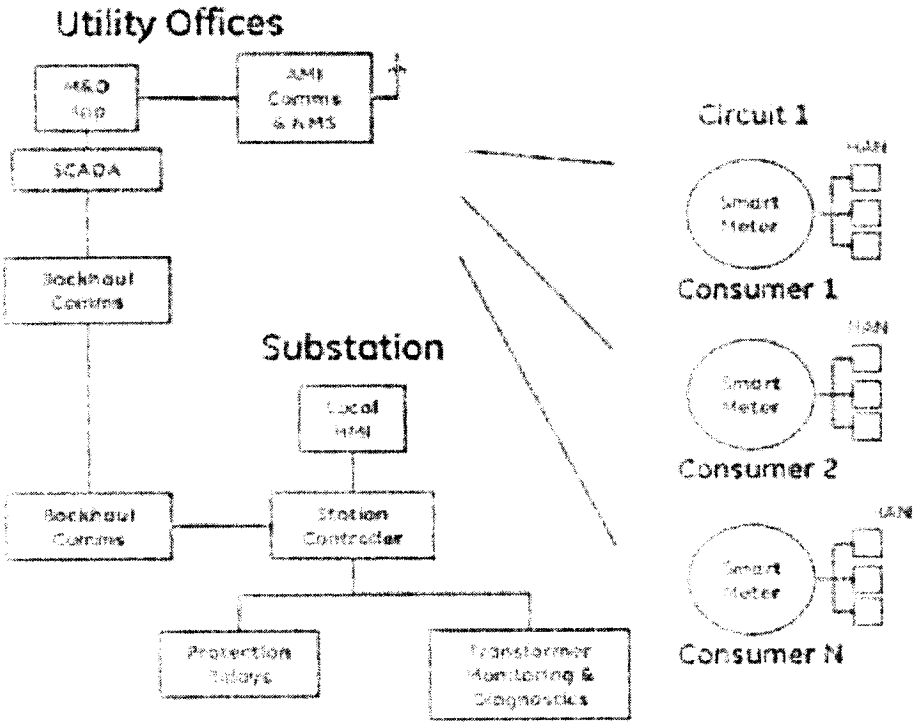


**Figure 4-5: Distribution Automation System**

The architecture shown above uses a centralized distribution automation system with the addition of communication to smart metering. The algorithm can utilize the information from the smart meters to assist in detecting outages outside of the monitored range of the automated devices. This includes fuses or other non-automated fault interrupters. The meters can detect and report an outage and can report successful restoration. Using the restoration detection, the system can determine customers have been properly restored as expected.

## 4.9 PERFORMANCE

Smart Grids will make use of new design concepts and advanced materials in system components like transformers and circuit breakers to improve efficiency, safety and operational performance. Widespread use of power electronic devices will help maximize performance of existing assets and make the grid more resilient in the event of disruptions.

## 4.10 SECURITY & SAFETY

Improvements in security increase the robustness and resiliency of the grid from a physical perspective and a cyber perspective, thereby reducing the probability and consequences of man-made attacks and natural disasters. In addition, reductions in oil imports made possible by the Smart Grid enhance national security.

Improvements in safety reduce the hazards inherent in an energized electric system as well as the time of exposure to those hazards. Generally Smart Grid Infrastructure will help through followings:

- Reduction in the probability that a deliberate man-made cyber or physical attack could occur and a reduction in the consequences of any that are not detected or prevented
- Improved restoration times following storms and other natural events
- Reduction in theft and vandalism of property due to increased detection capability
- Reduction in injuries and deaths of employees due to reduction in time spent in hazardous situations and the availability of more intelligent systems that support worker safety

These benefits will decrease the probability that extended outages impacting the security of customers will occur by reducing the threat, vulnerability, and consequences of man-made attacks. The increased reliance on digital Smart Grid technologies will require the deployment of new systems to address cyber security ensuring this critical infrastructure is as "hack proof" as possible. The increased robustness and resilience of the smart grid will also reduce the impact of many natural events that today result in extended outages.

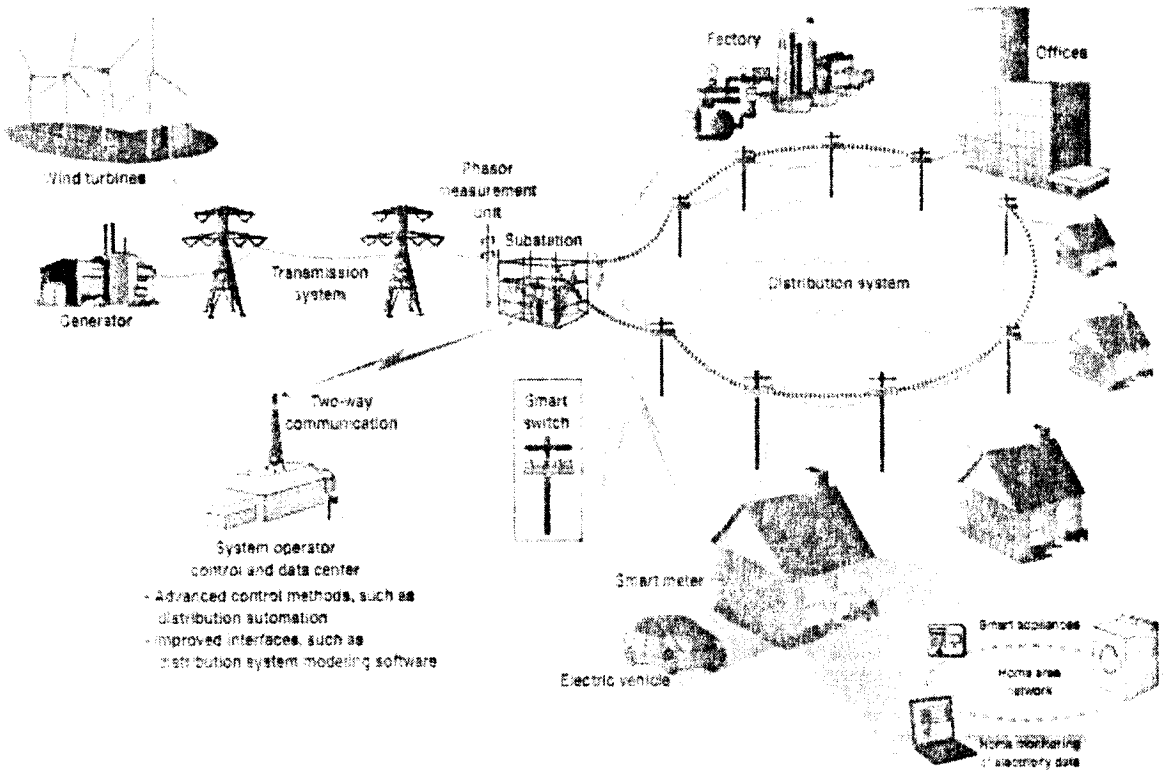


**Figure 4-6: A Secure Smart Grid System**

## 5. BENEFITS OF SMART GRID ELEMENTS

A modernized electrical grid has following features:

- Improves power reliability and quality
- Optimizes facility utilization and averts construction of backup (peak load) power plants
- Enhances capacity and efficiency of existing electric power networks
- Improves resilience to disruption
- Enables predictive maintenance and "self-healing" responses to system disturbances
- Facilitates expanded deployment of renewable energy sources
- Accommodates distributed power sources
- Automates maintenance and operation

- Reduces greenhouse gas emissions by enabling electric vehicles and new power sources
- Reduces oil consumption by reducing the need for inefficient generation during peak usage periods
- Presents opportunities to improve grid security
- Enables transition to plug-in electric vehicles and new energy storage options
- Increases consumer choice
- Enables new products, services, and markets and consumer access to them
- Improved distribution system efficiency
- Reduced distribution line losses
- Improved voltage profile along feeder
- Improved system stability and capacity
- Deferred capital upgrades
- Reduced energy demand
- Reduction of environmentally harmful emissions

# 3

## DESIGN LOAD SHEET SECTOR-05 (PACKAGE-3)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-3)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
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Consulting Engineers – Architects – Planners
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Tel: +92-21-34536007 / 08, 34546541/42
Fax: +92-21-34534691
Email: ocl-khi@osmani.com,
Web: www.osmani.com

# DCK - SECTOR-05 (PACKAGE-3)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

**AMENITIES**

| S. No. | Plot Area (Sq.yds) | Type of Plot | Covered Area as per DCK Bye Laws | | | | KESC Load Criteria | | General Load | A/C Load | Water Pump Load (W) | Max. Connected Load (W) | Group Div. Factor 80% (W) | TOTAL NO. OF PLOTS | Total Load (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | |
| 1 | 928 | KINDER GARTEN | 100% | 8352 | 1 | 8352 | 1.5 | 1 | 12528 | 2000 | | 14529 | 11623.2 | 1 | 11.62 |
| 2 | 900 | PARK & PG | 100% | 8100 | 1 | 8100 | 1.5 | 0 | 12150 | 0 | | 12150 | 9720 | 1 | 9.72 |
| 3 | 3884 | PARK & PG | 100% | 34956 | 1 | 34956 | 1.5 | 0 | 52434 | 0 | | 52434 | 41947.2 | 1 | 41.95 |
| 4 | 13047 | PARK & PG | 100% | 117423 | 1 | 117423 | 1.5 | 0 | 176134.5 | 0 | | 176134.5 | 140907.6 | 1 | 140.91 |
| 5 | 320 | PARKING | 100% | 2880 | 1 | 2880 | 0.75 | 0 | 2160 | 0 | | 2160 | 1728 | 1 | 1.73 |
| 6 | 575 | PARKING | 100% | 5175 | 1 | 5175 | 0.75 | 0 | 3881.25 | 0 | | 3881.25 | 3105 | 1 | 3.11 |
| 7 | 1652 | PIAZZA | 100% | 14868 | 1 | 14868 | 0.5 | 0 | 7434 | 0 | | 7434 | 5947.2 | 1 | 5.95 |
| 8 | 3995 | PIAZZA | 100% | 35955 | 1 | 35955 | 0.5 | 0 | 17977.5 | 0 | | 17977.5 | 14382 | 1 | 14.38 |
| 9 | 4573 | PIAZZA | 100% | 41157 | 1 | 41157 | 0.5 | 0 | 20578.5 | 0 | | 20578.5 | 16462.8 | 1 | 16.46 |
| | | | | | | | | | | | | | | **TOTAL (kW)** | **245.82** |

# DCK - SECTOR-05 (PACKAGE-3)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

**COMMERCIAL**

| S. No. | Plot Area (Sq.yds) | Type of Plot | Covered Area as per DCK Bye Laws | | | | KESC Load Criteria | | General Load | A/C Load | Lift Load (W) | Water Pump Load (W) | Max. Connected Load (W) | Group Div. Factor 80% (W) | TOTAL NO. OF PLOTS | Total Load (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | | |
| 1 | 200 | C2 | 100% | 1800 | 6 | 10800 | 10 | 0 | 108000 | 0 | 8952 | 3729 | 120681 | 96544.8 | 4 | 386.18 |
| 2 | 300 | C3 | 90% | 2430 | 6 | 14580 | 10 | 0 | 145800 | 0 | 8952 | 3729 | 158481 | 126784.8 | 9 | 1141.06 |
| 3 | 500 | C5 | GF=85% ABOVE=75% | 20700 | 6 | 20700 | 10 | 0 | 207000 | 0 | 8952 | 3729 | 219681 | 175744.8 | 7 | 1230.21 |
| 4 | 200 | M2 (C+R) | 100% | 1800 | 6 | 10800 | 10-GF 1.75 UP | 1 | 33750 | 10000 | 8952 | 3729 | 56431 | 45144.8 | 7 | 316.01 |
| 5 | 300 | M3 | 90% | 2430 | 6 | 14580 | 10-GF 1.75 UP | 1 | 45562.5 | 10000 | 8952 | 3729 | 68243.5 | 54594.8 | 3 | 163.78 |
| 6 | 370 | MK | 100% | 3330 | 1 | 3330 | 10 | 0 | 33300 | 0 | | | 33300 | 26640 | 1 | 26.64 |
| | | | | | | | | | | | | | | | TOTAL (kW) | 3263.89 |

# DCK - SECTOR-05 (PACKAGE-3)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

**COMMERCIAL C-5**

| S. No. | Plot Area (Sq.yds) | Type of Plot | Covered Area as per DCK Bye Laws | | | KESC Load Criteria | | General Load | A/C Load | Lift Load (W) | Water Pump Load (W) | Max. Connected Load (W) | Group Div. Factor 80% (W) | TOTAL NO. OF PLOTS | Total Load (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | | |
| 1 | 200 | C2 | 100% | 6 | 10800 | 10 | 0 | 108000 | 0 | 8952 | 3729 | 120681 | 96544.8 | 14 | 1351.63 |
| 2 | 300 | C3 | 90% | 6 | 14580 | 10 | 0 | 145800 | 0 | 8952 | 3729 | 158481 | 126784.8 | 8 | 1014.28 |
| 3 | 500 | C5 | GF=85% ABOVE=75% | 6 | 20700 | 10 | 0 | 207000 | 0 | 8952 | 3729 | 219681 | 175744.8 | 1 | 175.74 |
| 4 | 200 | M2 (C+R) | 100% | 6 | 10800 | 10-GF 1.75 UP | 1 | 33750 | 10000 | 8952 | 3729 | 56431 | 45144.8 | 13 | 586.88 |
| | | | | | | | | | | | | | | TOTAL (kW) | 3128.53 |

## DCK - SECTOR-05 (PACKAGE-3)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

**RESIDENTIAL**

| S. No. | Plot Area (Sq.yds) | Type of Plot | Covered Area as per DHA Bye Laws | | | | KESC Load Criteria | | General Load | A/C Load | Max. Connected Load (W) | Connected Load at 40% DF (W) | Group Div. Factor 80% (W) | TOTAL NO. OF PLOTS | Total Load (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | |
| 1 | 300 | R3 | 75% | 2025 | 3 | 6075 | 1.75 | 1 | 10631.25 | 6000 | 16631.25 | 6652.5 | 5322 | 1 | 5.32 |
| 2 | 500 | R5 | 60% | 2700 | 3 | 8100 | 1.75 | 1 | 14175 | 6000 | 20175 | 8070 | 6456 | 306 | 1975.54 |
| 3 | 1000 | R10 | 50% | 4500 | 3 | 13500 | 1.75 | 2 | 23625 | 12000 | 35625 | 14250 | 11400 | 10 | 114.00 |
| | | | | | | | | | | | | | **TOTAL** | **317** | **2094.86** |

# 4

## FEEDER SIZING
## SECTOR-05 (PACKAGE-3)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-3)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


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Fax: +92-21-34534691
Email: ocl-khi@osmani.com,
Web: www.osmani.com

# D.H.A CITY
# SECTOR-05 (PACKAGE 3)
# RING MAIN VOLTAGE DROPS (CALCULATIONS)

## RING MAIN NO.1 (FEEDER NO. 1)

| | |
|---|---|
| **Ring Main No. 1 (Feeder No. 1) Load** | **= 2.99 MW** |
| a) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from 1st transformer to grid station | = 2397 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 2.397 x 0.158 | = 146.58 Volts |
| b) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from last transformer to switching station | = 301 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.301 x 0.158 | = 18.41 Volts |
| c) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from transformer to transformer | = 836 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.836 x 0.158 | = 51.12 Volts |
| Total voltage drop for ring main no.1 = 146.58 + 18.41 + 51.12 | = 216.11 Volts |
| % Voltage drop = 216.11 x 100 / 11000 | = 1.96 % |

## RING MAIN NO.2 (FEEDER NO. 2)

| | |
|---|---|
| **Ring Main No. 2 (Feeder No. 2) Load** | **= 3.25 MW** |
| a) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from 1st transformer to grid station | = 2719 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 2.719 x 0.158 | = 166.26 Volts |
| b) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from last transformer to switching station | = 201 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.201 x 0.158 | = 12.29 Volts |
| c) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from transformer to transformer | = 708 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.708 x 0.158 | = 43.29 Volts |
| Total voltage drop for Ring Main No.2 = 166.26 + 12.29 + 43.29 | = 221.84 Volts |
| % Voltage drop = 221.84 x 100 / 11000 | = 2.01 % |

## RING MAIN NO.3 (FEEDER NO. 3)

| | |
|---|---|
| **Ring Main No. 3 (Feeder No. 3) Load** | **= 3.90 MW** |
| d) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from 1st transformer to grid station | = 3251 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 3.251 x 0.158 | = 198.8 Volts |
| e) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from last transformer to switching station | = 364 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.364 x 0.158 | = 22.26 Volts |
| f) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from transformer to transformer | = 528 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.528 x 0.158 | = 32.29 Volts |
| Total voltage drop for Ring Main No.3 = 198.8 + 22.26 + 32.29 | = 253.35 Volts |
| % Voltage drop = 253.35 x 100 / 11000 | = 2.3 % |

## RING MAIN NO.4 (FEEDER NO. 4)

| | |
|---|---|
| **Ring Main No. 4 (Feeder No. 4) Load** | **= 3.35 MW** |
| g) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from 1st transformer to grid station | = 2925 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 2.925 x 0.158 | = 178.86 Volts |
| h) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from last transformer to switching station | = 228 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.228 x 0.158 | = 13.94 Volts |
| i) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from transformer to transformer | = 1643 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 1.643 x 0.158 | = 100.47 Volts |
| Total voltage drop for Ring Main No.4 = 178.86 + 13.94 + 100.47 | = 293.27 Volts |
| % Voltage drop = 293.27 x 100 / 11000 | =2.66 % |

## EXPRESS FEEDER # 1

| | |
|---|---|
| Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from grid station to switching station | = 3394 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 3.394 x 0.158 | = 207.54 Volts |
| % Voltage drop = 207.54 x 100 / 11000 | = 1.89 % |

# 5

## LV- VOLTAGE DROP
## SECTOR-05 (PACKAGE-3)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-3)
.DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
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| | LENGTH | FEEDER | | (TP MCCB) | (TP MCCB) | of Installation | DERATING FACTORS | | | | Carrying Capacity for Cable In/ODF | | Size & Numbers | Capacity as per IEE Regulations | per Parallel Cable | Ca |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | |
| FP 1/1 | 43 | 69.90 | 151 | (160A)TP | (30A) TP + (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 157 | | 120 | 174 | 151 | |
| FP 1/2 | 114 | 134.90 | 291 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 303 | 2 | 95 | 154 | 146 | |
| FP 1/3 | 33 | 58.50 | 126 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 131 | | 95 | 154 | 126 | |
| FP 1/4 | 10 | 117.00 | 253 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 263 | | 300 | 286 | 253 | |
| FP 1/5 | 56 | 117.00 | 253 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 263 | | 300 | 286 | 253 | |
| FP 1/6 | 23 | 58.50 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 131 | | 95 | 154 | 126 | |
| FP 1/7 | 142 | 117.00 | 253 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 263 | | 300 | 286 | 253 | |
| FP 1/8 | 23 | 58.50 | 126 | (150A) TP | (9 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 131 | | 95 | 154 | 126 | |
| FP 1/9 | 70 | 52.00 | 112 | (125A) TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 117 | | 70 | 130 | 112 | |
| C2 | | 96.54 | 209 | Feed From Trafo-1 | | | | | | | | | | | | |
| FP 2/1 | 37 | 101.00 | 218 | (125A) TP | (60A + 10A) + ( 2 x 30A) + 15A TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 227 | | 240 | 253 | 218 | |
| C2 | | 96.54 | 209 | Feed From Trafo-2 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-2 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-2 | | | | | | | | | | | | |
| FP 3/1 | 51 | 65.00 | 140 | (150A) TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| FP 3/2 | 104 | 69.90 | 151 | (160A)TP | (9 x 15A) TP + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 157 | | 120 | 174 | 151 | |
| FP 3/3 | 6 | 157.34 | 340 | (160A)TP | (9 x 15A) TP + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 353 | 2 | 150 | 197 | 170 | |
| FP 3/4 | 151 | 87.44 | 189 | (200A)TP | (7 x 15A) TP +(100A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 196 | | 150 | 197 | 189 | |
| FP 3/5 | 55 | 87.44 | 189 | (200A)TP | (3 x 15A) TP +(2 x 30) TP + (100A)TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 196 | | 150 | 197 | 189 | |
| FP 4/1 | 4 | 90.29 | 195 | (200A)TP | ( 2 x 100A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 203 | | 185 | 220 | 195 | |
| C3 | | 126.78 | 274 | Feed From Trafo-4 | | | | | | | | | | | | |
| C3 | | 126.78 | 274 | Feed From Trafo-4 | | | | | | | | | | | | |
| C3 | | 126.78 | 274 | Feed From Trafo-5 | | | | | | | | | | | | |
| C3 | | 126.78 | 274 | Feed From Trafo-5 | | | | | | | | | | | | |
| M2 | | 45.15 | 98 | Feed From Trafo-5 | | | | | | | | | | | | |
| M2 | | 45.15 | 98 | Feed From Trafo-5 | | | | | | | | | | | | |

| | LENGTH | FEEDER | | (TP MCCB) | (TP MCCB) | of Installation | DERATING FACTORS | | | | Carrying Capacity for Cable In/ODF | | Size & Numbers | Capacity as per IEE Regulations | per Parallel Cable | Ca |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | |
| C3 | | 126.78 | 274 | Feed From Trafo-6 | | | | | | | | | | | | |
| C3 | | 126.78 | 274 | Feed From Trafo-6 | | | | | | | | | | | | |
| M2 | | 45.15 | 98 | Feed From Trafo-6 | | | | | | | | | | | | |
| M2 | | 45.15 | 98 | Feed From Trafo-6 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-7 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-7 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-7 | | | | | | | | | | | | |
| M3 | | 54.54 | 118 | Feed From Trafo-7 | | | | | | | | | | | | |
| M3 | | 54.54 | 118 | Feed From Trafo-7 | | | | | | | | | | | | |
| M3 | | 54.54 | 118 | Feed From Trafo-7 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-8 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-8 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-8 | | | | | | | | | | | | |
| M2 | | 45.15 | 98 | Feed From Trafo-8 | | | | | | | | | | | | |
| M2 | | 45.15 | 98 | Feed From Trafo-8 | | | | | | | | | | | | |
| M2 | | 45.15 | 98 | Feed From Trafo-8 | | | | | | | | | | | | |
| OH/ST | | 320.00 | 691 | Feed From Trafo-9 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-10 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-10 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-11 | | | | | | | | | | | | |
| FP 11/1 | 58 | 147.49 | 319 | (225A)TP | (2 x 100A) TP + (10A) TP + (125A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 331 | 2 | 120 | 174 | 159 | |
| C5 | | 175.74 | 380 | Feed From Trafo-12 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-12 | | | | | | | | | | | | |
| C5-S | | 175.74 | 380 | Feed From Trafo-12 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-13 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-13 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-14 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-14 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-15 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-15 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-15 | | | | | | | | | | | | |
| C5 | | 175.74 | 380 | Feed From Trafo-15 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-16 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-16 | | | | | | | | | | | | |
| C10 | | 391.00 | 845 | Feed From Trafo-16 | | | | | | | | | | | | |

| | LENGTH | FEEDER | | (TP MCCB) | (TP MCCB) | of Installation | DERATING FACTORS | | | | Carrying Capacity for Cable In/ODF | | Size & Numbers | Capacity as per IEE Regulations | per Parallel Cable | Ca |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | |
| FP 16/1 | 80 | 96.79 | 209 | (225A)TP | (2 x 100A) TP + (15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 217 | | 185 | 220 | 209 | |
| C10 | | 391.00 | 845 | Feed From Trafo-17 | | | | | | | | | | | | |
| FP 17/1 | 69 | 90.29 | 195 | (225A)TP | (2 x 100A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 203 | | 185 | 220 | 195 | |
| M2 | | 73.97 | 160 | Feed From Trafo-18 | | | | | | | | | | | | |
| GAS STATION | | 200.00 | 432 | Feed From Trafo-18 | | | | | | | | | | | | |
| FP 18/1 | 5 | 104.57 | 226 | (250A)TP | (2 x 100A) TP + (40A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 235 | | 240 | 253 | 226 | |
| FP 19/1 | 8 | 90.29 | 195 | (200A)TP | (2 x 100A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 203 | | 185 | 220 | 195 | |
| C3 | | 126.78 | 274 | Feed From Trafo-19 | | | | | | | | | | | | |
| C3 | | 126.78 | 274 | Feed From Trafo-19 | | | | | | | | | | | | |
| FP 20/1 | 7 | 90.29 | 195 | (200A)TP | (2 x 100A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 203 | | 185 | 220 | 195 | |
| C3 | | 126.78 | 274 | Feed From Trafo-20 | | | | | | | | | | | | |
| C3 | | 126.78 | 274 | Feed From Trafo-20 | | | | | | | | | | | | |
| FP 21/1 | 23 | 23.86 | 52 | (60A)TP | (40A) TP + (20A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 54 | | 16 | 59 | 52 | |
| C2 | | 96.54 | 209 | Feed From Trafo-21 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-21 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-21 | | | | | | | | | | | | |
| C3 | | 126.78 | 274 | Feed From Trafo-21 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-22 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-22 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-22 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-23 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-23 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-23 | | | | | | | | | | | | |
| FP 24/1 | 80 | 46.99 | 101 | (125A)TP | (60A) TP + (50A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 105 | | 50 | 106 | 101 | |
| C2 | | 96.54 | 209 | Feed From Trafo-24 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-24 | | | | | | | | | | | | |
| PARK | | 273.90 | 592 | Feed From Trafo-24 | | | | | | | | | | | | |
| EDUCATION | | 168.77 | 365 | Feed From Trafo-24 | | | | | | | | | | | | |
| FP 25/1 | 33 | 97.34 | 210 | (200A)TP | (2 x 100A) TP + (20A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 218 | | 185 | 220 | 210 | |
| C5 | | 175.74 | 380 | Feed From Trafo-25 | | | | | | | | | | | | |
| C3 | | 126.78 | 274 | Feed From Trafo-25 | | | | | | | | | | | | |
| C3 | | 126.78 | 274 | Feed From Trafo-25 | | | | | | | | | | | | |
| C3 | | 126.78 | 274 | Feed From Trafo-25 | | | | | | | | | | | | |
| FP 26/1 | 50 | 85.54 | 185 | (200A)TP | (60A) TP + (3 x 15A) TP + (100A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 192 | | 150 | 197 | 185 | |

| | LENGTH | FEEDER | | (TP MCCB) | (TP MCCB) | of Installation | DERATING FACTORS | | | | Carrying Capacity for Cable In/ODF | | Size & Numbers | Capacity as per IEE Regulations | per Parallel Cable | Ca |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | |
| PUBLIC SERVICE | | 50.13 | 108 | Feed From Trafo-26 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-26 | | | | | | | | | | | | |
| FP 271 | 4 | 92.48 | 200 | (200A)TP | (2 x 100A) TP + (10A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 208 | | 185 | 220 | 200 | |
| C2 | | 96.54 | 209 | Feed From Trafo-27 | | | | | | | | | | | | |
| C2 | | 96.54 | 209 | Feed From Trafo-27 | | | | | | | | | | | | |
| PARK | | 140.90 | 304 | Feed From Trafo-28 | | | | | | | | | | | | |
| FP 28/1 | 224 | 31.35 | 68 | (75A)TP | (5 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 70 | | 70 | 130 | 68 | |
| FP 28/2 | 148 | 63.40 | 137 | (150A)TP | (8 x 15A) TP + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 142 | | 95 | 154 | 137 | |
| FP 28/3 | 9 | 142.11 | 307 | (150A)TP | (8 x 15A) TP + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 319 | 2 | 120 | 174 | 153 | |
| FP 28/4 | 173 | 78.71 | 170 | (200A)TP | (6 x 15A) TP + (60A) TP + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 177 | | 150 | 197 | 170 | |
| FP 29/1 | 28 | 78.00 | 168 | (100A)TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 175 | | 150 | 197 | 168 | |
| FP 29/2 | 7 | 117.00 | 253 | (150A)TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 263 | | 300 | 286 | 253 | |
| FP 29/3 | 146 | 65.00 | 140 | (150A)TP | (10 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 146 | | 95 | 154 | 140 | |
| FP 29/4 | 75 | 52.00 | 112 | (125A)TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 117 | | 70 | 130 | 112 | |
| FP 29/5 | 250 | 52.00 | 112 | (125A)TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 117 | | 120 | 174 | 112 | |
| FP 29/6 | 80 | 39.00 | 84 | (100A)TP | (6 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 88 | | 35 | 90 | 84 | |
| FP 30/1 | 7 | 91.00 | 197 | (100A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 204 | | 185 | 220 | 197 | |
| FP 30/2 | 69 | 45.50 | 98 | (100A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 102 | | 50 | 106 | 98 | |
| FP 30/3 | 34 | 45.50 | 98 | (100A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 102 | | 50 | 106 | 98 | |
| FP 30/4 | 34 | 91.00 | 197 | (100A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 204 | | 185 | 220 | 197 | |
| FP 30/5 | 50 | 45.50 | 98 | (100A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 102 | | 50 | 106 | 98 | |
| FP 30/6 | 37 | 91.00 | 197 | (100A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 204 | | 185 | 220 | 197 | |
| FP 30/7 | 24 | 45.50 | 98 | (100A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 102 | | 50 | 106 | 98 | |
| FP 31/1 | 25 | 45.50 | 98 | (100A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 102 | | 50 | 106 | 98 | |
| FP 31/2 | 104 | 45.50 | 98 | (100A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 102 | | 50 | 106 | 98 | |
| FP 31/3 | 73 | 91.00 | 197 | (100A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 204 | | 185 | 220 | 197 | |

| | LENGTH | FEEDER | | (TP MCCB) | (TP MCCB) | of Installation | DERATING FACTORS | | | | Carrying Capacity for Cable In/ODF | | Size & Numbers | Capacity as per IEE Regulations | per Parallel Cable | Ca |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | |
| FP 31/4 | 34 | 95.90 | 207 | (125A)TP | (6 x 15A) TP + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 215 | | 185 | 220 | 207 | |
| FP 31/5 | 25 | 45.50 | 98 | (100A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 102 | | 50 | 106 | 98 | |
| FP 31/6 | 34 | 97.50 | 211 | (125A)TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 219 | | 185 | 220 | 211 | |
| FP 31/7 | 36 | 45.50 | 98 | (100A)TP | (7 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 102 | | 50 | 106 | 98 | |
| FP 32/1 | 34 | 52.00 | 112 | (125A)TP | (8 x 15A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 117 | | 70 | 130 | 112 | |
| FP 32/2 | 188 | 56.90 | 123 | (125A)TP | (7 x 15A) TP + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.96 | 128 | | 95 | 154 | 123 | |
| C5 | | 175.74 | 380 | Feed From Trafo-32 | | | | | | | | | | | | |
| C3 | | 126.78 | 274 | Feed From Trafo-32 | | | | | | | | | | | | |
| C3 | | 126.78 | 274 | Feed From Trafo-32 | | | | | | | | | | | | |
| C3 | | 126.78 | 274 | Feed From Trafo-32 | | | | | | | | | | | | |

*$T_f$) at 25$^0$ C=0.93*

*) 1.2 K.m/w = 1.15*
*-TfxGf*

*)*
*able for continuous service(IZ= It x odf)*

***tion refer to IEE 17th edition chapter 05***

**METHOD OF INSTALLATION**

A = Conduit in thermally insulated wall conduit
B = Clipped on wall
C = Direct in masonry
D = Buried in ground
E or F = On cable trays

**Maximum Voltage Drop 5% Allowed**
400 V = 20 V
**REF:**
NEPRA DISTRIBUTION CODE= DPC-

**TYPE OF CABLE**
A- AL, xLPE,PVC /SWA /PVC

# 6

## LOADING OF TRANSFORMERS IN SECTOR-05 (PACKAGE-3)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-3)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
Consulting Engineers – Architects – Planners
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Web: www.osmani.com

# D.H.A CITY

## SECTOR-05 (PACKAGE 3)

| FEEDER | | TRANSFORMERS | |
|---|---|---|---|
| Feeder No: | 1 | 1000 kVA(TYPE-A) =1 | b) 1000 kVA(TYPE-B)=1 |
| Feeder Load: | 2.99 MW | 500 kVA(TYPE-A) =1 | b) 500 kVA(TYPE-B) =4 |

| S. No. | TRANSFORMER | | | | |
|---|---|---|---|---|---|
| | No. | Rating kVA | Rating kW | Connected Load kW | Loading Efficiency % |
| 1 | 1 | 1000 | 800 | 634.4 | 79.30% |
| 2 | 2 | 500 | 400 | 345.15 | 86.29% |
| 3 | 3 | 500 | 400 | 379.69 | 94.92% |
| 4 | 4 | 500 | 400 | 343.86 | 85.97% |
| 5 | 5 | 500 | 400 | 298.71 | 74.68% |
| 6 | 6 | 500 | 400 | 298.71 | 74.68% |
| 7 | 7 | 1000 | 800 | 690.85 | 86.36% |

| FEEDER | | TRANSFORMERS |
|---|---|---|
| Feeder No: | 2 | 1000 kVA(TYPE-A) =1 b) 1000 kVA(TYPE-B)=2 |
| Feeder Load: | 3.42 MW | 500 kVA(TYPE-A) =1 b) 500 kVA(TYPE-B) =4 |

| S. No. | TRANSFORMER | | | | |
|---|---|---|---|---|---|
| | No. | Rating kVA | Rating kW | Connected Load kW | Loading Efficiency % |
| 1 | 8 | 1000 | 800 | 572.38 | 71.55% |
| 2 | 9 | 500 | 400 | 320 | 80.00% |
| 3 | 10 | 500 | 400 | 351.45 | 87.86% |
| 4 | 11 | 500 | 400 | 323.24 | 80.81% |
| 5 | 12 | 1000 | 800 | 527.23 | 65.90% |
| 6 | 13 | 500 | 400 | 351.5 | 87.88% |
| 7 | 14 | 500 | 400 | 351.5 | 87.88% |
| 8 | 15 | 1000 | 800 | 626.88 | 78.36% |

| FEEDER | | TRANSFORMERS |
|---|---|---|
| Feeder No: | 3 | 1000 kVA(TYPE-A) =1 b) 1000 kVA(TYPE-B)=1 |
| Feeder Load: | 3.90 MW | b) 630 kVA(TYPE-B) =2 |
| | | 500 kVA(TYPE-A) =1 b) 500 kVA(TYPE-B) =4 |

| S. No. | TRANSFORMER | | | | |
|---|---|---|---|---|---|
| | No. | Rating kVA | Rating kW | Connected Load kW | Loading Efficiency % |
| 1 | 16 | 1000 | 800 | 680.8 | 85.10% |
| 2 | 17 | 630 | 504 | 481.3 | 95.50% |
| 3 | 18 | 500 | 400 | 349.72 | 87.43% |
| 4 | 19 | 500 | 400 | 343.86 | 85.97% |
| 5 | 20 | 500 | 400 | 343.86 | 85.97% |
| 6 | 21 | 630 | 504 | 440.27 | 87.36% |
| 7 | 22 | 500 | 400 | 289.63 | 72.41% |
| 8 | 23 | 500 | 400 | 289.63 | 72.41% |
| 9 | 24 | 1000 | 800 | 682.75 | 85.34% |

| FEEDER | | TRANSFORMERS | |
|---|---|---|---|
| Feeder No: | 4 | 1000 kVA(TYPE-A) =1 | b) 1000 kVA(TYPE-B)=1 |
| Feeder Load: | 3.35 MW | 500 kVA(TYPE-A) =1 | b) 500 kVA(TYPE-B) =5 |

| S. No. | TRANSFORMER | | | | |
|---|---|---|---|---|---|
| | No. | Rating kVA | Rating kW | Connected Load kW | Loading Efficiency % |
| 1 | 25 | 1000 | 800 | 660.48 | 82.56% |
| 2 | 26 | 500 | 400 | 353.68 | 88.42% |
| 3 | 27 | 500 | 400 | 330.63 | 82.66% |
| 4 | 28 | 500 | 400 | 377.76 | 94.44% |
| 5 | 29 | 500 | 400 | 312 | 78.00% |
| 6 | 30 | 500 | 400 | 318.5 | 79.63% |
| 7 | 31 | 500 | 400 | 329.9 | 82.48% |
| 8 | 32 | 1000 | 800 | 664.98 | 83.12% |

# 8

## BoQ

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-3)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
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# ENGINEER'S ESTIMATE

**CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI**
**NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS**
**LOCATION : DHA CITY SECTOR '05' (PACKAGE-3)**
**SUB-HEAD : ELECTRICAL WORKS LV DISTRIBUTION**

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| | **EXCAVATION** | | | | |
| 1 | Excavation and back filling as in hard/sofft or any soil upto 1.0m depth and 0.9m wide for MV/LV/ITC cable and pipe trenches complete as directed by the Engineer.(Excluding cost of cable & pipe) | 5,410 | Cum | 900 | 4,869,000 |
| 1.1 | Excavation and back filling as in hard/sofft or any soil upto 1.0m depth and 0.6m wide for LV/ITC cable and pipe trenches complete as directed by the Engineer.(Excluding cost of cable & pipe) | 1,850 | Cum | 900 | 1,665,000 |
| | **LV CABLE** | | | | |
| 2 | Supply, laying , conecting and testing Cable electric LV 600/1000V stranded aluminium conductor, XLPE insulated, Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, sand,warning tap with all accessories as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| 2.1) | 4 core 300mm² AL, XLPE,PVC / SWA / PVC | 233 | m | 5,600 | 1,304,800 |
| 2.2) | 4 core 240mm² AL, XLPE,PVC / SWA / PVC | 42 | m | 4,500 | 189,000 |
| 2.3) | 4 core 185mm² AL, XLPE,PVC / SWA / PVC | 424 | m | 3,500 | 1,484,000 |
| 2.4) | 4 core 150mm² AL, XLPE,PVC / SWA / PVC | 469 | m | 2,800 | 1,313,200 |
| 2.5) | 4 core 120mm² AL, XLPE,PVC / SWA / PVC | 531 | m | 2,500 | 1,327,500 |
| 2.6) | 4 core 95mm² AL, XLPE,PVC / SWA / PVC | 840 | m | 2,000 | 1,680,000 |
| 2.7) | 4 core 70mm² AL, XLPE,PVC / SWA / PVC | 403 | m | 1,750 | 705,250 |
| 2.8) | 4 core 50mm² AL, XLPE,PVC / SWA / PVC | 447 | m | 1,200 | 536,400 |
| 2.9) | 4 core 35mm² AL, XLPE,PVC / SWA / PVC | 80 | m | 950 | 76,000 |
| 2.10) | 4 core 16mm² AL, XLPE,PVC / SWA / PVC | 23 | m | 630 | 14,490 |
| 3 | Danger sign for MV & LV not less than 250 X 125 mm enameled as required, supply and fixing. | 95 | Each | 2,000 | 190,000 |
| | **Feeder pillar** | | | | |
| 4 | Providing, installing, testing and commissioning of floor mounted Feeder pillar in 16 SWG sheet steel housing, dust, weather proof IP-54 paint, hinged door/lock, suitable for 3 phase neutral and earth strip 400 volts. Almunium busbars & Insulators for distribution to out going breakers.Seperate Almunium busbars chamber in locking arrangement. Installed on RCC pad, including cost of RCC foundation. complete as per Drawings and accessories as Directed by | | | | |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4.1) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>10-10A to 60A TP MCCB 16KA | 8 | Each | 255,000 | 2,040,000 |
| 4.1) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>9-10A to 60A TP MCCB 16KA<br>1-TP MCCB Space only | 7 | Each | 245,000 | 1,715,000 |
| 4.2) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>8-10A to 60A TP MCCB 16KA<br>2-TP MCCB Space only | 7 | Each | 235,000 | 1,645,000 |
| 4.2) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>7-10A to 60A TP MCCB 16KA<br>1-100A TP MCCB 25KA<br>2-TP MCCB Space only | 1 | Each | 240,000 | 240,000 |
| 4.3) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>7-10A to 60A TP MCCB 16KA<br>3-TP MCCB Space only | 13 | Each | 225,000 | 2,925,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4.4) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>6-10A to 60A TP MCCB 16KA<br>4-TP MCCB Space only | 2 | Each | 205,000 | 410,000 |
| 4.4) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>5-10A to 60A TP MCCB 16KA<br>1-100A TP MCCB 25KA<br>4-TP MCCB Space only | 1 | Each | 215,000 | 215,000 |
| 4.5) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>5-10A to 60A TP MCCB 16KA<br>5-TP MCCB Space only | 1 | Each | 195,000 | 195,000 |
| 4.5) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>4-10A to 60A TP MCCB 16KA<br>1-100A TP MCCB 25KA<br>5-TP MCCB Space only | 1 | Each | 200,000 | 200,000 |
| 4.5) c) | **Incoming**<br>1-75A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>5-10A to 60A TP MCCB 16KA<br>5-TP MCCB Space only | 1 | Each | 200,000 | 200,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4.6) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>2-100A TP MCCB 25KA<br>1-125A TP MCCB 25KA<br>1-10A TP MCCB 16KA<br>6-TP MCCB Space only | 1 | Each | 190,000 | 190,000 |
| 4.7) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>1-10A TP MCCB 16KA<br>2-100A TP MCCB 25KA<br>7-TP MCCB Space only | 4 | Each | 170,000 | 680,000 |
| 4.7) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>1-10A TP MCCB 16KA<br>1-100 A TP MCCB 25KA<br>1-80 A TP MCCB 25KA<br>7-TP MCCB Space only | 1 | Each | 170,000 | 170,000 |
| 4.8) a) | **Incoming**<br>1-60A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>2-10A to 60A TP MCCB 16KA<br>8-TP MCCB Space only | 1 | Each | 160,000 | 160,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4.8) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>2-100A TP MCCB 25KA<br>8-TP MCCB Space only | 4 | Each | 160,000 | 640,000 |
| 4.8) c) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>2-10 to 60A TP MCCB 16KA<br>8-TP MCCB Space only | 1 | Each | 160,000 | 160,000 |
| | **Earthing Electrodes** | | | | |
| 5 | Supply, installation, connection & testing of copper earth electrodes, 20mm dia, 3000mm in length, driven vertically in ground, including cost of Test pit 300x300x300mm, internal plaster, 100mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 60 | Job | 45,000 | 2,700,000 |
| 6 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Feeder Pillars as shown on the drawing. or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 600 | m | 500 | 300,000 |
| | | | | **Total of Rs.** | **30,139,640** |

# ENGINEER'S ESTIMATE

**CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI**
**NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS**
**LOCATION : DHA CITY SECTOR '05' (PACKAGE-3)**
**SUB-HEAD : ELECTRICAL WORKS MV DISTRIBUTION.** **(Feeders & Express feeder)**

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| 1 | **MV CABLE**<br>Supply,laying and conecting, Cable electric MV 15-kV stranded aluminium conductor, XLPE insulated,Triple Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, soft sand coushion, warning tape, Marker as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| | **FEEDER No 1.** | | | | |
| 1.1) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-1 as shown on the drawings. | 2,397 | m | 7,600 | 18,217,200 |
| 1.2) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 836 | m | 7,600 | 6,353,600 |
| 1.3) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-7 to Switch station-1 as shown on the drawings. | 301 | m | 7,600 | 2,287,600 |
| | **FEEDER No 2.** | | | | |
| 1.4) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-8 as shown on the drawings. | 2,719 | m | 7,600 | 20,664,400 |
| 1.5) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 708 | m | 7,600 | 5,380,800 |
| 1.6) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-15 to Switch station-1 as shown on the drawings. | 201 | m | 7,600 | 1,527,600 |
| | **FEEDER No 3.** | | | | |
| 1.7) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-16 as shown on the drawings. | 3,251 | m | 7,600 | 24,707,600 |
| 1.8) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 528 | m | 7,600 | 4,012,800 |
| 1.9) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-24 to Switch station-1 as shown on the drawings. | 364 | m | 7,600 | 2,766,400 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **FEEDER No 4.** | | | | |
| 1.10) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-32 as shown on the drawings. | 2,925 | m | 7,600 | 22,230,000 |
| 1.11) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 1,643 | m | 7,600 | 12,486,800 |
| 1.12) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-25 to Switch station-1 as shown on the drawings. | 228 | m | 7,600 | 1,732,800 |
| | **EXPRESS FEEDER-1** | | | | |
| 1.13) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from Grid station to Switch station-1 as shown on the drawings. | 3,394 | m | 7,600 | 25,794,400 |
| **2** | PVC straight joint, MV 15kV, for XLPE cable consisting of mould, resin, MV tape, semi conducting tape, ferrules and earth wire etc. suitable for MV cables, 3 core 300mm², supply and fixing complete with all installation accessories as per KESC standard. | | | | |
| | **FEEDER No 1.** | | | | |
| 2.1) | From grid station to TR-1 | 24 | Each | 80,000 | 1,920,000 |
| 2.2) | From TR-7 to Switching station. | 3 | Each | 80,000 | 240,000 |
| | **FEEDER No 2.** | | | | |
| 2.3) | From grid station to TR-8 | 30 | Each | 80,000 | 2,400,000 |
| 2.4) | From TR-15 to Switching station. | 2 | Each | 80,000 | 160,000 |
| | **FEEDER No 3.** | | | | |
| 2.5) | From grid station to TR-16 | 35 | Each | 80,000 | 2,800,000 |
| 2.6) | From TR-24 to Switching station. | 4 | Each | 80,000 | 320,000 |
| | **FEEDER No 4.** | | | | |
| 2.7) | From grid station to TR-32 | 30 | Each | 80,000 | 2,400,000 |
| 2.8) | From TR-25 to Switching station. | 3 | Each | 80,000 | 240,000 |
| | **EXPRESS FEEDER No 1.** | | | | |
| 2.9) | From Switching station No-1 to grid station. | 35 | Each | 80,000 | 2,800,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 3 | **SWITCHING STATION NO-1**<br>Supply Installation, testing and commissioning outdoor type of Switching station.Substation will have **1-incoming & 4-outgoing 17.5kV** Vaccum circuit breaker (VCB), **350MVA, 630A**, with protection devices housed in metalic frame **IP 54**. Switching station will be mounted on RCC plateform circuit breaker (CB) will be trolley raised type to avoid floor unevenness if any. The male & female contacts shall be rod & Tulip type with vertical arrangement. **EFI** will be installed on each cable. The breaker shall be provided with bimetalic lugs to accomodate 2-Almunium cable connection with copper bus-bars. **C.T & P.T** will be installed on each breaker. C.T ratio **1200/600/1/1** P.T ratio **11kV/110V**. Each VCB shall have earthing switch to ground cable. Earthing switch shall have inter-lock with "ON" Mechanism. Digital type Relays on each VCB shall be over current 2Nos; Earth Fault one No with series/shunt trip prorivions. The relay shall have additional potential free contacts for SCADA. Relays shall have self supervision provision. SCADA provision- each VCB will have potential **"NO" & "NC"** contact for status monitoring locally as well as at remote control room through SCADA. Switching Station (SS) housing shall be designed for safe operation by operator locally. No arc should comeout in any case. As per spacification installed on RCC pad, including the cost of RCC foundation pad complete with all civil and other installation accessories as shown on the drawing or as directed by the Engineers'.<br><br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 1 | Job | 9,300,000 | 9,300,000 |
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-A)** with **630 Amps**. VCB **17.5 kV, 350MVA, 1000 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going VCBs on MV side. Air Circuit Breaker of **1600 Amps** outgoing **6 Nos** MCCB of **400 Amps** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br><br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 4 | Each | 7,050,000 | 28,200,000 |

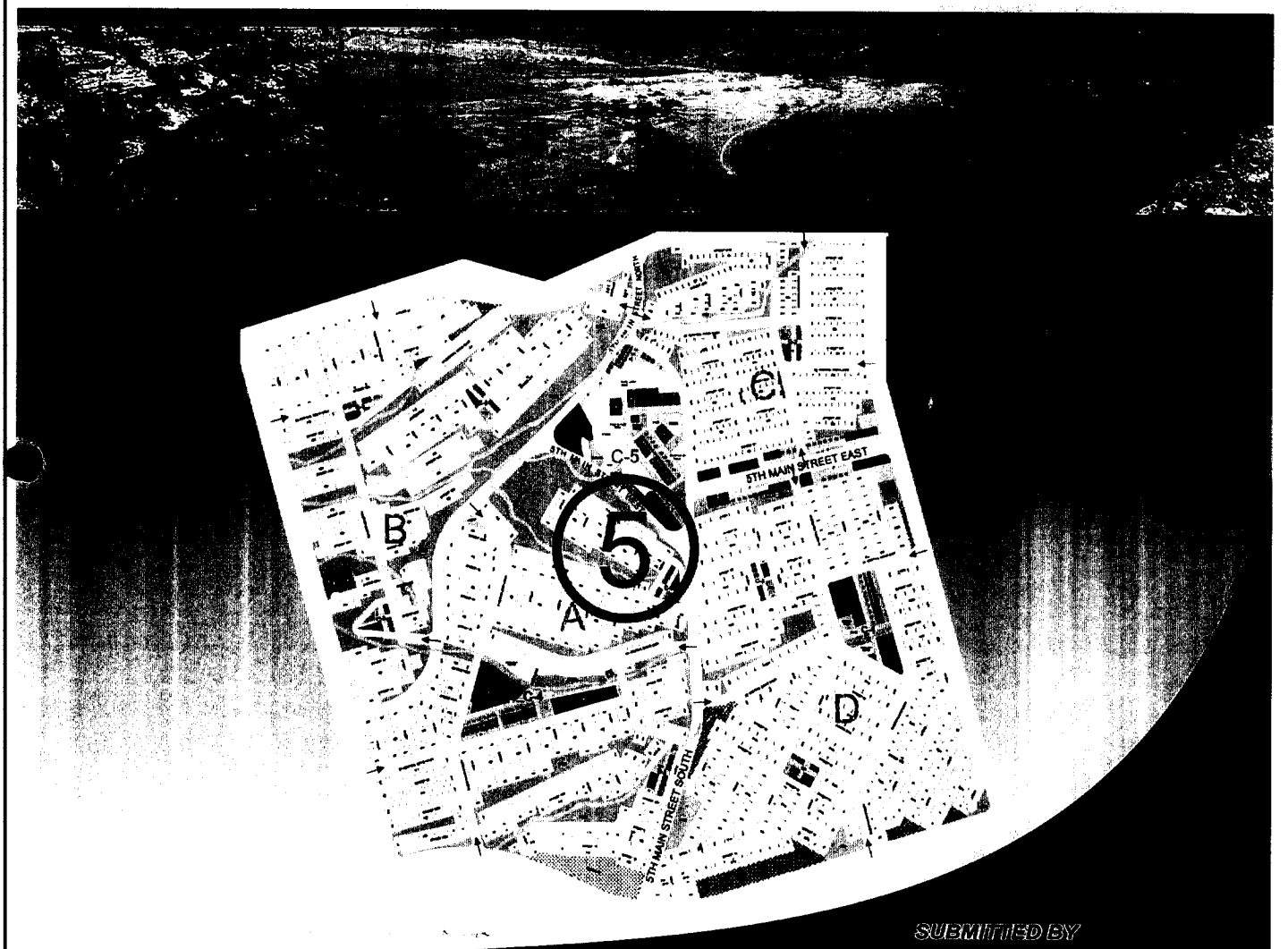
| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 5 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amps**. VCB **17.5kV**, **350MVA**, **1000 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going load break switches with **SF6 Fuses** on MV side. Air Circuit Breaker of **1600 Amps** outgoing 6 Nos MCCB of **400 Amps** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 5 | Each | 6,000,000 | 30,000,000 |
| 6 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amps**. VCB **17.5kV**, **350MVA**, **630 kVA** Oil filled Transformer 11/0.42 kV with incoming & out going load break switches with **SF6 Fuses** on MV side. Air Circuit Breaker of **1600 Amps** outgoing **6 Nos** MCCB of **400 Amps** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | 5,600,000 | 11,200,000 |
| 7 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-A)** with **630 Amps**. VCB **17.5kV**, **350MVA**, **500 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going VCBs on MV side. Air Circuit Breaker of **1600 Amps** outgoing 6 Nos MCCB of **300 Amps** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 4 | Each | 5,300,000 | 21,200,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 8 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amps.** VCB **17.5kV**, **350MVA**, **500 kVA** Oil filled Transformer **11/0.42 kV** with incoming & out going load break switches with **SF6 Fuses** on MV side. Air Circuit Breaker of **1600 Amps** outgoing **6 Nos** MCCB of **300 Amps** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 17 | Each | 4,300,000 | 73,100,000 |
| 9 | **Earthing Electrodes**<br>Supply, installation, connection & testing of copper earth electrodes, 20mm dia, 3000mm in length, driven vertically in ground, including cost of Test pit 300x300x300mm, internal plaster, 100mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 35 | Job | 45,000 | 1,575,000 |
| 10 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Switching Station & Transformer as shown on the drawing. or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 350 | m | 500 | 175,000 |
| | | | | **Total of Rs.** | **336,192,000** |

# PAKISTAN DEFENCE OFFICERS' HOUSING AUTHORITY KARACHI

# PLANNING AND DESIGNING OF ELECTRICAL DISTRIBUTION SYSTEM OF DHA CITY KARACHI SECTOR - 5 ( PACKAGE - 04 )

# DETAILED DESIGN REPORT

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# PLANNING & DESIGNING OF ELECTRICAL DISTRIBUTION SYSTEM OF DHA CITY, KARACHI
# SECTOR-05
# (PACKAGE-4)

## DETAILED DESIGN & DRAWINGS

# DEFENCE HOUSING AUTHORITY
# KARACHI

SHORT-TERM PLAN ENERGY SECTOR – 05 (Package-04)
DHA CITY KARACHI

# DETAILED DESIGN REPORT

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# 1

## DESIGN BRIEF & DESIGN CRITERIA

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-4)
DHA CITY KARACHI

DETAIL DESIGN REPORT

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# 1. EXECUTIVE SUMMARY

Main components of Energy Design for Sector-5D, Short Term Development Plan comprises the following:

**A) MV Distribution Network comprising of:**

**1) MV Cable:**

- 3 core 300 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable — 3,991 m
- 3 core 400 mm² AL, XLPE/PVC/SWA/PVC 15 kV cable — 10,535 m

**2) Switching Stations:**

**a) 3 - way** — 1 No.

**3) Kiosk Sub Station:**

- Kiosk Sub Station (Type-A) 1000 kVA Transformer 11/0.42 kV Oil filled — 2 Nos.
- Kiosk Sub Station (Type-B) 1000 kVA Transformer 11/0.42 kV Oil filled — 2 Nos.
- Kiosk Sub Station (Type-B) 630 kVA Transformer 11/0.42 kV Oil filled — 1 No.
- Kiosk Sub Station (Type-A) 500 kVA Transformer 11/0.42 kV Oil filled — 2 Nos.
- Kiosk Sub Station (Type-B) 500 kVA Transformer 11/0.42 kV Oil filled — 11 Nos.

**B) LV Distribution Network comprising of:**

**1) LV Cables:**

| | | | |
|---|---|---|---|
| a) | 4 core 300 mm² AL, XLPE/PVC/SWA/PVC cable | 18 | m |
| b) | 4 core 240 mm² AL, XLPE/PVC/SWA/PVC cable | 388 | m |
| c) | 4 core 185 mm² AL, XLPE/PVC/SWA/PVC cable | 1712 | m |
| d) | 4 core 150 mm² AL, XLPE/PVC/SWA/PVC cable | 1850 | m |
| e) | 4 core 120 mm² AL XLPE/PVC/SWA/PVC cable | 702 | m |
| f) | 4 core 95 mm² AL, XLPE/PVC/SWA/PVC cable | 621 | m |
| g) | 4 core 70 mm² AL, XLPE/PVC/SWA/PVC cable | 238 | m |
| h) | 4 core 50 mm² AL, XLPE/PVC/SWA/PVC cable | 57 | m |

2) **Feeder Pillars:**

| | |
|---|---|
| **9-way FP** | **1 No.** |
| **8-way FP** | **20 Nos.** |
| **7-way FP** | **18 Nos.** |
| **6-way FP** | **13 Nos.** |
| **5-way FP** | **6 Nos.** |
| **4-way FP** | **1 No** |
| **3-way FP** | **3 No** |
| **2- way FP** | **1 No.** |

C) **Smart Grid ICT Network / pipe sleeves comprising:**

1) HDPE Pipe 2" dia. (2 Nos.) for MV/LV cables 47,000 m

2) RCC hand hole with cover (L=5', W=3', D=3') 185 Nos.

# 2. GENERAL FEATURES

## 2.1 INTRODUCTION

Pakistan Defence Officers Housing Authority (DHA) has commissioned M/s Osmani and Company (Pvt.) Ltd. to provide consultancy services for Development of DHA City Karachi (DCK) in August 2010. DHA City is spread over an area of 11,640 acres with numerous ridges and nalas following a rolling / mountainous terrain. DHA City is planned and divided into 16 sectors as listed below in Table 2-1

**Table 2-1: Area of Sectors**

| S.NO. | LOCATION | AREA (acres) | S.NO. | LOCATION | AREA (acres) |
|---|---|---|---|---|---|
| 1 | SECTOR 1 | 525 | 9 | SECTOR 9 | 604 |
| 2 | SECTOR 2 | 600 | 10 | SECTOR 10 | 541 |
| 3 | SECTOR 3 | 311 | 11 | SECTOR 11 | 663 |
| 4 | SECTOR 4 | 337 | 12 | SECTOR 12 | 504 |
| **5** | **SECTOR 5** | **483** | 13 | SECTOR 13 | 575 |
| 6 | SECTOR 6 | 823 | 14 | SECTOR 14 | 655 |
| 7 | SECTOR 7 | 631 | 15 | SECTOR 15 | 697 |
| 8 | SECTOR 8 | 339 | 16 | SECTOR 16 | 383 |
| **GRAND TOTAL** | | | | | **8,675** |

Sector development works are to be carried out with respect to development strategy, which has been divided into 3 phases;

- Short Term Development Plan (2015 – 2018)
- Mid Term Development Plan (2018 – 2021)
- Long Term Development Plan (2021 – 2030)

The following ***Figure 2-1*** shows the location of various sub-sectors planned under short term development.

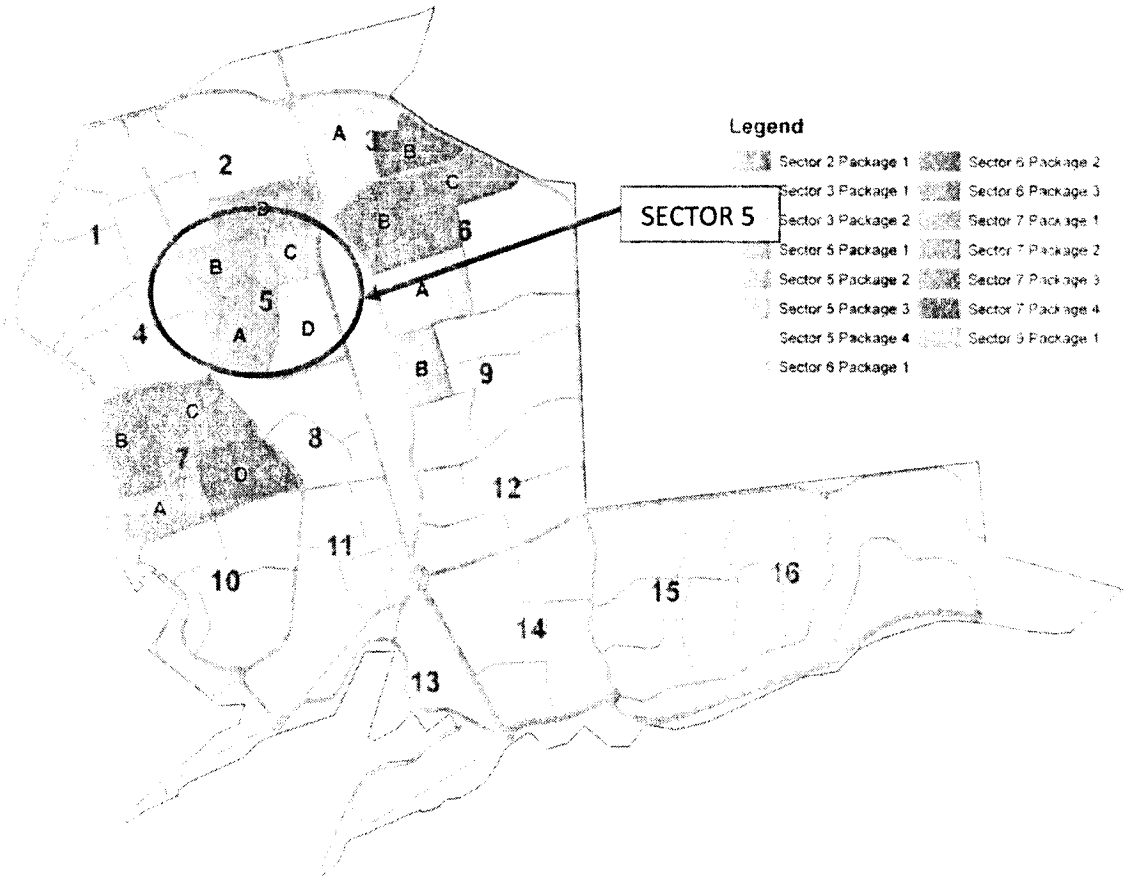


**Figure 2-1: Sectors under Short Term Development Plan**

Sectors are generally divided into four sub sectors as per the design criteria of 'Ekistics' for ease of communication of urban city. Acreage of each sub sector is given in Table 2-1 of Short Term Development Plan. Sector 5 has a total developed area of 2,335,734 square yards or 483 acres, excluding road network. About 2/3 of the area of sector 5 is utilized for residential purposes.

***Table 2-2*** shows the areas of various sectors under short term development plan:

**Table 2-2: Areas of Sectors under Short Term Plan**

| Areas in acres | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sector** | **Sub-Sector** | | | | | **Other than Sub Sector** | **Total** |
| | **A** | **B** | **C** | **C-5** | **D** | | |
| 2 | | | | | 141 | | 141 |
| 3 | 215 | 81 | | 15 | | | 311 |
| **5** | **136** | **108** | **63** | **18** | **136** | **22** | **483** |
| 6 | 167 | 97 | 112 | 40 | | | 416 |
| 7 | 136 | 129 | 198 | 19 | 149 | | 631 |
| 9 | | 89 | | | | | 89 |
| CBD | | | | | | 104 | 104 |
| **Total** | **654** | **504** | **373** | **92** | **426** | **126** | **2,175** |

Sector 5 is one of the model sectors being developed under Short Term Plan. This sector has plots of different sizes ranges from R3-S to R20-S. Majority of plots are of size R5 and R10.

## 2.2 SCOPE OF THE REPORT

The main objective of this report is to explain the Detailed Design for Energy Distribution Network of DCK. The main objectives of this Detailed Design Report (DDR) are the following:

- Present the Detailed Design of Sector 5D to enable client review prior to progression to the bidding stage.
- Provide details of how the design has been developed since the submission of the Preliminary Design Energy Distribution Report.
- Provide an updated description of the works.

- Confirm the design criteria and parameters used for the design of Electrical Distribution System. Provide a rough cost estimate for the project component.
- Provide details of any information obtained; and information still required to complete the project and highlight any potential difficulties in obtaining such information. This report will cover Detailed Design of Sector-5D as encircled in Figure 2-1 and highlighted in Table 2-1: Area of Sectors

## 2.3 BACKGROUND

Sector 5 was planned on 483 acres area, with City Boulevard (PA 01) to the west, Main Boulevard West (PA 02D) to the east, West Avenue 1W (PC 01) to the north and West Avenue 2W (PA 04) on the south. For tendering purpose, Sector 5 is divided in to 4 packages i.e. 1, 2, 3 and 4. Package 1 contains sub-sector A with an approx. area of 136 acres, package 2 contains sub-sector B with an approx. area of 108 acres, package 3 contains sub-sector C and commercial centre C5 with an approx. area of 81 acres and lastly package 4 contains sub-sector D with an approx. area of 136 acres.

Figure 2-2: Boundaries of Packages 1 to 4 of Sector 5 shows the boundaries of packages 1 to 4 of sector 5.

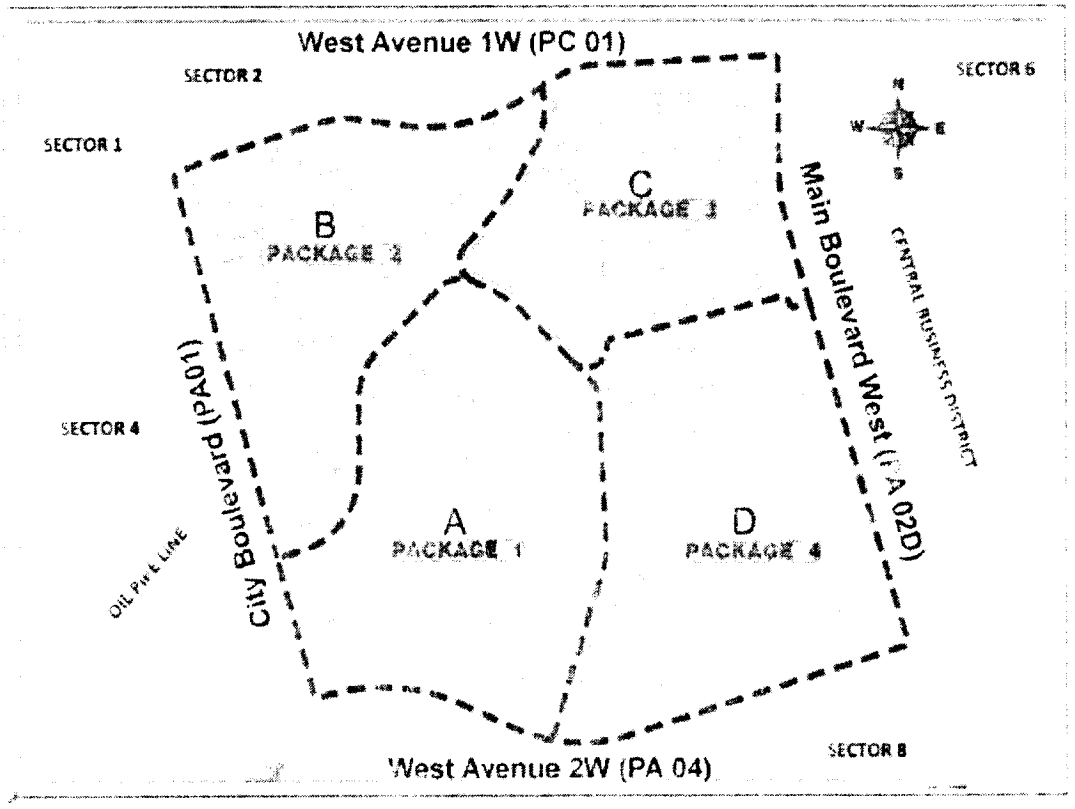

**Figure 2-2: Boundaries of Packages 1 to 4 of Sector 5**

## 2.4 TOPOGRAPHY OF SUB-SECTOR 5-D

Sub-sector 5-D is mostly hilly with patches of even land. Figure 2-3 shows that it has the highest elevation of 587.626 ft and lowest elevation of 469 ft., with a difference of 118.626 ft.

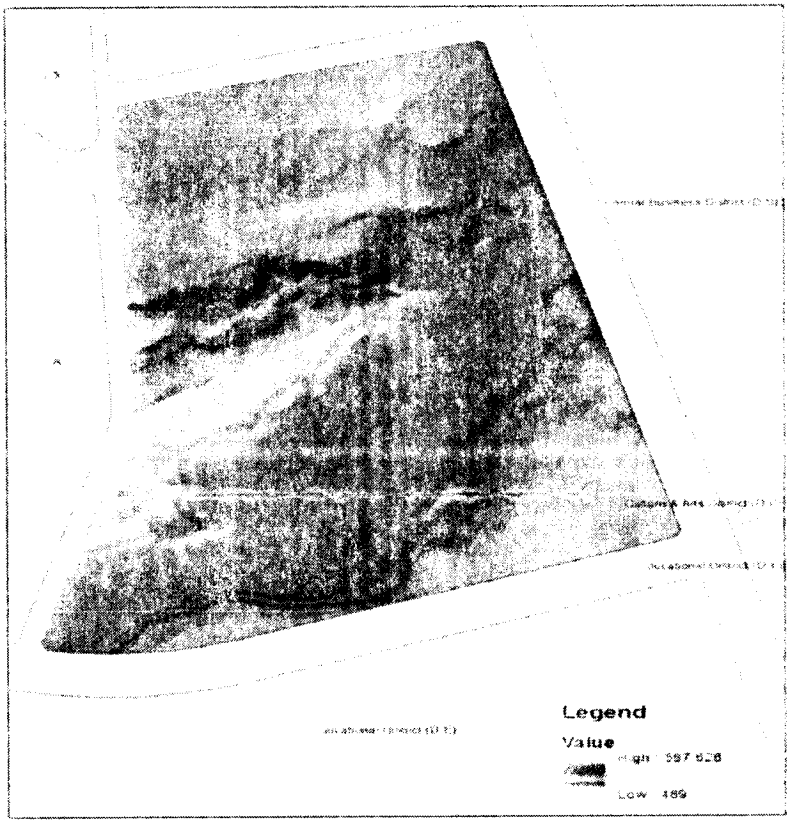


**Figure 2-3: Topography of Sub-Sector 5-D**

## 2.5 POPULATION AND DEVELOPMENT

The DCK will be developed in stages aiming to reach eventually more than 600,000 people. The overall planning of DCK is based on ekistics, leading to sectors of 20-40,000 people each. Sector 5 has a total developed area of 2,335,734 square yards, excluding road network. The table below describes the land use in sector 5. About 2/3 of the area of sector 5 is utilized for residential purposes. Residential area has different plot categories from 100 square yards to 2,000

square yards. Other facilities include commercial areas, amenities, educational institutions, graveyard, healthcare facilities and green space areas.

**Table 2-3: Sector 5: Land Use Statistics**

| SECTOR 5 LAND USE STATISTICS | | | |
|---|---|---|---|
| **Zonal Land use** | **Categories** | **Area (sq.yards)** | **Total Area (sq.yards)** |
| Agriculture and Preserved Open Spaces | Nallah | 38738.43 | **269616.5** |
| | Oil Pipe Line | 10986.53 | |
| | Open & Green Space | 219891.6 | |
| Amenities | Cemetery | 5039.94 | **63286.45** |
| | College/ A-Level/ Professional (CA/ ACCA etc.) | 6947.61 | |
| | Community Hall | 5260.62 | |
| | Dispensary | 756.46 | |
| | Health Centre | 3033.58 | |
| | Kindergarten | 7225.15 | |
| | Marriage Hall | 1555.55 | |
| | Masjid | 4510.28 | |
| | PS/ SS/ O-Level | 26977.56 | |
| | Public Service (Club) | 1979.7 | |
| Commercial | - | - | **36622.17** |
| Mixed use | - | - | **11279.09** |
| Recreation | Nursery | 53830.99 | **114651.8** |
| | Parks and Playground | 60820.86 | |
| Residential | - | - | **1100971** |
| Transportation | Commercial Collector Roads (120' ROW) | 21000.71 | **721689.8** |
| | Commercial Collector Roads (60' Row) | 28936.15 | |
| | Parking | 17406.59 | |
| | Pedestrian way | 9979.16 | |
| | Piazza | 53540.53 | |
| | Residential Collector Roads (90' ROW) | 63726.05 | |
| | Streets | 527100.6 | |
| Utilities | ICT and Security | 1183.57 | **17616.83** |
| | Overhead Reservoir | 2288.72 | |
| | Sewage Treatment Plant | 5218.79 | |
| | Unclassified Utility | 8925.74 | |
| **Grand Total** | | | **2,335,734** |

## 2.6 CONTRACT PACKAGES

Sector 5 consists of 4 contract packages. Refer Figure 2-2 for location and boundary of various packages. The detailed layout plans showing detailed MV & LV network of package 4 is also attached in Detailed Design Drawings of the report. The statistical description of package 4 is given below:

- **Package 4**

This package comprises of sub-sector D which has an area of 136 acres as given in Table 2-2 and consists of an approx. road network of 30,638 ft (9.34km). Table 2-4: Plots Summary, Sub-Sector 5-Dshows the Plots Summary of sub-sector 5-D under categories of Residential, Commercial & Mix Use.

**Table 2-4: Plots Summary, Sub-Sector 5-D**

**SECTOR 5**
**PLOTS SUMMARY**

**Residential Plots**

| | R1 | R2 | R2.5 | R3 | R5 | R10 | R20 | Total |
|---|---|---|---|---|---|---|---|---|
| Sector 5 | | | | 3 | 1,369 | 396 | 5 | 1,773 |
| Sub-Sector 5-D | | | | | 1 | 376 | 5 | 382 |

**Commercial Plots**

| | C1 | C2 | C2.5 | C3 | C5 | C10 | C20 | Total |
|---|---|---|---|---|---|---|---|---|
| Sector 5 | | 66 | 5 | 17 | 16 | 2 | | 106 |
| Sub-Sector 5-D | | 19 | | | 8 | 2 | | 29 |

**Mix Use (Residential + Commercial) Plots**

| | M1 | M2 | M2.5 | M3 | M5 | M10 | M20 | Total |
|---|---|---|---|---|---|---|---|---|
| Sector 5 | | 49 | 1 | 3 | | | | 53 |
| Sub-Sector 5-D | | 16 | | | | | | 16 |

## 2.7 OVERVIEW OF DCK ELECTRICAL DISTRIBUTION DESIGN

Design of the Electrical Distribution Network for DHA City Karachi (DCK) is a very important task of the project. Analysis of the latest technologies, current industry standards, local field practices and availability of skilled Human Resource (HR) have been done with a view of current and future requirements of DCK residential and commercial users. Electrical network design layout of DCK is based on the geographic and sector wise distribution.

The DCK is a vision to build an urban city with adaption of new technologies. Distinctly it has to be a part of global smart cities family, which integrates various technical trends into a single place to facilitate best options to the local residents as well as business community. Any urban society can't be accomplished without proper plan so decision for opting of a reliable electrical distribution system for DCK will really need a higher priority at early stage.

Thus it is proposed to design and construct an electrical network that will be capable to deliver electrical services within DCK. In order to enable the level of operational efficiencies needed for a project of this kind, the use of 'smart building technologies' is the basis of this design to fulfil DCK requirement for provisioning of electrical services. The aim is to provide a network with reliable electricity supply to the residents and stakeholders.

Kiosk type substations can only be the favourable medium for smart distribution in DCK, which can provide the monitoring and control required. We believe that key for reliable electricity is a reliable distribution system with few faults and their fast location and removal. In this regard best efforts are being made to

make DCK a prosperous place in current and future scenarios. This will enable DCK to append and merge forthcoming technologies without modifying its existing infrastructure system. The description of various kiosks Sub-Stations used is given below.

- **Kiosk Sub-Station Type-A** (1000 kVA, 630 kVA, 500 kVA) Oil filled Transformer 11/0.42 kV, with incoming & out going VCBs on MV side.

- **Kiosk Sub-Station Type-B** (1000 kVA, 630 kVA, 500 kVA) Oil filled Transformer 11/0.42 kV, with incoming and outgoing SF6 load break switches with fuses on MV side.

# 3. DESIGN CRITERIA

## 3.1 DESIGN CODES & STANDARDS

All systems shall adapt the following main standards, wherever applicable:

- European Committee for Standardization (CEN) and European Committee for Electro technical Standardization (CENELEC)
- International Electro technical Commission (IEC)
- International Organization for Standardization (ISO)
- Other Standards and Codes can be used in areas not covered by these standards. Other standards include:
- European Standards like EN, DIN
- British Standards (BS)

The Electrical products used, should be tested and approved to meet the applicable standards by one of the independent test laboratories including following:

- KEMA
- CESI
- UL or other similar laboratories

## 3.2 USER REQUIREMENTS

The user requirements for DCK that are given by the DHA include the followings:

a) Completely underground distribution system.

b) Use of aluminium conductor cables for cost saving.

c) Use of Kiosk type substations for space saving and faster installation.

d) Smart Metering Technologies.

e) Remote monitoring and control.

## 3.3 DESIGN CRITERIA

The DCK Electrical Distribution must meet following requirements:

- High reliability
- Safe Operation
- Route Protection
- Redundancy
- Reliable Technology
- Easy to maintain and troubleshoot
- Environmentally Protected
- Cost Effective
- Future Proof

## 3.4 DESIGN CONSIDERATIONS

- Underground distribution for reliable power supply.
- MV ring distribution for fast restoration of power in case of fault.
- Use of MV express feeder to provide backup in case of simultaneous fault on two feeders.
- Use of Kiosk type substation for space saving and faster installation.
- Use of VCB type Ring Main Units (RMUs) for reliable maintenance free switching.
- Fibre Optic cable network for remote monitoring and control.
- Use of Smart Meters in residences, offices & commercial premises for two way flow of power, thus encouraging use of renewable energy by consumers.
- Remote monitoring and control of MV and LV distribution system and automatic meter reading and billing.
- Use of cost saving aluminium conductor for MV and LV cables.

# 4. SMART GRID

## 4.1 GENERAL

Traditional Electric Power Systems have been designed through deploying large central generation units built away from cities and residential areas, while electricity has been delivered to consumers through interlinked transmission lines and grid stations. Each individual generation unit, whether it is powered by fossil fuels or hydro, may be rated of up to hundreds of Megawatts (MWs). Transmission line distance also varies up to hundreds of kilometres and Electricity is then transferred to end-users through distribution transformers. The distribution system is very extensive but is almost entirely passive with *little communication* and only limited local controls. There is no *real-time monitoring* hence there is very little interaction between the loads and the power system.

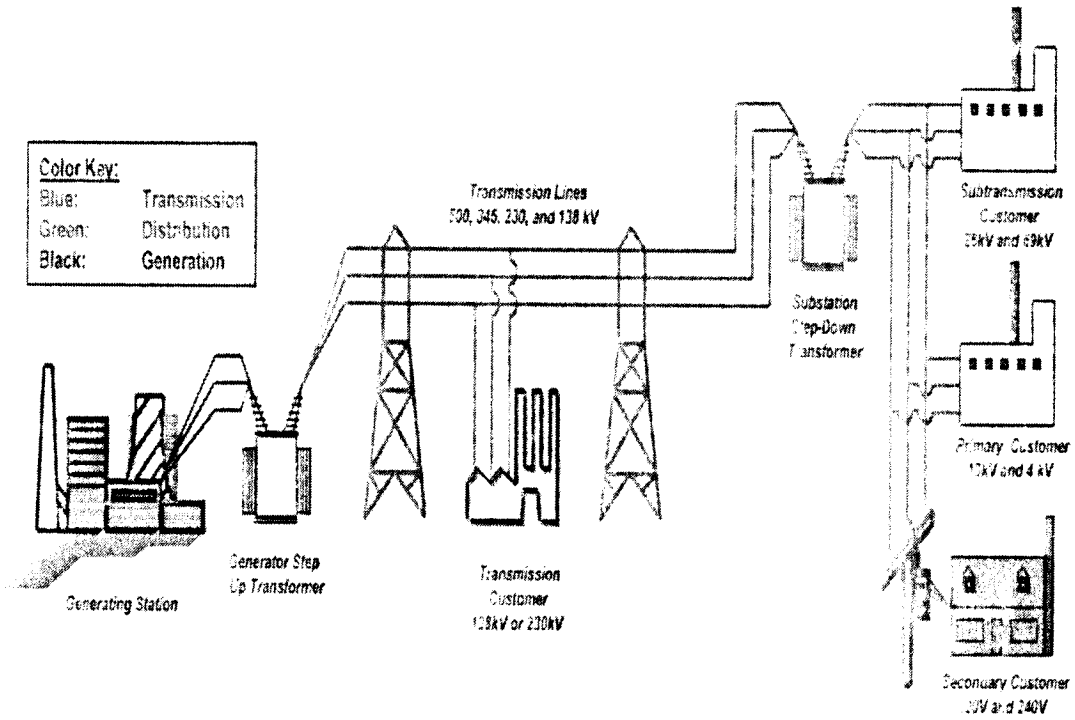


**Figure 4-1: Existing Power System Infrastructure**

The present advances in communication systems, particularly high speed networks, offer the possibility of much greater monitoring and control throughout the power system and hence more effective, flexible and lower cost operations.

Today, design concept of power system has changed and it does not required to be isolated from cities by using large scale generators. Instead large numbers of small scale generation units located at various places are being combined together to deliver electricity to local city residents. Using ICT services at smaller scale is very feasible as well as cost effective. This concept of intelligent delivery of electricity is known as ***Smart Grid***.

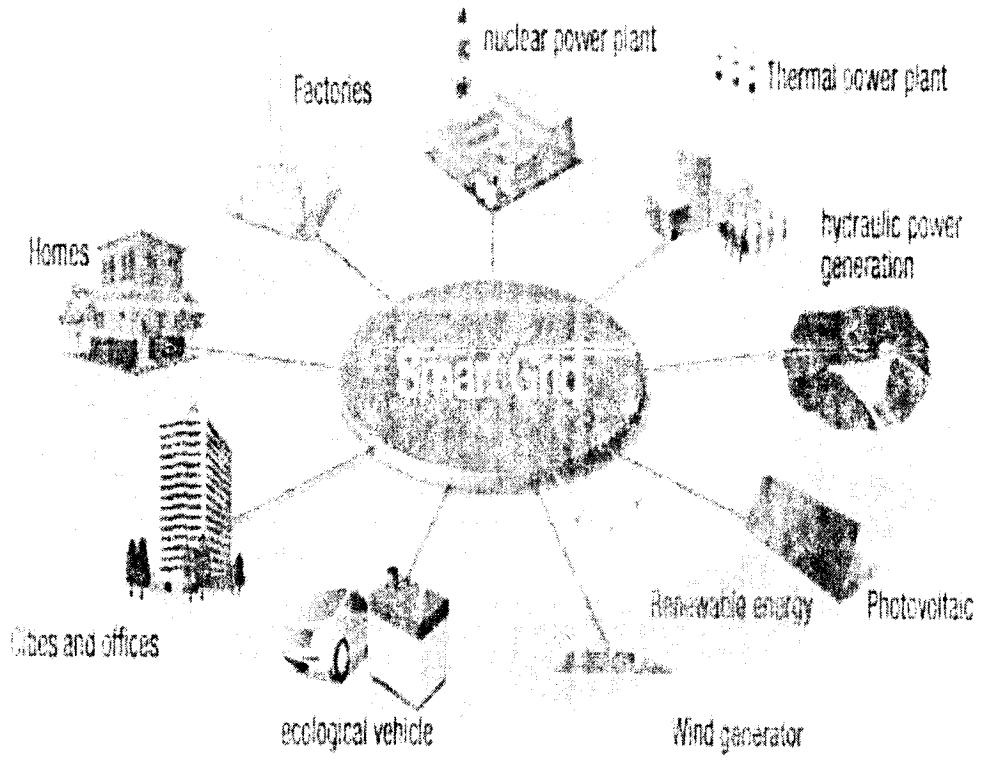


**Figure 4-2: A Smart Grid Infrastructure**

One of the best features of DHA City Karachi (DCK) is the introduction of Smart Grid Technology which will help in managing and protecting the resources of DCK electricity network. Electrical components will be 'network' enabled which will help to monitor the electricity consumption by DCK Power Operators remotely at Network Control Centre (NCC). Real-time Electricity database will then be used to optimize power generation and distribution.

Not only this, but real-time monitoring and control will enable to avoid any unwanted circumstance such as blackout due to heavy short circuits within network and brownout due to unplanned heavy loads. These cases not only affect the power quality but also damage costly power equipment such as power trans-

formers and bus bars at Sub-Stations/grid stations. This technology will enable the DCK consumers to see how much Electricity is being consumed and can also see utility bills any time online at their homes through smart meters.

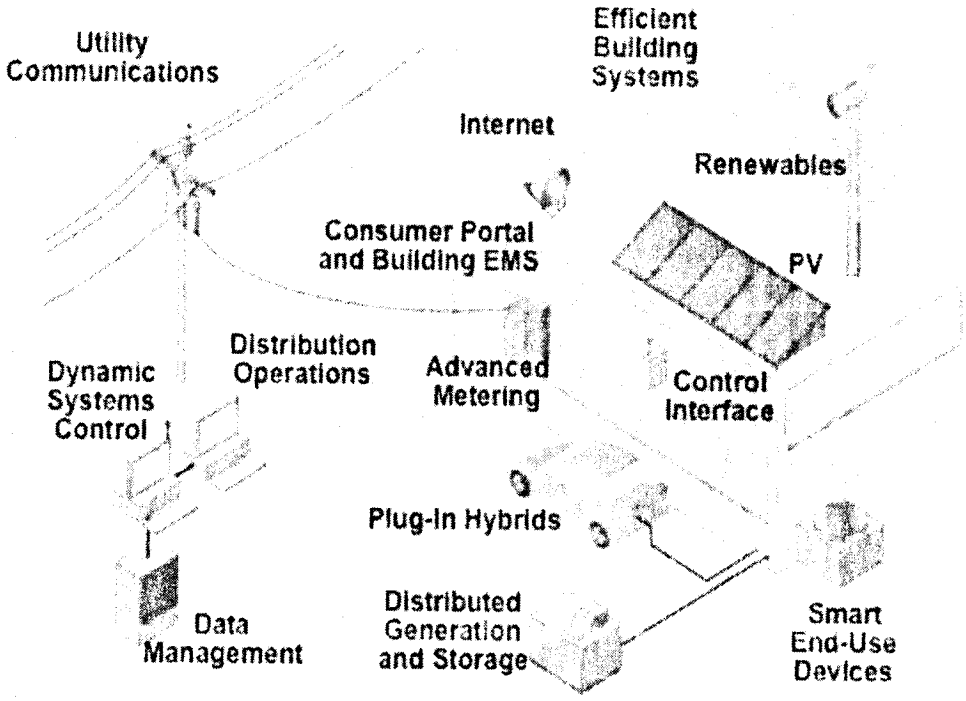


**Figure 4-3: Latest Electrical Network Infrastructure**

The design of power transmission and distribution system of DCK has also been done with a consideration of futuristic demands of any urban city. The design is aligned with the requirements of latest Codes and Standards defined for a Smart Grid and assures modular deployment of any future elements whenever required.

## 4.2 ACCOMMODATION OF RENEWABLE ENERGY INTO EXISTING GRIDS

The global concern for the environment and the need to counteract the effects that lead to global warming are the most important drivers for an improved electrical energy system. Along with establishing a common understanding of man-made changes in the global climate, scenarios have been presented, showing how future carbon emissions might be limited, or even reduced. The major proposals in these scenarios is the introduction of renewable energy sources to replace the traditional fossil based power generation with higher priority as we have a very limited fossil-fuel in future.

## 4.3 DIFFERENCE BETWEEN CONVENTIONAL AND SMART GRIDS

Following table shows a brief difference between a conventional and a Smart Grid.

**Table 4-1: Difference between a Conventional & Smart Grid**

| CHARACTERISTIC | EXISTING GRID | SMART GRID |
|---|---|---|
| Enables active participation by consumers | Consumers are uninformed and non-participative with power system | Informed, involved, and active consumers - demand response and distributed energy resources. |
| Accommodates all generation and storage options | Dominated by central generation- many obstacles exist for distributed energy resources interconnection | Many distributed energy resources with plug-and-play convenience focus on renewable |
| Enables new products, services and markets | Limited wholesale markets, not well integrated - limited opportunities for consumers | Mature, well-integrated wholesale markets, growth of new electricity markets for consumers |
| Provides power quality for the digital economy | Focus on outages - slow response to power quality issues | Power quality is a priority with a variety of quality/ price options - rapid resolution of issues |
| Optimizes assets & operates efficiently | Little integration of operational data with asset management - business process silos | Greatly expanded data acquisition of grid parameters - focus on prevention, minimizing impact to consumers |
| Anticipates and responds to system disturbances (self-heals) | Responds to prevent further damage- focus is on protecting assets following fault | Automatically detects and responds to problems - focus on prevention, minimizing impact to consumer |
| Operates resiliently against attack and natural disaster | Vulnerable to malicious acts of terror and natural disasters | Resilient to attack and natural disasters with rapid restoration capabilities |

## 4.4 USER REQUIREMENTS

- Demand & Supply Balancing
- Optimized and cost-effective Power Generation
- Consumer-Interacted Advance Metering Technology
- Remote Monitoring & Control
- High level protection of EHV, HV, MV and LV equipments
- Accommodation of Generation from Renewable Energy
- Resiliently to Disturbances, Attacks, & Natural Disasters
- High Speed Communication medium throughout the Transmission & Distribution Network
- Power Quality
- Accuracy in load prediction
- Reliability
- Future Proof Technology

## 4.5 NEED OF SMART GRID INFRASTRUCTURE

Today, existing grids are under pressure to deliver the growing demand for power, as well as provide a stable and sustainable supply of electricity. These complex challenges are driving the evolution of smart grid technologies. Smart grid is specifically designed to meet the increasing global demand for electricity, by providing sufficient capacity, as well as reliability, efficiency and sustainability.

## 4.6 ADVANCED METERING INFRASTRUCTURE

Advance Metering Infrastructure (AMI) systems that support two-way communications with customers while allowing secure and reliable system-wide communication for distribution automation are the enabling foundation for the Smart Grid. Advanced Metering Infrastructure will give consumers the consumption and pricing information they need to enable them to more effectively participate in peak load reduction and energy conservation.

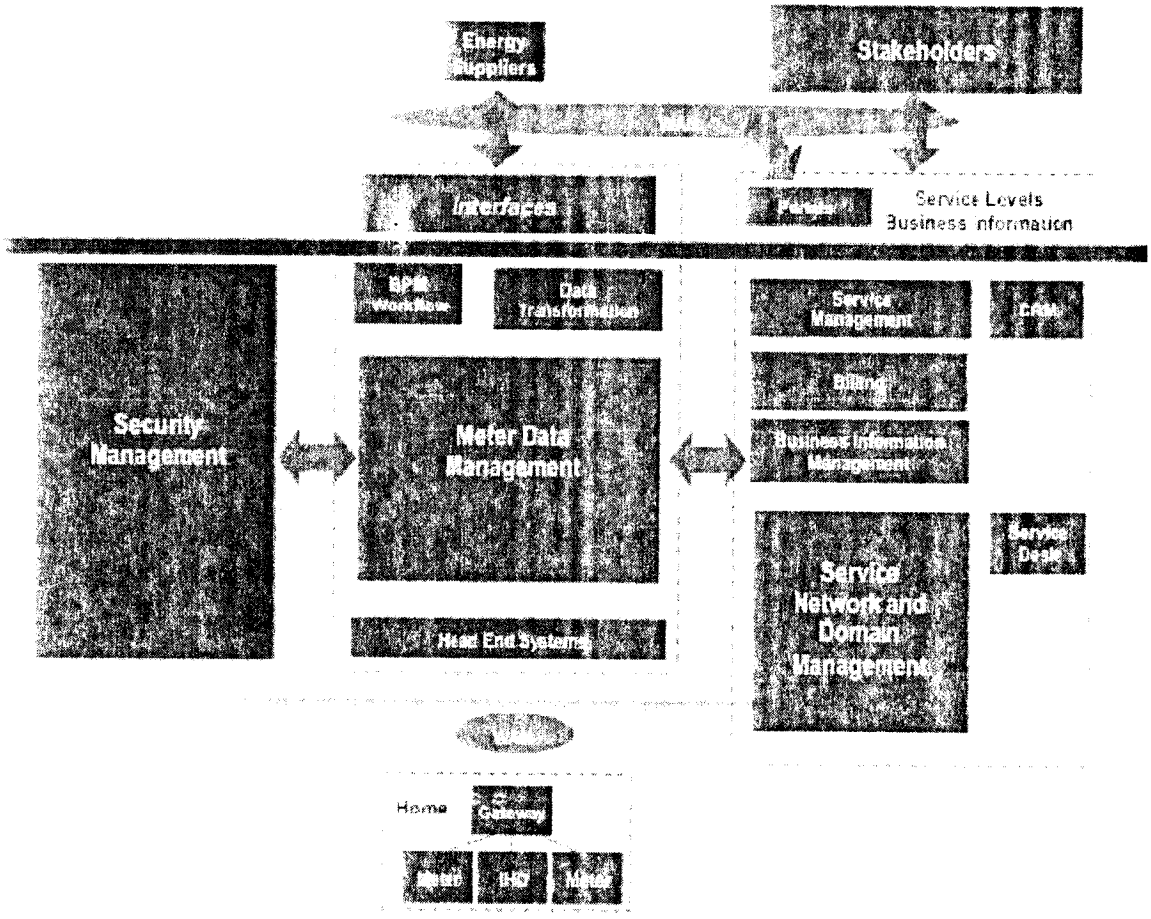


**Figure 4-4: Advance Metering Infrastructure System**

AMI consists of the communications hardware and software, and the associated system and data management software, that together create a two-way network between advanced meters and utility business systems, enabling collection and distribution of information to customers and other parties, such as the competitive retail supplier or the utility itself. Generally AMI have following functionalities:

- Two way communications
- Interval measurement and storage of consumption data
- Display of consumption data to consumer
- Remote connection/disconnection
- Support for variable energy tariffs
- Demand control

## 4.7 DISTRIBUTION AND OUTAGE MANAGEMENT

Distribution and Outage Management Systems (DMS/OMS) provide real-time response to adverse or unstable conditions. It saves money and improves customer service. Through the consolidation of both real-time OMS and DMS functionality, telemetry, and integrated security, smart distribution systems will be poised to become truly self-healing.

## 4.8 DISTRIBUTION AND SUBSTATION AUTOMATION

A Smart Grid requires control centre supervision, area-wide solutions and visualization with centralized modelling. Implementations should leverage installed infrastructure and use a model-based, scalable approach. This practical, cost-effective method ensures that current technology eventually gives way to reactive, software-driven intelligence.

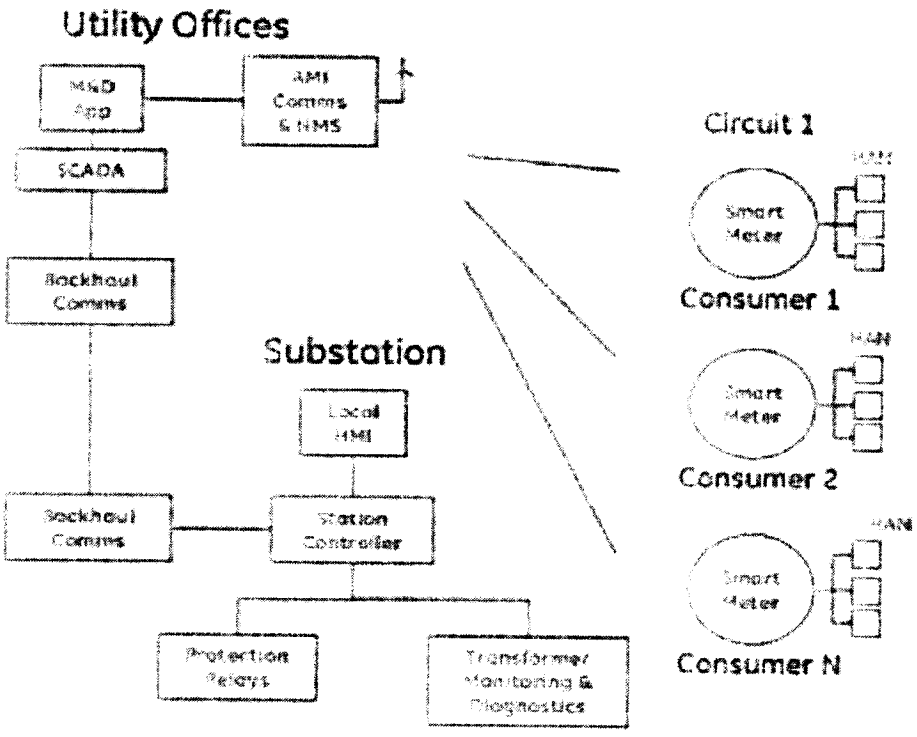


**Figure 4-5: Distribution Automation System**

The architecture shown above uses a centralized distribution automation system with the addition of communication to smart metering. The algorithm can utilize the information from the smart meters to assist in detecting outages outside of the monitored range of the automated devices. This includes fuses or other non-automated fault interrupters. The meters can detect and report an outage and can report successful restoration. Using the restoration detection, the system can determine customers have been properly restored as expected.

## 4.9 PERFORMANCE

Smart Grids will make use of new design concepts and advanced materials in system components like transformers and circuit breakers to improve efficiency, safety and operational performance. Widespread use of power electronic devices will help maximize performance of existing assets and make the grid more resilient in the event of disruptions.

## 4.10 SECURITY & SAFETY

Improvements in security increase the robustness and resiliency of the grid from a physical perspective and a cyber perspective, thereby reducing the probability and consequences of man-made attacks and natural disasters. In addition, reductions in oil imports made possible by the Smart Grid enhance national security.

Improvements in safety reduce the hazards inherent in an energized electric system as well as the time of exposure to those hazards. Generally Smart Grid Infrastructure will help through following:

- Reduction in the probability that a deliberate man-made cyber or physical attack could occur and a reduction in the consequences of any that are not detected or prevented
- Improved restoration times following storms and other natural events
- Reduction in theft and vandalism of property due to increased detection capability
- Reduction in injuries and deaths of employees due to reduction in time spent in hazardous situations and the availability of more intelligent systems that support worker safety

These benefits will decrease the probability that extended outages impacting the security of customers will occur by reducing the threat, vulnerability, and consequences of man-made attacks. The increased reliance on digital Smart Grid technologies will require the deployment of new systems to address cyber security ensuring this critical infrastructure is as "hack proof" as possible. The increased robustness and resilience of the smart grid will also reduce the impact of many natural events that today result in extended outages.

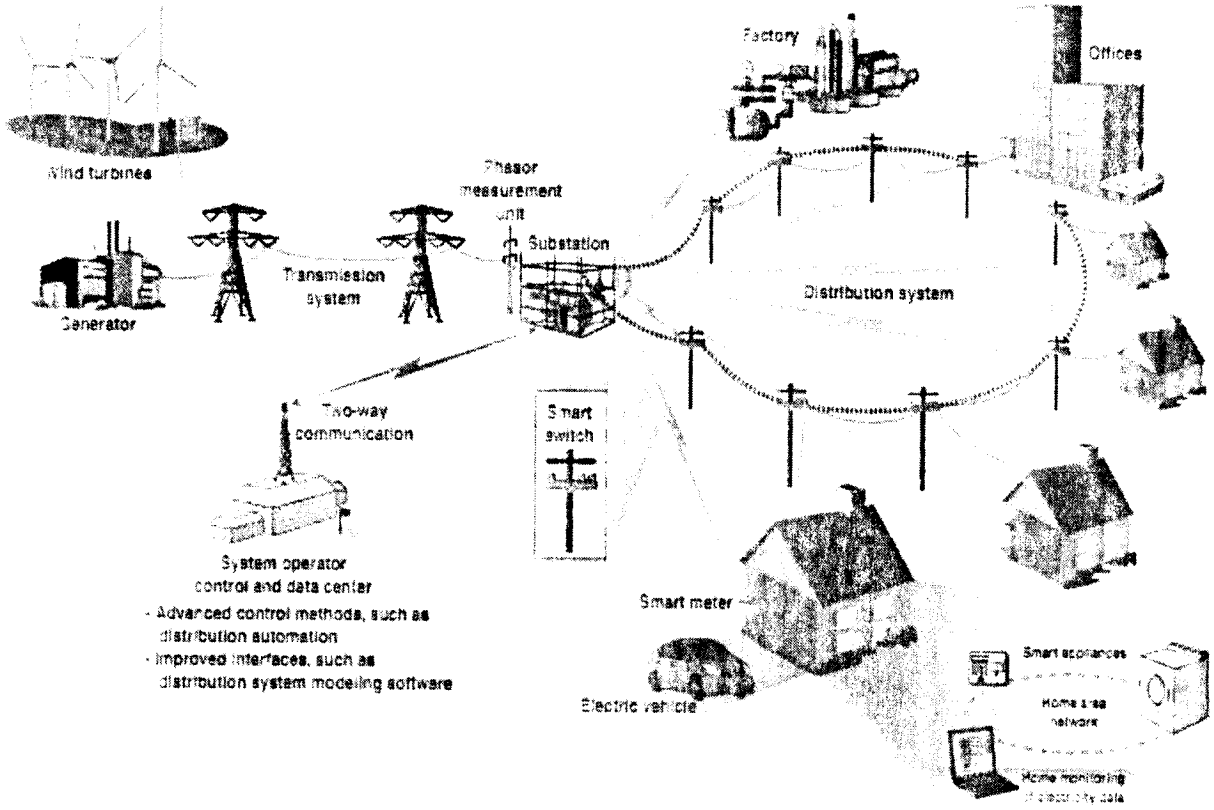


**Figure 4-6: A Secure Smart Grid System**

## 5. BENEFITS OF SMART GRID ELEMENTS

A modernized electrical grid has following features:

- Improves power reliability and quality
- Optimizes facility utilization and averts construction of backup (peak load) power plants
- Enhances capacity and efficiency of existing electric power networks
- Improves resilience to disruption
- Enables predictive maintenance and "self-healing" responses to system disturbances
- Facilitates expanded deployment of renewable energy sources
- Accommodates distributed power sources
- Automates maintenance and operation

- Reduces greenhouse gas emissions by enabling electric vehicles and new power sources
- Reduces oil consumption by reducing the need for inefficient generation during peak usage periods
- Presents opportunities to improve grid security
- Enables transition to plug-in electric vehicles and new energy storage options
- Increases consumer choice
- Enables new products, services, and markets and consumer access to them
- Improved distribution system efficiency
- Reduced distribution line losses
- Improved voltage profile along feeder
- Improved system stability and capacity
- Deferred capital upgrades
- Reduced energy demand
- Reduction of environmentally harmful emissions

# 3

## DESIGN LOAD SHEET SECTOR-05 (PACKAGE-4)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-4)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


OSMANI

Engineering - Architecture - Planning - Mapping - Technology

**OSMANI & COMPANY (PVT.) LTD.**

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# DCK - SECTOR-05 (PACKAGE-4)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

**COMMERCIAL**

| S. No. | Plot Area (Sq.yds) | Type of Plot | Covered Area as per DCK Bye Laws | | | | KESC Load Criteria | | General Load | A/C Load | Lift Load (W) | Water Pump Load (W) | Max. Connected Load (W) | Group div: factor 80% (W) | TOTAL NO. OF PLOTS | Total Load (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | | |
| 1 | 1000 | C10 | GF=75% ABOVE=65% | 47700 | 8 | 47700 | 10 | 0 | 477000 | 0 | 8952 | 3729 | 489681 | 391744.8 | 2 | 979.36 |
| 2 | 200 | C2 | 100% | 1800 | 6 | 10800 | 10 | 0 | 108000 | 0 | 8952 | 3729 | 120681 | 96544.8 | 19 | 2292.94 |
| 3 | 500 | C5 | GF=85% ABOVE=75% | 20700 | 6 | 20700 | 10 | 0 | 207000 | 0 | 8952 | 3729 | 219681 | 175744.8 | 8 | 1757.45 |
| 4 | 200 | M2 (C+R) | 100% | 1800 | 6 | 10800 | 10-GF 1.75 UP | 1 | 33750 | 10000 | 8952 | 3729 | 56431 | 45144.8 | 16 | 902.90 |
| 5 | 395 | MK | 100% | 3555 | 1 | 3555 | 10 | 0 | 35550 | 0 | | | 35550 | 28440 | 1 | 35.55 |
| 6 | 400 | MK | 100% | 3600 | 1 | 3600 | 10 | 0 | 36000 | 0 | | | 36000 | 28800 | 1 | 36.00 |
| | | | | | | | | | | | | | | | TOTAL (kW) | 6004.20 |

## DCK - SECTOR-05 (PACKAGE-4)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

**RESIDENTIAL**

| S. No. | Plot Area (Sq.yds) | Type of Plot | Covered Area as per DHA Bye Laws | | | | KESC Load Criteria | | General Load | A/C Load | Max. Connected Load (W) | Connected load at 40% DF (W) | Group div: factor 80% (W) | TOTAL NO. OF PLOTS | Load (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | |
| 1 | 500 | R5 | 60% | 2700 | 3 | 8100 | 1.75 | 1 | 14175 | 6000 | 20175 | 8070 | 6456 | 1 | 20.18 |
| 2 | 1000 | R10 | 50% | 4500 | 3 | 13500 | 1.75 | 2 | 23625 | 12000 | 35625 | 14250 | 11400 | 358 | 12753.75 |
| 3 | 1250 | R10 A | 50% | 5625 | 3 | 16875 | 1.75 | 2 | 29531.25 | 12000 | 41531.25 | 16612.5 | 13290 | 13 | 539.91 |
| 4 | 1500 | R10 B | 50% | 6750 | 3 | 20250 | 1.75 | 2 | 35437.5 | 12000 | 47437.5 | 18975 | 15180 | 5 | 237.19 |
| 5 | 2000 | R20 | 50% | 9000 | 3 | 27000 | 1.75 | 2 | 47250 | 12000 | 59250 | 23700 | 18960 | 5 | 296.25 |
| 6 | 2500 | R20 A | 50% | 11250 | 3 | 33750 | 1.75 | 2 | 59062.5 | 12000 | 71062.5 | 28425 | 22740 | 1 | 71.06 |
| | | | | | | | | | | | | | TOTAL | 383 | 13918.33 |

**DCK - SECTOR-05 (PACKAGE-4)**
**ELECTRICAL LOAD CALCULATIONS**
**LOAD AS PER KESC STANDARDS**

| DESCRIPTION | TOTAL NO. OF PLOTS | TOTAL RESIDENTIAL LOAD (kW) | TOTAL AMENITIES LOAD (kW) | TOTAL COMMERCIAL LOAD (kW) | TOTAL (kW) |
|---|---|---|---|---|---|
| No. of Plots | 383 | | | | 22,029.73 |
| Residential Load | | 13,918.33 | | | |
| Amenities Load | | | 2,107.20 | | |
| Commercial Load | | | | 6,004.20 | |
| **Total Load (MW)** | **383** | **13.92** | **2.11** | **6.00** | **22.03** |

## DCK - SECTOR-05 (PACKAGE-4)
## ELECTRICAL LOAD CALCULATIONS
## LOAD AS PER KESC STANDARDS

AMENITIES

| S. No. | Plot Area (Sq.yds) | Type of Plot | Covered Area as per DCK Bye Laws | | | | KESC Load Criteria | | General Load | A/C Load | Water Pump Load (W) | Max. Connected Load (W) | Group div: factor 80% (W) | TOTAL NO. OF PLOTS | Total Load (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | Covered Area (Sq.ft) | No. of Floor | Total Sq.ft | General Load (W/sft) | A/C 2.0 kW per Floor | Connected Load (W) | Connected Load (W) | | | | | |
| 1 | 1040 | COMMINITY CENTER | 60% | 5616 | 1 | 5616 | 2.5 | 1 | 14040 | 2000 | | 16041 | 12832.8 | 1 | 16.04 |
| 2 | 1043 | PUBLIC SERVICE (CLUB) | 50% | 4693.5 | 4 | 18774 | 2.5 | 1 | 46935 | 8000 | 12681 | 67617 | 54093.6 | 1 | 67.62 |
| 3 | 1056 | MOSQUE | 80% | 7603.2 | 2 | 15206.4 | 1.5 | 0 | 22809.6 | 0 | | 22809.6 | 18247.68 | 1 | 22.81 |
| 4 | 670 | KINDER GARTEN | 100% | 6030 | 1 | 6030 | 1.5 | 1 | 9045 | 2000 | | 11046 | 8836.8 | 1 | 11.05 |
| 5 | 976 | KINDER GARTEN | 100% | 8784 | 1 | 8784 | 1.5 | 1 | 13176 | 2000 | | 15177 | 12141.6 | 1 | 15.18 |
| 6 | 4541 | PRIMARY EDUCATION | 40% | 16347.6 | 3 | 49042.8 | 2.5 | 3 | 122607 | 18000 | | 140610 | 112488 | 1 | 140.61 |
| 7 | 6611 | SECONDARY EDUCATION | 40% | 23799.6 | 3 | 71398.8 | 2.5 | 3 | 178497 | 18000 | | 196500 | 157200 | 1 | 196.50 |
| 8 | 1542<br>3122<br>15590<br>1414<br>6128 | NURSERY | 100% | - | 1 | - | 4.9kW fixed for any area | 0 | 4900 | 0 | | 4900 | 3920 | 5 | 24.50 |
| 9 | 700 | PARK & PG | 100% | 6300 | 1 | 6300 | 1.5 | 0 | 9450 | 0 | | 9450 | 7560 | 1 | 9.45 |
| 10 | 880 | PARK & PG | 100% | 7920 | 1 | 7920 | 1.5 | 0 | 11880 | 0 | | 11880 | 9504 | 1 | 11.88 |
| 11 | 1581 | PARK & PG | 100% | 14229 | 1 | 14229 | 1.5 | 0 | 21343.5 | 0 | | 21343.5 | 17074.8 | 1 | 21.34 |
| 12 | 391 | PARK & PG | 100% | 35217 | 1 | 35217 | 1.5 | 0 | 52825.5 | 0 | | 52825.5 | 42260.4 | 1 | 52.83 |
| 13 | 9256 | PARK & PG | 100% | 83304 | 1 | 83304 | 1.5 | 0 | 124956 | 0 | | 124956 | 99964.8 | 1 | 124.96 |
| 14 | 328 | DISPENSARY | 80% | 2361.6 | 1 | 2361.6 | 5 | 0 | 11808 | 0 | | 11808 | 9446.4 | 1 | 11.81 |
| 15 | 1621 | UTILITY | 100% | 14589 | 1 | 14589 | 10 | 0 | 145890 | 0 | | 145890 | 116712 | 1 | 145.89 |
| 16 | 4285 | UTILITY | 100% | 38565 | 1 | 38565 | 10 | 0 | 385650 | 0 | | 385650 | 308520 | 1 | 385.65 |
| 17 | 1772 | UTILITY | 100% | 15948 | 1 | 15948 | 10 | 0 | 159480 | 0 | | 159480 | 127584 | 1 | 159.48 |
| 18 | 1970 | UTILITY | 100% | 17730 | 1 | 17730 | 10 | 0 | 177300 | 0 | | 177300 | 141840 | 1 | 177.30 |
| 19 | 190 | PARKING | 100% | 1710 | 1 | 1710 | 0.75 | 0 | 1282.5 | 0 | | 1282.5 | 1026 | 2 | 2.57 |
| 20 | 300 | PARKING | 100% | 2700 | 1 | 2700 | 0.75 | 0 | 2025 | 0 | | 2025 | 1620 | 1 | 2.03 |
| 21 | 573 | PARKING | 100% | 5157 | 1 | 5157 | 0.75 | 0 | 3867.75 | 0 | | 3867.75 | 3094.2 | 1 | 3.87 |
| 22 | 615 | PARKING | 100% | 5535 | 1 | 5535 | 0.75 | 0 | 4151.25 | 0 | | 4151.25 | 3321 | 1 | 4.15 |
| 23 | 816 | PARKING | 100% | 7344 | 1 | 7344 | 0.75 | 0 | 5508 | 0 | | 5508 | 4406.4 | 1 | 5.51 |
| 24 | 1165 | PARKING | 100% | 10485 | 1 | 10485 | 0.75 | 0 | 7863.75 | 0 | | 7863.75 | 6291 | 1 | 7.86 |
| 25 | 133 | PARKING | 100% | 12033 | 1 | 12033 | 0.75 | 0 | 9024.75 | 0 | | 9024.75 | 7219.8 | 1 | 9.02 |
| 26 | 1544 | PARKING | 100% | 13896 | 1 | 13896 | 0.75 | 0 | 10422 | 0 | | 10422 | 8337.6 | 1 | 10.42 |
| 27 | 1650 | PIAZZA | 100% | 14850 | 1 | 14850 | 0.5 | 0 | 7425 | 0 | | 7425 | 5940 | 1 | 7.43 |
| | 1520 | PIAZZA | 100% | 13680 | 1 | 13680 | 0.5 | 0 | 6840 | 0 | | 6840 | 5472 | 1 | 6.84 |
| 29 | 1950 | PIAZZA | 100% | 17550 | 1 | 17550 | 0.5 | 0 | 8775 | 0 | | 8775 | 7020 | 1 | 8.78 |
| 30 | 4648 | PIAZZA | 100% | 41832 | 1 | 41832 | 0.5 | 0 | 20916 | 0 | | 20916 | 16732.8 | 1 | 20.92 |
| 31 | 5097 | PIAZZA | 100% | 45873 | 1 | 45873 | 0.5 | 0 | 22936.5 | 0 | | 22936.5 | 18349.2 | 1 | 22.94 |
| 32 | 1940 | OH/ST | 100% | 17460 | 1 | 17460 | | | 400000 | 0 | | 400000 | 320000 | 1 | 400.00 |
| | | | | | | | | | | | | | | TOTAL (kW) | 2107.20 |

# 4

## FEEDER SIZING
## SECTOR-05 (PACKAGE-4)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-4)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
Consulting Engineers – Architects – Planners
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Fax: +92-21-34534691
Email: ocl-khi@osmani.com,
Web: www.osmani.com

# D.H.A CITY
## SECTOR-05 (PACKAGE-4)

| FEEDER | | TRANSFORMERS |
|---|---|---|
| Feeder No: | 1 | 1000 kVA(TYPE-A) =1 b) 1000 kVA(TYPE-B)= 1 |
| Feeder Load: | 3.75 MW | b) 630 kVA(TYPE-B) =1 |
| | | 500 kVA(TYPE-A) =1 b) 500 kVA(TYPE-B) =5 |

| S. No. | TRANSFORMER | | | | |
|---|---|---|---|---|---|
| | TR-No. | Rating kVA | Rating kW | Connected Load kW | Loading Efficiency % |
| 1 | 1 | 1000 | 800 | 655.21 | 81.90% |
| 2 | 2 | 500 | 400 | 329.43 | 82.36% |
| 3 | 3 | 500 | 400 | 336.86 | 84.22% |
| 4 | 4 | 500 | 400 | 328.52 | 82.13% |
| 5 | 5 | 630 | 504 | 423.73 | 84.07% |
| 6 | 6 | 500 | 400 | 362 | 90.50% |
| 7 | 7 | 500 | 400 | 329.48 | 82.37% |
| 8 | 8 | 500 | 400 | 350.52 | 87.63% |
| 9 | 9 | 1000 | 800 | 637.28 | 79.66% |

| FEEDER | | TRANSFORMERS |
|---|---|---|
| Feeder No: | 2 | 1000 kVA(TYPE-A) =1 b) 1000 kVA(TYPE-B)= 1 |
| Feeder Load: | 3.70 MW | 500 kVA(TYPE-A) =1 b) 500 kVA(TYPE-B) =6 |

| S. No. | TRANSFORMER | | | | |
|---|---|---|---|---|---|
| | TR-Nos. | Rating kVA | Rating kW | Connected Load kW | Loading Efficiency % |
| 1 | 10 | 1000 | 800 | 643.6 | 80.45% |
| 2 | 11 | 500 | 400 | 334.32 | 83.58% |
| 3 | 12 | 500 | 400 | 343.89 | 85.97% |
| 4 | 13 | 500 | 400 | 339.56 | 84.89% |
| 5 | 14 | 500 | 400 | 330.6 | 82.65% |
| 6 | 15 | 500 | 400 | 339.4 | 84.85% |
| 7 | 16 | 500 | 400 | 348.29 | 87.07% |
| 8 | 17 | 500 | 400 | 350.4 | 87.60% |
| 9 | 18 | 1000 | 800 | 669.75 | 83.72% |

# 5

## LV- VOLTAGE DROP
## SECTOR-05 (PACKAGE-4)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-4)
.DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
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Fax: +92-21-34534691
Email: ocl-khi@osmani.com,
Web: www.osmani.com

| | | LENGTH | FEEDER | | (TP MCCB) | (TP [redacted]B) | of Installation | DERATING FACTORS | | | | Car[redacted]ng for Cable in/ODF | | Size & | Capacity as per IEE Regulations | per Parallel Cable | of Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | |
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 00 kVA) | FP 1/1 | 88 | 85.00 | 184 | (200A) TP | (7 x 30A) TP + (10A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 191 | | 150 | 197 | 184 | A |
| 0 kVA) | FP 1/2 | 99 | 91.20 | 197 | (225A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 205 | | 185 | 220 | 197 | A |
| 00 kVA) | FP 1/3 | 29 | 79.80 | 172 | (200A) TP | (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 179 | | 150 | 197 | 172 | A |
| 1/5 | FP 1/4 | 128 | 159.00 | 343 | (200A) TP | (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 357 | 2 | 150 | 197 | 172 | A |
| 00 kVA) | FP 1/5 | 45 | 79.8 | 172 | (200A) TP | (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 179 | | 150 | 197 | 172 | A |
| 1000 kVA) | FP 1/6 | 192 | 81.69 | 176 | (200A) TP | (6 x 30A) TP + (30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 183 | | 150 | 197 | 176 | A |
| 1000 kVA) | SECONDARY | | 157.20 | 340 | Feed From Trafo-1 | | | | | | | | | | | | |
| (500 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-2 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (500 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-2 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (500 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-2 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (500 kVA) | M2 | | 45.14 | 98 | Feed From Trafo-2 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (500 kVA) | FP 2/1 | 89 | 91.20 | 197 | (225A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 205 | | 185 | 220 | 197 | A |
| (500 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-3 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (500 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-3 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| 00 kVA) | FP 3/1 | 49 | 143.77 | 311 | (400A) TP | (3 x 125A) TP + (10A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 323 | 2 | 120 | 174 | 155 | A |
| (500 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-4 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (500 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-4 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (500 kVA) | FP 4/1 | 57 | 135.43 | 293 | (400A) TP | (3 x 125A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 304 | 2 | 95 | 154 | 146 | A |
| (630 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-5 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (630 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-5 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (630 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-5 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (630 kVA) | FP 5/1 | 59 | 90.28 | 195 | (225A) TP | (2 x 125A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 203 | | 185 | 220 | 195 | A |
| 630 kVA) | FP 5/2 | 53 | 43.81 | 95 | (100A) TP | (2 x 50A + 20A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 98 | | 50 | 106 | 95 | A |
| 500 kVA) | PRIMARY | | 112.48 | 243 | Feed From Trafo-6 | | | | | | | | | | | | |
| (500 kVA) | FP 6/1 | 73 | 68.40 | 148 | (225A) TP | (6 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 153 | | 95 | 154 | 148 | A |
| 6/4 | FP 6/2 | 37 | 138.69 | 300 | (160A) TP | (6 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 311 | 2 | 120 | 174 | 150 | A |
| (500 kVA) | FP 6/3 | 4 | 42.35 | 91 | (100A) TP | (2 x 30A + 40A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 95 | | 50 | 106 | 91 | A |
| (500 kVA) | FP 6/4 | 128 | 70.29 | 152 | (125A) TP | (6 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 158 | | 120 | 174 | 152 | A |
| (500 kVA) | FP 7/1 | 64 | 91.20 | 197 | (225A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 205 | | 185 | 220 | 197 | A |
| (500 kVA) | FP 7/2 | 54 | 79.80 | 172 | (200A) TP | (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 179 | | 150 | 197 | 172 | A |

| | | LENGTH | FEEDER | | (TP MCCB) | (TP M[illegible]B) | of Installation | DERATING FACTORS | | | | Car[illegible]g for Cable in/ODF | | Size & | Capacity as per IEE Regulations | per Parallel Cable | of Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .n | To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | |
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| (500 kVA) | FP 7/3 | 61 | 72.18 | 156 | (200A) TP | (5 x 30A) TP + (40A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 162 | | 120 | 174 | 156 | A |
| .00 kVA) | FP 7/4 | 153 | 86.30 | 186 | (200A) TP | (7 x 30A) TP + (15A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 194 | | 150 | 197 | 186 | A |
| .500 kVA) | UTILITY | | 116.71 | 252 | Feed From Trafo-8 | | | | | | | | | | | | |
| (500 kVA) | FP 8/1 | 79 | 85.61 | 185 | (200A) TP | (10A) TP + (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 192 | | 150 | 197 | 185 | A |
| (500 kVA) | FP 8/2 | 51 | 68.40 | 148 | (160A) TP | (6 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 153 | | 95 | 154 | 148 | A |
| (500 kVA) | FP 8/3 | 99 | 79.80 | 172 | (200A) TP | (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 179 | | 150 | 197 | 172 | A |
| 1000 kVA) | UTILITY | | 308.52 | 666 | Feed From Trafo-9 | | | | | | | | | | | | |
| 1000 kVA) | FP 9/1 | 34 | 77.96 | 168 | (200A) TP | (5 x 30A) TP + (50A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 175 | | 150 | 197 | 168 | A |
| 1000 kVA) | FP 9/2 | 108 | 91.20 | 197 | (225A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 205 | | 185 | 220 | 197 | A |
| 1000 kVA) | FP 9/3 | 34 | 79.80 | 172 | (200A) TP | (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 179 | | 150 | 197 | 172 | A |
| 1000 kVA) | FP 9/4 | 28 | 79.40 | 172 | (200A) TP | (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 178 | | 150 | 197 | 172 | A |
| (1000 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-10 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (1000 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-10 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| 1000 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-10 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| 1000 kVA) | FP 10/1 | 31 | 79.74 | 172 | (200A) TP | (5 x 30A) TP + (60A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 179 | | 150 | 197 | 172 | A |
| 0/5 | FP 10/2 | 36 | 144.64 | 312 | (150A) TP | (2 x 30A) TP + (2 x 5A) TP + (80A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 325 | 2 | 120 | 174 | 156 | A |
| 1000 kVA) | FP 10/3 | 104 | 159.60 | 345 | (160A) TP | (6 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 358 | 2 | 150 | 197 | 172 | A |
| 0/3 | FP 10/4 | 126 | 91.20 | 197 | (225A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 205 | | 185 | 220 | 197 | A |
| 1000 kVA) | FP 10/5 | 50 | 57.00 | 123 | (150A) TP | (5 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 128 | | 70 | 130 | 123 | A |
| (500 kVA) | FP 11/1 | 41 | 91.2 | 197 | (225A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 205 | | 185 | 220 | 197 | A |
| (500 kVA) | FP 11/2 | 261 | 87.36 | 189 | (200A) TP | (10A) TP + (6 x 30A) TP + (40A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 196 | | 240 | 253 | 189 | A |
| (500 kVA) | FP 11/3 | 4 | 87.36 | 189 | (200A) TP | (6 x 30A) TP + (40A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 196 | | 150 | 197 | 189 | A |
| 500 kVA) | FP 11/4 | 38 | 68.4 | 148 | (160A) TP | (6 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 153 | | 95 | 154 | 148 | A |
| .500 kVA) | FP 12/1 | 10 | 70.29 | 152 | (160A) TP | (6 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 158 | | 120 | 174 | 152 | A |
| 5 | FP 12/2 | 18 | 114 | 246 | (150A) TP | (5 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 256 | | 300 | 286 | 246 | A |
| 00 kVA) | FP 12/3 | 205 | 57 | 123 | (150A) TP | (5 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 128 | | 95 | 154 | 123 | A |
| 00 kVA) | FP 12/4 | - | 68.4 | 148 | (160A) TP | (6 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 153 | | 95 | 154 | 148 | A |
| 500 kVA) | FP 12/5 | 186 | 91.2 | 197 | (225A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 205 | | 185 | 220 | 197 | A |
| 00 kVA) | UTILITY | | 141.84 | 306 | Feed From Trafo-13 | | | | | | | | | | | | |
| 0 kVA) | FP 13/ | | 79.8 | 172 | (200A) TP | (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 179 | | 150 | 197 | 172 | A |

| | | LENGTH | FEEDER | | (TP MCCB) | (TP M[illegible]B) | of Installation | DERATING FACTORS | | | | Car[illegible]g for Cable in/ODF | | Size & | Capacity as per IEE Regulations | per Parallel Cable | of Cable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m | To | metre | kW | $I_b$ (A) | $I_n$ (A) | $I_n$ (A) | | $T_f$ | $S_f$ | $G_f$ | ODF | Amps | NO. | mm² | $I_t$ (Amp) | Amps | |
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| (500 kVA) | FP 13/3 | 79 | 57 | 123 | (150A) TP | (5 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 128 | | 70 | 130 | 123 | A |
| (500 kVA) | FP 14/1 | 39 | 91.20 | 197 | (225A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 205 | | 185 | 220 | 197 | A |
| (500 kVA) | FP 14/2 | 77 | 79.80 | 172 | (200A) TP | (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 179 | | 150 | 197 | 172 | A |
| (500 kVA) | FP 14/3 | 12 | 79.80 | 172 | (200A) TP | (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 179 | | 150 | 197 | 172 | A |
| (500 kVA) | FP 14/4 | 12 | 79.80 | 172 | (200A) TP | (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 179 | | 150 | 197 | 172 | A |
| (500 kVA) | FP 15/1 | 67 | 79.80 | 172 | (200A) TP | (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 179 | | 150 | 197 | 172 | A |
| (500 kVA) | FP 15/2 | 127 | 100.00 | 216 | (225A) TP | (6 x 30A) TP + (2 x 40A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 224 | | 240 | 253 | 216 | A |
| (500 kVA) | FP 15/3 | 139 | 79.80 | 172 | (200A) TP | (7 x 30A) TP + (1 x 5A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 179 | | 150 | 197 | 172 | A |
| (500 kVA) | FP 15/4 | 146 | 79.80 | 172 | (200A) TP | (7 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 179 | | 150 | 197 | 172 | A |
| (500 kVA) | FP 16/1 | 46 | 91.20 | 197 | (200A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 205 | | 185 | 220 | 197 | A |
| (500 kVA) | FP 16/2 | 133 | 91.20 | 197 | (200A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 205 | | 185 | 220 | 197 | A |
| (500 kVA) | FP 16/3 | 151 | 95.60 | 206 | (225A) TP | (7 x 30A) TP + (40A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 215 | | 185 | 220 | 206 | A |
| (500 kVA) | FP 16/4 | 109 | 70.29 | 152 | (200A) TP | (6 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 158 | | 120 | 174 | 152 | A |
| (500 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-17 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (500 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-17 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (500 kVA) | C2 | | 96.54 | 209 | Feed From Trafo-17 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| (500 kVA) | FP 17/1 | 35 | 60.78 | 131 | (150A) TP | (4 x 30A) TP + (40A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 136 | | 95 | 154 | 131 | A |
| 1000 kVA) | C2-S | | 96.54 | 20[illegible] | Feed From Trafo-18 | | | 0.93 | 1.15 | 0.9 | 0.963 | | | | | | |
| 1000 kVA) | FP 18/1 | 109 | 52.71 | 114 | (125A) TP | (80A) TP + (15A) TP + (2 x 5A) TP+ (2 x 20A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 118 | | 70 | 130 | 114 | A |
| 1000 kVA) | FP 18/2 | 82 | 91.20 | 197 | (225A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 205 | | 185 | 220 | 197 | A |
| 1000 kVA) | FP 18/3 | 172 | 93.09 | 201 | (225A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 209 | | 185 | 220 | 201 | A |
| 1000 kVA) | FP 18/4 | 101 | 180.45 | 390 | (225A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 405 | 2 | 185 | 220 | 195 | A |
| 4 | FP 18/5 | 115 | 89.25 | 193 | (225A) TP | (6 x 30A) TP + (50A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 200 | | 185 | 220 | 193 | A |
| 00 kVA) | FP 18/6 | 75 | 155.76 | 336 | (225A) TP | (8 x 30A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 350 | 2 | 120 | 174 | 168 | A |
| 6 | FP 18/7 | 89 | 64.56 | 139 | (150A) TP | (5 x 30A) TP + (20A) TP + (5A) TP | D | 0.93 | 1.15 | 0.9 | 0.963 | 145 | | 95 | 154 | 139 | A |

factor($T_f$) at 25$^0$ C=0.93

0.90

**METHOD OF INSTALLATION**

A = Conduit in thermally insulated wall conduit

B = Clipped on wall

**Maximum Voltage Drop 5% Allowed**

400 V = 20 V

**REF:**

# 6

## LOADING OF TRANSFORMERS IN SECTOR-05 (PACKAGE-4)

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-4)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
Consulting Engineers – Architects – Planners
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Email: ocl-khi@osmani.com,
Web: www.osmani.com

# D.H.A CITY
# SECTOR-05 (PACKAGE-4)
# RING MAIN VOLTAGE DROPS (CALCULATIONS)

## RING MAIN NO.1 (FEEDER NO. 1)

| | |
|---|---|
| **Ring Main No. 1 (Feeder No. 1) Load** | **= 3.75 MW** |
| a) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from 1st transformer to grid station | = 3121 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 3.121 x 0.158 | = 190.85 Volts |
| b) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from last transformer to switching station | = 252 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.252 x 0.158 | = 15.41 Volts |
| c) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from transformer to transformer | = 1063 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 1.063 x 0.158 | = 65 Volts |
| Total voltage drop for ring main no.1 = 190.85 + 15.41 + 65 | = 271.26 Volts |
| % Voltage drop = 271.26 x 100 / 11000 | = 2.46% |

## RING MAIN NO.2 (FEEDER NO. 2)

| | |
|---|---|
| **Ring Main No. 2 (Feeder No. 2) Load** | **= 3.70 MW** |
| a) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from 1st transformer to grid station | = 3263 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 3.263 x 0.158 | = 199.53 Volts |
| b) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from last transformer to switching station | = 324 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 0.324 x 0.158 | = 19.81 Volts |
| c) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from transformer to transformer | = 2352 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 2.352 x 0.158 | = 143.82 Volts |
| Total voltage drop for Ring Main No.2 = 199.53 + 19.81 + 143.82 | = 363.16 Volts |
| % Voltage drop = 363.16 x 100 / 11000 | = 3.30% |

## EXPRESS FEEDER # 1

| | |
|---|---|
| d) Length of 3 core 300mm2 AL, XLPE,PVC/SWA/PVC 15KV cable from grid station to switching station | = 4151 m |
| Approximate AC Impedance of conductor at 90°C | = 0.158 ohm/km |
| Sustained current, laid direct, ground temperature 30°C | = 387A |
| Voltage Drop = Vd = IZ<br>= Vd = 387 x 4.151 x 0.158 | = 253.83 Volts |
| % Voltage drop = 253.83 x 100 / 11000 | = 2.31 |

# 8

## BoQ

**Client:**

DEFENCE HOUSING AUTHORITY
KARACHI

**Project:**

SHORT-TERM PLAN ENERGY
SECTOR-05 (PACKAGE-4)
DHA CITY KARACHI

DETAIL DESIGN REPORT

**CONSULTANTS:**


عثمانی OSMANI
Engineering - Architecture - Planning - Mapping - Technology
**OSMANI & COMPANY (PVT.) LTD.**
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Email: ocl-khi@osmani.com,
Web: www.osmani.

# ENGINEER'S ESTIMATE

**CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI**
**NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS**
**LOCATION : DHA CITY SECTOR '05' (PACKAGE-4)**
**SUB-HEAD : ELECTRICAL WORKS LV DISTRIBUTION**

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| | **EXCAVATION** | | | | |
| 1 | Excavation and back filling as in hard/sofft or any soil upto 1.0m depth and 0.9m wide for MV/LV/ITC cable and pipe trenches complete as directed by the Engineer.(Excluding cost of cable & pipe) | 4,752 | Cum | 900 | 4,276,800 |
| 1.1 | Excavation and back filling as in hard/sofft or any soil upto 1.0m depth and 0.6m wide for LV/ITC cable and pipe trenches complete as directed by the Engineer.(Excluding cost of cable & pipe) | 2,083 | Cum | 900 | 1,874,700 |
| | **LV CABLE** | | | | |
| 2 | Supply, laying , conecting and testing Cable electric LV 600/1000V stranded aluminium conductor, XLPE insulated, Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, sand,warning tap with all accessories as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| 2.1) | 4 core 300mm² AL, XLPE,PVC / SWA / PVC | 18 | m | 5,600 | 100,800 |
| 2.2) | 4 core 240mm² AL, XLPE,PVC / SWA / PVC | 388 | m | 4,500 | 1,746,000 |
| 2.3) | 4 core 185mm² AL, XLPE,PVC / SWA / PVC | 1,712 | m | 3,500 | 5,992,000 |
| 2.4) | 4 core 150mm² AL, XLPE,PVC / SWA / PVC | 1,850 | m | 2,800 | 5,180,000 |
| 2.5) | 4 core 120mm² AL, XLPE,PVC / SWA / PVC | 702 | m | 2,500 | 1,755,000 |
| 2.6) | 4 core 95mm² AL, XLPE,PVC / SWA / PVC | 621 | m | 2,000 | 1,242,000 |
| 2.7) | 4 core 70mm² AL, XLPE,PVC / SWA / PVC | 238 | m | 1,750 | 416,500 |
| 2.8) | 4 core 50mm² AL, XLPE,PVC / SWA / PVC | 57 | m | 1,200 | 68,400 |
| 3 | Danger sign for MV & LV not less than 250 X 125 mm enameled as required, supply and fixing. | 90 | Each | 2,000 | 180,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4 | **Feeder pillar**<br>Providing, installing, testing and commissioning of floor mounted Feeder pillar in 16 SWG sheet steel housing, dust, weather proof IP-54 paint, hinged door/lock, suitable for 3 phase neutral and earth strip 400 volts, Almunium busbars & Insulators for distribution to out going breakers.Seperate Almunium busbars chamber in locking arrangement. Installed on RCC pad, including cost of RCC foundation, complete as per Drawings and accessories as Directed by the engineer. | | | | |
| 4.1) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>9-10A to 60A TP MCCB 16KA<br>1-TP MCCB Space only | 1 | Each | 245,000 | 245,000 |
| 4.2) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>8-10A to 60A TP MCCB 16KA<br>2-TP MCCB Space only | 20 | Each | 235,000 | 4,700,000 |
| 4.3) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>7-10A to 60A TP MCCB 16KA<br>3-TP MCCB Space only | 18 | Each | 225,000 | 4,050,000 |
| 4.4)<br>a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>6-10A to 60A TP MCCB 16KA<br>4-TP MCCB Space only | 12 | Each | 205,000 | 2,460,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4.4) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>5-10A to 60A TP MCCB 16KA<br>1-80A TP MCCB 25KA<br>4-TP MCCB Space only | 1 | Each | 215,000 | 215,000 |
| 4.5) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>5-10A to 60A TP MCCB 16KA<br>5-TP MCCB Space only | 5 | Each | 195,000 | 975,000 |
| 4.5) b) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>4-10A to 60A TP MCCB 16KA<br>1-80A TP MCCB 25KA<br>5-TP MCCB Space only | 1 | Each | 200,000 | 200,000 |
| 4.6) | **Incoming**<br>1-400A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>1-10A to 60A TP MCCB 16KA<br>3-125A TP MCCB 25KA<br>6-TP MCCB Space only | 1 | Each | 190,000 | 190,000 |
| 4.7) a) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>3-10A to 60A TP MCCB 16KA<br>7-TP MCCB Space only | 2 | Each | 165,000 | 330,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4.7) b) | **Incoming**<br>1-400A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>3-125A TP MCCB 25KA<br>7-TP MCCB Space only | 1 | Each | 170,000 | 170,000 |
| 4.8) | **Incoming**<br>1-100A to 300A TP MCCB 25KA<br>1- 300A TPN+E Almunium Busbar with insulators for out going MCCB<br>1- 600A TPN+E Almunium Busbar with insulators for I/C & Sutable cable gland<br>3-Indication lamps<br>**Outgoing**<br>2-125A TP MCCB 25KA<br>8-TP MCCB Space only | 1 | Each | 160,000 | 160,000 |
| 5 | **Earthing Electrodes**<br>Supply, installation, connection & testing of copper earth electrodes, 20mm dia, 3000mm in length, driven vertically in ground, including cost of Test pit 300x300x300mm, internal plaster, 100mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 65 | Job | 45,000 | 2,925,000 |
| 6 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Feeder Pillars as shown on the drawing. or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 650 | m | 500 | 325,000 |
| | | | | **Total of Rs.** | **39,777,200** |

# ENGINEER'S ESTIMATE

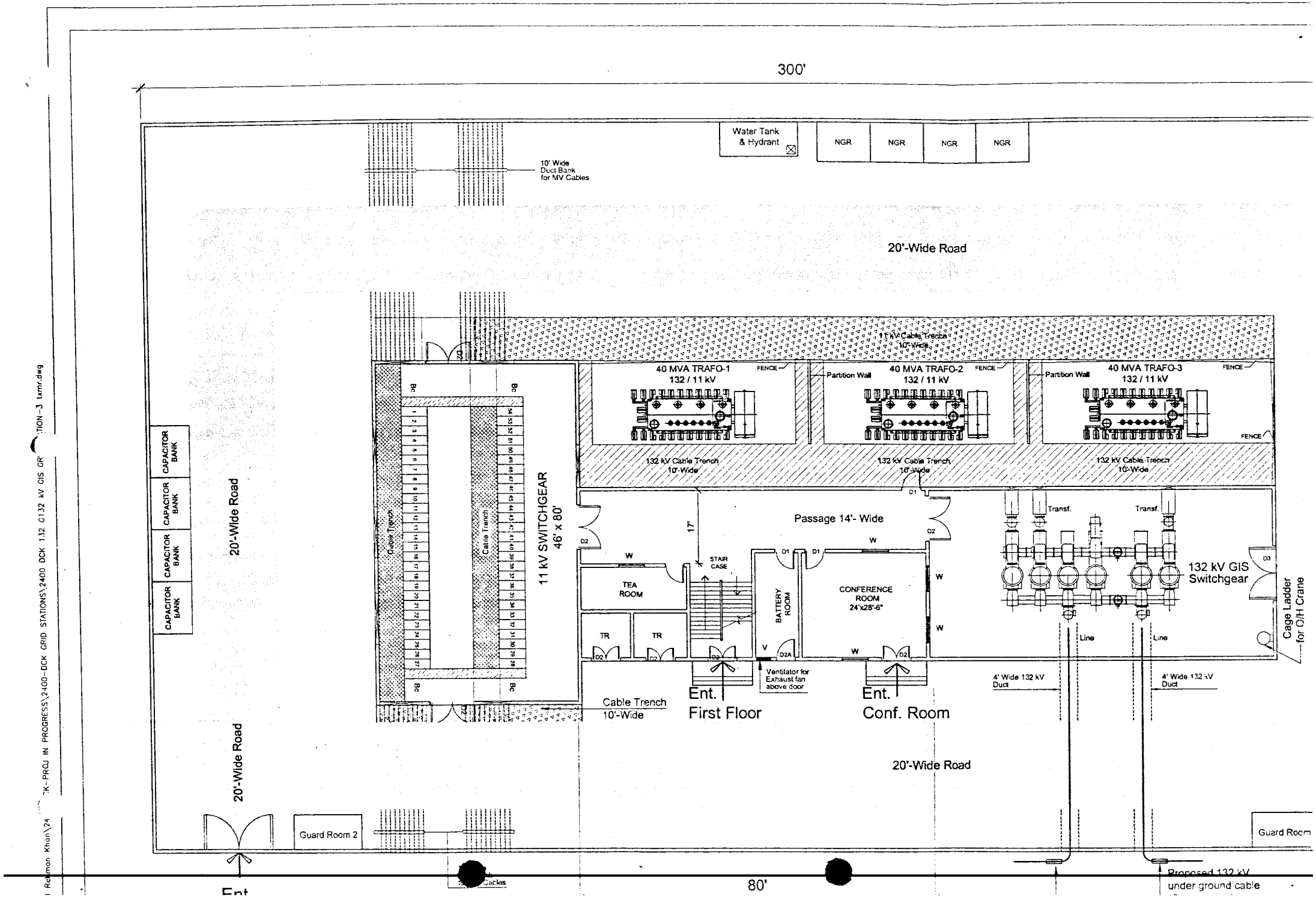
**CLIENT/OWNER : PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY,KARACHI**
**NAME OF WORK : INFRASTRUCTURE DEVELOPMENT WORKS**
**LOCATION : DHA CITY SECTOR '05' (PACKAGE-4)**
**SUB-HEAD : ELECTRICAL WORKS MV DISTRIBUTION.** **(Feeders & Express feeder)**

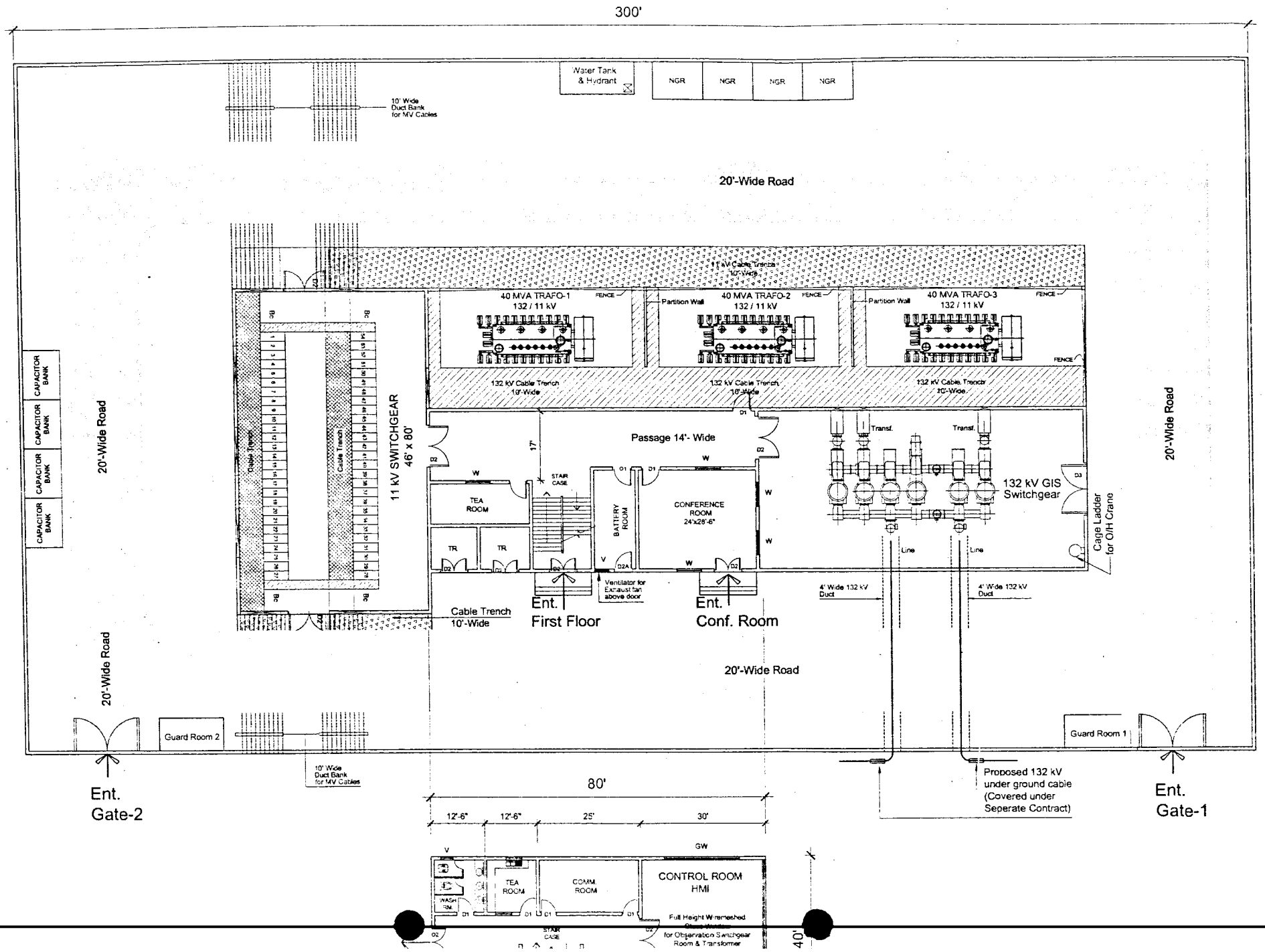
| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **Notes**<br>**Supplying, installation at any height, testing and commissioning of the following items of work (unless specifically stated otherwise) including all materials, labour, tools, plants, accessories, as required for proper completion of each item in all respect including all lead and lift as per drawings, approved shop drawings, specification, miscellaneous details and instructions of Engineer.** | | | | |
| 1 | **MV CABLE**<br>Supply,laying and conecting, Cable electric MV 15-kV stranded aluminium conductor, XLPE insulated,Triple Extruded PVC bedded, steel wire armoured and PVC sheathed overall, laid in trenches complete with bricks, soft sand coushion, warning tape, Marker as directed by the Engineer. The cable size as under.(Exclusive of cost of excavation & back filling). | | | | |
| | **FEEDER No 1.** | | | | |
| 1.1) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-1 as shown on the drawings. | 3,121 | m | 7,600 | 23,719,600 |
| 1.2) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 1,063 | m | 7,600 | 8,078,800 |
| 1.3) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-9 to Switch station-1 as shown on the drawings. | 252 | m | 7,600 | 1,915,200 |
| | **FEEDER No 2.** | | | | |
| 1.4) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from grid station to TR-18 as shown on the drawings. | 3,263 | m | 7,600 | 24,798,800 |
| 1.5) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from transformar to transformer as shown on the drawings. | 2,352 | m | 7,600 | 17,875,200 |
| 1.6) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from TR-10 to Switch station-1 as shown on the drawings. | 324 | m | 7,600 | 2,462,400 |
| | **EXPRESS FEEDER-1** | | | | |
| 1.10) | 3 core 300mm² AL, XLPE,PVC / SWA / PVC 15kV from Grid station to Switch station-1 as shown on the drawings. | 4,151 | m | 7,600 | 31,547,600 |
| 2 | PVC straight joint, MV 15kV, for XLPE cable consisting of mould, resin, MV tape, semi conducting tape, ferrules and earth wire etc. suitable for MV cables, 3 core 300mm², supply and fixing complete with all installation accessories as per KESC standard. | | | | |
| | **FEEDER No 1.** | | | | |
| 2.1) | From grid station to TR-1 | 32 | Each | 80,000 | 2,560,000 |
| 2.2) | From TR-9 to Switching station. | 5 | Each | 80,000 | 400,000 |

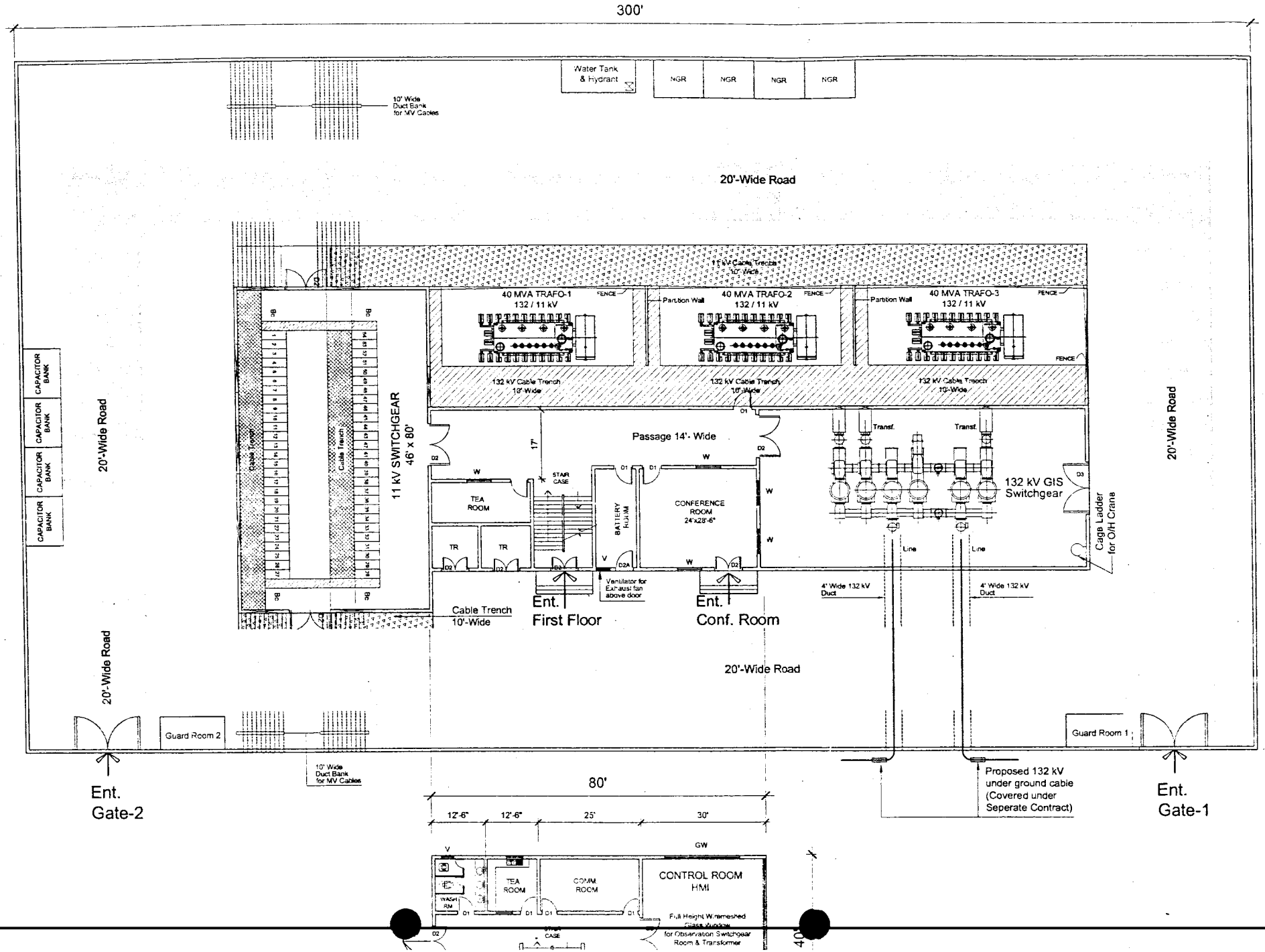
| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| | **FEEDER No 2.** | | | | |
| 2.3) | From grid station to TR-18 | 35 | Each | 80,000 | 2,800,000 |
| 2.4) | From TR-10 to Switching station. | 5 | Each | 80,000 | 400,000 |
| | **EXPRESS FEEDER No 1.** | | | | |
| 2.8) | From Switching station No-1 to grid station. | 45 | Each | 80,000 | 3,600,000 |
| 3 | **SWITCHING STATION NO-1**<br>Supply Installation, testing and commissioning outdoor type of Switching station WAPDA or KESC standard.Substation will have **1-incoming & 2-outgoing 17.5kV** Vaccum circuit breaker (VCB), **350MVA**, 630A, with protection devices housed in metalic frame **IP 54**. Switching station will be mounted on RCC plateform circuit breaker (CB) will be trolley raised type to avoid floor unevenness if any. The male & female contacts shall be rod & carolla type. EFI will be installed on each cable. The breaker shall be provided with bimetalic lugs to accomodate Almunium cable connection with copper bus-bars. C.T & P.T will be installed on each breaker. C.T ratio **1200/600/1/1** P.T ratio **11kV/110V**. Each VCB shall have earthing switch to ground cable. Earthing switch shall have inter-lock with "ON" Mechanism. Digital type Relays on each VCB shall be over current 2Nos; Earth Fault one No with series/shunt trip prorivions. The relay shall have additional potential force contacts for SCADA. Relays shall have self supervision provision. SCADA provision- each VCB will have potential "NO" & "NC" contact for status monitoring locally as well as at remote control room through SCADA. Switching Station (SS) housing shall be designed for safe operation by operator locally. No arc should comeout in any case. As per spacification installed on RCC pad, including the cost of RCC foundation pad complete with all civil and other installation accessories as shown on the drawing or as directed by the Engineers'. | 1 | Job | 7,800,000 | 7,800,000 |
| | **NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | | | | |

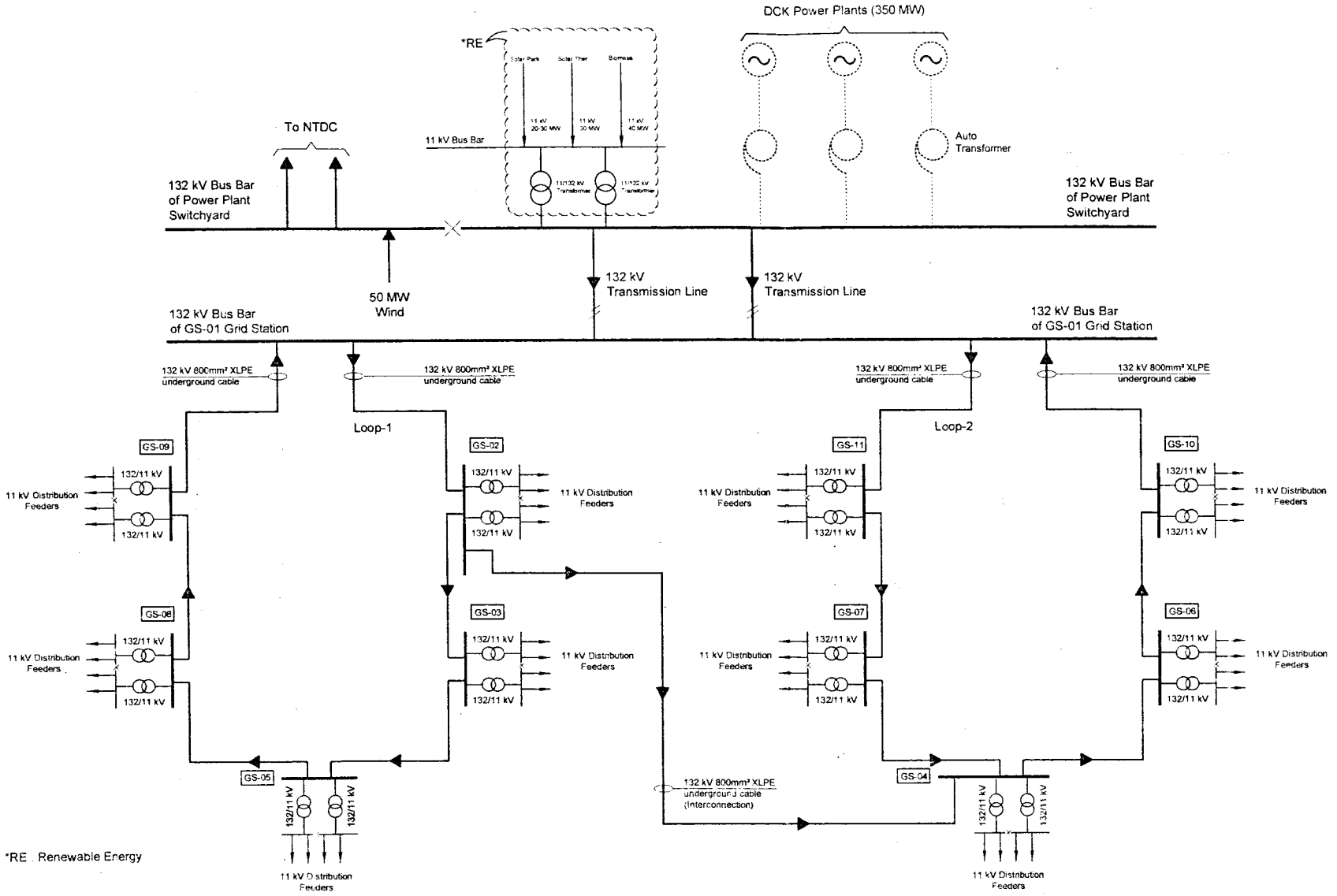
| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 4 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing **Kiosk Sub Station (Type-A) with 630 Amp.** VCB type **1000 kVA** Oil filled type **Transformer 11/0.42 kV** with incoming & out going VCB on MV side. Air Circuit Breaker of **1600 Amps** outgoing 6 Nos MCCB of **400 Amps** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | 7,050,000 | 14,100,000 |
| 5 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing **Kiosk Sub Station (Type-B) with 630 Amps.** VCB type **1000 kVA** Oil filled type **Transformer 11/0.42 kV** with incoming & out going load break switches on MV side. Air Circuit Breaker of **1600 Amps** outgoing 6 Nos MCCB of **400 Amps** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | 6,000,000 | 12,000,000 |
| 6 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing Kiosk Sub Station **(Type-B)** with **630 Amps**. VCB **17.5kV**, **350MVA**, **630 kVA** Oil filled Transformer 11/0.42 kV with incoming & out going load break switches with **SF6 Fuses** on MV side. Air Circuit Breaker of **1600 Amps** outgoing **6 Nos** MCCB of **400 Amps** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 1 | Each | 5,600,000 | 5,600,000 |

| Sr. # | Particulars | Qty. | Unit | Rate Rs. | Amount Rs. |
|---|---|---|---|---|---|
| 7 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing **Kiosk Sub Station (Type-A) with 630 Amp. VCB type 500 kVA** Oil filled type **Transformer 11/0.42 kV** with incoming & out going on MV side. Air Circuit Breaker of **1600 Amps** outgoing **6 Nos** MCCB of **300 Amps** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 2 | Each | 5,300,000 | 10,600,000 |
| 8 | **KIOSK SUBSTATIONS**<br>Supply, installing, conecting and testing **Kiosk Sub Station (Type-B) with 630 Amps.** VCB type **500 kVA** Oil filled type **Transformer 11/0.42 kV** with incoming & out going load break switches with **SF6 Fuses** on MV side. Air Circuit Breaker of **1600 Amps** outgoing **6 Nos** MCCB of **300 Amps** according to KESC / WAPDA standard specifications, smart meters and remote monitoring and control equipments. KIOSK SUBSTATION is installed on RCC foundation pad & other accessories as directed by the Engineer.<br>**NOTE**<br>KIOSK SUBSTATION shall have provision for integrationwith smart grid / SCADA with relevant low voltage / extra low voltage line sensing device. Modem shall be capable of connectivity with optical fiber network. Communication solutions to be provided | 11 | Each | 4,300,000 | 47,300,000 |
| 9 | **Earthing Electrodes**<br>Supply, installation, connection & testing of copper earth electrodes, 20mm dia, 3000mm in length, driven vertically in ground, including cost of Test pit 300x300x300mm, internal plaster, 100mm thick R.C.C. cover with lifting hooks, all necessary accessories and material, complete in all respects as shown in the drawing or as directed by the Engineers. | 20 | Job | 45,000 | 900,000 |
| 10 | Providing,laying and connecting 2/0-SWG ECC hard drawing bare copper conductor leads from earthpit to Switching Station & Transformer as shown on the drawing. or as directed by the Engineer. The copper leads to be laid in suitable size of pvc pipe complete with all pvc pipe and other accessories as directed by the engineer. | 200 | | 500 | 100,000 |
| | | | | **Total of Rs.** | **218,557,600** |


300'
80'
Water Tank & Hydrant
NGR
NGR
NGR
NGR
10' Wide Duct Bank for MV Cables
20'-Wide Road
11 kV Cable Trench 10'-Wide
40 MVA TRAFO-1 132 / 11 kV
40 MVA TRAFO-2 132 / 11 kV
40 MVA TRAFO-3 132 / 11 kV
FENCE
Partition Wall
132 kV Cable Trench 10'-Wide
11 kV SWITCHGEAR 46' x 80'
Cable Trench
Passage 14'- Wide
17'
STAIR CASE
TEA ROOM
TR
TR
BATTERY ROOM
CONFERENCE ROOM 24'x28'-6"
Ventilator for Exhaust fan above door
Transf.
132 kV GIS Switchgear
Line
Cage Ladder for O/H Crane
4' Wide 132 kV Duct
Cable Trench 10'-Wide
Ent. First Floor
Ent. Conf. Room
CAPACITOR BANK
Guard Room 2
Guard Room
Ent
Proposed 132 kV under ground cable


300'
170'
Water Tank & Hydrant
NGR
NGR
NGR
NGR
10' Wide Duct Bank for MV Cables
20'-Wide Road
11 kV Cable Trench 10'-Wide
40 MVA TRAFO-1 132 / 11 kV
40 MVA TRAFO-2 132 / 11 kV
40 MVA TRAFO-3 132 / 11 kV
FENCE
Partition Wall
132 kV Cable Trench 10'-Wide
CAPACITOR BANK
CAPACITOR BANK
CAPACITOR BANK
CAPACITOR BANK
20'-Wide Road
Cable Trench
Cable Trench
11 kV SWITCHGEAR 46' x 80'
Passage 14'- Wide
17'
STAIR CASE
TEA ROOM
TR
TR
BATTERY ROOM
CONFERENCE ROOM 24'x28'-6"
Transf.
Transf.
132 kV GIS Switchgear
Line
Line
Cage Ladder for O/H Crane
Ventilator for Exhaust fan above door
Ent. First Floor
Ent. Conf. Room
4' Wide 132 kV Duct
4' Wide 132 kV Duct
Cable Trench 10'-Wide
20'-Wide Road
20'-Wide Road
Guard Room 2
Guard Room 1
10' Wide Duct Bank for MV Cables
Ent. Gate-2
Ent. Gate-1
Proposed 132 kV under ground cable (Covered under Seperate Contract)
80'
12'-6"
12'-6"
25'
30'
40'
TEA ROOM
COMM. ROOM
CONTROL ROOM HMI
WASH BM
STAIR CASE
Full Height Wire meshed
for Observation Switchgear Room & Transformer


300'
170'
Water Tank & Hydrant
NGR
NGR
NGR
NGR
10' Wide Duct Bank for MV Cables
20'-Wide Road
11 kV Cable Trench 10'-Wide
40 MVA TRAFO-1 132 / 11 kV
40 MVA TRAFO-2 132 / 11 kV
40 MVA TRAFO-3 132 / 11 kV
Partition Wall
Partition Wall
FENCE
132 kV Cable Trench 10'-Wide
132 kV Cable Trench 10'-Wide
132 kV Cable Trench 10'-Wide
CAPACITOR BANK
CAPACITOR BANK
CAPACITOR BANK
CAPACITOR BANK
20'-Wide Road
Cable Trench
Cable Trench
11 kV SWITCHGEAR 46' x 80'
Passage 14'- Wide
17'
STAIR CASE
TEA ROOM
TR
TR
BATTERY ROOM
CONFERENCE ROOM 24'x28'-6"
Transf.
Transf.
132 kV GIS Switchgear
Line
Line
Cage Ladder for O/H Crane
20'-Wide Road
Ventilator for Exhaust fan above door
4' Wide 132 kV Duct
4' Wide 132 kV Duct
Cable Trench 10'-Wide
Ent. First Floor
Ent. Conf. Room
20'-Wide Road
20'-Wide Road
Guard Room 2
Guard Room 1
10' Wide Duct Bank for MV Cables
Ent. Gate-2
Ent. Gate-1
Proposed 132 kV under ground cable (Covered under Seperate Contract)
80'
12'-6"
12'-6"
25'
30'
TEA ROOM
COMM ROOM
CONTROL ROOM HMI
WASH RM
Full Height Wiremesh Glass Window for Observation Switchgear Room & Transformer
STAIR CASE




N
W E
S

**Note:**

1. *This drawing is not to be used for construction or for ordering material.*

| S. No. | Date | Revisions | Drawn | Checked |
|---|---|---|---|---|

Project: DHA CITY KARACHI

Client: PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY, KARACHI

Project Consultant: OSMANI — Engineering - Architecture - Planning - Mapping - Technology

Status of Drawing: DETAIL DRAWING

Drawing Discipline: ELECTRICAL

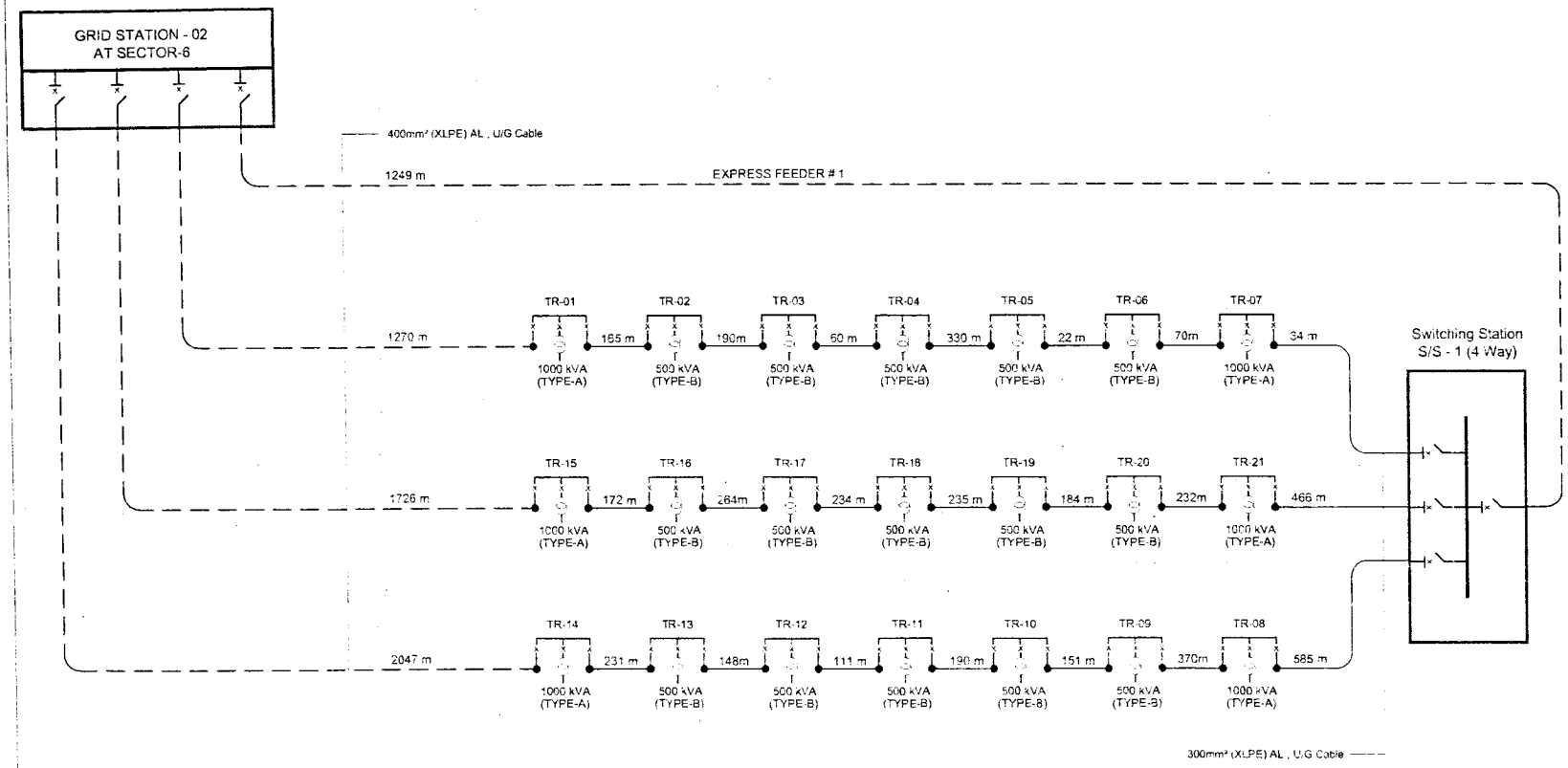
Drawing Title: POWER GENERATION, GRID DISTRIBUTION NETWORK IN DCK

Drawing Description: DCK - SINGLE LINE DIAGRAM

Drawn by | Designed by | Checked by | Coordinated By | Approved By

Scale | CAD File Name | Dated | Project No | Sheet No

Dwg No: 2400-E01 | Rev No: 00




## LEGEND

| SYMBOL | DESCRIPTION |
|---|---|
| | PAD MOUNTED UNIT (PMU) |
| | VACUUM CIRCUIT BREAKER |
| | SWITCHING STATION |
| —— | 300mm² (XLPE) AL , U/G Cable |
| - - - - | 400mm² (XLPE) AL , U/G Cable |

| No. | Date | Revisions | Drawn | Checked |
|---|---|---|---|---|

Project: DHA CITY KARACHI

Client: PAKISTAN DEFENCE OFFICERS HOUSING AUTHORITY, KARACHI

Project Consultant: OSMANI
Engineering - Architecture - Planning - Mapping - Technology

Status of Drawing: PRELIMINARY DRAWINGS

Drawing Discipline: ELECTRICAL

Drawing Title: TYPICAL SINGLE LINE DIAGRAM MV NETWORK OF A.C.B-SECTOR

Location Description: SECTOR-6 PACKAGE-01

Drawn By: SAMAN
Designed By: SEF

Scale: NTS
Date: 2400-E113
Sheet No.: 1
Rev. No.: TD