



**National Electric Power Regulatory Authority**  
Islamic Republic of Pakistan

2nd Floor, OPF Building, G-5/2, Islamabad  
Ph: 9206500, 9207200, Fax: 9210215  
E-mail: registrar@nepra.org.pk

**Registrar**

No. NEPRA/R/LAG-202/6606-08

July 27, 2012

Mr. Nadeem Abdullah  
Chief Executive  
Sapphire Wind Power Company Limited  
313-Cotton Exchange Building,  
I. I. Chundrigar Road,  
Karachi

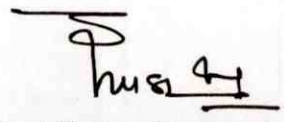
Subject: **Generation Licence No. WPGL/18/2012**  
**Licence Application No. LAG-202**  
**Sapphire Wind Power Company Limited**

Reference: *Your application vide No. nil, dated 29 August, 2011.*

Enclosed please find herewith Generation Licence No. WPGL/18/2012 granted by National Electric Power Regulatory Authority (NEPRA) to Sapphire Wind Power Company Limited, pursuant to Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of 1997). Further, the determination of the Authority in the subject matter is also attached.

2. Please quote above mentioned Generation Licence No. for future correspondence.

Enclosure: **Generation Licence**  
**(WPGL/18/2012)**

  
(Syed Safeer Hussain)

Copy to:

1. Chief Executive Officer, Hyderabad Electric Supply Company (HESCO), WAPDA Water Wing Complex, Hussainabad, Hyderabad
2. Director General, Pakistan Environmental Protection Agency, House No. 311, Main Margalla Road, F-11/3, Islamabad.

**National Electric Power Regulatory Authority  
(NEPRA)  
Islamabad – Pakistan**

**GENERATION LICENCE**

**No. WPGL/18/2012**

In exercise of the Powers conferred upon the National Electric Power Regulatory Authority (NEPRA) under Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act 1997, the Authority hereby grants a Generation Licence to:

**SAPPHIRE WIND POWER COMPANY LIMITED**

Incorporated under Section 32 of the Companies Ordinance, 1984

Company Registration No. 00000013490/20061207, dated December 27, 2006

for its Wind Farm Located at Jhampir, near Nooriabad  
District Thatta, Sindh

(Installed Capacity: 49.50 MW Gross ISO)

to engage in generation business subject to and in accordance with the Articles of this Licence.

Given under my hand this 27<sup>th</sup> day of July Two Thousand  
& Twelve and expires on day of 30<sup>th</sup> December, Two  
Thousand & Thirty Three

P Hussain  
Registrar

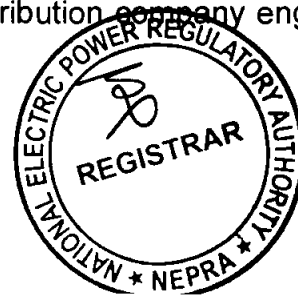


**Article-1**  
**Definitions**

1.1 In this Licence

- (a) "Act" means "the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (XL of 1997)";
- (b) "Authority" means "the National Electric Power Regulatory Authority constituted under section 3 of the Act";
- (c) "CPPA" means "the Central Power Purchasing Agency of NTDC or any other entity created for the like purpose";
- (d) "Licensee" means "Sapphire Wind Power Company Limited";
- (e) "NTDC" means "the National Transmission and Despatch Company Limited";
- (f) "Policy" means "the Policy for Development of Renewable Energy for Power Generation, 2006" of Government of Pakistan as amended from time to time;
- (g) "Power Purchaser" means "the CPPA of NTDC purchasing power on behalf of XW-DISCOs";
- (h) "Rules" mean "the National Electric Power Regulatory Authority Licensing (Generation) Rules, 2000";
- (i) "Wind Farm" means a cluster of wind turbines in the same location used for production of electric power;
- (j) "XW DISCO" means an Ex-WAPDA distribution company engaged in the distribution of electric power.





1.2 Words and expressions used but not defined herein bear the meaning given thereto in the Act or in the Rules.

**Article-2**  
**Application of Rules**

This Licence is issued subject to the provisions of the Rules, as amended from time to time.

**Article-3**  
**Generation Facilities**

3.1 The location, size (capacity in MW), technology, interconnection arrangements, technical limits, technical and functional specifications and other details specific to the Wind Farm of the Licensee are set out in Schedule-I to this Licence.

3.2 The net capacity of the Wind Farm of the Licensee is set out in Schedule-II hereto.

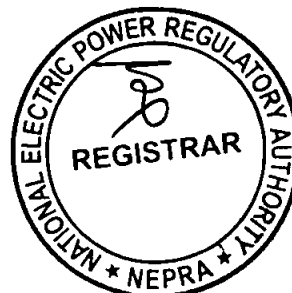
3.3 The Licensee shall provide the final arrangement, technical and financial specifications and other specific details pertaining to its Wind Farm before its commissioning.

**Article-4**  
**Term of Licence**

4.1 The Licence is granted for a term of twenty (20) years after the Commercial Operation Date (COD).

4.2 Unless suspended or revoked earlier, the Licensee may within ninety (90) days prior to the expiry of the term of the Licence, apply for renewal of the Licence under the National Electric Power Regulatory Authority Licensing (Application and Modification Procedures) Regulations, 1999 as amended or replaced from time to time.





**Article-5**  
**Licence fee**

After the grant of the Generation Licence, the Licensee shall pay to the Authority the Licence fee, in the amount and manner and at the time set out in the National Electric Power Regulatory Authority (Fees) Rules, 2002.

**Article-6**  
**Tariff**

The Licensee shall charge only such tariff which has been approved, determined, adjusted or specified by the Authority.

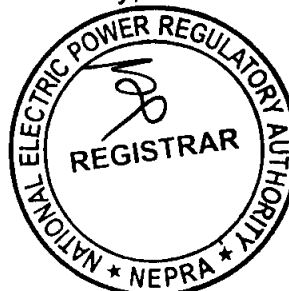
**Article-7**  
**Competitive Trading Arrangement**

7.1 The Licensee shall participate in such manner as may be directed by the Authority from time to time for development of a Competitive Trading Arrangement. The Licensee shall in good faith work towards implementation and operation of the aforesaid Competitive Trading Arrangement in the manner and time period specified by the Authority. Provided that, any such participation shall be subject to any contract entered between the Licensee and another party with the approval of the Authority.

7.2 Any variation or modification in the above-mentioned contracts for allowing the parties thereto to participate wholly or partially in the Competitive Trading Arrangement shall be subject to mutual agreement of the parties thereto and such terms and conditions as may be approved by the Authority.

**Article-8**  
**Maintenance of Records**

For the purpose of sub-rule (1) of Rule 19 of the Rules, copies of records and data shall be retained in standard and electronic form and all such records and data shall, subject to just claims of confidentiality, be accessible by authorized officers of the Authority.





**Article-9**  
**Compliance with Performance Standards**

The Licensee shall comply with the relevant provisions of National Electric Power Regulatory Authority Performance (Generation) Rules 2009 as amended from time to time.

**Article-10**  
**Compliance with Environmental Standards**

The Licensee shall comply with the environmental standards as may be prescribed by the relevant competent authority from time to time.

**Article-11**  
**Power off take Point and Voltage**

The Licensee shall deliver power at the outgoing bus of its 132 KV grid station. The up-gradation (step up) of generation voltage up to 132 KV will be the responsibility of the Licensee.

**Article-12**  
**Performance Data of Wind Farm**

The Licensee shall install monitoring mast with properly calibrated automatic computerized wind speed recording meters at the same height as that of the wind turbine generators and a compatible communication/SCADA system both at its Wind Farm and control room of the Power Purchaser for transmission of wind speed and power output data to the control room of the Power Purchaser for record of data.

**Article-13**  
**Provision of Information**

13.1 The obligation of the Licensee to provide information to the Authority shall be in accordance with Section 44 of the Act.

13.2 The Licensee shall in addition to 13.1 above, supply information to NTDC regarding Wind data specific to the Licensee's site and other related information on a regular basis and in a manner required by NTDC.



13.3 The Licensee shall be subject to such penalties as may be specified in the relevant rules made by the Authority for failure to furnish such information as may be required from time to time by the Authority and which is or ought to be or has been in the control or possession of the Licensee.

**Article-14**  
**Emissions Trading /Carbon Credits**



The Licensee shall process and obtain emissions/Carbon Credits expeditiously and credit the proceeds to the Power Purchaser as per prevailing Policy issued by the Government on the subject.

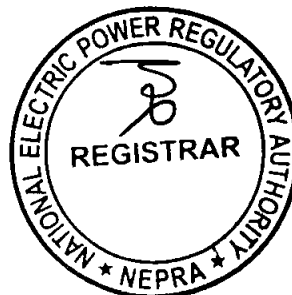
**Article-15**  
**Design & Manufacturing Standards**

Wind Turbine Generation system shall be designed, manufactured and tested according to the latest IEC standards or other equivalent standards. All plant and equipment shall be un-used and brand new.

**Article-16**  
**Power Curve**

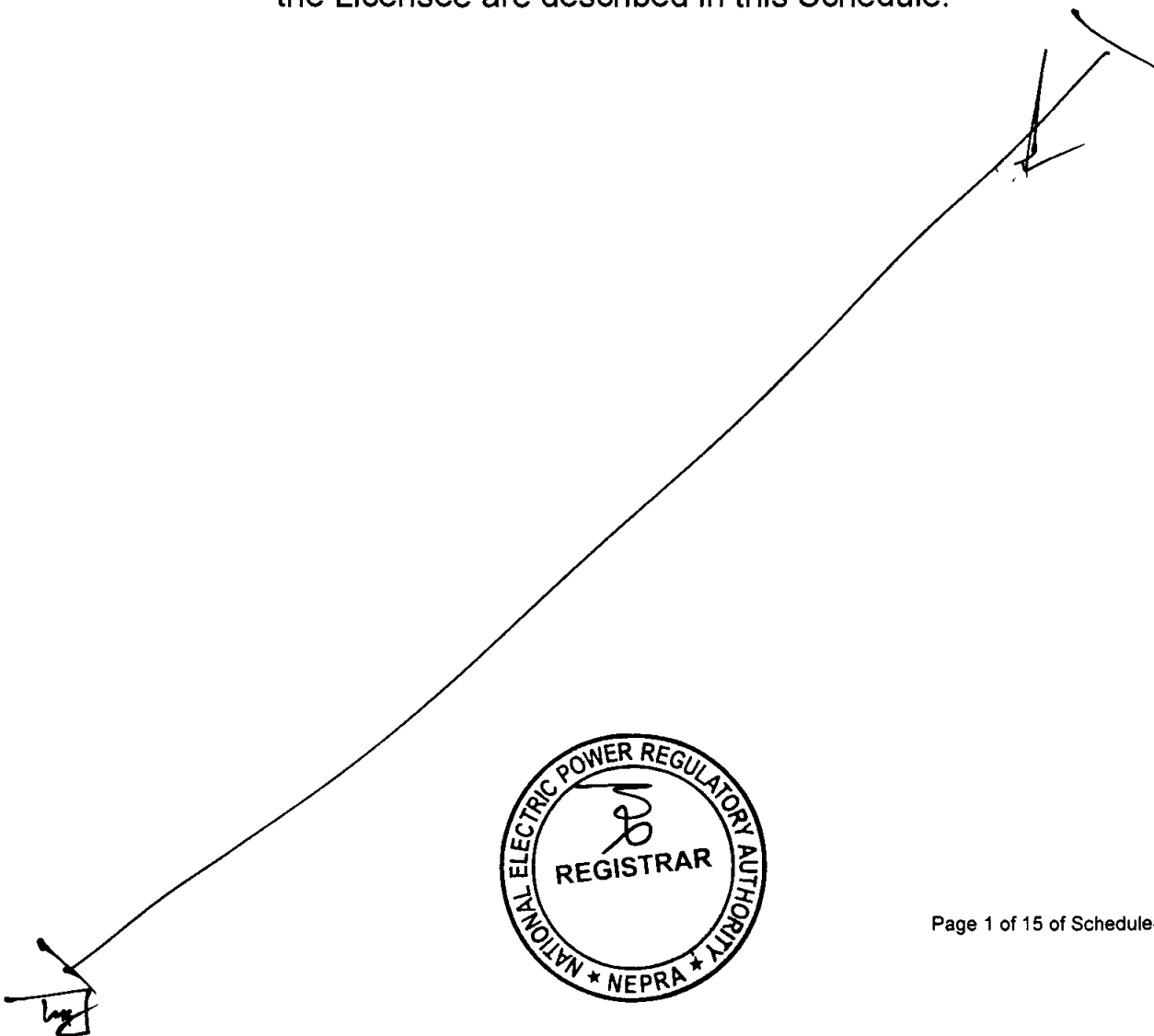
The power curve for the individual Wind Turbine provided by the manufacturer and as mentioned in this Generation Licence shall form the basis in determining the cumulative Power Curve of Wind Farm/Complex.



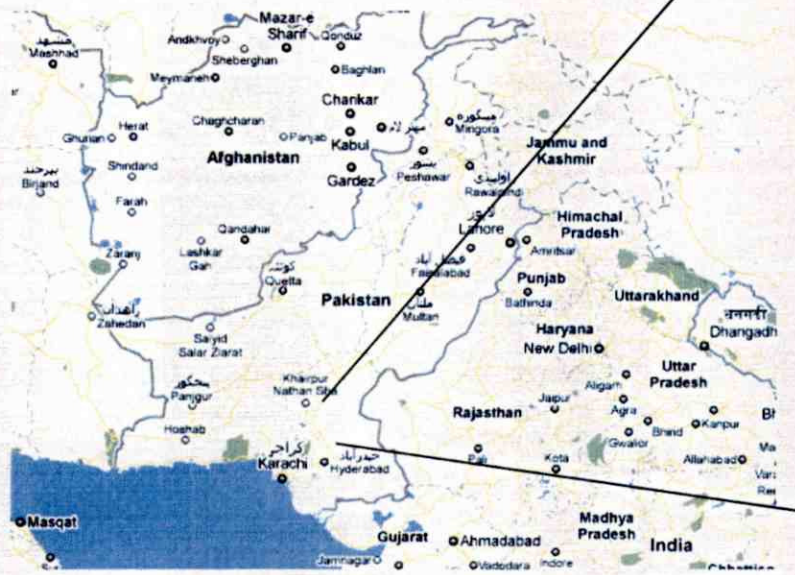
## **SCHEDULE-I**

The Location, Size (i.e. Capacity in MW), Type of Technology, Interconnection Arrangements, Technical Limits, Technical/Functional Specifications and other details specific to the Generation Facilities of the Licensee are described in this Schedule.





## Location Map of Wind Farm



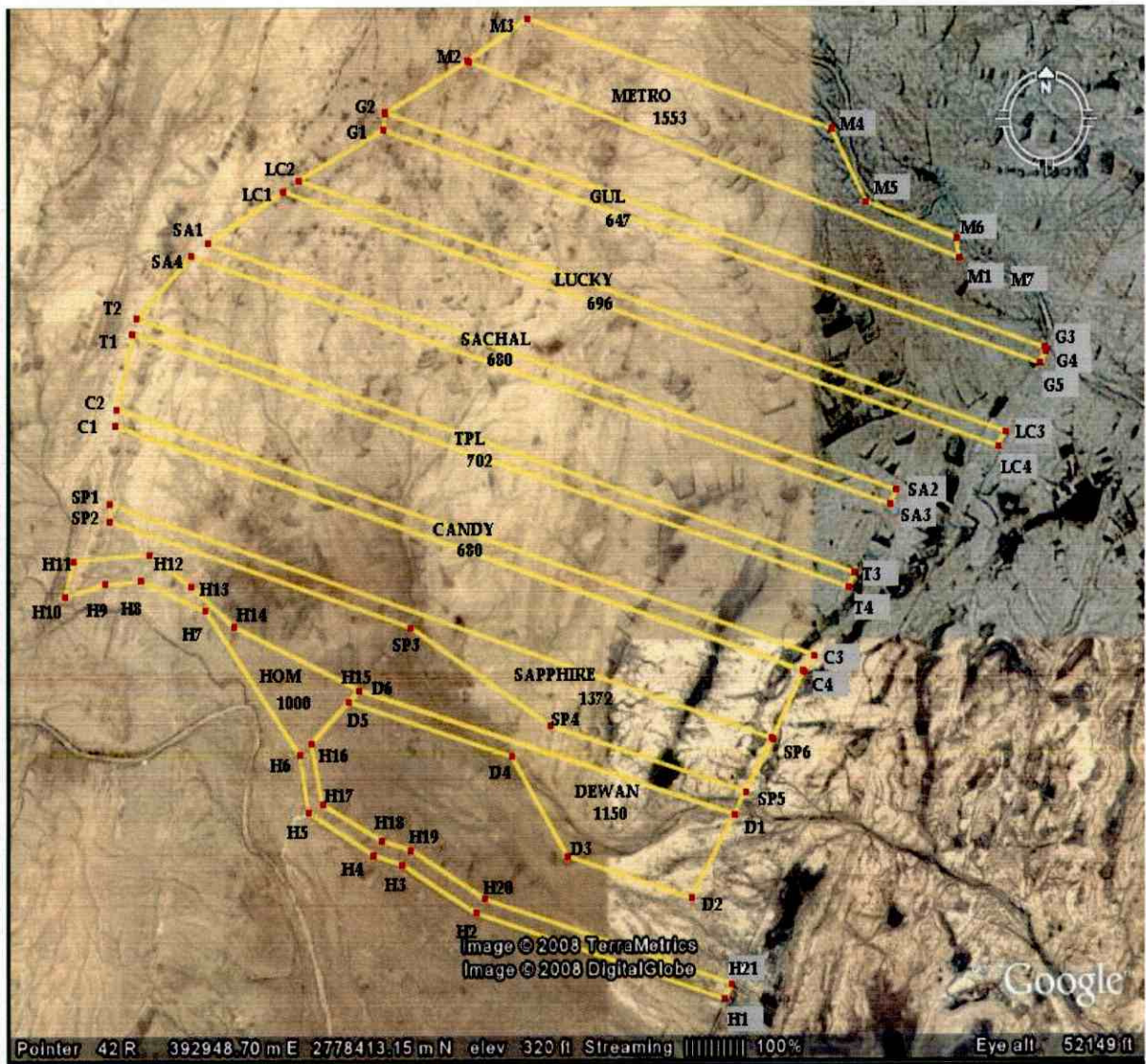
### Land Co-ordinates

Sr. No.	Longitude	Latitude
1	25° 07' 18.40"	67° 51' 48.33"
2	25° 07' 10.59"	67° 51' 48.03"
3	25° 06' 20.95"	67° 54' 40.46"
4	25° 05' 35.46"	67° 56' 01.05"
5	25° 05' 03.55"	67° 57' 53.13"
6	25° 05' 28.90"	67° 58' 08.95"



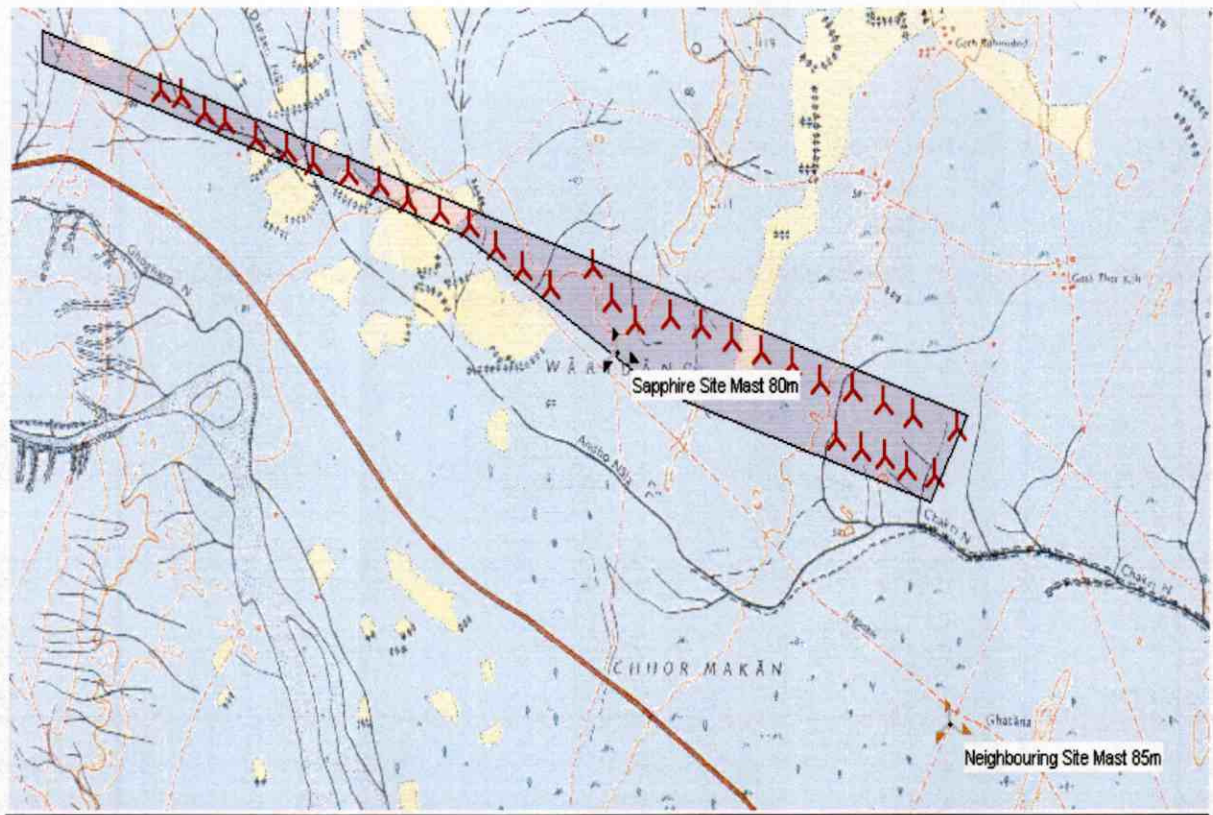


## Lay Out of Wind Farm

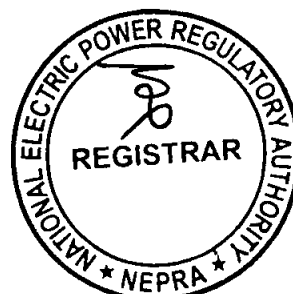
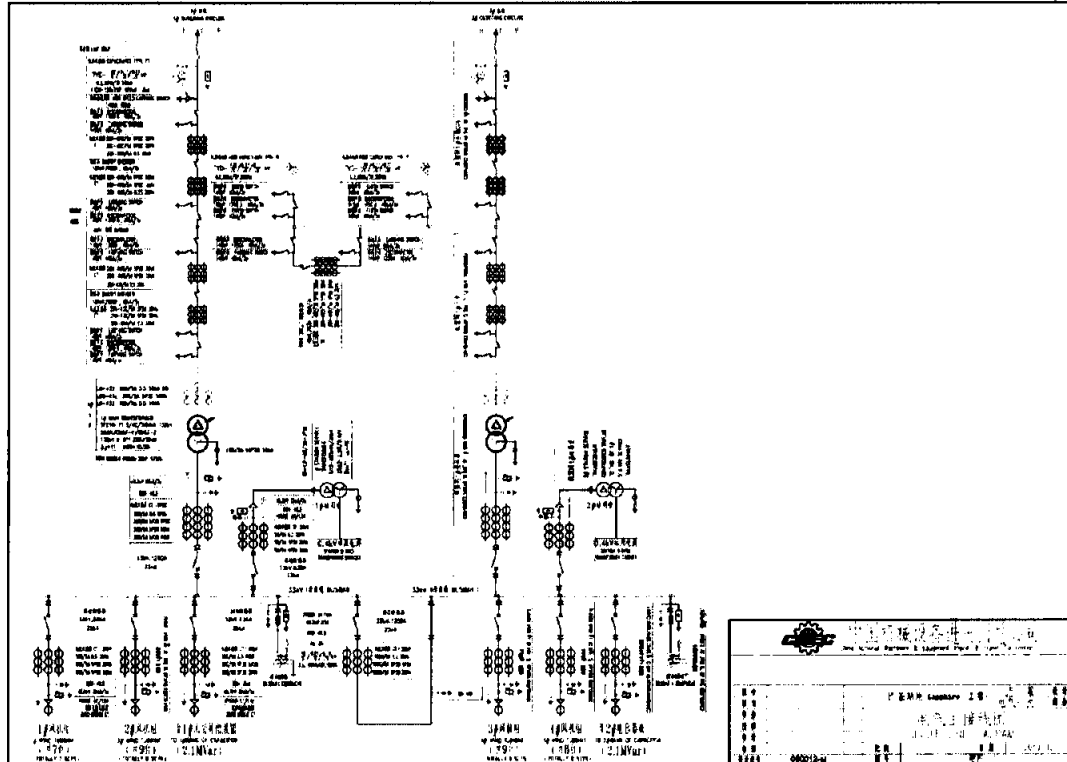




## Micro-Sitting of Wind Farm



## Single Line Diagram of Electrical System of Wind Farm



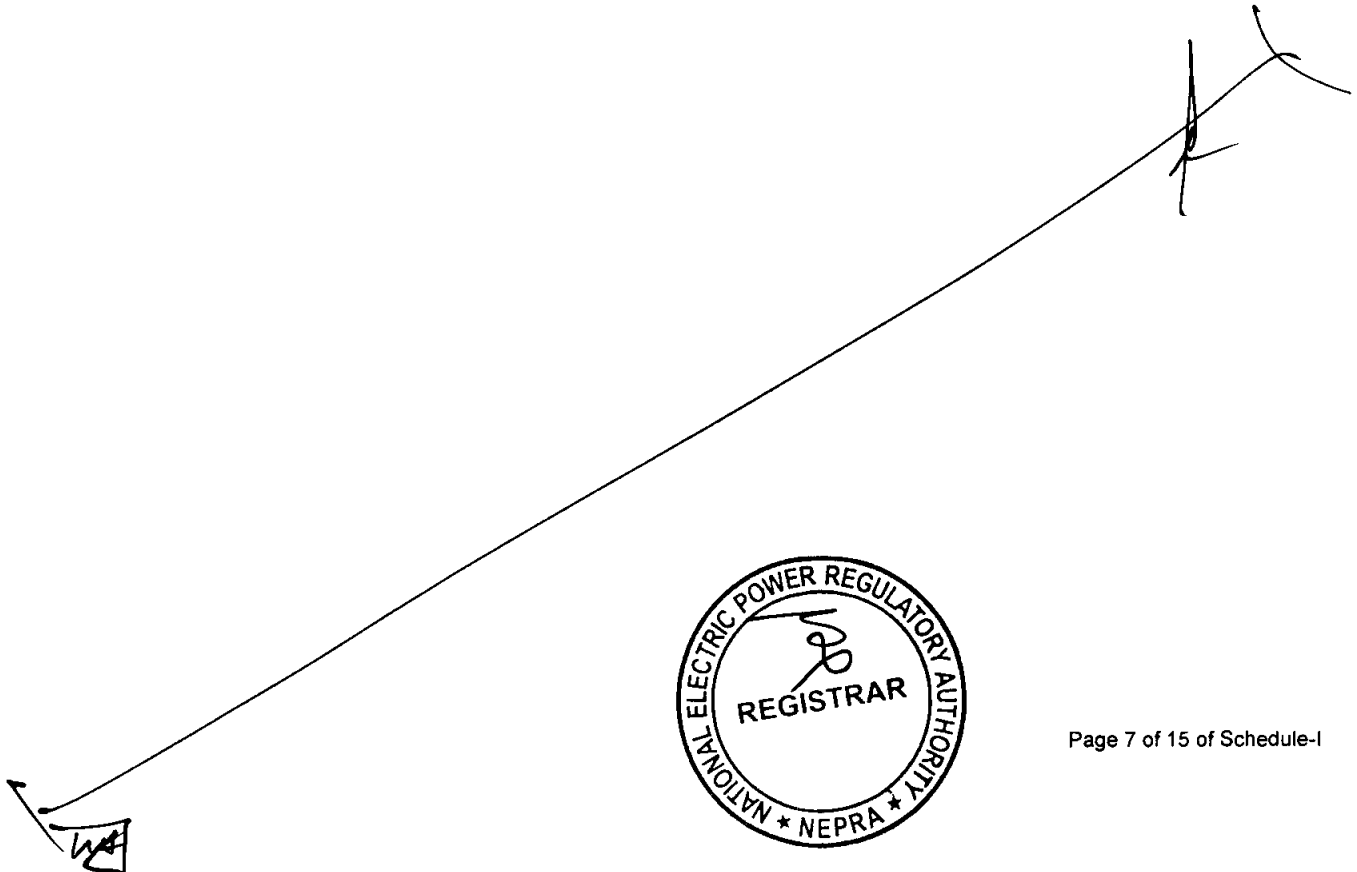
## **INTERCONNECTION** **ARRANGEMENT FOR DISPERSAL OF POWER** **FROM THE WIND FARM**

The power generated by the Licensee from the Wind Farm (WF) shall be dispersed to the Load Center/Ring of HESCO, at 132 KV voltage level.

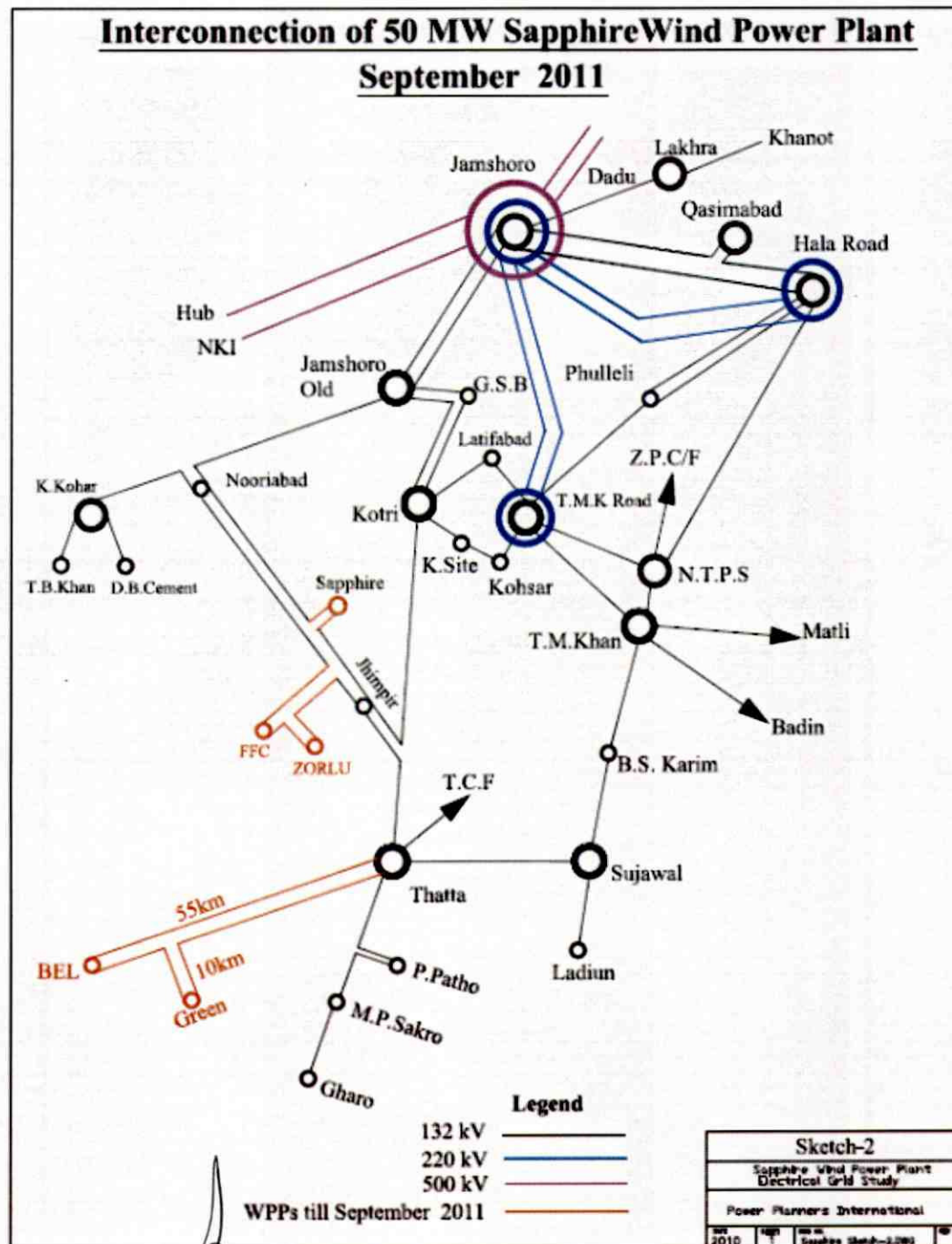
The dispersal/interconnection arrangement will be consisting of an In-Out of arrangement of one Circuit of 132 KV D/C Jhampir-Nooriabad Transmission Line at Substation of Sapphire Wind Power Company Limited (SWPCL).

The In-Out arrangement will be made through a new 132 KV D/C Transmission Line measuring about 7-Kilometers connecting the WF of SWPCL to one 132 KV D/C Jhampir-Nooriabad Transmission Line.

Any change in the final Interconnection and Transmission Arrangement(s), for the dispersal of power other than the above, as agreed among SWPCL, NTDC and HESCO shall be communicated to NEPRA in due course of time.



## Schematic Diagram for Interconnection/Transmission Arrangement for Dispersal of Power from SWPCL





## Detail of Generation Facility/ Wind Farm\*

### (A). General Information

(i).	Name of Applicant/Company	Sapphire Wind Power Company Limited
(ii).	Registered/Business Office	149, Cotton Exchange Building, I.I.Chundrigar Road, Karachi.
(iii).	Plant Location	District Thatta, Sindh.
(iv).	Type of Generation Facility	Wind Power

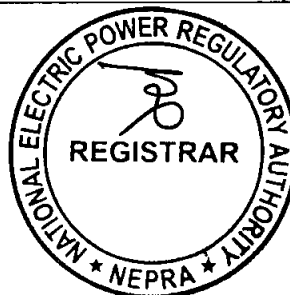
### (B). Wind Farm Capacity & Configuration

(i).	Wind Turbine type, Make & Model	GE 1.5 xle
(ii).	Installed Capacity of Wind Farm (MW)	49.5 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (KW)	33 x 1.5 MW

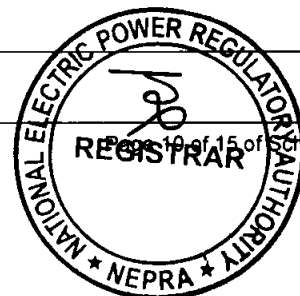
### (C). Wind Turbine Details

(a). <u>Rotor</u>		
(i).	Number of blades	3
(ii).	Rotor speed	9.8 – 18.7 rpm
(iii).	Rotor diameter	82.5 m
(iv).	Swept area	5346 m <sup>2</sup>
(v).	Power regulation	Combination of blade pitch angle adjustment, and generator / converter torque control.

\* As provided by Sapphire Wind Power Company Limited



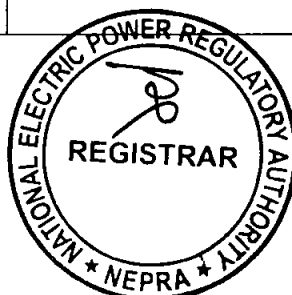
(vi).	Rated power at	12 m/s (air density = 1.225 kg/m <sup>3</sup> )
(v).	Cut-in wind speed	3 m/s
(vi).	Cut-out wind speed	25 m/s
(vii)	Survival wind speed	3s 56 m/s, 10 min 40 m/s
(viii)	Pitch regulation	Electric motor drives a ring gear mounted to the inner race of the blade pitch bearing.
<b>(b). <u>Blades</u></b>		
(i).	Blade length	40.3 m
(ii).	Material	Fiberglass polyester resin
(iii).	Weight	6,200kg
<b>(c). <u>Gearbox</u></b>		
(i).	Type	Three-stage planetary/helical gear design
(ii).	Gear ratio	1:107.1
(iii).	Weight	15,800kg
(iv).	Oil quantity	300 – 450 litres.
(v)	Main shaft bearing	Roller bearing mounted in a pillow-block housing arrangement.
<b>(d). <u>Generator</u></b>		
(i).	Power	1,500 kW
(ii).	Voltage	690 V
(iii).	Type	Double-fed asynchronous generator, air-cooled
(iv).	Speed	Range: 1000 - 2000 rpm (synchronous speed 1500 rpm).
(v).	Enclosure class	IP 54
(vi).	Coupling	Flexible coupling.
(vii).	Efficiency	≥97%
(viii).	Weight	8,450kg
(ix).	Power factor	+0.9 to -0.9



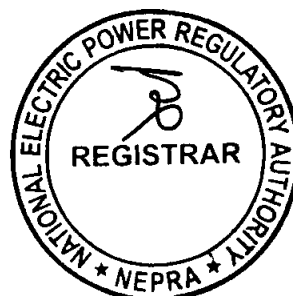
<b>(e). <u>Yaw System</u></b>		
(i).	Yaw bearing	Roller bearing
(ii).	Brake	Planetary yaw drives (with brakes that engage when the drive is disabled)
(iii).	Yaw drive	4 planetary yaw drives.
(iv).	Speed	0.5 degree/s
<b>(f). <u>Control System</u></b>		
(i).	Type	Automatic or manually controlled.
(ii).	Grid connection	Via IGBT converter.
(iii).	Scope of monitoring	Remote monitoring of more than 300 different parameters, e.g. temperature sensors, pitch parameters, speed, generator torque, wind speed and direction, etc.
(iv).	Recording	Production data, event list, long and short-term trends
<b>(g). <u>Brake</u></b>		
(i).	Design	Three independent systems, fail safe (individual pitch)
(ii).	Operational brake	Aerodynamic brake achieved by feathering blades.
(iii).	Secondary brake	Mechanical brake on (high speed) shaft of gearbox.
<b>(h). <u>Tower</u></b>		
(i).	Type	Cylindrical tubular steel tower
(ii).	Hub heights	Tubular tower 80 m

**(D). Other Details**

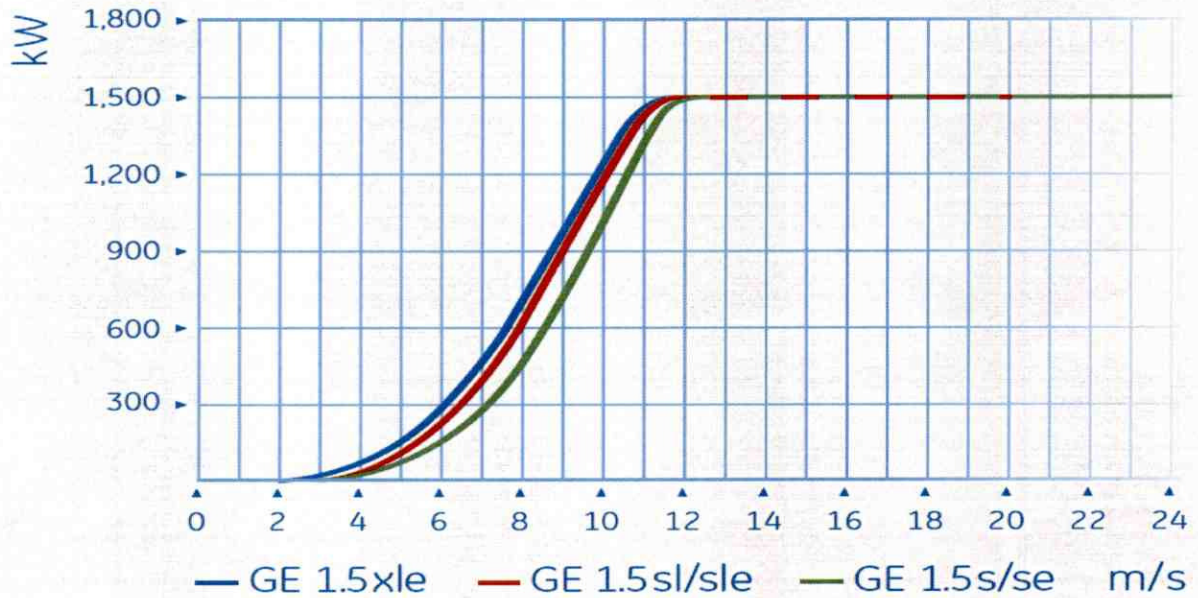
(i).	Project Commissioning date (Anticipated)	December 31, 2013
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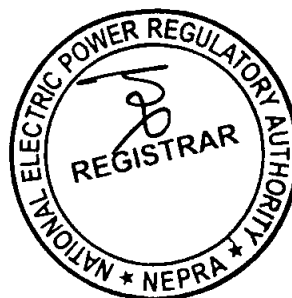
(ii).	Expected Life of the Project from Commercial Operation date (COD)	20 Years
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**Power Curve**  
**With Graphic**  
**GE- 1.5XLe 1.5 MW**



**Power Curve GE- 1.5xle 1.5 MW**  
**(Tabular Form)**



# 1 Calculated Power Curve GE 1.5xle - 50 Hz and 60 Hz

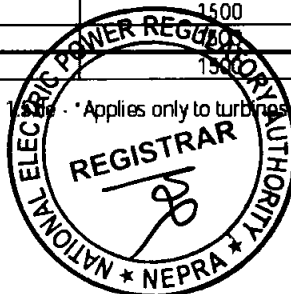
Standard Atmospheric Conditions (Air Density of 1.225 kg/m<sup>3</sup>)

Rotor Diameter: 825 m

(Cut-out wind speed based on 10 minutes average)

Wind Speed at HH [m/s]	Electrical Power [kW]			C <sub>p</sub> normal turbulence intensities
	Low turbulence intensities TI < 10 %	Normal turbulence intensities 10 % < TI < 15 %	High turbulence intensities 15 % < TI < 20 %	
3.0	0	0	0	0.000
3.5	13	14	19	0.102
4.0	55	57	62	0.272
4.5	107	109	115	0.365
5.0	167	170	177	0.414
5.5	235	239	249	0.438
6.0	315	320	333	0.452
6.5	408	414	431	0.461
7.0	517	525	547	0.468
7.5	641	650	675	0.471
8.0	781	792	817	0.472
8.5	936	947	967	0.471
9.0	1098	1100	1096	0.461
9.5	1250	1239	1219	0.441
10.0	1380	1362	1330	0.416
10.5	1463	1443	1407	0.381
11.0	1497	1483	1451	0.340
11.5	1500	1495	1469	0.300
12.0	1500	1500	1485	0.265
12.5	1500	1500	1495	0.235
13.0	1500	1500	1500	0.209
13.5	1500	1500	1500	0.186
14.0	1500	1500	1500	0.167
14.5	1500	1500	1500	0.150
15.0	1500	1500	1500	0.136
15.5	1500	1500	1500	0.123
16.0	1500	1500	1500	0.112
16.5	1500	1500	1500	0.102
17.0	1500	1500	1500	0.093
17.5	1500	1500	1500	0.085
18.0	1500	1500	1500	0.079
18.5	1500	1500	1500	0.072
19.0	1500	1500	1500	0.067
19.5	1500	1500	1500	0.062
20.0	1500	1500	1500	0.057
20.5*	1500	1500	1500	0.053
21.0*	1500	1500	1500	0.049
21.5*	1500	1500	1500	0.046
22.0*	1500	1500	1500	0.043
22.5*	1500	1500	1500	0.040
23.0*	1500	1500	1500	0.038
23.5*	1500	1500	1500	0.035
24.0*	1500	1500	1500	0.033
24.5*	1500	1500	1500	0.031
25.0*	1500	1500	1500	0.029

Table 1: Calculated power curve for the GE 1.5xle - 50 Hz. \* Applies only to turbines with windEXTEND enabled





## **SCHEDULE-II**

The Installed/ISO Capacity (MW), De-Rated Capacity At Mean Site Conditions (MW), Auxiliary Consumption (MW) and the Net Capacity At Mean Site Conditions (MW) of the Generation Facilities of Licensee is given in this Schedule

*[A large diagonal line with handwritten marks at both ends, possibly indicating a signature or a placeholder for a signature.]*



## **SCHEDULE-II\***

1.	Total Installed Capacity of the plant (Gross ISO)	49.50 MW
2.	De-rated Capacity at Mean Site Conditions (on account of Air density, humidity, temperature, Wake effect, wind direction, rain etc)	46.21 MW
3.	Auxiliary Consumption	1.15 MW
4.	Total Net Capacity of the Plant at Mean Site Conditions	45.06 MW

### **Note**

All the above figures are indicative as provided by the Licensee. The Net Capacity available to NTDC for dispatch and provision to purchasers will be determined through procedures contained in the Agreements or Grid Code.

\*As provided by Sapphire Wind Power Company Limited

