The Registrar
National Electric Power Regulatory Authority
2nd Floor, OPF Building,
Sector G-5/2,
Islamabad

SUBJECT: **Application for a Generation License for Din Energy Limited 50 MW Wind Power Project**

I, Fawad Jawed the Chief Executive being the duly authorized representative of Din Energy Limited by virtue of Board Resolution dated 11 April 2016, hereby apply to the National Electric Power Regulatory Authority for the grant of a Generation License to Din Energy Limited pursuant to Section 15 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 ("**AMPR**"), 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.

A Bank Draft in the sum of 286,640, being the non-refundable license application fee calculated in accordance with Schedule II of the AMPR, is also attached herewith. Further, additional documents/information, pursuant to the AMPR, are attached herewith.

Fawad Jawed

DIN ENERGY LIMITED KARACHI

Fawad Jawed
Chief Executive
Din Energy Limited

DIN ENERGY LIMITED KARACHI

60/24-1

5431

BEFORE
THE NATIONAL ELECTRIC
POWER REGULATORY AUTHORITY

APPLICATION FOR THE GRANT OF A GENERATION LICENSE UNDER SECTION 15 OF THE REGULATION OF GENERATION, TRANSMISSION AND DISTRIBUTION ACT 1997, AND THE RULES & REGULATIONS MADE THERE UNDER

IN RESPECT OF
DIN ENERGY LIMITED
50 MW WIND POWER PROJECT AT JHIMPIR DISTRICT THATTA, SINDH

Dated: 20 May, 2016

Filed for and behalf of:
DIN Energy Limited

Through;
RIAA BARKER GILLETTE
ADVOCATES & CORPORATE COUNSELORS
68, NAZIMUDDIN ROAD, F-8/4, ISLAMABAD
TEL: (051) 111-LAWYER
www.riaabg.com

The Registrar
National Electric Power Regulatory Authority
2nd Floor, OPF Building,
Sector G-5/2,
Islamabad

SUBJECT: <u>Application for a Generation License for Din Energy Limited 50 MW Wind Power Project</u>

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A Bank Draft in the sum of 286,640, being the non-refundable license application fee calculated in accordance with Schedule II of the AMPR, is also attached herewith. Further, additional documents/information, pursuant to the AMPR, are attached herewith.

DIN ENERGY LIMITED
KARACHI

Fawad Jawed
Chief Executive
Din Energy Limited

APPLICATION FOR THE GRANT OF A GENERATION LICENSE UNDER SECTION 15 OF THE ACT AND REGULATION 3 OF THE AMP REGULATIONS

1. NEPRA's Participation in the Process

1.1. Section 15 of the Regulation of Generation, Transmission, and Distribution of Electric Power Act, 1997 (the "**Act**") provides, *inter alia,* that:

> "(1) *No person except under the authority of a license issued by the Authority under this Act and subject to the conditions specified in this Act and as may be imposed by the Authority, construct own or operate a generation facility.*
>
> (2) *An application for the grant of a license for a generation facility shall specify-*
>
> (i) *the type of facility for which the license is applied;*
>
> (ii) *the location of the generation facility; and*
>
> (iii) *the expected life of the generation facility."*

1.2. Furthermore, Regulation 3 of the National Electric Power Regulatory Authority (Application and Modification Procedure) Regulations, 1999 (the "**AMP Regulations**") provides that an application for a license shall be made in the form specified in the AMP Regulations and further enumerates the documents required to be submitted to the Authority along with the requisite application.

1.3. This Application for the grant of a generation license is made pursuant to Section 15 of the Act and Regulation 3 of the AMP Regulations (this "**Application**").

2. Introduction of the Applicant/Sponsor

2.1. As required under the Section 24 of Act Din Energy Limited (the "**Applicant**" or the "**Company**" or the "**Project Company**") is a Public limited un-listed company incorporated under the Companies Ordinance, 1984, to act as a special purpose vehicle (the "**SPV**") and develop a 50 MW wind power generation facility located at Jhimpir, District Thatta, Province of Sindh (the "**Project**"). The company's Board Resolution, constitutive documents, other pertinent details of the Applicant and description of the Project are annexed herewith as **Annex-A** hereto. The sponsors of the company are individuals, the description of whom is available in Form-A attached with and supported by information in **Annex-B**.

AN INTRODUCTION

DEL is sponsored by the Din Group of Companies, which is being represented by fourteen (14) individual sponsors (the "Sponsors") of the Group who hold an aggregate shareholding of 100% in the Project Company. Brief Profiles of the Sponsors are given below:

Din Group

Din Group of Industries was formed in 1954 by Shaikh Mohammad Din. It represents one of Pakistan's premier business groups having diversified investments, which include textiles, leather products, financial institutions, real estate, investment in blue chip stocks/bonds, and poultry farming. Furthermore, the Group, in their individual capacities, has investments in various power, fertilizer, and E&P companies. In addition, the Sponsors have representation on the Board of Directors of MCB Bank Ltd., Adamjee Insurance Company and Fauji Fertilizer Company. The Group directly employs over 5,000 people across Pakistan.

Din Leather (Pvt.) Ltd

Din Leather (Pvt.) Ltd. is one of the largest tanneries of the Country, exporting finished leather across the globe, specializing in high-end leather. The production plant is based in Karachi. Din Leather has been awarded numerous Best Export Performance awards by the Federation of Pakistan Chambers of Commerce & Industry (FPCCI) and has also been awarded Gold Medal Award by the International Export Association U.K. in recognition of their export achievements.

Din Textile Mills Ltd

Din Textile Mills Ltd., consist of 4 units of spinning and one dyeing plant, producing value added cotton yarn such as mélange yarn, core spun stretch yarn and compact yarn. Total 100,000 spindles are in operation and most of the products are exported across the globe.

Din Farm Products

Din Farm Products is atomized poultry project with production of 300,000 eggs per day. This project was initiated in the year 2011 for the diversification of the group.

Din Group is also actively involved in philanthropy as part of its corporate social responsibility program. The group's CSR activities include, naming a few, running many dispensaries, maternity homes, educational Institutes and hospitals across Pakistan.

3. The Project Overview

The wind farm Project is located in Jhimpir, which is located approximately 120 km from Karachi, Pakistan's commercial hub and main coastal/port city. The Project site consists of 325 acres of land, which has been acquired by the project company. The Karachi-Hyderabad Motorway (Super Highway) and National Highway are the connecting roads to the Project site. The Jhimpir wind corridor is identified as potential area for the development of wind power projects. The overview of the project site is shown in Figure below.

3.1 Project Company

3.1.1 The Company is developing its Project under the NEPRA Upfront Tariff regime. The Letter Of Intent (the "**LOI**") has been awarded by Directorate of Alternative Energy (the "**DAE**"), Energy Department Government of Sindh to the DIN Energy Limited (a company duly organized and existing under the laws of Pakistan, with its office located at Din House, 35-A/I Lalazar Area, Opposite Beach Luxury Hotel, Karachi) (the Project Company) dated July 24th, 2015 vide letter No. DAE/Wind/90/2015 (the LOI). The Project Company is diligently working towards the early implementation of the Project. The Project Company proposes to design, engineer, construct, insure, commission, operate and maintain the Project. The construction of 50 MW wind power plant on GAMESA G114-2.0MW Wind Turbine Generator technology will take approximately 15 months from the issuance of notice to proceed to the project contractors, so that plant commissioning is expected within 18 months after financial close. The LOI for this Project is annexed as **Annex-J** hereto.

3.2 Issuance of "Letter of Intent"

3.2.1 The project development phase has recently started after getting the Letter of Intent (LOI) from Directorate of Alternative Energy, Energy Department Government of Sindh and land allocation from Government of Sindh (GoS) on July 24th, 2015.

3.2.2 Although the Applicant will opt for the Upfront Tariff and as such all risks associated with the Project are to be borne by the Applicant, nevertheless, the Company has undertaken various studies to assess the feasibility of the Project. These studies *inter alia* include the following:

a. Wind resources assessment;
b. Geo technical investigation;
c. Digital topographic map;
d. Initial environmental examination; and
e. Grid interconnection study.

A complete feasibility study that has already been submitted by the Project Company to DAE, Government of Sindh is annexed as **Annex-D** hereto.

4. Power Purchaser

4.1. The electricity generated from this Project would be supplied to Central Power Purchasing Agency (Guarantee) Limited / National Transmission & Dispatch Company. The power generated by the Project will be sold for the term of 20 years under the standard Energy Purchase Agreement (the "EPA") starting from commencement of commercial operations.

5. Site

5.1. The proposed Project site is located at Jhimpir, District Thatta, Province of Sindh, Pakistan (the "**Site**"). The Site proposed for the implementation of the Project has been selected by considering the following:

a. Location in the wind corridor;
b. Wind conditions at the Site;
c. Topographic conditions;

d. Site accessibility; and
e. Location of the grid with reference to the Site for interconnection.

5.2. The Site is located within the wind corridor identified by DAE, GOS. As already mentioned above the Site is located in Jhimpir, District Thatta, Sindh, which is one of the most promising areas where wind power projects can be viably installed.

5.3. <u>This Land Description of the Project Site</u>

The Project site consists of 325 acres of land and the Project shall have an installed capacity of 50 MW. The overview of site and neighboring wind farms is shown in Figure below:

The micrositing of 25 turbines with 2.0 MW each is shown in figure below:

5.4. The Project Site is exposed to very strong westerly winds, wind data analysis of the area suggests that, 80% wind blows from the south west direction. The terrain of the area is flat with small change in altitude. The proposed site lies under roughness class 1.5 as there is low vegetation. The site is easily accessible through metallic roads. The ground is hard and rocky; the subsurface soil also includes clay and silt.

5.5. The proposed wind farms lies on a flat inland area with hard and rocky ground conditions. The site would be categorized as inland wind development as opposed to offshore/coastal wind project development (which is more difficult to develop due to tides and soft subsoil clay). The general terrain at the site can be described as simple and flat terrain. Internal access roads are the roads connecting the single wind turbine locations with each other and the external access roads and grid station would be constructed during the civil works of the wind farm.

5.6 Topographic conditions

The Site is on a plain area at an elevation of 45-113 m, which is generally flat, but a bit higher on the west and lower on the east. The landform at wind farm sites is mainly of pediment and the vegetation there is less developed.

5.7 Geological conditions

The planned wind farm sites are covered mainly by marine alluvium of Holocene and recent weathered deposit, and underlain mainly by Tertiary limestone. The bedrock in the site is generally outcropped. As the WTG is a high-rise structure, it has a high gravity center and should sustain high loads, large horizontal wind force and overturning moments. WTGs are designed to withstand these forces.

5.8 Hydrology

According to the regional hydrological data available, the Project site is in a dry area, where the water table is deeply underground, and the surface water and water in the shallow surface layers is weakly to slightly corrosive to the concrete and is corrosive to the rebars in the concrete which has been immerged in water for a long-time or alternatively in wet and dry conditions. Corrosion prevention measures will be adopted in the design and implementation of the wind farm.

The Site Map and other pertinent details regarding the project site is annexed **Annex-K** hereto.

6. Operations & Maintenance Arrangement

6.1. For the purpose of designing, engineering, procuring, constructing, installing, testing, completing, commissioning, operation and maintenance of the Project, the Project Company has signed the 'Heads of Agreement' with 'Gamesa Wind (Tianjin) Co. Ltd.,' and 'Orient Energy System (Pvt) Ltd.,' on February 26, 2016.

6.2. With 20 years' experience, Gamesa is a global leader in the design, manufacture, installation and maintenance of wind turbines, with over 28,800 MW installed in 43 countries across five continents. Operation & Maintenance (O&M) is one of the key activities upon which Gamesa bases its development, having 70% of its fleet under an Operation & Maintenance contract thanks to an expansion of this activity in over 30 countries.

6.3. Backed by 20 years of experience in wind turbine O&M and optimization, Gamesa continues to be committed to adding value, offering cutting edge solutions, such as the useful life extension, integral solutions for the O&M of other manufacturers' wind turbines, and personalized financing options to meet the needs of each customer. Gamesa focuses intensively on programs for maximizing energy production, improving availability and reducing O&M related costs, with the goal of decreasing energy costs by 30%.

7. Financing

7.1. The Total Project Cost of US$ 110,132,915 (United States Dollars One Hundred and Ten Million One Hundred and Thirty Two and Nine Hundred and Fifteen) is to be financed in a debt to equity ratio of 75:25, which is in accordance with the RE Policy 2006. Further, total debt financing for the Project is going to be funded through a1 mix of foreign and local debt.

Detailed information regarding the capital budget and the financing plan and Expression of Interest from Banks are appended herewith as **Annex F**.

8. Selection of Technology

8.1. The proposed wind farm contains 25 Gamesa G114-2.0MWCIIA Wind Turbine with hub height 80 meters for the Company's Wind Power Project. The output of the farm will be 50 MW with capacity factor not less than 35% at P90 probability of exceedance. The project construction timeline will be around 15 months after issuance of Notice to Proceed (NTP). The WTG is sourced from world renowned wind turbine manufacturer, GAMESA Corporation with a total of 21 years of experience and more than 31.2 GW capacity installed around the world. GAMESA is the world technology leader in Wind Power.

Specifications of G114-2.0 MW CIIA Wind Turbine

(a).	**Rotor**	
(i).	Number of blades	3
(ii).	Rotor diameter	114 m
(iii).	Swept area	10207 m^2
(iv).	Power regulation	Combination of blade pitch angle adjustment, and generator / converter torque control.

(v).	Cut-in wind speed	3 m/s
(vi).	Cut-out wind speed	25 m/s
(vii)	Survival wind speed	59.5 m/s (Maximum 3 sec)
(viii)	Pitch regulation	Electric motor drives a ring gear mounted to the inner race of the blade pitch bearing.
(b).	**<u>Blades</u>**	
(i).	Blade length	56 m
(ii).	Material	Composite material reinforced with fiberglass through resin infusion technology.
(c).	**<u>Gearbox</u>**	
(i).	Type	3 combined stages: 1 stage planetary, 2 parallel shift gears.
(ii).	Gear ratio	1:128.5
(iii).	Main shaft	Cast shaft
(d).	**<u>Generator</u>**	
(i).	Nominal Power	2070 (kW)
(ii).	Voltage	690 V
(iii).	Type	Doubly fed with coil rotor and slip rings
(iv).	Degree of Protection	IP54 Turbine – IP21 Ring Body
(v).	Coupling	Main Shaft: Cone Collar, High Speed Shaft: Flexible coupling.
(vi).	Power factor	0.95
(e).	**<u>Control System</u>**	
(i).	Type	Automatic or manually controlled.
(ii).	Scope of monitoring	Remote monitoring of different parameters, e.g. temperature sensors, pitch parameters, speed, generator torque, wind speed and direction, etc.

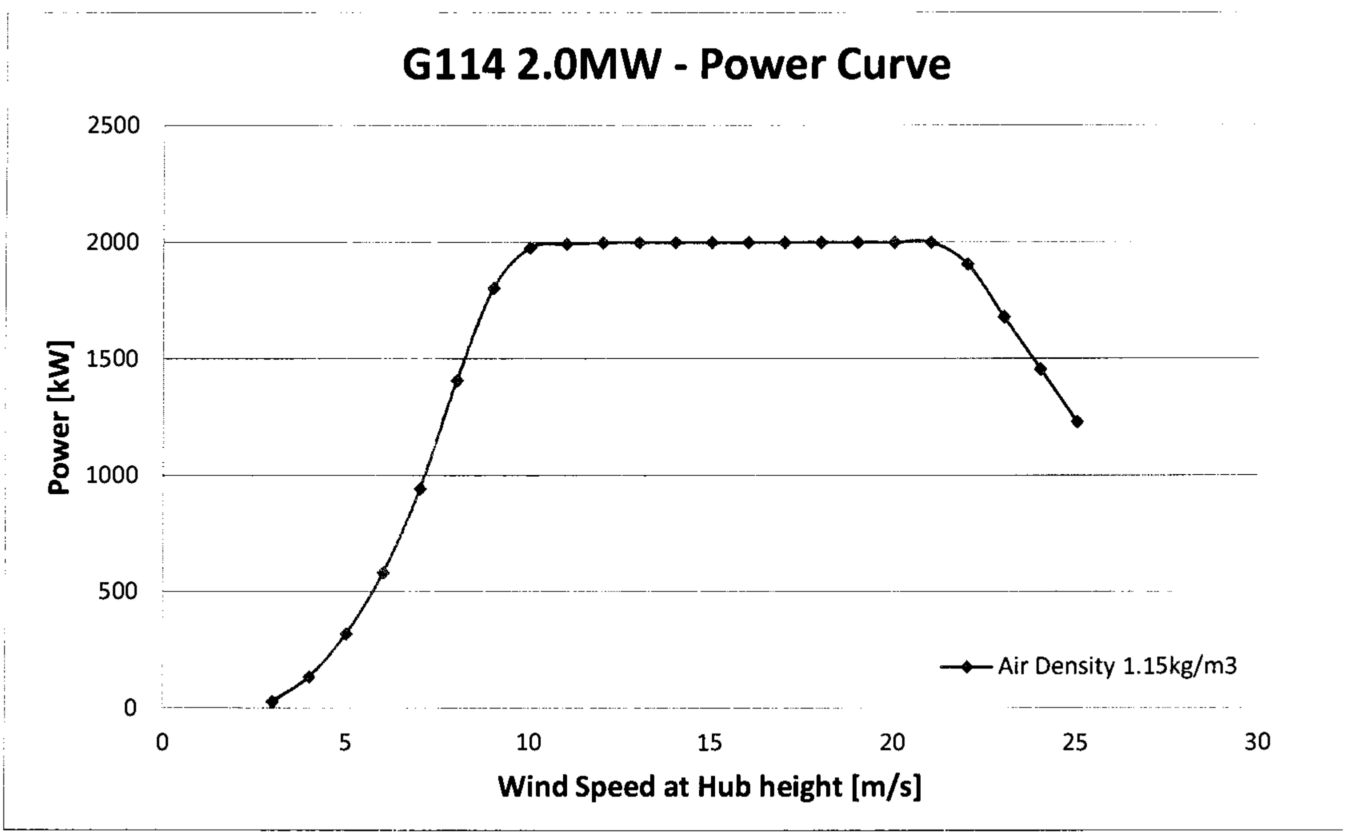
(iii).	Recording	Production data, event list, long and short-term trends
(f).	**<u>Brake</u>**	
(i).	Design	Mechanical brakes
(ii).	Operational brake	Aerodynamic brake achieved by feathering blades.
(iii).	Secondary brake	Mechanical brake on (high speed) shaft of gearbox.
(g).	**<u>Tower</u>**	
(i).	Type	Conical barrel tube
(ii).	Hub heights	80 m

Power Curve of Gamesa G114-2.0MW Wind Turbine Generator

The tabular and graphical values of Power curve are shown below:

[redacted]	
3	29
4	135
5	319
6	581
7	943
8	1408
9	1804
10	1977
11	1993
12	1999

13	2000
14	2000
15	2000
16	2000
17	2000
18	2000
19	2000
20	2000
21	2000
22	1906
23	1681
24	1455
25	1230



The energy production of Wind Farm is given in Table below:

(1).	Total Installed Gross ISO Capacity of the Generation Facility /Wind Farm (MW/GWh)	50 MW
(2).	Total Annual Full Load Hours	3066
(3).	Average Wind Turbine Generator (WTG) Availability	97%
(4).	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	173.74
(5).	Array & Miscellaneous Losses GWh	12.58
(6).	Availability Losses GWh	4.72
(7).	Balance of Plant Losses GWh	3.14
(8).	Annual Energy Generation (20 year equivalent Net AEP) GWh	153.3
(9).	Net Capacity Factor	35 %

9. Health and Safety

9.1. During the construction and operation of the Project, the guideline of "safety first, (accident) prevention foremost" will be practiced. Comprehensive management and supervision will be applied to all staff members and the whole operation process, in order to ensure safe operation of the equipment and personal safety of workers.

9.2. The Company shall ensure that the EPC Contractor shall take all due precautions to ensure the safety of its employees, agents and subcontractors and, in collaboration with and to the requirements of the local health authorities, to ensure that suitable arrangements such as medical staff, first aid equipment and stores, sick bay and suitable ambulance services are available at all times throughout the period of the construction period as necessary and that suitable arrangements are made for all necessary welfare and hygiene requirements..

9.3. The EPC Contractor shall maintain records concerning safety, health and welfare of persons and damage to property, and make such reports, as are consistent with Good Utility Practice and shall report details of any accident to the Company as soon as possible after its occurrence.

10. Environmental Impact

10.1 The project is located in an area which was historically reported as the major and significant migratory bird's route during winter, therefore the environmental impact related to mortality of birds due to wind turbines is also evaluated along with any human resettlement. Based on the site evaluation and wind data measurement done by National Renewable Energy Laboratories (USA) under the USAID assistance program in 2007, the project locations within Jhimpir area falls among the best wind corridors w.r.t. wind power generation.

10.2 The wind farm will be developed in an area which is not under intensive agriculture use. There is no sensitive habitats with a high ecological value were found during the field survey on the proposed land and no impacts caused by the human settlement is expected. The same assessment is made regarding the possible impacts on soil. The proposed project has been allocated 325 acres of land by the Land Utilization Department, GOS for the turbine towers and right of way for the access road. No rare or threatened vegetation species grow along the proposed site or access road. Most of the plants found here have a wide ecological aptitude and populations large enough to ensure their genetic diversity. The removal of a small portion of vegetation will not harm the overall diversity of plant communities in the area. Only raptors use the proposed site as a hunting ground and for soaring overhead. Given that wind power is a 'clean' source of energy, its key environmental benefit is in terms of the emission offsets it provides.

10.3 Lifespan of the Wind Farm

It is envisaged that the wind farm will be in operation for up to 20 years. At the end of this period the wind farm will either be decommissioned or new wind turbines will be installed. Once the wind farm has reached the end of its lifespan, the decommissioning process will include removal of the turbines and the return of the site to its condition prior to the construction of the wind farm.

11. Additional Annexes

11.1. In addition to the Annexes highlighted in the paragraphs above, we submit further Annexes, which may be considered as integral parts of this Application for Generation License.

12. Evidence/relevant correspondence

12.1. Copies of the pertinent correspondence are enclosed herewith for the learned Authority's assistance and consideration.

12.2. The Applicant would be pleased to provide any other assistance that the learned Authority may require in the matter of grant of Generation License.

12.3. This Application and its Annexes are being submitted in triplicate, with certain documents certified as necessary, each in accordance with Regulation 3(4) of the AMP Regulations.

13. Additional Grounds

13.1. The Applicant seeks to raise further additional grounds in support of this Application at the hearing stage.

14. Prayer

14.1 It is most humbly prayed to the esteemed Authority as follows:

(i) That the Applicant be granted a Generation License for the development of the Project

(ii) That the terms of the Generation License may kindly be made consistent with the terms of the GoP concession documents.

(iii) That the Authority may be pleased to treat the Applicant's request for the grant of Generation License on a non-discriminatory basis and any concession offered to comparable projects on the date of filing of this Applicant and at any stage subsequent to the grant of license may kindly be granted to the Applicant as well.

(iv) Any further and better relief that the Authority may deem appropriate in the circumstances may kindly be granted to the Applicant.

We hope the information/explanation provided above meets your requirements, and remain available to assist you if you have any further queries.

Respectfully submitted for and on behalf of the Applicant:

DIN ENERGY LIMITED
KARACHI

Sincerely,
Din Energy Limited
20 May, 2016

TEAR OF HERE

Account Payee only

HABIB METROPOLITAN BANK LTD.

Islamic Bkg.–Alfalah Court
Branch Code : 64

D.D No. 01331942
Stationery/Ref. No. 01331942

Date : 19 05 16

On Demand Pay NEPRA A/C DIN ENERGY LIMITED Or Order

PKR ***286,640.00***

Rupees two hundred and eighty six thousand six hundred and forty only

Drawee Bank/Branch
Habib Metropolitan Bank Ltd.
Islamic Bkg.–Islamabad (220)
Islamabad

Please do not write below this line

Signatory
Attorney No. 8604

MUHAMMAD YOUSUF
VICE PRESIDENT
A-423

⑈01331942⑈0640 220⑆0000000001610852⑈010⑆000028664000⑆

DIN GROUP

Extracts from
Resolution Passed by the Board of Directors of
Din Energy Limited on April 11, 2016

"**RESOLVED** that an application for the Generation License (the "**GL Application**") be filed by and on behalf of **Din Energy Limited** (the "**Company**") with the National Electric Power Regulatory Authority ("**NEPRA**"), in connection with the GL Application for the Company in respect of the Company's 50 MW wind energy power project at Deh Kohistan, 7/3 & 7/4, Tapo Jungshahi, Taluka / Distt. Thatta.

RESOLVED FURTHER that **Mr. Fawad Jawed** the **Chief Executive Officer, Mr. Sohail Rana** the **Financial Controller** of the Company and **Ms. Saira Khalid** bearing CNIC number 61101-9657810-4, are hereby singly authorized to sign the GL Application, and any documentation ancillary thereto, pay all filing fees, and provide any information required by NEPRA in respect of the Project, and do all acts and things necessary for the processing, completion and finalization of the GL Application.

Certified true copy

Director
Din Energy Limited

CERTIFICATION

CERTIFIED, that, the above resolution by circulation was duly passed by the Board of Directors of **Din Energy Limited** on 11-04-2016, 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.

Company Secretary
Din Energy Limited

DIN GROUP

VAKALATNAMA

I **Mr. Fawad Jawed, Chief Executive** of **Din Energy Limited** (the "**Company**"), hereby appoint and constitute **MR. NADIR ALTAF, MR. MUSTAFA MUNIR AHMED, MR. BILAL ALSAMARRAI, MS. SAIRA KHALID, MS. NOREEN IQBAL** of **RIAA BARKER GILLETTE**, to appear and act for us as our advocates in connection with processing presentation of the Company's petition for Generation License (the "**Petition**") before the National Electric Power Regulatory Authority ("**NEPRA**").

I also authorize the said Advocates or any one of them to do all acts and things necessary for the processing, completion and finalization of the Petition with NEPRA.

Accepted

SIGNATURE: Fawad Jawed

DIN ENERGY LIMITED KARACHI

Received by us: ______________________

From: ______________________

RIAA BARKER GILLETTE
68 NAZIMUDDIN ROAD, F-8/4,
ISLAMABAD
Tel: 051-111-LAWYER

H098378

Rupees 50 روپیہ ۵۰

SHAKEEL IQBAL STAMP VENDOR
Lic # 50, Shop # 113, New Ruby Centre,
Talpur Road, Boultan Market, Karachi

17 MAY 2018

(RUPEES FIFTY ONLY)

S.No....................Date..............
Issued to with Address....................
Through with Address......................
Purpose...................................
Value Rs.......50.....Attached............
Stamp Vendor's Signature..................
(NOT USE FOR FREE BILL & DIVORCE PURPOSE)

BEFORE
THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

AFFIDAVIT

I, **Fawad Jawed** S/o **Shaikh Mohammad Jawed** bearing CNIC No **42201-0403382-5** the **Chief Executive** of **Din Energy Limited** do hereby solemnly affirm and declare on oath as under:

1. That the Generation License Petition has been filed before the National Electric Power Regulatory Authority (the "**NEPRA**") and the contents of the same may kindly be read as an integral part of this affidavit.

2. That the contents of the accompanying Generation License Petition are true and correct to the best of my knowledge and belief and nothing has been concealed or misstated therein.

[*Chief Executive*]
(Deponent)

Seal & Signature of the Oath Commissioner

ANNEX A

APPLICANT COMPANY'S CONSTITUTIVE DOCUMENTS

Annex - A,

A001838

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE, KARACHI

CERTIFICATE OF INCORPORATION

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

Corporate Universal Identification No. **0089063**

I hereby certify that **DIN ENERGY 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 **July,** Two **Thousand** and **Fourteen**.

Incorporation fee Rs. 9,000/= only

(Sidney Custodio Pereira)
Joint Registrar of Companies
Karachi

Certified to be True Copy
Joint Registrar of Companies
17/5/16

PARTICULARS OF DIRECTORS AND OFFICERS, INCLUDING THE CHIEF EXECUTIVE, MANAGING AGENT, SECRETARY, CHIEF ACCOUNTANT, AUDITORS AND LEGAL ADVISERS, OR OF ANY CHANGE THEREIN

THE COMPANIES ORDINANCE, 1984 FORM 29

[SECTION 205]

1. Incorporation Number 0089093

2. Name of Company DIN ENERGY LIMITED

3. Fee Paid (Rs.) 600.0 Name and Branch of Bank

KARACHI, MCB - KARACHI, MAIN BRANCH [0001]

4. Receipt No. E-2015-386549 13/11/2015

5. Mode of Payment (Indicate) Bank Challan

6. Particulars*:

6.1. New Appointment/Election

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation *** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointement / change / any other remarks (i)
FAWAD JAWED	4220104033825	SHAIKH MOHAMAMD JAWED	35 AL HAMRA SOCIETY OFF. TIPU SULTAN ROAD, KARACHI Sindh Pakistan	Director	Pakistan		31/10/2015	Re-Elected
IRFAN MUNEER	4220150933017	SHAIKH MOHAMMAD MUNEER	55 AL HAMRA SOCIETY OFF. TIPU SULTAN ROAD, KARACHI Sindh Pakistan	Director	Pakistan		31/10/2015	Re-Elected
SHAIKH MOHAMMAD PERVEZ	4220186576387	SHAIKH MOHAMMAD DIN	41 AL HAMRA SOCIETY OFF. TIPU SULTAN ROAD, KARACHI Sindh Pakistan	Director	Pakistan		31/10/2015	Re-Elected
FARHAD SHAIKH MOHAMMAD	4220158069277	SHAIKH MOHAMAMD TARIQ	37 AL HAMRA SOCIETY OFF. TIPU SULTAN ROAD, KARACHI Sindh Pakistan	Director	Pakistan		31/10/2015	Re-Elected

6.2. Ceasing of Officer/Retirement/Resignation

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation *** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointement / change / any other remarks (i)

6.3. Any other change in particulars relating to columns (a) to (g) above

Certified to be True Copy

Joint Registrar of Companies

17/5/16

20/11/15

https://eservices.secp.gov.pk/eServices/EFormControllerServlet?action=open&fromC... 11/13/2015

Present Name in Full (a)	NIC No. or Passport No. (in case of Foreign National) (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation *** (if any) (g)	Present Appointment or Change (h)	Appointment or change / any other remarks (i)

Name of Signatory	ISLAM AHMED	Designation	Secretary
Signature of Chief Executive/Secretary		Date (DD/MM/YYYY)	13/11/2015

A PUBLIC COMPANY LIMITED BY SHARES

UNDER THE COMPANIES ORDINANCE, 1984

MEMORANDUM OF ASSOCIATION

OF

DIN ENERGY LIMITED

I. The name of the Company is **"Din Energy Limited"**.

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

III. The objects for which the Company is established are:

1. To carry on the business of generating electric power, by any means whatsoever, including power generation through wind turbine, to feed electricity so generated into the National grid and to construct, lay down, establish, fix and carry out all necessary power stations, cables, wires, lines, accumulators, lamps and works and to generate, distribute and supply electricity and to light industries and places, both public and private, cities, towns, streets, docks, markets, theatres, buildings and for all other purposes for which electrical energy can be employed.
2. To carry out the construction and manufacture of wind, thermal gas, hydroelectric and thermal energy projects such as gas energy, solar energy, bio-thermal energy and to construct, establish and fix necessary power stations.
3. To acquire, manufacture, produce, use, sell and supply electricity for lighting, heating or power purposes and to deal with, manufacture and render saleable all residual products obtained in the production of electric power.
4. To import purchase, supply and acquire all kinds of raw and other materials for generation of energy / electricity and sell, transmit and deliver the same thus generated anywhere in Pakistan
5. To import, buy, own, install or otherwise procure plants, machinery and other equipment and to fabricate parts in the Company's workshop and to take or give on rent plants, machinery and other equipment for the purposes of the business and/or to dispose-off such plants, machinery and spare parts which have become obsolete.
6. To purchase or by any other means acquire and take options over any property, whatsoever, and any rights or privileges of any kind over or in respect of any property.

To undertake the business of consultants, and to grant rights or privileges in respect of, or otherwise deal with all, or any part of the property and rights including engineering designs, intellectual and tangible property, and to establish laboratories, research and development centers to perform such research and development as the Company may deem advisable or feasible, and to expend money on experimenting upon and testing and improving or securing any process, patent or protecting any invention or inventions which the Company may acquire or propose to acquire or deal with.

8 To develop and or transfer technology and to acquire or pass on technical know-how, and to train personnel and workers, both in Pakistan and abroad, to attain technical proficiency in various specialties connected with the Business of the Company.

9 To carry on any other trade or business which can be advantageously carried on in connection with or ancillary to any of the businesses.

10. To apply for, register, purchase or by other means acquire and protect, prolong and renew, whether in Pakistan or elsewhere any patents, patent rights, brevets d'invention, licenses, secret processes, trademarks, designs, protections and concessions and to disclaim, alter, modify, use and turn to account and to manufacture under or grant licenses or privileges in respect of the same, and to expend money in experimenting upon, testing and improving any patents, inventions or rights which the Company may acquire or propose to acquire.

11. To acquire or undertake the whole or any part of the business, goodwill, and assets of any person, firm or company carrying on or proposing to carry on any of the business which the Company is authorized to carry on 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 cooperation, or for mutual assistance with any such person, firm or company, or for subsidizing 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, and to hold and retain, or sell, mortgage and deal with any shares, debentures, debenture stock or securities so received.

12. To acquire, purchase, take on lease, hire, exchange, sell, transfer, conveyor dispose of any movable and immovable property, rights and privileges on such terms and conditions as the Company may think necessary or convenient for the purposes of its Business, and to manage, construct, repair, develop, mortgage, charge, sell, turn to account, grant licenses, options, rights and privileges in respect of or otherwise deal with all or any part of the property and rights of the Company necessary or convenient for the purposes of the business of the Company.

13 To purchase or otherwise acquire the whole or any part of the business, goodwill and assets of the company, firm or person carrying on or proposing to carry on any of the businesses which the Company is authorized to carry on and to give and receive consideration for such acquisition and to undertake all or any of the liabilities of such company, firm or person.

nto arrangements with any Government or authorities, central or provincial, local or otherwise, public or quasi-public bodies, or with any other persons in where the Company may have interests that may seem conducive to the of the Business and to obtain from any such Government authorities or persons , privileges and concessions which the Company may think fit to obtain and to exercise and comply therewith.

or deposit monies of the Company, not immediately required, in such shares, bentures, debenture stocks or in any investments, movable or immovable, in ner as may from time to time be decided by the directors.

ibe for, take, purchase, or otherwise acquire, hold, sell and dispose of, shares, s, debenture stocks, bonds, obligations or securities issued or guaranteed by any npany constituted or carrying on business in any part of the world, and s, debenture stocks, bonds obligations or securities issued or guaranteed by any nt or authority, municipal, local or otherwise, in any part of the world.

erate any person, firm or company rendering services to the Company either by nent or by the allotment to him or them of shares or other securities of the credited as paid up in full as may be thought expedient.

ibe or contribute or otherwise assist or to grant money to charitable, benevolent, , national public institutions, objects or purposes; to support and subscribe to ution, society or club which may be for the benefit of the Company or its or employees; to establish and maintain or procure the establishment and nce of any contributory or non-contributory pension or superannuation funds for fit of and give or procure the giving of donations, gratuities, pensions, es, or emoluments and provide advantages, facilities and services for any who are or have been Directors or Officers of, or who are or have been employed ho are serving or have served the Company, or any company which is a y of the Company or is allied or associated with the Company or with such y company and the wives, widows, children and other relatives and dependents persons; to make payments towards insurance; and to do any of the matters as either alone or in conjunction with any such other company as aforesaid, but olitical purposes.

bute among the members in specie any property of the Company of whatever any proceeds of the sale or disposal of any property of the Company, in the winding up.

gamate with any other company having objects altogether or in part similar to this Company, and to enter into partnership or any arrangement for sharing mion of interest, co-operation, joint-venture, reciprocal concession or otherwise person or company carrying on or engaged in, or about business or transaction is Company is authorized to carry on or engage in, or about business or on capable of being conducted so as directly or indirectly to benefit this y.

14. To enter into agreement(s) with any individual, firm, co-operative or other society, company, corporate body, Government or local authority or other legal entity necessary or expedient for the purpose of carrying on the business of the Company.

15. To invest the surplus moneys of the Company not immediately required in such manner as may from time to time be determined and to hold or otherwise deal with such investments made.

16. To make advances to customers and staff with or without security and upon such terms as the Company may approve.

17. To acquire or construct, maintain and alter any building or works necessary or convenient for the purpose of the company and to sale any such property as an when deemed fit.

18. To borrow money on loan and to borrow from financial institutions and scheduled banks as the Company shall think fit for its business, and in particular, by the issue of debentures, or debenture stock (perpetual or otherwise), term finance certificates and like instruments and finances under interest free system such as finances by purchase of movable and immovable properties, securities and instruments with buy-back agreements, and to secure the payment/repayment of the finances, indebtedness and any money borrowed, or owed by mortgage, charge, lien or any other security upon all or any part of the property or assets of the Company (both present and future) and also by a similar mortgage, charge, lien or any other security to secure and guarantee the performance by the Company of any obligation undertaken by the Company which may become binding on it.

19. To open, close, maintain and operate bank accounts of the Company with any bank or banks and to draw, make, accept, endorse, discount, negotiate, execute and issue cheques, bills of exchange, promissory notes, bills of lading, warrants, debentures, and other negotiable or transferable instruments concerning the business.

20. To receive payment on the sale or disposal of the whole or any part of the business or property of the Company, either in cash, by installments or otherwise, for such consideration as the Directors of the Company may think fit, and in particular for shares, debentures or otherwise in securities of any company and generally to dispose, hold or otherwise deal with any shares, stocks or securities so acquired.

21. To apply for, and obtain necessary consents permissions and licenses from any Government, State or Local and other authorities for enabling the Company to carry any of its objects into effect, or for effecting any modification of the constitution of the Company, or for any other purpose which may seem calculated directly or indirectly to promote the Company's interests, and to oppose any proceedings or applications which may seem calculated directly or indirectly to prejudice the Company's interests.

22. To enter into arrangements with any Government or authorities, central or provincial, municipal, local or otherwise, public or quasi-public bodies, or with any other persons in any place where the Company may have interests that may seem conducive to the purposes of the Business and to obtain from any such Government authorities or persons any rights, privileges and concessions which the Company may think fit to obtain and to carry out, exercise and comply therewith.

23. To invest or deposit monies of the Company, not immediately required, in such shares, stocks, debentures, debenture stocks or in any investments, movable or immovable, in such manner as may from time to time be decided by the directors.

24. To subscribe for, take, purchase, or otherwise acquire, hold, sell and dispose of, shares, debentures, debenture stocks, bonds, obligations or securities issued or guaranteed by any other company constituted or carrying on business in any part of the world, and debentures, debenture stocks, bonds obligations or securities issued or guaranteed by any government or authority, municipal, local or otherwise, in any part of the world.

25. To remunerate any person, firm or company rendering services to the Company either by cash payment or by the allotment to him or them of shares or other securities of the Company credited as paid up in full as may be thought expedient.

26. To subscribe or contribute or otherwise assist or to grant money to charitable, benevolent, scientific, national public institutions, objects or purposes; to support and subscribe to any institution, society or club which may be for the benefit of the Company or its Directors or employees; to establish and maintain or procure the establishment and maintenance of any contributory or non-contributory pension or superannuation funds for the benefit of and give or procure the giving of donations, gratuities, pensions, allowances, or emoluments and provide advantages, facilities and services for any persons who are or have been Directors or Officers of, or who are or have been employed by, or who are serving or have served the Company, or any company which is a subsidiary of the Company or is allied or associated with the Company or with such subsidiary company and the wives, widows, children and other relatives and dependents of such persons; to make payments towards insurance; and to do any of the matters as aforesaid either alone or in conjunction with any such other company as aforesaid, but not for political purposes.

27. To distribute among the members in specie any property of the Company of whatever nature or any proceeds of the sale or disposal of any property of the Company, in the event of winding up.

28. To amalgamate with any other company having objects altogether or in part similar to those of this Company, and to enter into partnership or any arrangement for sharing profits, union of interest, co-operation, joint-venture, reciprocal concession or otherwise with any person or company carrying on or engaged in, or about business or transaction which this Company is authorized to carry on or engage in, or about business or transaction capable of being conducted so as directly or indirectly to benefit this Company.

29. To do all or any of the things or matters aforesaid in any part of the world and either as principals, agents (except managing agent), contractors or otherwise, and by or through agents, brokers except stock brokers, sub-contractors or otherwise and either alone or in conjuaction with others.

30. To do all such other things as may be deemed incidental or conducive to the attainment of the objects of the Company or any of them

31. None of the Sub-Clauses of this Clause and none of the objects therein specified shall be deemed subsidiary or ancillary to any of the objects specified in any other such sub-clause, and the Company shall have as full a power to exercise each and every one of the objects specified in each sub-clause of this Clause as though each sub-clause contain the objects of a separate Company.

32. The word "company" in this Clause except where used in reference to this Company, shall be deemed to include any partnership or other body of persons whether corporate or unincorporated, and whether domiciled in Pakistan or elsewhere.

33. Notwithstanding anything contained in this Clause, nothing herein shall be construed as empowering the Company to undertake to, indulge in the business of banking, finance, investment, leasing, insurance or builders, directly or indirectly, as restricted under law or any unlawful operations. The Company shall not launch multilevel marketing, pyramid and ponzi schemes.

34. Notwithstanding anything stated in any object clause, the Company shall obtain such other approval or license 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 authorised share capital of the Company is Rs.200,000,000/- (Rupees Two Hundred Million Only) divided into 20,000,000 (Twenty Million) Ordinary Shares of Rs.10/- each with the rights, privileges and conditions attaching thereto as are provided by the regulations of the Company for the time being, with powers to increase, reduce, sub-divide, consolidate or reorganize the capital of the Company and to divide the shares in the capital of the Company for the time being into several classes in accordance with the provisions of the Companies Ordinance, 1984 and to attach thereto respectively such special rights, privileges or conditions as may be determined by or in accordance with the regulations of the Company, provided however, that rights, as between various classes of ordinary shares, if any, as to profits, votes and other benefits shall be strictly proportionate to the paid up value of the shares.

For ... ENERGY LIMITED

COMPANY SECRETARY

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 our respective names:

Sr. No.	Name, Father's Name, CNIC Number or passport No. (if foreigner)	Nationality with any Former Nationality If any	Occupation	Residential address in full	No. of Shares taken by each Subscriber	Signature of Subscriber
1.	Mr. Shaikh Mohammad Pervez S/o Mr. Shaikh Mohammad Din CNIC 42201-8857688-7	Pakistani	Industrialist	4 Al Hamra Society off: Tipu Sultan Road, Karachi	12,500 (Twelve Thousand Five Hundred)	
2.	Mr. IrfanMuneer S/o Mr. Shaikh Mohammad Muneer CNIC 42201-5903301-7	Pakistani	Industrialist	55 Al Hamra Society off: Tipu Sultan Road, Karachi	12,500 (Twelve Thousand Five Hundred)	
3.	Mr. Fawad Jawed S/o Mr. Shaikh Mohammad Jawed CNIC 42201-0403382-5	Pakistani	Industrialist	35 Al Hamra Society off: Tipu Sultan Road, Karachi	12,500 (Twelve Thousand Five Hundred)	
4.	Mr. FarhadShaikh Mohammad S/o Mr. Shaikh Mohammad Tariq CNIC 42201-5826927-7	Pakistani	Industrialist	37 Al Hamra Society off: Tipu Sultan Road, Karachi	12,500 (Twelve Thousand Five Hundred)	

Total Shares 50,000 (Fifty Thousand)

Karachi date this 30th day of June 2014

Witness to above signatures.

Full Name	Mushtaq Ahmed Vohra
Father's Name	S/o Haji Mohammad Ismail
CNIC Number	42301-0952156-3
Nationality & Occupation	(Pakistani) Advocate
Full Address of Witness	Mushtaq & Company Chartered Accountants 407, Commerce Centre HasratMohani Road Karachi.

Certified to be True Copy

Joint Registrar of Companies

13/5/16

A PUBLIC COMPANY LIMITED BY SHARES

UNDER THE COMPANIES ORDINANCE, 1984

ARTICLES OF ASSOCIATION

OF

DIN ENERGY LIMITED

PRELIMINARY

1. The regulations contained in Table A in the First Schedule to the Companies Ordinance,1984, shall not apply to the Company.

2. In the construction of these Articles of Association, unless the contrary be expressed or is to be inferred from the context:

"Articles" shall mean these Articles of Association as originally framed or as from time to time altered by special resolution.

"Board" shall mean Board of Directors for the time being of the Company.

"Chief Executive" shall mean an individual who subject to the control and directions of the directors is entrusted with the whole of the powers of management of the affairs of the company which includes a director or any other person occupying the position of a Chief Executive, by whatever name called, and whether under a contract of service or otherwise.

"Proxy" includes Attorney duly constituted under a Power of Attorney

"Directors" shall mean the Board of Directors for the time being of the Company.

"Dividend" shall include bonus shares.

"In writing" or "written" shall include printed, lithographed typed and other modes of representing or reproducing words in visible form.

"Member" shall mean a registered holder of any share or stock of the Company.

"Month" shall mean a calendar month according to the English Calendar.

"Office" shall mean the Registered Office for the time being of the Company.

"Ordinance" shall mean the Companies Ordinance, 1984, or any modification or re-enactment thereof for the time being in force

"Register" shall mean the Register of Members to be kept pursuant to the Ordinance.

"Seal" shall mean the Common Seal of the Company.

"Secretary" shall mean Company Secretary of the company appointed by the Directors to perform any of the duties of the Secretary.

"Section" shall mean section of the Companies Ordinance, 1984.

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

Words importing the masculine gender shall include the feminine gender.

Words signifying persons shall, where applicable include bodies corporate.

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 of Association.

SHARE CAPITAL

3. The share capital of the company is Rs.200,000,000 (Rupees Two Hundred Million Only) divided into 20,000,000 (Twenty Million) ordinary shares of Rs. 10 - each with the rights, privileges and conditions attaching thereto as are provided by the regulations of the Company for the time being, with powers to increase, reduce, sub-divide, consolidate or reorganize the capital of the Company and to divide the shares in the capital of the Company for the time being into several classes in accordance with the provisions of the Companies Ordinance, 1984 and to attach thereto respectively such special rights, privileges or conditions as may be determined by or in accordance with the regulations of the Company, provided however, that rights, as between various classes of ordinary shares, if any, as to profits, votes and other benefits shall be strictly proportionate to the paid up value of the shares.

4. The minimum subscription is Rs. 500,000 (Rupees five hundred thousand only).

5. The company may from time to time by ordinary resolution increase the share capital by such sum, to be divided into shares of such amount, as the resolution shall prescribe

6. Subject to the provisions of the Ordinance, all unissued and any new shares shall, before issue, be offered to the Members in proportion, as nearly as the circumstances admit, to the amount of the existing shares held by each Member. The offer shall be made by notice specifying the number of shares offered, and limiting a time within which the offer, if not accepted, will be deemed to be cancelled, and after the expiration of that time, or on the receipt of an earlier intimation from the person to whom the offer is made that he declines to accept the shares offered, the Directors may from time to time dispose of the same to such person or persons, whether Member or not, in such manner as they in their absolute discretion shall think fit. The Directors may likewise so dispose of any new shares which (by reason of the ratio which the new shares bear to shares held by persons entitled to an offer of new shares) cannot, in the opinion of the Directors, be conveniently offered under this regulation

7. The share capital of the company shall comprise of Ordinary shares. The company may issue shares of a single class or of different classes. Where ordinary shares of more than one class are issued, the rights as between the various classes of such ordinary shares shall be strictly proportionate to the paid value of the ordinary shares as regards voting, dividend and other benefits

8. Subject to the provisions of Section 92, the Company may by ordinary resolution:

(a) consolidate and divide its share capital into shares of larger amount than its existing shares;

(b) sub-divide its existing shares, or any of them, into shares of smaller amount than is fixed by the Memorandem of Association;

(c) cancel any shares which, at date of the passing of the resolution, have not been taken or agreed to be taken by any person and diminish the amount of its share capital by the amount of the shares so cancelled.

9. The company may be special resolution reduce its share capital, or any share premium account in any manner and with, and subject to, any incident authorised, and consent required by law.

SHARES

10. The Directors shall, as regards any allotment of shares, duly comply with such provisions of Section 68 to 73 as may be applicable.

11. Subject to the provisions of the Ordinance, the shares in the capital for the time being shall be at the disposal of the Directors, who may allot or otherwise dispose of the same to such persons, on such terms and conditions, and at such times as they may think fit.

12. The Company may exercise the powers of paying commission conferred by Section 82, provided that the rate percent, or the amount of the commission paid or agreed to be paid, shall be disclosed in the manner required by the said Section and the rate of commission shall not exceed such rate as may be fixed under the said Section. Subject to the provisions of the Ordinance, such commission may be satisfied by the payment of cash or the allotment of fully paid shares or partly in one way and partly in the other. The company may also on any issue of shares pay such brokerage as may be lawful.

13. Except as required by law, no person shall be recognised by the Company as holding any share upon any trust, and the Company shall not be bound by or be compelled in any way to recognize (even when having notice thereof) any equitable, contingent, future or partial interest in any share or any interest in any fractional part of a share or (except only as by these Articles or by law otherwise provided) any other rights in respect of any share except an absolute right to the entirety thereof in the registered holder.

14. The Company shall not give, whether directly or indirectly, and whether by means of a loan, gurarantee, the provision of security or otherwise, any financial assistance for the purpose of or in connection with a purchase or subscription made or to be made by any person of or for any shares in the Company, nor shall the Company make a loan for any purpose whatsoever on the security of its shares, but nothing in this Article shall prohibit any transactions which may be permitted by the Ordinance.

15. The amount payable on application on each share shall be the full nominal amount of the share.

16. The joint-holders of a share shall be severally as well as jointly liable for the payment of any amount due in respect of such share.

CERTIFICATES

17. Every person whose name is entered as a member in the register of members shall, without payment, be entitled to receive, within two months after allotment or within forty-five days of the application or registration of transfer, a certificate under the seal specifying the share or shares held by him and the amount paid up thereon.

In respect of a share or shares held jointly by several persons, the company shall not be bound to issue more than one certificate and delivery of a certificate for a share to one of the several joint holders shall be sufficient delivery to all.

If a share certificate is defaced, lost or destroyed, it may be renewed on payment of such fee, if any, not exceeding one rupee, and on such terms, if any, as to evidence and indemnity and payment of expenses incurred by the company in investing title, as the directors think fit. Within forty-five days of the application directors shall issue certificate to the applicant.

Except to the extent and in the manner allowed by Section 95, no part of the funds of the company shall be employed in the purchase of, or in loans upon the security of, the company's shares.

TRANSFER OF SHARES

18. Subject to such of the restrictions of these Articles as may be applicable, any Member may transfer all or any of his shares by instrument in writing in any usual or common form or any other form which the Directors may approve.

19. The instrument of transfer of any share shall be signed by both the transferor and the transferee, and the transferor shall be deemed to remain the holder of such share until the name of the transferee is entered in the Register in respect thereof.

20. The Directors shall not refuse to transfer any fully paid shares unless the transfer deed is defective or invalid. The Directors may decline to recognize any instrument of transfer unless:-

(a) such fee not exceeding two rupees as the Directors may from time to time require, is paid to the Company in respect thereof; and

(b) The duly stamped instrument of transfer is deposited at the Office or such other place as the Directors may appoint, accompanied by the certificate of the shares to which it relates, and such other evidence as the Directors may reasonably require to show the right of the transferor to make the transfer.

If the Directors refuse to register a transfer of shares they shall within thirty days after the date on which the transfer deed was lodged with the Company send to the transferee notice of the refusal indicating the defect or invalidity to the transferee, who shall, after removal of such defect or invalidity, be entitled to relodge the transfer deed with the Company.

21. On giving seven days previous notice by as are specified in Section 151, the Register may be closed for such period or periods not exceeding in the whole forty-five days in any year as the Directors may from time to time direct, but so that the Register shall not be closed for a longer period than thirty days at a time.

22. There shall be paid to the Company in respect of the registration of any probate, letters of administrating, certificate of marriage or death, power of attorney or other document relating to or affecting the title to any shares, such fee, not exceeding two rupees, as the Directors may from time to time prescribe.

23. All instruments of transfer which shall be registered shall be retained by the Company, but any instrument of transfer which the Directors may decline to register shall (except in any case of fraud) be returned to the person depositing the same.

24. Nothing in these Articles shall preclude the Directors from recognizing a renunciation of the allotment of any share by the allottee in favour of some other person.

TRANSMISSION OF SHARES

25. The executors, administrators, heirs, or nominees, as the case may be, of a deceased sole holder of a share shall be the only persons recognized by the Company as having any title to the share. In the case of a share registered in the names of two or more holders, the survivors, or survivor, or the executors or administrators of the deceased survivor, shall be the only persons recognized by the Company as having any title to the share.

26. Any person becoming entitled to a share in consequent of the death or bankruptcy of a Member may, upon such evidence as to the title being produced as may from time to time be required by the Directors, and subject as hereinafter provided, elect either to be registered himself as holder of the share or to have some person nominated by him registered as the transferee thereof, but the Directors shall in either case have the same right to decline or suspend registration as they would have had in the case of a transfer of the share by that Member before his death or bankruptcy as the case may be.

27. If the person so becoming entitled shall elect to be registered himself, he shall deliver or send to the Company a notice in writing signed by him, stating that he so elects. If he shall elect to have another person registered he shall testify his election by executing to that person a transfer of the share. All the limitations, restrictions and provisions of these Articles relating to the right to transfer and the registration of transfer of shares shall be applicable to any such notice or transfer as aforesaid as if the death or bankruptcy of a Member had not occurred and the notice or transfer were a transfer singed by that Member.

28. A person becoming entitled to a share by reason of death or bankruptcy of the holder shall be entitled to the same dividends and other advantages to which he would be entitled if he were the registered holder of the share, except that he shall not, before being registered as a Member in respect of the share, be entitled in respect of it to exercise any right conferred by membership in relation to meetings of the Company. Provided always that the Directors may at any time give notice requiring any such person to elect either to be registered himself or to transfer the share, and if the notice is not complied with within ninety days the Directors may thereafter withhold payment of all dividends or other moneys payable on or in respect of the share until the requirements of the notice have been complied with.

GENERAL MEETINGS

29. The Company shall hold statutory meeting within a period of not less than three months, nor more than six months, from the date at which the Company is entitled to commence business.

30. The Company shall hold, in addition to any other meeting, a General Meeting, as its Annual General Meeting, within eighteen months from the date of its incorporation and thereafter once at least 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, and shall specify the meeting as such in the notices calling it. Subject to the provisions of Section 158, the Annual General Meeting shall be held at such time and place as the Directors shall appoint.

31. All General Meetings other than the Statutory Meeting or Annual General Meeting, shall be called Extraordinary General Meetings.

32. The Directors may, whenever they think fit, convene an Extraordinary General Meeting, and Extraordinary Meetings shall also be convened on such requisition, or, in default, may be convened by such requisitionists, as provided by Section 159. If at any time there are not within Pakistan sufficient Directors capable to form a quorum, any Director or any two Members of the Company may convene an Extraordinary General Meeting in the same manner as nearly as possible as that in which meetings may be convened by the Directors.

NOTICE OF GENERAL MEETING

33. Twenty-one days notice at least (exclusive of the day on which the notice is served or deemed to be served, but inclusive of the day for which notice is given) specifying the place, the day and hour of meeting and, in case of special business, the general nature of that business, shall be given in the manner provided in Section 50 and sub-section 3 of Section 158 for the General Meeting, to such persons as are, under Section 160 or the regulations of the Company, entitled to receive such notice 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.

PROCEEDINGS AT GENERAL MEETINGS

34. All business shall be deemed special that in transacted at an Extraordinary General Meeting, and also all that is transacted at an Annual General Meeting, with the exception of declaring a dividend, consideration of account, balance sheets, and reports of the Directors and Auditors, election of Directors and the appointment and fixation of remuneration of Auditors.

35. Where, by any provision contained in the Ordinance, special notice is required of a resolution, the resolution shall not be effective unless notice of the intension to move it has been given to the Company not less than twenty-one days (or such shorter period as the Ordinance permits) before the meeting at which it is moved, and the Company shall give to the Members notice of any such resolution as required by and in accordance with the provision of the Ordinance.

36. No business shall be transacted at any General Meeting unless a quorum of Members is present at that time when the meeting proceeds to business. Save as in theses Articles otherwise provided, three Members present in person who represent not less than 25% of the total voting power either on their own account or through proxies shall be a quorum.

37. 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 or by Members, shall be dissolved, in any other case it shall stand adjourned to the same day in the next week, at the same time and place, and if at the adjourned meeting a quorum is not present within half an hour from the time appointed for the meeting, the Members present, being not less than two, shall be a quorum.

38. The Chairman of the Board of Directors shall preside as Chairman at every general Meeting. If there is no such Chairman or if at any meeting he is not present within fifteen minutes after the time appointed for holding the meeting, or is unwilling to act as Chairman, the Directors present shall choose someone of their number to be Chairman. If no Director is willing to act as Chairman or no Director is present within fifteen minutes after the time appointed for holding the meeting, the Members present shall choose on the their number to be Chairman of the meeting.

39. The Chairman of the meeting may, with the consent of any meeting at which a quorum is preset (and shall if so directed by the meeting), adjourn the meeting from time to time and from place to place, but no business shall be transacted at any adjourned meeting other than the business left unfinished at the meeting from which the adjourned took place. When a meeting is adjourned for thirty days or more, notice of the adjourned meeting shall be given as in the case of an original meeting. Save as aforesaid, it shall not be necessary to give any notice of an adjournment or of the business to be transacted at an adjourned meeting.

40. At any General Meeting, a resolution put to the vote of the meeting shall 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:

(a) by the Chairman of the meeting; or

(b) by at least three Members present in person or by proxy; or

(c) by any Member or Members present in person or by proxy and representing not less than one-tenth of the total voting rights of all the Members having the right to vote at the meeting; or

(d) by a Member or Members present in person or by proxy holding shares in the Company conferring a right to vote at the meeting, being shares on which an aggregate sum has been paid up equal to not less than one-tenth of that total sum paid up on all the shares conferring that right.

Unless a poll is so demanded, a declaration by the Chairman of the meeting that a resolution has on a show of hands been carried or carried unanimously, or by a particular majority, or last, or not carried by a particular majority, and an entry to that effect in the book contain the minutes of the proceedings shall, until the contrary is proved, be evidence of the fact, without proof of the number or proportion of the votes recorded in favor of or against such resolution. The demand for a poll may be withdrawn.

41. Except as provided in Article 42 and subject to the provisions of the Ordinance, if a poll is duly demanded it shall be taken in such manner as the Chairman of the meeting directs, and the result of the poll shall be deemed to be the resolution of the meeting at which the poll was demanded.

42. In the 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 be entitled to a second or casting vote.

43. A poll demanded on the election of a Chairman or on a question of adjournment shall be taken forthwith. A poll demanded on any other question shall be taken at such time, not more than fourteen days from the date on which it is demanded, as the Chairman of the meeting directs, and any business other than that upon which a poll has been demanded may be preceded with pending the taking of the poll.

VOTES OF MEMBERS

44. All the Members may participate in a General Meeting either personally or through proxy.

Subject and without prejudice to any special conditions or restrictions as to voting for the time being attached to shares, on a show of hands, every Member present in person or by proxy shall have one vote for very share held by him in respect of which he is entitled to vote; provided that for the election of Directors, the provision of Section 178 shall apply.

45. Where there are joint registered holders of any share any one of such person may vote at any meeting either personally or by proxy in respect of such share as if he were solely entitled thereto, and if more than one of such joint-holders be present at any meeting or at any poll personally or by proxy, that one of the said persons so present whose name stand first in the Register in respect of such share shall alone be entitled to vote in respect thereof.

46. A Member of unsound mind, or in respect of whom an order has been made by any Court having jurisdiction in lunacy, may vote, whether on a show of hands or on a poll, by his committee or other legal guardian, and any such committee or guardian may on a poll vote by proxy, provided that such evidence as the Directors may require of the authority of the person claiming to vote shall have been deposited at the Office not less than forty-eight hours before the time for holding the meeting or adjourned meeting at which such person claims to vote.

47. No objection shall be raised to the qualification of any voter except at the meeting or adjourned meeting at which the vote objected to is given or tendered, and every vote not disallowed at such meeting shall be valid for all purposes. Any such objection made in due time shall be referred to the Chairman of the meeting, whose decision shall be final and conclusive.

48. On a poll votes may be given either personally or by proxy.

49. (a) The instrument appointing a proxy shall be in writing under the hand of the appointer or of his attorney duly authorized in writing, or, if the appointer is a body corporate, be either under its seal or under the hand of an officer or attorney duly authorized by it. The instrument of proxy need not be witnessed.

(b) A proxy must be a Member of the Company.

50. The instrument appointing a proxy and the power of attorney or other authority, if any, under which it is signed or a notarially certified copy of that power or authority shall be deposited at the registered office not less than forty-eight hours before the time of holding the meeting or adjourned meeting, at which the person named in the instrument proposes to vote, or, in the case of a poll, not less than forty-eight hours before the time appointed for the taking of the poll, and in default the instrument of proxy shall not be treated as valid.

51. A general proxy may be given by any Member to any person or persons for any and every meeting of the Company held at any time and at any and every adjournment of such meeting, and shall be in force and of full effect and available for any and every meeting until a revocation in writing shall have been received by the Company from the Member giving such proxy.

52. The instrument of a proxy shall be in any usual form or common form are as near thereto which the directors shall approve.

53. (a) The instrument appointing a proxy shall be deemed to confer authority to demand or join in demanding a poll.

(b) A duly appointed proxy shall have such rights as to expression of views and voting at the meeting as are available to a Member.

54. A vote given in accordance with the terms of an instrument of proxy shall be valid notwithstanding the previous death or insanity of the principal or revocation of the proxy or of the authority under which the proxy was executed, or the transfer of the share in respect of which the proxy is given, provided that no intimation in writing of such death, insanity, revocation or transfer as aforesaid shall have been received by the Company at the office before the commencement of the meeting or adjourned meeting at which the proxy is used.

CORPORATION ACTING BY REPRESENTATIVE AT MEETINGS

55. Any corporation which is a Member of the Company may by resolution of its directors or other governing body authorize such person as it thinks fit to act as its representative at any meeting of the Company or of Members of the Company, and the person so authorized shall be entitled to exercise the same powers on behalf of the corporation which he represents as that corporation could exercise if it were an individual Member of the Company.

56. The number of Directors shall not be less than three. Following are the directors of the Company.

1. Mr. Shaikh Mohammad Pervez
2. Mr. Irfan Muneer
3. Mr. Fawad Jawed
4. Mr. Farhad Shaikh Mohammad

57. No person shall be appointed a Director of the Company if he:

(i) is a minor;

(ii) is of unsound mind;

(iii) has applied to be adjudicated as an insolvent and his application is pending;

(iv) is an undischarged insolvent;

(v) has been convicted by a court of law for an offence involving moral turpitude;

(vi) has been debarred from holding such office under any provision of the Ordinance;

(vii) has betrayed lack of fiduciary behaviour and a declaration to this effect has been made by the Court under Section 217 at any time during the preceding five years;

(viii) is not a Member excepting a person representing the government or an institution or authority which is a Member or a whole time Director who is an employee of the Company or a Chief Executive or a person representing a creditor.

58. The qualification of a Director shall be the holding of shares in the Company, provided that a Director who is a full time employee of the Company or who represents interest of financial institutions shall not be required to hold any qualification shares.

59. (a) The ordinary remuneration of a Director other than the regularly paid Chief Executive and full time working Directors, shall not exceed rupees five hundred per meeting of the Board of Directors or a Committee of such Board attended by him.

(b) The Directors may repay to any Director all traveling, hotel and other expenses properly incurred by him in attending and returning from meeting of the Board of Directors or of any committee of such Board or General Meetings of the Company or in connection with the business of the Company which shall be charged as part of the Company's ordinary working expenses.

(c) Subject to such consent or approvals being granted and within such limits as may be prescribed by the Ordinance or any other law for the time being in force, the Board of Directors may from time to time authorize the payment of remuneration (in addition to the ordinary remuneration referred to in paragraph (a) of this Article and whether payable as salary, commission, bonus, allowances, consultancy fees or otherwise) or the grant of benefits other than remuneration to any Director, either in respect of or in connection with any office of profit held by him under the Company whether as salaried executive, consultant or otherwise, or for the performance by him of extra services otherwise than in connection with such office of profit and outside the scope of the ordinary duties of a Director.

ELECTION AND RETIREMENT OF DIRECTORS

60. Subject to the provisions of these Articles, the Directors shall be elected by the Members in General Meeting.

61. A Director elected by the Members in General Meeting shall hold office for a period of three years following the date from which his election is effective unless he earlier resigns, becomes disqualified from being a Director or otherwise ceases to hold office.

62. Any casual vacancy occurring among the Directors may be filled by the Directors and the person so appointed shall hold office for the remainder of the term of the Director in whose place he is appointed.

63. No person shall be eligible for election to the office of Director at any General Meeting unless not less than fourteen nor more than twenty one days before the date appointed for the meeting there shall have been left at the Office of the Company a notice in writing signed by him of his intention to offer himself for election as a Director.

64. The Directors shall, unless the number of persons who offer themselves for election as Directors is not more than the number fixed for election, be elected by the Members in General Meeting from amongst the candidates eligible for election, in the following manner, namely:

(a) every Member present in person or by proxy or by a representative shall have such number of votes as is equal to the product of the number of shares or securities carrying the right to vote held by him and the number of Directors to be elected;

(b) the number of votes calculated in accordance with the preceding clause (a) may be given to a single candidate or may be divided between any two or more candidates in such manner as the person voting may choose; and

(c) the candidate who gets the highest number of votes shall be declared elected as Director and then the candidate who gets the next highest number of votes shall be so declared and so on until the total number of Directors to be elected has been so selected.

65. The Company may at any time by resolution remove a Director appointed under Article 63 or elected under Article 65 before the expiration of his period of office provided that no such resolution shall be deemed to have been passed if the number of votes cast in favour of such resolution is less than:

(a) the minimum number of votes that were cast for the election of a Director at the immediately preceding election of Directors if the resolution relates to the removal of a Director elected under Article 63; or

(b) the total number of votes for the time being computed in the manner laid down in Article 65 and divided by the number of Directors for the time being, if the resolution relates to the removal of a Director appointed under Article 61.

66. A Director may retire from his office upon giving one month's notice in writing to the Company of his intention so to do, and such resignation shall take effect upon the expiration of such notice or its earlier acceptance by the Directors.

ALTERNATE DIRECTORS

67. A Director who is about to leave or is absent for a period of three months or more from Pakistan may with the approval of the Directors appoint any person to be an alternate Director during his absence and such appointment shall have effect and such appointee, whilst he holds office as an alternate Director, shall not be required to hold any share qualification and shall be entitled to notice of meetings of the Directors and to attend and vote there at accordingly, but shall ipso facto vacate office when his appointer returns to Pakistan or vacates office as a Director, or removes the appointee from office. Any appointment or removal under this Article shall be effected by notice in writing to the Company under the hand of the Director making the same.

The appointment of an alternate Director will constitute leave of absence for the Director for whom such alternate Director is appointed.

DISQUALIFICATION OF DIRECTORS

68. The office of a Director shall *ipso facto* be vacated:

(a) if he becomes bankrupt or be adjudged insolvent or suspends payments or compounds with his creditors;

(b) if he be found lunatic or becomes of unsound mind;

(c) if removed by a resolution of Members as provided by Article 64;

(d) if by notice in writing given to the Company he resigns his office;

(e) in any of the other events specified in sub-section (1) of Section 188.

CHIEF EXECUTIVE

69. The Directors shall appoint one of their body as chief executive in accordance with the provisions of Sections 198 and 199, and designate such chief executive as Managing Director, and may from time to time remove such Chief Executive from office in accordance with the provisions of Section 202.

The Chief Executive shall have such powers and functions as the Directors may, subject to the provisions of section 196, from time to time confer upon or entrust to him either collaterally with or to the exclusion of their own powers.

70. The chief executive shall hold office on such terms as the Directors may determine and shall be paid remuneration and other benefits as may be authorized by the Directors from time to time, subject to such consents or approvals being granted and within such limits as may be prescribed by law or regulations for the time being in force.

POWERS AND DUTIES OF DIRECTORS

71. The business of the Company shall be managed by the Directors who may exercise all the powers of the Company except such as are by the Ordinance or by these Articles required to be exercised by the company in General Meeting, subject, nevertheless, to the provisions of these Articles and of the Ordinance, and also to the control and regulations of any General Meeting; but no regulation made by the company in General Meeting shall invalidate any prior act of the Directors which would have been valid if such regulation had not been made. Without prejudice to the generality of the foregoing powers and the special powers vested in the Directors by these Articles or the Ordinance, the Directors may do all acts and thing which they shall consider proper or advantageous for accomplishing the objects or carrying on the business of the company, and may in particular exercise the following powers:

(i) To pay the costs, charges and expense preliminary and incidental to the promotion, formation, establishment and registration of the Company.

(ii) To purchase or otherwise acquire for the company any property, rights or privileges which the company is authorized to acquire at such price and generally on such terms and conditions as they may think fit.

(iii) To secure the fulfillment of any contracts or engagement entered into by the company by mortgage or charge of all or any of the property of the Company or in such other manner as they may think fit.

(iv) To appoint, and at their discretion remove or suspend, such managers, officers and other employees for permanent, temporary or special services as they may from time to time think fit and to determine their powers and duties and fix their salaries or emoluments and to require security in such instances and to such amount as they think fit and to appoint any special agent or agents except Managing Agents (who may include any of the Directors) in order either to inspect and report on the affairs, property and business of, or to transact any special matters or business on behalf o the Company, in any specified country or locality on such terms and with such general or special powers, including powers of substitution as the Directors may thing kit to allow and as the conduct o the business of the Company my require, and any remuneration which may in such cases be agreed to be paid to any Director in respect of any appointment and service thereunder shall be in addition to such ordinary remuneration (if any) as he would otherwise be entitled to.

(v) To appoint an person or persons (whether incorporated or not) to accept and hold in trust for the Company any property belonging to the company or in which it is interested or for any other purposes, and to execute and do all such deeds, documents and things as may be requisite in relation to any such trust and to provide for the remuneration of such trustee or trustees.

(vi) To institute, conduct, defend, compound or abandon any legal proceedings by or against the Company or it officers or otherwise concerning the affairs of the Company and also to compound and allow time for payment or satisfaction of any debts due and of for payment or satisfaction of any debts due and of any claims or demands by or against the Company.

(vii) To refer any claim or demand by or against the company to arbitration and observer and perform the awards.

(viii) To make and give receipts, releases and to be discharges for money payable to the Company and for the claims sead demands of the Company.

(ix) To determine who shall be entitled to sign on the Company's behalf, bills, notes, receipts, acceptances, endorsements, cheques and other negotiable instruments, releases, contracts and documents.

(x) To invest and deal with any of the moneys of the company not immediately required for the purposes thereof in such investments or securities (not being shares in this company) and in such manner as they may think fit, and from time to time to vary or realise such investments.

(xi) To execute in the name and on behalf other Company in favour of any Director or to the person who may incur or be about to incur any personal liability for the benefit of the Company such mortgages of the company's property (present and future (as they think fit and any such mortgage any contain a power of sale and such other powers, covenants and provisions as shall be agreed on.

(xii) To give any person employed by the Company a Commission on the profits of any particular business or transaction of the Company and such commission or share of profits shall be treated as part of the working expenses of the Company.

(xiii) From time to time make, vary and repeal bye-laws for the regulation of the business of the Company, its officers and servants.

(xiv) To enter into all such negotiations and contracts and rescind and vary all such contracts and execute and do all such acts, deeds and things in the name and non behalf of the Company as they may consider expedient for or in relation to any of the matters aforesaid or otherwise for the propose of the Company.

(xv) To effect all kinds of insurance which in the opinion of the Directors ought to be effected for the benefit of the Company.

(xvi) To appoint from time to time by power of attorney under the Seal any person, firm or company, including a Director or officer or body of persons whether nominated directly or indirectly by the Directors, to be attorneys of the Company for such purposes and with such powers, authorities and discretions (not exceeding those vested in or exercisable by the Directors under these Articles) and for such period of subject to such conditions as they may think fit, and any such powers of attorney may contain such provisions for the protection and convinces of person dealing with any such attorney as the Directors may think fit and may also authorise any such attorney to delegate all or any of the powers, authorities and discretions vested in him.

(xvii) To establish and maintain or procure the establishment and maintenance of any contributory or non-contributory pension or superannuation funds for the benefit of, and give or procure the giving of donations, gratuities, pensions, allowances or emoluments to any persons who are or were at any time in the employment or service of the Company, or of any company which is a subsidiary of the company or is allied to or associate with the Company or who are or were at any time Directors or Officers of the Company and the wives, widows, families and dependants of any such persons, and make payments for or towards the insurance of any such persons as aforesaid and subscribe or guarantee money for any charitable or benevolent objects.Subject always, if the Ordinance shall so require, to particulars with respect to the proposed payments being disclosed to the Members and to the proposal being approved by the Company, and a Director holding any such employment or office shall be entitled to participate in and retain for his own benefit any such donation, gratuity, pension, allowance or emolument.

(xviii) In addition, the Directors shall exercise all such powers as are required to be exercised by them under Section 196 and other provisions of the Ordinance.

72. The Company may exercise the powers conferred by Section 213 with regard to having an official seal for use abroad and such powers shall be vested in the Directors

73. Subject to the provisions of Section 214 and 216, no Director shall be disqualified by his office from contracting with the Company, either as vendor, purchaser or otherwise, nor shall such contract or any contract or arrangement entered into by or on behalf of the Company in which any Director shall be in any way interested be avoided, nor shall any Director so contracting or being so interested be liable to account to the Company for the profit realised by any such contract or arrangement by reason so such Director holding that office, or of the fiduciary relation thereby established, but it is declared that the fact of his having and interest must, unless all the Directors are interested, be disclosed by him at the meeting of the Directors at which the contract or arrangement is determined on, if his interest then exists, or in any other case at the first meeting of the Directors after the acquisition of his interest. A general notice that a Director is a member of any specified firm or company, and is to be regarded as interested in all transactions with that firm or company shall be a sufficient disclosure under this clause as regards such Director and the said transactions, and after such general notice it shall not be necessary for such Director to give a special notice of any particular transaction with that firm or company.

74. The Directors shall cause minutes to be made in books provided for the purpose:

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

(b) of the names of the Directors present at each meeting of the Directors and of any Committee of the Directors;

(c) of all resolutions and proceedings at all meeting of the Company and of the Directors and of Committees of the Directors.

Any such minute if purporting to be signed by the Chairman of the meeting at which the proceedings were held, or by the Chairman of the next succeeding meeting, shall be evidence of the proceedings.

BORROWING POWERS

75. Subject to the provisions of the Ordinance and any regulations made by the Company in General Meeting, the Directors may exercise all the powers of the Company to borrow money, and to raise funds for the company, and to mortgage or charge its undertaking, property and or any part thereof, and to issue debentures, debenture stock, and other securities, whether outright or as security for any debt, liability or obligation of the Company or of any third party.

76. The Directors may, from time to time, at their discretion and on such terms and conditions as they think fit, obtain finance for the purposes of the Company on the basis of mark-up musharika, mudaraba or any other approved mode of non interest based financing from banks, financial institutions or from any other institution set up by the Federal Government or by any Provincial Government and may secure such finance by the issue of participation term certificates, musharika certificates, mudaraba certificates, term finance certificates or any other security or obligation not based on interest, other than the ordinary shares of the Company, representing an instrument or a certificate of a specified denominating called the face value or nominal value, evidencing investment of the holder in the Capital of the Company on terms and conditions of the agreement for the issue of such instrument or certificate or such other certificate or instrument as the Federal Government may permit.

77. Notwithstanding the generality of the foregoing powers, the Directors may raise and secure the payment of any sum or sums of money through issue of participation term certificates having a right to share in the profit and loss of the Company on terms and conditions agreed between the Company and the syndicate providing such funds the participation term certificates may be issued against any investment, discount or against any sum of money due for payment to the syndicate with special privileges as to voting rights, redemption, conversion into convertible share *pari pasu* with the ordinary shares and their subsequent reconversion into participation term certificates.

PROCEEDINGS OF DIRECTORS

78. The Director may meet together for the dispatch of business, adjourn, and otherwise regulate their meetings, as they think fit. Questions arising at any meeting shall be decided by a majority of votes. A Director may, and the Secretary on the requisition of a Director shall, at any time summon a meeting of the Directors. It shall not be necessary to give notice of a meeting of Directors to any Director for the time being absent from Pakistan.

79. The Directors shall meet at least twice in a year.

80. The quorum for a meeting of Directors shall be one-third of their number or three, whichever is greater.

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

82. The continuing Directors may act notwithstanding any vacancy in their body provided that their number is not reduced below the number fixed by or in accordance with these Articles as the necessary quorum of Directors.

83. The Directors may elect a Chairman for their meetings and determine the period for which he is to hold office. The Chairman so elected shall preside as Chairman at every meeting of Directors. If there is no Chairman or if at any meeting he is not present within fifteen minutes after the time appointed for holding the same, the Directors present may choose someone of their number to be Chairman of the meeting.

84. In the case of an equality of votes, the Chairman for the meting, if he be the Chairman elected under Article 84, shall have a second or casting vote, but no other Chairman of a meeting of Directors shall have such a second or casting vote.

85. The Chairman shall be subject to the same provisions as to resignation and removal as the other Directors of the Company and if the Chairman for the time being ceases to hold office of Director for any cause he shall *ipso facto* cease to be the Chairman.

86. The Directors may delegate any of their powers not required to be exercised in their meeting to committees consisting so such member or members of their body as they think fit; nay Committee so formed shall in the exercise of the powers so delegated conform to any regulations that may be framed for the purpose by the Directors.

87. A Committee may elect a chairman of its meetings; if no such chairman is elected, or if at any meeting the chairman is not present at the time appointed for holding the same, the members present may choose one of their number to be the chairman of the meeting.

88. A Committee may meet and adjourn as it thinks proper. Questions arising at any meeting shall be determined by a majority of votes of the members present, and in the case of an equality of votes the Chairman shall have a second or casting vote. The quorum for a meeting of a Committee consisting of two or more members, unless otherwise determined by the Committee, shall be two.

89. All acts done by any meeting of Directors or of a Committee of Directors, or by any person acting as a Director shall notwithstanding that it be afterwards discovered that there was some defect in the appointment of any such Director or person acting as aforesaid, or that they or any of them were disqualified or had vacated office or were not entitled to vote be as valid both against and in favour of the Company and all other persons (but not in favour of such person) as if every such person had been duly appointed and was qualified and had continued to be a Director and had been entitled to vote.

90. A resolution signed by all the directors, passed by circulation by majority of the Directors without a meeting of the Directors shall be as valid and effectual as if it had been passed at a meeting of the Directors duly convened and held.

ELECTRONIC COMMUNICATION OF BOARD MEETINGS

90(1). A meeting of the directors may be held between directors if few or all of them are in different places provided that each director who participates in the meeting is able to communicate with each other participating directors whether directly or by any form of electronic communication or a combination of such methods, such that each director is able:

(a) to hear each of the other participating directors addressing the meeting; and
(b) if he so wishes, to address each of the other participating directors simultaneously.

SECRETARY

91. The Directors shall appoint, and at their discretion remove, a person, firm or company to be called the Secretary to keep the Register, to perform any other functions which by the Ordinance or these Articles are to be performed by the Secretary, and to execute any other duties which may from time to time be assigned to the Secretary by the Directors.

92. Anything by the Ordinance required or authorized to be done by the Secretary may, if the office is vacant or there is for any other reason no Secretary capable of acting, be done by an assistant or Deputy Secretary, or if there is no Assistant or Deputy Secretary capable of acting, by any officer of the Company authorized generally or specially in that behalf by the Directors. Provided that any provisions of the Ordinance or of these Articles requiring or authorizing a thing to be done by a Director and the Secretary shall be satisfied by it being done by the same person acting both as a Director and the Secretary.

THE SEAL

93. There shall be a Common Seal of the Company. The Directors shall provide for the safe custody of the Seal which shall only be used by the authority of a resolution of the Directors or of a Committee of the Directors authorised by the Directors in that behalf, and every instrument to which the Seal shall be affixed shall be signed by a Director and shall be countersigned by the Secretary or by a second Director or by some other person appointed by the Directors for that purpose.

DIVIDENDS AND RESERVE

94. The Company in General Meeting may declare dividends, but no dividend shall exceed the amount recommended by the Directors.

95. The Directors may if they think fit from time to time pay to the Members such interim dividends as appear to the Directors to be justified by the profits of the Company. If at any time the share capital of the Company is divided into different classes, the Directors may, subject to the provisions of the Ordinance, pay such interim dividends in respect of all the different classes of shares, and provided that the Directors act bonafide they shall not incur any responsibility to the holders of any class of shares for any damage that they may suffer by reason of the payment of an interim dividend on any shares of a different class.

96. No dividend shall be paid otherwise than out of profits.

97. The Directors 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 Directors, be applicable for any purpose to which the profits of the Company may be properly applied, and pending such application may, at the like discretion, either be employed in the business of the Company or be invested, subject to the provisions of the Ordinance, in such investments (other than shares of the Company) as the Directors may from time to time think fit. The Directors may also without placing the same to reserve carry forward any profits which they may think prudent not to divide.

98. Subject to the rights of persons, if any, entitled to shares, all dividends shall be declared and paid according to the amounts paid up on the shares in respect whereof the dividend is paid, but if and so along as nothing is paid up on any of the shares in the company, dividends may be calculated and paid according to the amounts of the shares.

99. The Directors may deduct from any dividend or other moneys payable to any Member on or in respect of a share all sums of money (if any) presently payable by him to the Company on account of Zakat in relation to the shares held by such Member.

100. The Company in General Meeting may subject to the provisions of the Ordinance resolve that any capital assets of the Company in excess of the Company's paid-up capital for the time being shall be distributed among the holders of ordinary shares of the Company as and by way of a capital destruction either in the form of cash or by the allocation of such holders of particular assets of the Company in specie or by the distribution among such holders of fully paid-up shares as and by way of increase of their respective shares in the capital of the Company or in any one or more of such ways, such distribution to be in proportion to the amounts for the time being paid-up on the ordinary shares held by them respectively and the Directors shall give effect to such resolution. And in case any difficulty arises in regard to the distribution, they may settle the same as they may think expedient and in particular may issue fractional certificates and may fix the value of the same for the purposes of distribution of such specific assets or any part thereof and may determine that cash payments shall be made to any Members upon the footing of the value so fixed in order to adjust the rights of all parties. Provided always that no distribution shall be made which would amount to a reduction of capital except in manner appointed by law.

101. All unclaimed dividends may be invested or otherwise made use of by the Directors for the benefit of the Company until claimed.

102. Any dividend or other moneys payable in cash on or in respect of a share may be paid by cheque or warrant sent by registered post to the registered address of the Member or person entitled thereto and in the case of joint-holders to the registered address of that one of the joint-holders who is first named on the Register, or to such person and to such address as the holder or joint-holders may in writing direct. Every such cheque or warrant shall be made payable to the order of the person to whom it is sent or to such person as the holder or joint-holders may direct and payment of the cheque or warrant if purporting to be endorsed shall be a good discharge to the Company. Every such cheque or warrant shall be sent at the risk of the person entitled to the money represented thereby

103. If several persons are registered as joint-holders of any share, any one of them may give effectual receipt for any dividend or other moneys payable on or in respect of the shares.

104. A General Meeting declaring a dividend may direct payment of such dividend wholly or in part by the distribution of specific assets, and in particular of paid-up shares or debentures of any other company, and the Directors shall give effect to such resolution; and where any difficulty arises in regard to distribution they may settle and same as they think expedient and in particular may issue and may fix the value for distribution particular may issue and may fix the value for destruction of such specific assets or any part thereof any may determine that cash payments shall be made to any Members upon the footing of the value so fixed, in order to adjust the rights of

Members, and may vest any specific assets in trustees upon trust for the persons entitled to the dividends as may seem expedient to the Directors, and generally may make such arrangements for the allotment, acceptance and sale of such specific assets or any part thereof, and otherwise as they think fit

105. Any dividend that has been declared shall be paid within the period laid down in the Ordinance.

CAPITALISATION OF PROFITS

106. The Company in General Meeting may, upon the recommendation of the Directors resolve that it is desirable to capitalise any undivided profits of the Company (including profits carried and standing to any reserve or reserves) not required for paying nay dividends due on any shares or, subject as hereinafter provided, any sum standing to the credit of share premium account and accordingly that the Directors by authorized and directed to appropriate the profits or sum resolved to be capitalized to the Members in the proportion in which such profits or sum would have been divisible amongst them had the same been applied or been applicable in paying dividends and to apply such profits or sum on their behalf in paying up in full unissued shares or debentures of the Company of a nominal amount equal to such profits or sum, such shares or debentures to be allotted and distributed, credited as fully paid up, to and amongst such Members in the proportion aforesaid; Provided that the share premium account may, for the purpose of this Article, only be applied in the paying up of unissued shares to be issued to Members as fully paid

107. Whenever such a resolution as aforesaid shall have been passed, the Directors shall make all appropriations and applications of the profits or sums resolved to be capitalized thereby, and all allotments and issues of fully paid shares or debentures, if any, and generally shall do all acts and things required to give effect thereto, with full power to the Directors to make such provision by the issue of fractional certificates or by payment in cash or otherwise they think fit to facilitate shares or debentures becoming distributable in fractions, and also to authorise any person to enter on behalf of all the Members entitled thereto into an agreement with the Company, for the allotment to them respectively, credited as fully paid up, of any further shares to which they may be entitled upon such capitalization and an agreement made under such authority shall be effective and binding on all such Members.

ACCOUNTS

108. The Directors shall cause to be kept proper books of account as required under Section 230.

109. The books of account shall be kept at the Office or at such other place or places in Pakistan as the Directors think fit, and shall be open to inspection by the Directors during business hours.

110. The Directors shall from time to time determine whether and to what extent and at what times and places and under what conditions or regulations the accounts and books or papers of the Company or any of them shall be open to the inspection of Members not being Directors, and no Member (not being a Director) shall have any right of inspecting any account and books or papers or documents of the Company except as conferred by the Ordinance or authorised by the Directors or by the Company in General Meeting.

111. The Directors shall as required by Sections 233 and 236 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 are referred to in those Sections.

112. A copy of every balance sheet and profit and loss account which is to be laid before the Company in General Meeting, together with copies of the reports of the Directors and the Auditors shall, not less than twenty-one days before the date of the Meeting, be sent to the persons entitled to receive notices of General meetings and to every holder of debentures in the Company in the manner in which notices are to be given hereunder. Provided that this Article shall not require a copy of those documents to be sent to any person of whose address the Company is not aware or to more than one of the joint-holders of any shares or debentures.

AUDIT

113. The Company shall at each Annual General Meeting appoint an Auditor or Auditors to hold office from the completion of that meeting until the completion of the next Annual General Meeting

114. The remuneration of the Auditors shall be fixed by the Company in General Meeting, except that the remuneration of Auditors appointed to fill any casual vacancy may be fixed by the Directors.

115. Notwithstanding the foregoing provisions, the Auditors shall be appointed and their powers and duties regulated in accordance with the provisions of the Ordinance.

NOTICES

116. Any notice or document may be served by the Company on any member either personally or by sending it by post to such Member at his registered address. Where a notice or document is sent by post service of the notice or document shall be deemed to be effected by properly addressing, prepaying 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 be delivered in the ordinary course of post.

117. If a member has no registered address in Pakistan, and has not supplied to the Company an address within Pakistan for the giving of notices to him, a notice addressed to him or to the shareholders generally and published in newspapers in the manner provided in subsection 3 of Section 50 shall be deemed to be duly given to him on the day on which the advertisement appears.

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

119. A notice may be given by the Company to the persons 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, by the title of representatives of the deceased, or assignees of the insolvent or 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 and 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

WINDING UP

120. If the Company shall be wound up the liquidator may, with the sanction of Special Resolution of the Company and any other sanction required by the Ordinance, divide among the Members, in specie or kind, the whole or any part of the assets of the Company, whether they shall consist of property of the same kind or not, and may, for such purpose set such value as he deems fair upon any property to be divided as aforesaid. 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 shall think fit, but so that no Member shall be compelled to accept any shares or securities whereon there is any liability.

SECRECY CLAUSES

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

122. No member shall be entitled except to the extent expressly permitted by the ordinance or these Articles to enter upon the property of the Company or to require discovery of or any information respecting any detail of the Company's trading or any matter which is or may be in the nature of a trade secret, mystery of trade or secret process which may relate to the conduct of the business of the Company and which, in the opinion of the Directors, it will be inexpedient in the interest of the members of the Company to communicate to the public.

INDEMNITY

123. Every Director, Agent, Auditor, Secretary and other Officer for the time being of the Company shall be indemnified out of the assets of the Company against any liability incurred by him in defending any proceedings, whether civil or criminal, arising out of his dealings in relation to the affairs of the Company, except those brought by the Company against him, in which judgment is given in his favour or in which he is acquitted or in connection with any application under Section 488 in which relief is granted to him by the Court.

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

Sr. No.	Name, Father's Name, CNIC Number or passport No. (if foreigner)	Nationality with any Former Nationality If any	Occupation	Residential address in full	No. of Shares taken by each Subscriber	Signature of Subscriber
1.	Mr. Shaikh Mohammad Pervez S/o Mr. Shaikh Mohammad Din CNIC 42201-8857683-7	Pakistani	Industrialist	41 Al Hamra Society off: Tipu Sultan Road, Karachi	12,500 (Twelve Thousand Five Hundred)	
2.	Mr. IrfanMuneer S/o Mr. Shaikh Mohammad Muneer CNIC 42201-5903301-7	Pakistani	Industrialist	55 Al Hamra Society off: Tipu Sultan Road, Karachi	12,500 (Twelve Thousand Five Hundred)	
3.	Mr. Fawad Jawed S/o Mr. Shaikh Mohammad Jawed CNIC 42201-0403382-5	Pakistani	Industrialist	35 Al Hamra Society off: Tipu Sultan Road, Karachi	12,500 (Twelve Thousand Five Hundred)	
4.	Mr. FarhadShaikh Mohammad S/o Mr. Shaikh Mohammad Tariq CNIC 42201-5826927-7	Pakistani	Industrialist	37 Al Hamra Society off: Tipu Sultan Road, Karachi	12,500 (Twelve Thousand Five Hundred)	

Total Shares 50,000
(Fifty Thousand)

Karachi date this 30th day of June 2014

Witness to above signatures.

Full Name	Mushtaq Ahmed Vohra
Father's Name	S/o Haji Mohammad Ismail
CNIC Number	42301-0952156-3
Nationality & Occupation	(Pakistani) Advocate
Full Address of Witness	Mushtaq & Company Chartered Accountants 407, Commerce Centre Hasrat Mohani Road Karachi.

COMPANY SECRETARY

Certified to be True Copy
Joint Registrar of Companies
2016

ANNEX B

APPLICANT'S PROFILE OF EXPERIENCE, NET WORTH, FINANCIAL STATEMENTS AND CASH BALANCE & BANK CERTIFICATE

BRIEF INTRODUCTION OF THE APPLICANT

DEL is a public limited company incorporated in Pakistan and registered under the Companies Ordinance, 1984. DEL has been specifically established to undertake wind power generation business and activities in Pakistan. The registered office of DEL is Din House, 35-A/I, Lalazar Area, Opposite Beach Luxury Hotel, Karachi, Pakistan.

Brief Sponsor Profile

DEL is sponsored by the Din Group of Companies, which is being represented by fourteen (14) individual sponsors (the "Sponsors") of the Group who hold an aggregate shareholding of 100% in the Project Company. Brief Profiles of the Sponsors are given below:

Din Group

Din Group of Industries was formed in 1954 by Shaikh Mohammad Din. It represents one of Pakistan's premier business groups having diversified investments, which include textiles, leather products, financial institutions, real estate, investment in bluechip stocks/bonds, and poultry farming. Furthermore, the Group, in their individual capacities, has investments in various power, fertilizer, and E&P companies. In addition, the Sponsors have representation on the Board of Directors of MCB Bank Ltd., Adamjee Insurance Company and Fauji Fertilizer Company. The Group directly employs over 5,000 people across Pakistan.

Din Leather (Pvt.) Ltd

Din Leather (Pvt.) Ltd. is one of the largest tanneries of the Country, exporting finished leather across the globe, specializing in high-end leather. The production plant is based in Karachi. Din Leather has been awarded numerous Best Export Performance awards by the Federation of Pakistan Chambers of Commerce & Industry (FPCCI) and has also been awarded Gold Medal Award by the International Export Association U.K. in recognition of their export achievements.

Din Textile Mills Ltd

Din Textile Mills Ltd., consist of 4 units of spinning and one dyeing plant, producing value added cotton yarn such as mélange yarn, core spun stretch yarn and compact yarn. Total 100,000 spindles are in operation and most of the products are exported across the globe.

Din Farm Products

Din Farm Products is atomized poultry project with production of 300,000 eggs per day. This project was initiated in the year 2011 for the diversification of the group.

Din Group is also actively involved in philanthropy as part of its corporate social responsibility program. The group's CSR activities include, naming a few, running many dispensaries, maternity homes, educational Institutes and hospitals across Pakistan.

Group Key Financials

Din Group of Companies	2013	2014	2015
Key Financials	PKR (000)	PKR (000)	PKR (000)
Annual Turnover	10,960,787	13,526,091	10,931,733
Total Assets	10,218,667	10,699,441	8,846,355
Net Assets	5,866,512	6,158,295	5,156,918

DIN's Energy Experience

Din Group has had extensive experience in procurement, installation, commissioning, and operations and maintenance of over 25.8MW of captive power generation capacity for its group companies at four of their production facilities. The captive power plants are based on thermal technology with their primary fuel being natural gas and diesel. The group has operated the captive power plants since 1990 and employs qualified and professional personnel for the operations and maintenance of the power plants.

Furthermore, since the Sponsors have significant shareholding in HUBCO, Nishat Power, and Nishat Chunian Power, they are well informed of the developments in the Pakistan power sector. Additionally, as the Sponsors have representation on the Board of Fauji Fertilizer, who were the pioneers to develop the wind power industry in Pakistan (50MW wind farm), they have familiarized themselves with all the project development activities associated with such projects, hence their interest to develop their own wind project. Additionally, the Group has taken on-board a professional team of technical, legal, and financial advisors who are working alongside DIN's top management for project implementation. Further, DIN is in the process of putting together a dedicated team consisting of a Project Director, finance director, and qualified engineering staff to develop the Project.

Summary of Existing Power Generation

S. No.	Unit /Plant	Make of Generator	Capacity (MW)	Fuel Type
1	Pattoki	Caterpillar	11.311	FO, NG, & Dsl
2	Raiwind unit no.5	Caterpillar	5.300	NG, Dsl
3	Raiwind unit no.3	Caterpillar	7.350	NG, Dsl
4	SITE Karachi	Caterpillar	1.863	Dsl
Total			**25.824**	

ANNEX - B,

THIRD SCHEDULE

(See section 156)

FORM A - ANNUAL RETURN OF COMPANY HAVING SHARE CAPITAL

1 Registration No: 0069063

2 Name of the Company: DIN ENERGY LIMITED

3 Form A made upto (Day/Month/Year): 31/10/2015

4 Date of AGM (Day/Month/Year): 31/10/2015

PART - A

5 Registered Office Address: DIN HOUSE 35 A/1, LALAZAR AREA, OPP BEACH LUXURY HOTEL, M.T. KHAN ROAD, KARACHI Sindh

6 Email Address: dingroup@dingroup.com

7 Office Tel No: 35610001

8 Office Fax No: 35610009

9 Nature of Business: POWER GENERATION - ALLIED (OTHER)

10 Authorized Share Capital

Type of Shares	No. of Shares	Amount	Face Value
Ordinary Shares		500,000.00	

11 Paid up Share Capital

Type of Shares	No. of Shares	Amount	Issue Price
Ordinary Shares		500,000.00	

12 Amount of indebtedness on the date upto which form A is made in respect of all Mortgages/Charges: 0.00

13. Particulars of the holding company

Name:

Registration No.: % Shares Held:

14. Chief Executive

Name: FAWAD JAWED NIC: 42201-0403382-5

Address: 35 AL-HAMRA SOCIETY OFF TIPU SULTAN ROAD KARCHI

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Joint Registrar of Companies
Company Registration Office
Karachi

1/12/15

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15. Chief Accountant

Name ISLAM AHMED NIC 42201-9408669-3

Address HOUSE NO.455 P E B. HOUSING SOCIETY NEW TOWN KARACHI

16. Secretary

Name ISLAM AHMED NIC 42201-9408669-3

Address HOUSE NO.455 P E B. HOUSING SOCIETY NEW TOWN KARACHI

17. Legal Advisor

Name MOHSIN TAYEBALY AND CO

Address 1ST FLOOR DIM CENTRE BC-4 BLOCK 9 KEHKASHAN CLIFTON KARACHI

18. Auditors

Name M. YOUSUF ADIL SALEEM AND CO

Address CAVISH COURT A-35 BLOCK-7AND8 K.C.H.S.U. SHAHRAH E-FAISAL KARACHI

19. List of Directors on the date of Form-A

Name of Director	Address	Nationality	NIC (Passport No. if Foreigner)
FARHAD SHAIKH MOHAMMAD	37 AL HAMRA SOCIETY OFF: TIPU S	Pakistan	4220158260277
FAWAD JAWED	35 AL HAMRA SOCIETY OFF: TIPU S	Pakistan	4220104033625
IRFAN MUNEER	55 AL HAMRA SOCIETY OFF: TIPU S	Pakistan	4220159033017
SHAIKH MOHAMMAD PERVEZ	41 AL HAMRA SOCIETY OFF: TIPU S	Pakistan	4220188576887

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19. List of Directors on the date of Form-A

Name of Director	Address	Nationality	NIC (Passport No. if Foreigner)

Previous Page Next Page

PART-B

20. List of members & debenture holders on the date upto which this Form A is made

Folio	Name of Members/Debenture Holders	Address	Nationality	No. of Shares	NIC (Passport No. if Foreigner)
1	SHAIKH MOHAMMAD PERVEZ	41, AL HAMRA SOCIETY, OFF	Pakistan	6250	42201-8857688-7
10	FAISAL JAWED	35, AL-HAMRA SOCIETY, OFF	Pakistan	3125	42201-0403377-5
11	FARAZ JAWED	35, AL-HAMRA SOCIETY, OFF	Pakistan	3125	42201-3394054-5
12	SHAIKH MOHAMMAD TARIQ	37, AL-HAMRA SOCIETY, OFF	Pakistan	3125	42201-0403386-3
13	AMNA TARIQ	37, AL-HAMRA SOCIETY, OFF	Pakistan	3125	42000-0131217-8
14	SHAIKH MOHAMMAD RAFFAY	37, AL-HAMRA SOCIETY, OFF	Pakistan	3125	42201-2580114-7
2	IRFAN MUNEER	55, AL-HAMRA SOCIETY, OFF	Pakistan	3125	42201-5903301-7
3	FAWAD JAWED	35, AL-HAMRA SOCIETY, OFF	Pakistan	3125	42201-0403382-5
4	FARHAD SHAIKH MOHAMMAD	37, AL-HAMRA SOCIETY, OFF	Pakistan	3125	42201-5826927-7
5	GHAZALA PERVEZ	41, AL-HAMRA SOCIETY, OFF	Pakistan	6250	42201-0349176-0
6	SAEEDA PARVEEN	55, AL-HAMRA SOCIETY, OFF	Pakistan	3125	42201-0349181-0
7	SHAIKH MUHAMMAD TANVEER	55, AL-HAMRA SOCIETY, OFF	Pakistan	3125	42201-2328985-1
8	SHAIKH MOHAMMAD IMRAN	55, AL-HAMRA SOCIETY, OFF	Pakistan	3125	42201-0403383-3
9	UNEZA JAWED	35, AL-HAMRA SOCIETY, OFF	Pakistan	3125	42201-4027454-8

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21. Transfer of shares (debentures) since last Form A was made

No	Name of Transferor (Members)	Name of Transferee	Number of Shares Transferred	Date of Registration of
1	S. M. PERVEZ	GHAZALA PERVEZ	6250	20/04/2015
10	FARHAD SHAIKH MOHAMMAD	S. M. RAFFAY	3125	20/04/2015
2	IRFAN MUNEER	SAEEDA PARVEEN	3125	20/04/2015
3	IRFAN MUNEER	S. M. TANVEER	3125	20/04/2015
4	IRFAN MUNEER	S. M. IMRAN	3125	20/04/2015
5	FAWAD JAWED	UNEZA JAWED	3125	20/04/2015
6	FAWAD JAWED	FAISAL JAWED	3125	20/04/2015
7	FAWAD JAWED	FARAZ JAWED	3125	20/04/2015
8	FARHAD SHAIKH MOHAMMAD	S. M. TARIQ	3125	20/04/2015
9	FARHAD SHAIKH MOHAMMAD	AMNA TARIQ	3125	20/04/2015

22. I certify that this return and the accompanying statements state the facts correctly and completely as on the date upto which this Form-A is made

Date (DD/MM/YYYY) 01/12/2015

Signature ISLAM AHMED

Designation
[ ] Chief Executive
[✓] Secretary

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Joint Registrar of Companies
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Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation *** (if any) (g)	Present Appointment or Change (h)	Appointment change / any other remarks (i)

Name of Signatory	ISLAM AHMED	Designation	Secretary
Signature of Chief Executive/Secretary		Date (DD/MM/YYYY)	13/11/2015

PARTICULARS OF DIRECTORS AND OFFICERS INCLUDING THE CHIEF EXECUTIVE, MANAGING AGENT, SECRETARY, CHIEF ACCOUNTANT, AUDITORS AND LEGAL ADVISERS OR OF ANY CHANGE THEREIN

THE COMPANIES ORDINANCE 1984 FORM 29

(SECTION 205)

1. Incorporation Number 0039093

2. Name of Company DIN ENERGY LIMITED

3. Fee Paid (Rs.) 600.0 Name and Branch of Bank KARACHI, MCB - KARACHI MAIN BRANCH (0001)

4. Receipt No IE-2015-386549 31/10/2015

5. Mode of Payment (Indicate) Bank Challan

6. Particulars*:

6.1 New Appointment/Election

Present Name in Full (a)	NIC No. or Passport No. (in case of Foreign National) (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation *** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointment / change / any other remarks (i)
FAWAD JAWED	42201040338 25	SHAIKH MOHAMAMD JAWED	35 AL HAMRA SOCIETY OFF TIPU SULTAN ROAD, KARACHI Sindh Pakistan	Director	Pakistan		31/10/2015	Re-Elected
[illegible] MUNEER	42201500330 17	SHAIKH MOHAMMAD MUNEER	55 AL HAMRA SOCIETY OFF TIPU SULTAN ROAD, KARACHI Sindh Pakistan	Director	Pakistan		31/10/2015	Re-Elected
SHAIKH MOHAMMAD PERVEZ	42201865763 87	SHAIKH MOHAMMAD DIN	41 AL HAMRA SOCIETY OFF TIPU SULTAN ROAD, KARACHI Sindh Pakistan	Director	Pakistan		31/10/2015	Re-Elected
FARHAD SHAIKH MOHAMMAD	42201512092 77	SHAIKH MOHAMAMD TARIQ	37 AL HAMRA SOCIETY OFF TIPU SULTAN ROAD KARACHI Sindh Pakistan	Director	Pakistan		31/10/2015	Re-Elected

6.2 Ceasing of Officer/Retirement/Resignation

Present Name in Full (a)	NIC No. or Passport No. (in case of Foreign National) (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation *** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointment / change / any other remarks (i)

6.3 Any other change in particulars relating to columns (a) to (g) above

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17/5/16

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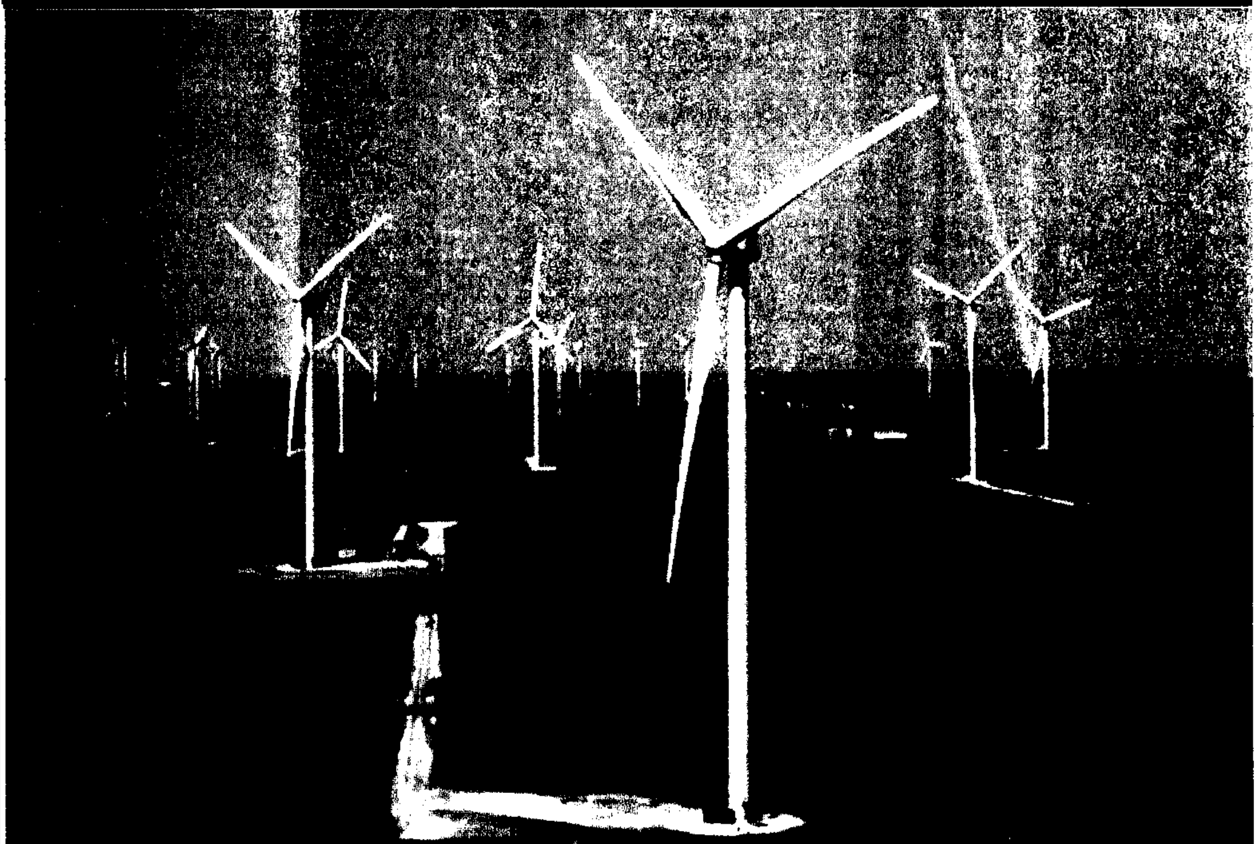
Annex-D

DIN GROUP

RE
RE



March, 2016

APPROVAL SHEET

TITLE	:	Feasibility Study Report for 50 MW Wind Power Project in Jhimpir-Sindh, Pakistan
DOCUMENT NUMBER	:	RE2-141-184-001 Issue: 01
CLASSIFICATION	:	CONTROLLED

SYNOPSIS

This document is a feasibility study report of the 50MW Wind Power Project being developed by Din Energy Ltd. It contains hardware specifications, energy yield estimates, electrical interface, civil works design and the project cost. It also includes the environmental impact assessment, soil investigations, site topography, grid interconnection studies and the project management information. This report has been prepared by Renewable Resources (Pvt.) Ltd, Pakistan.

PREPARED BY :

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REVIEWED BY :

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Head of Projects
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APPROVED BY :

(Muhammad Ammad Riaz)
Chief Technical Officer
Renewable Resources (Pvt.) Ltd
info@renewableresources.com.pk

:

Irfan Afzal Mirza
CEO
Renewable Resources (Pvt.) Ltd
irfan@renewableresources.com.pk

DATE : March, 2016

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LIST OF ABBREVIATIONS

AC	Alternate Current
AEDB	Alternative Energy Development Board
C.R	Core Recovery
CDM	Clean Development Mechanism
CFCs	Chlorofluoro Carbons
CH4	Methane
cm	Centimeter
CMA	Certified Management Accountant
CNG	Compressed Natural Gas
CO2	Carbon dioxide
CoP	Conference of the Parties
CPPA	Central Power Purchasing Agency
DAE, ED, GoS	Directorate of Alternative Energy, Energy Department, Government of Sindh
DC	Direct Current
DISCOs	Distribution Companies
EE	Energy Efficiency
EMP	Environment Management Plan
EPA	Energy Purchase Agreement
EPC	Engineering, Procurement and Construction
EU	European Union

GDP	Gross Domestic Product
GENCOs	Generation Companies
GHG	Green House Gas
GIS	Geographic Information System
GoP	Government of Pakistan
GPS	Global Positioning System
GW	Gold Wind
HAWT	Horizontal Axis Wind Turbine
HESCO	Hyderabad Electric Supply Corporation
Hz	Hertz
IEE	Initial Environmental Examination
IPPs	Independent Power Producers
JI	Joint Implementation
KANUPP	Karachi Atomic Nuclear Power Plant
KESC	Karachi Electric Supply Company
km	Kilometer
kV	Kilovolt
kW	Kilowatt
LNG	Liquefied Natural Gas
LOI	Letter of Intent
LPG	Liquefied Petroleum Gas
LOS	Letter of Support
LUC	Local Control Unit
m2	Meter square
m3/h	Meter cube per hour
MTDF	Medium Term Development Framework

MVA	Million Volt-Ampere
MW	Megawatt
N2O	Nitrous Oxide
NAPWD	Northern Areas Public Works Department
NCS	National Conservation Strategy
NEPRA	National Electricity Power Regulatory Authority
NEQS	National Environmental Quality Standards
NOCs	No Objection Certificates
NREL	National Renewable Energy Laboratories
NTDC	National Transmission and Dispatch Company
O & M	Operation & Management
OECD	Organization for Economic Cooperation and Development
OHL	Overhead Lines
OLTC	On-Load Tap Changer
PAEC	Pakistan Atomic Energy Commission
PCM	Pulse Code Modulation
PEPA	Pakistan Environment Protection Act
PLC	Programmable Logic Control
PMD	Pakistan Meteorological Department
PPIB	Private Power Infrastructure Board
PVC	Poly Vinyl Carbonate
QC	Quality Control
R & D	Research and Development
RE	Renewable Energy
RE2	Renewable Resources (Pvt.) Ltd

RQD	Rock Quality Designation
SF6	Sulfur Hexafluoride
SPT	Standard Penetration Test
UPS	Uninterruptible Power Supply
USA	United States of America
VAWT	Vertical Axis Wind Turbine
WAPDA	Water And Power Development Authority
WMO	World Meteorological Organization
WTG	Wind Turbine Generator

ACKNOWLEDGEMENTS

The management of Din Energy Ltd is thankful to the Ministry of Water and Power and the dedicated team of Directorate of Alternative Energy (DAE, Energy Department) Govt. of Sindh for generous support at all stages of project development and looks forward to their continued support in the future.

The management of Din Energy Ltd also looks forward to the cooperation of Government of Sindh and other Government departments (NEPRA, NTDC, HESCO) which is being extended to the Project.

DISCLAIMERS

This report is prepared for the benefit of Din Energy Ltd (the "Client"), and may not be relied upon or disclosed to any other person for any purpose, other than as stated below, without the Client's prior written consent in each specific case. The information contained in this report is intended to be used by the Client for such other purpose as may be necessary for the development and implementation of the Project.

COMPANY CONTACT INFORMATION

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DOCUMENT INFORMATION

Purpose and Scope:

The purpose of this report is to provide information required for the relevant agencies to make an informed decision regarding the implementation and execution of this project.

1 EXECUTIVE SUMMARY

Located on the western stretch of the South Asian Continent, The Islamic Republic of Pakistan is largely under the influence of a tropical desert climate. The thermal depression of South Asia and the monsoon winds shape up Pakistan's southern coastal areas and northern mountain areas into a land rich in wind energy resources. The costal wind-energy-rich areas normally refer to Southern Sindh and the vast plateau to the east and the northeast of Karachi city. The relative shortage of conventional energy resources in Pakistan and the hiking of fuel prices worldwide spurred the Pakistan Government to find alternative sources, including wind power.

Government of Sindh has formulated a policy to encourage the participation of private sector in the development and application of renewable energies. A Government organization called the Directorate of Alternative Energy, Energy Department, Govt. of Sindh (DAE, ED, Sindh) has been established to facilitate the implementation of renewable energy projects.

At present, six (06) wind power projects of approx. 50 MW each capacity each are in operation. A total of eight projects (six of 50 MW each, one of 99 MW and one of 30 MW) have achieved financial close and entered construction.

Din Group of Industries was formed in 1954. Din Leather (Pvt) Ltd., Din Textile Mills Ltd., Din Farm Products (Pvt) Ltd., and Din Developers (Pvt) Ltd., are part of Din Group of Industries. Din Group has employed more than 5,000 employees across Pakistan. Annual turnover of the Group is about US$:150 million. Din Group also has representation on the Board of Directors of MCB Bank Ltd., Adamjee Insurance Company and Fauji Fertilizer Company. Din Group is actively involved in Real Estate and Equity Market.

Din Leather (Pvt) Ltd., is one of the largest tanneries of the Country, exporting finished leather across the globe, specializing in high end leather. The production plant is based in Karachi.

Din Leather has been awarded many Best Export Performance Trophies by the Federation of Pakistan Chambers of Commerce & Industry (FPCCI) and has also been awarded Gold Medal Award by the International Export Association U.K. in recognition of their export achievements.

Din Textile Mills Ltd., consist of 4 units of spinning and one dyeing plant, producing value added cotton yarn such as mélange yarn, core spun stretch yarn and compact yarn. Total 100,000 spindles are in operation and most of the products are exported across the globe.

Din Farm Products is atomized poultry project with production of 300,000 eggs per day. This project was initiated in the year 2011 for the diversification of the group.

Din Group is actively involved in philanthropy as part of corporate social responsibility. The group is running many dispensaries, maternity homes, educational Institutes and hospitals across Pakistan.

The Chairman Mr. S. M. Muneer has been awarded SITARA-I-ISAR and SITARA-I-IMTIAZ by the President of Pakistan for his outstanding public services for the cause of humanity. He has been awarded twice Honorary PHD Degree of Doctorate of Philosophy from Institute of Business & Technology and from Indus Institute of Higher Education. He has also been awarded "The best business man of the year award by the Federation of Pakistan Chambers of Commerce & Industry (FPCCI). He is former President of FPCCI and former Federal Minister.

Din Group is one of the most well diversified groups of Pakistan and is well recognized for the performance of the companies, satisfaction of customers and corporate social responsibilities.

Din Energy Ltd is sponsored by Din Group and is interested in setting up a Wind Power Project of 50 MW capacity in Jhimpir, Sindh, Pakistan. Renewable Resources (Pvt.) Limited (RE2) is the consultant for Din Energy Ltd for developing this project.

1.1 PROJECT OVERVIEW AND SITE

The wind project is located in Jhimpir, which is located approximately 75 km (aerial distance) East of Karachi, Pakistan's commercial hub and main coastal/port city. The Project site consists of 325 acres of land, which has been acquired by the project company. The Karachi-Hyderabad Motorway (Super Highway) and National Highway are the connecting roads to the Project site. The Jhimpir wind corridor is identified as potential area for the development of wind power projects. The overview of the project site is shown in ***Figure 1***.

Figure 1: Din Energy Ltd Site overview

The Project Site has flat terrain with sparse vegetation, consisting of small shrubby bushes.

Further details of Site are given in Section 07 and the Site Transportation and Access Study are attached as Annex II.

1.1.1 Project Size

The Project site consists of 325 acres of land and the Project shall have an installed capacity of 50 MW

1.1.2 Project Status and Calendar

The project calendar is given on the next page:

Table 1-1: Project Planned Milestones

Activity / Milestone	2015	2016				2017				2018	
	4th QTR	1st QTR	2nd QTR	3rd QTR	4th QTR	1st QTR	2nd QTR	3rd QTR	4th QTR	1st QTR	2nd QTR
Time consumed in Land arrangement and Grid Data.											
Preparation of Feasibility											
Submission of Feasibility Study											
Approval of Feasibility Study											
Generation License											
Upfront Tariff											
Signing of EPA											
Signing of IA											
Financial Close											
Project Construction											
Start of Operations											

Table 1-2: Project Construction Scheduling

Activity / Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Engineering and Mobilization																		
Construction of Temporary Establishment																		
Civil Works of WTGs and Substation																		
Construction of Substation																		
Supply of WTGs and Towers																		
Cables and Interconnection																		
Erection and Installation																		
Testing and Commissioning of EBOP																		
Testing and Commissioning of WTGs																		
EPA Tests and Reliability Run Test																		

1.1.3 Wind Resource Assessment (WRA)

A separate study has been carried out for the WRA including complete analysis of wind data and long term correlation.

1.1.4 Energy Yield Estimates

The energy yield estimates have been generated including development of wind farm layouts, determination of energy yields and uncertainty assessments.

1.1.5 Geological Conditions

The Project area has a wide range of soil types due to its diverse land forms, which include sandy, deltaic, alluvial, gravel, coastal, and mountainous.

The information related to geological conditions is given in Section 11. The detailed Geotechnical Investigation Report is attached as Annex V.

1.1.6 Design of Civil Works

Information related to the civil works is given in Section 12.

1.1.7 Design of Electrical Works

Information related to the electrical works is given in Section 13.

The Project has an installed capacity of 50 MW, using wind turbine generators (WTG), each with a capacity in the range of 1.5 – 3 3 MW and an output voltage of 0.62 - 0.69 kV. A substation consisting of step up transformer and other BOP equipment will connect the farm to the 132 kV power lines. The power from the turbine will be stepped up to Medium voltage (MV) through a generator step up transformer which will be housed in a separate compartment in close proximity to the wind turbine tower. Power from all the WTGs in the plant will be delivered to the substation, and onwards to the grid via the step up transformers and HV switchgear, built within the boundaries of the wind power plant. The switchgear gantries will be the point of metering and connection to the 132 kV power lines.

Grid interconnection point and required reactive power compensation, if any, for the project shall be as per the findings of the grid interconnection study.

Please refer to the Grid Interconnection Study attached as Annex VI.

1.1.8 Construction Management

Information related to the construction management is given in Section 14.

1.1.9 O & M Management

The O&M shall be managed by the O&M Contractor for initial 2 years of Warranty Period followed by a complete Field Service Agreement till end of five years of operations. The local team shall remain part of the O&M and shall gradually take over after having On Job Trainings (OJT).

O&M management will be established with the principle of requiring "few on-duty staff". After entering the electrical equipment and machinery to their stable operation mode, the wind turbine and associated apparatus shall be managed with "no on-call staff and few on-guard staff".

The production area includes facilities such as generators, transformers, and the substation. There shall be buildings for protection and control, telecommunication, DC power supply and for administrative purposes.

1.1.10 Environmental Management

Information related to the environmental management works is given in Section 15.

A separate environment study has been carried out. The Initial Environment Examination (IEE) report is attached as Annex VII.

There are no significant hazards. The minor adjustments required during construction phase have been addressed and mitigation plan provided. A data collection survey was also done that included geology, meteorology, hydrology, ambient air quality, water quality, soil characteristics, noise levels, shadow forecasting, flora and fauna, land use pattern, and socioeconomic conditions.

1.1.11 Health and Safety

During the construction and operation of the Project, the guideline of "safety first, (accident) prevention foremost" will be practiced. Comprehensive management and supervision will be applied to all staff members and the whole operation process, in order to ensure safe operation of the equipment and personal safety of workers.

A safety and health supervision department will be established on the wind farm, which is to be in charge of the education, training and management of safety and health related issues after the project is put into operation. There will be safety personnel in the production section, and a part-time worker for the routine safety and health work.

The systems of patrol inspection, operation guardianship, maintenance and over-haul will be established for the daily maintenance of production equipment, instruments and apparatus. The safety and health supervision department will provide sound meter and other appropriate inspection equipment, as well as necessary public education service for production safety.

A comprehensive safety system will be established during the preparation phase, and carefully implemented during the construction process. The systems of work sheet, operation sheet, shift relief, patrol inspection, operation guardianship, maintenance and over-haul will be strictly implemented. The Safety Regulation of the wind farm will also be carefully observed to minimize accidents.

[illegible] CDM Aspect

The Project is a power generation project using a renewable resource with zero emissions. When put into operation, the project can provide power supply to the southern Pakistan power grid, which currently is mainly relying on fossil fuel. Therefore, it can help to reduce the greenhouse gas emission from coal or oil-fired power generation. It can deliver substantial environmental and social benefits. It is also consistent with the spirit of the Kyoto Protocol and qualified for the application of CDM projects.

The Project Company intends to develop a CDM project according to the provisions of the prevailing Policy.

1.2 LIST OF ANNEXURE

ANNEX – I: Pakistan Energy Profile and Global Wind Energy Stats

ANNEX – II: Transportation and Access Study Report

ANNEX – III: Wind Resource Assessment Report

ANNEX – IV: Energy Yield Estimates Report

ANNEX – V: Geo Technical Investigation Report

ANNEX – VI: Electrical Grid Interconnection Study Report

ANNEX – VII: Initial Environmental Examination (IEE) Report

Presently, the Project plans to opt for upfront tariff. Therefore Annex III and Annex IV, being not required for an upfront tariff, are not being submitted for approval. If for any reason, the Project is not able to opt for the upfront tariff, then the cost plus option will be opted and the wind studies will be submitted to relevant departments.

1.3 PROJECT TEAM

1.3.1 Din Energy Ltd

Din Energy Ltd is sponsored by Din Group and is interested in setting up a Wind Power Project of 50 MW capacity in Jhimpir, Sindh, Pakistan. Din Group of Industries was formed in 1954. Din Leather (Pvt) Ltd., Din Textile Mills Ltd., Din Farm Products (Pvt) Ltd., and Din Developers (Pvt) Ltd., are part of Din Group of Industries. Din Group has employed more than 5,000 employees across Pakistan. Annual turnover of the Group is about US$:150 million. Din Group also has representation on the Board of Directors of MCB Bank Ltd., Adamjee Insurance Company and Fauji Fertilizer Company. Din Group is actively involved in Real Estate and Equity Market.

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Din Group is one of the most well diversified groups of Pakistan and is well recognized for the performance of the companies, satisfaction of customers and corporate social responsibilities.

Din Energy Ltd is sponsored by Din Group and is interested in setting up a Wind Power Project of 50 MW capacity in Jhimpir, Sindh, Pakistan. Renewable Resources (Pvt.) Limited (RE2) is the consultant for Din Energy Ltd for developing this project.

The Sponsors have a valid LOI from Energy Department Government of Sindh ("EDGOS") and has been allotted 325 acres of land in Jhimpir for which the GoS has already issued a land allotment letter.

1.3.2 Renewable Resources (Pvt.) Ltd – Project Consultant

www.renewableresources.com.pk

Renewable Resources (RE2) is the professional technical advisor for the Project. RE2 is a consulting company specialized in Renewable Energy (RE), Energy Efficiency (EE) and Environment (Env) Projects. The company is owned by group of professionals who have been intimately involved in the renewable energy program of Pakistan, and have a fundamental understanding of issues relating to power project development, which include but are not limited to feasibility studies, regulatory approvals, concession and security documents, and applicable policies.

RE2 is capable of conducting full feasibility package featuring power production estimates, grid interconnection and tariff model. RE2 also has the expertise to deal with all technical aspects regarding the legal documents of power projects. The professional team of RE2 is well acquainted with the policies, regulations, methodologies and standards of RE power Projects and its work output meets international standards. RE2 is presently a consultant for various power Projects in Pakistan sponsored by local and international investors, with international banks.

1.3.3 Power Planners International- Electrical and Grid Studies (PPI)

PPI is a limited company registered in England and Wales and has a team of highly skilled and experienced professionals. Power Planners is also registered with Saudi Electricity Company (SEC), with Pakistan Engineering Council and Alternative Energy Development Board, Pakistan. It is a renowned company in power sector in the field of power system analysis and planning especially in the areas of grid interconnection studies of renewable energy resources such as wind, solar, small Hydel etc. PPI comprises of enterprising group of professionals to provide consultancy services for:

- Feasibility studies of new power plants of any nature; Hydel, Thermal, Wind-Farms and other renewable energy sources, and their interconnections with the main electrical grid.
- Feasibility Studies for cross-border or cross-country interconnections of electrical grids for power exchange.
- Analytical studies for electric utilities, Independent Power Producers (IPPs), Independent System Operators (ISOs) and industries, that are planning to add new facilities or seek solutions to problems in their existing systems to enhance power quantity and quality to their customers.
- Preparation of engineering, design and specifications for new power projects.
- Training and developing the human resource in technical skills for power planning and expansion of energy sources. PPI's engineers possess highly specialized skills, vast and profound experience, and expertise of the advanced and latest state-of-the art software prevailing in the contemporary power systems industry.

The team at PPI comprises of engineers having a work experience of 10 to 30 years with utilities and consultant companies in Pakistan and Middle East in the fields of transmission planning, power system analysis, load forecasting and generation planning for systems of wide range of operating voltages.

2 COUNTRY AND INDUSTRY OVERVIEW

The detailed stats and situation of energy in Pakistan, specific information and prospects of wind and international trends in wind power sector is given in Annex I.

At this juncture, we are encountering the worst electricity crisis of the history of Pakistan resulting in extended load shedding to an extent which virtually suspends social life. The situation has further forced Government of Pakistan to again take decisions like early market shutdown, power cutoff to industry, and two holidays per week thus affecting all business activities.

Pakistan's major electricity sources are thermal and hydro generation, meeting approximately 70% and 28% (respectively) of the country's annual electricity demand. The primary thermal generation fuels employed are furnace oil and gas. Oil import is a significant burden on the national exchequer. Import of gas could be seen as a viable option to overcome the depleting domestic reserves, but gas import has significant issues, mainly the need for substantial capital investment in infrastructure, security difficulties and physical terrain concerns. Moreover, it would still be an imported product.

Alternatives to further fuel imports for electricity generation are the use of domestic coal, or generation from hydro or other renewable sources, such as wind / solar power. These options will assist in reducing Pakistan's reliance on imported oil, and consequent vulnerability to changes in global oil prices which will in turn have a positive effect on the current trade deficit and inflating import bill.

Looking at how the country's future electricity needs might be met, wind has the potential of being a strong contributor in future because of being an indigenous resource and available in huge quantities in the country.

3 REGULATORY REGIME

Power sector Pakistan has a ministry overlooking the electricity business in the country and a regulatory authority, independent of the ministry, to control the business practices in the market. There are a number of stakeholders involved in the cycle:

- Ministry of Water and Power
- National Electricity Power Regulatory Authority (NEPRA)
- National Transmission and Dispatch Company (NTDC)
- Central Power Purchase Agency Guarantee Ltd. (CPPA-GL)
- Directorate of Alternative Energy, Energy Department, Govt. Sindh.

3.1 MINISTRY OF WATER AND POWER

The federal Ministry of Water and Power is the GoPs executive arm for all issues relating to electricity generation, transmission and distribution, pricing, regulation, and consumption. It exercises these functions through its various line agencies as well as relevant autonomous bodies. It also serves to coordinate and plan the nation's power sector, formulate policy and specific incentives, and liaise with provincial governments on all related issues.

3.2 NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (NEPRA)

NEPRA has been created to introduce transparent and judicious economic regulation, based on sound commercial principles, in the electric power sector of Pakistan. NEPRA regulates the electric power sector to promote a competitive structure for the industry and to ensure the coordinated, reliable and adequate supply of electric power in the future. By law, NEPRA is mandated to ensure that the interests of the investor and the customer are protected through judicious decisions based on transparent commercial principles.

NEPRA remains to be the same platform for federal as well as provincial projects.

3.3 NATIONAL TRANSMISSION AND DISPATCH COMPANY (NTDC)

NTDC shall be the power purchaser. National Transmission & Dispatch Company (NTDC) Limited was incorporated on 3rd August 1998 and commenced commercial operation on 1st March 1999. It was organized to take over all the properties, rights and assets obligations and liabilities of 220kV and 500kV Grid Stations and Transmission Lines/Network owned by Pakistan Water and Power Development Authority (WAPDA). The NTDC operates and maintains nine 500kV Grid Stations, 4,160 km of 500 kV transmission line and 4,000km of 220kV transmission line in Pakistan.

For low voltage power such as 11 kV, the autonomous distribution companies (commonly called as DISCOS) are the power purchasers. Functionally, DISCOs fall at a step lower than NTDC and are looking after low voltage assets.

3.4 CENTRAL POWER PURCHASE AGENCY GUARANTEE LIMITED (CPPA-GL)

CPPA-GL is an agency to purchase power from Wind power plants on behalf of NTDC. CPPA-GL acts as a one window for all affairs related to NTDC for the Project including signing of the Energy Purchase Agreement (EPA), establishment of Operating Committee (OC), development of Operating Procedures (OP), appointment of Independent Engineer (IE) and testing of the Project leading to declaration of commercial operations. CPPA-GL also handles payments to the Project against sale of electricity and all sort of Non Project Missed Volume (NPMV) under the EPA.

3.5 Directorate of Alternative Energy, Energy Department, Govt. of Sindh (DAE, ED, GOS)

The Directorate of Alternative Energy, Energy Department, Govt. of Sindh is responsible for harnessing the alternative/renewable energy resources, addressed the relevant issues/matters at provincial level, facilitates local and foreign investors and donors for promotion and implementation of alternative energy/renewable energy projects, plan and implement project through public funding, foreign grants, loans etc. and design alternative energy policy for province and review it from time to time.

4 CARBON CREDITS

The Kyoto Protocol to the United Nations Framework Convention on Climate Change will strengthen the international response to climate change. Adopted by consensus at the third session of the Conference of the Parties (COP) in December 1997, it contains legally binding emissions targets for Annex I (industrialized) countries. By arresting and reversing the upward trend in greenhouse gas emissions that started in these countries 150 years ago, the Protocol promises to move the international community one step closer to achieving the Convention's ultimate objective of preventing dangerous anthropogenic [man-made] interference with the climate system.

The developed countries are to reduce their collective emissions of six key greenhouse gases by at least 5%. This group target will be achieved through cuts of 8% by Switzerland, most Central and East European states, and the European Union (the EU will meet its group target by distributing different rates among its member states); 7% by the US; and 6% by Canada, Hungary, Japan, and Poland. Russia, New Zealand, and Ukraine are to stabilize their emissions, while Norway may increase emissions by up to 1%, Australia by up to 8%, and Iceland 10%. The six gases are to be combined in a "basket", with reductions in individual gases translated into "CO_2 equivalents" that are then added up to produce a single figure.

Each country's emissions target must be achieved by the period 2008 - 2012. It will be calculated as an average over the five years. "Demonstrable progress" must be made by 2005. Cuts in the three most important gases carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) will be measured against a base year of 1990 (with exceptions for some countries with economies in transition). Cuts in three long-lived industrial gases – hydro fluorocarbons (HFCs), per fluorocarbons (PFCs), and sulfur hexafluoride (SF_6) - can be measured against either a 1990 or 1995 baseline. A major group of industrial gases, chlorofluorocarbons, or CFCs, are dealt with under the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer.

Actual emission reductions will be much larger than 5%. Compared to emissions levels projected for the year 2000, the richest industrialized countries (OECD members) will need to reduce their collective output by about 10%. This is because many of these countries will not succeed in meeting their earlier non-binding aim of returning emissions to 1990 levels by the year 2000, and their emissions have in fact risen since 1990. While the countries with economies in transition have experienced falling emissions since 1990, this trend is now reversing. Therefore, for the developed countries as a whole, the 5% Protocol target represents an actual cut of around 20% when compared to the emissions levels that are projected for 2010 if no emissions-control measures are adopted.

The Kyoto Protocol provides that nations can redeem a part of their climate protection commitments by implementing projects aimed at reducing emissions in other countries. These projects are primarily to be carried out by the private sector.

These investment projects can financially benefit from generating additional emissions reductions as compared to a business as usual case.

4.1 EMISSION REDUCTION MECHANISMS

There are three methods in Kyoto Protocol which permits the acquisition of emissions credits by means of project-based investment abroad.

4.1.1 Emissions Trading

Emission trading or Carbon Trading involves trading carbon emission credits within nations. Allowances are created, thereby making emissions a commodity that can be traded between industries etc. The Kyoto Protocol says that it is ok to trade in emissions, but that it should not be the major means to achieve one's commitments. Some European countries and corporations have started implementing such programs to get a head start and to see how well it will work.

Clean Development Mechanism (CDM)

Clean Development Mechanism (CDM) allows richer countries to offset their CO_2 emission against the emissions prevented when technology that cuts down on greenhouse gas emissions is deployed in poor countries.

Joint Implementation (JI)

Joint Implementation (also known as Activities Implemented Jointly) is where developed countries invest in emission-reducing activities in other industrialized countries, and gaining reduction units as a result.

4.2 ROLE OF CDM IN THE DIN ENERGY LTD PROJECT

The Project is a power generation project with renewable resource and zero emission. When put into operation, the project can provide power supply to the southern Pakistan power grid, which currently is mainly relying on fossil fuel. Therefore, it can help to reduce the greenhouse gas emission from coal or oil-fired power generation. It can deliver significant environmental and social benefits. It is also consistent with the spirit of the Kyoto Protocol and qualified for the application of CDM projects. If the project is approved and registered as a CDM project, CERs can provide extra financial resource for the project. It will provide favorable conditions for the project financing, improve competitiveness of the project, and reduce investment risk during the project implementation process. The CDM benefits in the Project (if incurred) shall be availed according to the provision in the Policy.

5 WIND INDUSTRY IN PAKISTAN

5.1 CURRENT STATUS OF WIND IPPs IN PAKISTAN

The wind energy sector of Pakistan has been matured in the last few years. The major impediments delaying the development of wind power projects have been removed. Wind data of almost 10 years is available for two locations, i.e. Gharo and Jhimpir. All the stakeholders are now at the same frequency and are fully motivated to facilitate the development of wind power in the country.

Initially very few suppliers wanted to come to new market like Pakistan. But now most of the suppliers are keen for the Pakistani market. One factor could be the Pakistani market getting matured. Now GE, Nordex, Vestas, Gamesa and Goldwind are all active in the market.

5.1.1 Letter of Intent (LOI)

The total number of LOIs issued by AEDB and DAE, Energy Department, Govt. of Sindh for various projects till date are in the range of 100.

5.1.2 Land Allocation by AEDB / GOS

AEDB and DAE, Energy Department, GoS have got approx. 31,000 acres of land from GOS and further allocated land to Wind IPPs.

5.3.3 Projects at Advanced Stages

Total of six (06) different projects with capacity of more than 300 MW have achieved their CODs. Following projects have started their commercial operations:

1	FFC Energy Ltd	49.5	1st Quarter 2013
2	Zorlu Energy	56.4	2nd Quarter 2013
3	Foundation Wind Energy I	50.0	1st Quarter 2015
4	Foundation Wind Energy II	50.0	4th Quarter 2014
5	Three Gorges First Wind Farm Pakistan (Pvt) Ltd	49.5	4th Quarter 2014
6	Sapphire Wind Energy Ltd	52.8	4th Quarter 2015

Following projects have achieved financial close during 2014-15 and are currently under construction:

1	Yunus Energy Ltd.	50.0
2	Metro Power Company Ltd.	50.0
3	Gul Ahmed Wind Power Ltd.	50.0
4	UEP Wind (Pvt) Ltd.	99.0
5	Master Wind Energy Ltd.	52.8
6	Tapal Wind (Pvt) Ltd.	30.0
7	HydroChina Dawood Power (Pvt.) Ltd.	49.5
8	Tenega Genars	49.5

5.1.4 Projects at Advanced Development Stages

Following projects have reached the Generation License / Tariff stage:

1	HAWA Energy (Pvt) Ltd	49.3
2	Jhimpir Power Ltd	49.3
3	Hartford Energy (Pvt) Ltd	49.3
4	Tricon Boston 1	49.3
5	Tricon Boston 2	49.3
6	Tricon Boston 3	49.3
7	Three Gorges Second Wind Farm Ltd	49.5
8	Three Gorges Third Wind Farm Ltd	49.5
9	Western Energy Ltd	49.5

5.1.5 Projects at Initial Development Stages

During 2015-16, various projects got their LOIs and lands from DAE, Energy Department, GoS. The approvals of land have been done. All these projects are currently at different stages of feasibility study and EPC bidding. Some of these include:

1	Master Green Energy Ltd	100.0
2	Metro Wind Power Ltd	60.0
3	Gul Ahmed Electric Ltd	50.0
4	ACT2 Wind (Pvt) Ltd	50.0
5	Artistic Wind Power (Pvt) Ltd	50.0
6	Uni Energy Ltd	50.0
7	Noor Solar Energy (Pvt) Ltd	50.0
8	Zulaikha Energy (Pvt) Ltd	50.0
9	Lakeside Energy (Pvt) Ltd	50.0

5.2 TARIFF REGIME IN PAKISTAN

5.2.1 Negotiated Tariff for Wind IPPs

The initial regime was of a negotiated tariff, which is still applicable. The Project Company justifies all expenses and financial position to NEPRA through a petition. The NEPRA in return determines the project tariff on a "cost plus" basis. The Project Company is allowed 17% IRR on the equity. There are four projects so far at cost plus tariff and all are currently in operation phase.

5.2.2 Upfront Tariff for Wind IPPs

NEPRA has announced a few upfront tariffs from time to time during past. The wind risk lies with the project company for upfront tariff. In lieu of it, the project companies can create cost efficiencies and draw maximum benefits from this "take and pay" basis. The indexations such as LIBOR / KIBOR, US$ and inflation are available.

The current upfront tariff allows full payment till an annual capacity factor of 35% is achieved. Afterwards, the tariff decreases to 75% from 35% till 36% capacity factor is achieved. Then the tariff starts rising, reaching 80% from 36% till 37% capacity factor is achieved. Thereafter, the tariff regains its 100% value. This scheme is to intensify the high efficiency WTGs.

Most of the projects now prefer upfront tariff. Din Energy Ltd will also be opting for the upfront tariff.

6 PROJECT IN TERMS OF POLICY FRAMEWORK

6.1 LETTER OF INTENT (LOI)

First step was to obtain Letter of Intent from DAE, Energy Department, GoS, which was accomplished on 14th July, 2015. This letter entitled the Project Company to start working on wind power project at official level and get support from DAE, Energy Department, GoS and other government departments in the preparation of feasibility study and acquisition of land for the project. The feasibility is being submitted before expiration of LOI and in accordance with the timeline mentioned.

6.2 ACQUISITION OF LAND

The land has been acquired by the project company from the Government of Sindh in terms of legal formalities.

6.3 FEASIBILITY STUDY

The feasibility study of the Project is being finalized in this document.

6.4 GENERATION LICENSE

Rights to produce and sell electricity in Pakistan are granted by NEPRA through "Generation License". Project Company will file an application to NEPRA for Generation License which authorizes a company to produce and sell electricity in the country.

6.5 TARIFF DETERMINATION

A separate application shall be prepared for approval of upfront tariff.

6.6 LETTER OF SUPPORT (LOS)

Once the tariff is approved, the Project Company is required to move for arrangement of financing. DAE, Energy Department, GoS will issue tripartite Letter of Support for the Project Company giving government guarantees until EPA and IA are fully effective to ensure sponsors and lender of the full government support. A bank guarantee of US$ 2,500 / MW shall be required to be submitted by the Project Company before issuance of LOS.

6.7 ENERGY PURCHASE AGREEMENT (EPA)

Agreement between the Power Purchaser and the Project Company is called Energy Purchase Agreement (EPA). This agreement lists terms and conditions for the sale and purchase of electricity between the two companies. As soon as the feasibility study is submitted and upfront tariff is filed, the Project Company shall enter into the discussions of EPA. This is going to be a significant step in the project development.

IMPLEMENTATION AGREEMENT (IA)

The Implementation Agreement (IA) provides security to the sponsors and lenders against the performance of the power purchases through guarantees from Government of Pakistan. Its discussions shall start alongside the EPA.

FINANCIAL CLOSE

Upon approval of feasibility study, grant of generation license, determination of tariff and the signing of project documents (EPA and IA); the Project Company shall move forward to complete the financial close. However, the discussions with lenders have already been started.

7 PROJECT SITE

7.1 WIND CORRIDOR OF PAKISTAN

Pakistan has a 1046 km long coastal line with a very encouraging wind regime. According to a study carried out by NREL and the wind masts installed in the Gharo and Keti Bandar wind corridor, the average wind speed in the region is 7.4 m/s making a regional potential of more than 50,000 MW. Wind Map of Pakistan by NREL is shown in ***Figure 3***.

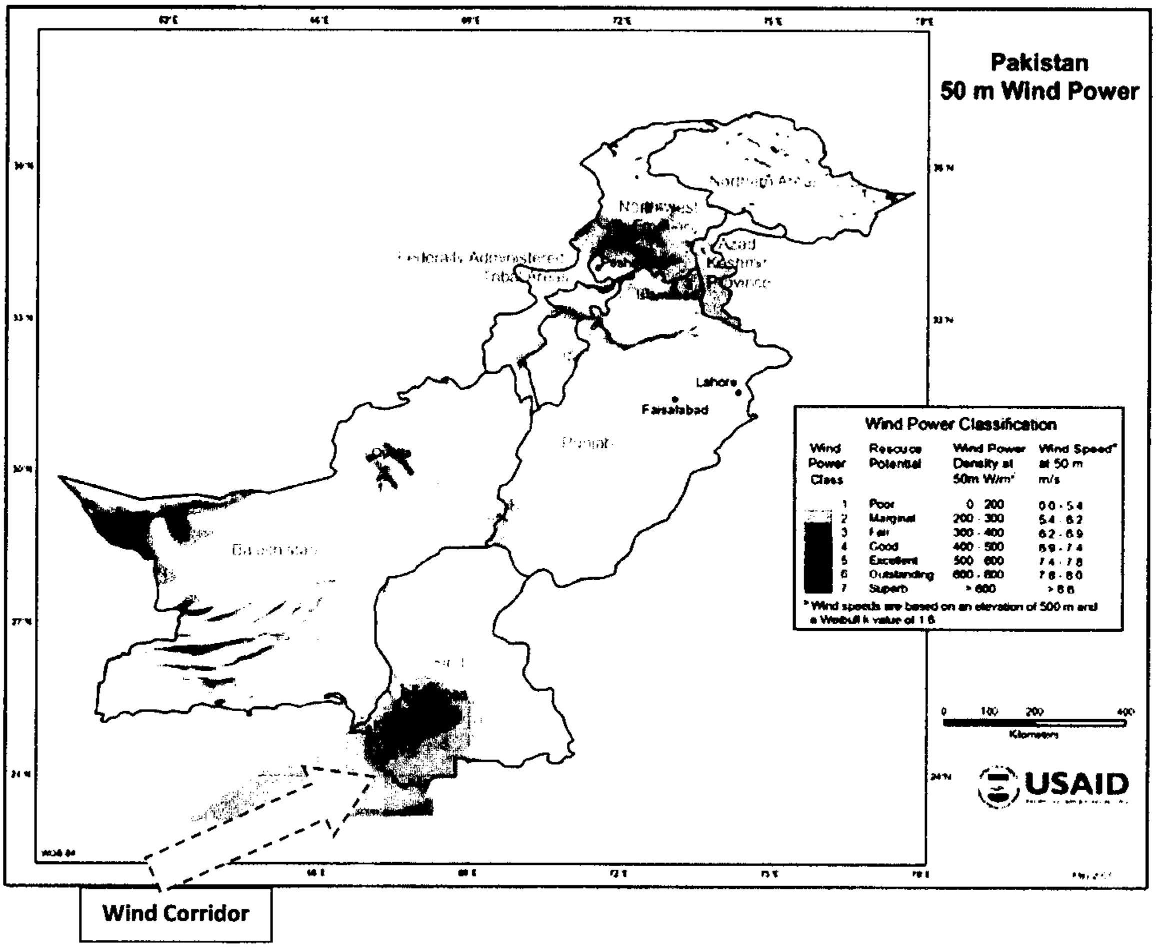


Figure 2: Wind Map of Pakistan by NREL

Based on the wind potential, Government of Pakistan initiated the wind power projects and facilitated land to the potential investors. The lands were allocated in Gharo, Bhambore and Jhimpir, where different wind power developers have taken the land. Later, GOS started facilitating the developers with land as well. The Sponsors have a valid LOI from Energy Department Government of Sindh ("EDGOS") and has been allotted 325 acres of land in Jhimpir for which the GOS has already issued a land allotment letter.

An overview of the project site allocated in Jhimpir region is shown in *Figure 3*:

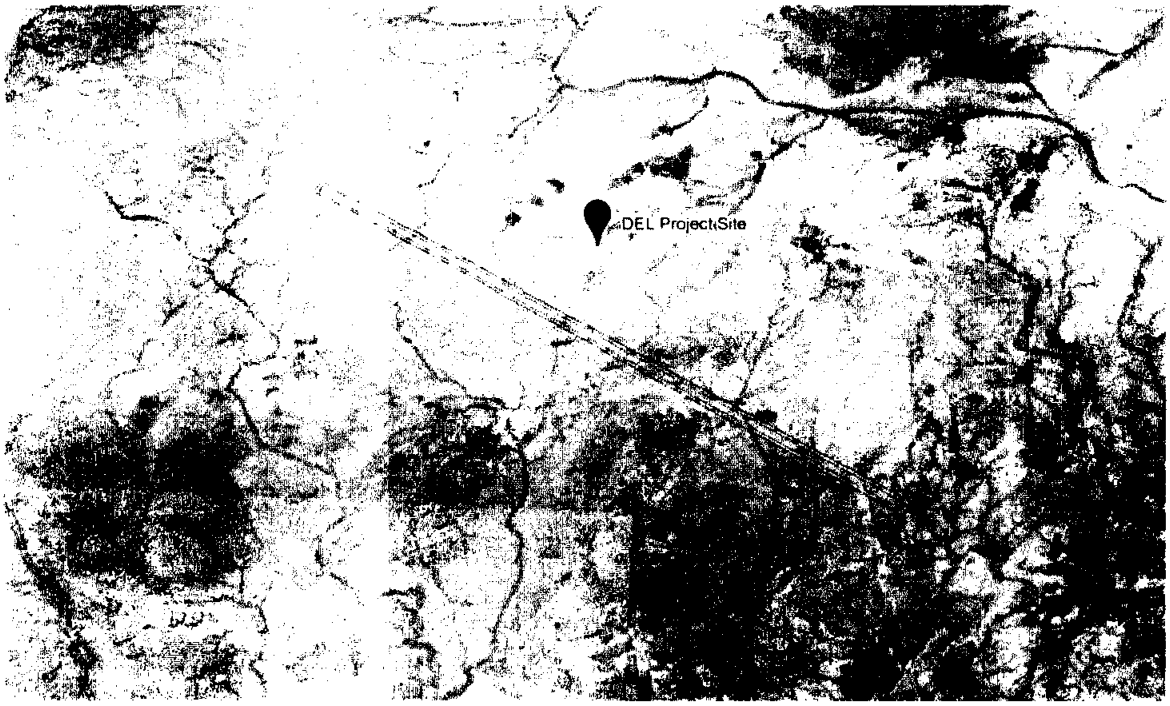


Figure 3: Overview of Din Energy Ltd Site

7.2 SITE DETAILS

The site is located in Jhimpir, Sindh which is towards the North East of Karachi as shown in Figure 4.

Figure 4: Din Energy Ltd Site Location

The electrical network within the vicinity of the site of the plant comprises of LV (11 kV) and HV (132 kV and 220 kV) lines.

Hyderabad Electrical Supply Company 132/11 kV grid station is DISCO in Jhimpir. Nearest Grid is New Jhimpir Grid. The distance of the grid station from the Project site is approximately 20 kilometers.

A separate electrical and grid interconnection study will be conducted for the project including Power Quality, Load Flow, Short Circuit and Power Evacuation.

The site is nearly flat with the surroundings having same characteristics.

7.3 TRANSPORTATION AND ACCESS NETWORK

A Transportation and Access Study has been carried out and is attached as Annex II.

The major section of track from Karachi to the site is via the National and Super high-way. The track is a multi-lane road. It has a flat terrain, and long and heavy vehicles can easily navigate through this road. However, access to the site is not suitable for heavy transport for a minor segment of the track, hence requires track maintenance from M-9 Super high-way turning point up until the Project site.

There are many neighboring wind farms in the surrounding area of Thatta. The site is located in Jhimpir, Sindh that is towards the East of Karachi and within the same corridor as many other wind power projects.

The Bin Qasim port, which is one of the major ports of Pakistan, is the point of delivery of equipment for the proposed wind power project. The details are given in Annex II.

7.4 CLIMATIC CONDITIONS

The climate of the southern parts of Sindh is characterized by fluctuating temperatures and sparse rainfall. The summers are hot and humid with average temperature ranging between 33°C to 40°C. The temperature in summers may reach up to 50°C. The winters are pleasant with average temperature in the range of 15°C to 25°C. The months of July and August generally observe the annual monsoon rainfalls. The climate information of Karachi, which lies near to the site, is shown in table below:

Table 7-1: Maximum & Minimum Temperatures in Jhimpir Region[1]

S. No.	Month	Mean (°C)	Median (°C)	Min (°C)	Max (°C)	Std. Dev. (°C)
1	Jan	20.6	20	10.3	34.5	5.7
2	Feb	22.9	22.3	12.9	33.3	4.8
3	Mar	26.7	25.9	14.7	42.6	5
4	Apr	29.8	28.9	20.4	41.9	4.8
5	May	31.6	30.2	25.2	42.8	4.3
6	Jun	31.1	30.3	25.9	38.2	2.8
7	Jul	29.4	28.7	25.7	35.8	2.2
8	Aug	28.5	27.8	24.7	34.6	2.1
9	Sep	28.6	27.8	23.6	38.5	3.5
10	Oct	28.9	28.4	21.6	38.5	4
11	Nov	25.8	25	17.9	35.9	4.4
12	Dec	21.8	21.6	9.9	34.8	5.7

Table 7-2: Average Precipitation and Rainfall Days in Jhimpir Region[2]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
14mm	6mm	7mm	6mm	5mm	12mm	21mm	50mm	13mm	3mm	0mm	16mm
2	1	0	1	0	1	3	4	1	0	0	1

[1] Meteorological Department of Pakistan
[2] Meteorological Department of Pakistan

7.5 TELECOMMUNICATION

PTCL telephone service is not available but mobile carriers have coverage on the site area.

7.6 EARTHQUAKES

According to the seismic zoning map of Pakistan, the Jhimpir region falls in ZONE II-B with moderate to severe damage area probability. This has been separately covered in the Geo Technical Study and the Initial Environment Examination Report.

8 WIND RESOURCE ASSESSMENT AND ENERGY YIELD ESTIMATES

The detailed wind resource assessment report and energy yield estimates have been prepared as Annex III and Annex IV of this document respectively. At present, these studies are not being submitted with this feasibility study to DAE, Energy Department, GoS as the Project plans to opt for the upfront tariff determined by NEPRA.

9 SELECTION OF WTG AND EPC CONTRACTOR

Din Energy Ltd is currently working on the selection of following WTG suppliers and EPC Contractors. The details of EPC Contractors and WTGs offered by them are as follows:

EPC Contractor	Turbinesoffering	Capacityof Turbine
DESCON	• General Electric GE 1.7-103 • Gold Wind GW 121-2.5	• 1.7 MW • 2.5 MW
Power China	• General Electric GE 1.7-103 • General Electric GE 2.75 • Gold Wind GW 121-2.5 • Gamesa G114-2.0 • Gamesa G114-2.5	• 1.7 MW • 2.75 MW • 2.5 MW • 2.0 MW • 2.5 MW
Nordex	• Nordex N131-3000	• 3.0 MW
Vestas	• Vestas V126-3.3	• 3.3 MW

Turnkey EPC proposals have been invited through a bidding process, which will be evaluated on merit and then initial meetings shall take place with all bidders. Following this, detailed negotiations will be done with the two better prospective options to make a final selection.

The main aspects to select the WTG and EPC Contractor are as follows:

a) The quality of WTG and Type Certification according to site suitability
b) The quality and certifications of EBOP equipment
c) The ultimate energy yield potential at P90 for the Project
d) The total EPC cost and resultant tariff / IRR
e) Technical guarantees, warrantees and obligations
f) Time for Completion
g) The commercial and legal terms of the EPC package

At the moment, the entire feasibility is based on all WTGs mentioned in this section. The Project plans to make a final selection of the WTG and EPC Contractor by the time the stage for Generation License and Tariff of the Project is reached.

10 GEOLOGICAL CONDITIONS

In order to collect detailed regional geological information, Din Energy Ltd hired professional services of Soil Testing Services–Pakistan Alternative Engineering Services (Pvt.) Ltd: a Pakistani local prospecting agency to conduct field exploration and drilling of (06) bore holes on the Site during February, 2016. The average drilling depth is 20 m. The complete Geotechnical Investigation Report is report is attached as Annex-V.

10.1 OBJECTIVES OF GEOTECHNICAL STUDIES

- To execute 06 boreholes, at the site of each proposed turbine location, 20m in depth.
- To execute field and laboratory geotechnical testing.
- To investigate the surface and sub-surface soil condition, to evaluate foundation design parameters.
- To provide shallow and deep foundation recommendations.

10.2 GEOLOGY OF KARACHI REGION AND SURROUNDINGS

Geologically Karachi trough is located on the southern extension of the Kirther folded structures. It carries marine terrigenous and calcareous terrigenous Oligocene and Neogene sediments. Geological structure map of Karachi is shown in figure above.

The folds in the Palaeogene and Mesozoic sediments are overlain by the Oligocene-Neogene sediments of Karachi embayment.

The Karachi trough is delineated by the north-trending severely deformed mountain ranges namely Mor Range, Pab Range and Belaophiolite/mélange zone to the west. It is surrounded by Kirther Range to the north and to the east, and by the Indus delta and the Arabian Sea Creeks to the south-east and south. In the south, the Karachi structural embayment opens to the Arabian Sea. The trough is somewhat an asymmetrical Synclinorium.

The eastern limb of this trough is wider and comparatively greater than the western limb. The prominent strikes of the folds of the trough are sub-meridional north-south changing into southwestern direction in the south. The trough may be sub-divided into three principal regions named below:

- Northern Relatively Uplifted Region
- Southern Sub Merged Region
- Western Monocline

The tectonic map of Pakistan, Geological and Sub Surface details of Jhimpir are shown in ***Figure 8 & Figure 9***:

Figure 5: Tectonic Map of Pakistan

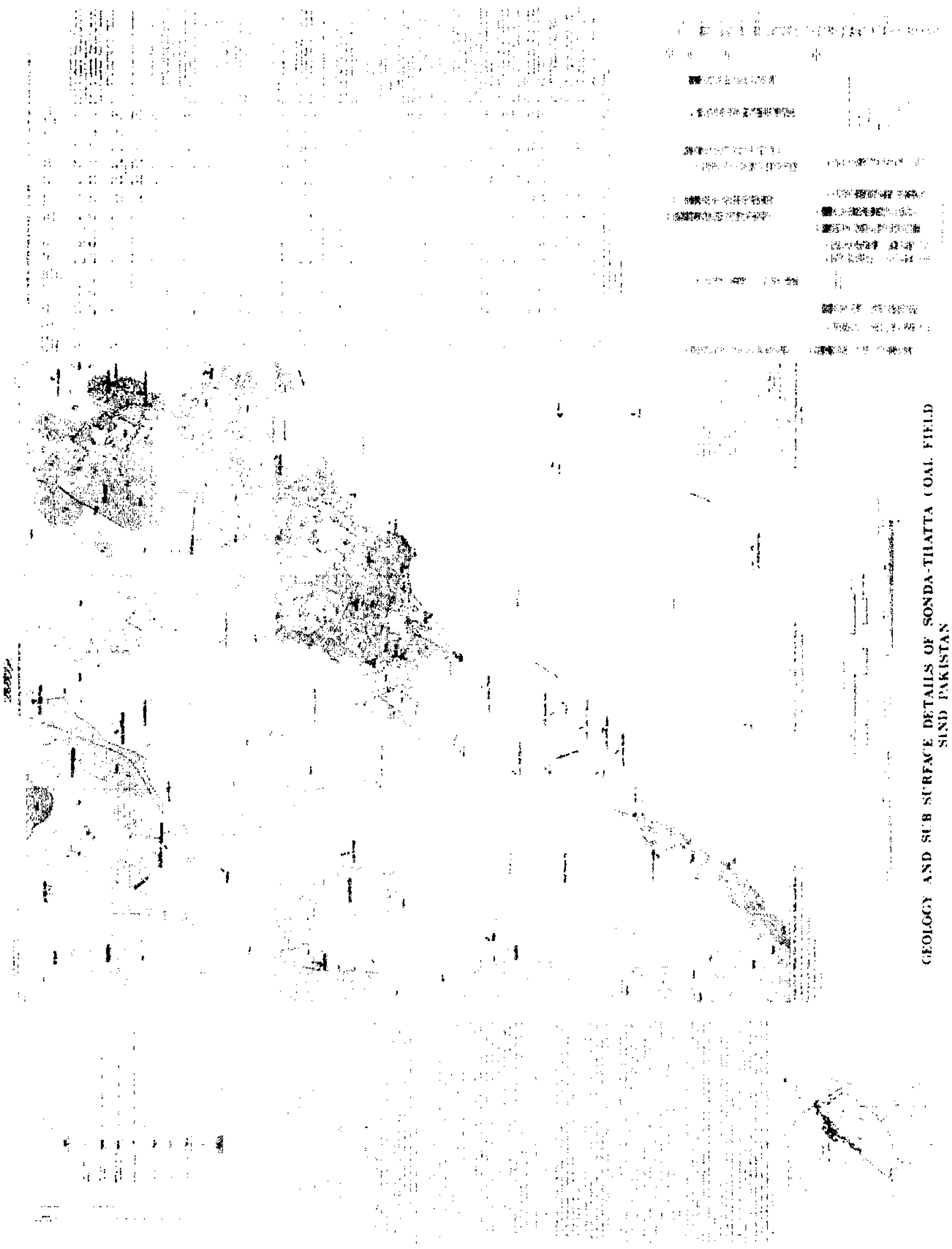


Figure 6: Geological and Sub Surface details of Jhimpir

10.3 SEISMOLOGY OF KARACHI REGION

The region is surrounded by some active fault lines; namely Pab Fault, Ornach Nal Fault and Runn of Kuch Fault. The history of earthquakes in Karachi is given in table below:

Table 10-1: **Earthquake Records around Karachi**

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1962	24.70	66.00	0	4.50	——	Karachi
1965	25.03	66.76	40	4.50	——	Karachi
1966	25.00	68.00	——	5.00	VI - VII	Jhimpir
1968	24.61	66.42	19	4.10	——	Karachi
1970	25.28	66.65	33	4.90	V	Karachi
1971	25.00	68.00	——	4.50	V	Jhimpir
1972	25.35	66.71	33	4.50	V	Karachi
1973	25.00	68.00	——	5.00	VI	Jhimpir
1973	25.48	66.33	57	4.90	V	Karachi
1975	25.50	66.80	——	4.50	V	Gadani
1975	25.22	66.59	33	4.70	V	Karachi
1976	24.96	70.38	14	4.70	V	Karachi
1984	25.86	66.41	33	5.00	VI	Karachi
1985	24.90	67.39	33	5.00	VI	Karachi
1986	25.34	66.60	33	4.60	V	Karachi
1992	25.25	67.76	33	3.60	IV	Karachi
1996	25.06	66.76	33	——	——	Karachi
1998	25.69	66.46	33	4.40	V	Karachi
1998	24.85	66.35	33	4.50	V	Karachi

The seismic parameters of Karachi region are given in the table below along with the map in *Figure 10*:

Table 10-2: Seismic Parameters of Karachi

Seismic Parameters	Value
UBC Zone	2B
Max Peak Ground Acceleration	16% - 20% of 'g' (g = 9.8 m/s^2)
Seismic Hazard	Upper Moderate
Magnitude (Richter Scale)	5.5 to 6.5
Intensity (MM Scale)	VI – VII

Figure 7: Seismic Map of Pakistan

10.4 FIELD WORK

10.4.1 Borehole Drilling

The drilling and sampling work has been performed using the standards, procedures and equipment's recommended for engineering site investigation. All borings were advanced through soil between sampling intervals by rotary wash methods, using rotary drilling machines of hydraulic feed. These machines are most suitable to the site conditions with all accessories for extending the bore to required depths, taking samples and performing the necessary onsite tests. Minimum drilling fluid consisting of water bentonite slurry was used for flushing out the cutting to provide a positive head and to maintain stability of the drilled hole. The boreholes were also stabilized using casing with a nominal diameter of 130mm. A drag bit was used to advance the boring. Observations during drilling such as change of strata, texture, color and drilling difficulties were noted. The soil layers encountered in the borehole were visually classified and were later upgraded as per laboratory test results. Few samples were obtained from split spoon sampler after performing standard penetration test (SPT). A number of core samples were preserved. The samples were cleaned, labeled and put in especially made core-boxes for onward transmission to the laboratory for testing. Special care was taken during handling and transportation of samples.

10.4.2 Rock Core Drilling

Rock core drilling relates to the procedure in which underlying rock is investigated by coring so as to obtain samples for classification, to determine the quality of rock, and to check for possible detrimental properties such as cracks, fissures and weathering or other deterioration that could affect the strength of the formation. To obtain rock core samples, NX diameter core barrels with special bits were used. Under rotary action, the core bit advances into the rock. A circulating supply of water was provided in the cutting edge to help flush rock cuttings and dissipate heat. "Core Runs" were made to drill the hole in segments. At the completion of a core run, the barrel and rock sample were brought to the surface, the depth of recovery was properly recorded for further evaluation in the laboratory. Based on the length of the rock core recovered from each run, core recovery (C.R.) and rock quality designation (RQD) were calculated for a general evaluation of rock quality encountered. Suitable core samples were preserved for shear strength characteristics.

10.4.3 List of Field and Lab Tests

Geotechnical laboratory testing was carried out on retrieved disturbed soil samples. The following are the relevant tests carried out on selected samples as required for determining the subsurface conditions and correlating with the information obtained from field testing and sampling:

- Grain Size Analysis
- Liquid and Plastic limits
- Natural Moisture Contents
- Density
- Specific Gravity
- Direct Shear Test
- Unconfined Compressive Strength of Rocks
- Chemical Test

10.5 CONCLUSIONS OF GEOTECHNICAL STUDIES

The Geo technical Investigation for Din Energy Ltd Wind Power Project in Jhimpir, Sindh was carried out in Feb, 2016. Scope of work included drilling of (06) bore holes up to 20 meters depth. Soil ERS was also conducted at 06 location across the site. Soil and rock samples were also collected during the field investigation. Laboratory testing of the soil and rock samples has been carried out in STS lab which includes natural moisture content, specific gravity, water absorption, density, unconfined compressive strength etc. Chemical characteristics of the soil and ground water samples have also been assessed through determination of total dissolved solids, sulphate content, chloride content and pH. Keeping in view, the results from field, and laboratory tests and the expected loads being transferred to the founding stratum, allowable bearing pressures for shallow foundations at depth of 1.5meters. Exposure to chloride and sulphate salts is 'negligible' for soil; therefore, Ordinary Portland Cement (OPC) should be used for underground concreting.

11 CIVIL ENGINEERING DESIGN

The civil engineering design mainly includes following structures:

- Foundation of WTG Towers
- Foundation of substation and grid interconnection apparatus, i.e. transformer, switchgear.
- Construction of permanent buildings (residence and offices) of O&M staff.

The design activity of the civil works shall be carried out as part of the EPC contract during early phase of construction. However, the geo technical risk shall lie under contractor's responsibility as per the terms of the EPC Contract.

12 ELECTRICAL ENGINEERING DESIGN

The basic electrical design of the wind farm is discussed in this chapter. The overall electrical system has been designed considering the data from HESCO/NTDC and requirements of the grid code addendum for wind energy approved by NEPRA. As part of the grid interconnection study (**attached as Annex VI**), complete modeling of the wind farm has been performed. Load Flow Studies, Short Circuit Analysis, and Transient Stability Analysis along with the Power Quality Analysis have also been performed on the existing and future planned HESCO/NTDC network as part of the report.

The dispatch voltage shall be 132 kV. There will be a two-stage step voltage, one step up to MV level at each WTG level through individual GSUs, and the other at the substation. The MV level shall be at either 22 kV or 33 kV. The Wind Farm shall have two 132 kV outgoing lines to keep the N-1 grid connectivity criteria. The termination points of the lines on the two remote ends have been identified, which will be firmed up during the construction phase by NTDC considering the network scenario at that time. The protection and telecommunication scheme will be accordingly finalized at that time.

The Wind Farm shall be divided into collector groups, each having approx. five (05) WTGs. Every WTG shall be equipped with own step-up transformer and shall be connected with the successive WTG by means of Ring Main Units (RMU) and vacuum breaker in configuration in/out. The connection of the RMUs to the main MV Switchgear shall be achieved by underground XLPE insulated single core aluminum conductor. The MV Switch gear shall have two bus sections with bus-coupler device, each feeding half of the WTG groups. It will also feed auxiliary transformer and capacitor bank to meet the power factor requirements of the national grid code (0.95 lagging).

The 132 kV substation shall consist of two bus sections of a single bus bar with a coupler and two breaker bays to connect main transformers with the 132 kV double circuit overhead lines (OHL). The Main Transformers shall meet the N-1 grid code criteria and thus may be two (02) in number (31.5/40/50 MVA each). The instrumentation transformers (CTs, VTs and CVTs) for all purposes shall be sized according to requirement. The 132 kV OHLs from the Wind farm substation to the 132 kV to far end connection points (whether adjacent grid stations or neighboring project substations) are out of the scope of the contractor and shall be installed and connected by NTDC. The HV/MV switchgear, main power transformer and other protection equipment shall be of reputable manufacturers, confirming to the requirements to be spelled in detail in the EPC Contract and in the EPA. Further, the detailed electrical design will be subject to approval of both Din Energy and NTDC as per the requirements of EPC Contract and EPA.

In this regard, the concept mentioned in this section serves as guidelines and firm design will be prepared during construction phase, which may be somewhat different from predicted here.

CONSTRUCTION MANAGEMENT

Like all wind power projects in Pakistan, the structure of EPC contract is on a "turnkey" basis. Everything shall be managed from one platform (one window) of the EPC contractor. The partners of EPC contractor shall be underneath that platform through "subcontracting" or "joint and several arrangements". In this way, the role of Din Energy Ltd shall become to supervise and monitor everything.

Din Energy Ltd personnel will supervise construction activities right from the beginning. Din Energy Ltd team will monitor the construction schedule, owner's engineers and the EPC contractor to complete the project within given time frame and in-line with HSE guidelines.

Din Energy Ltd requires careful management for construction. To achieve this, Din Energy Ltd will prepare a Construction Management Master Plan taking into account all relevant aspects. The master plan shall be regularly reviewed, updated and shared with all project stakeholders.

Construction Management Plan depends on the nature of work, likelihood of disruptions, impact on local amenity, dangers or risks involved and any other relevant issue required to be addressed under the planning permit.

In order to manage all the above operations correctly, Din Energy Ltd shall have a consultant as a "Construction Supervisor" who shall supervise the quality and progress of all contractors and give approvals of the milestones.

The project construction shall take 18 months from the date of planning till the COD. The activity structure and timelines are given in table below:

Table 13-1: Project Construction Scheduling

Activity / Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Engineering and Mobilization																		
Construction of Temporary Establishment																		
Civil Works of WTGs and Substation																		
Construction of Substation																		
Supply of WTGs and Towers																		
Cables and Interconnection																		
Erection and Installation																		
Testing and Commissioning of EBOP																		
Testing and Commissioning of WTGs																		
EPA Tests and Reliability Run Test																		

14 Initial Environment Examination (IEE)

The Initial Environment Examination (IEE) has been carried out as per the Pakistan Environmental Protection Act, 1997, according to the requirements of Environmental Protection Agency, Government of Sindh and has already been submitted. **The report is attached as Annex VII.**

A data collection survey, which included geology, meteorology, hydrology, ambient air quality, water quality, soil characteristics, noise levels, shadow forecasting, flora and fauna, land use pattern and socioeconomic conditions, was undertaken based on the available secondary information or through data collected in the field. The primary data was collected to establish baseline conditions for the soil, water (surface and ground) quality, flora and fauna, and noise. The secondary data was collected for land, ecology, climate, and socioeconomic factors.

According to the study conducted, the prime benefit of the Project will be the replacement of conventional power generation with renewable energy. Wind energy will replace fossil fuel powered generation, and therefore reduce suspended particulate matter and greenhouse gas emissions into the atmosphere.

The impacts are manageable and can be managed cost effectively - environmental impacts are likely to result from the proposed power project. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this stage and are taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites, or through the careful selection of sites and access routes. Since proposed land is covered with shrubs, thus there is no need for removal of any significant vegetation for the construction of the wind power Project.

The proposed Project will have a number of positive impacts and negligible negative impacts to the existing environment as follows:

- Significant improvement in economic activities in the surrounding areas due to generation of direct and indirect employment opportunities.
- There is negligible removal of trees for the Project, which is the main positive impact to the proposed Project area.
- Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, nuisance from dust, noise, vehicle fumes, black smoke, vibration are the short term negative impacts due to proposed Project with mitigations being properly taken care.

Proper GRM will have to be implemented by Din Energy Ltd to overcome the public inconvenience during the proposed Project activities.

Based on the environmental and social assessment and surveys conducted for the Project, the potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified in the EMP. Adequate provisions are being made by Din Energy Ltd to cover the environmental mitigation and monitoring requirements, and their associated costs.

An environment and social analysis has been carried out looking at various criteria such as topology, air, noise, water resources and water quality, ecology, demography of the area, climate and natural habitat, community and employee health and safety etc. The impact analysis, found that due to careful consideration of environmental and social aspects during route and site selection by Din Energy Ltd, no major adverse impacts are expected. There is no adverse impact of migration on the habitat, any natural existing land resources and there is no effect on the regular life of people

The environment and social impact associated with the project is limited to the extent of construction phase and can be mitigated through a set of recommended measures and adequate provision for environment and social impacts which cover monitoring, measuring and mitigation.

Most of the impacts are expected to occur during the construction phase and are considered to be of a temporary nature. The transmission corridor will be carefully selected after undergoing an options assessment. This enabled the right of way alignment to bypass villages and important water supplies and resources. The main project impacts are associated with clearing of shrub vegetation, waste management and excavation and movement of soils.

From this perspective, the project is expected to have a lesser "environmental footprint". No endangered or protected species of flora or fauna are reported near the project sites.

The stakeholder from the Government and Non-Government sector has also appreciated the project activities, raised concerns related to the social and environment areas which shall be addressed through effective planning and management.

Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts, along with their associated costs. Adverse impacts if noticed during implementation will be mitigated using appropriate design and management measures. Mitigation measures related to Construction, as specified in the EMP, will be incorporated into civil works contracts, and their implementation will be primarily the responsibility of the contractors. Hence, the proposed project has limited adverse environmental and social impacts, which can be mitigated following the EMP & shall be pollution free Renewable source of Power generation with low Environmental foot prints.

Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts, along with their associated costs. Adverse impacts if noticed during implementation will be mitigated using appropriate design and management measures. The potential cumulative and residual impacts of the project as a whole indicate that the project is classified as a category "B", in accordance with ADB's Safeguards Policy Statement 2009. The project is not considered highly sensitive or complex. The mitigation measures related to construction, as specified in the EMP, will be incorporated into civil works contracts, and their implementation will be primarily the responsibility of the contractors. Hence, the proposed project has limited adverse environmental and social impact, which can be mitigated following the EMP and shall be a pollution free renewable source of power generation with small environmental foot prints.

In view of the aforementioned details, it is concluded that development of the 50 MW wind power project by Din Energy Ltd will have no adverse environmental impact and the project can be regarded as an Environmental Friendly Green Project.

15 CONCLUSIONS OF FEASIBILITY STUDY

The detailed feasibility of the project has been conducted which covers all aspects required for developing the Project.

The wind climate observed on the site indicates advantageous annual average wind speed. Thus the annual energy estimates are also favourable and it is feasible to develop the project based on General Electric GE 1.7-103 (1.7 MW), Gold Wind 121-2.5 (2.5 MW), General Electric GE 2.75 (2.75 MW), Gamesa G114-2.0 (2.0 MW), Gamesa G114-2.5 (2.5 MW), Nordex N131-3000 (3.0 MW), Vestas V126-3.3 (3.3 MW) turbines. The IRR of the Project as currently being assessed is suitable.

The project site is feasible for the wind farm with easy access for the transportation of equipment. The climatic conditions at the project site are moderate and there is no significant impact of seismic hazards foreseen in the area. The telecommunication and transportation facilities are adequate.

The Project shall not have negative environmental impact during its life cycle. Instead, the project will bring positive development and improve the socio-economic conditions of the area through generation of employment opportunities and contribute in environmental sustainability of the area.

All WTGs considered in the study are worthy for the project. However, the negotiations of the EPC contract and price shall play a vital role in the final selection.

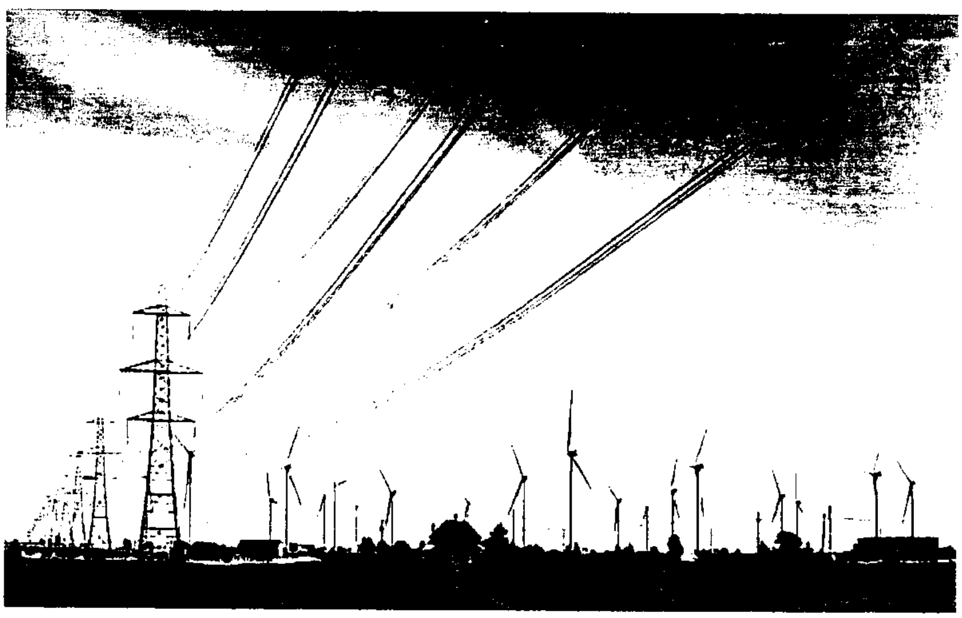
The project site is conveniently located close to the grid of HESCO and NTDC. However, the remaining Grid Interconnection study will tell exactly which grid is to be selected for the connection.

From here onwards, the project may enter into getting licenses and permits and into negotiation of security documents. The next steps after approval of feasibility study would be to apply for the Generation License and Tariff, and to begin negotiations for EPA and IA. The Project may also enter into discussions with lenders at some stage.

It is expected that the Project will achieve financial close by 4th quarter of year 2016 and construction will be completed by 2nd quarter of year 2018. It is anticipated that the Din Energy Ltd Project would be a valuable addition to the National Grid for generating electricity and contributing to overcome the current energy crisis of Pakistan.

National Transmission and Despatch Company Limited (NTDCL)

Grid Interconnection Study for Evacuation of Power from 50 MW DIN Energy Wind Power Project to the National Grid



Planning (Power) Department
4th Floor, PIA Tower, Egerton Road, Lahore.

May 2016

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Appendices

Executive Summary

1. Ministry of Water and Power in association with AEDB, Energy Department, Government of Sindh, in April 2016, decided to allocate the 500 MW wind power capacity vacated by M/s NBT Wind Power Pakistan-II & III to the 10 Wind Power Projects (WPPs) of approx. 50 MW each at Jhimpir. District Thatta, Sindh. The 10 WPPs comprise of ACT-2, Gul Ahmad Electric, Shaheen Foundation, Din Energy, Zulaikha Energy, Artistic, Harvey (Cacho), Norinco, Western Energy and Trans Atlantic. These 10 WPPs are in addition to the already planned/under construction WPPs in Jhimpir and Gharo clusters. Afterwards, the list of the selected 10 WPPs was communicated to CPPA-G and NTDCL for information and further action at their ends.

2. The sponsor of DIN Energy WPP, i.e., M/s DIN Energy Limited, has engaged Planning Power department of NTDCL to carry out interconnection studies and to propose interconnection scheme for its power evacuation to the National Grid.

3. The project sponsor of DIN Energy WPP, as per requirements of NTDCL Planning Power, provided the project site location/coordinates, and other necessary technical data/information of DIN Energy WPP, i.e., No., generation capacity, voltage, p.f. & type of WTGs, collector group configuration, gross & net output capacity of the plant, No. & rating of transformers, switchyard voltage levels, single line diagram & equipment rating etc.

4. As per information provided by the project sponsor, DIN Energy WPP comprises of 25 No. WTGs and each WTG is of Gamesa make, Type-3 with 2 MW gross capacity. The total gross generation capacity of DIN Energy WPP is 50 MW and total net capacity that will flow to the grid, after subtracting project losses/auxiliary consumption, is 47.9 MW.

5. This is the interconnection study report which has been prepared only to propose interconnection scheme for power evacuation from DIN Energy WPP in integration with other WPPs in its vicinity. In this report, he results of load flow, short circuit, transient stability and power quality studies have been

presented with the proposed interconnection scheme for evacuation of power from DIN Energy WPP to the National Grid in the light of NEPRA Grid Code.

6. Considering the capacity, locations, existing/planned system network in the area, the following integrated interconnection scheme of the 7 WPPs lying in southern part of Jhimpir including ACT-2, Gul Ahmad Electric, Trans Atlantic, Zulaikha Energy, Artistic, Cacho and Din Energy, has been proposed for their reliable power evacuation to the grid:

   i) A new 220/132 kV Jhimpir-2 substation 3x250 MVA, 220/132 kV transformers.

   ii) 220 kV double circuit (D/C) transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA D/C transmission line at Jhimpir-2.

   iii) 220 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir New (Jhimpir-1) – Gharo New D/C transmission line at Jhimpir-2.

   iv) 132 kV D/C transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including DIN Energy WPP with Jhimpir-2. In this scheme, the interconnection of DIN Energy WPP includes 132 kV D/C transmission line, approx. 2 km long, on twin-bundled Greeley conductor for looping In/Out from DIN Energy WPP on the 132 kV single circuit from Zulaikha-E WPP to Trans Atlantic WPP.

7. The integrated scheme for the remaining 3 WPPs lying in northern part of Jhimpir including Shaheen Foundation, Norinco, and Western Energy, has been proposed with power evacuation from the under-construction Jhimpir-1 220/132kV grid station, through network reinforcement.

8. The above proposed interconnection scheme is assumed to be completed in Dec. 2019. It is added that the expected timeline of the proposed interconnection scheme may be extended depending on variation of completion

of the related activities, i.e., preparation and approval of PC-1, funding arrangement, tendering process, contract award, land acquisition, ROW availability and construction etc.

9. Detailed load flow studies have been carried out for various operating scenarios with maximum dispatch from all the existing/under-construction/planned WPPs in Jhimpir and Gharo clusters to evaluate the adequacy of the above proposed interconnection schemes of the 10 WPPs including DIN Energy WPP for their reliable power evacuation to the grid.

10. The proposed interconnection scheme for DIN Energy WPP has been found adequate after performing the load flow studies to assess the steady state system performance under normal and N-1 contingency conditions. The voltage profile, line loading, frequency and active/reactive power flow etc. from the DIN Energy WPP and on the grid are within the NEPRA Grid Code criteria. It has been found on the basis of the study results that the power from DIN Energy WPP can be dispersed to the National Grid in a reliable manner during normal and N-1 contingency conditions without any constraints.

11. The short circuit studies have been carried out with proposed interconnection of DIN Energy WPP to compute the maximum three phase and single phase short circuit levels at the 132 kV switchyard of DIN Energy WPP and other substations in its vicinity. The minimum three phase and single phase short circuit levels have also been carried out at the 132 kV switchyard of DIN Energy WPP for various number of WTGs in operation and reduced generation in its vicinity. It is found that the induction of DIN Energy WPP with the proposed interconnection scheme has no adverse impact on the existing and proposed substations in its vicinity.

12. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of DIN Energy WPP are 11.05 kA and 7.93 kA respectively in the year 2021-22 but these are expected to rise due to future grid system expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding

areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of DIN Energy WPP.

13. Transient stability analysis has been carried out for DIN Energy WPP with the proposed interconnection scheme. The stability of the DIN Energy WPP and the power system has been checked with application of different disturbances on the wind farm and at the substations in its vicinity. It has been found that the DIN Energy WPP and the power system remain stable with no adverse effects after subjected to faults as per Grid Code requirement.

14. The LVRT requirements for DIN Energy WPP have been tested against contingency conditions of 100ms (5 cycles) under normal clearing time and 180ms (9 cycles) for delayed fault clearing. The stability simulations have proved that DIN Energy WPP fulfills the LVRT criteria as mentioned in the NEPRA's Grid Code Addendum for WPPs.

15. The impact of induction of DIN Energy WPP on power quality has also been analyzed. The study results indicate that the power quality indices including flicker and voltage unbalance, remain within the permissible limits as mentioned in the IEC and other international standards. It is clearly mentioned that it is the responsibility of developer of the Trans Atlantic WPP to install the plant and necessary compensating equipment at its switchyard on the basis of detailed design/field testing studies to meet the power quality standards as per requirements of NEPRA Grid Code Addendum for WPPs.

16. It is added that the Grid Code Addendum for WPPs is currently under revision and the project sponsor of DIN Energy WPP will be required to follow/implement the requirements/recommendations given in the revised Grid Code, after its approval from NEPRA and make necessary modifications in the equipment/substation of DIN Energy WPP, if necessary, in this regard.

17. It is concluded on the basis of the results of the detailed system studies that the proposed interconnection scheme has no transmission system constraints in power evacuation from DIN Energy WPP to the National Grid.

1 Introduction

There is huge potential of wind power at Jhimpir, Gharo and in their surrounding areas in Southern Part of Pakistan. At present, about 308 MW of Wind Power Projects (WPPs) in operation, whereas, some WPPs are in testing/commission phase and many other WPPs are at different stages of implementation. In 2013, a PC-1 was prepared to propose evacuation scheme of 1756 MW of WPPs, located at Jhimpir, Gharo and near Jamshoro, to the National Grid. Out this wind capacity, a total of 500 MW WPPs located near Jamshoro was planned to be inducted by two companies, i.e., 250 MW each by M/s NBT Wind Power Pakistan-II (Pvt.) Ltd. and NBT Wind Power Pakistan-III (Pvt.) Ltd. The LOIs of these two WPPs were cancelled later due to non-achievement of the required milestones.

Ministry of Water and Power in association with AEDB, Energy Department, Government of Sindh, in April 2016, decided to allocate the 500 MW wind power capacity vacated by M/s NBT Wind Power Pakistan-II & III to the 10 Wind Power Projects (WPPs) of approx. 50 MW each at Jhimpir, district Thatta, Sindh.

The 10 WPPs comprise of Trans Atlantic, ACT-2, Gul Ahmad Electric, Shaheen Foundation, Zulaikha Energy, Artistic, Harvey (Cacho), Norinco, Western Energy and Din Energy. These 10 WPPs are in addition to the already planned/under construction WPPs in Jhimpir and Gharo clusters. Afterwards, the list of the 10 WPPs was communicated to NTDCL through CPPA-G Ltd. for their information and further action at their ends.

The sponsor of DIN Energy WPP, i.e., M/s DIN Energy Limited, has engaged NTDCL to carry out interconnection studies and to propose interconnection scheme for its power evacuation to the National Grid.

The site location/coordinates and other necessary technical data/information of the DIN Energy WPP, i.e., number, generation capacity, voltage, p.f. & type of WTGs; collector group configuration; gross & net output capacity of the plant; number &

rating of transformers; single line diagram; switchyard voltage levels & equipment rating etc., have been provided by its sponsor and is attached in Appendix-1.

As per information provided by the project sponsor, DIN Energy WPP comprises of 25 No. WTGs and each WTG is of Gamesa make, Type-3 with 2 MW gross capacity. The total gross generation capacity of DIN Energy WPP is 50 MW and total net capacity that will flow to the grid, after subtracting project losses/auxiliary consumption, is 47.9 MW.

This is the interconnection study report which has been prepared only to propose interconnection scheme for power evacuation from DIN Energy WPP in integration with other WPPs in its vicinity. In this report, the results of load flow, short circuit, transient stability and power quality studies have been presented with the proposed interconnection scheme for evacuation of power from DIN Energy WPP to the National Grid in the light of NEPRA Grid Code.

2 Technical Data of DIN Energy WPP

The project sponsor has provided the location/site coordinates, micro-siting arrangements of WTGs, proposed sketch of the WPP and detailed technical data/parameters of WTG and switchyard equipment etc. for DIN Energy WPP which is attached in Appendix-1. The salient parameters of DIN Energy WPP are given as under:

a) **WTG Generator Data**:

- Number of WTGs = 25
- Manufacturer/Model = Gamesa G114-2 / II-A
- Gross capacity = 2.0 MW
- Type = 3
- Voltage = 0.69 kV
- Power factor = 0.95 (Lagging/Leading)

b) **WTG Arrangement in Wind Farm**

- No. of collector groups = 4
- No. of WTGs in one collector group = 3 x 6 WTGs + 1 x 7WTGs
- Length of each collector group with the switchyard = 3 km

c) **Total Wind Farm Capacity:**

- Total gross capacity= 50 MW
- EBOP Losses = 1.5 MW
- Auxiliary Consumption = 0.6 MW
- Total net output capacity that will flow to the Grid = 47.9 MW

d) **Generator Step-up Transformer Data:**

- No. of step-up transformers = 25
- Voltage ratio = 0.69/22 kV

- MVA rating = 2.35 MVA
- Percentage Impedance = 10.5%

e) Proposed Switchyard of Wind Power Project:

- High Voltage (HV) Level = 132 kV
- Medium Voltage (MV) Level = 22 kV
- Bus Bar Scheme = Double bus single breaker
- Bus Bar capacity = 2500 Amp.
- Power (HV/MV) transformer:
  - No. of transformers = 2
  - Voltage ratio = 132/22 kV
  - MVA rating = 31.5/40/50 MVA
  - Percentage Impedance = 10-12%
- Switchgear data, single line diagram and layout of switchyard attached in Appendix-1.

f) Proposed Reactive Power Compensation

2x10 MVAR Capacitor bank or SVC (to be decided in detailed design stage)

The other technical data/information about switchyard equipment is attached in Appendix-1.

3 Study Objectives, Assumptions and Criteria

3.1 Study Objectives

The objectives of the interconnection study are given as under:

- To propose the transmission scheme for reliable dispersal of power from DIN Energy WPP to the National Grid under normal and N-1 contingency conditions.
- To evaluate adequacy of the proposed interconnection scheme and to assess the impact of DIN Energy WPP on the grid system and vice versa through load flow, short circuit, transient stability studies and power quality analyses.

3.2 Study Assumptions

The system studies are based on the following assumptions:

- Latest load forecast.
- Latest generation expansion plan.
- Latest transmission expansion plans of NTDC and DISCOs, especially HESCO.
- Export of power from NTDC to K-Electric is assumed as 650 MW.
- Interconnected transmission system has been assumed, however, split bus has been assumed at 132 kV bus bars of Hala Road and T.M. Khan Road 220/132 kV substations as per system requirements.
- The existing, under-construction and already planned WPPs at Jhimpir and Gharo clusters with their interconnection arrangements. The under-construction 220/132 kV substations, i.e., Jhimpir New (Jhimpir-1) and Gharo New, with their allied transmission lines are assumed to be commissioned.
- As per information provided by project sponsor, the total gross & net capacity of DIN Energy WPP have been assumed as 50 MW & 47.9 MW respectively. The modeling of DIN Energy WPP in PSS/E software has been made as under:

- There are a total number of 25 WTGs and four collector groups in the wind farm with each WTG having gross capacity of 2 MW and generating pow at 0.69 kV which has been stepped up to 22 kV through 2.35 M transformer.
- Out of four collector groups, three collector groups comprising of 6 WTGs have been modeled with 2x6=12 MW capacity each and equivalent 0.69/22 kV transformers and one collector group comprising of 7 WTGs has been modeled with 2x7=14 MW capacity and equivalent 0.69/22 kV transformer.
- Each of the four collector groups have been connected through individual 22 kV cables with 22 kV bus bar of the 132/22 kV substation.
- The 20 MVAR switched capacitor has been assumed in the studies and modeled at 22 kV bus bar.
- At 132/22 kV substation, 2 No. 132/22 kV transformers have been modeled separately. The percentage impedance of 132/22 kV transformer has been assumed as 12%.

- Other WPPs in the vicinity of DIN Energy have also been modeled according to their own WTG capacities and collector group configurations.
- This interconnection study report is based on the information supplied by M/s DIN Energy Limited and NTDCL is not responsible for the study results on account of any deficiency and/or inaccuracy of the supplied information.

3.3 Study Criteria

The interconnection studies have been carried out keeping in view of the following system operating criteria/limits in accordance with NEPRA Grid Code:

Voltage Limits	±5% under normal and ±10% under contingency conditions. However, voltages at some generation buses and some substations may be kept upto +8% under normal operating conditions

	as per network configuration and/or system requirements.
Transmission Line Loading Limits	80% under normal and 100% under N-1 contingency conditions.
Transformer Loading Limits	80% under normal and 110% under N-1 contingency conditions.
Frequency Limits	49.8 – 50.2 Hz under normal condition and 49.4 – 50.5 Hz under N-1 condition.
Stability Criteria	System stability must be maintained after subjected to the following disturbances • 3-phase fault at bus bar cleared in 5-cycles/ 100 ms (normal clearing condition) and tripping of the associated circuit. • 3-phase fault at bus bar cleared in 9 cycles/180 ms (delayed clearing or stuck breaker condition) and tripping of the associated circuit.
Low Voltage Ride Through (LVRT) Requirements	• A wind power plant must withstand a voltage dip down to 30% of retained voltage for a duration of at least 100 ms for a normal clearing case, and at least 180 ms in the case of stuck breaker contingency event. • The wind power plant shall manage active power restoration, after the voltage recovery, at a rate of at least 20% of nominal output power per second, subject to availability of adequate wind speed at site.

4 Proposed Interconnection Scheme

The following integrated interconnection scheme has been proposed for 7 WPPs lying in south of Jhimpir including ACT-2, Gul Ahmad Electric, Trans Atlantic, Zulaikha Energy, Artistic, Cacho and Din Energy, keeping in view their generation capacities, the location, the existing/planned system network in its vicinity, for reliable dispersal of power from 50 MW DIN Energy Limited WPP to the National Grid:

- A new 220/132 kV Jhimpir-2 substation 3x250 MVA, 220/132 kV transformers.
- 220 kV D/C transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA D/C transmission line at Jhimpir New-2.
- 220 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir-1 – Gharo New D/C transmission line at Jhimpir-2.
- 132 kV D/C transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including Din Energy WPP with Jhimpir-2.
- In the above proposed scheme, the interconnection of DIN Energy WPP includes 132 kV D/C transmission line, approx. 2 km long, on twin-bundled Greeley conductor for looping In/Out from DIN Energy WPP on the 132 kV single circuit from Zulaikha Energy WPP to Trans Atlantic WPP.

It is intimated that lengths of the above mentioned lines are approximate and will be finalized after route survey.

The geographical diagram showing above proposed interconnection scheme for power dispersal of DIN Energy WPP is attached as Figure #1 (Appendix-2). The google earth diagram indicating the locations/layout of the WPPs in Jhimpir area including DIN Energy WPP is also attached in Appendix-2.

5 Load Flow Studies

The detailed load flow studies have been carried out with the proposed interconnection scheme for various operating scenarios with maximum dispatch from all the existing/under-construction/planned WPPs in Jhimpir and Gharo clusters to evaluate the adequacy of the proposed interconnection scheme for Din Energy WPP for its reliable power evacuation to the National Grid. In this regard, system scenarios for peak load conditions in years 2019 and 2021 have been simulated to evaluate the adequacy of the proposed interconnection scheme and performance of Din Energy WPP on the system under normal and N-1 contingency conditions. In addition, the load flow studies have also been carried out for Off-peak load condition in 2019 to analyze the impact of the Din Energy WPP on the system.

It is to be noted that all the load flow study Exhibits referred in the following sections are attached in Appendix-3. The results of the load flow studies for dispersal of power from Din Energy WPP to the National Grid are described as under:

5.1 Peak Load 2019 Scenario

Load flow study for the peak load condition in 2019 under normal system condition has been carried out with net output of 47.7 MW from Din Energy WPP and is attached as Exhibit #1.0 & 1.0A. As per load flow study, the power flows on the transmission lines/transformers at/around Din Energy WPP and on the surrounding southern network are given as under:

Transmission Line/Transformers	Power Flow (MW)
Din Energy WPP – Zulaikha Energy WPP 132 kV S/C	156.5
Trans Atlantic WPP – Din Energy WPP 132 kV S/C	108.8
ACT 2 WPP – Trans Atlantic WPP 132 kV S/C	62.9

Transmission Line/Transformers	Power Flow (MW)
Cacho WPP – Gul Ahmed Electric WPP 132 kV S/C	80.7
Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C	128.1
Jhimpir-1 – Jhimpir-2 220 kV S/C	167.1
Gharo New – Jhimpir-2 220 kV S/C	118.1
Jhimpir-2 – Jamshoro 220 kV S/C	237.6
Jhimpir-2 – KDA-33 220 kV S/C	376.3
Jhimpir-1 – T.M. Khan Road 220 kV D/C	504
3x250 MVA, 220/132 kV transformers at Jhimpir-2	330.9

The active and reactive power flows from Din Energy WPP and other WPPs in its vicinity remain within limits.

a. N-1 Contingency Analysis

The load flow analysis has also been carried out for N-1 contingency conditions during peak load scenario of 2019. The results of contingency studies are attached as Exhibit# 1.1 to 1.11 and are summarized as under:

Exhibit #	Contingency Conditions	Remarks
1.1	Din Energy WPP – Zulaikha Energy WPP 132 kV S/C out	Power flows on the other transmission lines and transformers as well as the voltage profile of the system remain within limits.
1.2	Din Energy WPP – Trans Atlantic WPP 132 kV S/C out	-do-
1.3	1x50 MVA, 132/22 kV transformer at Din Energy WPP out	-do-

Exhibit #	Contingency Conditions	Remarks
1.4	One collector group (7 WTGs) at Din Energy WPP out	-do-
1.5	Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C out	-do-
1.6	1x250 MVA, 220/132 kV transformer at Jhimpir-2 out	-do-
1.7	Jhimpir-2 – Jhimpir-1 220 kV S/C out	-do-
1.8	Jhimpir-2 – Gharo New 220 kV S/C out	-do-
1.9	Jhimpir-2 – Jamshoro 220 kV S/C out	-do-
1.10	Jhimpir-2 – KDA-33 220 kV S/C out	-do-
1.11	Jhimpir-1 – T.M. Khan Road 220 kV S/C out	-do-

b. Comments on Normal and N-1 Contingency Analysis

As per load flow study result, the power flows on transmission lines and transformers at/in the vicinity of Din Energy WPP are well within their capacities. In general, the study depicts that the voltage profile of the system and at the switchyard of Din Energy WPP is within limits and there would be no transmission system constraints in the flow of power from Din Energy WPP to the system under normal and N-1 contingency conditions.

5.2 Off-peak Load 2019 Scenario

Load flow study for the off-peak load condition in 2019 under normal system condition has been carried out with net output of 47.7 MW from Din Energy WPP and is attached as Exhibit #2.0 & 2.0A. As per load flow study, the power flows on the transmission lines/transformers at/around Din Energy WPP and on the surrounding southern network are given as under:

Transmission Line/Transformers	Power Flow (MW)
Din Energy WPP – Zulaikha Energy WPP 132 kV S/C	156.5
Trans Atlantic WPP – Din Energy WPP 132 kV S/C	108.8
ACT 2 WPP – Trans Atlantic WPP 132 kV S/C	62.9
Cacho WPP – Gul Ahmed Electric WPP 132 kV S/C	80.7
Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C	128.1
Jhimpir-1 – Jhimpir-2 220 kV S/C	183.9
Gharo New – Jhimpir-2 220 kV S/C	122.0
Jhimpir-2 – Jamshoro 220 kV S/C	251.4
Jhimpir-2 – KDA-33 220 kV S/C	383.9
Jhimpir-1 – T.M. Khan Road 220 kV D/C	504.8
3x250 MVA, 220/132 kV transformers at Jhimpir-2	330.9

It is evident from the above table that the power flows on the 132 kV interconnection circuits of 7 WPPs including Din Energy WPP remain the same, however, the power flows on the 220 kV circuits and on other part of the system has varied mainly due to lower demand during off-peak load condition in 2019. The active and reactive power flows from Din Energy WPP and other WPPs in its vicinity remain within limits.

a. N-1 Contingency Analysis

The load flow analysis has also been carried out for N-1 contingency conditions during off-peak load condition in 2019. The results of contingency studies are attached as Exhibit #2.1 to 2.11 and are summarized as under:

Exhibit #	Contingency Conditions	Remarks
2.1	Din Energy WPP – Zulaikha Energy WPP 132 kV S/C out	Power flows on the other transmission lines and transformers as well as the voltage profile of the system remain within limits.
2.2	Din Energy WPP – Trans Atlantic WPP 132 kV S/C out	-do-
2.3	1x50 MVA, 132/22 kV transformer at Din Energy WPP out	-do-
2.4	One collector group (7 WTGs) at Din Energy WPP out	-do-
2.5	Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C out	-do-
2.6	1x250 MVA, 220/132 kV transformer at Jhimpir-2 out	-do-
2.7	Jhimpir-2 – Jhimpir-1 220 kV S/C out	-do-
2.8	Jhimpir-2 – Gharo New 220 kV S/C out	-do-
2.9	Jhimpir-2 – Jamshoro 220 kV S/C out	-do-
2.10	Jhimpir-2 – KDA-33 220 kV S/C out	-do-
2.11	Jhimpir-1 – T.M. Khan Road 220kV S/C out	-do-

b. Comments on Normal and N-1 Contingency Analysis

As per load flow study result, the power flows on transmission lines and transformers in the vicinity of proposed Din Energy WPP are well within their capacities. In general, the study depicts that the voltage profile of the system is within limits and there would be no transmission system constraints in the flow of power from the proposed Din Energy WPP to the system under normal and N-1 contingency conditions.

5.3 Peak Load 2021 Scenario

Load flow study for the peak load condition in 2021 under normal system condition has been carried out with net output of 47.7 MW from Din Enegy WPP and is attached as Exhibit #3.0 & 3.0A. As per load flow study, the power flows on the transmission lines/transformers at/around Din Energy WPP and on the surrounding southern network are given as under:

Transmission Line/Transformers	Power Flow (MW)
Din Energy WPP – Zulaikha Energy WPP 132 kV S/C	156.5
Trans Atlantic WPP – Din Energy WPP 132 kV S/C	108.8
ACT 2 WPP – Trans Atlantic WPP 132 kV S/C	62.9
Cacho WPP – Gul Ahmed Electric WPP 132 kV S/C	80.7
Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C	128.1
Jhimpir-1 – Jhimpir-2 220 kV S/C	111.4
Gharo New – Jhimpir-2 220 kV S/C	105.3
Jhimpir-2 – Jamshoro 220 kV S/C	247.4
Jhimpir-2 – KDA-33 220 kV S/C	299.4

Transmission Line/Transformers	Power Flow (MW)
Jhimpir-1 – T.M.Khan Road 220 kV D/C	533.4
3x250 MVA, 220/132 kV transformers at Jhimpir-2	330.9

The active and reactive power flows from Din Energy WPP and other WPPs in its vicinity remain within limits.

a. N-1 Contingency Analysis

The load flow analysis has also been carried out for N-1 contingency conditions for peak load condition in 2021. The results of contingency studies are attached as Exhibit #3.1 to 3.11 and are summarized as under:

Exhibit #	Contingency Conditions	Remarks
3.1	Din Energy WPP – Zulaikha Energy WPP 132 kV S/C out	Power flows on the other transmission lines and transformers as well as the voltage profile of the system remain within limits.
3.2	Din Energy WPP – Trans Atlantic WPP 132 kV S/C out	-do-
3.3	1x50 MVA, 132/22 kV transformer at Din Energy WPP out	-do-
3.4	One collector group (7 WTGs) at Din Energy WPP out	-do-
3.5	Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C out	-do-
3.6	1x250 MVA, 220/132 kV transformer at	-do-

Exhibit #	Contingency Conditions	Remarks
	Jhimpir-2 out	
3.7	Jhimpir-2 – Jhimpir-1 220 kV S/C out	-do-
3.8	Jhimpir-2 – Gharo New 220 kV S/C out	-do-
3.9	Jhimpir-2 – Jamshoro 220 kV S/C out	-do-
3.10	Jhimpir-2 – KDA-33 220 kV S/C out	-do-
3.11	Jhimpir-1 – T.M. Khan Road 220 kV S/C out	-do-

b. Comments on Normal and N-1 Contingency Analysis

As per load flow study results, the power flows on transmission lines and transformers in the vicinity of proposed Din Energy WPP are well within their capacities. In general, the study depicts that the voltage profile of the system is within limits and there would be no transmission system constraints in the flow of power from Din Energy WPP to the system under normal and N-1 contingency conditions.

5.4 Conclusions of Load Flow Analysis

The proposed interconnection scheme for evacuation of power from 50 MW Din Energy WPP to the National Grid has been found reliable in various operating scenarios under normal and N-1 contingency conditions with no transmission system constraints.

6 Short Circuit Studies

The short circuit studies have been carried out with proposed Interconnection scheme of Din Energy WPP to compute the maximum three phase and single phase short circuit levels at the switchyard of Din Energy WPP and substations in its vicinity. The studies have been carried out with all the existing and planned generation in operation and with interconnected transmission system. The minimum three phase and single phase short circuit levels have also been carried out at the 132 kV switchyard of Din Energy WPP for various number of WTGs in operation and reduced generation in its vicinity.

6.1 Methodology and Assumptions

The methodology of IEC 909 has been applied in short circuit analysis for which provision is available in the PSS/E software used for these studies. The maximum and minimum short circuit currents have been calculated with the following assumptions under IEC 909 standard:

- Set tap ratios to unity
- Set line charging to Zero
- Set shunt to zero in positive sequence
- The voltage magnitude at bus bars set equal to 1.10 p.u for maximum short circuit analysis and 0.9 p.u for minimum short circuit analysis.

In the short circuit analysis, the parameters of generator and step-up transformer for Din Energy WPP, have been assumed as per information provided by its sponsor, attached in Appendix-1. The results of maximum and minimum short circuit studies with necessary details are presented in Appendix-4.

6.2 Short Circuit Study Results

The short circuit studies have been carried out with proposed Interconnection scheme and by using the above parameters for generator and step-up transformer to compute the maximum three phase and single phase short circuit levels at the switchyard of Din Energy WPP and other substations in its vicinity. The studies have been carried out for the year 2021-22 with all the existing and planned generation in operation and with interconnected transmission system except 132 kV split buses at 220/132 kV substations of Hala Road and T.M. Khan Road. The results of maximum short circuit studies for the year 2021-22 are summarized as under:

Maximum Short Circuit Levels

Name of Faulted Bus Bars	Maximum Short Circuit Levels	
	Three Phase (kA)	Single Phase (kA)
Din Energy WPP 132 kV	11.05	7.93
Trans Atlantic WPP 132 kV	9.22	6.26
Zulaikha WPP 132 kV	12.65	9.38
Jhimpir-2 220 kV	18.96	11.47
Jhimpir-2 132 kV	15.48	12.01
Jhimpir-1 220 kV	19.89	11.66
Jhimpir-1 132 kV	27.59	13.56

The minimum three phase and single phase short circuit levels have also been computed for system scenario of 2019 at the 132 kV switchyard of Din Energy WPP with all WTGs and one WTG in operation; and with reduced generation in operation in its vicinity. The minimum short circuit levels at the 132 kV switchyard of Din Energy WPP are tabulated as under:

Minimum Short Circuit Levels at Din Energy 132 kV Bus

WTGs in Operation at Din Energy WPP	Minimum Short Circuit Levels	
	Three Phase (kA)	Single Phase (kA)
All WTGs	8.59	5.98
One WTG	8.02	5.3

6.3 Conclusions of Short Circuit Analysis

It is evident from the short circuit analysis that the induction of Din Energy WPP and its surrounding WPPs have no adverse impact on the existing and proposed substations in their vicinity as far as short circuit levels are concerned. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Din Energy WPP are 11.05 kA and 7.93 kA respectively in the year 2021-22 but these are expected to rise due to future grid system expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of Din Energy WPP.

7. Transient Stability Studies

Transient stability studies have been carried out with the proposed interconnection scheme to evaluate the dynamic response of generators and the power system after occurrences of faults. The transient stability simulations are used to check in time domain whether the generators at and in the vicinity of Din Energy WPP as well as the power system remain stable after subjected to severe disturbances as per Grid Code requirement.

7.1 Study Methodology

The dynamic simulation model of the entire network has been developed in the PSS/E software. The dynamic model parameters of WTG Type-3 used for Din Energy WPP, in the studies are attached in Appendix-5. On the other hand, the dynamic models/parameters of generators, exciters and governors of all the other power plants, already available in Planning (Power) NTDCL, have been used in the studies.

Two worst types of disturbances have been simulated to assess the stability of the Din Energy WPP and the power system as per NEPRA grid code criteria which are given as under:

- 3-phase fault at bus bar cleared in 5-cycles (100 ms) and tripping of the associated circuit.
- 3-phase fault at bus bar cleared in 9 cycles (180 ms) (delayed clearing or stuck breaker condition) and tripping of the associated circuit.

The simulations have been run in the time domain in the following sequence:

- Running simulation for initial one second for pre-fault steady state condition.
- Fault application at 1.0 second and running the simulation upto 1.1 second for 5 cycle fault (up to 1.18 second for 9 cycle fault).
- Fault clearance at 1.1 second for 5 cycle fault (1.18 second for 9 cycle fault) and tripping of the associated circuit.

- Running simulation up to 10 seconds after fault clearance.

The following generator and network parameters are monitored in the simulations and have been presented in the report through the following stability plots for each type of disturbance:

i. Bus frequency and voltage

ii. WTG (Pmechanical, Speed, Speed Deviation, Pitch, Aero Dynamic Torque, Paero, angle, active and reactive power output)

iii. Line power flows, i.e., P (MW) & Q (MVAR)

iv. Conventional thermal generator rotor angle

In order to interpret the stability plots, the bus numbers assigned to the bus bars and the voltage levels, are given as under:

Bus Number	Bus Name / Voltage
81116	Din-E / 132 kV
811161	Din-E MV/22 kV
811166, 811167, 811168 & 811169	Din-E LV-1 to LV-4 / 0.69kV
81115	Trans ATL / 132kV
81117	Zulaikha-E / 132 kV
8111	Jhimpir-2 / 132 kV
811	Jhimpir-2 / 220kV
9429	Jhimpir-1 / 220kV
800	Jamshoro / 220 kV
900	KDA / 220 kV
530	M.Garh / 220 kV
90	Hub / 500 kV

7.2 Transient Stability Analysis Results

The transient stability analysis for Din Energy WPP with the proposed interconnection scheme has been carried out for peak load 2019 scenario. The stability of the Din Energy WPP and the power system has been tested with application of different disturbances on the wind farm and at the substations in its vicinity. The plotted results of the stability simulations are attached in Appendix-6 and described as under:

(i) For Normal Clearing Time (100 ms)

The transient stability studies for faults with normal clearing time of 100 ms corresponding to 5 cycles, have been carried out. The details of the faults & the associated outages, monitored variables, respective exhibits and stability behavior of Din Energy WPP & other generators as well as the power system are mentioned and presented in the following table:

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
1	Din-E WPP 132kV Bus	Din-E WPP – Zulaikha-E WPP 132kV S/C	1.1	Bus Frequency	Din Energy WPP and NTDCL systems remain stable.
			1.2	Bus Voltage	
			1.3	WTG Collector Group Output (P&Q)	
			1.4	Pmechanical & Speed of WTG	
			1.5	Pitch & Aero Dynamic Torque of WTG	
			1.6	Paero on Rotor Blade & Shaft Twist Angle	
			1.7	Turbine Rotor Speed Deviation & Gen. Speed Deviation	

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
			1.8	Pitch Compensation & Pitch Control	
			1.9	Line Power Flows (P&Q)	
			1.10	Rotor Angle	
2	Din-E WPP 132 kV Bus	Din-E WPP - Trans Atlantic WPP 132kV S/C	1.11	Bus Frequency	Din Energy WPP and NTDCL systems remain stable.
			1.12	Bus Voltage	
			1.13	WTG collector group Output (P&Q)	
			1.14	Pmechanical & Speed	
			1.15	Pitch & Aero Dynamic Torque of WTG	
			1.16	Paero on Rotor Blade & Shaft Twist Angle	
			1.17	Turbine Rotor Speed Deviation & Gen. Speed Deviation	
			1.18	Pitch Compensation & Pitch Control	
			1.19	Line Power Flows (P&Q)	
			1.20	Rotor Angle	
3	Din-E WPP 132 kV Bus	One 132/22 kV T/F at Din-E WPP	1.21	Bus Frequency	Din Energy WPP and NTDCL systems remain stable.
			1.22	Bus Voltage	
			1.23	WTG collector group Output (P&Q)	
			1.24	Pmechanical & Speed	
			1.25	Pitch & Aero Dynamic Torque	

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
				of WTG	
			1.26	Paero on Rotor Blade & Shaft Twist Angle	
			1.27	Turbine Rotor Speed Deviation & Gen. Speed Deviation	
			1.28	Pitch Compensation & Pitch Control	
			1.29	Line Power Flows (P&Q)	
			1.30	Rotor Angle	
4	Din-E WPP 22 kV MV Bus	One Collector Group comprising of 7 WTGs at Din-E WPP	1.31	Bus Frequency	Din Energy WPP and NTDCL systems remain stable.
			1.32	Bus Voltage	
			1.33	WTG collector group Output (P&Q)	
			1.34	Pmechanical & Speed	
			1.35	Pitch & Aero Dynamic Torque of WTG	
			1.36	Paero on Rotor Blade & Shaft Twist Angle	
			1.37	Turbine Rotor Speed Deviation & Gen. Speed Deviation	
			1.38	Pitch Compensation & Pitch Control	
			1.39	Line Power Flows (P&Q)	
			1.40	Rotor Angle	
5	Jhimpir-2	One 220/132 kV T/F	1.41	Bus Frequency	Din Energy

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
	220 kV Bus	at Jhimpir-2	1.42	Bus Voltage	WPP and NTDCL systems remain stable.
			1.42A	WTG collector group Output (P&Q)	
			1.43	Line Power Flows (P&Q)	
			1.44	Rotor Angle	
6	Jhimpir-2 220 kV Bus	Jhimpir-2 - Jhimpir-1 220 kV S/C	1.45	Bus Frequency	Din Energy WPP and NTDCL systems remain stable.
			1.46	Bus Voltage	
			1.46A	WTG Collector Group Output (P&Q)	
			1.47	Line Power Flows (P&Q)	
			1.48	Rotor Angle	
7	Jhimpir-2 220 kV Bus	Jhimpir-2 - Gharo 220 kV S/C	1.49	Bus Frequency	Din Energy WPP and NTDCL systems remain stable.
			1.50	Bus Voltage	
			1.50A	WTG collector group Output (P&Q)	
			1.51	Line Power Flows (P&Q)	
			1.52	Rotor Angle	
8	Jhimpir-2 220 kV Bus	Jhimpir-2 - Jamshoro 220 kV S/C	1.53	Bus Frequency	Din Energy WPP and NTDCL systems remain stable.
			1.54	Bus Voltage	
			1.54A	WTG collector group Output (P&Q)	
			1.55	Line Power Flows (P&Q)	
			1.56	Rotor Angle	
9	Jhimpir-2 220 kV Bus	Jhimpir-2 - KDA-33 220 kV S/C	1.57	Bus Frequency	Din Energy WPP and NTDCL
			1.58	Bus Voltage	

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
			1.58A	WTG collector group Output (P&Q)	systems remain stable.
			1.59	Line Power Flows (P&Q)	
			1.60	Rotor Angle	
10	Jhimpir-1 220 kV Bus	Jhimpir-1 – T.M.Khan Road 220kV S/C	1.61	Bus Frequency	Din Energy WPP and NTDCL systems remain stable.
			1.62	Bus Voltage	
			1.62A	WTG collector group Output (P&Q)	
			1.63	Line Power Flows (P&Q)	
			1.64	Rotor Angle	

It is evident from the above stability Exhibits that Din Energy WPP meets LVRT requirements as mentioned in the NEPRA Grid Code Addendum for WPPs.

(ii) For Delayed Clearing Time (180 ms)

The transient stability studies for faults with delayed clearing time of 180 ms corresponding to 9-cycle fault (stuck breaker condition) have been carried out. The details of the faults & the associated outages, monitored variables, respective exhibits and stability behavior of Din Energy WPP & other generators as well as the power system are mentioned and presented in the following table:

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
1	Din-E WPP 132kV Bus	Din-E WPP – Zulaikha-E 132 kV S/C	2.1	Bus Frequency	Din Energy WPP and NTDCL
			2.2	Bus Voltage	

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
			2.3	WTG collector group Output (P&Q)	systems remain stable.
			2.4	Pmechanical & Speed	
			2.5	Pitch & Aero Dynamic Torque of WTG	
			2.6	Paero on Rotor Blade & Shaft Twist Angle	
			2.7	Turbine Rotor Speed Deviation & Gen. Speed Deviation	
			2.8	Pitch Compensation & Pitch Control	
			2.9	Line Power Flows (P&Q)	
			2.10	Rotor Angle	
2	Din-E WPP 132 kV Bus	Din-E WPP - Trans Atlantic WPP 132 kV S/C	2.11	Bus Frequency	Din Energy WPP and NTDCL systems remain stable.
			2.12	Bus Voltage	
			2.13	WTG collector group Output (P&Q)	
			2.14	Pmechanical & Speed	
			2.15	Pitch & Aero Dynamic Torque of WTG	
			2.16	Paero on Rotor Blade & Shaft Twist Angle	
			2.17	Turbine Rotor Speed Deviation & Gen. Speed Deviation	

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
			2.18	Pitch Compensation & Pitch Control	
			2.19	Line Power Flows (P&Q)	
			2.20	Rotor Angle	
3	Din-E WPP 132 kV Bus	One 132/22 kV T/F at Din Energy WPP	2.21	Bus Frequency	Din Energy WPP and NTDCL systems remain stable.
			2.22	Bus Voltage	
			2.23	WTG collector group Output (P&Q)	
			2.24	Pmechanical & Speed	
			2.25	Pitch & Aero Dynamic Torque of WTG	
			2.26	Paero on Rotor Blade & Shaft Twist Angle	
			2.27	Turbine Rotor Speed Deviation & Gen. Speed Deviation	
			2.28	Pitch Compensation & Pitch Control	
			2.29	Line Power Flows (P&Q)	
			2.30	Rotor Angle	
4	Din-E WPP 22 kV MV Bus	One Collector Group comprising of 7 WTGs at Din-E WPP	2.31	Bus Frequency	Din Energy WPP and NTDCL systems remain stable.
			2.32	Bus Voltage	
			2.33	WTG collector group Output (P&Q)	
			2.34	Pmechanical & Speed	

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
			2.35	Pitch & Aero Dynamic Torque of WTG	
			2.36	Paero on Rotor Blade & Shaft Twist Angle	
			2.37	Turbine Rotor Speed Deviation & Gen. Speed Deviation	
			2.38	Pitch Compensation & Pitch Control	
			2.39	Line Power Flows (P&Q)	
			2.40	Rotor Angle	

It is evident from the above stability Exhibits that Din Energy WPP meets LVRT requirements as mentioned in the NEPRA Grid Code Addendum for WPPs.

7.3 Conclusions of Transient Stability Analysis

The results of transient stability analysis indicate that Din Energy WPP & other generators in its vicinity and the power system remain stable with no adverse effects after subjected to severe disturbances either on Din Energy WPP or at the other substations in its vicinity. The stability simulations also proved that the proposed Din Energy WPP fulfills the LVRT criteria as mentioned in the NEPRA's Grid Code Addendum for WPPs.

8 Power Quality Analysis

The power quality analysis is very important for a wind power plant that may cause flicker and distortions in the power supply. These issues become more significant for weak power systems having low short circuit strength. Therefore, power quality analysis including flicker and voltage unbalance, has been carried out with the proposed interconnection scheme of 50 MW Din Energy WPP for the worst case scenario of minimum system short circuit levels in 2019.

8.1 Flicker

IEC61400-21 standard have been used for the calculation of flicker levels for steady-state continuous operation. The probability of 99th percentile flicker emission from a single inverter during continuous operation for short time $P_{st\Sigma}$ and long time flicker level $P_{lt\Sigma}$ are assumed same and calculated by the following formula:

$$P_{st\Sigma} = P_{lt\Sigma} = \frac{1}{S_k} \cdot \sqrt{\sum_{i=1}^{N_{wt}} (c_i(\psi_k, \upsilon_a) . S_{n,i})^2} \qquad \text{(A)}$$

Where

S_n is the rated apparent power of the WTG

S_k is the short-circuit apparent power at PCC

N_{wt} is the number of WTGs connected to the PCC

The value of c (φ_k) may not be greater than 1, therefore for the present analysis, the value of 1 for the worst case has been assumed. PCC is the point of common coupling which is 132 kV bus of the switchyard of 50 MW Din Energy WPP.

For the minimum short circuit case, the system network in the vicinity of 50 MW Din Energy WPP has been modeled with minimum generation in operation. The short circuit calculations have been done at 0.9 p.u. voltage. The values used in the calculation of flicker are as below:

S_n = 2.105 MVA

N_{WT} = 25

S_k = 1963.15 MVA

Using the above data in Equation (A), we get

$P_{St\Sigma} = P_{lt\Sigma} = 0.0053613 = 0.54\ \%$

Whereas, the acceptable value in IEC Standard is less than 4%. Therefore, the flicker level is far less than the maximum permissible limit which implies that the inverters at 50 MW Din Energy WPP would not cause any flicker problem during steady state operation even in the weakest system conditions.

8.2 Voltage Unbalance

(i) Voltage Step-Change

The voltage step-change occurs when only a single WTG is energized. The value of voltage change depends on the impedance of the network from the connection point to PCC. Voltage step-change should be less than or equal to 3% and this condition is evaluated by using the following formula:

$$\Delta V = \sum Swka\ \left[\left(\frac{1}{Ske}\right) - \left(\frac{1}{Skss}\right)\right] \leq 3\% \qquad \text{(B)}$$

Where

S_{wka} is the MVA rating of the inverter

S_{ke} is the Short Circuit MVA at connection point

S_{kss} is the Short circuit MVA at PCC

The values used in the calculation of voltage step-change are as below:

$S_{wka} = 2.105$ MVA

$S_{ke} = 350.43$ MVA

$S_{kss} = 1834.62$ MVA

Using the above data in Equation (B), we get

$\Delta V = 0.0048595 = 0.49\ \%$

The voltage step-change is less than the maximum permissible limit of 3% which implies that the WTG of Din Energy WPP would not cause any voltage step-change problem.

(ii) Voltage Fluctuation

The voltage fluctuation has been calculated assuming only one WTG in operation, using the following equation and it is found to be within permissible limits.

$$Volatge\ Fluctuation = \sqrt{\sum(\frac{Pwka}{Ske})^2} \quad \leq 1/25 \quad \text{or} \quad 4\% \qquad \text{(C)}$$

Where

P_{wka} is the MW rating of WTG

S_{ke} is the Short Circuit MVA at PCC

The values used in the calculation of voltage fluctuation are as below:

P_{wka} = 2 MW

S_{ke} = 350.43 MVA

Using the above data in Equation (C), we get

Voltage Fluctuation = 0.005707 = 0.571 %

The value of voltage fluctuation is less than the maximum permissible limit of 4% which implies that the WTGs of Din Energy WPP would not cause any voltage fluctuation problem.

8.3 Conclusions of Power Quality Analysis

The important power quality indices like flicker and voltage unbalance have been computed with Din Energy WPP and compared with limits given in IEC and other international standards. The study results indicate that the levels of flicker and voltage unbalance are within permissible limits, with the interconnection of subject WPP.

It is added that it is the responsibility of developer of Din Energy WPP to install the plant and necessary compensating equipment at its switchyard on the basis of detailed design/field testing studies to meet the power quality standards as per requirements of NEPRA Grid Code Addendum for WPPs.

9 Overall Conclusions and Recommendations

i) On the basis of detailed interconnection studies, the following integrated interconnection scheme of the 7 WPPs lying in southern part of Jhimpir including Din Energy WPP, has been found reliable for power evacuation to the National grid:

- A new 220/132 kV Jhimpir-2 substation 3x250 MVA, 220/132 kV transformers.
- 220 kV D/C transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA-33 D/C transmission line at Jhimpir-2.
- 220 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir-1 – Gharo New D/C transmission line at Jhimpir-2.
- 132 kV D/C transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including Din Energy WPP with Jhimpir-2. In this scheme, the interconnection of Din Energy WPP includes 132 kV D/C transmission line, approx. 2 km long, on twin-bundled Greeley conductor for looping In/Out from Din Energy WPP on the 132 kV single circuit from Trans Atlantic WPP to Zulaikha Energy WPP.

ii) The above proposed interconnection scheme is expected to be completed in Dec. 2019. It is added that the expected timeline of the proposed interconnection scheme may be extended depending on variation in completion of the related activities, i.e., preparation and approval of PC-1, funding arrangement, tendering process, contract award, land acquisition, ROW availability and construction etc.

iii) The results of detailed load flow studies for various operating scenarios indicate that the power from Din Energy WPP can be dispersed to the

National Grid in a reliable manner during normal and N-1 contingency conditions without any constraints. The voltage profile, line loading, frequency and active/reactive power flow etc. from Din Energy WPP and on the grid are within the NEPRA Grid Code criteria

iv) The results of short circuit studies indicate that Din Energy WPP and its surrounding WPPs have no adverse impact on the existing and proposed substations in their vicinity as far as short circuit levels are concerned. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Din Energy WPP are 11.05 kA and 7.93 kA respectively in the year 2021-22 but these are expected to rise due to future grid system expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of Din Energy WPP.

v) The results of transient stability analysis indicate that Din Energy WPP & other power plants in its vicinity and the power system remain stable with no adverse effects after subjected to severe disturbances either on Din Energy WPP or at the other substations in its vicinity. The stability simulations also proved that Din Energy WPP fulfills the LVRT criteria as mentioned in the NEPRA's Grid Code Addendum for WPPs.

vi) The important power quality indices like flicker and voltage unbalance have been computed with Din Energy WPP. The study results indicate that the levels of flicker and voltage unbalance are within permissible limits as mentioned in the IEC and other international standards, with the proposed interconnection of Din Energy WPP. It is clearly mentioned that it is the responsibility of developer of Din Energy WPP to install the plant and necessary compensating equipment at its switchyard on the basis of detailed design/field testing studies to meet the power quality standards as per requirements of NEPRA Grid Code Addendum for WPPs.

vii) It is concluded on the basis of the results of the detailed system studies that the proposed interconnection scheme has no transmission system constraints in power evacuation from Din Energy WPP to the National Grid.

viii) It is added that the Grid Code Addendum for WPPs is currently under revision and the project sponsor of Din Energy WPP will be required to follow/implement the requirements/recommendations given in the revised Grid Code, after its approval from NEPRA and make necessary additions/modifications in the equipment/substation of Din Energy WPP, if any, in this regard.

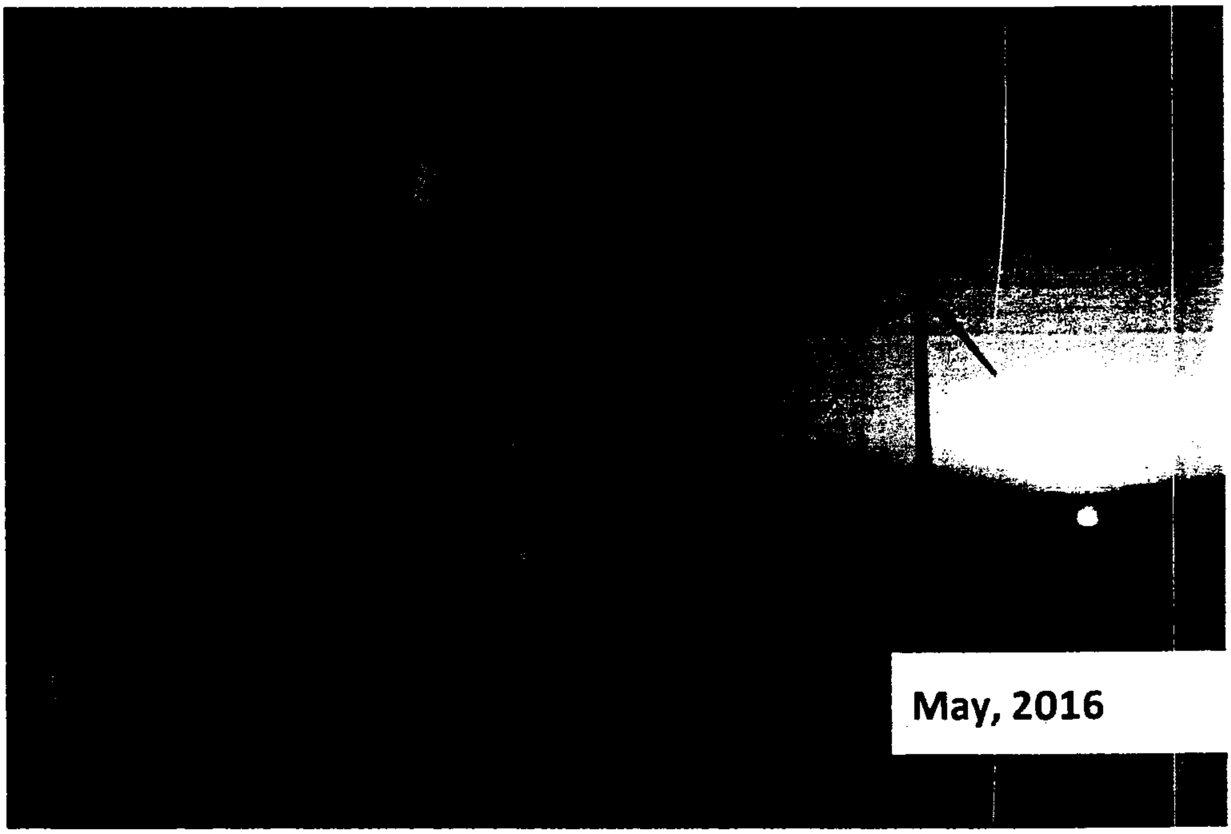
ix) In view of the huge wind potential at Jhimpir & in its surrounding areas, the power system network around Din Energy WPP will be developed in future. Therefore, there may be possibility of modification in the interconnection arrangement of Din Energy WPP in future, if needed necessary as per system requirements.

Appendix-1

Din Energy WPP Data Received from Project sponsor

DIN GROUP

DATA / INFORMATION REQUIRED FOR INTERCONNECTION STUDY OF WIND POWER PROJECT (WPP)



May, 2016

PROJECT SPONSOR

DIN Energy Limited

PROJECT CONSULTANTS

Renewable Resources (Pvt) Limited

TABLE OF CONTENTS

Summary & Introduction

This document presents technical information for the purposes of performing the grid interconnection studies of 50 MW DIN Energy Limited (the **"Project"**). The requirement is in response to the template received from NTDC Planning Power. The Project has completed all development steps and has been shortlisted for a grid slot amongst ten in total for evacuation of 500 MW capacity in the existing plans of NTDC. It has been conveyed that NTDC Planning Power shall develop the Grid Interconnection Studies for the Project by 25th May, 16.

2 Location, site coordinates and proposed sketch of the WPP:

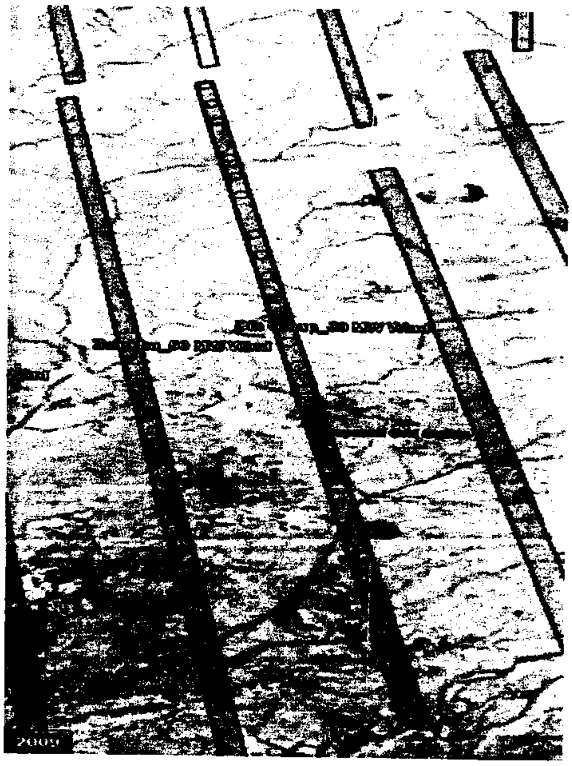
Location: Jhimpir – Sindh, Pakistan

Site Coordinates:

[redacted]

S. No.	Latitude	Longitude
1	24.918706	67.804546
2	24.919855	67.805300
3	24.960504	67.731179
4	24.961598	67.731958

Sketch:



3 Geographical diagram indicating approx. distance of the WPP with the surrounding WPPs and grid stations/transmission lines.

4 Manufacturer and Type of WTG

Gamesa G114-2.0
Type = II A

5 WTG Generator Data:

5.1 Number of WTGs

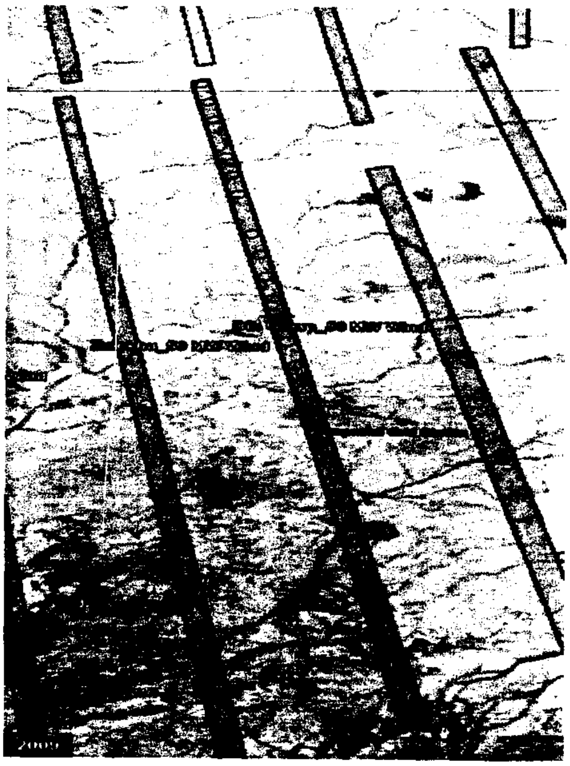
Number of WTGs : 25

5.2 Voltage, Gross capacity [MVA, MW], Power factor (Lagging/Leading),

- ✓ Voltage = 690V
- ✓ Gross Capacity = 2.0MW
- ✓ Power Factor = 0.95 Inductive~0.95 capacitive

6 WTG Arrangement in Wind Farm:

6.1 Micro-siting arrangement of WTGs



[redacted]

Din_G01	372013	2761200
Din_G02	372282	2761028
Din_G03	372551	2760857
Din_G04	373089	2760514
Din_G05	373358	2760342
Din_G06	373627	2760171
Din_G07	374165	2759828

Din_G08	374434	2759656
Din_G09	374703	2759485
Din_G10	374972	2759313
Din_G11	375241	2759142
Din_G12	375510	2758970
Din_G13	375779	2758799
Din_G14	376048	2758627
Din_G15	376317	2758456
Din_G16	376585	2758284
Din_G17	376854	2758113
Din_G18	377123	2757941
Din_G19	377661	2757598
Din_G20	377930	2757426
Din_G21	378199	2757255
Din_G22	378468	2757083
Din_G23	378737	2756912
Din_G24	379006	2756740
Din_G25	379269	2756572

6.2 No. of Collector group

No of Collector Groups : 04

6.3 WTGs connection in each Collector group

- ✓ 03 collector groups of 06 WTGs each
- ✓ 01 collector group of 07 WTGs

6.4 Length of each Collector group with the switchyard

Approx. 3 km.

6.5 Type of conductor or cable for collector group

Medium-voltage XLPE (cross- linked polyethylene) armoured each core separate metallic cables (Al) suitable for laying in ground for interconnection between WTGs.

7 Total Wind Farm Capacity:

7.1 Total Gross Capacity (MW)

Total Gross Capacity : 50 MW

7.2 Wake Losses, EBOP Losses, Auxiliary Consumption

- ✓ Wake losses = 14.8%
- ✓ EBoP losses = 1500 kW
- ✓ Auxiliary Consumption = 600 kW

7.3 Total Net Output Capacity (MW) that will flow towards Grid

Total Net Output : 47.9 MW

8 Generator Step-up Transformer Data:

8.1 No. of step-up transformers

No of step-up transformers : 25

8.2 Voltage ratio

Voltage Ratio : 0.69/22kV

8.3 MVA rating

MVA Rating : 2350 kVA

8.4 Percentage Impedances

% Impedances : ±10.5%

8.5 Number of Generators connected to each step-up transformer.

One WTG will be connected with One Step-up transformers.

9 Proposed Switchyard of Wind Power Project:

9.1 Single line diagram

Please refer to the project SLD attached in **Annex 1.** Major equipment planned for the project includes the following:

Two 132/22kV, 31.5/40/50 MVA, Power Transformers,

HV Switch Gear 132 kV has following bays

i. Two bays for OHTL
ii. Two bays for power transformers
iii. One bay for Bus Coupler

They comprise of following:

- 132kV circuit breakers
- Dis-connectors / Isolators
- Earthing Isolators
- Voltage transformers
- Current transformers
- 132 kV Surge arrestors
- 132 kV Coupling Capacitor Voltage transformers
- Protection system with relays

9.2 Layout of Switchyard of Proposed Power Project indicating plant and switchyard equipment

To be provided in detailed design stage

9.3 High Voltage (HV) Level (132 kV)

HV Level : 132 kV

9.4 Medium Voltage (MV) Level

MV Level : 22 kV

9.5 HV/MV transformer: No. of transformers, Voltage ratio, MVA rating, Percentage Impedances

HV Transformers : Two, 132/22kV, 31.5/40/50 MVA, 10-12%

9.6 Bus Bar Scheme: One-and-a-half breaker or Double Bus Single Breaker

Bus Bar Scheme : Double Bus Bar

9.7 Switchgear (circuit breaker, disconnectors etc.) data : Rated Voltage, Normal Current Rating, Short Circuit Rating.

- ✓ Circuit Breaker = 145kV rated, 2500A, 40kA 3sec, 50Hz
- ✓ Disconnector = Motor operated, three poles, 145kV rated, 2500A, 40kA, 3 sec, 50Hz

9.8 Bus Bar: Type/conductor name, maximum current rating

Bus Bar Type : Stranded Aluminium Conductor
Rating : 2500 Amps

10 Proposed Reactive Power Compensation:

10.1 Type of Reactive Compensation device at MV level (SVC or Switched Capacitor)

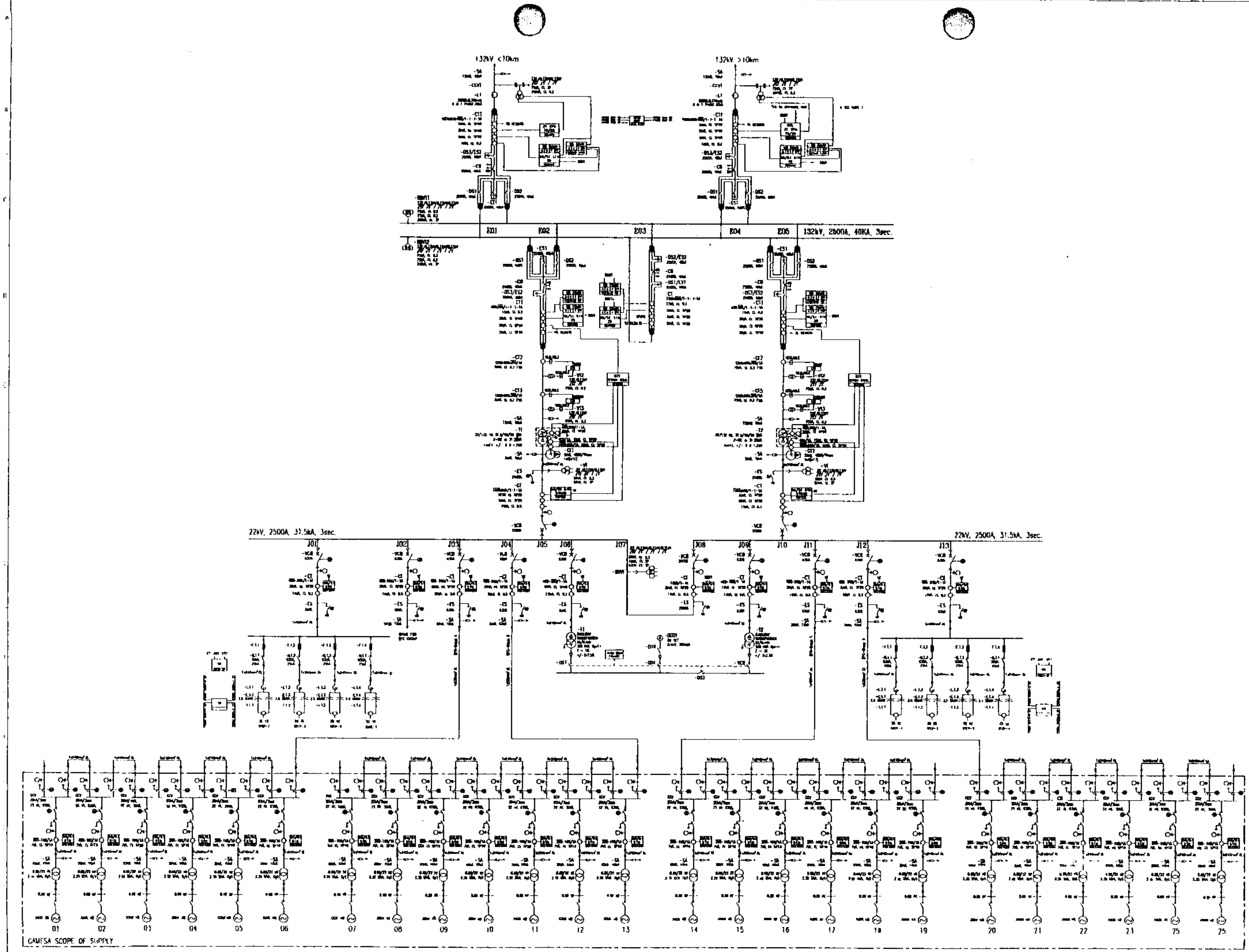
Type : Reactive Compensation System, whether capacitor bank based or SVC, to be decided in detailed design stage.

10.2 MVAR Rating

MVAR Rating : 2 x 10 MVAR

11 Expected COD

2018-2019



LEGEND

SYMBOL	DESCRIPTION
	CIRCUIT BREAKER (CB)
	ISOLATOR WITH EARTHING SWITCH (DS/ES)
	CURRENT TRANSFORMER (CT)
	INDUCTIVE VOLTAGE TRANSFORMER (VT)
	LINE TRAP
	COUPLING CAPACITOR VOLTAGE TRANSFORMER(CCVT)
	SURGE ARRESSTOR (SA)
	POWER TRANSFORMER (Tx)
	GROUNDING TRA[illegible]
	DETUNED REACTOR
	CAPACITOR BANK
	VACUUM CIRCUIT BREAKER (WITH-DRAWABLE)
	EARTH SWITCH (MV SWITCH GEAR)
	CAPACITIVE VOLTAGE INDICATION
	HH FUSE
	LOAD BREAK SWITCH WITH EARTHING SWITCH
	CABLE WITH TERMINATIONS
87L	LINE DIFFERENTIAL PROTECTION
21	LINE DISTANCE PROTECTION
87T	TRANSFORMER DIFFERENTIAL PROTECTION
87NH	RESTRICTED EARTH FAULT PROTECTION HV SIDE
87NL	RESTRICTED EARTH FAULT PROTECTION LV SIDE
87BB	BUS BAR PROTECTION
50/51	OVER CURRENT PROTECTION, 2 STAGE
51N	EARTH FAULT PROTECTION
51NSB	STAND BY EARTH FAULT PROTECTION
67N	(SENSITIVE) DIRECTIONAL EARTH FAULT PROTECTION
50BF	BREAKER FAILURE PROTECTION
79/25	AUTO RECLOSING RELAY WITH SYNCHROCHECK
25	SYNCHROCHECK FOR MANUAL CLOSE
46	UNBALANCE PROTECTION
55	POWER FACTOR RELAY
EM	0.2 CLASS ENERGY METER
	CIRCUIT BREAKER (FOR RMU)
	DISCONNECTOR WITH EARTH SWITCH (FOR RMU)
V	CIRCUIT BREAKER MODULE (V MODULE)
C	LOAD BREAK SWITCH MODULE (C MODULE)

NOTES:

1- THE PROPOSED ARRANGEMENT IS PRELIMINARY & MAY BE REVISED AS PER EQUIPMENT APPROVED DURING DETAIL DESIGN.
2- ABB SCOPE OF WORK IS FROM 132kV LINE TERMINATION TO MV CABLE TERMINATIONS OF 22 kV RMU GSU TRANSFORMERS SIDE.
3- LINE DIFFERENTIAL RELAY SHALL COMMUNICATE THROUGH OPGW/ADDS DIRECTLY WITH SAMOTE END'S DIFFERENTIAL RELAY. SUPPLY AND LAYING OF OPGW/ADDS IS NOT IN ABB SCOPE
4- NTDC METERING PANEL WILL BE PROVIDED BY NTDC.
5- QUANTITY OF MV CABLES MENTIONED IS PER PHASE QUANTITY.
6- CT BURDENS PROVIDED IN SLR ARE ON MENTIONED TAP.
7 DUE TO PRACTICAL SPACE LIMITATION AT 132kV TRANSFORMER BAYS, CT CORE FOR BUS BAR PROTECTION IS PLACED BEFORE SF6 TO AIR BUSHING. TO MEET 30 VA AT LOWEST TAP, IT IS NOT POSSIBLE TO ACCOMMODATE ALL THREE CORES ADJACENT TO CB.

FOR TENDERING PURPOSE ONLY

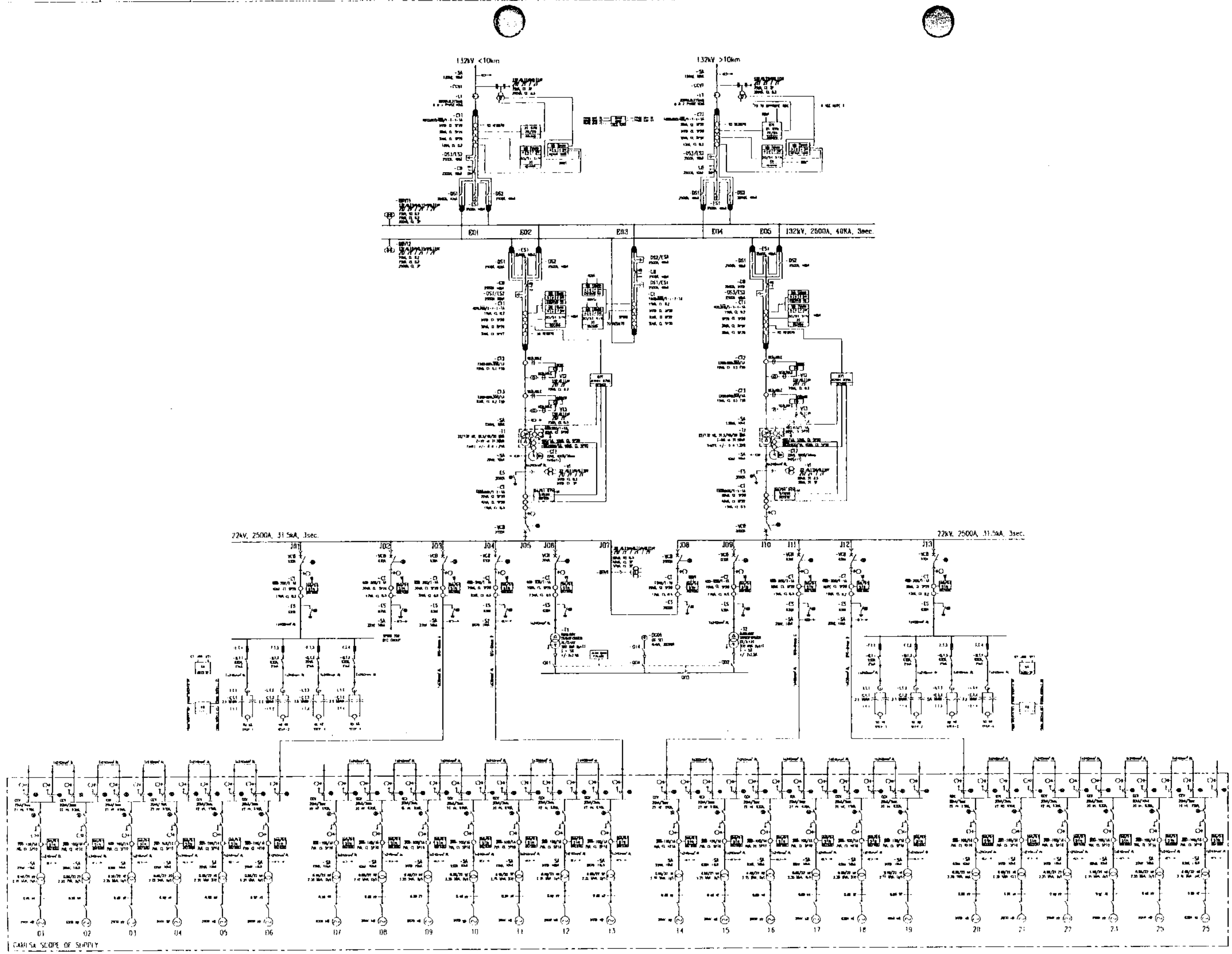
REV	DATE	DESCRIPTION	DRN	CHK	APP
0	05.04.16	FOR TENDERING PURPOSE ONLY	UA	MHA	MHE

ORIENT ENERGY SYSTEMS

ABB

50MW WIND POWER PROJECT

SINGLE LINE & PROTECTION / METERING DIAGRAM
(132kV HYBRID SWITCHGEAR)



LEGEND

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	SURGE ARRESSTOR (SA)
	POWER TRANSFORMER (Tx)
	GROUNDING TRANSFORMER (GTx)
	DETUNED REACTOR
	CAPACITOR BANK
	VACUUM CIRCUIT BREAKER (WITH-DRAWABLE)
	EARTH SWITCH (MV SWITCH GEAR)
	CAPACITIVE VOLTAGE INDICATION
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50BF	BREAKER FAILURE PROTECTION
79/25	AUTO RECLOSING RELAY WITH SYNCHROCHECK
25	SYNCHROCHECK FOR MANUAL CLOSE
45	UNBALANCE PROTECTION
55	POWER FACTOR RELAY
EM	0.2 CLASS ENERGY METER
	CIRCUIT BREAKER (FOR RMU)
	DISCONNECTOR WITH EARTH SWITCH (FOR RMU)
V	CIRCUIT BREAKER MODULE (V MODULE)
C	LOAD BREAK SWITCH MODULE (C MODULE)

NOTES:

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6- CT BURDENS PROVIDED IN SLD ARE ON MENTIONED TAP.
7- DUE TO PRACTICAL SPACE LIMITATION AT 132kV TRANSFORMER BAYS, CT CORE FOR BUS BAR PROTECTION IS PLACED BEFORE SF6 TO AIR BUSHING. TO MEET 30 VA [illegible] IT IS NOT POSSIBLE TO ACCOMMODATE ALL THREE CORES ADJACENT TO CB

FOR TENDERING PURPOSE ONLY

REV	DATE	DESCRIPTION	DRN.	CHK.	APP.
0	29.04.16	FOR TENDERING PURPOSE ONLY	MA	MHA	MHE

EMPLOYER
ORIENT ENERGY SYSTEMS

CONTRACTOR
ABB

PROJECT
50MW WIND POWER PROJECT

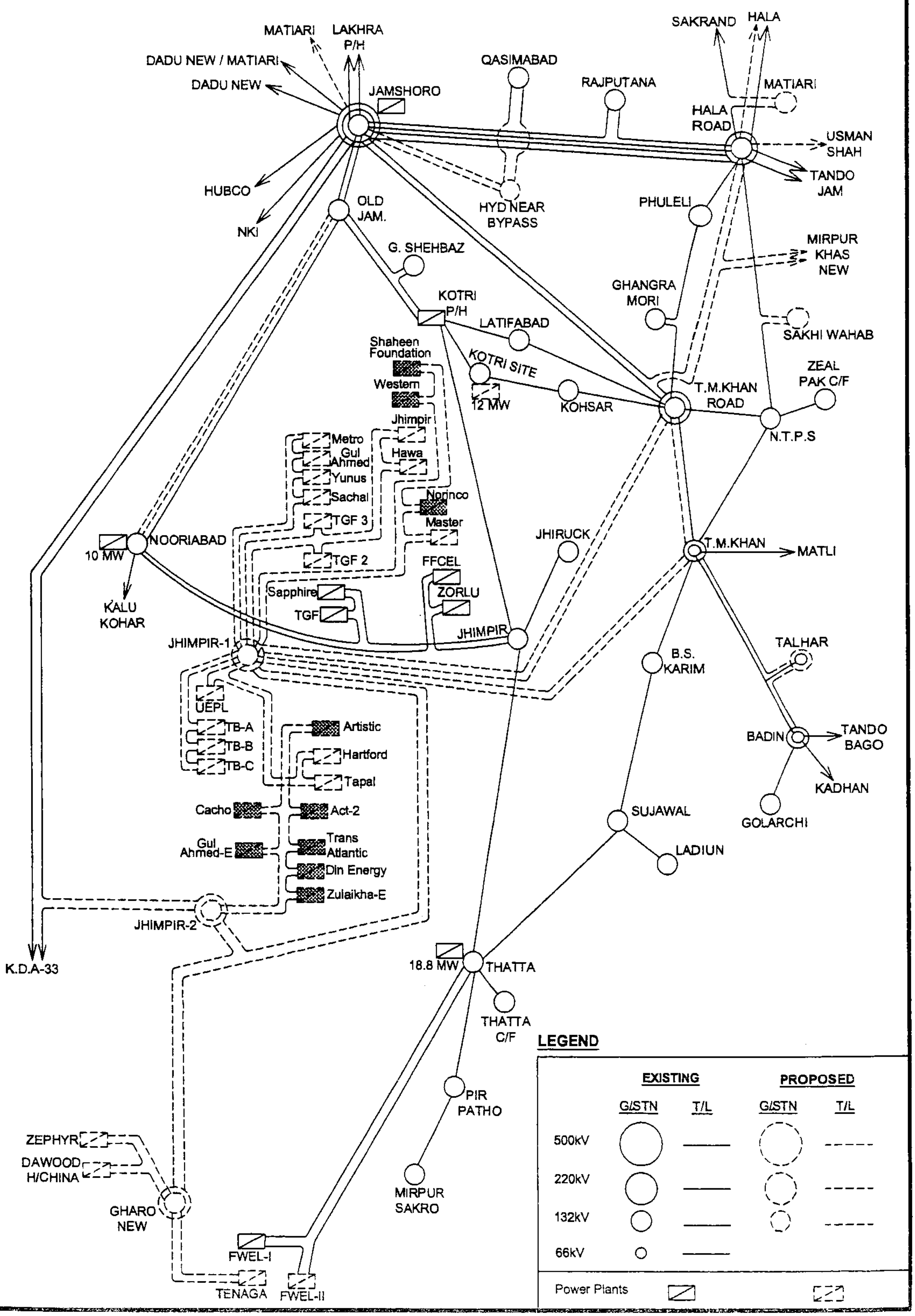
DRAWING TITLE
SINGLE LINE & PROTECTION / METERING DIAGRAM
(132kV HYBRID SWITCHGEAR)

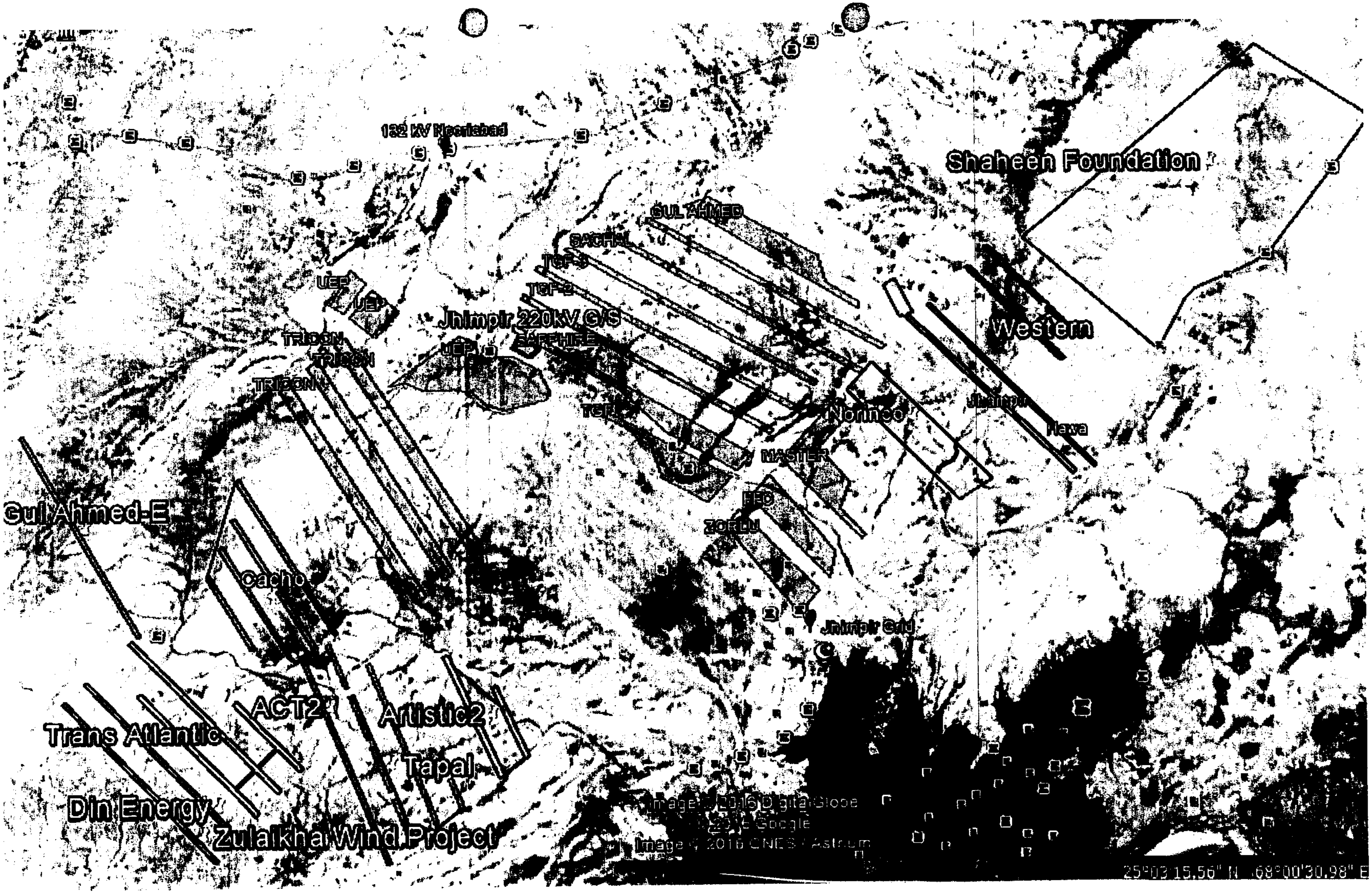
APPROVED	[illegible]	DRAWING NO.	DATE	[illegible]
CHECKED	MHA		SCALE	[illegible]
DRAWN	MA	OWNER NO.	SHEET	[illegible]
FORMAT	[illegible]		REVISION	[illegible]

Appendix-2

Proposed Interconnection Diagram for DIN Energy WPP

Figure #1: Proposed Interconnection Scheme For Power Evacuation of Din Energy Wind Power Project





132 kV Nooriabad
Shaheen Foundation
GUL AHMED
SACHAL
TGF-3
TGF-2
UEP
UEP
Jhimpir 220kV G/S
SAPPHIRE
TRICON
TRICON
TRICON
Western
Norinco
Jhimpir
Hawa
MASTER
FFC
ZORLU
Jhimpir Grid
Gul Ahmed-E
Cacho
ACT2
Artistic2
Trans Atlantic
Tapal
Din Energy
Zulaikha Wind Project
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25°03'15.56" N 68°00'30.98" E