

TriconBoston

Consulting Corporation

Private Limited

Date: 24.10.2016

The Registrar

National Electric Power Regulatory Authority ("NEPRA")
NEPRA Tower, Attaturk Avenue (East)
Sector G-5/1, Islamabad

Subject: Application for Modification of the Generation License

Dear Sir,

Triconboston Consulting Corporation (Private) Limited (the "Company") was granted the Generation License No. WPGL/34/2016 on 21.10.2016 (the "Generation License") by NEPRA under Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (the "NEPRA Act") in respect of its wind power project (Plant-B) to be located at Jhimpir, District Thatta in the province of Sindh (the "Project").

As you are already aware, the Company filed an application dated 02.10.2015 for grant of the Generation License and was issued the same on 21.10.2016. The application was filed for the Project with a proposed capacity of 49.6MW based on thirty one (31) Wind Turbine Generators ("WTGs") of GE's 1.6 XLE WTG model. During the pendency of the application and our contract negotiations, GE suggested numerous improvements to the WTGs and offered a more efficient model (GE 1.7 - 103) for the local conditions. We are pleased to inform you that the Company has negotiated this model (instead of the 1.6 XLE model) as part of its EPC Contract for the Project. This new model has a maximum output of 1.715 MW which allows us to increase the overall Project capacity to 49.735 MW whilst using only twenty nine (29) GE 1.7 WTGs. At this initial stage of the Project, the overall Project design can be developed with an inherent flexibility to seamlessly change the model, number and specifications of the WTGs and increase the Project's overall capacity as provided herein.

In view of the foregoing and pursuant to Regulation 10(2) of the NEPRA Licensing (Application & Modification Procedure) Regulations, 1999 (the "Regulations"), I, Khalid Aslam, Chief Operating Officer of the Company, being the duly authorized representative of the Company by virtue of Board Resolution dated 21.10.2016, hereby apply to NEPRA, on behalf of the Company, for a modification of the Generation License to cater for the change in the model, number and specifications of the WTGs and the Project's overall capacity.

It is respectfully submitted that other project companies (i.e. Hawa Energy (Private) Limited and Jhimpir Power (Private) Limited) had also applied to NEPRA for modifications to their generation licenses on the same grounds (i.e. change in the WTG model) and their modified licenses were issued by NEPRA. In view thereof, your good offices are humbly requested to process this application expeditiously and issue the modified Generation License at the earliest, enabling the Company to achieve financial close as per its schedule.

A Project of Sapphire Group
Triconboston Consulting Corporation (Pvt.) Ltd.
7 - A/K, Main Boulevard, Gulberg II, Lahore - 54000, Pakistan
Phone: +92-42-111-000-100 Fax: +92-42-35788744
Contact: khalid.aslam@sapphire.com.pk

For information &
DRD/DRD-1 mpa H.
Sub.
SA (Tech)
Dir (Ltr)
LA (Ltr)
m/f
26.x.16
re. chairman,
VC (MGT)
m (Ltr)
m (CA)

Received alongwith cheq Rs=291.424.00

Registrar
By No. 10255
Dated. 24-10-16

TriconBoston

Consulting Corporation

Private Limited

In relation to the foregoing, I certify that the documents-in-support enclosed with this application are prepared and submitted in conformity with the provisions of the Regulations, and that the Company undertakes to abide by the terms and provisions of the Regulations. I further undertake and confirm that the information provided in the enclosed documents-in-support is true and correct to the best of my knowledge and belief.

A bank draft (Ref No. DD GBL 00197486) dated 24.10.2016 in the sum of PKR 291,424/- (Pakistani Rupees Two Hundred Ninety One Thousand Four Hundred and Twenty Four Only), being the applicable processing fee calculated in accordance with Schedule II to the Regulations, is also attached herewith.

In light of this application and its enclosures, you are kindly requested to accept our application for the modification of the Generation License.

Yours sincerely

For and on behalf of

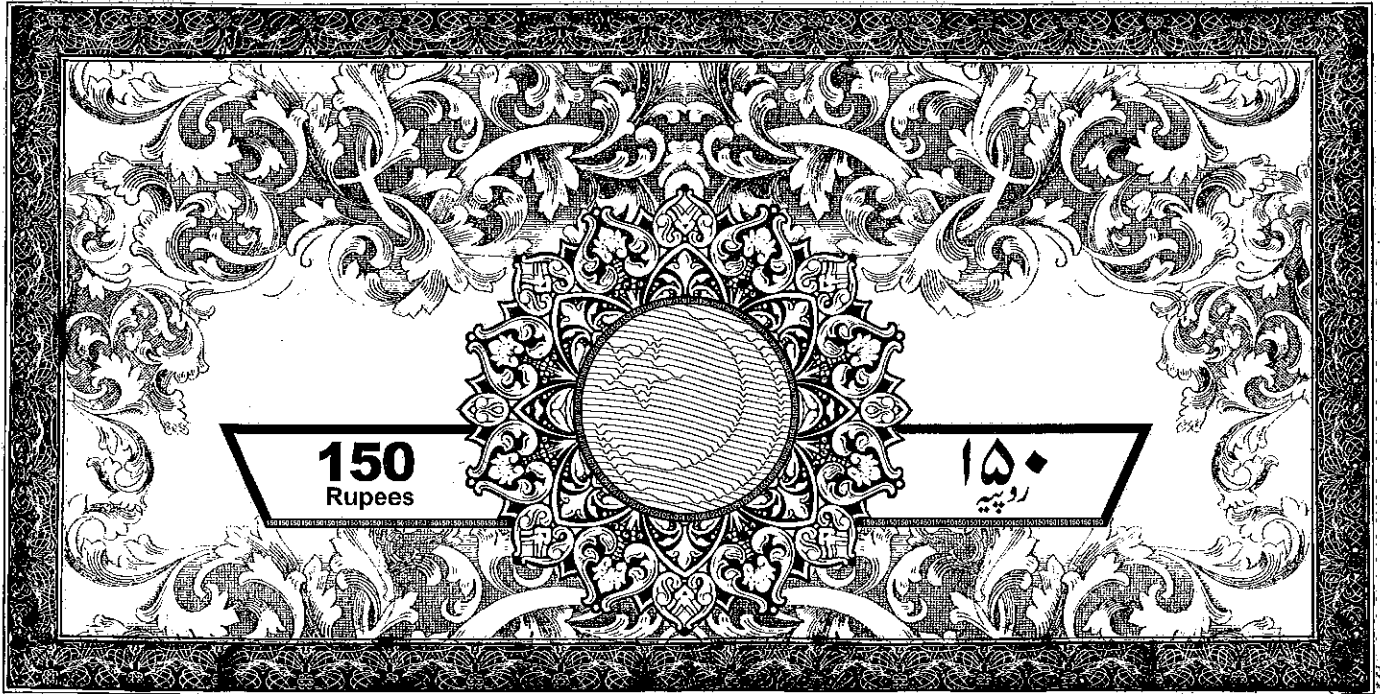
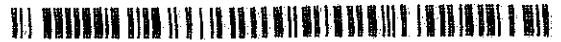
Triconboston Consulting Corporation (Private) Limited



Khalid Aslam
Chief Operating Officer

Appended with this application are the following documents:

1. Bank Draft dated 24.10.2016 as **Annex A**;
2. Extract of Board Resolution dated 21.10.2016 as **Annex B**;
3. Affidavit dated 24.10.2016 as **Annex C**;
4. Vakalatnama dated 24.10.2016 as **Annex D**;
5. Text of the Proposed Modification as **Annex E**;
6. Statement of the Reasons in Support of the Proposed Modification as **Annex F**; and
7. Statement of the Impact on the Tariff, Quality of Service and the Performance by the Company of its obligations under the Generation Licence as **Annex G**.



BEFORE THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

AFFIDAVIT

I, Khalid Aslam, son of Sheikh Muhammad Aslam, resident of House No. 100, Sarwar Colony, Sarwar Road, Lahore Cantt., having CNIC No. 52858-6142316-1, as Chief Operating Officer of Triconboston Consulting Corporation (Private) Limited, being the duly authorized representative of Triconboston Consulting Corporation (Private) Limited, hereby solemnly affirm and declare that the contents of the accompanying 'Application for Modification of the Generation License' dated 24.10.2016 (and its annexes) including all supporting documents, are true and correct to the best of my knowledge and belief and that nothing has been concealed.

I also affirm that all further documentation and information to be provided by me in connection with the accompanying application shall be true to the best of my knowledge and belief.

DEPONENT

Khalid Aslam

Chief Operating Officer

CNIC No.: 52858-6142316-1

Verification:

1287

1287

5856

LS

Handwritten notes and signatures:

- 1807
- 5856
- Handwritten signature: "Khalid bin Al-Walid"

ANNEX A
BANK DRAFT

A/C Payee Only



Bank Alfalah

(0028) Main Gulberg Branch Lahore

Amount not over PKR 291,424.00

DD No. DD GBL 00197486

FT16298168279091

Ref No.

Date only

24-10-2016

On Demand Pay

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

PKR

291,424.00

Rupees

TWO HUNDRED NINETY ONE THOUSAND FOUR HUNDRED TWENTY FOUR ONLY

Drawee Bank/Branch

Drawn on:

F-10 Islamabad

Please do not write below this line.

Authorized Signatory
PA/Attorney No

Authorized Signatory
PA/Attorney No

0019748605301021

0101

(0028) Main Gulberg Branch Lahore



Bank Alfalah

DD No. DD GBL 00197486

Ref No.

FT16298168279091

Date issued

24-10-2016

Beneficiary

NATIONAL ELECTRIC POWER RAGULATOR
Y AUTHORITY

Ordering Customer

TRICONBOSTON CONSULTING COR PVT LTD

Amount in PKR. 291,424.00

Charges

FED

Total Amount PKR291,424.00

ANNEX B

EXTRACT OF BOARD RESOLUTION

TriconBoston

Consulting Corporation

Private Limited

EXTRACT OF THE RESOLUTION PASSED BY THE BOARD OF DIRECTORS OF TRICONBOSTON CONSULTING CORPORATION (PRIVATE) LIMITED (THE "COMPANY") IN A MEETING HELD ON 21 OCTOBER 2016 AT ITS REGISTERED OFFICE

"RESOLVED that Mr. Nadeem Abdullah and Mr. Khalid Aslam were authorised to file three applications for issuance of generation licenses before National Electric Power Regulatory Authority ("**NEPRA**" or "**Authority**") in respect of the Company's three wind power projects (TBCCPL-A, TBCCPL-B and TBCCPL-C) to be located at Jhimpir, District Thatta in the province of Sindh, each with a capacity of 49.6 MW based on thirty one (31) Wind Turbine Generators ("**WTGs**") of GE's 1.6 XLE WTG model.

FURTHER RESOLVED THAT since NEPRA is in the process of issuing three generation licenses for the three wind power projects (the "**Generation Licenses**"), in light of GE's revised offer and the Company's intention to use the latest GE 1.7 – 103 WTG model (instead of the 1.6 XLE model), the Generation Licenses, once issued, shall need to be modified to reflect the changes in the WTG model and increase in the overall capacity for all three projects.

FURTHER RESOLVED THAT the Company may file three applications before NEPRA for modifications of the three Generation Licenses at any time after their issuance by the Authority (the "**Applications**").

FURTHER RESOLVED THAT Mr. Khalid Aslam (the "**Authorised Person**") is duly authorized to file, submit and present the Applications (along with all annexes) and any documents in support thereof before NEPRA, sign the necessary documentation, pay the necessary filing fees, appear and/or make any oral / written representations on behalf of the Company before NEPRA, and undertake or do any matter(s) / act(s) necessary for the filing, submission, processing, completion and finalization of the Applications, or incidental thereto.

FURTHER RESOLVED THAT in addition to the Authorised Person, the associates and partners of RIAA Barker Gillette (formerly RIAALAW), including Mr. Wasee-ul-Hasnain Naqvee and Mr. Nadir Altaf, shall also have the afore-stated powers."

Certified that the above resolution: (i) was duly passed on 21 October 2016 at a meeting of the board of directors of Triconboston Consulting Corporation (Private) Limited held with the necessary quorum of directors; and (ii) has not been rescinded and remains in operation and that this is a true copy of the extract of the said resolution.

Dated: 21 October 2016

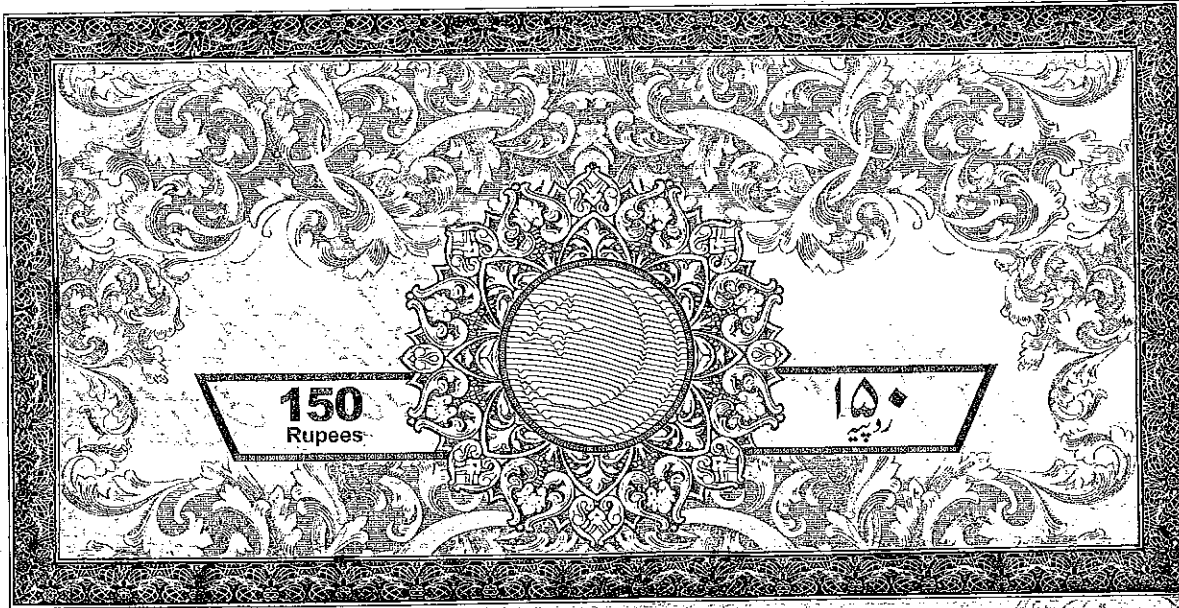


Chief Executive Officer



A Project of Sapphire Group
Triconboston Consulting Corporation (Pvt.) Ltd.
7 - A/K, Main Boulevard, Gulberg II, Lahore - 54000, Pakistan
Phone: +92-42-111-000-100 Fax: +92-42-35788744
Contact: khalid.aslam@sapphire.com.pk

ANNEX C
AFFIDAVIT



BEFORE THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

AFFIDAVIT

I, Khalid Aslam, son of Sheikh Muhammad Aslam, resident of House No. 100, Sarwar Colony, Sarwar Road, Lahore Cantt., having CNIC No. 52858-6142316-1, as Chief Operating Officer of Triconboston Consulting Corporation (Private) Limited, being the duly authorized representative of Triconboston Consulting Corporation (Private) Limited, hereby solemnly affirm and declare that the contents of the accompanying 'Application for Modification of the Generation License' dated 24.10.2016 (and its annexes) including all supporting documents, are true and correct to the best of my knowledge and belief and that nothing has been concealed.

I also affirm that all further documentation and information to be provided by me in connection with the accompanying application shall be true to the best of my knowledge and belief.

DEPONENT

Khalid Aslam

Chief Operating Officer

CNIC No.: 52858-6142316-1

Verification:

Verified on oath at Lahore on this 24th day of October 2016 that the contents of the above affidavit are correct and true to the best of my knowledge and belief.

ATTESTED

DEPONENT

Khalid Aslam

Chief Operating Officer

CNIC NO.: 52858-6142316-1

24/10/16

Lahore High Court Lahore

ANNEX D
VAKALATNAMA

VAKALATNAMA

We, Triconboston Consulting Corporation (Private) Limited (the "Company") hereby appoint and constitute jointly and severally all partners and associates working with RIAA Barker Gillette (formerly RIAALAW) including **MR. WASEE-UL-HASNAIN NAQVEE** and **MR. NADIR ALTAF** to appear and act for us as our advocates in connection with the filing, submission, processing and presentation of the Company's application dated 24.10.2016 (along with annexes) and any documents in support thereof, before the National Electric Power Regulatory Authority ("NEPRA" or "Authority") for modification of the Company's generation license bearing reference number WPGL/33/2016 granted by the Authority on 21.10.2016.

We also authorize the said advocates or any one of them to sign the necessary documentation, pay the necessary filing fees, appear and/or make any oral and/or written representations on behalf of the Company before NEPRA and undertake or do any other matters / acts necessary for the filing, submission, processing, completion and finalization of the application before NEPRA, or incidental thereto.

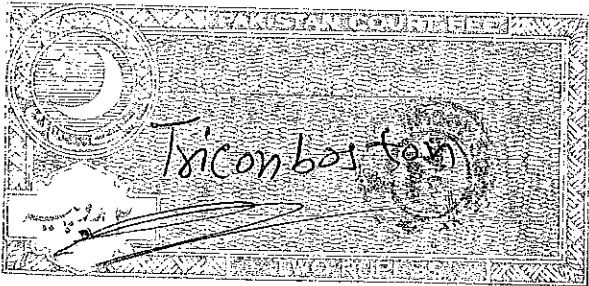
Signature:



Khalid Aslam, Chief Operating Officer

Triconboston Consulting Corporation
(Private) Limited

Dated: 24.10.2016



ACCEPTED



RIAA BARKER GILLETTE

RIAA Barker Gillette Chambers
191-A, Shami Road, Cavalry Ground, Lahore Cantt
Ph: 042-3662-0588-0599. Fax: 36620577

RIAA Barker Gillette
(Formerly RIAALAW)

191-A, Street # 4,
Cavalry Ground, Shami Road
Lahore Cantt.
PAKISTAN

UAN: 111-LAWYER

ANNEX E

PROPOSED MODIFICATION

TriconBoston

Consulting Corporation

Private Limited

TEXT OF THE PROPOSED MODIFICATION

As you are already aware, the Company filed an application dated 02.10.2015 for grant of the Generation License and was issued the same on 21.10.2016. The application was filed for the Project with a proposed capacity of 49.6MW based on thirty one (31) Wind Turbine Generators ("WTGs") of GE's 1.6 XLE WTG model. During the pendency of the application and our contract negotiations, GE suggested numerous improvements to the WTGs and offered a more efficient model (GE 1.7 – 103) for the local conditions.

We are pleased to inform you that the Company has negotiated this model (instead of the 1.6 XLE model) as part of its EPC Contract for the Project. This new model has a maximum output of 1.715 MW which not only reduces the number of WTGs to twenty nine (29) but also increases the overall Project capacity to 49.735 MW (the "Capacity Enhancement").

Kindly note that to cater for the change in the model, number and specifications of the WTGs and the Capacity Enhancement (please see Annex F (*Statement of Reasons*) for further details), Schedule-I and Schedule-II to the Generation License shall need to be modified. In view thereof, please find appended herewith the following modified schedules to the Generation License (the "Proposed Modification"):

- (a) Modified Schedule-I to the Generation License, as **Annex E-1**; and
- (b) Modified Schedule-II to the Generation License, as **Annex E-2**.

Furthermore, we humbly request the Authority to correct the licensee's name to "Triconboston Consulting Corporation (Private) Limited", as provided in the Company's certificate of incorporation (appended herewith as **Annex E-3**)

ANNEX E1

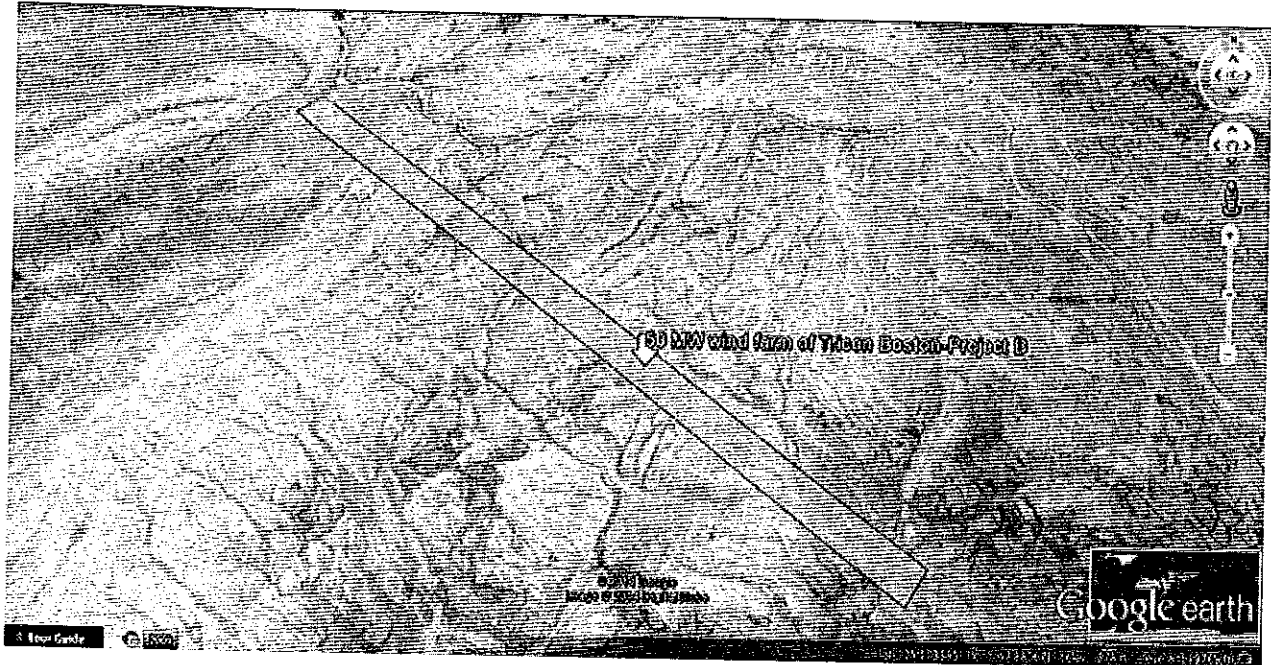
MODIFIED SCHEDULE-I TO THE GENERATION LICENSE

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.

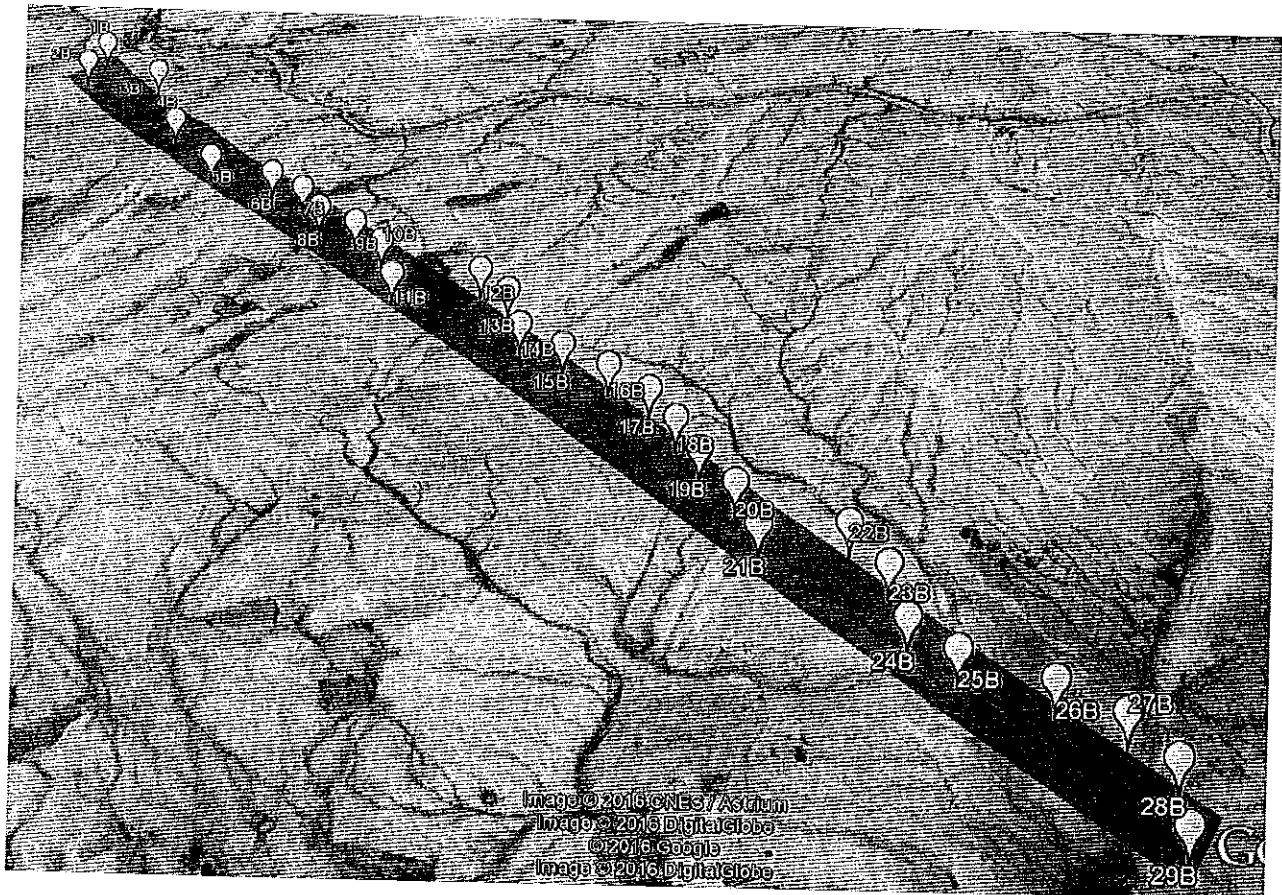


Land Coordinates



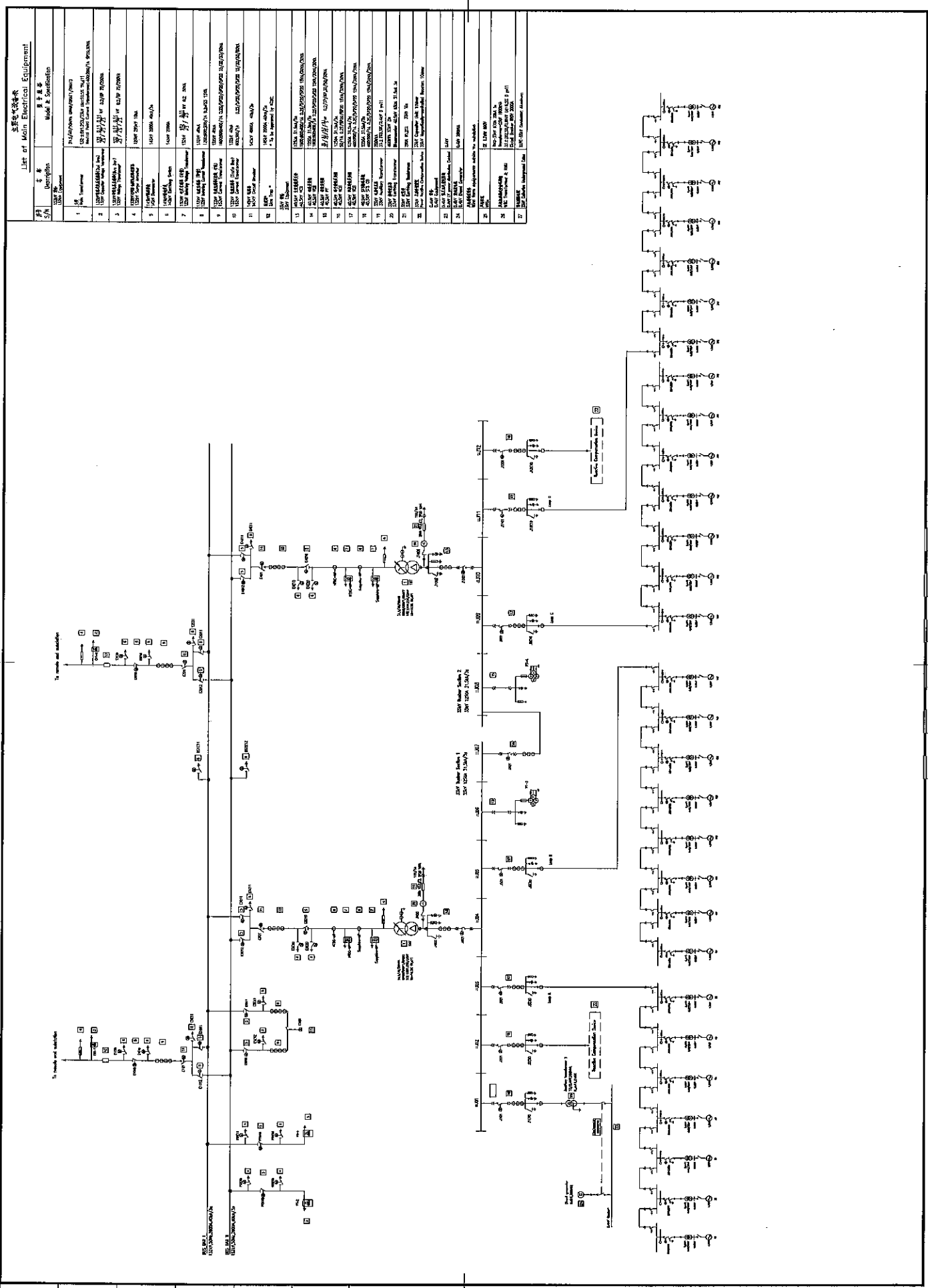
Land Coordinates of TBCCPL - B	
Latitude	Longitude
25.02374059	67.8601161
25.02739251	67.86296168
25.09062032	67.78537616
25.09409417	67.78848019

Wind Farm Layout



Triconboston Consulting Corporation Private Limited TBCCPL - B
Generation License
Nooriabad,
District Thatta
Sindh

Electrical Schematic



**Interconnection Arrangement for Dispersal of Power from the Wind
Farm of 50 MW TriconBoston Consulting Corporation Private Limited
(TBCCPL - B)**

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

(2). The dispersal of power for the proposed WF of TBCCPL - B will consist of the following:-

(a). by looping in-out of the new Jhimpir 220/132 kV circuit at WF of TBCCPL - B

(3). Any change in the above mentioned Interconnection Arrangement/Transmission Facilities duly agreed by TBCCPL and NTDC shall be communicated to the Authority in due course of time.

Figure : Interconnection Scheme For Power Evacuation of 10 Wind Power Projects at Jhimpir

The diagram illustrates the proposed interconnection scheme for power evacuation from 10 wind power projects located near Jhimpir. It shows a dense network of transmission lines connecting various substations and power plants across the region.

Legend:

	EXISTING		PROPOSED	
	GISTN	T/L	GISTN	T/L
600KV	(Solid Circle)	(Solid Line)	(Dashed Circle)	(Dashed Line)
220KV	(Large Solid Circle)	(Solid Line)	(Large Dashed Circle)	(Dashed Line)
132KV	(Small Solid Circle)	(Solid Line)	(Small Dashed Circle)	(Dashed Line)
66KV	(Tiny Solid Circle)	(Solid Line)	(Tiny Dashed Circle)	(Dashed Line)
Power Plants	(Square with diagonal line)		(Square with diagonal line)	

Detail of Generation Facility/Wind Farm

(A). General Information

(i).	Name of Applicant/Company	TriconBoston Consulting Corporation (Private) Limited
(ii).	Registered/Business Office	7-A/K, Main Boulevard, Gulberg II, Lahore
(iii).	Plant Location	Jhampir, Nooriabad, District Thatta, Sindh
(iv).	Type of Generation Facility	Wind Power

(B). Wind Farm Capacity & Configuration

(i).	Wind Turbine Type, Make & Model	General Electric GE 1.7-103
(ii).	Installed Capacity of Wind Farm (MW)	49.735 MW
(iii).	Number of Wind Turbine Units/Size of each Unit (KW)	29 x 1.715 MW

(C). Wind Turbine Details

(a). <u>Rotor</u>		
(i).	Number of Blades	3
(ii).	Rotor Speed	9.2 – 17.47 rpm
(iii).	Rotor Diameter	103 m
(iv).	Swept Area	8332 m ²
(v).	Power Regulation	Pitch control on each blade
(vi).	Rated Power at	10.35 m/sec
(vii).	Cut-in wind speed	3 m/sec
(viii).	Cut-out wind speed	20 m/sec
(ix).	Survival wind speed	36m/s as per project MLA. Standard design 37.5 m/s

(x).	Pitch regulation	yes
(b). <u>Blades</u>		
(i).	Blade Length	50.2 m
(ii).	Material	Glass fiber reinforced epoxy resin
(iii).	Weight	9580 Kg
(c). <u>Gearbox</u>		
(i).	Type	Planetary-helical
(ii).	Gear ratio	111.54
(iii).	Weight	16500 Kg
(iv).	Oil quantity	Typical 300l to 320l (can be 430l) depending on supplier.
(v).	Main shaft bearing	Cylindrical roller bearings or tapered and ball bearings. Depends on the supplier.
(d). <u>Generator</u>		
(i).	Power	1715 kW
(ii).	Voltage	690
(iii).	Type	Double-fed
(iv).	Speed	1735 rpm
(v).	Enclosure class	IP54 (isolation class F)
(vi).	Coupling	Flexible coupling
(vii).	Efficiency	≥ 97%
(viii).	Weight	8,450 kg
(ix).	Power factor	+/- 0.90
(e). <u>Yaw System</u>		
(i).	Yaw bearing	Ball bearing slewing ring
(ii).	Brake	Magnetic
(iii).	Yaw drive	4 stage planetary yaw drives
(iv).	Speed	0.5 degree/s
(f). <u>Control System</u>		
(i).	Type	Automatic or manually controlled
(ii).	Grid connection	Via IGBT converter
	Scope of monitoring	Remote monitoring of more than 300 different parameters,

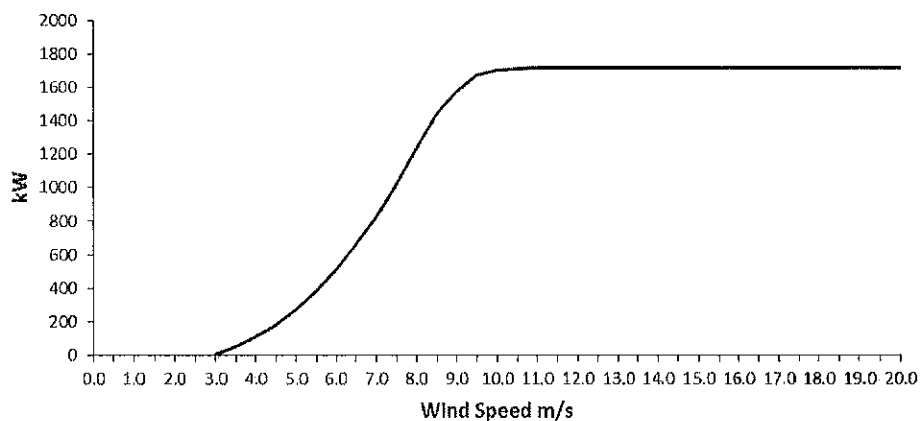
(iii).		e.g. temperature sensors, pitch parameters, speed, generator torque, wind speed and direction, etc.
(iv).	Recording	Production data, event list, long and short-term trends
(g). <u>Brake</u>		
(i).	Design	Full feathering aerodynamic brakes
(ii).	Operational brake	Aerodynamic
(iii).	Secondary brake	Disc brake on high speed shaft (auxiliary brake)
(h). <u>Tower</u>		
(i).	Type	Tubular
(ii).	Hub heights	79.7m

(D). Other Details

(i).	Project Commissioning Date (Anticipated)	January, 2018
(ii).	Expected Life of the Project from Commercial Operation Date (COD)	20 Years

Power Curve of G.E. 1.7 MW Wind Turbine Generator (WTG)

GE 1.7 - 103 Power Curve



Standard Atmospheric Conditions (air density of 1.225 kg/m³)

Rotor Diameter: 103 m

Wind Speed at Hub Height (m/s)	Electrical Power (kW)			
	Normal Turbulence Intensities 10% < TI < 15%	Low Turbulence Intensities TI < 10%	High Turbulence Intensities 15% < TI < 20%	C _p Normal Turbulence Intensities
3.0	3	3	3	-
3.5	55	54	57	0.25
4.0	112	109	119	0.34
4.5	183	179	194	0.39
5.0	275	271	288	0.43
5.5	388	381	406	0.46
6.0	515	507	539	0.47
6.5	664	653	692	0.47
7.0	829	816	861	0.47
7.5	1023	1010	1056	0.48
8.0	1240	1229	1258	0.47
8.5	1445	1431	1477	0.46
9.0	1579	1601	1536	0.42
9.5	1675	1690	1640	0.38
10.0	1704	1712	1682	0.33
10.5	1713	1715	1700	0.29
11.0	1715	1715	1714	0.25
11.5 to cut out	1715	1715	1715	-

ANNEX E2

MODIFIED SCHEDULE-II TO THE GENERATION LICENSE

SCHEDULE-II

The Total Installed/Gross ISO Capacity (MW), Total Annual Full Load Hours, Average Wind Turbine Generator (WTG) Availability, Total Gross Generation of the Generation Facility/Wind Farm (in GWh), Array & Miscellaneous Losses (GWh), Availability Losses (GWh), Balance of Plant Losses (GWh) and Annual Energy Generation (GWh) of the Generation Facility /Wind Farm of Licensee is given in this Schedule

SCHEDULE-II

(1).	Total Installed Gross ISO Capacity of the Generation Facility /Wind Farm (MW/GWh)	49.735 MW
(2).	Total Annual Full Load Hours	3644 Hrs
(3).	Average Wind Turbine Generator (WTG) Availability	97.8 %
(4).	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	220 GWh
(5).	Array & Miscellaneous Losses GWh	26.42 GWh
(6).	Availability Losses GWh	9.55 GWh
(7).	Balance of Plant Losses GWh	4.62 GWh
(8).	Annual Energy Generation (20 year equivalent Net AEP) GWh	181.29 GWh
(9).	Net Capacity Factor	41.6 %

Note

All the above figures are indicative as provided by the Licensee. The Net energy available to NTDC for dispatch will be determined through procedures contained in the Energy Purchase Agreement.

ANNEX E3
CERTIFICATE OF INCORPORATION



SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE
LAHORE

CERTIFICATE OF INCORPORATION

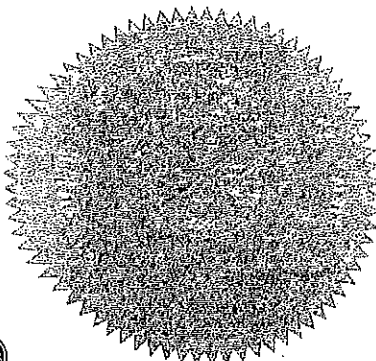
[Under section 32 of the Companies Ordinance, 1984 (XLVII of 1984)]

Corporate Universal Identification No. **0080968**

I hereby certify that **TRICONBOSTON CONSULTING CORPORATION (PVT.) LIMITED** is this day incorporated under the Companies Ordinance, 1984 (XLVII of 1984) and that the company is Limited by Shares.

Given under my hand at Lahore this Thirtieth day of August Two Thousand and Twelve.

Fee Rs. 27,000/-




(LIAQAT ALI DOLLA)
Joint Registrar (Incharge)

No. JRL/ 3195

Dated: 31/8/12

ANNEX F

STATEMENT OF REASONS IN SUPPORT OF PROPOSED MODIFICATION

TriconBoston

Consulting Corporation

Private Limited

STATEMENT OF REASONS IN SUPPORT OF THE PROPOSED MODIFICATION

As you are already aware, the Company filed an application dated 02.10.2015 for grant of the Generation License and was issued the same on 21.10.2016. The application was filed for the Project with a proposed capacity of 49.6MW based on thirty one (31) Wind Turbine Generators ("WTGs") of GE's 1.6 XLE WTG model. During the pendency of the application and our contract negotiations, GE suggested numerous improvements to the WTGs and offered a more efficient model (GE 1.7 – 103) for the local conditions. We are pleased to inform you that the Company has negotiated this model (instead of the 1.6 XLE model) as part of its EPC Contract for the Project. This new model has a maximum output of 1.715 MW which not only reduces the number of WTGs to twenty nine (29) but also increases the overall Project capacity to 49.735 MW (the "Capacity Enhancement").

We have appended herewith the following documents issued by GE, for your kind consideration and record:

- (a) Technical Documentation Wind Turbine Generator Systems 1.7-103 50Hz and 60Hz – Technical Descriptions and Data, as **Annex F-1**; and
- (b) Technical Documentation Wind Turbine Generator Systems 1.7-103 50Hz and 60Hz – Calculated Power Curve and Thrust Coefficient, as **Annex F-2**.

Please note that the new model of the WTGs and the Capacity Enhancement will enable the Project to operate at its maximum available capacity thereby making it more efficient. The Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (the "NEPRA Act") provides that *"in performing its functions under this Act, the Authority shall, as far as practicable, protect the interests of consumers and companies providing electric power services in accordance with guidelines, not inconsistent with the provisions of this Act, laid down by the Federal Government"*¹. Furthermore, in relation to tariffs, the NEPRA Act also states that the Authority shall *"encourage efficiency in licensees operations and quality of service."*²

The Project is currently in its planning / development phase and at this initial stage the Generation License can be updated easily with an inherent flexibility to seamlessly cater for the change in the model/number/specifications of the WTGs and increase the overall Project capacity to 49.735 MW.

It is respectfully submitted that other project companies (i.e. Hawa Energy (Private) Limited and Jhimpir Power (Private) Limited) had also applied to NEPRA for modifications to their generation licenses on the **same grounds** (i.e. change in the WTG model) and their modified licenses were issued by NEPRA. In view thereof, your good offices are humbly requested to process this application expeditiously and issue the modified Generation License at the earliest, enabling the Company to achieve financial close as per its schedule.

¹ Section 7(6) of the NEPRA Act.

² Section 31(2)(c) of the NEPRA Act.

TriconBoston

Consulting Corporation

Private Limited

The Proposed Modification will also be in the best interest for the public as it is in compliance with the applicable laws, in particular Regulation 10(5) of the Regulations, and:

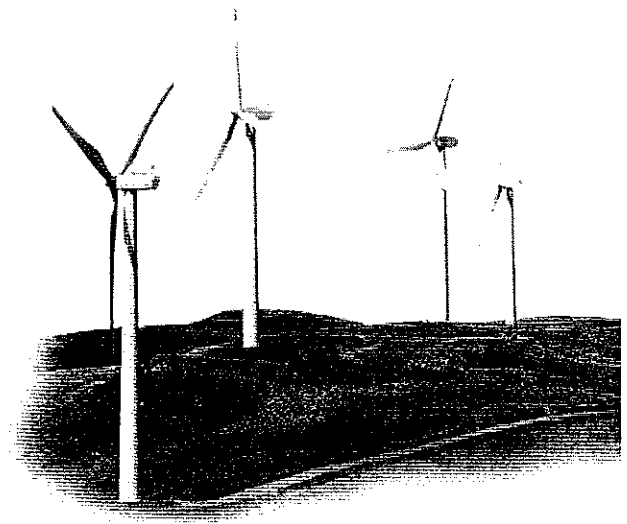
- (a) does not adversely affect the performance by the Company of its obligations;
- (b) does not cause the Authority to act or acquiesce in any act or omission of the Company in a manner contrary to the provisions of the NEPRA Act or the rules or regulations made pursuant to the NEPRA Act;
- (c) is or is likely to be beneficial to the consumers;
- (d) is reasonably necessary for the Company to effectively and efficiently perform its obligations under the Generation License; and
- (e) is reasonably necessary to ensure the continuous, safe and reliable supply of electric power to the consumers keeping in view the financial and technical viability of the Company.

It is respectfully submitted that in view of the on-going energy crisis in the country, we also believe that proceeding with the Proposed Modification is mutually beneficial for all stakeholders, including the consumers who will benefit from the additional electricity generated. In light hereof, since the Proposed Modification will result in a more resourceful Project and ultimately lead to the benefit of the general public and consumers at large, we request the Authority to proceed in accepting our application for the modification of the Generation License.

ANNEX F1

TECHNICAL DESCRIPTIONS AND DATA

Technical Documentation Wind Turbine Generator Systems 1.7-103 - 50 Hz and 60 Hz



Technical Description and Data



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GE Renewable Energy

- Original -

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1 Introduction

This document summarizes the technical description and specifications of the GE Energy (GE) 1.7-103 wind turbine generator system.

2 Technical Description of the Wind Turbine and Major Components

The wind turbine is a three bladed, upwind, horizontal-axis wind turbine with a rotor diameter of 103 m. The turbine rotor and nacelle are mounted on top of a tubular tower giving a hub height of 80 m. The machine employs active yaw control (designed to steer the machine with respect to the wind direction), active blade pitch control (designed to regulate turbine rotor speed), and a generator/power electronic converter system.

The wind turbine features a distributed drive train design wherein the major drive train components including main shaft bearings, gearbox, generator, yaw drives, and control panel are attached to a bedplate.

2.1 Rotor

The rotor diameter is 103 m, resulting in a swept area of 8,332 m², and is designed to operate between 10 and ~17 revolutions per minute (rpm). Rotor speed is regulated by a combination of blade pitch angle adjustment and generator/converter torque control. The rotor spins in a clock-wise direction under normal operating conditions when viewed from an upwind location.

Full blade pitch angle range is approximately 90°, with the 0°-position being with the airfoil chord line flat to the prevailing wind. The blades being pitched to a full feather pitch angle of approximately 90° accomplishes aerodynamic braking of the rotor; whereby the blades "spill" the wind thus limiting rotor speed.

2.2 Blades

There are three rotor blades used on each wind turbine. The airfoils transition along the blade span with the thicker airfoils being located in-board towards the blade root (hub) and gradually tapering to thinner cross sections out towards the blade tip.

2.3 Blade Pitch Control System

The rotor utilizes three (one for each blade) independent electric pitch motors and controllers to provide adjustment of the blade pitch angle during operation. Blade pitch angle is adjusted by an electric drive that is mounted inside the rotor hub and is coupled to a ring gear mounted to the inner race of the blade pitch bearing.

GE's active-pitch controller enables the wind turbine rotor to regulate speed, when above rated wind speed, by allowing the blade to "spill" excess aerodynamic lift. Energy from wind gusts below rated wind speed is captured by allowing the rotor to speed up, transforming this gust energy into kinetic which may then be extracted from the rotor.

Three independent back-up units are provided to power each individual blade pitch system to feather the blades and shut down the machine in the event of a grid line outage or other fault. By having all three blades outfitted with independent pitch systems, redundancy of individual blade aerodynamic braking capability is provided.

2.4 Hub

The hub is used to connect the three rotor blades to the turbine main shaft. The hub also houses the three electric blade pitch systems and is mounted directly to the main shaft. Access to the inside of the hub is provided through a hatch.

2.5 Gearbox

The gearbox in the wind turbine is designed to transmit power between the low-rpm turbine rotor and high-rpm electric generator. The gearbox is a multi-stage planetary/helical gear design. The gearbox is mounted to the machine bedplate. The gearing is designed to transfer torsional power from the wind turbine rotor to the electric generator. A parking brake is mounted on the high-speed shaft of the gearbox.

2.6 Bearings

The blade pitch bearing is designed to allow the blade to pitch about a span-wise pitch axis. The inner race of the blade pitch bearing is outfitted with a blade drive gear that enables the blade to be driven in pitch by an electric gear-driven motor/controller.

The main shaft bearing is a roller bearing mounted in a pillow-block housing arrangement.

The bearings used inside the gearbox are of the cylindrical, ball and tapered roller type. These bearings are designed to provide bearing and alignment of the internal gearing shafts and accommodate radial and axial loads.

2.7 Brake System

The electrically actuated individual blade pitch systems act as the main braking system for the wind turbine. Braking under normal operating conditions is accomplished by feathering the blades out of the wind. Any single feathered rotor blade is designed to slow the rotor, and each rotor blade has its own back-up to provide power to the electric drive in the event of a grid line loss.

The turbine is also equipped with a mechanical brake located at the output (high-speed) shaft of the gearbox. This brake is only applied as an auxiliary brake to the main aerodynamic brake and to prevent rotation of the machinery as required by certain service activities.

2.8 Generator

The generator is a doubly-fed induction type. The generator meets protection class requirements of the International Standard IP 54 (totally enclosed). The generator is mounted to the bedplate and the mounting is designed so as to reduce vibration and noise transfer to the bedplate.

2.9 Flexible Coupling

Designed to protect the drive train from excessive torque loads, a flexible coupling is provided between the generator and gearbox output shaft. This coupling is equipped with a torque-limiting device sized to keep the maximum allowable torque below the maximum design limit of the drive train.

2.10 Yaw System

A roller bearing attached between the nacelle and tower facilitates yaw motion. Planetary yaw drives (with brakes that engage when the drive is disabled) mesh with the outside gear of the yaw bearing and steer the machine to track the wind in yaw. The automatic yaw brakes engage in order to prevent the yaw drives from seeing peak loads from any turbulent wind.

The controller activates the yaw drives to align the nacelle to the average wind direction based on the wind vane sensor mounted on top of the nacelle.

A cable twist sensor provides a record of nacelle yaw position and cable twisting. After the sensor detects excessive rotation in one direction, the controller automatically brings the rotor to a complete stop, untwists the cable by counter yawing of the nacelle, and restarts the wind turbine.

2.11 Tower

The wind turbine is mounted on top of a tubular tower. The tubular tower is manufactured in sections from steel plate. Access to the turbine is through a lockable steel door at the base of the tower. Service platforms are provided. Access to the nacelle is provided by a ladder and a fall arresting safety system is included. Interior lights are installed at critical points from the base of the tower to the tower top.

2.12 Nacelle

The nacelle houses the main components of the wind turbine generator. Access from the tower into the nacelle is through the bottom of the nacelle. The nacelle is ventilated. It is illuminated with electric light. A hatch at the front end of the nacelle provides access to the blades and hub. The rotor can be secured in place with a rotor lock.

2.13 Anemometer, Wind Vane and Lightning Rod

An anemometer, wind vane and lightning rod are mounted on top of the nacelle housing. Access to these sensors is accomplished through a hatch in the nacelle roof.

2.14 Lightning Protection

The rotor blades are equipped with a lightning receptors mounted in the blade. The turbine is grounded and shielded to protect against lightning, however, lightning is an unpredictable force of nature, and it is possible that a lightning strike could damage various components notwithstanding the lightning protection deployed in the machine.

2.15 Wind Turbine Control System

The wind turbine machine can be controlled automatically or manually from either an interface located inside the nacelle or from a control box at the bottom of the tower. Control signals can also be sent from a remote computer via a Supervisory Control and Data Acquisition System (SCADA), with local lockout capability provided at the turbine controller.

Service switches at the tower top prevent service personnel at the bottom of the tower from operating certain systems of the turbine while service personnel are in the nacelle. To override any machine operation, Emergency-stop buttons located in the tower base and in the nacelle can be activated to stop the turbine in the event of an emergency.

2.16 Power Converter

The wind turbine uses a power converter system that consists of a converter on the rotor side, a DC intermediate circuit, and a power inverter on the grid side.

The converter system consists of a power module and the associated electrical equipment. Variable output frequency of the converter allows operation of the generator.

3 Technical Data for the 1.7-103

3.1 Rotor

Diameter	103 m
Number of blades	3
Swept area	8,332 m ²
Rotational direction	Clockwise looking downwind
Orientation	Upwind
Speed regulation	Pitch control
Aerodynamic brakes	Full feathering

3.2 Pitch System

Principle	Independent blade pitch control
Actuation	Individual electric drive

3.3 Yaw System

Yaw rate	0.5 degree/s
----------	--------------

3.4 Corrosion Protection

Atmospheric corrosion protection (corrosion categories as defined by ISO 12944-2:1998)				
50 & 60 Hz	Standard		Enhanced (Option)	
Recommended Climate	Dry, arid, inland, non-industrial areas		Humid, coastal, industrial areas	
Component	Internal	External	Internal	External
Blades	C-4	C-5	C-4	C-5
Tower shell coating	C-2	C-3	C-4	C-5M
Tower internal fasteners, tower stair fasteners	C-4	C-4	C-4	C-5
Hub, bedplate, generator frame, mainshaft, pillowblock, gearbox, generator	C-4	C-4	C-4	C-4
Nacelle, hub fasteners	C-4	C-4	C-4	C-5
Automatic lubrication system (option for 1-2MW Platform)	C-3	C-3	C-5	C-5

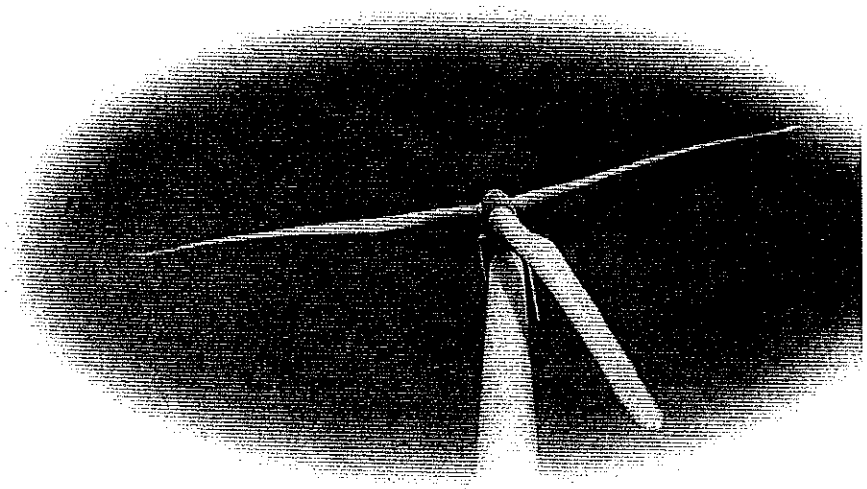
4 Operational Limits

Height above sea level	Maximum 2500 m. See notes in section maximum standard ambient temperature below.
Minimum temperature (standard) operational / survival	Standard weather: -15°C / -20°C Cold weather package: -30° C / -40° C Switching on takes place at a hysteresis of 5K (-10°C resp. -25°C)
Maximum standard ambient temperature (rated power operation / survival)	+40°C / +50°C The maximum power that the wind turbine achieves at high temperatures can be limited by factors such as grid voltage, power factor, altitude and ambient temperature. Refer to the 1&2MW Grid Interconnection and High Temperature, High Altitude Operation Documents.
Wind conditions according to IEC 61400	50 Hz/60 Hz: (IEC S) $V_{average} = 7 \text{ m/s}$, $T_1 = 16 \% @ 15 \text{ m/s}$
Maximum extreme gust (10 min) according to IEC 61400	50 Hz/60 Hz: Standard weather package: 37.5 m/s Cold weather package: 37.5 m/s

ANNEX F2

CALCULATED POWER CURVE AND THRUST COEFFICIENT

Technical Documentation Wind Turbine Generator Systems 1.7-103 - 50 Hz and 60 Hz



Calculated Power Curve and Thrust Coefficient



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1 Calculated Power Curve 1.7-103

Standard Atmospheric Conditions (air density of 1.225 kg/m³)

Rotor Diameter: 103 m

Wind Speed at Hub Height [m/s]	Electrical Power [kW]			
	Normal Turbulence Intensities 10% < TI < 15%	Low Turbulence Intensities TI < 10%	High Turbulence Intensities 15% < TI < 20%	Cp,e Normal Turbulence Intensities
3.0	3	3	3	-
3.5	55	54	57	0.25
4.0	112	109	119	0.34
4.5	183	179	194	0.39
5.0	275	271	288	0.43
5.5	388	381	406	0.46
6.0	515	507	539	0.47
6.5	664	653	692	0.47
7.0	829	816	861	0.47
7.5	1023	1010	1056	0.48
8.0	1240	1229	1258	0.47
8.5	1445	1451	1427	0.46
9.0	1579	1601	1536	0.42
9.5	1675	1690	1640	0.38
10.0	1704	1712	1682	0.33
10.5	1713	1715	1700	0.29
11.0	1715	1715	1714	0.25
11.5 to cut out	1715	1715	1715	-

Table 1: Calculated power curve for the 1.7-103

2 Calculated Power Curve with Different Air Densities and Turbulence Intensities

Wind Speed at Hub Height [m/s]	Electrical Output (kW) as a function of density (kg/m ³)										
	$\rho = 1.02$	$\rho = 1.04$	$\rho = 1.06$	$\rho = 1.08$	$\rho = 1.1$	$\rho = 1.12$	$\rho = 1.14$	$\rho = 1.16$	$\rho = 1.18$	$\rho = 1.2$	$\rho = 1.225$
3.0	2	2	2	2	2	3	3	3	3	3	3
3.5	45	46	46	47	48	49	51	52	53	54	55
4.0	91	93	95	97	99	101	103	105	107	109	112
4.5	148	151	155	158	162	165	168	172	175	179	183
5.0	223	228	233	238	243	249	254	259	264	269	275
5.5	316	323	330	337	344	351	358	365	372	379	388
6.0	422	431	440	449	458	467	476	485	494	504	515
6.5	544	556	567	579	591	602	614	626	637	649	664
7.0	681	695	710	724	739	753	768	782	796	811	829
7.5	843	860	878	896	913	931	949	966	984	1001	1023
8.0	1029	1050	1071	1092	1113	1134	1154	1175	1195	1215	1240
8.5	1236	1260	1284	1307	1329	1351	1371	1391	1409	1426	1445
9.0	1430	1452	1473	1492	1509	1524	1537	1548	1558	1567	1579
9.5	1583	1599	1613	1627	1638	1647	1655	1661	1666	1670	1675
10.0	1672	1680	1687	1693	1697	1700	1702	1703	1704	1704	1704
10.5	1706	1709	1711	1712	1713	1713	1713	1713	1713	1713	1713
11 to cut out	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715

Table 2: Calculated power curve for the 1.7-103 for normal turbulence intensities

Wind Speed at Hub Height [m/s]	Electrical Output (kW) as a function of density (kg/m ³)										
	$\rho = 1.02$	$\rho = 1.04$	$\rho = 1.06$	$\rho = 1.08$	$\rho = 1.1$	$\rho = 1.12$	$\rho = 1.14$	$\rho = 1.16$	$\rho = 1.18$	$\rho = 1.2$	$\rho = 1.225$
3.0	2	2	2	2	3	3	3	3	3	3	3
3.5	42	44	45	47	48	49	51	52	53	53	54
4.0	89	91	93	95	97	99	101	103	105	107	109
4.5	145	148	151	154	158	161	165	168	171	175	179
5.0	219	224	229	234	239	244	249	254	259	264	271
5.5	311	317	324	331	338	345	352	359	366	373	381
6.0	415	424	433	441	450	459	468	477	486	495	507
6.5	535	546	558	569	580	592	603	615	626	638	653
7.0	671	685	699	713	727	741	756	770	784	798	816
7.5	830	848	865	883	900	918	935	953	970	988	1010
8.0	1016	1037	1058	1079	1100	1120	1141	1162	1183	1203	1229
8.5	1222	1247	1271	1296	1320	1343	1366	1388	1409	1429	1451
9.0	1438	1462	1485	1506	1524	1541	1555	1567	1578	1589	1601
9.5	1604	1621	1637	1651	1663	1672	1678	1683	1686	1689	1690
10.0	1695	1701	1706	1709	1711	1712	1712	1712	1712	1712	1712
10.5 to cut out	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715

Table 3: Calculated power curve for the 1.7-103 for low turbulence intensities

Wind Speed at Hub Height (m/s)	Electrical Output (kW) as a function of density (kg/m ³)										
	$\rho = 1.02$	$\rho = 1.04$	$\rho = 1.06$	$\rho = 1.08$	$\rho = 1.1$	$\rho = 1.12$	$\rho = 1.14$	$\rho = 1.16$	$\rho = 1.18$	$\rho = 1.2$	$\rho = 1.225$
3.0	2	2	2	2	2	2	3	3	3	3	3
3.5	46	47	48	49	51	53	55	56	57	57	57
4.0	96	99	101	103	105	107	110	112	114	116	119
4.5	157	160	164	167	171	175	178	182	185	189	194
5.0	234	240	245	250	255	261	266	271	277	282	288
5.5	332	339	346	353	361	368	375	383	390	397	406
6.0	441	451	460	470	479	489	498	508	517	527	539
6.5	569	581	593	605	617	629	641	653	665	677	692
7.0	709	724	738	753	768	783	798	813	827	842	861
7.5	875	893	911	929	947	964	982	999	1017	1034	1056
8.0	1063	1084	1105	1125	1145	1165	1184	1203	1221	1238	1258
8.5	1258	1279	1299	1318	1337	1354	1370	1386	1400	1413	1427
9.0	1413	1430	1446	1461	1474	1487	1499	1509	1519	1527	1536
9.5	1544	1559	1572	1584	1595	1605	1613	1621	1628	1633	1640
10.0	1632	1641	1650	1658	1664	1669	1673	1676	1679	1680	1682
10.5	1679	1684	1688	1692	1694	1696	1698	1698	1699	1699	1700
11.0	1702	1704	1706	1707	1708	1709	1709	1710	1711	1712	1714
11.5	1714	1714	1715	1715	1715	1715	1715	1715	1715	1715	1715
12 to cutout	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715

Table 4: Calculated power curve for the 1.7-103 for high turbulence intensities

3 Applicability

The power curve information provided in this document applies under the following conditions:

- Mean air density during the course of the measurement campaign falling in the range of air densities specified in Section 2.
- The stated range of mean horizontal wind turbulence intensity, defined as the mean value at 15-m/s average hub height wind speed.
- The calculated power curve at the measured air density must be established by linear interpolation from the reference power curves in Tables 2-4, rounded to the nearest 0.01 kg/m³.
- If the measured average air density during a power performance test falls out of the range of provided densities, data shall be density-corrected to the nearest density provided in Tables 2-4 by employing equation 3 of the IEC standard 61400-12-1. The reference air density shall be the nearest density provided in Tables 2-4.

In addition to the comprehensive requirements detailed in the Technical Specification for Machine Power Performance Test:

- The stated performance of the power curve in this document applies to:
 - Clean, non-degraded and uncontaminated blade surfaces with no icing.
 - A wind turbine generator system whose power output is not being actively regulated or curtailed and the wind turbine generator is free to operate up to the maximum capacity of the machine and without restriction to the rate at which the turbine increases power.
 - A wind turbine experiencing normal operation, e.g., performance not limited by low noise operation, grid events or other operational conditions prohibiting maximum turbine output.
 - Power shall be measured on the low-voltage side of the transformer unless the net electric power output is referenced otherwise in this document.
- Wind-speed labels are mid-bin values; for example, the 5.0 m/s bin extends from 4.75 to 5.25 m/s.
- The flow inclination angle at the site should be within the turbine design conditions (up to +/-8° per IEC 61400-1).
- In certain very rare situations where the turbine must provide full reactive power while the terminal voltage is at its lower limit, for certain turbine models, the turbine may need to deliberately run slightly below rated (active) power at or above rated wind speed. Please consult the Grid Interconnection document for any details applicable to this turbine model.

4 Cut-Out and Re-Cut-In Wind Speeds 1.7-103

Subject to the results of a site-specific MLA¹, if the average wind speed exceeds

- 20 m/s in a 600-second time interval
- 23 m/s in a 30-second time interval or
- 25 m/s in a 3-second time interval

the wind turbine generator system will shut down.

If the 4-minute rolling average wind speed drops below 17 m/s the wind turbine generator system will cut in again.

5 Calculated Thrust Coefficient 1.7-103

Rotor diameter: 103 m

Wind Speed at Hub Height [m/s]	Thrust Coefficient Ct [-]	Wind Speed at Hub Height [m/s]	Thrust Coefficient Ct [-]
3.0	0.96	12.0	0.26
3.5	0.90	12.5	0.23
4.0	0.89	13.0	0.20
4.5	0.90	13.5	0.18
5.0	0.87	14.0	0.16
5.5	0.83	14.5	0.14
6.0	0.81	15.0	0.13
6.5	0.80	15.5	0.12
7.0	0.80	16.0	0.11
7.5	0.80	16.5	0.10
8.0	0.80	17.0	0.09
8.5	0.76	17.5	0.08
9.0	0.69	18.0	0.08
9.5	0.59	18.5	0.07
10.0	0.49	19.0	0.06
10.5	0.41	19.5	0.06
11.0	0.35	20.0	0.06
11.5	0.30		

Table 5: Calculated thrust coefficient table for 1.7-103

Calculated using Standard Atmospheric Conditions according to ISO 2533.

¹A site-specific Mechanical Loads Analysis (MLA) is required to determine turbine suitability and whether the default cut-out and re-cut-in wind speeds require adjustment to mitigate site-specific loads.

ANNEX G

STATEMENT OF IMPACT

TriconBoston

Consulting Corporation

Private Limited

STATEMENT OF THE IMPACT ON THE TARIFF, QUALITY OF SERVICE AND THE PERFORMANCE BY THE COMPANY OF ITS OBLIGATIONS UNDER THE GENERATION LICENSE

A. Impact on Tariff:

The Company hereby confirms that there shall be no impact on the tariff awarded to it by NEPRA.

B. Impact on Quality of Service:

The new WTG model (GE 1.7 – 103) is of international standard, more efficient and robust than the previously selected WTG model. Hence, the technical performance and quality of service of the Company shall improve significantly.

C. Impact on Performance of Obligations under the Generation License:

The roles, responsibilities and obligations of the Company under the Generation License shall not change because of the Proposed Modification.