

**Registered Office:** F-25 • Block 5 • Rojhan Street Kehkashan • Clifton • Karachi - 75600 • Pakistan **Tel** : +92-21-35876994 - 7 **Fax** : +92-21-35876991 & 35876993

> Date: - March 31, 2015 REF.: - WE/FIN/010/15

**THE REGISTRAR** National Electric Power Regulatory Authority, NEPRA Tower, Attaturk Avenue (East) G-5/1, Islamabad.

#### SUBJECT: <u>APPLICATION FOR THE GRANT OF GENERATION LICENSE ON BEHALF OF</u> <u>WESTERN ENERGY (PRIVATE) LIMITED IN RELATION TO ITS 50MW WIND</u> <u>POWER GENERATION PROJECT TO BE LOCATED AT JHIMPIR, DISTRICT</u> <u>THATTA, PROVINCE OF SINDH</u>

I, MUSTAFA LAKDAWALA, being the duly authorized representative of WESTERN ENERGY (PRIVATE) LIMITED (a company incorporated under the laws of Pakistan with its registered office located at F-25, Block 5, Kehkashan, Clifton, Karachi, Pakistan) hereby, pursuant to Rule 3 of the National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, apply to the National Electric Power Regulatory Authority (NEPRA) for the grant of the Generation License to WESTERN ENERGY (PRIVATE) LIMITED.

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 (Generation) Rules 2000, and undertake to abide by the terms and provisions of the same. 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.

We are submitting with this Generation License Application the required generation license fee through a non-refundable bank draft in the amount of PKR 270,943/- (Pakistani Rupees Two Hundred Seventy Thousand Nine Hundred and Forty Three) dated March 27, 2015 drawn in favor of NEPRA.

Sincerely, For and on behalf of WESTERN ENERGY (PRIVATE) LIMITED

MUSTAEA LAKDAWALA

DIRECTOR & AUTHORISED REPRESENTATIVE

# COPY OF WESTERN ENERGY (PRIVATE) LIMITED BOARD RESOLUTION





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### <u>CERTIFIED TRUE COPY OF RESOLUTION OF</u> <u>THE BOARD OF DIRECTORS OF</u> <u>WESTERN ENERGY (PRIVATE) LIMITED</u> <u>PASSED BY CIRCULAR UNDER</u> <u>ARTICLE 97 OF THE ARTICLES OF ASSOCIATION</u> <u>ON MARCH 27, 2015</u>

EREAS the Company has obtained a Letter of Intent from the Alternate Energy relopment Board for the establishment and operation of a 50 MW wind power proje posed to be located at Jhimpir, Thatta, in the province of Sindh (Project).

D WHEREAS the Company has hired various consultants to undertake the feasibility, environmental impact assessment and other studies required to be undertaken printer construction of the Project and most of the work in respect of the aforesaid has no completed and the Company is moving closer to the financing and construction Project.

D WHEREAS the Company is desirous of filing the Generation License Application w National Electric Power Regulatory Authority (NEPRA) (required to be filed pursuant Regulation of Generation, Transmission and Distribution of Electric Power Act (XL ( )7 (NEPRA Act) and rules/regulations made thereunder), which generation licen uld enable the Company to operate the Project and generate electricity therefrom.

D WHEREAS the Company desires to authorize certain of its officers to file su neration License Application with the NEPRA and to take all required steps and actio connection therewith.

## is hereby unanimously resolved that:

- a) the Company do file an application to the National Electric Power Regulatory Authority for seeking a generation license for the 50 MW wind power project to be constructed at Jhimpir, pursuant to and under Sections 7(2)(a) and 15 of the NEPRA Act read with other enabling provisions of the NEPRA Act, the National Electric Power Regulatory Authority Licensing (Application & Modification Procedure) Regulations 1999, National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, and in accordance with the Policy for Development of Renewable Energy for Power Generation 2006.
- b) Mr. Tabish Tapal, the Chief Executive Officer of the Company and Mr. Mustafa Lakdawala, Director and Company Secretary of the Company, be and each of them are hereby authorized to singly do, execute, transact and perform for and on behalf and in the name of the Company all such acts deeds and things as may be necessary or required or desirable to be done or executed by the



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Company for or in connection with or in relation to the application to the National Electric Power Regulatory Authority for seeking a generation license under the NEPRA Act and without limiting the generality of the foregoing and in connection therewith to do any or all of the following acts deeds and things, namely, to file applications, swear affidavits, review documents and information, make correspondence, letters, submissions, claims, objections of all kinds and to file or submit them before the National Electric Power Regulatory Authority and to appear and represent the Company before the National Electric Power Regulatory Authority or any other regulatory authority or body and to accept the terms and conditions on which a Generation License is granted by the National Electric Power Regulatory Authority."

Company Secretary

## 1. BACKGROUND TO GENERATION LICENSE APPLICATION

## 1.1 <u>PROCESS OF ISSUANCE OF LETTER OF INTENT LEADING TO GENERATION</u> <u>LICENSE APPLICATION</u>

#### 1.1.1 Issuance of "Letter of Intent"

WESTERN ENERGY (PRIVATE) LIMITED (a company duly organized and existing under the laws of Pakistan, with its office located at F-25, Block 5, Kehkashan, Clifton, Karachi, Pakistan) (the **Project Company**), was issued a LETTER OF INTENT by the Alternative Energy Development Board (the **AEDB**) on March 6, 2013 vide its letter No. B/3/16/2007 -138 (the **LOI**) to develop and establish a 15 MW wind farm project to be located at Jhimpir, Thatta. The Project Company had also submitted a bank guarantee for an amount equal to US\$ 7,500. The capacity of the wind farm project in the LOI was subsequently increased by the AEDB to 50MW vide its letter No. B/3/1/WEPL/13 on April 15, 2014, upon payment of project facilitation fee of Rs. 500,000/- and submission of a revised bank guarantee for an amount equal to US\$ 25,000 (**Project**). The LOI was subsequently extended by AEDB twice: first vide its letter No. B/3/1/WEPL/13 dated March 27, 2015. As such, the LOI is currently valid until August 1, 2015.

## 1.1.2 Submission of the Feasibility Study

Pursuant to the relevant provisions of the Policy for Development of Renewable Energy for Power Generation 2006 (the **RE Policy 2006**) and the LOI, the Project Company hired technical consultants, M/s. Pakistan Alternative Engineering Services (Private) Limited, who completed the detailed technical feasibility study for the Project and the Project Company submitted the same to AEDB for its approval on August 21, 2014 (the **Project Feasibility Study**). A copy of Project Feasibility Study is attached hereto as ANNEXURE A for NEPRA's perusal.

## 1.1.3 Submission of Initial Environmental Examination.

The Project Company hired consultants, M/s. First Wind (Private) Limited, who completed the initial environmental examination for the Project (the **Initial Environmental Examination**) and the Project Company submitted the same to the Sindh Environmental Protection Agency (the **SEPA**) on May 05, 2014.

After careful review and analysis of the Initial Environmental Examination, the SEPA accorded its approval for the Project through its decision (Ref:

EPA/2014/05/05/IEE/33) dated May 10, 2014 (the **IEE Approval Decision**). A copy of the IEE Approval Decision is attached hereto at ANNEXURE B for NEPRA's perusal.

## 1.1.4 Grid Interconnection Studies

The Project Company has engaged independent consultants, M/s. Power Planners International, who are currently undertaking the grid interconnection studies (the **Grid Interconnection Studies**). The Project Company's consultants presently await the inputs required from the National Transmission and Dispatch Company (the **NTDC**). The Project Company is pursuing the NTDC to provide the requested information and inputs so that the Grid Interconnection Studies are completed as soon as possible. We are hopeful that the requisite information and approvals will be provided by NTDC very soon and our Grid Interconnection Studies will be completed.

## 1.1.5 Request for grant of a generation license

Based on the matter provided in Section 1.1.1, 1.1.2, 1.1.3 and 1.1.4 above whereby the Project Company, on its part, has undertaken and completed all activities required for procurement of approvals of the relevant matters from various stakeholders – including the procurement of approvals of its IEE Report from SEPA – it is submitted that the requirements of the regulatory process for applying to NEPRA for grant of a generation license for the Project Company are complete.

## 1.2 <u>SUBMISSION</u>

- 1.2.1 Under the Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of) 1997 (the NEPRA Act) and the National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, the National Electric Power Regulatory Authority (NEPRA) is responsible for and has the authority to, *inter alia*, grant licenses for the generation of electric power and other terms and conditions for the supply of electricity through generation.
- 1.2.2 PURSUANT TO the Sections 7 (2) (a) and 15 of the NEPRA Act read with other enabling provisions of the NEPRA Act, the National Electric Power Regulatory Authority Licensing (Application & Modification Procedure) Regulations 1999, National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, <u>AND</u> in accordance with the RE Policy 2006: <u>WESTERN ENERGY (PRIVATE) LIMITED HEREBY SUBMITS</u>, for NEPRA's kind and gracious consideration, the application for the grant of a generation license along with supporting documents (the Generation License

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**Application**) for its 50 MW power generation facility to be located at Jhimpir, District Thatta, Sindh, Pakistan.

- 1.2.3 In order to highlight the advance stage of the progress made by the Project Company with regard to the EPC arrangements, financing arrangements and other activities necessary to culminate the generation facility to its commercial operation, the Project Company hereby encloses as ANNEXURE J a copy of the 'Project Progress Report' dated March 19, 2015 submitted by the Project Company to the AEDB.
- 1.2.4 Given the advance stage of the Project, NEPRA is kindly requested to process this Generation License request at the earliest, thereby enabling the Project Company to proceed further with the development process.
- 1.2.5 This Generation License Application is submitted in triplicate.
- 1.2.6 The generation license fee, payable by the Project Company, in respect of this Generation License Application is also enclosed in the form of a pay order for an amount of PKR 270,943/- (Pakistani Rupees Two Hundred Seventy Thousand Nine Hundred and Forty Three) dated March 27, 2015 drawn in favor of NEPRA.



## 2. APPLICANT – WESTERN ENERGY (PRIVATE) LIMITED

- 2.1 The Project Company, being the applicant under this Generation License Application, is a private limited company incorporated under the laws of Pakistan and has been specifically established to undertake power generation business and activities in Pakistan.
- 2.2 The Project Company (following grant of a generation license and approval of the Project Company's reference generation tariff by NEPRA) proposes to design, engineer, construct, insure, commission, operate and maintain the Project constituting of a 50 MW power generation facility (the **Facility**) to be located at Jhimpir, District Thatta, Province of Sindh, Pakistan (the **Site**).
- 2.3 For the purposes of designing, engineering, procuring, constructing, installing, testing, completing, commissioning, operation and maintenance of the Project, the Project Company has finalized the following detailed contracts: (i) the offshore supply and services agreement with globally reputable contractor, SHANGHAI MARINE DIESEL ENGINE RESEARCH INSTITUTE (the **SMDERI**), a fully owned subsidiary of *China Shipbuilding Industry Corporation* (the **CSIC**); and (ii) the onshore supply and services agreement and the operations and maintenance agreement with an affiliate of SMDERI in Pakistan, SINO-QIYAO INTERNATIONAL (PRIVATE) LIMITED, (the **EPC and O&M Terms & Arrangements**). The profile of SMDERI is attached herewith as ANNEXURE I.
- 2.4 The following supporting documents relating to the Project Company are attached herewith as follows:

DOCUMENTS	ANNEXURE
Shareholding Pattern	ANNEXURE C
Memorandum and Articles of Association	ANNEXURE D
Certificate of Incorporation	ANNEXURE E



## **3.** FACILITY UTILIZATION

#### 3.1 ELECTRICITY DEMAND & WIND CORRIDOR

- 3.1.1 Pakistan is a developing economy having a constant growth in industrialization coupled with a constantly rising demand for electricity. The non-availability of natural resources for expansion of the power sector has widened the gap between demand and supply, which has resulted in excessive and frequent load shedding. The shortfall in supply could be the major cause for stunned growth in the industrial sector in Pakistan. The total installed capacity of Pakistan as on June 30, 2013 was 23,663 MW; of which 16,000 MW (67.62%) was thermal, 6,826 MW (28.85%) was hydroelectric, 787 MW (3.33%) was nuclear and 50 MW (0.21%) was wind.
- 3.1.2 The demand for electricity has continued to increase by out pacing the growth rate of the economy. The shortfall at times crosses 6,000MW and this is the time when urban areas have 8-12 hours of load shedding and small cities/ rural areas have 18 hours of load shedding. The industry, having its self-generation on gas, has a suspended supply of gas for 2-3 days a week during winters. As mentioned above, Pakistan's major electricity sources at present are thermal and hydro generation, meeting approximately 97% of the country's annual electricity demand. The primary thermal generation fuels employed are furnace oil and gas. While both fuels are produced domestically, demand for them already outstrips supply by a considerable amount. Oil imports are already a significant burden on the national exchequer and the increasing import bill continues to exert further pressure on the foreign exchange reserves. Therefore, securing alternative fuels and the technical management should be strengthened to solve these problems and wind power can play a very important role in overcoming Pakistan's growing energy crisis.
- 3.1.3 The wind power program in Pakistan was initiated around ten (10) years ago by installation of wind measuring stations in the coastal areas of Sindh, Pakistan. The energy potential of 346,000 MW in the country is estimated by National Renewable Energy Laboratory, USA and only the Gharo – Keti Bander – Hyderabad wind corridor (the **Wind Corridor**) has a potential of 43,000 MW of wind power generation. If harnessed adequately, wind energy alone would eradicate energy shortages in the country. The Government of Pakistan is currently looking to build wind farms in the Wind Corridor, some of which are regions where electricity supply through the national grid has been a challenge.
- 3.1.4 The Government of Pakistan has clearly articulated its support for the development of renewable energies. Due to the fact that the use of wind energy is actually the most economical renewable energy production technique, the focus is on supporting the development of wind farms through wind based independent power producers (the **Wind IPPs**).

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- 3.1.5 In light of compliance by the Project Company of all requirements under the RE Policy 2006 for eligibility of an application for a generation license and following grant of a generation license and approval of Project Company's reference generation tariff, in each case, by NEPRA, the Project Company will finance, design, engineer, procure, construct, install, test, complete, commission, insure, operate and maintain the Project at Site.
- 3.1.6 The proposed Project has the advantage of being located in the Wind Corridor and thus will, following its completion, contribute towards relieving the shortage of electric power in the country.
- 3.1.7 Based on a thorough analysis of the national electricity generation structure and in light of technical parameters, it is anticipated that the Project shall operate as one of the most competitive independent power producers in Pakistan.

## 3.2 <u>Power off-take</u>

Following commercial operation date of the Project, the electricity generated will be sold to National Transmission and Despatch Company Limited (through its central power purchasing agency) on behalf of ex-Wapda distribution companies (the **Power Purchaser**) pursuant to an energy purchase agreement (the **EPA**), which in turn will distribute and modulate the electricity generated by the Project Company.

The EPA will be finalized and executed by and between the Project Company and the Power Purchaser following NEPRA's approval of the Project Company's twenty (20) years reference generation tariff, the grant of a generation license to the Project Company and the issuance by the Government of Pakistan of the Letter of Support.



#### 4. THE SPONSORS

#### 4.1 <u>AN INTRODUCTION</u>

The primary sponsor financing the Project is the **TAPAL GROUP**, principals of AMEEJEE VALEEJEE & SONS (PRIVATE) LIMITED and major shareholders of TAPAL ENERGY (PRIVATE) LIMITED (which is a 126 MW diesel engine based power project in operation and under the management of the owners of the Project Company for the past 17 years).

AMEEJEE VALEEJEE & SONS (PRIVATE) LIMITED is a business house established in 1867 dealing in engineering and construction related products, chemicals and consumer products. It represents some of the most renowned international companies like Steinmuller, Lurgi, Standard, Chint, Buhler, Kessel, Henkels, Dorr Oliver, Atlas Copco etc. dealing in engineering equipment and has been a key player in installation of several power plants in public utility companies and various industries in Pakistan.

TAPAL ENERGY (PRIVATE) LIMITED is a Karachi based company that owns a 126 MW power generation project formed under the Power Policy of 1994 at a project cost of US\$ 130 million. The development of the project was jointly done by Tapal Group and Wartsila Corporation who was also the EPC contractor. Tapal Energy (Private) Limited has the privilege of being one of the first projects to start its operations under the Power Policy of 1994.

Tapal Energy (Pvt) Limited has internationally acclaimed companies like Sithe Mauritius Limited, Mauritius, a subsidiary of Marubeni Corporation, Japan and Wartsila Corporation of Finland as its joint venture partners and shareholders.

The management of Tapal Energy (Private) Limited is with the Tapal Group, with Mr. Tabish Tapal as the Chief Executive. Tapal Energy (Private) Limited has been successfully providing reliable, uninterrupted power to the public utility K-Electric Limited (former Karachi Electric Supply Corporation) for the past seventeen (17) years. Tapal Energy (Private) Limited is one of the few independent power producers in Pakistan that are operated and maintained by its sponsors without any external operations and maintenance contractor.

## 4.2 <u>THE TAPAL GROUP BUSINESS</u>

Tapal Group has been in business for the past 145 years. The reason for its successful existence in the highly competitive corporate sector for such a long period is its good standing as a professionally managed group. Tapal Group follows a strict code of conduct regulated by properly documented policy guidelines, which are periodically reviewed and modified according to the changing times.



Tapal Group is proud of its dependable human resource pool comprising of highly qualified professionals in the field of engineering, business administration and finance. All Tapal Group companies have a defined set of organograms, documented job descriptions and a clearly defined hierarchy. New projects are taken up by our group after forming a committee from within our resource pool to do the development work.

Tapal Group's development team members are experienced developers of power projects. Induction of additional resources for the expansion of Tapal Group's development team are done as and when the projects progress.

The pride of the Tapal Group is its technical resource pool which comprises of highly qualified engineers who are capable to operate and maintain all kinds of plant and machinery.

Besides Tapal Group's in house resource pool, it has alliances with engineering firms of repute around the world. In addition, it is are also aligned with various local construction companies who can undertake the local construction works on all Tapal Group's projects.

The key board of directors in various companies and concerns forming the Tapal Group are as follows:

- (a) Mr. Moiz Tapal;
- (b) Mr. Tajwar Tapal; and
- (c) Mr. Tabish Tapal.

The key financial figures of the Tapal Group are illustrated below for reference:

			Rupees in '000			Rupees in '000
		Гараl Energy	7		AVS	
	2014	2013	2012	2014	2013	2012
Revenue	14,373,264	12,336,960	8,916,948	478,406	374,129	225,070
Profit	1,833,081	1,523,498	1,034,062	12,111	23,975	34,371
Taxation	28,105	9,736	1,401	24,920	28,350	20,249
Total Assets	7,336,535	7,094,431	6,551,435	480,791	510,693	455,334
Total Liabilities	1,421,809	1,399,016	498,812	81,506	123,518	88,714



## 4.3 FINANCIAL HIGHLIGHTS

Tapal Group's main financial highlights for the year ended June 30, 2014 include a turnover of Rs. 14.8 billion and its cost of assets nearing Rs.7.8 billion. The Tapal Group has contributed to a yearly income tax of Rs. 53 Million.

## 4.4 <u>COMMITMENT TO PROJECT</u>

Having an annually increasing group turnover of more than Rs.14 billion, the Tapal Group is committed to playing its part in the development of Pakistan's various sectors. Realizing the role of clean energy in the development of the nation, the Tapal Group has now ventured into the wind power generation sector by planning to install the Project through the Project Company.

The unmatched standards of corporate governance, efficiency, safety and operations established by Tapal Group in its diversified businesses are expected to be replicated in its wind power generation venture – thus raising the bar for all future wind power projects.



## 5. **Resources**

## 5.1 SENIOR MANAGEMENT & PERSONNEL

- 5.1.1 The Project Company has access to and has engaged the highly qualified personnel of Tapal Group for the development of the Project. The Project Company is presently under the process of appointing various personnel and details of the same will be provided upon finalization of the terms and conditions of their appointment.
- 5.1.2 In addition, the curriculum vitae of the following individuals currently engaged by the Project Company are attached herewith at ANNEXURE F:

	NAME OF INDIVIDUALS	Position	ANNEXURE
1.	TABISH TAPAL	CHIEF EXECUTIVE OFFICER	F
2.	MUSTAFA LAKDAWALA	DIRECTOR & COMPANY SECRETARY	F
3.	SYED RAZA ABBAS	PROJECT MANAGER	F
4.	IMRAN ADHI	MANAGER FINANCE	F

## 5.2 <u>THE O&M CONTRACTOR</u>

5.2.1 In addition to recruitment of its own management, staff and personnel for the purposes of the Project, the operations and maintenance (the O&M) of the Project will be performed by the SINO-QIYAO INTERNATIONAL (PRIVATE) LIMITED, an affiliate of SMDERI in Pakistan (the Operator), for ten (10) years following Commercial Operations Date. The Project Company has finalized with the Operator the operations and maintenance agreement for the Project, following detailed negotiations and development of a comprehensive contractual structure, that contains all commercial, technical and legal terms and arrangements with the Operator for the <u>turn-key O&M</u> of its Project.

## 5.3 <u>LEGAL ADVISER</u>

5.3.1 HAIDERMOTABNR & Co. has been selected by the Project Company to provide legal support on all legal aspects of the Project including Project documentation, regulation and financing matters. HaidermotaBNR & Co. has been actively involved in the power sector and projects and has advised various project companies / sponsors, lenders and the Government of Pakistan on various transactions and matters. It is ranked by Chamber & Partners as a "Band 1" firm in Pakistan for Projects, Banking & Finance and Corporate & Commercial.



## 6. CAPITAL BUDGET

- 6.1 The estimated total Project cost (the **Total Project Cost**), expressed in United States Dollars, has been calculated after thorough analysis, evaluation and understanding of the dynamics that affect the development and operation of a wind farm. The Total Project Cost comes to approximately US\$ 127,770,000 (United States Dollars One Hundred Twenty Seven Million Seven Hundred and Seventy Thousand).
- 6.2 The capital structure of the Project is proposed as follows:

	USD IN THOUSANDS
Девт	95,830
EQUITY	31,940
TOTAL PROJECT COST	127,770



## 7. FINANCIAL PLAN

The Total Project Cost of US\$ 127,770,000 (United States Dollars One Hundred Twenty Seven Million Seven Hundred and Seventy Thousand) is to be financed in a debt to equity ratio of 75:25, which is in accordance with the RE Policy 2006.

## 7.1 <u>Debt</u>

- 7.1.1 It is expected that the debt for the Project (the **Debt**) will be secured from **EXPORT IMPORT BANK OF CHINA** (the **China Exim Bank**), which will provide foreign financing in United States Dollars to the Project Company.
- 7.1.2 The terms and conditions for the Debt are at the final stages of negotiation with the China Exim Bank and will be backed by an insurance cover of China Export and Credit Insurance Corporation (SINOSURE). It will be ensured that the terms and conditions for the Debt are within the scope of the tariff.

## 7.2 <u>EQUITY</u>

- 7.2.1 Based on the Debt to Equity ratio of 75:25, the equity required to be injected by the Tapal Group (the Equity), being the primary sponsor, amounts to USD 31.94 Million. The Tapal Group will subscribe to the total amount of the Equity required for the Project from time to time. The Tapal Group is also in advance stage of negotiations with SMDERI whereby it is expected that SMDERI may take an equity stake of up to 40% in this Project.
- 7.2.2 The financial strength and net worth of Tapal Group (being the primary sponsor of the Project Company) is illustrated by the Auditor's Report attached at ANNEXURE G of Ameejee Valeejee & Sons and Tapal Energy (Private) Limited the same being the flagship concerns of the Tapal Group. Further, the recent financial statements of the Project Company are also attached hereto at ANNEXURE H.



## 8. THE FACILITY

## 8.1 <u>TECHNOLOGY</u>

### 8.1.1 Technology Selection Criteria

The technology for the Project has been selected after detailed analyses of various power generation technologies available internationally for the purposes of power generation through wind. Various factors were considered in selection of equipment and technology which included:

- (a) equipment to be of latest proven technology, megawatt class and high efficiency;
- (b) safe transportation of equipment to the wind farm site;
- (c) maintainability of the equipment and availability of OEM service personnel;
- (d) energy output with warranted power curve and performance warranty;
- (e) grid compatibility with proposed Energy yields and grid code requirements; and
- (f) suitability of operation and maintenance concept for the size and location of projects with suitable availability of spare parts, consumables and main components.

#### 8.1.2 The Selected Technology

After a consummate search, an elaborate process and thorough due diligence, the following WTGs have been selected for the Project:

MANUFACTURER	CSIC (CHONGQING) HAIZHUANG
	WINDPOWER EQUIPMENT CO., LTD.
WIND TURBINE GENERATOR	H111-2.0 MW
HUB HEIGHT	80 M
NUMBER OF TURBINES	25 (Twenty Five)
TOTAL INSTALLED CAPACITY	50 MW



The Facility configuration consists of 25 numbers of H-111-2.0 WIND TURBINE GENERATORS (the **WTG**); 75 (seventy five) blades (55.2m length); electrical equipment, together with ancillary equipment and other goods and machinery.

All functions of the selected H-111-2.0 WTG are monitored and controlled by a micro-processor based control system. In addition the wind turbines are equipped with a remote monitoring system.

The design used by the H-111-2.0 WTG is aimed at achieving high safety and environment mechanisms. Moreover, as per the Project Company's analyses, the equipment is suited to the conditions at the Project's Site.

The 2 MW series is SMDERI's most widely deployed wind turbine i.e. more than 500 WTGs contracted globally and is known for its:

- conformance and compliance to the International Electrotechnical Commission (the IEC) standards;
- high availability in a variety of wind classes;
- continual investment for achievement of highest capacity factor in its class; and
- sharing of components that ensures consistent workhorse reliability, ease of maintenance planning and high commonality in spare parts.

## 8.1.3 WTG System Specifications

Rotor	
Diameter	1111 M
Swept Area	9677 M2
Number of Blades	3
Blade Length	55.2 M
Airfoil	SR55.2
Blade Material	FIBERGLASS
Rotor Speed	13.7 RPM
Aerodynamic Brake	FULL FEATHERING
Direction of Rotation	ROTOR CLOCKWISE (FRONT VIEW)



BLADE	
Type description	H111
Blade length	55.2 M
Material	FIBERGLASS
Type of rotor	SPHEROIDAL GRAPHITE CAST IRON
Blade profiles	HORIZONTAL AXLE, UP-WIND

Нив		
Type description	CAST BALL SHELL HUB	
Material	SPHEROIDAL GRAPHITE CAST IRON	
Corrosion protection	CORROSION PROTECTIVE COATING	

GEARBOX	
Type description	PLANETARY LEVEL WITH TWO
	BALANCE SHAFT
Gear house material	QT400-18AL
Ratio	128
Mechanical power	2282
Shaft seals	MECHANICAL SEAL

YAW SYSTEM	
Type description	ELECTRICAL DRIVE
Number of units	4
Yaw speed	0.66 °/s
Voltage	400V

NACELLE	
Nacelle Cover	GFRP

Tower	
Material	STEEL
Corrosion protection	CORROSION PROTECTIVE COATING
Access conditions	CLIMBER /ELEVATOR



GENERATOR	
Type description	DOUBLE FED ASYNCHRONOUS
D ( 1	GENERATOR
Rated power	2150 KW
Rated voltage	690 V
Frequency	50 HZ
Number of poles	4
Synchronous speed	1500 RPM
Speed at rated power	1755 RPM
Operation speed range	950-2050 RPM
Speed range for constant power	1755-2050 RPM
Rated speed	1755 RPM
Max rotor slip	37%
Power factor	0.95 LEAD / 0.95 LAG
Nominal current	1760
Winding connection stator	$\Delta$ DELTA CONNECTION
Winding connection rotor	Y TYPE CONNECTION
Protection class (Generator)	IP54
Protection class (Slip ring-unit)	IP23
Thermal classification	Н

## 8.2 <u>The Project Site</u>

The Site of the Project is located near the village of Jhimpir, District Thatta, Sindh. The Jhimpir area has been selected for implementing the Project on the basis of its exceptional wind regime, flat terrain and nearness to the national and local grid. The area has been extensively surveyed and is identified as having strong potential for the proposed wind farm. The following other parameters have also been considered for the implementation of the Project at the proposed Site:

- Forecasted power output
- Access to the proposed site (materials and equipment transport feasibility study)
- Suitability for the surrounding environment

The Project Company has been allocated the Site for the Project from the Government of Sindh (GoS) for the development of the Project. The Site is located about 105km northeast of Karachi. The nearest settlement to the proposed Site is Nooriabad (22km Southwest). The Site is located in a strong and partly rocky area at 53m to 94m above sea level. The size of the whole



wind farm is about 852 acres. The Site allocation letter from the GoS is attached herewith as ANNEXURE K.

UTM Coordinates; zone 42R		Geodetic Coordinates	
Easting [m]	Northing [m]	Latitude	Longitude
398219.71	2793815.31	25°15'26.07"N	67°59'21.45"E
398559.69	2793935.81	25°15'30.07"N	67°59'33.57"E
399506.43	2789834.10	25°13'16.97"N	68° 0'8.50"E
399865.03	2789889.59	25°13'18.86"N	68° 0'21.30"E
402811.52	2785133.37	25°10'44.95"N	68° 2'7.81"E
403091.00	2785358.00	25°10'52.32"N	68° 2'17.74"E

The coordinates of the Site are as follows:

## FIGURE 1: SITE OVERVIEW









## 9.1 INVESTIGATION SUMMARY

The investigations at Site have shown that in general the realization of the Project is possible at the Site from an environmental point of view and no adverse impact on the existing flora and fauna at Site is expected. The Facility will not emit any solid, liquid and gaseous waste during the entire life of the Project and thus the power will be generated without polluting the environment of the surroundings.

A data collection survey 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 was undertaken based on available secondary information or data collected in the field. Primary data was collected to establish baseline conditions for the soil, water (surface and ground) quality, flora and fauna, and noise. Secondary data was collected for land, ecology, climate, and socioeconomic factors.

It was observed that the area is highly underdeveloped and there is no industrialization in the area and thus the baseline emissions are very low. The nearest settlements of human habitats are located 2 Km away from the Project Site. There is very sparse vegetation in the forms of herbs and shrubs, there being no reserved forest site or sanctuary located within the Project land area that needs to be demolished. The Site is located in remote areas with very little social and commercial activity and thus limiting the long term social impact.

Noise impacts will be around 60 DB(A) which are within the range as per National Environmental Quality Standards (NEQs) of Pakistan. There are no exceeds of shadow from the permissible limits calculated for all WTG type scenarios. The environmental disturbance normally associated with construction activities will be minimized through an Environment Management Plan (EMP), implementation of which will continue during Project operation and which includes monitoring arrangements.

There exist high potential of wind energy at the Project Site and the proposed Project will help in tapping this potential without impairing the environmental conditions of the area. It is envisaged that the more is the wind power generation from the Facility, the less is the GHG gases emissions – thus resulting in cleaner environment.



## 9.2 <u>IEE Report Approval from the Environmental Protection</u> <u>Agency, Sindh</u>

As already submitted in Section 1 (*Background to Generation License Application*) above, the Sindh EPA has already accorded its **approval** to the IEE Report for the Project through its decision dated May 10, 2014.

### **10.** SAFETY

The Project will be implemented in accordance with internationally accepted health and safety standards and in-line with the acclaimed practices and procedures. Tapal Group's vision, being the primary sponsor of the Project Company, entails introducing and establishing its unmatched safety standards and procedures in the business operations of the Project Company, so as to establish an enviable benchmark in the country's wind energy sector.



## 11. TRAINING AND DEVELOPMENT

- 11.1 While the Project Company has engaged professional and competent contractors to undertake the operations and maintenance of the Facility for a period of up to ten (10) years following commercial operations of the Project, training of the Project Company's own staff forms an essential part of the Project Company's twenty (20) year plan for the Project.
- 11.2 The executed EPC and O&M Terms & Arrangements contemplate on-site and off-site training of the Project Company's staff. Such training, as per the scope of the contractors set out in the EPC and O&M Terms & Arrangements, will aim at preparing the Project Company's staff in operating and maintaining the Facility in accordance with international standards. The training will be conducted with an aim to teach the Project Company's staff the functions of each Facility system so that the staff is informed of the Facility's (or any part thereof) functions in question.



## **12. PROJECT FEASIBILITY STUDY**

- 12.1 The Project Company engaged leading technical consultants for elaborating the Project Feasibility Study and for supervising the wind measurements and preparing conceptual design of the Facility.
- 12.2 A copy of the Project Feasibility Study is attached hereto at ANNEXURE A.



## **13.** IMPLEMENTATION SCHEDULE

13.1 The following provides the key milestones and dates for the Project's development to date:

MILESTONES ACHIEVED TO DATE		
ACTIVITIES AND	COMPLETION	
Issuance of first Letter of Intent (for 15MW)	March 6, 2013	
Issuance of Second Letter of Intent (Upgraded to 50 MW)	April 15, 2014	
Installation of Wind Mast & Instruments	January 2014 specific data f wind mast is b collected since February 2014	
Initial allocation of Land by Additional Deputy Commissioner- I, Thatta	August 19, 20 (Final Lease v signed after th approved plan is finalized un new policy of the project foc basis)	
IEE approval by Sindh EPA	May 10, 2014	
Approval of Grid Interconnection Studies by NTDC	In process	
Topography Survey	October 3, 201	
Approval of Project Feasibility Study by AEDB	Awaited, pend submission of Interconnectio	
Signing of Offshore EPC Agreement	December 15,	
Signing of Onshore EPC Agreement	January 30, 20	
Signing of O&M Agreement	January 30, 20	



14.2 The following provides the key upcoming milestones and dates for the Project's development:

MILESTONES TO BE ACHIEVED		
ACTIVITIES	COMPLETION DATI	
Grant of Generation License	Upon NEPRA's approval	
Reference Tariff Determination	Upon NEPRA's determinat	
Submission of Performance Guarantee by Project Company for issuance of LOS	15 days after Tariff determ by NEPRA	
Issuance of LOS to Project Company by Government of Pakistan	7 days after submission of Performance Guarantee	
Site Lease agreement with Government of Sindh	Prior to Project Financial C and in accordance with Government of Sindh requi	
EPA Signing with NTDC	Within the time period allo under the LOS	
IA Signing with Government of Pakistan	Within the time period allo under the LOS	
Project Financial Close & ordering of equipment	Within the time period allo under the LOS	
Commercial Operation Date	18 months following Finan Close	
Adjustment of reference tariff by NEPRA	Following Commercial Ope Date	



## CONCLUSION

In light of the submissions, the relevant financial analysis and information contained in this Generation License Application, along with the Annexures attached hereto, this Generation License Application is submitted for NEPRA's kind consideration and grant of the Generation License to the Project Company.

Respectfully submitted for and on behalf of: WESTERN ENERGY (PRIVATE) LIMITED



MUSTAFA LAKDAWALA DIRECTOR & AUTHORIZED REPRESENTATIVE OF WESTERN ENERGY (PRIVATE) LIMITED

## **ANNEXURE A**

## FEASIBILITY STUDY REPORT





## **PROJECT FEASIBILITY REPORT**

## **50MW WIND POWER PROJECT AT JHAMPIR, THATTA**



**Project Company** 

# WESTERN ENERGY PRIVATE LIMITED

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## **Acknowledgements**

The management of Western Energy Private Limited (WEL) is thankful to Ministry of Water & Power & Alternative Energy Development Board for generous support at all stages of project development and looks forward to continue for future milestones.

The management of WEL also recognizes the cooperation of Sindh Board of Investment, Land Utilization Department & Energy Department Government of Sindh which was extended at every stage of the project.

## **Disclaimers**

This report has been prepared for the benefit of Western Energy Private Limited (the "Client"), and may not be relied upon or disclosed to any other person for any purpose, other than as stated below, without the prior written consent of the Client 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.

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# **Document Information**

### **Purpose and Scope**

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

# **1 EXECUTIVE SUMMARY**

# **1.1 PROJECT OVERVIEW**

In light of the threefold global crisis mankind is facing currently – the energy crisis, the finance crisis and the environment/climate crisis – it is becoming more and more obvious that wind energy offers solutions to all of these huge challenges, offering a domestic, reliable, affordable and clean energy supply.

At this point of time it is difficult to predict the short-term impacts of the credit crunch on investment in wind energy. However, in the mid to long term it is clear that wind energy investments will rather be strengthened due to their low-risk character and societal and additional economic benefits. Investment in a wind turbine today means that the electricity generation cost is fixed to the major extends over the lifetime of the wind turbine. Wind energy implies no expenses on fuel and operation and maintenance costs are usually well predictable and rather marginal, in relation to the overall investment.

Pakistan is also facing the severe problem of high energy demand to sustain the economic growth and development. This comes with the dire fact that the conventional sources of energy, the fossil fuels, are depleting. The environmental impacts of these conventional energy sources are also alarming. This has led towards the development of alternative energy resources especially wind energy so that fuel diversification is achieved and energy systems are not highly vulnerable to shortages or prices increases of a particular fuel.

Wind resource studies conducted by the Government of Pakistan (GoP) through Pakistan Metrological Department (PMD) and Alternative Energy Development Board (AEDB) have shown very encouraging results. Based on these studies GoP has offered private investors the opportunity to develop Independent Power Producer (IPP) companies for generating power through wind in the coastal regions of the Sindh province.

Western Energy Private Limited (WEL) intends to develop, own and operate a 50 MW Wind Farm in Jhampir, Thatta. This feasibility study, deals with the 50 MW Western Energy Project at Jhampir, will serve the purpose for making the executive decision based on the technical viability of the project by Western Energy authorities regarding project implementation.

The Jhampir area has been selected for implementing the project on the basis of its exceptional wind regime, flat terrain and closeness to the National and local grid. The area has been extensively surveyed and is identified as having strong potential site for the proposed wind farm.

The electricity generated from the 50 MW wind farm would be sold to Central Power Purchase Agency (CPPA) on the 132kV grid. The Energy Purchase Agreement (EPA) would be signed with the Central Power Purchase Agency (CPPA) for a project life of 20 years.

### **1.2 RATIONALE FOR WIND POWER**

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. While both are produced domestically, demand for oil already outstrips supply by a considerable amount, and gas demand is expected to outstrip domestic supply within a few years. Oil imports are already a significant burden on the national exchequer and the increasing import bill continues to exert further pressure on the foreign exchange reserves.

Importation 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 increase Pakistan's reliance on imported fuels with associated foreign exchange effects. This must be considered in the context of rising fuel costs for gas and oil-based fuels as a result of uncertainty over future supply.

Alternatives to further fuel imports for electricity generation are the use of domestic coal, or generation from hydro-electric or other renewable sources, such as wind 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. As with gas, securing future supplies of coal and hydro-electric power would rely on significant spending on infrastructure. Pakistan has significant domestic reserves of coal. However, coal currently makes up a very small proportion of total generation, largely the result of most of the reserves being located in one area, the Thar Desert. Exploiting the reserves would require huge and costly upfront investment in local infrastructure (including provision of water supplies), development of mines, housing and related infrastructure, and investment in transmission lines before power plant development could commence.

Hydro electric power already supplies almost 30% of electricity, and numerous sites for future investment exist, but due to their locations, would also require significant investment in transmission to meet the expected power needs.

Looking at how the country's future electricity needs might be met in a way that supports the environmental objectives of the Government of Pakistan, wind generation has the potential of being a strong contributor. The development of wind generation projects could reduce dependence on fuels for thermal power generation, increase diversity in Pakistan's electricity generation mix, and reduce greenhouse gas (GHG) emissions through the avoidance of thermal power generation. Also the per kWh tariff for wind power projects are comparatively less than that of furnace oil tariff.

# **1.3 COUNTRY OVERVIEW**

Demand for energy in Pakistan far exceeds supply and is continuing to grow. The Government of Pakistan intends to meet this demand by mobilizing independent power producers to exploit indigenous energy sources including renewable energy. The opportunities for the private sector are clear.

The Pakistani power sector is regulated and structured in a similar manner to free market power sectors such as those typically operating in Europe. This should offer a degree of reassurance to investors interested in the Pakistani power market.

Pakistan has a well defined renewable energy policy designed to pump-prime the renewable energy market in the short-term and ultimately results in cost-effective renewable energy generation in the longer term. The liberal package of incentives and risk cover offered in the short-term phase of the policy present excellent opportunities for private sector developers and investors.

With the successful installation of two (02) wind power projects on ground making a cumulative capacity of 106.4MW and considering the significant progress made by a number of IPPs towards the development of wind power projects in Pakistan, the Western Energy project is well placed to benefit from the opportunity posed by the short-term policy phase without having to overcome the challenges faced by the leading developers.

## **1.4 INDUSTRY OVERVIEW**

Wind Power has proven to be the fastest growing renewable energy technology in the world from a mere 6,100 MW in 1996 to visible more than 282,275 Megawatt by the end of year 2012. It is registered that the installed wind capacity is more than doubling every third year. The turnover of the wind sector worldwide reached 60 billion Euro (75 billion US\$) in 2012. The success of the industry has attracted investors from the mainstream finance and traditional energy sectors.

Proportion of electricity generation from wind energy to the conventional sources is growing at a speed that seems to challenge the traditional electricity sources. The significance is visible from the moves made by major world industry players in the conventional markets such as British Petroleum and General Electric who have entered this emerging market with huge investments.

### **1.5 ENERGY PRODUCTION ESTIMATION**

Western Energy intends to develop, own and operate a 50 MW Wind Farm in Jhampir, Thatta (the "Project"). The energy yield calculations for the 50MW wind farm have been calculated using the following WTGs types:

- 25 WTGs of H111-2.0MW with 80m hub height
- 20 WTGs GW109/2500 2.5MW with 80m hub height

Five wind measuring masts have been considered for this study namely, FFC Energy Mast (16.5 km south of Project site), Yunus Energy Mast (7.0 km southwest of Project site), Master Energy Mast (14 km south of Project site), Dewan Energy Mast (4.5 km west of Project site) and the wind measuring mast installed on the Project site i.e. Western Energy Mast.

The wind measuring mast of Yunus Energy Limited (YEL) has been selected for the calculation of annual energy yield at the wind farm site of western energy due to the following reasons:

- Installation arrangements of the mast are of IEC compliance
- Measnet Calibrated Anemometers
- Highest recording period/ Long term data

- Good data coverage for all the instruments during the measurement period
- \* Time series is good enough to generate a bankable wind resource assessment report
- Computed regression coefficient for anemometers installed at YEL mast with legends V85-a and V85-b is very good (r<sup>2</sup> = 0.9996) & correlation with other neighboring masts is also very good.
- Site conditions of project site are similar to that of YEL mast site.
- \* In close proximity of the project site than the other neighboring wind measuring masts.

The annual energy production for 50MW wind farm, using long term time series developed at YEL Mast, on the proposed wind turbine generators have been estimated using WAsP. The summary of estimated annual energy production of the 50MW wind farm is shown below:

Weston- Franky Wind Found	Wind Turbine Generators			
Wester II Energy wind rarin	H111-2.0MW	GW 109/2500		
Turbine Capacity (kW)	2000	2500		
Number of WTG	25	20		
Installed Wind Farm Capacity (MW)	50	50		
Hub Height (meters)	80	80		
Rotor Diameter (m)	111	109		
Gross Electrical Output of Wind Farm (GWh)	231.58	207.443		
Wake Losses (GWh)	8.462	7.451		
Net Electrical Output of Wind Farm (GWh)	223.118	199.992		
Power Curve density correction Losses (3.5%) - (GWh)	7.8091	-		
Availability (95%) - (GWh)	10.7654	9.9996		
Power Curve Losses (2%) - (GWh)	4.0909	3.7998		
Blade Degradation (0.5%) - (GWh)	1.0023	0.931		
Temperature Losses (2%) – (GWh)	3.989	3.7052		
Electrical Losses (3%) - (GWh)	5.8638	5.4467		
Scheduled maintenance/ Miscellaneous (1.0%) - (GWh)	1.896	1.7611		
P50 Wind Farm Yield (GWh/annum)	187.7015	174.3486		
P50 Capacity Factor (%age)	42.85	39.81		

### Table 1.1: Summary of Estimated Annual Energy Production

# **1.6 UNCERTAINITY ANALYSIS**

The uncertainties associated with the wind speed measurement accuracy, long term wind speed predictions, wind flow model, array loss modeling, instruments, topography, simulation software have been estimated. Annual Energy production of the wind farm is calculated at different probability level. The results obtained for different confidence levels for each WTG type are summarized in Table 1.2 below:

Table 1.2: Energy	y Production	Estimates for	proposed	50MW	Wind Farm
		the second s			

WTG Type	H111-2.0MW	GW109/ 2500
P50 Wind Farm Yield (GWh/annum)	187.7015	174.3486
P50 Capacity Factor (%age)	42.85	39.81
P70 Wind Farm Yield (GWh/annum)	167.89	155.94
P70 Capacity Factor (%age)	38.33	35.60
P80 Wind Farm Yield (GWh/annum)	155.69	144.62
P80 Capacity Factor (%age)	35.55	33.02
P90 Wind Farm Yield (GWh/annum)	138.93	129.05
P90 Capacity Factor (%age)	31.72	29.46

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# **2** GLOBAL WIND ENERGY INDUSTRY

### 2.1 WIND ENERGY BACKGROUND

The kinetic energy in the wind is a promising source of renewable energy with significant potential in many parts of the world. The energy that can be captured by wind turbines is highly dependent on the local average wind speed. Regions that normally present the most attractive potential are located near coasts, inland areas with open terrain or on the edge of bodies of water. Some mountainous areas also have good potential. In spite of these geographical limitations for wind energy project siting, there is ample terrain in most areas of the world to provide a significant portion of the local electricity needs with wind energy projects.

### 2.2 HISTORY OF WIND POWER

Wind energy has been used for thousands of years for a wide variety of purposes; its early harnessing, via sails, as a means of ship propulsion played a significant role in the expansion of the early empires. When static windmills were first used on land is uncertain, but it has been suggested that the Babylonian Emperor Hammurabi used them for an irrigation scheme in 700 BC.

By the 18th century, what we commonly call the Dutch windmill was becoming a common sight across Europe, used not only for the milling of corn and similar products, but also for lifting water for irrigation purposes. The other prominent development was the wind pump which sprung up all over rural America, Australia, and elsewhere as a means of pumping water from deep boreholes for cattle grazing and farm irrigation. It is estimated that there were 5 million such machines in the USA around 1900. Many can still be seen functioning around the world, apart from their frequent scene-setting role in Hollywood movies.



Figure 2-1: An old turbine

Between 1900 and the oil crisis of 1973 there was no sustained development of wind energy, although the odd electricity generating wind turbine did appear from time to time. However, the basis for the modern wind turbine for electricity generation was set during that period by European inventors such as Poul la Cour and Johannes Juul in Denmark and Ulrich Hütter in Germany.



Figure 2-2: Modern Day Wind Turbine

The USA was the first nation to invest heavily in wind energy, and in the early 1980s Californian wind farms served as a beacon to researchers and enthusiasts around the world. Activities increased in many western European countries but the falling back of oil prices tended to reduce the political and economic pressure for rapid progress. Various European countries continued to invest individually in the harnessing of wind energy for electricity production and rapid progress was made during the last quarter of the 20th century. The cost of wind-produced electricity from favorable sites is already competitive with fossil-fuel sources.

Today, wind turbines are gigantic rotating machines with blades up to twice the length of the largest plane wings. Nacelles with gearboxes and generators weighing more than a jumbo jet are erected on top of 120-140 metre masts, and rotors sweep an area the size of a football field. Wind technology can no longer borrow research from other sectors: it needs to forge ahead on its own.

### 2.3 DESCRIPTION OF WIND TURBINES

Wind turbine technology has reached a mature status during the past 15-20 years as a result of international commercial competition, mass production and continuing technical success in research and development (R&D). The earlier concerns that wind turbines were expensive and unreliable have largely been allayed. Wind energy project costs have declined and wind turbine technical availability is now consistently above 97%. Wind energy project plant capacity factors have also improved from 15% to over 35% today, for sites with a good wind regime.

Modern wind energy systems operate automatically. The wind turbines depend on the same aerodynamic forces created by the wings of an aeroplane to cause rotation. An anemometer that continuously measures wind speed is part of most wind turbine control systems. When the wind speed is high enough to overcome friction in the wind turbine drive train, the controls allow the rotor to rotate, thus producing a very small amount of power. This cut-in wind speed is usually a gentle breeze of about 4m/s. Power output increases rapidly as the wind speed rises. When output reaches the maximum power the machinery was designed for, the wind turbine controls govern the output to the rated power. The wind speed at which rated power is reached is called the rated wind speed of the turbine, and is usually a strong wind of about 15 m/s. Eventually, if the wind speed increases further, the control system shuts the wind turbine down to prevent damage to the machinery. This cut-out wind speed is usually around 25 m/s.

The major components of modern wind energy systems typically consist of the following:

- Rotor, with 2 or 3 blades, which converts the energy in the wind into mechanical energy onto the rotor shaft;
- Gearbox to match the slowly turning rotor shaft to the electric generator;
- Tall tower which supports the rotor high above the ground to capture the higher wind speeds;
- Solid foundation to prevent the wind turbine from blowing over in high winds and/or icing conditions; and
- Control system to start and stop the wind turbine and to monitor proper operation of the machinery.

Following figure illustrates the configuration of a typical "Horizontal Axis Wind Turbine" or HAWT wind energy system. A "Vertical Axis Wind Turbine" or VAWT is an equally viable alternative design, although it is not as common as the HAWT design in recent projects implemented around the world.



Figure 2-3: Horizontal Axis Wind Turbine

### 2.4 WIND ENERGY APPLICATION MARKETS

Wind energy markets can be classified based on the end-use application of the technology. Wind energy projects are common for off-grid applications. However, the largest market potential for wind energy projects is with on-grid (or grid-connected) applications.

### 2.4.1 OFF-GRID APPLICATIONS

Historically, wind energy was most competitive in remote sites, far from the electric grid and requiring relatively small amounts of power, typically less than 10 kW. In these off-grid applications, wind energy is typically used in the charging of batteries that store the energy captured by the wind turbines and provides the user with electrical energy on demand. Water pumping, where water, rather than energy, can be stored for future use, is also a key historical application of wind energy. The key competitive area for wind energy in remote off-grid power applications is against electric grid extension, primary (disposable) batteries, diesel, gas and thermoelectric generators. Wind energy is also competitive in water pumping applications.

### 2.4.2 ON-GRID APPLICATIONS

In on-grid applications the wind energy system feeds electrical energy directly into the electric utility grid. Two on-grid application types can be distinguished.

#### 2.4.2.1 ISOLATED-GRID ELECTRICITY GENERATION

Wind turbine generation capacities typically ranging from approximately 10kW to 200kW Isolated-grids are common in remote areas. Electricity generation is often relatively expensive due to the high cost of transporting diesel fuel to these isolated sites. However, if the site has good local winds, a small wind energy project could be installed to help supply a portion of the electricity requirements. These wind

energy projects are normally referred to as wind-diesel hybrid systems. The wind energy system's primary role is to help reduce the amount of diesel fuel consumption.

#### 2.4.2.2 CENTRAL-GRID ELECTRICITY GENERATION

Wind turbine generation capacities typically ranging from approximately 200kW to 3MW Central-grid applications for wind energy projects are becoming more common. In relatively windy areas, larger scale wind turbines are clustered together to create a wind farm with capacities in the multi-megawatt range. The land within the wind farm is usually used for other purposes, such as agriculture or forestry. Another common approach for wind energy project development includes the installation of one or larger scale wind turbines by individuals, businesses or co-operatives.

### 2.5 WIND FARM DEVELOPMENT

A wind farm consists of a number of wind turbines (which are often installed in rows perpendicular to the wind direction), access roads, electrical interconnections and a substation, a monitoring and control system and a maintenance building for the larger farms. The development of a wind energy project includes the determination of the wind resource, the acquisition of all authorizations and permits, the design and specification of the civil, electrical and mechanical infrastructure, the layout of the wind turbines, the purchasing of the equipment, the construction and the commissioning of the installation. Construction involves preparing the site, grading roads, building turbine foundations, installing the electrical collection lines and transformers, erecting the turbines and construction of the substation and building.

The wind resource assessment and approvals for a wind farm are often the longest activities in the development of the wind energy project. These can take up to 4 years in the case of a large wind farm requiring a comprehensive environmental impact study. The construction itself can normally be completed within a few months. The precise determination of the wind resource at a given site is one of the most important aspects in the development of a wind energy project as the available wind resource at the project site can dramatically impact the cost of wind energy production. In the case where a prefeasibility study indicates that a proposed wind energy project could be financially viable, it is typically

recommended that a project developer take at least a full year of wind measurements at the exact location where the wind energy project is going to be installed.

For very small-scale projects (e.g. off-grid battery charging and water pumping), the cost of wind monitoring could actually be higher than the cost to purchase and install a small wind turbine. In this case a detailed wind resource assessment would normally not be completed.

### 2.6 GROWTH TRENDS OF WIND INDUSTRY

Wind Power has proven to be the fastest growing renewable energy technology in the world from a mere 6,100 MW in 1996 to visible more than 282,275 Megawatt by the end of year 2012. It is registered that the installed wind capacity is more than doubling every third year. The turnover of the wind sector worldwide reached 60 billion Euro (75 billion US\$) in 2012. The success of the industry has attracted investors from the mainstream finance and traditional energy sectors.

Proportion of electricity generation from wind energy to the conventional sources is growing at a speed that seems to challenge the traditional electricity sources. The significance is visible from the moves made by major world industry players in the conventional markets such as British Petroleum and General Electric who have entered this emerging market with huge investments.

In the year 2012, the wind capacity reached worldwide 282,275 Megawatt, after 236,749 MW in 2011, 196,944 MW in 2010, and 159,742 MW in 2009.



Figure 2-4: Global Installed Capacity by Year<sup>1</sup>

The top five countries (China, USA, Germany, Spain and India) represented 74,2 % of the worldwide wind capacity, significantly more than 73 % in the year. China and USA and together represented 29 % of the global wind capacity in 2012.

<sup>&</sup>lt;sup>1</sup> World Wind Energy Report by WWEA, 2012



Figure 2-5: Top 10 Wind Power Producers in the World<sup>2</sup>

According to the half year report 2013 by World Wind Energy Association (WWEA), the latest shape of statistics for the year ending 2013 is given below:

<sup>&</sup>lt;sup>2</sup> World Wind Energy Report by WWEA, 2012

		Added		Added	-	Added	
Perition Country	for line 2013	Capacity first	and 2012	<b>Capacity first</b>	and 2011	Capacity first	and 2010
	feature	half 2013	Thereit.	half 2012		half 2011)	
1 China		EXCO.	TE-224	EI410	CO/DEA	d'ann	(MM)
2 (ISA	60'009	16	601007	2,883	02.304 46'919	2'252	44 /33 401190
3 Germany	32'422	1'143	31'308	941	29'075	766	277215
4 Spain	22'907	172	22785	414	21'673	480	20'676
5 India	19'564	1'243	18'321	1'471	15'880	1'480	13'065
6 United Kingdom	9'610	1'331	8'228	822	6'018	504	5'203
7 italy	8'415	273	8'152	320	6'877	460	5'797
8 France	7'821	198	7623	650	6'640	400	5'660
9 Canada	6'578	377	6'201	246	5'265	603	4'008
10 Denmark	4578	416	4162	56	3'927	•	3'734
11 Portugal	4'564	22 576	4'542	<b>19</b>	4'3/9	260	51/02
12 Auctralia	2000	200 875	3743 2'584		2130		2 US2 11/290
14 Brazil	2'788	281	2'507	. 118	1'429		980
15 Japan	2'655	41	2'614	- · ·	2'501		2'304
Rest of the World	26'204	2'030	24'174	3'026*	18'778	3'200*	15'805
Total	296255	13'980	282'275	16'376	2377717	18'405	199'739

Table 2-1: Top Wind Power Generating Countries (Comparison of 2010, 2011, 2012 & 2013)<sup>3</sup>

The world market for wind turbines in the second half of 2013, an additional capacity of 22GW is expected to be erected worldwide, which would bring new annual installation to 35.7 GW, significantly less than the 44.6 GW of the year 2012. The total installed wind capacity is expected to reach 318 GW by the end of this year, enough to provide almost 4% of the global electricity demand.

### 2.7 WIND ENERGY IN ASIA

The total installed wind capacity in Asia by the end of year 2012 reached to 100 GW (35.4 % of the global capacity). The continent had only the fourth highest growth rate of all world regions with 19.4 %, the growth was smaller than in 2011 (34%), 2010 (51%) and 2009 (67%).

<sup>&</sup>lt;sup>3</sup> WWEA Half Year Report 2013



Figure 2-6: Total Installed Wind Energy in Asia<sup>4</sup>

# 2.8 WIND SHARE IN ELECTRICITY SUPPLY

All wind turbines installed globally by the end of the year 2011 contribute potentially 580 Terawatthours to the worldwide electricity supply which represents more than 3 % of the global electricity demand.

This energy amount is more than the electricity needs of the United Kingdom, an industrialised country with more than 60 million inhabitants, and the sixth largest economy in the world.

In order to understand the actual commitment of a country to wind power and its progress in wind power utilization, it is worthwhile not only to look at the total figures, but also to put the installed capacity in relation to the size of a country. It becomes better visible that some of the smaller countries have made remarkable progress in wind power utilization as well and it reveals the potential of wind power utilization.

Denmark is the leader in terms of installed wind power capacity per person: Per inhabitant, the country has an installed wind capacity of 752 Watt. Amongst the major countries, also Spain, Portugal, Sweden, Germany, and Ireland rank amongst the top ten. The USA ranks 12th, with close to 200 Watt per person, and China ranks 36th, with 56 Watt per person, both far behind their absolute position but still above world average. India is on position 52 with 15 Watt.

<sup>&</sup>lt;sup>4</sup> World Wind Energy Report by WWEA, 2012

# **3** PAKISTAN ELECTRICITY MARKET

# 3.1 ELECTRICITY SUPPLIERS

The electricity suppliers in Pakistan are given below:

- Water & Power Development Authority (WAPDA) & Ex-WAPDA GENCOs with 11,332 MW installed capacity is the largest utility company in Pakistan and provides services to the entire country except Karachi.
- Karachi Electric Supply Company (KESC, <u>http://www.kesc.com.pk</u>) with installed capacity of 2,381MW supplies Karachi with electricity.
- Pakistan Atomic Energy Commission (PAEC, <u>http://www.paec.gov.pk</u>) has installed capacity of 787MW.
- Independent Power Producers (IPPs) have an installed capacity of 9,163MW (PPIB, <u>http://www.ppib.gov.pk</u>).

WAPDA and PAEC are government entities, while KESC and IPPs operate in private sector.



The primary energy supply by suppliers is shown below:

Figure 3-1: Percentage Share of Electricity Suppliers in Pakistan<sup>5</sup>

# 3.2 ELECTRICITY GENERATION SOURCES

The major sources of electricity generation are:

- Thermal (both Gas & Oil)
- Hydro Power
- Nuclear Power

Thermal generation capacity is distributed among WAPDA, IPPs and KESC. Majority of Hydro Power is owned by WAPDA and Nuclear by PAEC.

The total installed capacity of Pakistan as on June 30, 2013 was 23,663 MW; of which 16,000 MW (67.62%) was thermal, 6,826 MW (28.85%) was hydroelectric, 787 MW (3.33%) was nuclear and 50 MW (0.21%) was wind. The installed power generation capacity by sources is shown below:

<sup>&</sup>lt;sup>5</sup> State of Industry Report 2013 published by NEPRA



Figure 3-2: Percentage Share of Installed Power Generation Capacity

### **3.3 POWER CRISIS**

An increase in industrialization is accompanied by an increase in electricity demand. The non-availability of natural resources for expansion of the power sector has widened the gap between demand and supply, which has resulted in excessive and frequent load shedding. The shortfall in supply could be the major cause for stunned growth in the industrial sector in Pakistan. At the moment industrial units are facing a dichotomous situation where market sources demand increased production, especially of consumer products, while the utility infrastructure fails to keep pace with this requirement. This dilemma is typical for organizations which see the potential for enhancing the market share of their products, while the utility infrastructure fails to keep pace with this requirement. This dilemma is typical for organizations which see the potential for enhancing the market share of their products but are facing constraints in the reliability and supply of electricity.

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The demand for electricity has continued to increase by out pacing the growth rate of the economy. A power shortage was likely to appear in 2006 which did and forced the utilities to go for load-shedding. The shortfall at times crosses 6,000MW and this is the time when urban areas have 8-12 hours of load shedding and small cities/ rural areas have 18 hours of load shedding. The industry having its self-generation on gas has a suspended supply of gas for 2-3 days a week during winters.

The situation is so scary that Government even had to opt for early shut down of markets, two holidays per week, suspension of private functions etc; which reduced the productive working time and shortened the social life of the people. Electricity consumption by the sector is shown below:



Figure 3-2: Energy Consumption by Sector<sup>6</sup>

Increase in electricity demand is directly linked to the growth of the country's economy. Main drivers for the growth are industrial and domestic users. The demand for electricity from the industrial sector, given current growth trends, is going to rise substantially over the next five years. There has also been a rapid increase in the number of electricity consumers in recent years. This is due primarily to rapid urbanization

<sup>&</sup>lt;sup>6</sup> Pakistan Energy Year Book, 2012

and also the extension of the national grid to include an increased number of rural areas. In fact, village electrification has been a central part of the government's agenda.

Supply of electricity as compared to demand has been stagnant for last decade or so with very little additions. The actual position of demand and supply of the electric power during peak hours & the projected figures of planned generation capacity, demand growth rate and surplus/ deficit of electric power for the years to come, in the NTDC's and KESC's system are shown below:

Table 3.1: Surplus/	Deficit in Demand	d and Supply during	z NTDC's Sy	stem Peak Hours

A: Actual Figures					
Financial Year ending. 30 <sup>th</sup> June	Generation Capability (MW)	Demand During NTDC's System Peak Hours (MW)		Surplus /	(Deficit) (MW)
2009	13,637	17,852			-4,215
2010	12,751	18,467			-5,716
2011	13,193	18,521			-5,328
2012	12,320	18,940		-6,620	
2013	13,577	18,827		-5,250	
B: Projected Figures				1997) 1997)	
Financial Year ending 30 <sup>th</sup> June	Planned Generation Capability as per NTDC (MW)	NTDC Projected Demand Growth Rate (%)	NTDC's Pr Demand peak hours	ojected during s (MW)	Surplus / (Deficit) (MW)
2014	21,668	7.43	25,91	8	-4,250
2015	30,510	7.70	28,02	9	2,481
2016	20,352	5.50	24,01	8	-3,666
2017	21,616	4.80	25,52	1	-3,905
2018	24,924	4.80	26,75	5	-1,831

Source: NTDC

Table 3.2: Surplus/ Deficit in Demand and Supply during KESC's System Peak Hours

A: Actual Figur	<b>'es</b>						
Financial Year ending 30 <sup>th</sup> June	Generation Capability (MW)*		Demand During KESC's System Peak Hours (MW)		Surplus/ (Deficit) (MW)		
2009	2,403	****	2,4	162		-59	
2010	2,393		2,5	62		-169	
2011	2,237		2,565		-328		
2012	2,163	2,163		2,596		-433	
2013	2,246		2,778			-532	
<b>B:</b> Projected Fi	gures						
Financial Year ending 30 <sup>th</sup> June	Planned Generation Capability as per KESC (MW)	KESC's Projected KESC Demand Growth Dem Rate (%) Peak		KESC's Projected Demand during Peak hours (MW)		Surplus/ (Deficit) (MW)	
2014	2.419	5.00		2.827		-408	
2015	2,437	5.00		2.968		-531	
2016	2,737		5.00	3,11	6	-379	

\* includes own generation I impart from all sources.

Source: KESC

# 3.4 NECESSITY OF WIND ENERGY IN POWER SECTOR OF PAKISTAN

Pakistan faces chronic electricity shortage due to demand growth, no addition in generation capacity, high system losses, and seasonal reductions in the availability of hydropower, circular debt etc. rotating power outages ("load shedding") are common and many villages are not yet electrified.

The Government of Pakistan is making concerted efforts to speed up the development of energy resources to effectively contribute to the nation's economic growth. Pakistan, which suffers from a perennial insufficiency of energy supply, has enthusiastically taken up energy issues since the 1990's. However, the insufficiency of energy supply has obstructed the social and economic growth of Pakistan without definite resolution.

At present, 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. While both are produced domestically, demand for oil already outstrips supply by a considerable amount, and gas demand is expected to outstrip domestic supply within a few years. Oil imports are already a significant burden on the national exchequer and the increasing import bill continues to exert further pressure on the foreign exchange reserves.

Importation 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 increase Pakistan's reliance on imported fuels with associated foreign exchange effects. This must be considered in the context of rising fuel costs for gas and oil-based fuels as a result of uncertainty over future supply.

Increase of energy utilization will be expected by securing preparation of the infrastructure of energy supply since further economic growth will be expected in the near future. On the other hand, expansion of the nation's energy consumption will cause the following negative issues:

- a. Deterioration of the trade balance due to increase in imports of oil and oil products.
- b. Negative impacts on the global environment due to consumption of hydrocarbon fuels.

Securing alternative fuels and the technical management should be strengthened to solve these problems. Alternatives to further fuel imports for electricity generation are the use of domestic coal, or generation from hydro-electric or other renewable sources, such as wind power. Potential of wind energy in Pakistan

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has not been properly explored in the past. There is large potential of power generation from wind energy available in the country. The development of wind generation projects could reduce dependence on fuels for thermal power generation, increase diversity in Pakistan's electricity generation mix, and reduce greenhouse gas (GHG) emissions through the avoidance of thermal power generation. Also the per kWh tariff for wind power projects are comparatively less than that of furnace oil tariff.

# 4 INCENTIVES FOR THE DEVELOPMENT OF WIND PROJECTS IN PAKISTAN

The Government of Pakistan is actively promoting the deployment of renewable energy through the "Policy for Development of Renewable Energy for Power Generation", published in 2006. The purpose of the RE policy is to increase the deployment of renewable energy technologies in Pakistan so that renewable energy provides a higher proportion of the national energy supply mix (minimum of 9,700 MW by 2030) and helps ensure universal access to electricity in all regions of the country. In this regard, a number of incentives have been given in the RE policy for the development of wind energy.

## 4.1 INCENTIVES FOR DEVELOPERS

A number of incentives have been given to the project developer in the RE policy. Some of the key incentives given in the policy are given below:

### 4.1.1 GUARANTEED MARKET

It is mandatory for the power distribution utilities to buy all the electricity offered to them by renewable energy projects as long as the power is supplied in accordance with specified grid connection, off-take voltage and interface requirements.

### 4.1.2 GRID CONNECTION, OFF-TAKE VOLTAGE AND INTERFACE

The cost of grid connection is borne by the purchaser with the developer only being mandated to supply power to an agreed point at the boundary of the site. The requirement on the developer is to provide the power at a specified voltage (depending on the distance to the transmission system) and in accordance with the grid code.

#### 4.1.3 PLANNING PERMISSION

The risk of planning permission has been removed as all planning applications are being dealt with centrally by the AEDB.

#### 4.1.4 WHEELING

Renewable energy power producers shall be allowed to enter into direct (bilateral) sales contracts with end-use customers. Under this arrangement, they would be allowed to sell all or a part of the power generated by them to their direct customers and the rest to the utility for general distribution. For direct sales, they shall be required to pay 'wheeling' charges for the use of the transmission and distribution grid network used to transport the power from the plant to the purchaser. In practical terms, the IPP shall inject electricity into the grid system at one point and would be entitled to receive the same amount at any other location (within the same distance from the grid as the distance of the plant from the system) upon payment of a corresponding wheeling charge, to be determined by NEPRA. This wheeling charge will reflect the cost of providing and maintaining the transmission interconnection, including the energy losses suffered *en route*, calculated on a utility-wide basis by NEPRA.

#### 4.1.5 CARBON CREDITS

All qualifying renewable energy power projects eligible for financing under the Clean Development Mechanism (CDM) shall be encouraged to register for Certified Emission Reduction (CER) credits with the CDM Executive Board, either collectively or individually. The Government shall also strive, in collaboration with international development agencies to facilitate project applications for such carbon credits in order to reduce the associated initial transaction costs for project sponsors. Importantly, as this policy creates significant incremental costs for the power purchaser (e.g. higher tariffs, resource availability risks, backup power provision, transmission and interconnection infrastructure), any carbon credits obtained by renewable energy IPPs will be utilized to partly offset this burden so as to improve the economic competitiveness of renewable energy-based grid power for both the rate payers and the producers. The IPP shall therefore, at the time of submission of tariff petition to NEPRA, incorporate the CER-based revenue stream expected over the term of the project's Power Purchase Agreement (PPA), in the project's financial analysis on terms specified by the regulator (e.g. anticipated emissions offset and price per equivalent tonne of CO2 abated), whether opting for up-front tariff or negotiated tariff. A mechanism and legalised institutional arrangement shall be specified by the AEDB and approved by 27 | P a g e

NEPRA, comprising of potential primary beneficiaries (i.e., power producers and purchasers) jointly managing and selling the CERs thus obtained in the international carbon market at an optimum price.

The annual carbon revenues realized subsequently shall be divided in the following manner: (a) an upfront, nominal deduction shall be made for the administrative costs of the joint CER management mechanism; (b) an amount not exceeding that required to bring the IPP's return on equity (ROE) to the level allowed by NEPRA shall be payable to the power purchaser; and (c) the remaining revenues shall be divided in equal proportion between the IPP (as a 'green credit' for enhancing the financial returns accruing to the project's investors) and the power purchaser (as 'green tariff' support for lowering the per unit price of clean renewable power, thereby increasing its attractiveness for purchasers and consumers). Projects shall be required to sign a separate agreement binding them to the terms of such a carbon crediting mechanism, but shall not be penalized for failure to qualify for or obtain sufficient annual CER revenues to fully compensate the power purchaser under Item (b) above, provided they have complied with the terms of the carbon credit agreement, as certified by NEPRA.

The intention of the carbon credit sharing mechanism is to help further incentives and facilitate investments in renewable energy projects, increase the share of renewable energy in utilities' power purchase portfolios, and reduce the cost of renewable energy based power for the end user - factors which should help enhance the eligibility of such projects for CDM approval.

### 4.1.6 SECURITY PACKAGE

The power purchaser shall enter into a specific Power Purchase Agreement (PPA), based on a standard model agreement, with the IPP. The Government of Pakistan shall also enter into an Implementation Agreement (IA) which will guarantee the payment obligation of the public sector power purchaser on account of power sales extending over the term of the PPA. The PPAs will be much simpler than those for thermal or large hydro IPPs, and shall be based on the purchase of all power generated at a per-kWh rate (i.e. there will be no capacity charge, capacity testing, no risk, and no penalty conditions implied). The Government of Pakistan shall also undertake to facilitate the acquisition of CDM Certified Emissions Reduction units (CERs) by qualifying projects, and the sharing of associated revenues under a separate agreement and based on payment-on-delivery terms, subject to verification of the same, between the IPP (as a 'green' credit) and the power purchaser (as 'green tariff' support).

## 4.2 INCENTIVES FOR LENDERS

In addition to the incentives described above, the Implementation Agreement incorporates a number of terms designed specifically to act as incentives for lenders. These terms are summarized below.

### 4.2.1 ASSURANCE AGAINST DISCRIMINATORY ACTION

The government of Pakistan issues an assurance that no discriminatory action will be taken against the project investors or lenders.

### 4.2.2 FOREIGN EXCHANGE AVAILABILITY

The Government of Pakistan has guaranteed availability of foreign exchange, when ever required for payment to the lenders, under financing documents. In a market where foreign exchange is not a free commodity, this serves as an additional guarantee.

### 4.2.3 INSURANCE

The Government of Pakistan has explicitly agreed to subordinate its rights to the rights of lenders under insurance policies obtained by investors for the project insurance. This gives additional assurance to the lender.

### 4.2.4 RESTRICTION OF TRANSFER OF SHARES

Lead sponsors are required to hold their shares for a minimum of 6 years. This is intended to ensure that management will run the project effectively and so serves as a further guarantee to the lenders.

### 4.2.5 CREATION OF SECURITY IN FAVOUR OF LENDERS

The Implementation Agreement (IA) explicitly authorizes the investor to create security in favour of lenders in order to remove any legal bottleneck which may have come up in case of dispute. At the same time, lenders are not responsible to the Government of Pakistan unless they take over the project to run or sell it.

#### 4.2.6 SELLER'S DEFAULT

The Government of Pakistan cannot terminate the Implementation Agreement unless it has given notice and opportunity to the lenders to remedy the seller's event of default. Lender's rights remain protected regardless of whether they opt to intervene or not.

#### 4.2.7 COMPENSATION FOR TERMINATION

The lender's balance due is guaranteed for payment by the Government of Pakistan under all circumstances, regardless of whether the agreement is terminated by the Government of Pakistan or by the seller for any reason.

#### 4.2.8 EVENT OF DEFAULT

Any change in law which affects the lenders rights will be classed as event of default by the Government of Pakistan upon which sellers can terminate the agreement.

### 4.3 CONCLUSIONS

The incentives within the policy for developers guarantee access to market and evacuation of power, remove the need for planning consent (which has so often been the Achilles heel of wind energy projects), facilitate direct sales contracts between generators and consumers, facilitate access to carbon credits and

provide a comprehensive security package. There are further incentives for lenders to ensure that lender's capital is exposed to minimal risk.

The commitment of the Government of Pakistan to supporting private sector development of wind energy projects is clear. The package of incentives and risk cover in the RE policy present an excellent opportunity for private sector developers.

# **5 PROJECT SITE**

# 5.1 GENERAL AREA

The Gharo – Keti-Bandar wind corridor, identified by Alternative Energy Development Board, lies between the coastal towns of Gharo and Ketibandar stretching more than 80 Km along the coast of Arabian Sea and runs more than 170 km deep inland towards Hyderabad. The area has been surveyed by AEDB and Pakistan Meteorological Department (PMD) which shows a high wind speed regime within the corridor. The study carried out for wind mapping of Pakistan by NREL in 2006 also confirms the presence of high wind speed regime in the coastal areas of Sindh.



Figure 5-1: Pakistan wind map<sup>2</sup>

<sup>&</sup>lt;sup>7</sup> www.aedb.org

### 5.2 SELECTION OF PROPOSED SITE

The project site of Western Energy Pvt. Limited (WEL) is located near the village Jhampir, District Thatta, Sindh. The Jhampir area has been selected for implementing the project on the basis of its exceptional wind regime, flat terrain and nearness to the National and local grid. The area has been extensively surveyed and is identified as having strong potential site for the proposed wind farm. The following other parameters have also been considered for the implementation of the project at the proposed site.

- Forecasted power output
- Access to the proposed site (materials and equipment transport feasibility study)
- Suitability for the surrounding environment

### 5.3 LOCATION OF THE PROJECT SITE

Western Energy has received the project land from Government of Sindh (GoS) on lease basis for the development of 50MW wind power project. The project site is located about 105km northeast of Karachi. The nearest settlement to the proposed site is Nooriabad (22km Southwest). The site is located in a strong and partly rocky area at 53m to 94m above sea level. The size of the whole wind farm is 852.35 acres. The coordinates of Western Energy project wind farm site are given under:

	UTM Coordi	nates; zone 42R	Geodetic Coordinates		
	Easting [m]	Northing [m]	Latitude	Longitude	
1	398219.71	2793815.31	25°15'26.07"N	67°59'21.45"E	
2	398559.69	2793935.81	25°15'30.07"N	67°59'33.57"E	
3	399506.43	2789834.10	25°13'16.97"N	68° 0'8.50"E	
4	399865.03	2789889.59	25°13'18.86"N	68° 0'21.30"E	
5	402811.52	2785133.37	25°10'44.95"N	68° 2'7.81"E	
6	403091.00	2785358.00	25°10'52.32"N	68° 2'17.74"E	
				L	

Table 5-1: Land Coordinates

. ...



The geographical location of the site on the map is given below.

Figure 5-2: Site Location on Map

The terrain is flat at the project site with little plantation. There are some very small and scattered pieces of agriculture land within the project site & surroundings. The area has a dry climate. The satellite map of the project site is given below:


Figure 5-3: WEL Wind Farm Site Location on Map

# 5.4 CLIMATIC CONDITIONS

The climate of southern parts of the Sindh province is characterized by fluctuating temperatures and sparse rainfall. The summers are hot and humid with average temperature ranging between 33 °C to 37 °C. The temperature in summers may reach up to 45 °C. The winters are pleasant with average temperature in the range of 12 °C to 15 °C. The months of July and August generally observe the annual monsoon rainfalls. The climatologically information of Karachi is shown in table 5-2 below. The recorded monthly temperature data at 85m height from the neighboring mast of Yunus Energy Limited (YEL) to the project site is given in table 5-3 below. The monthly mean temperature at the YEL site which is on the same plane of the project site and is located at a distance of ~7.0 km in the south-west, ranges between 18.24 °C to 32.1 °C. Maximum temperature at the neighboring mast of YEL is recorded as 44.67 °C.

## Table 5-2: Karachi Climatological Information

Month	Average Temperature (°C)		th Average Temperature Relative Humidity (°C) (%)		Total Rainfall (mm)
	Min	Max	am	pm	Mean
Jan	13	25	63	45	3.6
Feb	14	26	72	49	6.4
Mar	19	29	79	57	8.3
Apr	23	32	87	62	4.9
May	26	34	88	68	0
Jun	28	34	86	69	3.9
Jul	27	33	28	73	64.4
Aug	26	31	90	74	44.8
Sep	25	31	89	71	22.8
Oct	22	33	83	57	0.3
Nov	18	31	68	49	1.7
Dec	14	27	64	45	4.5

Year	Month	Mean	Min	Max
	187	(-C)	( <del>-</del> C)	(-C)
2008	Nov	23.94	19.05	31.21
2008	Dec	19.82	12.65	29.94
2009	Jan	18.6	10.62	25.81
2009	Feb	23.24	14.67	34.08
2009	Mar	26.88	19.53	35.4
2009	Apr	30.77	21.86	42.35
2009	Мау	31.93	25.92	43.39
2009	Jun	31.29	25.68	41.91
2009	Jul	30.22	22.91	42.2
2009	Aug	29.04	23.74	38.12
2009	Sep	28.16	24.4	34.77
2009	Oct	29.5	22.44	40.32
2009	Nov	25.17	16.11	35.39
2009	Dec	20.87	13.55	27.54
2010	Jan	19.64	9.14	27.38
2010	Feb	22.34	11.51	33.54
2010	Mar	29.04	19.77	39.75
2010	Apr	30.7	21.89	40.57
2010	May	32.1	25.75	44.28
2010	Jun	30.3	22.24	40.03
2010	Jul	30.24	25.3	40.78
2010	Aug	29.01	23.99	37.9
L			· · · · · · · ·	

Table 5-3: Monthly Temperature conditions at Neighboring Mast of YEL

#### Project Feasibility Study Western Energy 50MW Wind Power Project in Jhampir, Thatta

 			1	
2010	Sep	29.16	23.68	36.81
2010	Oct	29.78	22.15	38.61
2010	Nov	25.46	16.89	33.16
2010	Dec	19.94	12.81	27.75
2011	Jan	18.24	5.85	27.38
2011	Feb	21.16	14.55	29.29
2011	Mar	27.17	14.89	39.01
2011	Apr	29.77	21.67	39.11
2011	Мау	30.59	24.4	43.35
2011	Jun	31.04	27.2	44.67
2011	Jul	30.01	26.49	38.47
2011	Aug	28.67	23.54	35.71
2011	Sep	-	-	
2011	Oct	-	-	-
2011	Nov	-	-	-
2011	Dec	-	-	-
2012	Jan	18.49	9.92	26.53
2012	Feb	19.74	9.06	31.05
2012	Mar	25.89	17.56	40.39
2012	Apr	29.68	20.91	40.03
2012	May	31.13	25.38	43.27
2012	Jun	30.42	26.49	41.88
2012	Jul	29.59	26.38	37.87
2012	Aug	29	25.89	36.93
2012	Sep	28.66	24.34	36.42

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2012	Oct	28.98	23.18	37.31
2012	Nov	26.34	18.16	34.25
2012	Dec	20.89	10.62	30.39
2013	Jan	19.62	10.31	28.52
2013	Feb	20.89	12.27	28.64
2013	Mar	26.87	16.39	34.97
2013	Apr	29.13	19.85	39.46
2013	May	31.48	24.83	41.78
2013	Jun	31.57	26.87	37.87
2013	Jul	-	-	-
2013	Aug	27.78	25.51	31.1
2013	Sep	29.91	24.81	38.88
2013	Oct	30.07	23.21	38.89
2013	Nov	25.76	18.54	33.37

# **6 WIND DATA ANALYSIS**

# 6.1 WIND DATA SOURCES

A total of six (06) wind measuring masts have been considered for this study namely:

- ✤ Karachi Airport Weather Station
- ✤ 81.5m High Wind Measuring Mast of FFC Energy Limited
- 85m High Wind Measuring Mast of Yunus Energy Limited
- ♦ 80m High Wind Measuring Mast of Master Wind Energy Pvt. Limited
- ♦ 80m High Wind Measuring Mast of Dewan Energy Pvt. Limited
- ♦ 85m High Wind Measuring Mast of Western Energy Pvt. Limited

Wind Data analysis has been made on the above mentioned wind measuring masts. The data analysis on these masts is presented below.

# 6.2 KARACHI AIRPORT WEATHER STATION

### 6.2.1 WEATHER STATION OVERVIEW

The weather station close to the wind farm site of Western Energy is the weather station in Karachi airport, which is located in the southwest side of the Project site in Karachi, the center of the observation field has a coordinate of 24° 54'N and 67° 08'E, with an altitude of 21m above sea-level, and the height of wind instrument is 7m. The weather station was built in 1928, and now is one of the stations participating in the global meteorological information exchange of the World Meteorological Organization (WMO), the unified number of which in WMO is 41780.

The weather station is located in the southwest of the site of the Western Energy wind farm site, and the linear distance between the center of the Project site and the weather station is about 95km. The Project site is an open and flat terrain, with a good topography and climate consistency.

Observing parameters including mainly the temperature (°C), precipitation (mm), wind speed (knot), and wind direction has been observed and recorded for three times every day, respectively at 5:00/8:00 a.m. and 5:00 p.m. local time before the year of 20112 in the airport weather station. From the beginning of 2012, these observing parameters were recorded hourly.

### 6.2.2 Analysis of Meteorological Data

#### 6.2.2.1 Meteorological Element Statistics

Meteorological parameters of Karachi airport weather station are shown in Table 6-1.

Table 6-1: Meteorological Parameters Statistics of Karachi Airport Weather Station

Item	Unit	Index	Remark
Average temperature of many years	°C	26.6	
Maximum temperature	°C	47.8	*****
Minimum temperature	°C	0.0	
Average precipitation of many years	mm	204	
Relative humidity of many years	%	76	
Annual average of wind speed	m/s	2.38	

#### 6.2.2.2 Mean Wind Speed

Statistics results of daily mean wind speed at 5:00/8:00 a.m. and 5:00 p.m. in the weather station of Karachi airport from 1980 to 2011 are shown in Table 6-2 and Fig. 6-1. Average wind speed of years at 5:00 a.m. is 1.69 m/s; Average wind speed of many years at 8:00 a.m. is 1.72 m/s; Average wind speed of years at 5:00 p.m. is 3.75 m/s, and average wind speed of many years is 2.38 m/s.

Statistics results of monthly mean wind speed from 1980 to 2011 in the airport weather station are shown in Table 6-3 and Fig. 6-2. Yearly mean wind speed from April to September is higher, and lower from October to March of the following year. Maximum mean wind speed is in August, which is 3.87 m/s, and minimum mean wind speed is in November, which is 1.10 m/s.

Year	5:00 a.m.	8:00 a.m.	5:00 p.m.	Average
1980	1.41	1.62	3.57	2.20
1981	1.53	1.69	3.91	2.38
1982	1.29	1.69	3.76	2.25
1983	1.50	1.59	3.71	2.27
1984	1.23	1.52	3.61	2.12
1985	1.14	1.86	3.53	2.18
1986	1.05	1.41	3.32	1.93
1987	1.39	1.83	3.79	2.34
1988	1.72	1.74	3.35	2.27
1989	1.26	1.69	3.36	2.10
1990	1.66	1.17	3.63	2.35
1991	1.45	1.51	3.46	2.14
1992	1.26	1.44	2.94	1.88
1993	1.19	1.33	3.11	1.88
1994	1.63	1.56	3.01	2.07
1995	1.58	1.53	3.38	2.16
1996	1.65	1.42	3.85	2.31
1997	1.98	1.79	4.06	2.61
1998	1.80	1.83	3.59	2.41
1999	1.95	2.16	3.80	2.64
2000	2.44	2.15	4.55	3.05
2001	2.07	1.90	3.98	2.65
2002	2.36	2.22	4.54	3.04

Table 6-2: Annual Mean Wind Speed Statistics

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2003	2.04	1.84	4.12	2.67
2004	2.27	2.02	4.46	2.92
2005	2.00	1.81	4.01	2.61
2006	2.01	1.75	3.94	2.57
2007	1.29	1.25	3.78	2.11
2008	1.96	1.71	4.09	2.53
2009	1.85	1.72	4.02	2.47
2010	2.02	1.72	3.67	2.61
2011	2.03	1.81	3.97	2.38
Average	1.69	1.72	3.75	2.38

Table 6-3: Monthly Mean Wind Speed Statistics (m/s)

Month	5:00 a.m.	8:00 a.m.	5:00 p.m.	Average
January	0.73	0.73	2.57	1.35
February	0.93	0.74	3.27	1.65
March	1.02	0.86	3.81	1.90
April	1.41	1.67	4.12	2.40
Мау	2.40	2.86	4.92	3.39
June	3.06	3.22	5.01	3.77
July	3.32	3.32	4.98	3.87
August	3.16	3.12	4.48	3.59
September	2.38	2.45	4.12	2.98
October	0.71	0.66	3.03	1.47
November	0.45	0.42	2.42	1.10
December	0.69	0.55	2.21	1.15
Average	1.69	1.72	3.75	2.38







Figure 6-2: Monthly Wind Speed Statistics

#### 6.2.2.3 Wind Direction

Statistics results of wind direction and mean wind direction at 5:00/8:00 a.m. and 5:00 p.m. from 2010 to 2011 in the airport weather station are observed. Prevailing wind direction at 5:00 a.m. is W (west), followed by N (north); Prevailing wind direction at 8:00 a.m. is N (north), followed by W (west); Prevailing wind direction at 5:00 p.m. is SW (southwest). Annual average prevailing wind direction is SW, followed by W/N.

#### 6.2.2.4 Air Temperature

Karachi has a high temperature in its whole region, which is a hotter area, with the obvious temperature variation of tropical regions.

Statistics results of annual average air temperature from 1980 to 2009 in the airport weather station are shown in Table 6-4 and Fig. 6-3. Annual average temperature of many years is 26.6 °C in the airport weather station, with a trend of gradually increasing; annual average temperature is 26.2 °C between 1980 and 1998, and 27.3 °C between 1998 and 2009, with a obvious trend.

Statistics results of monthly average temperature from 1980 to 2009 in the airport weather station are shown in Table 6-5 and Fig. 6-4. Monthly average temperature change is relatively small; the average temperature from April to October is high, with an average temperature of 30 °C; Minimum average temperature is in January, which is 18.6 °C; Maximum average temperature is in July, which is 31.9 °C.

Year	Average Temperature	Year	Average Temperature
1980	26.4	1995	26.6
1981	26.3	1996	26.4
1982	26.2	1997	26.2
1983	25.9	1998	27.3
1984	25.6	1999	26.7
1985	26.1	2000	27.1
1986	25.8	2001	27.9
1987	26.5	2002	26.8
1988	27.2	2003	27
1989	26.1	2004	27.3
1990	25.9	2005	27
1991	26.21	2006	27.4
1992	26.3	2007	27.5
1993	27.2	2008	26.8
1994	26.1	2009	27.6

Table 6-4: Annual Average Temperature Statistics of the Karachi Weather Station



Figure 6-3: Annual Average Temperature Change of the Airport Weather Station over the Years

Month	Average Temperature
Jan	18.6
Feb	21.2
Mar	25.3
Apr	28.9
May	31
Jun	31.9
Jul	30.5
Aug	29.2
Sep	29.4
Oct	28.8
Nov	24.6
Dec	20.4
Average	26.6

Table 6-5: Monthly Average Temperature Statistics of Airport Weather Station



Figure 6-4: Average Monthly Temperature at Karachi Airport Weather Station

#### 6.2.2.5 Tropical Cyclone

Tropical cyclone weather occurs in the Arabian Sea in the south of Pakistan, the incidence of which is about 1% of the global total cyclones. Tropical cyclones occurred in recent years in the Arabian Sea region are shown in Table 6-6.

No.	Date	Туре	Location	Maximum Wind
				Speed (m/s)
1	1993.11.05~11.16	A typhoon	Northeast of Arabian Sea	41
2	1994.07.05~07.09	Tropical Storm	South of Arabian Sea	23
3	1995.10.11~10.18	Tropical Storm	Southeast of Arabian Sea	26
4	1996.06.15~06.25	A typhoon	Mideast of Arabian Sea	33
5	1996.10.14~11.02	A typhoon	Southeast of Arabian Sea	33
6	1998.06.01~06.09	C Typhoon	Southeast of Arabian Sea	54
7	1998.10.15~10.18	Tropical Storm	Mideast of Arabian Sea	18
8	1999.05.15~05.21	C Typhoon	Mideast of Arabian Sea	57
9	2001.09.26~09.28	C Typhoon	Mideast of Arabian Sea	57
10	2001.09.29~09.28	Tropical Storm	Mideast of Arabian Sea	18
11	2002.05.10~05.15	Tropical Storm	Mideast of Arabian Sea	23
12	2004.05.04~05.09	Tropical Storm	Southeast of Arabian Sea	23
13	2004.09.30~10.10	Tropical Storm	Northeast of Arabian Sea	18
14	2006.09.19~09.26	Tropical Storm	Middle of Arabian Sea	28
15	2007.05.30~06.08	Typhoon of level 5	Northwest of Arabian Sea	74
16	2007.06.20~06.27	Tropical Storm	Northeast of Arabian Sea	26
17	2009.11.09~11.11	Tropical Storm	Southeast of Arabian Sea	26
18	2010.05.30~05.06	Typhoon of level 4	West & North East of Arabian	62
1			Sea	
19	2011.06.09~06.21	Tropical Storm	Southeast of Arabian Sea	18
20	2011.11.25~12.01	Tropical Storm	Midwest of Arabian Sea	18

Table 6-6: Arabian Sea Tropical Cyclone Statistic in Recent Years

# 6.3 NEIGHBORING WIND MEASURING MAST OF FFC ENERGY LIMITED

## 6.3.1 GENERAL INFORMATION OF MAST

The 81.5m high FFC Energy Limited (FFCEL) wind measuring mast was installed in June 2007 and has started collecting the wind data since then. FFCEL Mast is located at distance of 16.5 km in the south of Western Energy wind farm area as shown below in figure 6-5. The mast is of lattice structure with triangular cross section having side width of approx. 2 ft. The view of FFCEL wind measuring mast can be seen from the figure 6-6 whereas the installation arrangement at the mast can be seen from the figure 6-7 given below.



Figure 6-5: Neighboring Mast of FFCEL and Project Site



Figure 6-6: View of FFCEL Wind Measuring Mast



Figure 6-7: Installation Arrangements of Sensors installed at FFCEL Mast

### 6.3.2 INSTALLED SENSOR INFORMATION

Wind speed at FFCEL mast is recorded through five Theis first class anemometers installed at 81.5, 80, 60, 30 and 10m from ground level. The data from FFCEL mast were collected using Theis anemometers and NDL data logger. The anemometers were individually calibrated in the Measnet accredited wind tunnel at DKD.

The roughness of the FFCEL mast site is 0.0513m whereas the power law exponent calculated using the 4.9 year's data is 0.16. The specifications of FFCEL mast are shown in table 6-7 given below.

Latitude	25° 04' 33.20"N
Longitude	67° 58' 22.20"Е
Observation	Wind speed, wind direction, temperature,
Observation height	wind speed: 81.5, 80, 60, 30 & 10m (Theis first class anemometers)
	wind direction: 78.5, 28.5m
Observation period	From June 2007 ongoing
Data used for the Study	June 2007 to May 2012 (4.9 years)
	60m Wind Speed and 28.5m Direction

Table 6-7: Specification of FFCEL Mast

### 6.3.3 WIND DATA ANALYSIS

The data from the 81.5m high FFCEL wind measuring mast were collected over the period 1<sup>st</sup> June 2007 to 8<sup>th</sup> May 2012 (4.9 years). The data coverage was good for all the instruments during the measurement period. The data acquisition of FFCEL mast is presented in table below.

Installed Sensors	Data Acquisition Ratio
10m anemometer (V10)	89.81%
30m anemometer (V30)	89.65%
60m anemometer (V60)	89.38%
80m anemometer (V80b)	89.81%
81.5m anemometer (V80a)	89.81%
28.5m Wind Vane	89.81%
78.5m Wind Vane	89.81%

#### Table 6-8: Wind Data Acquisition ratio of FFCEL Mast

Data is analyzed using time series starting from  $1^{st}$  June 2007 to  $8^{th}$  May 2012. The computed regression coefficient for anemometers installed at 80 meters with legends V80-a and V80-b is 98.81% (r2 = 0.98.81) without gaps filling whereas the regression coefficient after filling the missing gaps comes to 98.95% (r2 = 0.9895).

The computed regression coefficient for Dir78.5 and Dir28.5 is 91.82% (r2 = 0.9182) without the filling of gaps present in the data whereas the regression coefficient after filling the missing gaps comes to 82.76% (r2 = 0.8276)

#### 6.3.3.1 MEAN WIND SPEED ANALYSIS

The wind data recoded at FFCEL Mast during the period i.e. June 2007 to May 2012 has been analyzed to determine the monthly mean wind speeds. The results are shown in table 6-9 and Figure 6-8 and 6-9 respectively.

Tuble 0 9. Monthly Moult wind opeous calculated at 11 CEE Mast	Table 6-9	: Monthly Mean	Wind Speeds	Calculated at	FFCEL Mast
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Year	Month	Mean WS 81.5m	Mean WS 80m	Mean WS 60m	Mean WS 30m	Mean WS 10m
		(m/s)	(m/s)	(m/s)	(m/s)	(m/s)
2007	Jul	8.711	8.608	8.514	7.942	6.9401
2007	Aug	8.973	8.75	8.737	8.122	7.1509
2007	Sep	8.348	8.191	8.078	7.414	6.3901
2007	Oct	6.064	6.066	5.716	4.837	3.6908
2007	Nov	5.243	5.25	4.925	4.062	2.9694
2007	Dec	7.145	7.184	6.715	5.499	4.1698
2008	Jan	7.115	7.144	6.727	5.61	4.3263
2008	Feb	5.243	5.238	5.047	4.338	3.3311
2008	Mar	6.631	6.613	6.333	5.594	4.5813
2008	Apr	7.5	7.357	7.222	6.536	5.5958
2008	May	11.852	11.526	11.597	10.893	9.7052
2008	Jun	9.035	8.876	8.87	8.369	7.4259
2008	Jul	10.243	9.872	10.07	9.539	8.5358
2008	Aug	9.464	9.127	9.257	8.706	7.7539
2008	Sep	8.173	7.944	7.912	7.249	6.3176
2008	Oct	6.88	6.833	6.553	5.705	4.577
2008	Nov	7.332	7.349	6.925	5.824	4.5347
2008	Dec	6.396	6.417	6.104	5.295	4.2777
2009	Jan	7.862	7.916	7.445	6.315	5.173

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2009	Feb	6.121	6.09	5.82	5.036	4.0463
2009	Mar	6.472	6.412	6.209	5.508	4.577
2009	Apr	7.202	7.133	6.909	6.209	5.2341
2009	May	9.192	9.01	8.974	8.378	7.3794
2009	Jun	9.913	9.688	9.681	9.052	7.9439
2009	Jul	8.509	8.396	8.273	7.676	6.6652
2009	Aug	9.031	8.762	8.79	8.19	7.0768
2009	Sep	8.488	8.19	8.134	7.442	6.4088
2009	Oct	5.505	5.487	5.185	4.463	3.4949
2009	Nov	6.738	6.78	6.299	5.185	3.8398
2009	Dec	6.837	6.885	6.379	5.223	3.9339
2010	Jan	6.363	6.394	5.954	4.96	3.8057
2010	Feb	6.236	6.259	5.88	5.036	3.9362
2010	Mar	6.759	6.687	6.433	5.75	4.727
2010	Apr	8.234	8.058	7.877	7.252	6.2567
2010	Мау	10.134	9.901	9.786	9.184	8.1104
2010	Jun	10.065	9.695	9.748	9.212	8.1409
2010	Jul	8.125	7.969	7.864	7.393	6.5232
2010	Aug	7.111	6.935	6.799	6.246	5.391
2010	Sep	7.113	7.037	6.789	6.117	5.1597
2010	Oct	5.912	5.916	5.551	4.79	3.6567
2010	Nov	6.582	6.637	6.175	5.183	3.9453
2010	Dec	6.892	6.932	6.429	5.398	4.0969
2011	Jan	6.678	6.702	6.26	5.258	4.0449
2011	Feb	6.193	6.213	5.832	5.002	3.9636
2011	Mar	6.624	6.585	6.291	5.611	4.6392
2011	Apr	6.565	6.517	6.251	5.642	4.7625
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2011	May	10.317	10.048	9.987	9.46	8.3834
2011	Jun	10.61	10.303	10.281	9.813	8.7191
2011	Jul	9.509	9.455	9.178	8.487	7.2776
2011	Aug	8.89	8.867	8.558	7.775	6.5086
2011	Sep	7.535	7.535	7.244	6.542	5.4291
2011	Oct	5.566	5.544	5.247	4.483	3.3614
2011	Nov	5.76	5.768	5.382	4.511	3.325
2011	Dec	6.918	6.958	6.432	5.252	3.7895
2012	Jan	6.335	6.351	5.978	5.004	3.7694
2012	Feb	6.591	6.615	6.168	5.179	4.0331
2012	Mar	6.736	6.682	6.372	5.65	4.5694
2012	Apr	6.972	6.898	6.636	5.994	5.0811
2012	May	6.888	6.83	6.589	5.943	4.9917







#### 6.3.3.2 DIURNAL VARIATION

The monthly and annual diurnal variation of wind speed, for the wind data recorded during the period of Jun 2007 to May 2012 at 10, 30, 60, 80 and 81.5m are shown below in figure 6-10 and 6-11 respectively.



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Figure 6-10: Monthly Diurnal Wind Speed Profile at FFCEL Site Wind Data

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Figure 6-11: Annual Diurnal Wind Speed Profile at FFCEL Site Wind Data

#### 6.3.3.3 WIND SHEAR PROFILE

The vertical and monthly wind shear profiles for the wind data recorded during the period of Jun 2007 to May 2012 have been computed. The results derived are given below.



Figure 6-12: Vertical Wind Shear Profile at FFCEL Site



Figure 6-13: Monthly Wind Shear Profile at FFCEL Site

Table 6-10: Monthly Wind Shear Profile

Month	Power law Exponent
Jan	0.237
Feb	0.220
Mar	0.174
Apr	0.143
May	0.099
Jun	0.097
Jul	0.106
Aug	0.116
Sep	0.136
Oct	0.224
Nov	0.258
Dec	0.254

#### 6.3.3.4 WIND DIRECTION AND FREQUENCY DISTRIBUTION

The annual and monthly wind rose developed using the FFCEL mast data (Jun 2007-May 2012) at 78.5m height are given below in Figure 6-14 and 6-15 respectively.



Figure 6-14: Wind Frequency Rose of FFCEL Mast at 78.5m

























The annual and monthly wind rose developed using the FFCEL mast data (Jun 2007-May 2012) at 28.5m height are given below in Figure 6-16 and 6-17 respectively.



Figure 6-16: Wind Frequency Rose of FFCEL Mast at 28.5m











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It can be seen from the wind rose given below that the predominant wind direction is southwest and westsouthwest to a lesser extent west. The frequency distributions of the measurement are given in the following table.

Table 6-11:	Wind Direction	Data with Fre	quency Distribution
		and the second se	

	Direction	Frequency (%)		
	Sector	Dir 28.5	Dir 78.5	
1	345 - 15	2.15	1.7545	
2	15 - 45	15.0876	16.3556	
3	45 - 75	7.1473	7.7662	
4	75 - 105	2.5529	2.5306	
5	105 - 135	1.3986	1.2584	
6	135 - 165	1.734	1.8223	
7	165 - 195	2.3122	2.0915	
8	195 - 225	4.089	4.3336	
9	225 - 255	27.7575	30.0785	
10	255 - 285	25.4495	21.914	
11	285 - 315	6.8149	7.2393	
12	315 - 345	3.5062	2.8541	
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# 6.4 NEIGHBORING WIND MEASURING MAST OF YUNUS ENERGY LIMITED

# 6.4.1 GENERAL INFORMATION OF MAST

The 85m high Yunus Energy Limited (YEL) wind measuring mast was installed in November 2008 and has started collecting the wind data since then. YEL Mast is located at distance of approx. 7.0 km in the southwest of WEL wind farm site as shown below in Figure 6-18. The mast is of lattice structure with triangular cross section having side width of approx. 2 ft. The view of the lucky energy mast can be seen from the figure 6-19 whereas the installation arrangement at the mast can be seen from the figure 6-20 given below.



Figure 6-18: Neighboring Mast of YEL and Project Site Area

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Figure 6-19: View of YEL Wind Measuring Mast
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Figure 6-20: Installation Arrangements of Sensors installed at YEL Mast

# 6.4.2 INSTALLED SENSOR INFORMATION

Wind speed at YEL mast is recorded through five Theis first class anemometers installed at 85-a, 85-b, 60, 30 and 10m from ground level. The data from YEL mast were collected using Theis anemometers and NDL data logger. The anemometers were individually calibrated in the Measnet accredited wind tunnel at DKD.

The roughness of the YEL mast site is 0.0341m whereas the power law exponent calculated using the five (05) year's wind data is 0.15. The specifications of YEL mast are shown in table 6-12 given below.

Latitude	25° 08' 0.80"N
Longitude	67° 59' 46.9"E
Observation	Wind speed, wind direction, temperature,
Observation height	wind speed: 85-a, 85-b, 60, 30 & 10m (Theis first class anemometers) wind direction: 83.5, 28.5m
Observation period	From November 2008 ongoing
Data used for the Analysis	November 2008 to November 2013 (05 years)

Table 6-12: Specification of YEL Mast

## 6.4.3 WIND DATA ANALYSIS

The data from the 85m high YEL wind measuring mast were collected over the period  $24^{\text{th}}$  November 2008 to  $13^{\text{th}}$  November 2013 (~05 years). The data coverage was good for all the instruments during the measurement period. The data acquisition of YEL mast is presented in table below.

94.47%
94.47%
94.47%
92.61%
86.68%
86.62%
94.38%

Table 6-13: Wind Data Acquisition ratio of YEL Mast

Data is analyzed using time series starting from 24<sup>th</sup> November 2008 to 13<sup>th</sup> November 2013. Wind vane installed at 28.5m height was recording the erroneous data for sector 15°-45° due to which erroneous data has been removed from the time series therefore the data coverage for the Dir 28.5 is 86.62.

The computed regression coefficient for anemometers installed at 85 meters with legends V85-a and V85b is 99.96% (r2 = 0.9996) without gaps filling whereas the regression coefficient after filling the missing gaps comes to 99.93% (r2 = 0.9993).

The computed regression coefficient for Dir78.5 and Dir28.5 is 87.10% (r2 = 0.8710) without the filling of gaps present in the data whereas the regression coefficient after filling the missing gaps comes to 64.43% (r2 = 0.6443)

## 6.4.3.1 MEAN WIND SPEED ANALYSIS

The wind data recoded at YEL Mast during the period of five (05) years has been analyzed to determine the monthly mean wind speeds. The results are shown in table 6-14 and Figure 6-21 and 6-22 respectively.

Table 6-14: Monthly Mean Wind Speeds Calculated at YEL Mast

1. 1.	-11.5	Mean WS	Mean WS	Mean WS	Mean WS	Mean WS
Year	Month	85m (a)	<b>85m</b> (b)	60 m	30m	10m
		(m/s)	(m/s)	(m/s)	(m/s)	(m/s)
2008	Nov	8.918	8.893	8.069	6.526	5.1125
2008	Dec	7.374	7.356	6.859	5.857	4.7326
2009	Jan	8.019	8.005	7.444	6.334	5.1507
2009	Feb	6.07	6.079	5.711	4.937	3.9816
2009	Mar	6.131	6.149	5.824	5.161	4.3107
2009	Apr	7.027	7.051	6.656	5.905	4.9913
2009	May	8.936	8.977	8.668	8.034	7.1246
2009	Jun	8.786	8.824	8.586	8.026	7.1841
2009	Jul	9.297	9.336	9.036	8.381	7.4504
2009	Aug	9.343	9.378	9.123	8.496	7.543
2009	Sep	8.446	8.487	8.105	7.343	6.3419
2009	Oct	5.685	5.691	5.331	4.585	3.6604
2009	Nov	6.853	6.84	6.353	5.233	3.9693
2009	Dec	7.11	7.084	6.552	5.297	4.0409
2010	Jan	6.477	6.458	6.082	5.07	3.9407
2010	Feb	6.17	6.169	5.775	4.966	3.98
2010	Mar	6.585	6.605	6.249	5.502	4.5774

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2010	Apr	8.02	8.058	7.658	6.931	6.0052	
2010	May	9.869	9.922	9.536	8.776	7.7361	
2010	Jun	9.605	9.651	9.335	8.637	7.6486	
2010	Jul	8.131	8.162	7.881	7.285	6.4308	
2010	Aug	7.047	7.075	6.736	6.075	5.1983	
2010	Sep	6.602	6.619	6.264	5.575	4.7248	
2010	Oct	5.94	5.95	5.53	4.738	3.7843	
2010	Nov	6.735	6.722	6.288	5.278	4.125	
2010	Dec	7.328	7.314	6.731	5.509	4.2773	
2011	Jan	6.677	6.662	6.22	5.198	4.0636	
2011	Feb	6.29	6.275	5.901	5.026	3.9945	
2011	Mar	6.693	6.709	6.296	5.529	4.6121	
2011	Apr	6.526	6.546	6.203	5.548	4.7139	
2011	May	10.039	10.087	9.775	9.079	8.0029	
2011	Jun	10.662	10.718	10.414	9.672	8.5744	
2011	Jul	9.441	9.486	9.236	8.603	7.6518	
2011	Aug	8.295	9.239	8.008	7.359	6.4762	
2011	Sep	7.716	-	7.234	6.337	5.3046	
2011	Oct	5.954	-	5.596	4.787	3.7399	
2011	Nov	5.904	8.683	5.542	4.596	3.5144	
2011	Dec	7.09	7.046	6.57	5.342	4.0755	
2012	Jan	6.477	6.451	6.057	5.112	4.0117	
2012	Feb	6.748	6.719	6.291	5.312	4.2564	
2012	Mar	6.615	6.59	6.231	5.487	4.5686	
2012	Apr	6.773	6.757	6.44	5.767	4.9154	
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 2012	May	8.624	8.604	8.383	7.759	6.8128
2012	Jun	10.78	10.765	10.572	9.812	8.7044
2012	lut	10.923	10.903	10.743	10.018	8.8761
2012	Aug	9.243	9.217	9.073	8.469	7.5391
2012	Sep	6.824	6.813	6.517	5.886	5.1027
2012	Oct	5.309	5.291	5.038	4.4	3.5362
2012	Nov	5.231	5.207	4.932	4.154	3.1522
2012	Dec	6.627	6.606	6.193	5.276	4.2442
2013	Jan	5.959	5.937	5.561	4.653	3.6114
2013	Feb	7.019	6.993	6.492	5.549	4.5137
2013	Mar	6.404	6.38	6.006	5.214	4.3205
2013	Apr	6.611	6.59	6.297	5.687	4.9072
2013	May	9.671	9.645	9.394	8.685	7.6114
2013	Jun	8.698	8.792	8.635	8.077	7.2005
2013	Jul	-	-	-	-	-
2013	Aug	-	-	10.287	9.526	8.4166
2013	Sep	-		7.09	6.474	5.6655
2013	Oct	5.771	5.785	5.49	4.879	4.094
2013	Nov	5.615	5.609	5.28	4.498	3.5988
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Figure 6-21: Mean of Monthly mean wind speeds at YEL Mast during 2008-2013



Figure 6-22: Monthly mean wind speeds at YEL Mast during 2008 - 2013

#### 6.4.3.2 DIURNAL VARIATION

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The monthly and annual diurnal variation of wind speed, for the wind data recoded during the period of November 2008 to November 2013 at 10, 30, 60, 85(a) and 85(b) m are shown below in figure 6-23 and 6-24 respectively



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Figure 6-23: Monthly Diurnal Wind Speed Profile at YEL Site Wind Data



Figure 6-24: Annual Diurnal Wind Speed Profile at YEL Site Wind Data

## 6.4.3.3 WIND SHEAR PROFILE

The vertical and monthly wind shear profiles for the wind data recorded during the period of November 2008 to November 2013 have been computed. The results derived are given below.

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Figure 6-26: Monthly Wind Shear Profile at YEL Site

Month	Power law Exponent
Jan	0.226
Feb	0.208
Mar	0.174
Apr	0.148
May	0.111
Jun	0.102
Jul	0.104
Aug	0.111
Sep	0.142
Oct	0.193
Nov	0.242
Dec	0.239

Table 6-15: Monthly Wind Shear Profile

#### 6.4.3.4 WIND DIRECTION AND FREQUENCY DISTRIBUTION

The data from the 85m high YEL mast were collected over the period Nov 2008 to Nov 2013. The data coverage was good for all of the instruments during the measurement period.

Based on our experience of this region, the prevailing wind direction recorded at YEL mast was slightly more westerly than expected. The Yunus Energy wind direction data was compared with the wind direction data from other neighboring wind measuring masts. The comparison indicated that the direction vanes from the YEL mast were recording directional data approx. 10° higher than the neighboring mast data. Therefore, an offset of 10° was applied to the YEL directional data.

The annual and monthly wind rose developed using the YEL mast data (Nov 2008 - Nov 2013) at 83.5m height are given below in Figure 6-27 and 6-28 respectively.



Figure 6-27: Wind Frequency Rose of YEL Mast at 83.5m

60°

90°

120\*

60°

90°

120"

60\*

90°

120"





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The annual and monthly wind rose developed using the YEL mast data (Dec 2008 - Mar 2012) at 28.5m height are given below in Figure 6-29 and 6-30 respectively.



















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Figure 6-30: Monthly Wind Frequency Rose of YEL Mast at 28.5m

The frequency distribution of the measurement is given in the following table.

	Direction	Frequency (%)			
	Sector	Dir 28.5m	Dir 83.5m		
1	345 - 15	4.4062	2.9433		
2	15 - 45	12.9016	19.1389		
3	45 - 75	3.4746	7.4127		
4	75 - 105	1.8053	2.1832		
5	105 - 135	1.3353	0.9971		
6	135 - 165	1.4767	1.0653		
7	165 - 195	2.9141	2.3594		
8	195 - 225	7.7753	4.4636		
9	225 - 255	34.0963	28.8717		
10	255 - 285	20.9861	21.9064		
11	285 - 315	5.6846	5.8130		
12	315 - 345	3.1433	2.8391		
1	1				

Table 6-16: Wind Direction Data with Frequency Distribution

# 6.5 NEIGHBORING WIND MEASURING MAST OF MASTER WIND ENERGY PVT LIMITED

# 6.5.1 GENERAL INFORMATION OF MAST

The 80m high Master Wind Energy Private Limited (MWEPL) wind measuring mast was installed in March 2007 and has started collecting the wind data since then. MWEPL Mast is located at distance of approx. 14 km in the south of Western Energy wind farm site as shown below in Figure 6-31. The mast is of lattice structure with triangular cross section having side width of approx. 2 ft. The view of the Master Energy mast can be seen from the figure 6-32 whereas the installation arrangement at the mast can be seen from the figure 6-33 given below.



Figure 6-31: Neighboring Mast of Master Energy and Project Site Area



Figure 6-32: View of MWEPL Wind Measuring Mast



Figure 6-33: Installation Arrangements of Sensors installed at MWEPL Mast

# 6.5.2 INSTALLED SENSOR INFORMATION

Wind speed at MWEPL mast is recorded through five Theis first class anemometers installed at 80-a, 80b, 60, 30 and 10m from ground level. The data from MWEPL mast were collected using Theis anemometers and NDL data logger. The anemometers were individually calibrated in the Measnet accredited wind tunnel at DKD.

The roughness of the MWEPL mast site is 0.0235m whereas the power law exponent calculated using the four (04) years data is 0.141. The specifications of MWEPL mast are shown in table 6-17 given below.

Latitude	25° 5'43.30"N
Longitude	67°59'6.80"E
Observation	Wind Speed, Wind Direction, Temperature,
	Wind Speed: 80a, 80b, 60, 30 & 10m (Theis
Observation height	first class anemometers)
	Wind Direction: 78.5, 28.5m
Observation period	From March, 2007 ongoing
Data used for the Analysis	April 2007 to Mar 2011 (4 years)

Table 6-17	Specification	of MWEPL Mast
1 4010 0-17.	opermeanon	Of INI WELL DIVIDUOL

## 6.5.3 WIND DATA ANALYSIS

The data from the 80m high Master Energy wind measuring mast were collected over the period 01<sup>st</sup> April 2007 to 31<sup>st</sup> March 2011 (04 years). The data coverage was good for all the instruments except anemometer V80\_a, wind vane Dir 78.5 and Temp 80 during the measurement period. The data acquisition of MWEPL mast is given in table below:

Installed Sensors	Data Acquisition Ratio		
10m anemometer (V10)	93.6%		
30m anemometer (V30)	93.6%		
60m anemometer (V60)	93.6%		
80-a m anemometer (V85a)	75.0%		
80-b m anemometer (V85b)	93.6%		
28.5m Wind Vane	93.6%		
78.5m Wind Vane	75.1%		

Table 6-18: Wind Data Acquisition ratio of MWEPL Mast

Data is analyzed using time series starting from April 2007 to April 2011. Anemometer installed at 80m height (V80-a) and wind vane installed at 78.5m height started malfunctioning from 6th July 2010 till April 2011 due to which erroneous data has been removed from the time series therefore the data coverage for the V80-a and Dir 78.5 is 75% and 75.1% respectively.

The computed regression coefficient for anemometers installed at 80 meters with legends V80-a and V80b is 99.73% (r2 = 0.9973) without gaps filling whereas the regression coefficient after filling the missing gaps comes to 99.78% (r2 = 0.9978).

The computed regression coefficient for Dir78.5 and Dir28.5 is 81.51% (r2 = 0.8151) without the filling of gaps present in the data whereas the regression coefficient after filling the missing gaps comes to 44.41% (r2 = 0.4441)

## 6.5.3.1 MEAN WIND SPEED ANALYSIS

The wind data recoded at Master Energy mast during the period of four (04) years has been analyzed to determine the monthly mean wind speeds. The results are shown in table 6-19 and Figure 6-34 and 6-35 respectively.

### Table 6-19: Monthly Mean Wind Speeds Calculated at MWEPL Mast

Year	Month	Mean WS 80m_a	Mean WS 80m_b	Mean WS 60m	Mean WS 30m	Mean WS 10m
	P	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)
	Apr	7.404	7.338	7.154	6.453	5.7797
	May	9.36	9.276	9.136	8.45	7.7246
	Jun	9.255	9.18	9.036	8.389	7.6709
	Jul	8.787	8.721	8.625	8.028	7.3614
2007	Aug	9.021	8.931	8.796	8.118	7.4176
	Sep	7.941	7.849	7.701	7	6.2867
	Oct	6.282	6.218	5.937	4.944	4.0306
	Nov	5.33	5.269	5.036	4.104	3.2371
	Dec	7.187	7.056	6.751	5.525	4.3678
	Jan	7.083	6.964	6.679	5.492	4.38
	Feb	5.327	5.267	5.116	4.422	3.6247
2008	Mar	6.504	6.432	6.184	5.367	4.6171
	Apr	7.463	7.392	7.202	6.45	5.7466
	May	11.796	11.674	11.561	10.752	9.8691
	Jun	9.095	9.021	8.94	8.398	7.7633
	Jul	9.799	9.79	9.433	8.598	7.4708

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	Aug	9.517	9.417	9.328	8.69	7.9919
	Sep	8.212	8.115	7.955	7.213	6.452
	Oct	6.806	6.75	6.489	5.556	4.7224
	Nov	7.282	7.141	6.819	5.542	4.4346
	Dec	7.28	7.133	6.883	5.879	4.9223
	Jan	7.924	7.8	7.446	6.289	5.2982
	Feb	6.171	6.087	5.869	5.007	4.2035
	Mar	6.472	6.406	6.213	5.457	4.7242
	Apr	7.216	7.149	6.918	6.118	5.4021
	May	9.267	9.172	9.037	8.355	7.6232
2000	Jun	8.952	8.866	8.78	8.215	7.5925
2009	Jul	9.393	9.299	9.198	8.573	7.8997
	Aug	9.203	9.104	9.043	8.465	7.7986
	Sep	8.539	8.447	8.257	7.438	6.6646
	Oct	5.65	5.589	5.37	4.56	3.7916
	Nov	6.853	6.718	6.429	5.267	4.1577
	Dec	7.07	6.892	6.578	5.331	4.2324
	Jan	6.428	6.33	6.062	5.039	4.0572
	Feb	6.308	6.207	5.987	5.091	4.2021
	Mar	6.727	6.658	6.452	5.659	4.9046
2010	Apr	8.202	8.117	7.929	7.167	6.4223
	May	9.899	9.845	9.59	8.775	7.7917
	Jun	9.961	9.919	9.65	8.867	7.8484
	Jul	8.153	8.142	8.04	7.459	6.8297

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	Aug	7.08	7.08	6.925	6.256	5.6054
	Sep	6.66	6.66	6.459	5.683	4.9641
	Oct	5.96	5.96	5.713	4.913	4.0737
	Nov	6.806	6.806	6.552	5.659	4.643
	Dec	7.023	7.023	6.753	5.535	4.4164
2011	Jan	6.651	6.651	6.371	5.303	4.2556
	Feb	6.336	6.336	6.103	5.172	4.2648
	Mar	6.76	6.76	6.553	5.789	5.0149







Figure 6-35: Monthly mean wind speeds at MWEPL Mast during 2007-2011

## 6.5.3.2 DIURNAL VARIATION

The monthly and annual diurnal variation of wind speed, for the wind data recoded during the period of April 2007 to March 2011 at 10, 30, 60, 80-a and 85-b m are shown below in figure 6-36 and 6-37 respectively.



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Figure 6-36: Monthly Diurnal Wind Speed Profile at MWEPL Site Wind Data



Figure 6-37: Annual Diurnal Wind Speed Profile at MWEPL Site Wind Data

## 6.5.3.3 WIND SHEAR PROFILE

The vertical wind shear and monthly wind shear profiles for the wind data recorded during the period of April 2007 to March 2011 have been computed. The results derived are given below:



Table 6-20: Monthly Wind Shear Profile of MWEPL Mast

Month	Power Law Exponent
Jan	0.215
Feb	0.190
Mar	0.153
Apr	0.126
May	0.096
Jun	0.090
Jul	0.097
Aug	0.091
Sep	0.121
Oct	0.192
Nov	0.226
Dec	0.224

## 6.5.3.4 WIND DIRECTION AND FREQUENCY DISTRIBUTION

The data from the 80m high Master Energy mast were collected over the period April 2007 to March 2011. The annual and monthly wind roses developed using the MWEPL mast data (Apr 2007-Mar 2011) at 78.5m height are given below in Figure 6-40 and 6-41 respectively.



Figure 6-40: Wind Frequency Rose of MWEPL Mast at 78.5m





22%

180°

22%

180°

44%

88% (ISO

44%

160% 150°

0% caim 30°

0% caim 30\*

60°

/120\*

60°

120\*

90\*

90°





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Figure 6-41: Monthly Wind Frequency Rose of MWEPL Mast at 78.5m

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The annual and monthly wind rose developed using the Master Energy mast data (April 2007 – March 2011) at 28.5m height are given below in Figure 6-42 and 6-43 respectively.



Figure 6-42: Wind Frequency Rose of MWEPL Mast at 28.5m



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22%

22%

44%

68% 150°

44%

00% 150°

0% caim 30\*

0% calm 30\*

60°

120\*

.60\*

(120°

90°

90°





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The frequency distribution of the measurement is given in the following table.

	Direction	Frequency (%)		
	Sector	Dir 28.5m	Dir 78.5m	
1	345 - 15	9.8279	11.4777	
2	15 - 45	13.3086	10.3272	
3	45 - 75	4.4103	3.4424	
4	75 - 105	1.3884	1.2398	
5	105 - 135	0.8691	0.9348	
6	135 - 165	1.7200	1.7559	
7	165 - 195	2.3106	2.4024	
8	195 - 225	8.1172	11.7897	
9	225 - 255	36.2862	34.8033	
10	255 - 285	13.5400	12.1558	
11	285 - 315	5.2333	5.7610	
12	315 - 345	2.9692	3.8909	

Table 6-21: Wind Direction Data with Frequency Distribution

# 6.6 NEIGHBORING WIND MEASURING MAST OF DEWAN ENERGY PRIVATE LIMITED

# 6.6.1 GENERAL INFORMATION OF MAST

The 80m high Dewan Energy Private Limited (DEL) wind measuring mast was installed in August 2012 and has started collecting the wind data since then. DEL Mast is located at distance of approx. 4.5 km in the west of Western Energy wind farm site as shown below in Figure 6-44. The mast is of lattice structure with triangular cross section having side width of approx. 2 ft. The view of the Dewan Energy mast can be seen from the figure 6-45 whereas the installation arrangement at the mast can be seen from the figure 6-46 given below.



Figure 6-44: Neighboring Mast of DEL and Project Site Area

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Figure 6-45: View of DEL Wind Measuring Mast

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Figure 6-46: Installation Arrangements of Sensors installed at DEL Mast

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# 6.6.2 INSTALLED SENSOR INFORMATION

Wind speed at DEL mast is recorded through five Theis first class anemometers installed at 80-a, 80-b, 60, 30 and 10m from ground level. The data from DEL mast were collected using Theis anemometers and NDL data logger. The anemometers were individually calibrated in the Measnet accredited wind tunnel at DKD.

The roughness of the DEL mast site is 0.0223m whereas the power law exponent calculated using the Eighteen (18) months wind data is 0.141. The specifications of DEL mast are shown in table 6-22 given below.

Table 6-22:	Specification	of DEL Mast
-------------	---------------	-------------

Latitude	25°14' 42.83"N		
Longitude	67° 57' 52.34"E		
Observation	wind speed, wind direction, temperature,		
Observation height	wind speed: 80-a, 80-b, 60, 30 & 10m (Theis first class anemometers)		
	wind direction: 78.5m, 28.5m		
Observation period	From August 2012 ongoing		
Data used for the Analysis	August 2012 to February 2014 (1.5 years)		

## 6.6.3 WIND DATA ANALYSIS

The data from the 80m high DEL wind measuring mast were collected over the period  $09^{th}$  August 2012 to  $18^{th}$  February 2014 (~1.5 years). The data coverage was good for all the instruments during the measurement period. The data acquisition of DEL mast is presented in table below.

Installed Sensors	Data Acquisition Ratio		
10m anemometer (V10)	99.63%		
30m anemometer (V30)	99.63%		
60m anemometer (V60)	99.63%		
80-a m anemometer (V85a)	99.63%		
80-b m anemometer (V85b)	99.63%		
28.5m Wind Vane	99.63%		
78.5m Wind Vane	99.63%		

Table 6-23: Wind Data Acquisition ratio of DEL Mast

Data is analyzed using time series starting from  $09^{th}$  August 2012 to  $18^{th}$  February 2014. The computed regression coefficient for anemometers installed at 80 meters with legends V80-a and V80-b is 99.94% (r2 = 0.9994) whereas the computed regression coefficient for Dir78.5 and Dir28.5 is 38.38% (r2 = 0.3838).

### 6.6.3.1 MEAN WIND SPEED ANALYSIS

The wind data recoded at DEL Mast during the period of Eighteen (18) months has been analyzed to determine the monthly mean wind speeds. The results are shown in table 6-24 and Figure 6-47 and 6-48 respectively.

		Mean WS Mean WS		Mean WS	Mean WS	Mean WS	
Year	Month	80m (a)	80m (b)	60 m	30m	10m	
		(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	
2012	Aug	9.403	9.396	9.222	8.734	7.8658	
2012	Sep	7.184	7.177	6.933	6.354	5.5493	
2012	Oct	5.596	5.572	5.386	4.809	3.9294	
2012	Nov	5.32	5.283	5.14	4.502	3.4926	
2012	Dec	6.766	6.717	6.474	5.67	4.482	
2013	Jan	6.176	6.135	5.954	5.197	4.0275	
2013	Feb	7.119	7.081	6.771	5.888	4.7309	
2013	Mar	6.656	6.623	6.395	5.691	4.7074	
2013	Apr	6.93	6.907	6.666	6.082	5.2911	
2013	May	10.399	10.377	10.137	9.515	8.4882	
2013	Jun	9.601	9.599	9.398	8.885	7.9707	
2013	Jul	10.721	10.721	10.533	10.029	9.048	
2013	Aug	9.636	9.62	9.429	8.913	7.9823	
2013	Sep	8.03	8.016	7.814	7.284	6.4379	
2013	Oct	6.006	5.969	5.799	5.256	4.4731	
2013	Nov	5.948	5.911	5.748	5.017	3.8882	
2013	Dec	6.261	6.222	6.015	5.313	4.1785	
2014	Jan	7.24	7.193	6.961	6.05	4.6537	
2014	Feb	6.225	6.195	5.986	5.288	4.2249	

Table 6-24: Monthly Mean Wind Speeds Calculated at DEL Mast

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# **THE COMPANIES ORDINANCE, 1984**

# (A Company Limited by Shares)

# MEMORANDUM OF ASSOCIATION

### OF

## WESTERN ENERGY (PRIVATE) LIMITED

- I. The name of the company is WESTERN ENERGY (PRIVATE) LIMITED.
- II. The Registered office of the company will be situated in the province of Sindh.
- III. The main and exclusive object for which the company is established is to set up an industrial undertaking in power sector to carry on the business of electric power generation, accumulation, transmission and distribution thereof in all its branches and aspects by the use of such forms of energy and in such manner as may be deemed feasible for that purpose. To achieve the main and exclusive object the Company shall be authorized:
  - 1. To market, sell, transmit and deliver the electric power generated by the Company any where in Pakistan.
  - 2. To arrange for buying all kinds of plant and machinery, equipments, tools and other raw material, whether local or imported, on cash, loan, deferred credit, pay-as-earn or non-repatriable investment basis.
  - 3. To acquire by purchase, exchange, hire, assignment or otherwise, tenements, buildings, easements, rights, advantages, moveable and immoveable property of any kind whatsoever, machinery, trade marks, patents or inventions, or other properties, plants and stock-in-trade and to employ, sell, exchange, mortgage, get on lease, license to use or otherwise.

- 4. To purchase, or acquire by some other means, any land or lands and build, erect, construct, furnish, equip, maintain or improve any building, structure and edifice and to carry on construction thereof for the purposes of the Company.
- 5. To arrange electricity, water, gas, sewerage and other utilities required for efficient running of the project.
- 6. To appoint agents, sub-agents, attorneys, consultants, brokers and contractors in connection with the business of the Company but not to act as managing agents.
- 7. To adopt such means of making known the product of the Company as may seem expedient, and in particular by advertising in the press and electronic media, by circulars, by purchase and exhibition of works of art or interest, by publication of books and periodicals, and by rewards, stipends and donations.
- 8. To enter into any arrangement with any governments or authorities (Federal, Provincial, Municipal, Local or otherwise), or any corporations, companies, firms or persons that may seem conducive to the Usimpany's exclusive object, and to obtain from any such governments authority, corporation, company, firm or person any charters, controls, decrees, rights, privileges and concessions which the Company may think desirable, and to carry out, exercise and comply with any such acharters, controls, decrees, rights, privileges and concessions.
- 9. To sell or otherwise dispose off all good that erials articles and things belonging to the Company either on cash or on credit and either for immediate or future delivery and to send the same for sale or export to any place that may be deemed necessary or expedient, in the event of winding up of the Company.
- 10. To get insured against losses, damages, risks, accidents and liabilities of all kinds which may affect the company whether in respect of its contracts, agreements, advances or securities or in respect of servants or cmployees of the company, or in respect of property belonging to or leased to or hired by the company, either by setting apart funds of the company or by effecting such insurance.
- 11. To open, close and operate bank accounts with scheduled banks or financial institutions and to draw, make, accept, endorse, discount, execute and issue promissory notes, bills of exchange, cheques, bills of lading, warrants, debentures and other negotiable or transferable instruments, concerning the business of this Company.
- 12. To borrow or procure on mark-up, profit or return in any form, money or finances, in local or any foreign currency from any bank or financial institution and to receive money on mark-up by issuing debentures, and on

security of any such money so borrowed or received to mortgage, pledge, charge or hypothecate whole or any part of property, assets or revenue of the Company (both present and future) including its capital by special assignment or otherwise, to transfer or convey the same conditionally, absolutely or in trust and to give, tender power to sell and other powers as may seem expedient, and to purchase or redeem such securities and pay for such borrowing and loans for the purpose of achieving the main and exclusive object.

- To procure or arrange finances from scheduled banks and financial 13. institutions under any mode of Islamic financing scheme like, redeemable capital including modaraba and musharaka and to procure, raise or secure the money in such manner as the company may deem fit and particularly by mortgage of its property in full or in part on both the present and future assets in accordance with the Islamic Laws and/or by the issue of shares, bonds, debentures, participation term certificates, Term Finance Certificates, or redeemable capital or any other securities charged or based upon the undertaking of the company, on any part of its property, both present and in future and generally to borrow money for achievement of the main and exclusive object of the company in such manner as the company shall deem fit. To issue debentures or participation term certificates, term finance certificates, redeemable capital, either permanent or redeemable or repayable or convertible into shares and to secure any securities of the company by a trust or other assurances.
- 14. To distribute any of the property of the Company amongst the members in specie or kind and in particular any shares, debentures or second stars of other companies belonging to this Company, or of which this Company, may have the power of dispose of, in the event of winding up of the Company.
- 15. To create any depreciation fund, provident fund, reserver fund, string fund, insurance fund, or any other special fund conducive to the interest of the company.
- 16. To establish and maintain branches, receiving offices and distribution centers and to enter into contracts or agency agreements (other than managing agency) with any other persons or firms or companies or for the distributing centers for achievement of the main and exclusive object of the Company.
- 17. To undertake and execute any trusts which the Company may think fit and expedient to undertake for the benefit of the employees.
- 18. To apply for, purchase, or other wise acquire, and protect and renew any patents, patent rights, trade marks, designs, licenses, concessions and the like, conferring any exclusive or non-exclusive or limited right to their use.
- 19. To train personnel and workers, in Pakistan and/or abroad, to obtain technical proficiency in various specialities connected with the business of the Company.

- 20. To give any indemnity, guarantee or security or enter into any bond and, without restricting the generality of the foregoing, to indemnify any person or company, and guarantee or otherwise become liable for the performance by any person or company of any obligation, contract or undertaking as may be required in connection with the business.
- 21. To carry on any other business or activity and do any act or thing which in the opinion of the Company is or may be capable of being conveniently carried on or done in connection with the objects of the Company and or any of the above powers, or likely directly or indirectly to enhance the value of or render more profitable all or any part of the Company's property or assets or otherwise to advance the interests of the Company or its members.
- 22. To carry out joint venture agreements with other companies or countries within the scope of the objects of the Company.
- 23. To amalgamate, merge with, absorb, reconstruct, de-merge, acquire or take over any other company or the whole or part of any undertaking having objectives altogether or in part similar to those of the Company or carrying on any business capable of being conducted so as directly or indirectly to benefit this Company, whether by sale or purchase of the assets, property or undertaking, or divestiture of the whole or part of the undertaking of the company or by partnership or any arrangement in the nature of partnership or in any other manner or to enter into and carry into effect any arrangement, or for sharing of profits, with any partnership undertaking or person carrying on business within the objects of this company.
- 24. To do and perform all other acts and things as are incident are conducive to the attainment of the above objects or any of them.
- 25. Notwithstanding anything contained in the foregoing object clause of this Memorandum of Association, nothing herein will be the transmission as empowering the Company to undertake or indulge in the best mess of a banking company, a financial institution, a leasing company, an investment company, an insurance company or an investment advisory company, directly or indirectly, as restricted under law or in any unlawful operation and that nothing in the object clause shall be construed to entitle it to engage in such business. The Company shall not launch multilevel marketing, pyramid and ponzy schemes.
- 26. Notwithstanding anything stated in any object clause, the Company shall obtain such other approval or licence from the competent authority, as may be required under any law for the time being in force, to undertake a particular business.

- IV. The liability of the Members is limited.
- V. The authorized share capital of the Company is Rs. 300,000 (Rupees Three Hundred thousand only) divided into 30,000 (Thirty Thousand) ordinary shares of Rs. 10 (Rupees Ten) each with powers to increase and reduce the capital of the Company in such manner as may be consistent with the provisions of the Companies Ordinance, 1984.



We, the serveral persons whose names and address are subscribed below, are desirous of being formed into a Company persaunt of this Memorandum of Association, and we agree to take number of shares in the capital of the Company set opposite our respective

Name and surname (present and former in full and block letters)	Father's/Husband's name in full	Nationality with any former Nationality	Occupation	Residential address	Number of shares taken by each subscriber	Signature
		if any				not n
MR. TAJWAR TAPAL CNIC No.35201-2649288-5	Mr. Moiz Ali Tapal	Pakistani	Business	6-A, 1st Gizri Lane, D.H.A., Karachi	2,500 (Two Thousand Five Hundred )	11.
MR. TABISH TAPAL CNIC No. 42301-2385059-9	Mr. Moiz Ali Tapal	Pakistani	Business	33-B, 3rd Gizri Street, Phase IV, D.H.A., Karachi	4,500 (Four Thousand Five Hunred )	
MR. MUHAMMAD SADIQ TAPAL CNIC No. 35201-2785819-5	Mr. Tajwar Tapal	Pakistani	Business	73/6A, Munir Road, Lahore, Pakistan	2,500 (Two Thousand Five Hundred )	hall
MR. MUSTAFA LAKDAWALA CNIC No. 42201-3140375-9	Mr. Abid Hussain Lakdawala	Pakistani	Service	94/1, Bahadur Yar Jang Society, Karachi, Pakistan	500 (Five Hundred )	Howaly
Total					10,000 (Ten Thousand)	



# THE COMPANIES ORDINANCE, 1984

# (COMPANY LIMITED BY SHARES)

# **ARTICLES OF ASSOCIATION**

## OF

# WESTERN ENERGY (PRIVATE) LIMITED

# PRELIMINARY

### Table A not to apply

The regulations contained in the Table 'A' in the First Schedule to the Companies Ordinance 1984, shall not apply to the Company except so far as the same are repeated, contained or expressly made applicable in these Articles or by the Ordinance.

The headings hereto shall not affect the construction hereof and in these presents, unless there is something in the subject of context for the time being in force.

- i) *'The Ordinance'* means the Companies Ordinance, 1984 or any statutory modification or re-enactment thereof for the time being in force;
- ii) *'The Articles*' means the Articles of Association as originally framed or as from time to time altered by Special Resolution;
- iii) The Company' means WESTERN ENERGY (PRIVATE)
- iv) 'Special Resolution' has the same meaning as assigned the to of the Ordinance;
- v) *Member'* means member of the Company in accordance with the provisions of Section 2(1)(21) of the Ordinance.
- vi) *'The Directors'* means the Directors, including alternate director for the time being of the Company.
- vii) *'The Chief Executive'* means the Managing Director of the Company, by whatever name called, appointed pursuant to Section 198 of the Ordinance.

- viii) The Board' means the Board of Directors for the time being.
- ix) 'The Secretary' means the Secretary for the time being of the Company.
- x) *"The Register'* means the Register of Members to be kept pursuant to Section 147 of the Ordinance.
- xi) *The Office* ' means the Registered Office for the time being of the Company.
- xii) 'Dividend' includes bonus shares.
- xiii) 'Seal' in relation to a Company means the Common Seal of the Company.
- xiv) 'Month' means calendar month.
- xv) *Proxy* includes an attorney duly constituted under a power of attorney.
- xvi) *'The Registrar'* means a Registrar, an Additional Registrar, a Joint Registrar, a Deputy Registrar or an Assistant Registrar of Companies.
- xvii) *'In Writing and Written'* includes printing, lithography, typewriting and other modes of representing or reproducing words in a visible form.
- xviii) Words importing the singular number shall include the plural number and vice versa.
- xix) Words importing the masculine gender shall include the feminine gender.
- *xix) Person*' includes Corporations.
- xxi) 'Family Members' mean and include Parents, Husband, Wife, Sons and Daughters.

Unless the context otherwise requires or unless expressly defined words of expressions contained in these Articles shall bear the same meaning as in the Ordinance or any supervision modification thereof in force at the date at which these present are binding on the Company.

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### BUSINESS

The business of the Company shall be the main and exclusive object provided in the Memorandum of Association.

### CAPITAL

The authorized share capital of the Company is Rs. 300,000 (Rupees Three Hundred Thousand only) divided into 30,000 (Thirty Thousand) ordinary shares of the nominal value of Rs. 10 (Rupees Ten) each.

The share capital of the Company may comprise of different classes of shares, issued from time to time, including ordinary shares, cumulative and non-cumulative preference share, and shares having different rights and privileges attached to them, subject to requirement and conditions mentioned in Companies Share Capital (Variation in Rights and Privileges) Rules, 2000. Subject to the aforesaid, shares of different classes and kinds may have different rights and privileges attached to them, however all shares of a particular class shall have same rights and privileges attached to them.

#### SHARES

The Company shall not issue partly paid shares.

Except to the extent and in the manner allowed by Section 95 of the Ordinance, 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.

The Directors may increase the share capital by such sum as they think fit, to be divided into shares of such amount as the resolution may prescribe, subject, nevertheless, to the provisions of Section 92 of the Ordinance.

Where the Directors decide to increase the Issued Capital of the Company by the issue of ordinary or preference shares, either at a premium or at par, such shares, shall be offered on such terms and conditions and for such consideration, and at such times as the directors deem fit, to the members in proportion to the existing shares held by each member and such offer shall be made by notice specifying the number of shares to which the members are specifying the number of shares to which the members are specifying the number of shares to which the members are specifying the number of shares to which the members are specifying the number of shares to which the members are specifying the number of shares to which the members are specifying the number of an intimation from the best of the best of the best of the specifying the declines to accept the shares offered the Directors may dispose of the same in such manner as they think most be best of the company.

The Company may at any time pay commission to any person for subscribing or debenture subscribe (whether absolutely or conditionally) for any shares, debentures or debenture stock of the Company, or procuring or agreeing to procure subscriptions (whether absolutely or conditionally), for any shares, debentures, debenture stock of the Company, but if the commission in respect of shares shall be paid or payable out of capital, the conditions and requirements laid-down in Section 82 of the Ordinance shall be observed. The amount or rate of commission shall not exceed any statutory limit thereon. The commission may be paid or satisfied in cash or in shares, debentures or debenture-stock of the Company.

Any capital raised by the creation of new shares, subject to the capital structure stipulated in these present shall be considered part of the original capital and shall be subject to the provisions herein contained with reference to the payment, transfer and transmission, surrender, voting and otherwise.

The Company may from time to time by Special Resolution reduce its share capital in any way and in particular (without prejudice to the generality of the power) by paying off capital or canceling capital which has been lost or is unrepresented by available assets or reducing the liability on the share or otherwise as may seem expedient and capital may be paid off which is in excess of the needs of the Company or otherwise, and paid up capital may be cancelled as aforesaid without reducing the nominal amount of the shares by the like amount to the extent that the capital shall be increased by the like amount.

Save as herein otherwise provided, the Company shall be entitled to treat the registered holder of any share as the absolute owner thereof and accordingly shall not, except as ordered by a court of competent jurisdiction, be bound to recognize any equitable, contingent or partial interest in or any other right in respect of such share on the part of any other person.

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

If any share stands in the name of two or more persons, the person first named in the Register shall, as regards receipt of dividend or bonus or service of notice, and all or any other matters connected with the Company except voting at the meeting and the transfer of shares, be deemed the sole holder.

In the case of the death of any one or more of the persons named in the Register as the joint-holder of any share, the survivor or survivors shall be the only person or persons recognized by the company as having any title to or interest in such share, but pottning herein contained shall be taken to release the estate of a joint holder from any liability Regist

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Every shareholder shall name to the Company a place in Pakistan to be readdress and such address shall for all purposes be deemed to be his place of r

Subject to the provisions of Section 92 of the Ordinance the Company m Resolution:

- a) consolidate and divide the whole or any part of its share capital into shares of larger amount than its existing shares;
- b) sub-divide its shares or any of them into shares of smaller amount than is fixed by the Memorandum of Association;

c) cancel any shares which at the date of passing of the resolution have not been taken or agreed to be taken by any person.

The Resolution by which any share is sub-divided or consolidated may determine that as between holders of shares resulting from sub-division or consolidation, rights of profits, votes and other benefit attaching to them will be proportionate to their paid up value and where shares issued as sub-divided or consolidated shares are of same class as those previously issued that rights attaching to them, subject as aforesaid, shall be the same as those attaching to the shares previously held.

Subject to the provisions of the Ordinance and these Articles, the Directors may allot and issue shares in the capital of the Company as payment or part payment of any property, sold or transferred, discharge of any indebtedness or obligations of the company, goods or machinery supplied or for services rendered to the Company in or about the formation or promotion of the Company or conduct of its business, and any shares which may be sold or allotted may be issued as fully paid-up shares, and, if so issued, shall be deemed to be fully paid up shares

## CERTIFICATE

Every person whose name is entered as Member in the Register shall without payment be entitled to receive, after allotment or registration of transfer, one certificate for all his shares or several certificates each for one or more of his shares and upon payment of such charges, if any, as the Directors may determine for every certificate after the first.

The certificates of title of share and duplicates thereof when necessary shall be issued under the seal of the Company and signed by two Directors, or by one Director and the Secretary.

The Company shall not be bound to issue more than one share certificate in respect of a share or shares held jointly by two or more persons, and delivery of a certificate for a share to any one of joint holders shall be sufficient delivery to all.

The Company shall, within ninety days, after the allotment of any of its shares, and within 45 days after the date on which the instrument of transfer has been lodged, complete and have ready for delivery the certificates of all shares, allotted or transferred, unless the conditions of issue of the shares otherwise provide.

If any certificate be worn out, defaced, destroyed or if there is no further space on the back thereof for endorsement of transfer, it may be renewed or replaced on payment of stelf-our not exceeding five Rupees, as the Directors may from time to time prescribe; provide however, that such new certificate shall not be granted except upon delivery of the worn out or defaced or used up certificate for the purpose of cancellation or upon proof of destruction or loss to the satisfaction of the Directors and on such indemnity as the Directors and deem adequate in case of certificate having been lost or destroyed. Any renewed certificates thall be marked as such.

# TRANSFER AND TRANSMISSION OF SHARES

- i. In the event of sale or transfer of shares as permitted under the Ordinance, the transferee of shares shall, if not already a member become a member and shall be bound by the terms of the Articles in the same manner and to the same extent as the transferor of shares.
- A share may, subject to the provisions of Section 76 of the Ordinance, at any time be transferred, by a Member or other person entitled to transfer, provided it is approved by the Board in accordance with the provisions contained in these present
- If the Directors refuse to register the transfer of any shares they shall within one month from the date on which the transfer was lodged with the Company send to the transferee and the transferor notice of such refusal indicating the defect or invalidity to the transferee, who shall, after removal of such defect or invalidity, be entitled to re-lodge the transfer deed with the Company. No transfer of shares in any case be made to an insolvent or person of unsound mind.

The transfer of shares shall be effected by an instrument in writing in the usual common form modified so as to suit the circumstances of the parties and shall be executed both by the transferor and the transferee and duly stamped according to law, whose execution be attested by at least one witness, who shall add his address and occupation, and the transferor shall be deemed to remain the holder of such shares until the name of transferee shall have been entered in the Register of members in respect hereof.

Every instrument of transfer shall be left at the office for registration, duly stamped and accompanied by the certificate of the shares to be transferred and such other evidence as the Company may require to prove the title of the transfer or his right to 'transfer the shares'. All instruments of transfer which will be registered shall be retained by the Company, but any instrument of transfer which the Directors may decline to register shall, on demand, be returned to the person depositing the same.

Where it is proved to the satisfaction of the Directors that an instrument of transfer signed by the transferor and the transferee has been lost, the Company may, if the Directors shall think fit, by an application in writing made by the transferee and bearing the stamp required by an instrument of transfer, register the transfer on such terms as to independ the Directors may think fit.

Nothing contained in Articles 26 and 29 shall prejudice any power of register as shareholder any person to whom the right to any shares of the transmitted by operation of law.

No fee will be charged for registering transfer of shares.



The transfer books and register of members may be closed for any time or times not exceeding in the whole forty five days in each year, but not exceeding thirty days at a time, in accordance with the manner specified in Section 151 of the Ordinance.

The nominees of a deceased member as specified in Section 80 of the Ordinance, or executors or administrators of a deceased member shall be the only persons recognized by the Company as having title to his share except in case of joint holders in which case the surviving holders or the executors or administrators of the last surviving holder shall be the only person entitled to be so recognized; but nothing herein contained shall release the estate of a deceased joint holder from any liability in respect of any share jointly held by him. The Company shall not be bound to nominee of deceased member or executor or administrator unless he shall have obtained probate or letters of administration or other legal representation, as the case may be, from a duly constituted court in Pakistan or from any court or authority authorized by any Act of the legislature or by any order or notification of the Federal or Provincial Government, to grant such probate or letters of administration. Provided nevertheless that in special cases, and in such cases only, it shall be lawful for the Directors to dispense with the production of probate or letters of administration or such other legal representation upon such terms as to indemnity or otherwise as the Directors may deem fit.

A person becoming entitled to a share by reason of the death or insolvency 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.

Neither the Company nor its Directors shall incur any liability or responsibility whatsoever in consequence of their registering or giving effect to any transfer of shares made or purporting to be made by an apparent legal owner thereof to the prejudice of persons having or claiming any equitable right, title or interest to or in the same, notwithstanding that the Company may have had notice of such equitable right, title or interest, or notice prohibiting registration of such transfer, and may have entered such notice or referred thereto in any book of the Company and shall not be bound or required to attend or give effect to any notice which may be given to them of any equitable right, title or interest or be under any liability whatsoever for refusing or neglecting so to do, though it may have been entered or referred to in some book of the Company; but the Company shall nevertheless be at liberty to regard and attend to any such notice and give effect thereto if the Directors shall so think fit.

### **GENERAL MEETINGS**



A general meeting, to be called Annual General Meeting, shall be held within eighteen months from the date of incorporation and thereafter once at least in each calendar year within a period of four (4) months following the close of its financial year of such time and place as the Directors may determine, provided, however, that no greater interval fifteen months shall be allowed to clapse between two Annual General Meetings. All general meetings of the Company other than Annual General Meeting shall be called Extraordinary General Meetings.

The Directors may, whenever they think fit, call an Extraordinary General Meeting and Extraordinary General Meeting shall also be called on the requisition of the holders of not

less than 10% of the issued capital of the Company on the date of deposit of requisition, the directors shall forthwith proceed to convene an Extraordinary General Meeting of the Company and in case of such requisition, the provisions of Section 159 of the Ordinance shall apply.

). If at any time sufficient number of directors capable of acting to form a quorum are not present in Pakistan, the directors may convene an extra ordinary general meeting in the same manner as nearly as possible in the manner in which the Meeting may be convened by the Directors

### NOTICE OF MEETING

- Subject to the provisions of Sections 158 and 159 of the Ordinance 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 the hour of meeting and, in case of special business the general nature of that business, shall be given in the manner provided by the Ordinance for the general meeting, to such persons as are under the Ordinance or the regulations of the Company, entitled to receive such notice from the Company. With the consent in writing of all the members entitled to receive notice of some particular meeting, that meeting may be convened by such shorter notice and in such manner as those members may deem fit.
  - The accidental omission to give notice of a meeting to or the non-receipt of notice of a meeting by, any member or person entitled to receive notice shall not invalidate the proceedings at any general meeting.

# PROCEEDINGS AT GENERAL MEETINGS

The business of the Annual General Meeting shall be to receive and consider the balance sheet and profit and loss account, the reports of the Directors and of the Auditors, to elect Directors, to declare dividends and to appoint Auditors, and fix their remunerations. All other business transacted at an Annual General Meeting and all business transacted at Extraordinary General Meetings, shall be deemed special.

No business shall be transacted at any General Meeting unless a quorum of members is present at the time when the meeting proceeds to business. Subject to the provisions of the Ordinance, two (2) members present personally who represent more infinite weather percent of the total voting power, either of their own account or as provisions that quorum.

If within half an hour from the time appointed for the meeting, a quorum is not the sector in the meeting if called upon requisition of 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, at the adjourned meeting the quorum shall be two (2) members present in person.

The Chairman, if any, of the Board shall preside as Chairman at every General Meeting of the Company, but if there is no such Chairman, or if he shall not be present within fifteen minutes after the time appointed for the holding of the meeting or is unwilling to act, the Directors present shall elect one of the members present to be Chairman of the meeting, or if no Directors be present or if Directors present decline to take the chair, the members present shall choose one of their member to be Chairman of the meeting.

- The Chairman may with the consent of any meeting at which a quorum is present (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 adjournment took place. When a meeting is adjourned for thirty days or more, notice of adjourned meeting shall be given as in the case of original meeting. Save as aforesaid, it shall not be necessary to give any notice.
- At a 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 show of hands) demanded in accordance with provisions of Section 167 of the Ordinance:
  - a) by the Chairman of the meeting of his own motion; or
  - (b) by one Member having the right to vote on the resolution and present in person or by proxy if not more than seven such members are personally present, and by two such Members present in person or by proxy if more than seven such Members are personally present; or
  - (c) by any Member or Members present in persons or by proxy and having not less than onetenth of the total voting power in respect of the resolution; or
  - (d) by any Member or Members present in person or by proxy and holding shares in the company conferring a right to vote on the resolution, being shares on which an aggregate sum has been paid up which is not less than one-tenth of the 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 lost, and an entry to that effect in the book containing the minutes of the proceedings of the Company shall be conclusive evidence of the fact without proof of the number or proportion of the votes recorded in favour of or against that resolution. any Registratio

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Any poll duly demanded on the election of a Chairman of a meeting or on adjournment shall be taken at the meeting and without adjournment.

If a poll is duly demanded, it shall be taken in accordance with the murger la section 168 of the Ordinance and the results of the poll shall be deemed to be the rese of the meeting at which the poll was demanded. hange Com

The demand of a poll shall not prevent the continuance of the meeting for the transaction of any business other than the question on which the poll has been demanded. The demand for a poll may be withdrawn at any time by the person or persons who made demand.

- . The Chairman of any meeting shall be the sole judge of the validity of every vote tendered at such meetings. The Chairman present at the time taking of a poll shall be the sole judge of the validity of every vote tendered at such poll.
- . The following matters shall be resolved only by Special Resolution of the Company in General Meeting.
  - a) Increase or reduction in the Authorized Share Capital;
  - b) Issue of debentures;
  - c) Sale or disposal or leasing out of a substantial part of the undertaking of the Company;
  - d) Sale of the whole of the undertaking of the Company;
  - e) Amendment to the Memorandum and Article of Association; and
  - the redemption or repurchase by the Company of outstanding shares of the Company to the extent so authorized by law.

### VOTES OF MEMBERS

Subject to any rights or restrictions for the time being attached to any class or classes of shares, on a show of hands every member present in person or by proxy and every corporation present by proxy or by a representative duly appointed pursuant to Article 64 shall have one vote except for election of Directors in which case the provisions of Section 178 of the Ordinance shall apply. On a poll every member shall have voting rights as laid down in Section 160 of the Ordinance.

In the case of joint holders the vote of the senior member present whether in person or by proxy shall be accepted to the exclusion of the votes of the other joint holders; and for this purpose seniority shall be determined by the order in which their names examt in the Register.

A member of unsound mind, or in respect of whom an order has been mad having jurisdiction in lunacy, may vote, whether on a show of hands or of committee or other legal guardian and any such committee or guardian may, by proxy.

No member shall be entitled to vote at any General Meeting unless an payable by him in respect of shares in the Company have been paid.

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.

- 1. On a poll votes may be given either personally or by proxy or in the case of a corporation by a representative duly authorized in accordance with Article 64.
- <sup>1</sup>. 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 corporation, under its common seal or the hand of an officer or attorney so authorized and in default the instrument of proxy shall not be duly authorized. A proxy must be a member of the Company.
- The instrument appointing a proxy and the power of attorney or other authority (if any) under which it is signed or a notarially certified copy of that power or authority, shall be deposited at the office not less than forty-eight hours before the time for holding the meeting at which the person named in the instrument proposes to vote, and in default the instrument of proxy shall not be treated as valid.
- An instrument appointing a proxy may be in the following form:-

### Signed this ..... day of.....

- The instrument appointing a proxy shall be deemed to confer authority to demand or join in demanding a poll.
- A vote given in accordance with the terms of an instrument or provessial be valid notwithstanding the previous death or insanity of the principal or revocation of the provession or of the authority under which the proxy was executed, or the transfer of the shares in resoof which the proxy is given, provided that no intimation in writing of such the proxy is given, provided that no intimation in writing of such the office performance of the meeting or adjourned meeting at the office before the commencement of the meeting or adjourned meeting at which the proxy is used.
- Subject to the provisions of Section 162 of the Ordinance, a comparative of others and corporate which is a member of the Company may by resolution of its Directors of other governing body authorize such person as it thinks fit, to act as its representative at any meeting of the Company or of any class of members of the Company, and the person so authorized shall be entitled to exercise the same power on behalf of the company which he represents as that company could exercise if it were an individual member of the Company

present in person. A corporation or company attending a meeting through such representative shall be deemed to be present at the meeting in person.

### DIRECTORS

- The number of Directors to be elected shall be fixed, according to the provisions of Section 178 of the Ordinance, from time to time by the Board, subject to the condition that there shall not be less than two (2) directors nor more than ten (10) directors, and until otherwise determined by the Company by a Special Resolution in a general meeting, the number of Directors including the Directors nominated by the Company's creditors or other special interest by virtue of contractual obligation in accordance with the provisions of the Ordinance, shall not be more than ten (10), including the Chief Executive of the Company.
- The following shall be the first Directors of the Company:
  - 1. Mr. Tajwar Tapal
  - 2. Mr. Tabish Tapal
  - 3. Mr. Muhammad Sadiq Tapal
  - 4. Mr. Mustafa Lakdawala
- Except in the manner and to the extent provided for nomination in Article 65 hereof, the appointment, election, tenure of office and removal of directors shall be made and/or carried out in accordance with provisions of the Ordinance.

Save as provided in Section 187 of the Ordinance and Article 65 hereof, no person shall be appointed as a director unless he is a member of the Company.

The first directors shall stand retired at the first annual general meeting, and directors shall be nominated in accordance with Article 65 hereof, be elected in their place in accordance with Article 72 hereof.

Any person who seeks to contest an election to the office of Director shall, whether he is a retiring Director or otherwise, file with the Company, not later than fourteen day before the date of the meeting at which elections are to be held, a notice of his intension to be fore himself for election as a Director. Provided that any such person may, at the before the holding of elections withdraw such notice.

Retiring Directors shall be eligible for re-election.

The Directors shall be elected in accordance with the provisions of the Orohance by the s Members in General Meeting from amongst the candidates eligible for electron in the following manner:

a) every member present in person or by proxy or by representative shall have such number of votes as is equal to the product of the number of voting shares 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 elected.
- The Company in General Meeting may remove a Director from office by a resolution passed with the requisite number of votes determined in accordance with the provisions of Section 181 of the Ordinance.
- . Retiring directors shall continue to perform their functions until their successors are elected.
- . 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.
- A casual vacancy occurring among the elected Directors may be filled up by the directors, but a person so appointed in lieu of an elected Directors shall hold office for the remainder of term of the Director in whose place he is appointed.
- When any director intends to be, or is absent for a period of not less than three (3) months from Pakistan, he may with the approval of the directors appoint any person to be his alternate director, and such alternate director during the absence of the appointer from Pakistan, shall be entitled to receive notice of and to attend and vote at meeting of directors and shall be subject to and entitled to the benefit of the provisions contained in these Articles with reference to directors and may exercise and perform all such powers, directions and duties as his appointer could have exercised or performed including the power of appointing another alternate director. An alternate director so appointed shall not be entitled to receive any remuneration from the Company nor be required to hold any qualification. Such appointment shall be recorded in the directors' minute book. A director may at any time by notice in writing to the Company remove an alternate director appointed by him upon the return of the appointer to Pakistan, or the death of, or the returnene to the resignation as director of the appointer, the alternate director shall cease to be with prostated that if any director retires but is re-elected at the meeting at which such for the meeting at w effect any appointment made by him pursuant to this Article which was in force immediately prior to this retirement and re-election and which has not otherwise search be effective shall continue to operate after his re-election as if he had not to retired. An alternate director shall not be deemed to be the agent of the director appointing then but shall be reckoned as one with his appointer. All appointments and removals of alternations consectors shall be effected by writing under the hand of the director making or revoking such appointment and left at the office. For the purpose of assessing a quorum in accordance with the provisions of Article 94 hereof an alternate director shall be deemed to be director. Any director may act an alternate director for any one or more directors, as well as being able to act as a director in his own right. An alternate director may resign as such upon giving thirty (30) days prior notice to the Board to this effect. An alternate director need not be a member of the Company.

- 3. The remuneration to be paid to any Director for attending meetings of the Board shall, from time to time, be determined by the Board of Directors. It shall not exceed Rs. 500 per meeting. The directors shall be paid such traveling expenses as may be fixed by the directors from time to time or in or about the performance of their duties as directors or if a director has to come to attend the Board meeting from outstation.
- . Any Director appointed to any executive office, including for purpose of this Article, the office of chief executive or chairman, who serves on any committee or who devotes special attention to the business of the Company or who otherwise performs extra services which in the opinion of the Board are outside the scope of the ordinary duties of a Director, may be paid such extra remuneration whether by way of salary, fees, percentage of profits or otherwise, as the Board may determine, which shall be charged as part of the Company's ordinary working expenses; subject to the provision of any law for the time being in force.
- . The Directors shall elect one of their number as the Chairman of the Board.
- . The Directors may from time to time delegate any of their powers to a committee or committees consisting of two (2) or more members of their body as they think fit. Any committee so formed shall conform to any regulations that may by imposed upon it by the Directors and shall be governed, in the exercise of the powers so delegated, by the provisions herein contained for regulating meetings and proceedings applicable to the Directors.

### POWERS AND DUTIES OF DIRECTORS

- The business of the Company shall be managed by the Directors, who may pay all expenses incurred in setting up and registering the Company, and may exercise all such powers of the Company as are not by the Ordinance or any Statutory modification thereof for the time being in force, or by any other law or these Articles, required to be exercised by the Company in General Meeting subject, never-the-less, to any regulations of these Articles, to the provisions of the Ordinance, and to such regulations being not inconsistent with the aforesaid regulations or provisions, as may be prescribed by the Company in General Meetings, but no regulation made by the Company in General Meeting shall invalide the provision of the Directors which would have been valid if that regulation had not be an additional to the provision of the Directors which would have been valid if that regulation had not be an additional to the provision of the Directors which would have been valid if that regulation had not be an additional to the provision of the Directors which would have been valid if that regulation had not be an additional to the provision of the Directors which would have been valid if that regulation had not be a support of the Directors which would have been valid if that regulation had not be a support of the Directors which would have been valid if that regulation had not be a support of the Directors which would have been valid if that regulation had not be a support of the Directors which would have been valid if that regulation had not be a support of the Directors which would have been valid if that regulation had not be a support of the Directors which would have been valid if that regulation had not be a support of the Directors which would have been valid if that regulation had not be a support of the Directors which would have been valid if the transmitter of the Directors which would have been valid if the transmitter of the Directors where the transmitter of the Directors where the transmitter of the Directors whe
- The Directors may exercise all the powers of the Company to borrow money and mortgage its undertaking, property and capital or any part thereof, and to issue sourthic debentures, Participation or Term Finance Certificates or any other instrument, wheth outright or as security for any debt, liability or obligation of the Company on of any thin party.
- The Directors may from time to time and at any time by power of attorney appoint any company, firm or person or body of persons, whether nominated directly or indirectly by the Directors, to be the attorney or attorneys of the company for such purposes and with such powers, authoritics and discretion (not exceeding those vested in or exercisable by the Directors under these Articles) for such period subject to such conditions, if any, as they may think fit, and any such powers of attorney may contain such provisions for the

protection and convenience of persons dealing with any such attorney to delegate all or any of the powers, authorities, and discretion vested in him.

- A Director of the Company or a firm of which such Director is a partner or private company of which such Director is a Director may with the consent of the Company in General Meeting hold any office of profit in the Company.
- Subject to the provisions of Section 195 and 196 of the Ordinance, the Directors shall not be disqualified from contracting with the Company either as vendor, purchaser, or otherwise, nor shall any such contract or agreement entered into by or on behalf of the company or partnership of or in which any Director of the Company shall be a member or otherwise interested be avoided nor shall any such Director so contracting or being such member or so interested be liable to account to the Company for any profit realized by any such contract or arrangement by reason of such Director holding that office or of the fiduciary relation thereby established, but the nature of his interest must be disclosed by him at the meeting of the Directors at which the contract or arrangement is determined on, if the interest then exists, or in any other case at the first meeting of the Directors after the acquisition of the interest. A General Notice that any Director of the Company is a Director or a member of any other company or is a member of any named firm and is to be regarded as interested in any subsequent transaction with such company or firm shall, as regards any such transaction, be sufficient disclosure under this Article and after any such general notice it shall not be necessary to give any special notice relating to any particular transaction with such firm or company. In the case of a contract for the appointment of a manager of the company, the provisions of Section 218 of the Ordinance shall be observed and performed.

In accordance with the provisions of Section 219 of the Ordinance a Register shall be kept by the Directors in which shall be entered particulars of all contracts or arrangements and which shall be open for inspection by any member at the office during business hours.

All cheques, promissory notes, drafts, bills of exchange and other negotiable instruments, and all receipts for moneys paid to the Company, shall be signed, drawn, accepted, endorsed, or otherwise executed, as the case may be, in such manner as the Directors shall from time to time by resolution determine.

The Directors shall duly comply with the provisions of the Ordinance or any statutory modification thereof for the time being in force, and in particular with the provisions in regard to the registration of the particulars of mortgages and charges affecting the provision of the Company or created by it, and to keep a Register of the Directors and Managerka and it is send to the Registrar an annual list of members and a summary of particulars relating thereto and notice of any consolidation or increase of share capital and copies of the creater is resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the Register of Directors and notification of any charges the resolutions and a copy of the register of Directors and notification of any charges the resolutions and a copy of the register of Directors and notification of any charges the resolutions and a copy of the register of Directors and notification of any charges t

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 of all meetings of the Company, and of the Directors and of committee of Directors; and every Director present at any meeting of Directors or committee of Directors shall sign his name in a book to be kept for the purpose and any such minute of such a meeting if purporting to be signed by the Chairman thereof, or by the Chairman of the next succeeding meeting of the same body, shall be sufficient evidence without any further proof of the facts therein stated.

## **DISQUALIFICATION OF DIRECTORS**

The Office of Director shall be vacated if:

- a) he is found to be of unsound mind by a court of competent jurisdiction, or
- b) he is adjudged an insolvent, or
- c) he ceases to be a member of the Company; as specified in section 187 of the Ordinance, or
- d) he or any firm of which he is a partner or any private company of which he is a director without the sanction of the company in general meeting accepts or holds any office of profit under the Company, or
- e) he absents himself from three consecutive meetings of the Directors or from all meetings of the Directors for a continuous period of three months whichever is the longer without leave of absence from the Board of Directors, or
- f) he acts in contravention of Section 195 of the Ordinance, or
- g) he resigns his office by notice in writing to the Company, or
- h) he suffers from any of the disabilities or disqualifications mentioned in Section 187 of the Ordinance, or
- i) he has been convicted by a Court of competent jurisdiction for an offence involving moral turpitude, or
- j) he has betrayed lack of fiduciary behavior and a declaration to this effect has been made by the Court under Section 217 of the Ordinance.
- If the nomination of the relevant Director by the Shareholder whose interpresented by such Director has been revoked or withdrawn in writing.

# **PROCEEDINGS OF DIRECTORS**

The Directors may meet together for the despatch 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 Director shall, at any time, summon a meeting of Directors. It shall not be necessary to give notice of

a meeting of directors to any director for the time being absent from Pakistan unless such Director has appointed alternate director.

The quorum necessary for the transaction of the business of the Directors shall not be less one third of their number or three Directors whichever is greater, actually present in person or by an alternate director. For the purposes of this Article, an Alternate appointed by a Director shall be counted in a quorum at a meeting at which the Director appointing him is not present.

All questions arising at any meeting of Directors shall be decided by a simple majority of votes.

The continuing Directors may act notwithstanding any vacancy in their body, but if and so long as their number is reduced below the number fixed by or pursuant to the regulations of the Company as the necessary quorum of Directors, the continuing Directors may act for the purpose of filling vacancies in their body or summoning a General Meeting of the Company, but for no other purpose.

All acts done at any meeting of the Directors or by any person acting as a Director shall notwithstanding that it shall afterwards be discovered that there was some defect in the appointment or continuance in office 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 as if every such person had been duly appointed or had duly continued in office and qualified and had continued to be a Director and had been entitled to be a Director.

Except as otherwise provided in the Ordinance, any action which may be taken at a meeting of the Board of Directors shall be validly taken without such meeting if a resolution in writing approving such action is excuted by the Directors. For this purpose, it shall be permissible to circulate the text of the proposed resolution duly signed by the Chief Executive or any Director and obtain the signatures of all the other Directors thereon separately by fax and such resolution shall be effective as soon as the text of the resolution signed by each of the other Directors shall have been faxed to and received by the Company.

If at any meeting the Chairman is absent, the Directors may elect any Director to act as the Chairman for the meeting.

The Directors may delegate any of their powers not required to be exercised up their meet to committees consisting of such member or members of their body as mey think fit: a committee so formed shall, in the exercise of the powers so delegates conform to restrictions that may be imposed on them by the directors.

A committee may elect a chairman of its meeting; but if no such chairman schered, or it at a any meeting the chairman is not present within ten minutes after the time appended to holding the same or is unwilling to act as chairman, the members present may choose one of their number to be chairman of the meeting.

A committee may meet and adjourn, as it thinks proper.

# CHIEF EXECUTIVE

- 102. The Directors shall within fourteen days after the constitution of the Board or from the date of election of Directors or the office of the Chief Executive falling vacant, as the case may be, appoint, subject to the provisions of Section 198 of the Ordinance, a person to be the Chief Executive of the Company who may be a Director or not. The period for which a Chief Executive shall be appointed shall not exceed three years from the date of appointment unless he earlier resigns or his services as Chief Executive have been terminated by the Board in accordance with the provisions of the Ordinance. On the expiry of his term of office, a Chief Executive shall be cligible for reappointment if nominated in the manner provided in this Article. The terms and conditions of appointment of a Chief Executive including his powers and remuneration shall be determined by the Directors, subject to the provisions of the Ordinance.
- D3. The Chief Executive shall, if not already a Director, be deemed to be a member of the Board and shall be entitled to such remuneration, benefits and allowances as the Board may specify from time to time. Subject to supervision of the Board, the Chief Executive shall be responsible, and hold the powers and authorities, for the implementation of policies, decisions, guidelines and directive of the Board for achievement of the objectives of the Company and shall have, full powers to execute the same, including powers for conducting day to day management and business of the Company, appointment and termination of personnel, he will inform the Board subsequently at the earliest possible opportunity and the Board may review it if it considers necessary, powers to carry out sale, production and distribution, import, export and operation of bank account and to make payment and powers to appoint distributors, authorized sub-contractors, dealers or agents. The Chief Executive may further delegate any of his powers to any other persons or committee as he may think fit subject to the overall approval of the Board.
- . The Chief Executive shall devote a substantial part of his time exclusively to the management of the Company except that he may, with the prior consent of the Board, devote lesser time to the Company or become a Director of such company or companies as are not engaged in any business in direct competition with that of the Company.

The Chief Executive and/or other personnel appointed by the Company shall be entitled to remuneration and benefits comparable to the best performance Companies in Pakistan which determination shall be done by the Board.

# SECRETARY

The Secretary shall be appointed by the Directors for such term, at such remundration and upon such conditions as they may think fit, and any Secretary so appointed may be removed by them. Where there is no Secretary capable of acting, the Directors may entry in an Assistant or Deputy Secretary or any other officer of the Company to Perform the dure sof



### THE SEAL

The Directors shall provide for the safe custody of the Seal which shall only be used by the authority of the Directors; and every instrument to which the Seal shall be affixed shall either be signed by two Directors and countersigned by Secretary or only by two Directors.

### **DIVIDENDS AND RESERVES**

The Company in General Meeting may declare dividends, but no dividend shall exceed the amount recommended by the Directors. No dividend shall be paid by the company otherwise than out of the profits of the company or in contravention of Section 248 (2) of the Ordinance.

The Directors may from time to time pay to the members such interim dividend as appear to the Directors to be justified by the profits of the Company.

The Directors may, before recommending any dividends, 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 meeting contingencies, or for equalizing dividends, or for any other purpose to which the profits of the Company may be properly applied, and pending such application may, at the like discretion, either be employed in the business of the Company or be invested in such investments (other than shares of the Company) as the Directors may from time to time think fit.

When any shareholder is indebted to the Company, all dividends payable to him, or a sufficient part thereof, may be retained and applied by the Directors in or towards satisfaction of the debt.

Any dividend, interest or other moneys payable in cash in respect of shares may be paid by cheque or warrant sent through the post direct to the registered address of the holder or, 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 persons 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. Any of two or more joint holders may give effectual receipts for any dividends, bonuses, or other moneys payable in respect of the shares held by them as joint holders. The dividend shall be paid within the period laid down in the Ordinance.

Unpaid dividends shall not bear interest as against the Company.

### **CAPITALIZATION OF PROFITS**


dividend and in the same proportion on condition that the same be not paid in cash but be applied either in or towards paying up any amounts for the time being unpaid on any shares held by such members respectively or paying up in full un-issued shares of the Company to be allotted and distributed/credited as fully paid up to and amongst such members in the proportion aforesaid, or partly in the other, and the Directors shall give effect to such resolution.

## ACCOUNTS

- . The Directors shall cause to keep proper books of account as required under Section 230 of the Ordinance.
- The books of account shall be kept at the registered office of the Company or at such other place as the directors shall think fit and shall be open to inspection by the Directors during business hours.
- . The Directors shall from time to time determine whether and to what extent and at what time and places and under what conditions or on regulations that 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 book or papers of the Company except as conferred by law or authorized by the Directors or by the Company in General meeting.
- The Directors shall as required by sections 233 and 236 of the Ordinance cause to be prepared and to be laid before the Company in general meeting such profit and loss account and balance sheets duly audited and reports as are referred to in those sections.

The balance sheet, profit and loss account, and other reports referred to in Article 116 shall be made out in every year and laid before the Company in annual general meeting made up to a date not more than four months before such meeting. The balance sheet and profit and loss account shall be accompanied by a report of the auditors' of the Company and the report of directors.

A copy of balance sheet and profit and loss account and reports of directors and auditors shall, at least twenty one days preceding the meeting, be sent to the persons entitled to receive notices of general meetings in the manner in which notices are to be given hercunder.

The Directors shall in all respect comply with the provisions of section 230 to 236 of the Ordinance.

## AUDIT

Auditors shall be appointed and their duties regulated in accordance with set in 255 of the Ordinance or any statutory modifications thereof for the time being in f

## NOTICES

(a) A notice may be given by the Company to any member either personally sending it by post to him to his registered address or (if he has no registered address

in Pakistan) to the address, if any, within Pakistan supplied by him to the Company for the giving of notices to him.

- (b) Where a notice is sent by post, service of the notice 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.
- 124. A notice may be given by the Company to the joint holders of a share by giving the notice to the joint holder named first in the Register in respect of the share and a notice so given shall be sufficient notice to all the holders of such shares.
- 125. 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 through the post in a prepaid letter addressed to them by name or by the title or representatives of the deceased, or assignee 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 entitled, or (until such an address has been so supplied) by giving the notice in any manner in which the same might have been given if the death or insolvency had not occurred.
- 26. Notice of every General Meeting shall be given in the manner hereinbefore authorized to (a) every member of the Company, except those members who have no registered address or have not supplied to the Company an address for the giving of notice to them, and also (b) every person entitled to a share in consequence of the death or insolvency of a member, who but for his death or insolvency would be entitled to receive notice of the meeting, and (c) to the auditors of the company for the time being.

# WINDING UP

- 7. (a) If the Company is wound up, the liquidator may, with the sanction of special resolution of the Company and other sanction required by the Ordinance, divide amongst the members, in specie or kind the whole or any part of the assets of the Company, whether they consist of property of the same kind or not.
  - (b) For the purpose aforesaid, the liquidator may set such value as he deems fair upon any property to be divided as aforesaid and may determine how such division shall be carried out as between the members or different classes of members.
  - (c) The liquidator may, with the like sanction, vest the whole of any part ensuch assets for the benefit of the contributories as the liquidator, with the like sanction, that so that no member shall be compelled to accept any share somether securities whereon there is any liability.

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#### SECRECY

3. Save as otherwise provided in the Ordinance no member or other person (not being a Director) shall be entitled to visit and inspect any of the Company's premises or properties of the Company without the permission of the Directors of the Company for the time being

or any person authorized in this behalf by the Directors or to require discovery of or 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 or of any matter whatsoever which may relate to the conduct of the business of the Company and which in the opinion of the Directors will be inexpedient in the interest of the members of the Company to communicate to the public.

#### **INDEMNITY**

Every Director or officer of the Company and every person employed by the Company as auditor shall be indemnified out of the funds of the Company against all liability incurred by him as such Director, officer or auditor in defending any proceeding, whether civil or criminal, in which judgment is given in his favour, or in which he is acquitted, or in connection with any application under section 488 of the Ordinance in which relief is granted to him by the court.

# RECONSTRUCTION

On any sale of the undertaking of the Company, the Directors or the Liquidator on a winding-up may, if authorized by Special Resolution, accept fully paid or party paid-up shares, debentures or securities of any other company, whether incorporated in Pakistan or not either then existing or to be formed for the purchase in whole or in part of the property of the Company, and the Directors (if the profits of the Company permit) or the Liquidator (in a winding-up) may distribute such shares, or any other property of the Company amongst the members without realization, or vest the same in trustees for them, and any special Resolution may provide for the distribution or appropriation of the cash, shares, or other securities, benefits or property, otherwise than in accordance with the strict legal rights of the members or contributories of the Company, and for the valuation of any such securities or property at such price and in such manner as the meeting may approve, and all holders of shares shall be bound by any valuation or distribution so authorized, and waive all rights in relation thereto, save only in case the Company is proposed to be or is in the course of being wound up, such statutory rights if any, under section 367 of the Ordinance as are incapable of being varied or excluded by these Articles.

#### ARBITRATION



Whenever any difference arises between the Company on the one-hand, and any of the members, their executors, administrators, or assigns on the other hand, touching the true intent or construction, or the incidents or consequences of these presents, or of the gratutes, or touching anything then or thereafter done, executed, omitted or suffered in pressuance of these presents, or of the statutes or touching any breach or alleged breach of these presents, or any claim on account of any such breach or alleged breach, or otherwise relating to the premises. or to these presents, or to any statute affecting the Company, or to any of the affairs of the Company, every such difference shall be referred under the Arbitration, Act, 1940, to the decision of an arbitrator to be appointed by the parties in differences, or if they cannot agree upon a single arbitrator, to the decision of two arbitrators, of whom one shall be appointed by each of the parties in difference, or an umpire to be appointed by the two arbitrators. The cost of, and incident to, any such reference and award shall be in the discretion of the arbitrators, or umpire respectively, who may determine the amount thereof, or direct the same to be taxed as between attorney and client or otherwise, and may award by whom, and to whom, and in what manner the same shall be borne and paid.

# **MISCELLANEOUS**

32. If the provisions of these Articles are in any way inconsistent with the provisions of the Ordinance or any other law for the time being in force, the provisions of that Ordinance or other law shall prevail, and these Articles shall be read subject to that Ordinance or that other Law.



We, the serveral persons whose names and address are subscribed below, are desirous of being formed into a Company persaunt of this Articles of Association, and we agree to take number of shares in the Company set opposite our respective names.

Name and surname (present and	Father's/Husband's name	Nationality with any	Occupation	Desidential add		
former in full and block letters)	in full	former Nationality	Occupation	Residential address	Number of shares taken by each subscriber	Signature
		ifany				
MR. TAJWAR TAPAL	Mr. Moiz Ali Tapal	Pakistani	Business	6-A. 1st Gizri Lane	2 500 (Two Thousand Fine Hundred)	
CNIC No.35201-2649288-5				D.H.A., Karachi.	2,500 (1 no 1 nousand 1 we rundled )	1511
				Pakistan		$\sim M/A$
MR. TABISH TAPAL	Mr. Moiz Ali Tapal	Pakistani	Business	33-B. 3rd Gizri Street	4 500 (Four Thousand Five Hunred)	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
CNIC No. 42301-2385059-9				Phase IV. D.II.A.	(1900 (Four Thousand Five Humed)	- t
				Karachi, Pakistan		
MR. MUHAMMAD SADIQ	Mr. Tajwar Tapal	Pakistani	Business	73/6A, Munir Road.	2,500 (Two Thousand Five Hundred)	24
CNUC No. 25201 2505010 5				Lahore, Pakistan	, (i	
CNIC NO. 35201-2785819-5						and the second s
MR. MUSTAFA LAKDAWALA	Mr. Abid Hussain	Pakistani	Service	94/1, Bahadur Yar Jang	500 (Five Hundred)	
CRTC .NO. 42201-3140375-9	Lakdawala			Society, Karachi,		Juntal -
Total				Pakistan		0000000
Total	Decurities a				10,000 (Ten Thousand)	
168 (168 )						
L						
Dated this 174 Mar						
		Witness to the above S	Signatures:			
Full Name Father/II		~				
Ton Hand, I and 2/HUSDate Strame		Signature		<b>Occupation</b>	Full Address	
Mr. Imran S/o	Mr. Imran S/o 34/stan + 30!!!!!		an			
Mr. Aba Umar	Vir. Aba Umar		Private Service	F-25, Block 5, Kehkashan Clifton, Karachi.		

Certified to be The 9/4 Joint Registrar of Companies

