#### BEFORE THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

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

#### IN RESPECT OF TRANS ATLANTIC ENERGY (PVT.) LIMITED 50 MW WIND POWER PROJECT AT JHIMPIR, DISTRICT THATTA, SINDH

Dated: 10.06.2016

Filed for and behalf of: Trans Atlantic Energy (Pvt.) Limited

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



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

#### 1. NEPRA's Participation in the Process

- 1.1. Section 15 of the Regulation of Generation, Transmission, and Distribution of Electric Power Act, 1997 (the "Act") provides, *inter alia*, that:
  - "(1) No person except under the authority of a license issued by the Authority under this Act and subject to the conditions specified in this Act and as may be imposed by the Authority, construct own or operate a generation facility.
  - (2) An application for the grant of a license for a generation facility shall specify-
    - (i) the type of facility for which the license is applied;
    - (ii) the location of the generation facility; and
    - (iii) the expected life of the generation facility."
- 1.2. Furthermore, Regulation 3 of the National Electric Power Regulatory Authority (Application and Modification Procedure) Regulations, 1999 (the "AMP Regulations") provides that an application for a license shall be made in the form specified in the AMP Regulations and further enumerates the documents required to be submitted to the Authority along with the requisite application.
- 1.3. This Application for the grant of a generation license is made pursuant to Section 15 of the Act and Regulation 3 of the AMP Regulations (this "Application").

#### 2. Introduction of the Applicant/Sponsor

2.1. As required under the Section 24 of Act, Trans Atlantic Energy (Pvt.) Limited (the "Applicant" or the "Company" or the "Project Company") is a Private limited company incorporated under the Companies Ordinance, 1984, to carry on, primarily, the business of power generation, as independent power producer of wind, thermal, hydel, nuclear, solar, steam, and/or any other alternative/renewable energy sources, and bio-energy. The Company intends to develop a 50 MW wind power generation facility located at Jhimpir, District Thatta, Province of Sindh (the "Project").



The company's Board Resolution, constitutive documents, other pertinent details of the Applicant and description of the Project are annexed herewith as **Annex-A**.

#### 2.2. Sponsors

#### 3. <u>The Project Overview</u>

#### 3.1 <u>Project Company</u>

3.1.1 The Company is developing its Project under the NEPRA Upfront Tariff regime. The Letter of Intent (the "LOI") has been awarded by AEDB dated 13<sup>th</sup> April 2016. The Project Company proposes to design, engineer, construct, insure, commission, operate and maintain the Project. The construction of 50 MW wind power plant on 3.45 MW Wind Turbine Generator technology will take approximately 18 months from the issuance of notice to proceed to the project contractors, so that plant commissioning is expected within 18 months after financial close. The LOI for this Project is annexed hereto.

#### 3.2 Issuance of "Letter of Intent"

- 3.2.1 The project submitted bank guarantee for LOI to AEDB in August 2015 and got Letter of Intent (LOI) from AEDB in April 2016.
- 3.2.2 Although the Applicant will opt for the Upfront Tariff and as such all risks associated with the Project are to be borne by the Applicant, nevertheless, the Company has undertaken various studies to assess the feasibility of the Project. These studies *inter alia* include the following:
  - a. Wind resources assessment;
  - b. Route Access Report;
  - c. Survey Report ; and
  - d. Grid interconnection study.

A complete technical/feasibility study is annexed as Annex-J hereto.

#### 4. <u>Power Purchaser</u>

- 4.1. The electricity generated from this Project would be supplied to NTDC. The power generated by the Project will be sold for the term of 20 years under the standard Energy Purchase Agreement (the "EPA") starting from commencement of commercial operations.
- 5. <u>Site</u>



Trans Atlantic Energy has got Land under lease of 1000 acres from Government of Sindh for establishing the 50MW wind farm. The site is located in the Jhimpir – Jhimpir – Keti Bander Wind Corridor.

The site has been visited many times to physically analyze all the pre-requisites for the Project. It was selected after going through various technical studies of terrain and assessment of wind. The land identification process was driven by technical, economical and environmental factors to determine location having the lowest combined investment and lifetime operating cost with lowest environmental impacts.

In addition, the site selection criteria included comparative evaluation of different factors such as site accessibility, land availability and costs, interconnection with the national grid, and geotechnical features. The land is un-inhabited, and there is no issue of habitat resettlement. There is no wild life sanctuary, protected area or known habitat of any kind. The site poses no risk to archeological sites or any aviation hazard as the nearest airport (Karachi) is at a considerable distance away.

Jhimpir is almost 110 km on Super Highway from Karachi. The site is linked with both the ports of Karachi; therefore the turbines can be easily shifted from both the ports through the Super Highway. The logistic study has also been carried out.

The raw wind data of the region was processed for further analysis of site specific climatology after going through topographic details. The analysis shows that the selected site is one of the best available sites for a wind farm in Pakistan having maximum wind potential for a wind power project.

The success of the project is based on the proper assessment of wind hence; a detailed analysis of wind is being carried out. Trans Atlantic has installed its own wind mast with a height of 80 meters.

The terrain is rough hard stone with sporadic vegetation like wild grass etc. The land is generally flat; majority of the terrain is 55-145m above sea level. Terrain conditions can be classified as regular in general; however in some places it is moderately hilly. The ground and soil conditions are stable for turbine foundations and crane pads. The load bearing capacity is high and stable.

The aerial view of the Project site is shown below:





S. No.	Longitude	Latitude
А	67°48'01.60"East	24°56'06.94''North
В	67°44'38.87''East	24°58'40.49''North
С	67°47'26.47''East	24°57'51.21''North
D	67°48'40.10''East	24°57'09.33''North
E	67°48'21.22''East	24°56'41.75''North
F	67°44'42.64''East	24°58'46.01''North
G	67°48'17.45''East	24°56'36.24''North
Н	67°47'58.58''East	24°56'08.66''North
I	67°49'22.11''East	24°56`45.43`'North
J	67°48'20.47''East	24°56'34.52''North
K	67°49'25.88''East	24°56'50.95''North
L	67°48'24.25''East	24°56'40.06' 'North
M	67°48'43.12''East	24°43`37.40''North
N	67°49'03.23''East	24°56'17.86''North
0	67°45'14.78''East	24°57'41.79''North
Р	67°47'30.24''East	24'57'56.72''North
Q	67°45'11.01''East	24°57'36.27''North
R	67°48'36.81''East	24°55'39.25''North
S	67°48'59.46''East	24°56'12.34''North
Т	67°48'40.58''East	24°55'44.76''North

# Micro-Sitting of Generation Facility/Wind farm

ANT VV (11 1991



UTM	WGS84 T42N				
Datum:					
Turbine ID	Turbine	Hub Height	Easting (m)	Northing (m)	UTM zone
	model	(m)			
WT-1	V126-	137	378021	2760169	42
	3.45MW				
WT-2	V126-	137	377777	2760324	42
	3.45MW				
WT-3	V126-	137	377533	2760479	42
	3.45MW				
WT-4	V126-	137	377289	2760634	42
	3.45MW				
WT-5	V126-	137	377045	2760789	42
	3.45MW				
WT-6	V126-	137	376801	2760944	42
	3.45MW				
WT-7	V126-	137	376558	2761099	ARTED
	3.45MW				AN AND
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					E
					SNAAT

WT-8	V126- 3.45MW	137	376070	2761409	42
WT-9	V126- 3.45MW	137	375826	2761564	42
WT-10	V126- 3.45MW	137	375582	2761719	42
WT-11	V126- 3.45MW	137	375338	2761874	42
WT-12	V126- 3.45MW	137	375094	2762030	42
WT-13	V126- 3.45MW	137	374850	2762185	42
WT-14	V126- 3.45MW	137	374607	2762340	42



#### 6. **Operations & Maintenance Arrangement**

- 6.1. For the purpose of designing, engineering, procuring, constructing, installing, testing, completing, commissioning, operation and maintenance of the Project, the Project Company has hired the services of M/S Xinjiang Electric Power Construction Co. Ltd (XEPC). O&M for first two years will be done by XEPC whereas for next 8 years Vestas will be engaged.
- 6.2. Xinjiang Electric Power Construction Co, Ltd was found in 1956, as the main strength of central enterprises China Energy Engineering Group Co., Ltd(CEEC) in Xinjiang Uygur Autonomous Region power construction industry .CEEC mainly involved in investment and operation ,project construction, consulting, designing, facility manufacturing of power industry, registered capital 26 billion RMB, operation revenue over 180 billion RMB, general assets over 220 billion RMB,160 thousand staff, ranks in" world top 500" and grade A enterprise in China.
- 6.3. Vestas has established experience and expertise not just in wind turbine engineering and manufacturing, but also in services, solutions, investment and a range of emerging and synergistic technologies. Renewable energy generation capacity isn't just a product: it's a whole industry and ecosystem.

#### 7. <u>Financing</u>

Lead financing bank is United Bank Limited along with EKF from Denmark. Both jointly will arrange and provide 50% of financing each. LOI is attached of UBL and EKF for the required total financing of the project.

#### 8. <u>Selection of Technology</u>

Detail of Generation Facility/ Wind Power Plant/ Wind Farm

#### A. General Information

i.	Name of Applicant Company	Trans Atlantic Energy Private Limited
i,	Registered/Business Office	130 Bahria Complex III MT Road Karachi, Pakistan
i.	Plant Location	Jhimpir District Thatta, Sindh
7.	Type of Generation Facility	Wind Power

#### B. Wind Farm Capacity & Configuration

i.	Wind Turbine Type, Make &	V126 3.45MW	
	Model		
			- STP-
			ENER PE

ii.	Installed Capacity of Wind Farm (MW)	48.3
iii.	Number of Wind Turbine Units/Size of each Unit (KW)	14 (3450kW)

#### C. Wind Turbine Details

a.	Rotor	
i.	Number of Blades	3
ii.	Rotor Speed	5.6-16.5rpm
iii.	Rotor Diameter	126m
iv.	Swept Area	12469 m <sup>2</sup>
<b>v</b> .	Power Regulation	Full Scale Converter
vi.	Rated power at	3.45MW
vii.	Cut-in Wind Speed	3m/s
viii.	Cut-out Wind Speed	22.5m/s
ix.	Survival Wind Speed	52.5m/s
X.	Pitch Regulation	Individual
b.	Blades	
i.	Blade Length	61.66m
ii.	Material	Fibreglass reinforced epoxy, carbon fibres and Solid Metal Tip (SMT)
iii.	Weight	5,550kg
с.	Gear Box	
i.	Туре	Planetary stages + one helical stage
ii.	Gear Ratio	1:102
iii.	Weight	35,000 kg
iv.	Oil Quantity	1000-1200
v.	Main Shaft Bearing	Double-row spherical roller bearing
d.	Generator	L



i.	Power	3650kW
ii.	Voltage	750V
iii.	Туре	Asynchronous with cage rotor
iv.	Speed	1450-1550 rpm
v.	Enclosure Class	IP54
vi.	Coupling	Squirrel cage
vii.	Efficiency	97.4%
viii.	Weight	8,050kg
ix.	Power Factor	+/- 0.95
e.	Yaw System	
i.	Yaw Bearing	Plain bearing system
ii.	Brake	Motor brake
iii.	Gear driving device	Multiple stages geared
iv.	Speed	1.4 rpm at output shaft
f.	Control System	
i.	Туре	multiprocessor
ii.	Grid Connection	Via full scale back-to-back AC-DC-AC power electronics converter
iii.	Scope of Monitoring	Remote monitoring of more than 300 different parameters, e.g. temperature sensors, pitch parameters, speed, generator torque, wind speed & direction, etc.
iv.	Recording	Production data, event list, long & short term trends
g.	Brake	
i.	Design	Three independent systems, fail safe (individual pitch)
ii.	Operational Brake	Aerodynamic brake achieved by feathering blades
iii.	Secondary Brake	Mechanical brake located at the output (high-speed) shaft of the gearbox
h.	<u>Tower</u>	TANT

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i.	Туре	Steel tubular with flange connections
ii.	Hub Heights	137m

#### D. Other Details

İ.	Project Commissioning Date (Anticipated)	December 31, 2018
İ.	Expected Life of the Project from Commercial Operation Date (COD)	20 years

#### Power Curve of (Graphic) of Wind Turbine Generator (Vestas 3.45-126)







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

	Air density [kg/m³]													
Wind speed	1 775	0.95	0.976		4 025	1.05			4 4 25				4.26	4 374
[ยพร]	1.220	0.35	0.373	1.0	1.020	1.05	1.970	1.1	1.123	1.13	1.1/5	12	120	1.275
3.0	31	13		10	19			22	24	26	27	20	33	34
3.5	37	64	07	10	1/3	76	/9	82	85	88	91	94	100	103
4.0	180	1.29	133	138	143	147	152	15/	101	100	1 1/1	1/5	184	189
4.0	2/3	200	212	210	220	232	239	240	252	259	205	272	285	202
5.0	537	100	300	315	324	333	342	101	301	570	510	520	400	415
0.0	335	408	420	432	600	400	406	460	402	504	010	020	1 201	303
6.0	014	243 600	710	730	760	770	707	0.54	000	000	08	090	121	142
7.0	314	005	000	030	060	000	197	1020	0.30	1070	8/5	000	¥33	1100
7.0	1419	1060	1 000 1 1 7 A	1144	1195	1014	1 24.4	1030	1004	10/9	1361	1200	1.1.40	1477
8.0	1722	1090	1271	1407	1100	170	1.513	1.13	1302	332	1301	1990	1755	147.
9.6	2069	1330	18.10	1407	1722	4774	1013	1048	1083	1015	1003	108/	2004	1/89
9.0	2033	1000	1040	7000	7758	2105	2162	1000	1087	7765	18/0	2010	2098	25.24
3.0	2434	2220	2005	2007	2000	2100	2103	2200	2240	1471	2342	2300		2024
3.5	2815	2692	2482	2300	2405	2402	2014	2007	2019	20/2	205	2702	2858	2901
10.0	3132	2002	2041	2007	2100	2017	2007	2010	2800	3010	3004	3093	3:02	3193
10.5	3322	2002	2900	3007	3009	3112	3147	3183	3218	3204	32/0	3299	3338	3304
11.0	3411	3148	3180	3224	3202	3300	3310	3339	3309	3380	3390	340	3418	3425
11.5	3443	3320	3540	3300	3380	3400	3408	3417	3425	3433	3430	3440	3444	3440
12.0	3449	3400	3414	3422	3431	3439	3441	3443	3445	3448	3448	3448	3449	3450
12.3	3450	3430	3441	3443	3440	3448	3448	3449	3449	3450	3450	3450	3450	3450
13.0	3450	3447	3448	3448	3449	3450	3450	3450	3450	3450	3450	3450	3450	3450
13.5	3450	3449	3449	3446	3450	3450	3450	3450	3450	3420	3400	3450	3450	3450
14.0	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
14.5	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3400	3450
15.0	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
15.5	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
16.0	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
16.5	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
17.0	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
17.5	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
18.0	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
18.5	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
19.0	3450	3450	3450	.45C	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
19.5	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
20.0	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
20.5	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
21.0	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
21.5	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
22.0	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
22.5	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450

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

(1).	Total Installed Gross ISO Capacity of the Generation Facility /Wind Farm (MW/GWh)	48.3 MW
(2).	Total Annual Full Load Hours	3388
(3).	Average Wind Turbine Generator (WTG) Availability	97.0 %
(4).	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	240.81 GWh
(5).	Array & Miscellaneous Losses GWh	12.006 GWh
(6).	Availability Losses GWh	7.2243 GWh
(7).	Balance of Plant Losses GWh	7.2243 GWh
(8).	Annual Energy Generation (20 year equivalent Net AEP) GWh	167.72 GWh (P75)
(9).	Net Capacity Factor	38.29%

#### 9. <u>Health and Safety</u>

- 9.1. During the construction and operation of the Project, the guideline of "safety first, (accident) prevention foremost" will be practiced. Comprehensive management and supervision will be applied to all staff members and the whole operation process, in order to ensure safe operation of the equipment and personal safety of workers.
- 9.2. The Company shall ensure that the EPC Contractor shall take all due precautions to ensure the safety of its employees, agents and subcontractors and, in collaboration with and to the requirements of the local health authorities, to ensure that suitable arrangements such as medical staff, first aid equipment and stores, sick bay and suitable ambulance services are available at all times throughout the period of the construction period as necessary and that suitable arrangements are made for all necessary welfare and hygiene requirements.



9.3. According to laws, regulations and rules related to safe production and occupational health, the EPC Contractor has established regulatory framework on occupational health, safety and environment protection. Its principals include "Safety First, Prevention Foremost, and Comprehensive Approach", "People-oriented, Safety Development", "Who takes charge shall take responsibility, and who takes charge of safe production shall take responsibility of safety", "dual-responsibilities for Party and governance" and "Punishment by responsibility; call account by duty dereliction; liability exemption by full duty". It keeps performing "no development without safety production; all involvement; start from me; be responsible for the safety for all", and builds safety management mechanism about "all-involvement, all-round and all-process", professional management and public surveillance.

#### 10. Environmental Impact

#### Lifespan of the Wind Farm

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

#### 11. Additional Annexes

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

#### 12. Evidence/relevant correspondence

- 12.1. The Applicant would be pleased to provide any other assistance that the learned Authority may require in the matter of grant of Generation License.
- 12.2. This Application and its Annexes are being submitted in triplicate, with certain documents certified as necessary, each in accordance with Regulation 3(4) of the AMP Regulations.

#### 13. Additional Grounds

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



#### 14. <u>Prayer</u>

- 14.1 It is most humbly prayed to the esteemed Authority as follows:
  - (i) That the Applicant be granted a Generation License for the development of the Project
  - (ii) That the terms of the Generation License may kindly be made consistent with the terms of the GoP concession documents.
  - (iii) That the Authority may be pleased to treat the Applicant's request for the grant of Generation License on a non-discriminatory basis and any concession offered to comparable projects on the date of filing of this Applicant and at any stage subsequent to the grant of license may kindly be granted to the Applicant as well.
  - (iv) Any further and better relief that the Authority may deem appropriate in the circumstances may kindly be granted to the Applicant.

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

Respectfully submitted for and on behalf of the Applicant:

Limi Sincerely, Trans Atlantic Er 10<sup>th</sup> June 2016

# VAKALATNAMA

I Waqas Anwer Qureshi of Trans Atlantic Energy (Pvt.) Limited (the "Company"), hereby appoint and constitute M/s MR. NADIR ALTAF, MR. MUSTAFA MUNIR AHMED, MS. SAIRA KHALID and MS. NOREEN IQBAL of RIAA BARKER GILLETTE, Advocates and Corporate Counsellors, to appear and act for us as our advocates in connection with the processing, presentation of the Company's Application for the Generation License (the "Application"), in connection with the Application for the Company in respect of the Company's 50 MW Wind Power Project in the province of Sindh (the "Project").

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

ACCEPTED SIGNATURE Received by us: nd From:

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







## SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

### CERTIFICATE OF INCORPORATION

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

Company Registration No. 00000011018/20050507

I hereby certify that <u>TRANS\_ATLANTIC\_ENERGY (PRIVATE)\_LIMITED</u> is this day incorporated under the Companies Ordinance, 1984 (XLVII of 1984) and that the company is limited by <u>Shares</u>.

Given under my hand at Karachi this 24th day of May two thousand and five.

Fee Rs. 7.000/- (Seven Thousand Only)

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(TAHIR MAHMOOD ) ADDITIONAL REGISTRAR OF COMPANIES CALL REPORT OF A REAL PROPERTY OF A REAL PROPERTY OF A REAL PROPERTY OF A REAL PROPERTY OF A REAL PROPERTY OF A

S. No: 13831. 01-2

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**COMPANY LIMITED BY SHARES** (INCORPORATED UNDER THE COMPANIES ORDINANCE, 1984)

# MEMORANDUM

And

# **ARTICLES OF ASSOCIATION**

Of



# TRANS ATLANTIC ENERGY (PRIVATE)LIMITED



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# COMPANY LIMITED BY SHARES

# (INCORPORATED UNDER THE COMPANIES ORDINANCE, 1984)

MEMORANDUM OF ASSOCIATION





# COMPANY LIMITED BY SHARES (INCORPORATED UNDER THE COMPANIES ORDINANCE, 1984)



#### MEMORANDUM OF ASSOCIATION

# TRANS ATLANTIC ENERGY (PRIVATE) LIMITED

I. The Name of the Company is Trans Atlantic Energy (Private) Limited.

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

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Itants

To carry on the business of Collection Agency, Ante

ects for which the Company is established are :-

Standing, Public Relationing, Management Consultants, Security Services, VIP seminars, Public Relationing, Managing Business, Centers, arranging seminars, conferences, building maintenance, fire services, function and health services;

2. To carry on the business of Tax Advisors, Trade Mark Advisors, Counterfeit and Infringement Detection Agency.

act as Consultants, Business Advisors and Human Resources

Aidech. To carry on the business of courier, running or express messenger, dispatch river and flyer services and to carry out all the ancillary activities therewith including carriage by air, land and sea and rapid desk to desk delivery of dutiable and non-dutiable commercial value shipments, complete handling of all documentation and different types of goods, freight, loading, un-loading, clearing and storing and forwarding of goods, pick up and delivery of carriage-able goods, including cargo service and warehousing facilities for the said purposes.

5. To transact or carry on all kinds commission, contract and agency business except managing agency in Pakistan or abroad and to act as Sales Representatives, Distributors, Consultants or Agents of all types of raw materials, machinery and equipment of all types, finished or semi-finished goods whether within the country or outside the country.

-: 3 :-

6. To carry on all or any part of the business of importers, exporters, stockiest, manufacturers, buyers, sellers of and to otherwise deal in chemicals, metals, plastics, resins machinery, equipments, produce goods, finished consumer goods, industrial goods, raw materials, agricultural produce and feed products, fibers, petroleum products, oils, cosmetics, medicines, paints, varnishes, paper and boards, electrical materials and instruments, construction materials, transport equipments, electric energy etc.

7. To acquire from any government, state or authority licenses, concessions, grants, decrees, rights, powers and privileges or other form of statutory or official authority whatsoever which may seem to the Company capable of being turned to account and to hold, use, explore, survey abandon, deal with, dispose off all or any part thereof.

8. To enter into and execute contracts of all kinds for the supply of goods or materials with any department of the Central or Provincial Government or any local or public authority or any other person or persons.

9. To enter into collaboration with any other person or company, Pakistani or foreign, by obtaining participation in and/or acquisition of technical know how, on such terms and conditions as the company may deem fit and proper.

10. To promote, acquire and undertake all or any liabilities or assets of any person or company, incorporated or not, carrying on business, which the Company is authorized to carry on and which is, directly or indirectly, calculated to benefit the Company.

11. To establish and manage the business of advisers and consultants of and erection of plant and machinery and provide maintenance services for such plant and machinery. 12. To carry on the business of exports and imports of all kinds of goods, commodities, Equipment & Machinery and merchandise from and to all countries of world.

13. To carry on business as agents, selling agents, exclusive agents for any person, firm or company, local or foreign, except Managing Agency.

14. To establish and run agro-based industries including agricultural farms, poultry farms, cattle farms, Cow and Buffalo farm.

15. To grow, purchase, prepare, preserve, pack, dry and fresh fruits and vegetables.

16. To provide and assist in providing of technical, commercial and managerial advice or assistance to any agricultural, commercial and industrial projects, undertaking or enterprise.

17. To establish, manage and run Hotels and Westing or anywhere in Pakistan.

18. To establish and carry on the business of Travel Agents, Tour operators in Pakistan and other countries

19. To guarantee the contracts of or otherwise assist any other company, firm or person, and to purchase, take or otherwise acquire, shares and securities of any such company, firm or person without indulging in the business of an investment company.

20. To enter into any arrangement or contract with any Government or Authority, Supreme, Municipal, Local or otherwise, that may seem conductive to the Company's objects or any one of them.

21. To advise and provide assistance to Government and industry in the selection, erection, installation and commissioning of requisite plants, equipment, apparatus and other facilities.

22. To develop information system relating to processes, plants and engineering products for industry or Government.

23. To establish branches or agencies for carrying on the business of the Company in and outside Pakistan and to employments for running such branches or agencies.

24. To purchase or otherwise acquire and hold shares in any other company in Pakistan or outside Pakistan having objects wholly or partially similar to those of this Company or carrying on any business capable of being conducted, directly or indirectly, to the benefit of the Company, without indulging in the business of investment Company.

25. To transact or carry on all kinds of agency business and in particular in relation to electrical, mechanical and industrial activities of all description and to act as agents, manufacturer's representative or exclusive agents of any person, firm, company, Government or Authority without doing the business of managing agency.

26. To make and arrange the supply of designs. drawings and specifications to machinery sections/components to industry or Government.

27. To produce designs, drawings and specifications requisite for new projects.

28. To enter into any agreement for sharing profits, font ventures, reciprocal concessions and other arrangements of like nature with any other person, company, Government or Authority.

.29. To enter into partnership or arrangement in the nature of partnership, cooperation or union or interest with any person or persons, company or corporation, Government or other Authority engaged or interested or about to become engaged or interested in carrying on or conduct of any business or enterprise which the Company is authorized to carry on or conduct or from which the Company might desire any benefit whether direct or indirect.

30. To amalgamate with or to work in association with any other company or firm having objects altogether or in part similar to those of the Company.

31. To cause the Company to be registered or recognized in any foreign country.

32. To enter into any arrangement for sharing profits, union of interest, cooperation, joint venture, reciprocal concession or otherwise, with any person or company carrying on or engaged in, about to carry on or engage in any business or transaction which the company is authorized to carry on and to advance money to guarantee the contract of or otherwise acquire shares and securities of any such company, and to sell, hold, re-issue with or without guarantee otherwise deal with the same, subject to permission, if any, required under law.

33. To borrow money in such manner as the Company shall think fit, and to secure the repayment of any money borrowed, raised or owing, by mortgage, charge upon all or any of the property or assets, present and future, of the Company.

34. To carry on the business of manufacturers sellers, importers and exporters and suppliers of goods or consumers of every kind and description.

35. To undertake the provision of any and all services conducive to improving the working and living environment of the people in Pakistan.

36. To export and import, to manufacture, purchase and prepare for market and generally deal in merchandise of every kind and description.

37. To manufacture, buy, sell, deal in and use products of whatever nature and all articles and things used in the manufacture, maintenance and working thereof, and also all apparatus and implement and things for use either alone or in connection with the products of which they are ingredients, or in the manufacture of which they are a factor.

38. To purchase or otherwise acquire, sell, supply, Market, Estribute exchange, or otherwise dispose of, import, export, store, hod package transport, use, experiment with, handle trade, dispense, acoly and generally deal in products of whatever nature, and so far as may be conducive to the attainment of the objects of the Company or convenient or advantageous in connection therewith.



39. To purchase, charter, hire, build or otherwise acquire vehicles of any or every sort or description, and to use the same for the carriage of passengers or goods of all kinds, and to carry on the business of owners and carriers in all or any of its respective branches.

40. To construct, own, purchase, acquire, lease, build, erect, install, establish, operate, manage and maintain plants, laboratories, equipment, apparatus and other facilities for the experimentation manufacture, processing, storage sale and distribution of all or any products whatsoever.

41. For the purposes of the business of the Company to purchase or otherwise acquire, become interested in, deal in and with, invest in, hold, sell, mortgage, pledge or otherwise dispose off turn to account or realize upon, all forms of securities, including shares, stocks, bonds, debentures, notices evidence of indebtedness, securities of any nature or form convertible into or exchangeable for other securities of any nature or form, certificate of interest, participation certificates, botting bust certificates and certificates evidencing shares of or interest in trust and other instruments, securities and rights.

42. To investigate and report with respect to such to undertake, carry on, aid, assist or participate in the organization, inquidation or reorganization, of commercial, mercantile, manufacturing, industrial or other business concerns, firms, association and corporations.

43. To institute, participate in or promote commercial, mercantile and industrial enterprises and operations.

44. To buy, sell, manufacture, store, repair, alter, improve exchange, hire, import, export the deal in all factories, works, plants machinery, tools, utensil, appliances, apparatus, products, materials, substances articles and things capable of being used in any business which this Company is competent to carry on or required by any customers or persons dealing with the Company or commonly dealt with by persons engaged in any such business or which may seem capable of being profitably dealt with in connection therewith and to manufacture, experiment with, render marketable and deal in all products of residue



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and by-products incidental to or obtained in any of the business carried on by the Company.

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45. To purchase, take on lease or tenancy or in exchange hire take options over or otherwise acquire for any estate or interest whatsoever and to hold, develop, work, cultivate deal with, dispose off and turn to account concessions, grants, decrees, licenses, privileges, claims, options lease property, movable or immovable or rights or powers of any kind which may appear to be necessary or convenient for any business of the Company or for purposes of investment or re-investment.

46. To aid any government or state, or any municipal or corporate, or company, or association, or individuals, with capital, credit, means or resources for the execution of any works, undertakings, projects, or enterprises.

47. To provide, the industrial working classes with commodious and healthy lodgings and dwellings.

48. To advertise all or any of the business or manufacture and goods of the Company in any way that may be thought advisable, iraluding the posting of bills in relation thereto, and the issue of books, panphlets and price lists, and the conducting of competitions, and the giving of prize thereof.

49. To obtain all powers and authorities necessary to carry out or extend any of the above objects.

50. To support and subscribe to any charitable or public object including donations to charitable and benevolent foundation and any institution, society or club or for any purpose which may be for the benefit of the Company or its employees, or may be connected with or for the benefit and welfare of any town or places where the Company carries on business to give pensions, gratuities or charitable aid to any persons who may have been directors of or may have served the Company, or the wives, children, or other relatives or dependents.

51. To enter into any arrangement and to take all necessary or proper steps with the Government of Pakistan and with the approval of the



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Government of Pakistan where required, with any provincial government or public authority, in local, municipal or otherwise or with any corporation or private persons or all or any of these for the purposes of directly or indirectly carrying out the objects of the Company or effecting any modification in the constitution of the Company or furthering the interest of the company and to oppose any such steps taken by any other authority, firm or person which the Company considers likely, directly or indirectly, to prejudice its interest, and to obtain or endeavor to obtain from any such governmental or other public authority any charter of the contracts, decrees, rights, grants, loans, subsides, privileges, concessions, indemnities, sanctions or consents as the Company may think preper.

52. To distribute all or any of the property of the Company are ongst the member in specie or kind, but so that no such distribution shall nount in to any unlawful reduction of capital.

53. To subscribe or guarantee money for any national charitable, benevolent, public, general or useful object or for any exhibition

54. To setup, acquire, produce, manufacture, treat pourify, store, transport, market, distribute, supply, sell and otherwise dispose of and generally trade in any and all kinds of independent power plants/projects and/or acquire and take over the running or likely to be running business of alike nature with or without assets, liabilities, rights, privileges, goodwill, registration, trade mark, import and export registration, or any other facilities.

To purchase or otherwise acquire, produce, manufacture, refine, treat, purify, blend, reduce, distil, store, transport, market, distribute, supply, sell and otherwise dispose of and generally trade in any and all kinds of petroleum and petroleum products, oils, gas, hydrocarbons, petrochemicals, asphalt, bituminous substances and the products and byproducts, which may be derived, produced, repaired, developed, compounded made or manufactured there from and or acquire and take over the running or likely to be running business of alike nature with or without and export registration, or any other facilities.

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56. The business of oil and petroleum, fabricate, contract, erect, lay, and manufacturers of plant, machinery and apparatus for oil and petroleum, gas and chemical installations and to purchase or otherwise acquire, produce, manufacture, refine, treat, purify, blend, reduce, distil, store, transport, market, distribute, supply, sell and otherwise dispose off and generally trade in any and all kinds of petroleum and petroleum products.

57. To carry on the business as petroleum engineers, providing consultancy services, preparation of feasibilities for all sorts of petroleum related industries and to manufacture, buy, sell, import, export and to deal in all sorts of oil field equipments.

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58. To refine, process, formulate, produce, buy, sell, export, import, indent or otherwise deal in all types of chemicals, petro-chemicals and petroleum industry or any material used or capable of being used in the petro-chemical industry, industrial chemicals or any mixtures, derivatives and compounds thereof.

59. To set up, install, erect, establish, run, cortol, manage and operate an industrial undertaking, including power plants and for the manufacture, production, formulation and blending of lubrating oils any where in Pakistan.

60. To set up, install, erect, establish, run, control, manage and operate an industrial undertaking for the production of electricity an other related fields any where in Pakistan.

57. To own prospect for, explore, acquire by lease, license or otherwise, open work, develop and maintain natural deposits of gas, petroleum and other mineral and chemical substances of all kinds and to carry on and conduct the business of working, obtaining and supplying to other persons such gas, oil, petroleum, and other substances.

> own prospect for, explore, acquire by lease, license or otherwise, develop and maintain electric supply of all kinds and to carry



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on and conjuct the Business of working, obtaining and supplying to other persons the same

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62. 63. To buy, import, export, indent, stock, contract, tender, distribute, acquire, secure and grant agency, distribution rights, representations and trade in or deal in any manner in gases of all kinds and gas plant, machinery, instruments, implements, appliances, equipments, tools, dies, presses and apparatus.

63. 64. To carry on the business of contractors, suppliers and manufacturers of electricity supply, gas regulators and component parts l' of gas appliances and all other buildings and works, meters, pipes fittings, machinery, apparatus, convenient or necessary for the purposes of the Company.

65. To carry on business and obtain appropriate licenses for supply of electricity, exploration of oil and gas etc. on such terms and conditions as the Company may think proper, subject to any permission/as required under the law.

To carry on and undertake trading business of all sorts and to act as indenters, importers, exporters, traders, suppliers, and commission agents of products, commodities and materials in any form of shape manufactured or supplied by any company, firm, association of persons, body, whether incorporated or not, individuals, Government, Semi-Government or any local authority.

67. To apply for, tender, offer, accept, purchase or otherwise acquire any contracts and concessions for or in relation to the projection, execution, carrying out, improvements, management, administration or control of works and conveniences and undertake, execute, carry out, dispose of or otherwise turn to account the same.

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Covernment Semi-Government Agencies, Armed Forces, Army, Military DF Defentse and to act as commission agents, indenters, traders, general merchants, wholesalers retailers, dealers, distributors, stockists in any



goods of products of within the scope of the object of the Company and subject to any permission required under the law.

69. For earry on in or outside Pakistan the business of manufacturers, importers, exporters, indentors, transporters, dealers in all articles and commodities akin to or connected with any of the business of the Company capable of being conveniently carried on or necessary for the promotion of the objects herein contained, as permissible under law.

To carry on business and obtain licenses for shipping agents, clearing and forwarding agents, purchasing and indenting agents, selling agents, (except managing agent) on such terms and conditions as the Company may think proper, subject to any permission as required under the law.

69.

To carry on agency business (except managing agency) and to acquire and hold selling agencies and to act as selling agents, commission agents, manufacturers' representatives and distribution of and for the distribution of all kinds of mertrandise. goods, commodities, products, materials, substances, articles and the whether finished, semi-finished, raw, under process, refined, treated of otherwise vertaining to trade and commerce and for that purpose to remunerate them and to open and maintain depots and branches.

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

73. To acquire by concession, grant, purchase, barter, license either absolutely or conditionally and either solely or jointly with others any lands, buildings, machinery, plants, equipments, privileges, rights,



licenses, trade marks, parents, and other movable and immovable property of any description which the Company may deem necessary or which may seem to the Company capable of being turned to account, subject to any permission as required under the law.

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73. 74. To act as representatives, for any person, firm or company and to undertake and perform sub-contracts, and also act in the business of the Company through or by means of agents, sub-contractors and to do all or any of the things mentioned herein in any part of the world and either alone or in collaboration with others and by or through agents, subcontractors or otherwise.

75. To go in for, buy or otherwise acquire and use any patent design, copyright, license, concession, convenience, innovation, invention, trade marks, rights, privileges, plants, tools or machinery and the like in Pakistan or elsewhere, which may for the time being appear to be useful or valuable for adding to the efficiency or productivity of the Company's work or business, as permissible under the law

75. To acquire and carry on all or any part of the business or property and to undertake any liabilities of any person, firm, association or company's possession of property suitable for any of the purposes of the Company or carrying on any business which this Company is authorized to carry on and in consideration for the same, to pay cash or to issue shares of the Company.

76 71. To enter into arrangements with the government or authority (supreme, municipal, local or otherwise) or any corporation, company or persons that may seem conducive to the Company's objects or any of them and to obtain from any such government, authority, corporation, any charters, contracts, rights, privileges and company or Derson. the Cop commissig pany may think desirable and to carry on th are exercise/and such charters, contracts, decrees, rights, privileges and conce ີນໂດກຣ.

78. To enter into partnership, to annalgamate or merge movable with immovable and // or to buy on all interests, assets, liabilities, stocks or to

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make any arrangement for sharing profits, union of interests, cooperation, joint-venture, reciprocal concession or otherwise with any person, firm or company carrying on or proposing to carry on any business which this Company is authorized to carry on or which is capable of being conducted so as directly or indirectly to benefit this Company and to have foreign collaborations and to pay royalties / technical fees to collaborators, subject to the provisions of the Companies Ordinance, 1984.

79. To engage into such other business as the board may decide in the best interest of the company.

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

**80**. **81**. To establish and **pastitute precencies**, consultancies, distributorships, representations maintain branches or depots and to carry on business on any part of perkistan **data** by parts the world, and to take such steps as may be necessary to give the Company such rights or privileges in any part of the world as are **forsessed** by local corporations or partnership firms as may be thought best.

**BZ**. To pay costs, charges and expenses of an incidental nature to the formation and registration of the Company. **B2**.

83. To open bank account of the Company and to draw, make, accept, endorse, execute, issue, negotiate and discount cheques, promissory notes, bills of exchange, bills of lading, warrants, deposit notes, debentures, letter of credit and other negotiable instruments and securities, concerning the business of this compare.

To manage improve develop, sell, exchange, mortgage, pledge, hypothecate, assign, transfer) deliver, dispose off, turn to account or otherwise deal with all or any part of the property and assets, movable or immovable, tangible or intangible and any right, title and interest of the



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ncluing rights, licenses, concessions and franchises as

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To pay out of the funds of the Company all expenses which the Company making fully pay with respect to the formation, promotion and registration of the Company or the issue of its capital.

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**85 86**. To pay for any rights or property acquired by the Company and to remunerate any person or any company, whether by cash payment or by the allotment of shares of the Company.

86. 87. To distribute among the members in specie any property of the Company, or any proceeds of sale or disposal of any property of the Company but so that, no distribution amounting to a reduction of capital be made except with the sanction (if any) for the time being required by law.

88. To arrange local and foreign currency loans from scheduled banks, industrial banks and financial institutions for the purpose of purchase, manufacture, market, supply, export and import of machinery, construction of factory, building and for the purpose of working casilal or for any other purpose.

88. To invest and deal with the surplus money of the Company not immediately required in such manner as may, from time to time, be determined by the directors without indulging, in investment company function.

**87 90**. To make advance of such sum or sums of money upon or in respect of or for the purpose of raw materials, goods, machinery, stores or any other property, articles and things required for the purpose of the Company upon such terms with or without security as the Company may deem expedient.

91. To make donations to such persons or institutions in each or in any other assets as may be thought, directly or indirectly, conducive to any of the company sobjects or otherwise expedient.

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Company

person for introducing business to the
93. The establish and support or aid in the establishment and support of any fund and/or trust for the penefit of the employees.

94. To create any Beserve Fund, Sinking Fund, Insurance Fund or any other special fund whether for depreciation or for repairing, improving, extending or maintaining any of the property of the Company or for any other purposes conducive to the interest of the Company.

**95**. To distribute the profits as dividend or bonus among the members or to place, to reserve or otherwise to apply as the Company, may from time to time, think fit.

96. To borrow or raise money by means of loans or other legal arrangements from banks, or other financial institutions, or Directors in such manner as the Company may think fit and in particular by issue of debentures, debenture stock, perpetual or otherwise convertible into shares and to mortgage, or charge the whole or any part of the property or assets of the Company, present or the property or assets of the Company, present or the property or the same absolutely or the trust as may seem expedient and to, purchase, redeem or part of any successful any seem expedient and to, purchase, redeem or part of any successful and to a successful any successful any seem expedient and to be a successful any successful any successful any successful any successful any successful and to be a successful any successful

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

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**96**. **98**. To give any servant or employee of the Company commission in the profits of the Company's business or any branch thereof and for the purpose to enter into any agreement or scheme of arrangement as the Company may deem fit and to procure any servants or employees of the Company to be insured against risk of accident in the course of their employment by the Company.

99. To establish and support or aid in the establishment and support of associations, institutions, funds and conveniences calculated to benefit persons who are or have been Directors of or who have been employed by



or who are serving of have served the Company or any other Company which is a subsidiary or associate of the Company or the dependents or connection of such solutions and to grant pensions, gratuities, allowances, relief and payments in any other manner calculated to benefit the persons described herein.

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

97. 101. To guarantee the performance of contract and obligations of the Company in relation to the payment of any loan, debenture-stock, bonds, obligations or securities issued by or in favour c' the Company and to guarantee the payment or return on such investments.

102. To carry out joint venture agreement of the objects of the Company. 103. To cause the Company to be registered or recognised in any foreign country. 104. To do and perform all other acts and things is are incidental or conducive to the attainment of the above objects or any of them.

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

106. It is declared that notwithstanding anything contained in the foregoing object clauses of this Memorandum of Association nothing contained therein shall be construed as empowering the Company to undertake or to include in business of banking company, banking,

And it is hereby expressly declared that in the interpretation of the 108. above paragraphs, the objects of the Company described in various subparagraphs, and power exercisable by the Company in pursuance thereto shall not be limited or restricted (unless it is expressly so stated) by reference to any sub-paragraph or to the name of the Company or by the order in which the various objects are described or by juxtaposition of two or more of the facts and every part of this paragraph shall be constructed in the way to widen and not to restrict powers of the Company.

106. The company shall not engage in banking business, business of an investment company, Non-Banking Finance Company, leasing company and insurance company, business of managing agency or any unlawful business and nothing in object clauses shall be construed to entitle company to engage in such business, directly or indirectly. The company Alsiant city launch multilevel marketing, pyramid and ponzi schemes.

The liability of the members is limited

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operation/business.

The capital of the Company is Rs. 10,000,000 (Ruper only) divided into 100,0 Ordinary Shares of RA 10 ea Company shall have power to increase or reduce the cap accordance with the Articles of Association of the Company subject to any restriction under the law.

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



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NO.OF NAME & SURNAME SHARES OCCUPATION 5 NATIONALITY RESIDENTIAL FATHER'S NAME TAKEN BY SIGNATURE & Former OF ADDRESS يسر. تنهر (Present & Former) EACH SUBSCRIBER NATIONALITY 8,4931,48 (in block letters) SUBSCRIBER BLOCK B-121 H SYED FAISAL NORTH NAZIMABAD, BUSINESS PAKISTAN AHMED JAFRI **KARACHI** :1. 42401-4090581-5 B-121 BLOCK Н NORTH NAZIMABAD, Shajeeya Jafri PAKISTAN HOUSEWIFE KARACHI -1-42301-8670193-C

KARACHI: Dated : 17-05-2005

Witness to the above Signatures:

Bashir Ahmed Khan (Advocate High Court) Son of Faquir A. Khan Occupation : Advocate High Court

Full Address: Mansoor Ahmad Khan & Co. Advocates & Legal Consultants F-2/3 Block 8 Kehkashan, KDA Scheme-V, Clifton, Karachi-75600.

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KAS0505/Memorandum-Association-Transatlantic final

#### THE COMPANIES ORDINANCE, 1984

# ARTICLES OF ASSOCIATION

OF

# TRANS ATLANTIC ENERGY (PRIVATE) LIMITED

## PRELIMINARY

1. The Regulations in Table 'A' in the First Schedule to the Companies Ordinance 1984, shall not apply to the Company except in so far as they are repeated or contained in these Articles.

2. In these Articles, unless there be something in the subject or context inconsistent therewith:-

. "The Ordinance" means the Companies Ordinance 1984, as amended and now in force in Pakistan and any amendment or enactment thereof for the time being in force.

"The Articles" means these Articles of Association as originally framed or as from time to time altered by Special Resolution.

"Special Resolution" has the meanings assigned thereto respectively by Section 2(1)(36) of the Ordinance.

"The Company" means Trans Atlantic (Private) Limited.

"Member" means member of the Company in accordance with the provisions of Section 2(1)(21) of the Ordinance.

"The Directors" means the Directors for the time being of the Company or the Directors present at a duly convened meeting of Directors at which a quorum is present.



"The Secretary" means the Secretary for the time being of the Company.

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"The Office" means the Registered Office for the time being of the Company.

"The Register" means the Register of members to be kept pursuant to Section 147 of the Ordinance.

"The Seal" means the Common Seal for the time being of the Company.

"Month" means the calendar month.

"Proxy" includes an attorney duly con attorney.

"In writing" and "written" inducties printing, other modes of representing or form.

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

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Words importing the masculine gender include the feminine gender.

Words importing persons include Corporations.

## PRIVATE COMPANY

3. The Company is a Private Company within the meaning of clause 28 of Section 2 (1) of the Companies Ordinance, 1984 and accordingly:-

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



(b) The number of the member of the company (exclusive of persons in the employment of the company) shall be limited to fifty provided that for the purposes of this provision when two or more persons hold one or more shares in the company jointly they shall, for this purpose, treated as a single member;

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

#### **BUSINESS**

4. The business of the Company shall include all or any of the objects enumerated in Memorandum of Association and can be commenced immediately after the incorporation of the Company as the Directors may think fit, notwithstanding that only parts of the capital has been subscribed.

ABACHI (Rupees The Million only) divided into 100,000 Ordinary Shares of PS. 10/04 (Rupees One Handbed) each.

6. The Directors may with the sanction of the Company in General ARA Meeting, increase the share capital by such sum as they may think fit, to be divided into shares of such amount as the resolution may prescribe

7. Where the Directors decide to increase the Capital of the Company by the issue of further shares such shares shall be offered 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 Member is entitled and limiting a time within which the offer, if not accepted, will be deemed to be declined, and after the expiration of such time or on receipt of an intimation from the member to whom such notice is given that he declines to accept the shares offered, the Directors may dispose of the same in such manner as they think most beneficial to the Company.

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8. Except so far as otherwise provided by the conditions of issue or by these presents any Capital raised by the creation of new shares shall be considered part of the original capital and shall be subject to the provisions herein contained with reference to transfer and transmission, surrender, voting and otherwise.

The Company may from time to time by Special Resolution reduce 9. 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 shares or otherwise as may seem expedient and capital may be paid off upon the footing that it may be PANY REGIS up again or otherwise, and paid up capital may be cap without reducing the nominal amount of the shares by the mount lo the intent that the unpaid and callable capital shall be increased by the like 新設用におけ amount subject to Section 96 and 97 of the the inance

#### SHARES

10. Subject to the provisions of the Ordinance, these Articles and any special directions by the Company in General Meeting, the shares shall be at the disposal of the Directors who may allot or otherwise dispose of the same subject to Section 86 of the Ordinance to such persons on such terms and conditions and at such times as they think fit.

11. 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.



12. Shares may be registered in the name of any Limited Company or other Corporate Body but not in the name of a minor. Not more than four persons shall be registered as joint holders of any shares.

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13. 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.

14. In the case of the death of any one or more of the persons named in the Register as the Joint Holders 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 shares, but nothing herein contained shall be taken to release the estate of a Joint Holden row liability on shares held by him jointly with any other person.

15. Except to the extent permitted by Section 95 of the Ordinance, no part of the Funds of the Company shall be employed in the purchase of any Shares of the Company, and the Company shall not give, whether directly or indirectly, and whether by means of a loan, guarantee, the provisions of security or otherwise, any financial assistance for the purpose of or in connection with a purchase made or to be made by any person of any Shares of the Company or give any loan upon the security of any Shares of the Company.

16. Every Shareholder shall name to the Company a place to be registered as his address and such address shall for all purposes be deemed to be his place of residence.

#### **CERTIFICATE**

17. Every person whose name is entered as a 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 upon payment of such



charges, if any, as the Directors may determine for every Certificate after the first.

-: 6 :-

18. The Certificates of Title to Shares shall be issued under the Seal of the Company.

19. The Company shall not be bound to issue more than one 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.

20. The Company shall within three months after the allotment of any of its Shares, and within three months after the registration of the transfer of any such Shares, complete and have ready for delivery the Certificates of all Shares, allotted or transferred, unless the conditions of issue of the Shares otherwise provide 1973

21. If any pertificate between our defaced, destroyed or lost or if there is no further space on the back thereoff or endorsements of transfer, it may be renewed a replaced on payment of such sum, not exceeding two rupees, as the provided and the time to time prescribe, provided, 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 indenunity as the Directors may deem adequate in case of Certificate having been lost or destroyed. Any renewed Certificate shall be marked as such.

#### TRANSFER OF SHARES

22. No ordinary share shall be transferred by a member or other person entitled to transfer to any member selected by the transferor, but may be transferred in the manner provided by these Articles and no other.

23. The member or person proposing to transfer any ordinary shares (hereinafter called the proposing transfer) shall give notice in writing (hereinafter called the transfer notice) to the Company that he desires to Indiana Indian Indian Indian Indian Indian Indiana Indiana Ino transfer the same. Such notice shall constitute the Company his agent for the sale of the share to any person as the Directors may decide to substitute for him PROVIDED that the person so substituted shall be a financial institution or a private person, according as the out-going member was a financial institution or a private person.

24. The Company shall, after being served with such notice, find a person, selected as aforesaid, willing to purchase the share (hereinafter called the purchasing member) and shall give notice thereof to the proposing transferor, who shall be bound, upon payment of the agreed price or fair value, to transfer the shares to the purchasing member.

The fair value aforesaid shall be ascertained as follows:-

25

- (a) The Company in general mean with from time to time by resolution passed by majority to not less than three-fourths in value of the holders of shares shares and entitled to vote declare the fair value of shares.
- (b) Such resolution shall remain in force until the expiration of one year after the passing thereof or for such less period as shall be specified therein.
- (c) If at the time when a transfer notice is given, as aforesaid any such resolution fixing the fair value is in force, the fair value fixed thereby shall be deemed to be the fair value of shares comprised in such transfer notice.
- (d) If at the time when a transfer notice is given, as aforesaid no such resolution is in force and the proposing transferor and the purchasing member are unable to agree as to the fair value of the shares, the Auditors of the Company shall on the application of either party certify in writing the sum which in their opinion is the fair value and in so certifying the Auditors shall be considered to be acting as experts and not as arbitrators and accordingly the Arbitration Act shall not apply.



26. If in any case the proposing transferor after having become bound as aforesaid makes default in transferring the share, the Company may receive the purchase money and shall thereupon cause the name of purchasing member to be entered in the register as the holder of the share, and shall hold the purchase money in trust for the proposing transferor. The receipt of the Company for the purchase money shall be a good discharge to the purchasing member, and after his name has been entered in the register in purported exercise of the aforesaid power, the validity of the proceedings shall not be questioned by any person.

27. Ordinary shares specified any transfer notice to the Company pursuant may be offered to the members in the proportion of their respective holdings or as near thereto as possible. If any member is not ready and willing to take up the shares offered to him or any of them they shall be offered to the remaining members again in the proportion of their respective holdings and if no member is ready thready the Directors as one shares, they may be offered to any person selected by the Directors as one whom it is desirable in the interest of the Company to admit to membershipt.

28. The Directors may at their absolute and uncontrolled discretions decline to register any transfer of shares and shall not be bound to give the shares and shall not be bound to give the shares and shall not be bound to give the shares and shall not be bound to give the shares the shares and shall not be bound to give the shares the shares the shares the shares and shall not be bound to give the shares the shares the shares and shall not be bound to give the shares t

29. If the Directors refuse to register the transfer of any shares they shall within one month from the date on which the transfer as lodged with the Company send to the transferee and the transferor notice of such refusal.

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

31. The instrument of transfer of any shares shall be in the usual common form or in the following form or as near thereto as circumstances will admit.

\_\_\_\_\_ of \_\_\_\_\_ in consideration I, of the sum of Rupees \_\_\_\_\_ paid to me by of \_\_\_\_\_\_ transfer to the transferee the sluares numbered \_\_\_\_\_\_ to the undertaking called inclusive in \_\_\_\_\_ to hold unto the transferee, his executors, administrators and assigns, subject to the several conditions on which I held the same immediately before the execution hereof and I, the transferee do hereby agree to take the said share (or shares) subject to the conditions aforesaid. As witness four? hands the day of witness to the signature of etc

32. Every instrument of transfer shall be defined the Office for registration duly stamped 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 transferor or his right to transfer the shares. All instruments of transfer which shall be registered shall be retained by the Company, but any instrument of transfer which the Directors may decline to register shall, on demand, be returned to the person depositing the same.

33. Where it is proved to the satisfaction of the Directors that an instrument of transfer signed by the transferor and transferee has been lost, the Company, may, if the Directors 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 indemnity as the Directors may think fit.

34. A fee not exceeding Rupees ten may be charged for each transfer, and shall, if required by the Directors, be paid before the registration thereof.



35. The transfer, books and registers of members and debentureholders 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.

36. The successors-in-interest, executors or administrators of a deceased member shall give a notice of transfer to the Company and the shares, registered in the name of the deceased member, shall be transferred in the same manner and subject to the same conditions as would have been the case if the said member had applied for transfer if he were alive.

37. The shares of a deceased member shall in case of or event devolve on a successors-in-interest or be the subject matter for his executors or administrators except in so far as and to the stern of the determination of the price under Article 25 which shall be payable and be paid in respect of the said shares by the person non-instead by the Directors in regard to which choice no objection shall be intertained from the seal heirs, the executors or the administrators.

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

39. The Company shall incur no liability or responsibility whatever in consequence of their registering or giving effect to any transfer of shares made or purporting to be made by an apparent legal owner hereof 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 the Company 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.



-: 10 :-

## GENERAL MEETINGS

40. An Annual General Meeting shall be held within eighteen months from the date of incorporation subject to Section 158 of the Ordinance and thereafter once at least in each calendar year at such time and place within the town in which the registered office of the Company is situated as the Directors may determine and within a period of **example** following the close of the financial year and not more than fifteen months after holding of its last preceding annual general meeting. The Directors may how ever for special reasons change the venue at a place out of the town, after proper permission is sought from the Securities & Exchange Commission if Pakistan.

41. The Directors may, whenever they think fit, and they shall on the requisition of the holders of not less than 10, of the sued capital of the Company, forthwith proceed to compane an Extra an inary General Meeting of the Company and in case of such requisition, the provisions of Section 159 of the Ordinance shall apply.

#### NOTICE OF MEETINGS

42. If at any time there are not sufficient Directors capable of acting to form a quorum any Director may convene an Extraordinary General Meeting in the same manner as nearly as possible as that in which meetings may be convened by the Directors.

43. Subject to the provisions of Sections 158 and 159 of the Ordinance relating to Annual General Meeting and Extraordinary General Meeting, twenty one days notice at least of every General Meeting (Annual or Extraordinary) and by whomsoever called, specifying the place, the day, hour of meeting and in case of special business the general nature of that business shall be given in the manner hereinafter provided or in such other manner if any, as may be prescribed by the Company in General Meeting to such persons as are under the Ordinance or under these Articles 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 think fit.

44. The accidental omission to give notice of a meeting to or the nonreceipt of notice of a meeting, by any person entitled to receive notice shall not invalidate the proceedings at that meeting.

## PROCEEDINGS AT GENERAL MEETINGS

45. The business of an Annual General Meeting shall be to receive and consider the profit and loss account, the balance sheet and the reports of

e Directors and of the Auditors to elect Directors, to declare dividends and to appoint Auditors and fix their remuneration. All other business transacted at an Annual General Meeting and all business transacted at Extraordinary Meetings shall be deemed special

46. No business shall be transacted at any General Meeting unless a KARANI unless a KARANI unless a KARANI personally or present by proxy who represent not less than twenty five percent of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting shall be a quorum in the second personal statement of the total voting power at the meeting statement of the total voting personal statement of the total voting personal statement of the total voting personal statement of the total voting personal statement of the total voting personal statement of the total voting personal statement of the total voting personal statement of the total voting personal statement of total voting personal statement of total voting personal statement of total voting personal statement of total voting personal statement of total voting personal statement of total voting personal statement

are day in the next week at the same time and place and at the adjourned meeting the meeting the shall be q quorum.

48. The Chairman, if any, of the Board of Directors shall preside as Chairman of every General Meeting of the Company, or 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 their Members to be Chairman of the Meeting, or if no Director be present or if all the Directors present decline to take the chair, the Members present shall choose one of their Members to be Chairman of the meeting.



particular meeting, that meeting may be convened by such shorter notice and in such manner as those members may think fit.

44. The accidental omission to give notice of a meeting to or the nonreceipt of notice of a meeting, by any person entitled to receive notice shall not invalidate the proceedings at that meeting.

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46. No business shall be transacted at any General Meeting uncass a sublium of the bers is present at the time when the meeting proceeds to business three sumbers personally or present by proxy who represent not less than twenty five percent of the total voting power at the meeting shall be a duorum.

aorum is not present, the meeting if called upon requisition of members shall be dissolved, any 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 members present shall be q quorum.

48. The Chairman, if any, of the Board of Directors shall preside as Chairman of every General Meeting of the Company, or 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 their Members to be Chairman of the Meeting, or if no Director be present or if all the Directors present decline to take the chair, the Members present shall choose one of their Members to be Chairman of the meeting.



49. 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.

50. 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

- (a) by the Chairman of the meeting; or
- (b) by any member or members present in person or by proxy holding not less than one tenth of the issued capital which carries voting rights.

Unless a poll is so demanded, a decuration by the Chairman of the meeting that a resolution has on a chow of the deen 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 such resolution.

51. If a poll is duly demanded, it shall be taken in such manner and at such time as the Chairman directs, and the result of the poll shall be deemed to be the resolution of the meeting at which the poll was demanded.

52. 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.

53. 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 taking of a poll shall be the sole judge of the validity of every note tendered at such poll.



#### **VOTES OF MEMBERS**

54. On a show of hands every member present in person shall have one vote. On a poll every member present in person or by proxy shall have one vote in respect of each share held by him.

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

b. A Member of unsound mind, or in respect of whom an order has made by any Court having jurisdiction in lunacy may vote, whether on a show of hands or on a poll, by his committee or other legal guardian and any such committee or guardian may, on a poll, vote by proxy.

57. No Member shall be entitled to vote at any General Meeting unless all sums presently payable by him in respect of Shares in the Company have been paid.

-58. 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

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.

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

60. The instrument appointing a proxy shall be in writing under the hand of the appointer or of his attorney duly authorized in writing, if the appointer is a corporation, under its common seal or the hand of an officer or attorney duly authorized. A proxy need not be a Member of the Company.

61. 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 of authority, shall be deposited at the office not less



-: 14 :-

than seventy-two 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.

62. An instrument appointing a proxy may be in the following form or in any other form which the Directors shall approve:-

#### (Private) Limited

" I, \_\_\_\_\_\_ in the district of \_\_\_\_\_\_ being a Member of \_\_\_\_\_\_ (Private) Limited, hereby appoint of \_\_\_\_\_\_ as my proxy to vote for me and on my behalf at the annual or extraordinary (as the case may be) general meeting of the Company to be held on the \_\_\_\_\_ day of \_\_\_\_\_\_ and at any adjournment thereof.

Signed this \_\_\_\_\_ day of

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

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

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



-: 16 :-

Corporation attending a meeting through such representative shall be deemed to be present at the meeting in person.

66. The following are the first Directors of the Company:-

1. Syed Faisal Ahmed Jafri

2. Shajeeya Jafri

67. Each of the first Directors shall hold office for a period of three years unless he earlier resigns, becomes disqualified as a Director or <sup>1</sup> otherwise ceases to hold office.

68. The remuneration of the Directors shall from time to time be determined by the Company in General Meaning

69. A Director shall be a member of the company. There shall be a minimum of two Directors.

70. The qualification for becoming a Unrector shall be that he is a member of the Company.

71. No person, is eligible for election to the office of Director at any Annual General Meeting, unless he has been duly proposed by a share holder and he or his authorized agent, has at least seven (7) clear days before the meeting, left at the office a notice in writing under his hand or under the hand of such agent signifying assent to his candidature for the office of Director.

72. Retiring Directors shall be eligible for re-election.

73. Subject to the provisions of Section 178 of the Ordinance the Directors shall be elected by the members in the Annual General meeting from amongst the candidates eligible for election in the manner provided for in Section 178 (5).



74. Subject to the provisions of Section 181, at any time the Company may by a Resolution in a General Meeting, remove any Director of the Company before the expiration of his period of office, but no such resolution shall be deemed to have been passed if the number of votes cast against it is equal to or exceeds the minimum number of votes that would have been necessary for the election of a candidate as a Director at the preceding General Meeting at which the election of Directors took place.

75. Retiring Directors shall continue to perform their functions until their successors are elected.

76. A Director elected by the Members in the Annual 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 for being a Director or otherwise ceases to hold office.

77. A casual vacancy occurring among the Directors hay be filled up by the Directors, but a person so appointed shall hold office for the remainder of the term of the Director in whose place he is appointed. Before filling any casual vacancy on the Board, the Directors shall in writing notify their intention of filling such vacancy to the argumber or members if any, whose interest were represented by the Director vacating office and shall fix a term of not less than fourteen clear days during which such Member may recommend a candidate for appointment as Director to fill the vacancy. If the Member or Members concerned recommend a candidate in writing within the term prescribed, the Directors may appoint him as Director to fill the casual vacancy, but upon such recommendation being made no person, other than the candidate recommended by such Member or Members, may be appointed by the Directors to fill the casual vacancy on the Board.

78. The remuneration of a Director for attending meetings of the Board shall be Rs.100.00 for each meeting attended by him. A Director may also be paid his traveling, hotel and other expenses properly incurred by him in attending and returning from meetings of the Directors or General Meetings of the Company or in connection with the business of the Company.



79. A Director who is about to leave or is absent for a period of three months or more from Pakistan may with the approval of the Directors appoint any person to be an Alternate Director during his absence from Pakistan and such appointment shall have effect and such appointee, whilst he holds office as an Alternate Director, shall be entitled to exercise in place of his appointer all the functions of his appointer as a Director of the Company but he shall *ipso facto* vacate his office as and when his appointer returns to Pakistan or vacates office as a Director or removes the appointee from office. Any appointment or removal under this Article shall be effected by notice in writing under the hand of the Director making the same. Such Alternate Director may be one of the Directors of e Company. In such case he shall be entitled to act in both capacities. An Alternate Director need not hold any qualification share.

80. Mr. Faisal Jafri shall be the first Chairman of the Board of Directors, unless he ceases to be a Director or resigns earlier, he will continue to function as the Chairman until his successor is elected in the manner hereinafter provided.

81. The Directors may elect one of their Members as the Chairman of the Board by a unanimous vote.

82. The Directors may from time to time delegate any of their powers 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 be 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

83. The Directors shall exercise all powers as contained in Section 196 of the Ordinance. 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 nevertheless 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 Meeting, but no regulation made by the Company in General Meeting shall invalidate any prior act of the Directors which would have been valid if that regulation had not been made.

84. The Directors may exercise all the powers of the Company to borrow money, and to mortgage or charge its undertakings, property and uncalled capital or any part thereof and to issue securities and debentures or debenture stocks, either permanent or redeemable or repayable and to make and issue other forms of security and collateral or further secure any security of the Company by trust deed or other assurance, whether outright or as security for any debt, liability of the Company or of any third party and to do all acts for the Company rontained in the Memorandum.

85. The Directors may from time to time and a any trave by power of attorney appoint any Company, finn of therean 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, authorities and discretions (not exceeding those vested in or exercisable by the Directors under these Articles) and for such period and 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 discretions vested in him.

86. A Director of the Company or a firm of which such Director is a partner or a private company of which such Director is a Director may with the consent of the Company in General Meeting hold any office of profit under the Company.



87. Subject to the provisions 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 with any Company or partnership of or in which any Director of the Company shall be a Members 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 named company or is a Member of any named firm and is to be regarded as interested in any subsequent transaction with such company of firm shaw as regards any such transaction be sufficient disclosure/inder this Anicle and after such General Notice it shall not be necessaring give any special notice relating to any particular transaction with such firm or company. In precase of a contract for the appointment of a Manager of the Company, the provisions of Sections 217 and 218 of the Ordinance shall be observed and performed.

-: 20 :-

88. In accordance with the provisions of Section 214 of the Ordinance, a Register shall be kept by the Directors in which shall be entered particulars of all contracts or arrangements to which Article 102 applies, and which shall be open to inspection by any member at the office during business hours.

89. 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.

90. 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 property of the company or created by it, and to keep a register of the Directors and Managers, and to 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, or conversion of Shares into Stock and copies of special resolutions and a copy of the Register of Directors and Managers and notification of any changes therein.

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

- (a) of all appointments of officers made by the Directors;
- (b) of the names of the Directors present at each meeting of the Directors and of any Committee of the Directors;
- (c) of all resolutions and proceedings at all meetings of the Company, and of the Directors, and of Committee of Directors;

and every Director present at any meeting or Committee of Directors shall sign his name in a book to be kept for that 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

- 92. The office of the Director shall be vacated if :-
  - (a) he is ineligible under Section 181 of the Ordinance;
  - (b) 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 longer, without leave of absence from the Directors;



- (c) he or any firm of which he is a partner or any private
  company of which he is a Director and accepts a loan and guarantee from the Company in contravention of Section 195 of the Ordinance;
- (d) he is found to be of unsound mind by a court of competent jurisdiction;
- (e) he is adjudged an insolvent, or
- (f) he resigns his office by notice in writing to the Company.

## PROCEEDINGS OF DIRECTORS

93. The Directors may meet together for the dispatch of business, adjourn and otherwise regulate their meetings, fit. A Director they vu may and the Secretary on the requisition any time summan a meath of Directors. ప SEAL KARACHI necessary for the transaction of the business of the be fixed by the Company in General I Directors may ecting ar d unless so ixed shall be three for the purposes of this Article and an Alternate inted by a Director shall be counted in a quorum at a meeting at

which the Director appointing him is not present.

95. No Resolution, concerning any matter listed below when put to vote, shall be deemed to be carried except by the unanimous vote in favour of such resolution.

- (i) The allotment of any existing or new Shares in the Capital of the Company or calls in respect of partly paid up Shares.
- (ii) The exercise of borrowing power and the issue of guarantees and indemnities on behalf of the Company.
- (iii) Investment in any business competing with the business of the Company.



- (iv) Unilateral repudiation of agreements for the supply of products of the Company.
- (v) Sale or disposal of the undertaking of Company or any substantial part thereof.
- (vi) Granting of advances to or guaranteeing the indebtedness of any person.

All other questions arising at any meeting of Directors shall be decided by a majority of votes. In the case of an equality of votes the Chairman of the meeting shall have a second or casting vote.

96. 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 for summoning a General Meeting of the Company but for no other purpose

97. All acts done at any meeting of the Directors on by any person acting as Directors 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.

98. A resolution in writing, signed by all the Directors, shall be as valid and effectual as if it has been passed at a meeting of the Directors duly called and constituted.

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



100. There shall be a Chief Executive who shall manage the Company appointed in the manner provided under Section 198 of the Ordinance.

101. The Directors of the Company shall appoint a Chief Executive within fourteen days from the date of election of Directors under Section 178 of the Ordinance, or if the office of the Chief Executive falls vacant, as the case may be, the Directors of a Company shall appoint a Director to be the Chief Executive, which appointment shall be for a period of 3 years from the date of appointment.

102. The terms and conditions of appointment of a Chief Executive shall be determined by the Directors subject to the provisions of the Ordinance.

103. The Chief Executive may be removed in accordance with the provisions of Section 202 of the Ordinance.

## **SECRETARY**

104. The Secretary shall be appointed by the Directors for such erm, at such remuneration and upon such conditions as the Linay think fit and any Secretary so appointed may be removed by them. Where there is no Secretary capable of acting the Directors may appoint an Assistant or Deputy Secretary or any other officer of the Company to perform the duties of Secretary.

## THE SEAL

105. 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 one Director and countersigned by Secretary or by a second Director or by some other person appointed by the Directors for the purpose.

## DIVIDENDS AND RESERVES

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



107. The Directors may from time to time pay to the Members such interim dividends as appear to the Directors to be justified by the profits of the Company.

108. The Directors may, before recommending any dividend, set aside out of the profits of the Company such sums as they think proper as a reserve or reserves, which shall at the discretion of the Directors, be applicable for 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 discretion, either be employed in the business of the Company or be invested in such investment (other than shares of the Company) as the Directors may from time to time think fit.

109. 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 the satisfaction of the debt *Record* 

110. Any dividend, interest or other moneys payable in cash as respect of Shares may be paid by cheque or warrant sent through the post directed 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 person and to such address as the holder or joint holders may in writing direct. Every such cheque or warrant shall be made payable to the order of the person to whom it is sent. Any one 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.

111. Unpaid dividends shall not bear interest as against tile Company.

## CAPITALIZATION OF PROFITS

112. The Company in General Meetings may upon the recommendation of the Directors resolve that it is desirable to capitalize any part of the attriount for the time being standing at the credit of any of the Company's resolve accounts or to the credit of the profit and loss account or otherwise available for distribution and accordingly that such sum be set free for distribution amongst the Members who would be entitled thereto of distribution by way of 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 unissued 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 one way and partly in the other and the Directors shall give effect to such resolution.

### **ACCOUNTS**

113. In the manner as provided in Section 230, the Directors shall cause proper books of account to be kept, in which shall be entered true and complete accounts of the affairs and transactions of the Company.

114. Any costs, charges and expenses incorred or sustained in or about the establishment of the Company, including therein the costs of advertising, printing, stationery, prokerage, commission, legal expenses, and other costs, charges and expenses which the Board considers may be fairly treated as preliminary expenses, may be placed to a separate account to be called the preliminary expenses account, and shall be chargeable either on the profits of company, or capital as the Board may deem expedient.

115. The books of account shall be kept at the Registered Office or at such other place (s) as the Directors think fit. The Directors shall from time to time determine whether and to what extent and at what times and places and under what conditions or regulations the accounts and books of the Company or any of them shall be open to inspection by Members not being Directors. No Member (not being a director) shall have any right to inspect the same except as conferred by the Ordinance, or authorized by the Directors, or by any Resolution of the Company in General Meeting.

116. 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 accounts, income and expenditure accounts, balance sheets and reports as are referred to in these Sections.



117. The profit and loss account shall, in addition to the matters referred to in Section 234 of the Ordinance, show arranged under the most convenient heads, the amount of gross income distinguishing the several sources from which it has been derived and the amount of gross expenditure, distinguishing the expenses of the establishment, salaries, and other like matters. Every item of expenditure fairly chargeable against a year's income shall be brought into account, so that a just balance of profit or loss may be laid before the meeting and in cases where any item of expenditure which may in fairness be distributed over several years has been incurred in any one year, the whole amount of such items be stated, with the reasons why only a portion of such expenditure is charged against the income of the year.

## NOTICES

118. (1) A notice may be given by the Company to any Member either personally or by sending it by test to hind 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.

(2) 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.

119. 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.

**120. Provide the provide the given by the Company to the persons entitled to a Share th consequence of the death or insolvency of a Member through the post in a prepare of the death or insolvency of a Member through the post in a prepare of the deceased to them by name or by the title of representatives of the deceased, or assigns of the insolvent or by any like description, at the address (if any) in Pakistan supplied for the purpose by** 

the person 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.

121. Notice of every General Meeting shall be given in the manner herein-before 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 to (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.

#### WINDING UP

122. Subject to the provisions of the Ordinance, if the Company shall be wound up, the liquidator may, with the sanction of an Extraordinary Resolution of the Company and any other sanction dequired by law divide amongst the Members in specie or kind the whole or any part of the assets of the Company (whether they shall consist of property of the same kind or not) and may, for such purpose, set such value as be deems fair upon any property to be divided as aforesard and, may determine how much division shall be carried out as between the Members or different classes of Members. The liquidator may, with the like sanction, vest the whole or any part of such assets in trustees upon such trusts for the benefit of the Members or any of them as the liquidator with the like sanction shall think fit, but so that no member shall be compelled to accept any Shares or other Securities whereon there is any liability.



#### SECRECY

123. 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 any information respecting any detail of the Company's trading or any matter which is or may be in the nature of a trade secret, mystery of trade or secret process 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.

-: 29 :-

#### **INDEMNITY**

124. 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 proceedings whether civil or criminal, in which, judgment is given in his favor, 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.

#### DISPUTE

125. All disputes, claims, proceedings and out of or connected with allotment of Shares, transfer of Shares and matters connected with administration, operation and management of the Company shall be settled and decided in accordance with the Arbitration Act.

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

_	NAME & SURNAME FATHER'S NAME (Present & Former) (in block letters)	NATIONALITY & Former NATIONALITY	OCCUPATION OF SUBSCRIBER	Residential Address	NO. OF Shares Taken by Each Subscriber	SIGNATURE
NIC	SYED FAISAL AHMED AFRI 42401 - 4053	PAKISTAN	Business	B-121 BLOCK H North Nazimabad, Karachi	70 (Serverty	H-
Ave NIC!	SHAJEEYA JAFRI	PAKISTAN	Housewife	B-121 BLOCK H NORTH NAZIMABAD, KARACHI	30 Thirds)	A CARLON CONTRACTOR
		C 11. A		Sino 19	1305. dt 3	1/105
•	RARACHIL Dated 77	+1-2005 05-2005		Certified	to be true Registrer of C	TO S Companies

Witness to the above Signatures:

Bashir Ahmed Khan (Advocate High Court) Son of Faquir A. Khan Occupation : Advocate High Court

COMPANY REGI

RST TO B

KARACHI LIC

SEAL

Full Address: Mansoor Ahmad Khan & Co. Advocates & Legal Consultants F-2/3 Block 8 Kehkashan, KDA Scheme-V, Clifton, Karachi-75600.

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Forand


# National Transmission and Despatch Company Limited (NTDCL)



Grid Interconnection Study for Evacuation of Power from 48.3 MW Trans Atlantic Energy Wind Power Project to the National Grid



Planning (Power) Department 4<sup>th</sup> Floor, PIA Tower, Egerton Road, Lahore

May 2016



**(()**)

# **Table of Contents**

Ex	ecutiv	e Summaryi		
1	Intro	Introduction1		
2	Tec	Technical Data of Trans Atlantic WPP3		
3	Study Objectives, Assumptions and Criteria			
	3.1	Study Objectives		
	3.2	Study Assumptions		
	3.3	Study Criteria		
4	Proj	posed Interconnection Scheme8		
5	Loa	d Flow Studies9		
	5.1	Peak Load 2019 Scenario		
	5.2	Off-peak Load 2019 Scenario		
	5.3	Peak Load 2021 Scenario14		
	5.4	Conclusions of Load Flow Analysis16		
6	Sho	rt Circuit Studies		
	6.1	Methodology and Assumptions17		
	6.2	Short Circuit Study Results		
	6.3	Conclusions of Short Circuit Analysis19		
7.	Tran	sient Stability Studies20		
	7.1	Study Methodology		
	7.2	Transient Stability Analysis Results		
-	7.3	Conclusions of Transient Stability Analysis		
8	8 Power Quality Analysis			
	<b>8</b> .1	Flicker		
	8.2	Voltage Unbalance		
	8.3	Conclusions of Power Quality Analysis		
9	Over	all Conclusions and Recommendations		

### Appendices

Appendix-1: Trans Atlantic WPP Data Received from Project Sponsor

Appendix-2: Proposed Interconnection Diagram for Trans Atlantic WPP

Appendix-3: Load Flow Study Exhibits

Appendix-4: Short Circuit Study Exhibits

Appendix-5: Dynamic Data of Trans Atlantic WPP for Stability Analysis

Appendix-6: Transient Stability Study Exhibits.



#### **Executive Summary**

- 1. Ministry of Water and Power in association with AEDB, Energy Department, Government of Sindh, in April 2016, decided to allocate the 500 MW wind power capacity vacated by M/s NBT Wind Power Pakistan-II & III to the 10 Wind Power Projects (WPPs) of approx. 50 MW each at Jhimpir, district Thatta, Sindh. The 10 WPPs comprise of ACT-2, Gul Ahmad Electric, Shaheen Foundation, Din Energy, Zulaikha Energy, Artistic, Harvey (Cacho), Norinco, Western Energy and Trans Atlantic. These 10 WPPs are in addition to the already planned/under construction WPPs in Jhimpir and Gharo clusters. Afterwards, the list of the selected 10 WPPs was communicated to CPPA-G and NTDCL for information and further action at their ends.
- 2. The sponsor of Trans Atlantic WPP, i.e., M/s Trans Atlantic Energy Private Limited, has engaged Planning Power department of NTDCL to carry out interconnection studies and to propose interconnection scheme for its power evacuation to the National Grid.
- 3. The project sponsor of Trans Atlantic WPP, as per requirements of NTDCL Planning Power, provided the project site location/coordinates, and other necessary technical data/information of Transatlantic WPP, i.e., No., generation capacity, voltage, p.f. & type of WTGs, collector group configuration, gross & net output capacity of the plant, No. & rating of transformers, switchyard voltage levels, single line diagram & equipment rating etc.
- 4. As per information provided by the project sponsor, Trans Atlantic WPP is located towards the North East of Karachi at a distance of approx. 95 km. Transatlantic WPP comprises of 14 No. WTGs and each WTG is of Vestas make, Type-4 with 3.45 MW gross capacity. The total gross generation capacity of Trans Atlantic WPP is 48.3 MW and total net capacity that will flow to the grid, after subtracting project losses/auxiliary consumption, is 46 MW.
- 5. This is the interconnection study report which has been prepared only to propose interconnection scheme for power evacuation from Trans Atlantic WPP in integration with other WPPs in its vicinity. In this report, he results of

load flow, short circuit, transient stability and power quality studies have been presented with the proposed interconnection scheme for evacuation of power from Transatlantic WPP to the National Grid in the light of NEPRA Grid Code.

- 6. Considering the capacity, locations, existing/planned system network in the area, the following integrated interconnection scheme of the 7 WPPs lying in southern part of Jhimpir including ACT-2, Gul Ahmad Electric, Din Energy, Zulaikha Energy, Artistic, Cacho and Trans Atlantic, has been proposed for their reliable power evacuation to the grid:
  - i) A new 220/132 kV Jhimpir-2 substation 3x250 MVA, 220/132 kV transformers.
  - ii) 220 kV double circuit (D/C) transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA D/C transmission line at Jhimpir-2.
  - 220 kV D/C transmission line, approx. 07 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir New (Jhimpir-1) – Gharo New D/C transmission line at Jhimpir-2.
  - iv) 132 kV D/C transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including Trans Atlantic WPP with Jhimpir-2. In this scheme, the interconnection of Trans Atlantic WPP includes 132 kV D/C transmission line, approx. 2km long, on twin-bundled Greeley conductor for looping In/Out from Transatlantic WPP on the 132 kV single circuit from ACT-2 WPP to DIN Energy WPP.
- 7. The integrated scheme for the remaining 3 WPPs lying in northern part of Jhimpir including Shaheen Foundation, Norinco, and Western Energy, has been proposed with power evacuation from the under-construction Jhimpir-1 220/132kV grid station, through network reinforcement.
- 8. The above proposed interconnection scheme is expected to be completed in Dec. 2019. It is added that the expected timeline of the proposed



interconnection scheme may be extended depending on variation in completion of the related activities, i.e., preparation and approval of PC-1, funding arrangement, tendering process, contract award, land acquisition, ROW availability and construction etc.

- 9. Detailed load flow studies have been carried out for various operating scenarios with maximum dispatch from all the existing/underconstruction/planned WPPs in Jhimpir and Gharo clusters to evaluate the adequacy of the above proposed interconnection schemes of the 10 WPPs including Trans Atlantic WPP for their reliable power evacuation to the grid.
- 10. The proposed interconnection scheme for Trans Atlantic WPP has been found adequate after performing the load flow studies to assess the steady state system performance under normal and N-1 contingency conditions. The voltage profile, line loading, frequency and active/reactive power flow etc. from the Trans Atlantic WPP and on the grid are within the NEPRA Grid Code criteria. It has been found on the basis of the study results that the power from Trans Atlantic WPP can be dispersed to the National Grid in a reliable manner during normal and N-1 contingency conditions without any constraints.
- 11. The short circuit studies have been carried out with proposed interconnection of Trans Atlantic WPP to compute the maximum three phase and single phase short circuit levels at the switchyard of Trans Atlantic WPP and other substations in its vicinity. The minimum three phase and single phase short circuit levels have also been carried out at the 132 kV switchyard of Trans Atlantic WPP for various number of WTGs in operation and reduced generation in its vicinity. It is found that the induction of Trans Atlantic WPP with the proposed interconnection scheme has no adverse impact on the existing and proposed substations in its vicinity.
- 12. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Trans Atlantic WPP are 9.22 kA and 6.26 kA respectively in the year 2021-22 but these are expected to rise due to future grid system expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding

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

- 13. Transient stability analysis has been carried out for Trans Atlantic WPP with the proposed interconnection scheme. The stability of the Trans Atlantic WPP and the power system has been checked with application of different disturbances on the wind farm and at the substations in its vicinity. It has been found that the Trans Atlantic WPP and the power system remain stable with no adverse effects after subjected to faults as per Grid Code requirement.
- 14. The LVRT requirements for Trans Atlantic WPP have been tested against contingency conditions of 100ms (5 cycles) under normal clearing time and 180ms (9 cycles) for delayed fault clearing. The stability simulations have proved that Trans Atlantic WPP fulfills the LVRT criteria as mentioned in the NEPRA's Grid Code Addendum for WPPs.
- 15. The impact of induction of Trans Atlantic WPP on power quality has also been analyzed. The study results indicate that the power quality indices including flicker and voltage unbalance, remain within the permissible limits as mentioned in the IEC and other international standards. It is clearly mentioned that it is the responsibility of developer of the Trans Atlantic WPP to install the plant and necessary compensating equipment at its switchyard on the basis of detailed design studies to meet the power quality standards as per requirements of NEPRA Grid Code Addendum for WPPs.
- 16. It is added that the Grid Code Addendum for WPPs is currently under revision and the project sponsor of Trans -Atlantic WPP will be required to follow/implement the requirements/recommendations given in the revised Grid Code, after its approval from NEPRA and make necessary modifications in the equipment/substation of Trans Atlantic WPP, if any, in this regard.
- 17. It is concluded on the basis of the results of the detailed system studies that the proposed interconnection scheme has no transmission system constraints in power evacuation from Trans Atlantic WPP to the National Grid.



#### 1 Introduction

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

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

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

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

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

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

As per information provided by the project sponsor, Trans Atlantic WPP is located towards the North East of Karachi at a distance of approx. 95 km. Trans Atlantic WPP comprises of 14 No. WTGs and each WTG is of Vestas make, Type-4 with 3.45 MW gross capacity. The total gross generation capacity of Trans Atlantic WPP is 48.3 MW and total net capacity that will flow to the grid, after subtracting project losses/auxiliary consumption, is 46 MW.

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



# 2 Technical Data of Trans Atlantic WPP

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

#### a) WTG Generator Data:

- Number of WTGs = 14
- Manufacturer/Model = Vestas / V126 3.45 MW IEC III-A
- Gross capacity = 3.45 MW
- Type = 4
- Voltage = 0.75 kV
- Power factor = 0.95 (Lagging/Leading)

#### b) WTG Arrangement in Wind Farm

- No. of collector groups = 2
- No. of WTGs in one collector group = 7
- Length of each collector group with the switchyard = 3 km

#### c) Total Wind Farm Capacity:

- Total gross capacity= 48.3 MW
- EBOP Losses = 1.5 MW
- Auxiliary Consumption = 0.8 MW
- Total net output capacity that will flow to the Grid = 46 MW

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

- No. of step-up transformers = 1
- Voltage ratio = 0.75/33 kV
- MVA rating = 3.6 MVA
- Percentage Impedance = 6.5%

#### e) Proposed Switchyard of Wind Power Project:

- High Voltage (HV) Level = 132 kV
- Medium Voltage (MV) Level = 33 kV
- Bus Bar Scheme = Double bus single breaker
- Bus Bar capacity = 4000 Amp.
- Power (HV/MV) transformer:
  - No. of transformers = 2
  - Voltage ratio = 132/33 kV
  - MVA rating = 31.5/40/50 MVA
  - Percentage Impedance = 10.5%
- Switchgear data, single line diagram and layout of switchyard attached in Appendix-1.

### f) Proposed Reactive Power Compensation

Static Var Compensator (SVC) = ±20 MVAR (capacitive/Inductive)

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



# 3 Study Objectives, Assumptions and Criteria

#### 3.1 Study Objectives

The objectives of the interconnection study are given as under:

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

#### 3.2 Study Assumptions

The system studies are based on the following assumptions:

- Latest load forecast.
- Latest generation expansion plan.
- Latest transmission expansion plans of NTDC and DISCOs, especially HESCO.
- Export of power from NTDC to K-Electric is assumed as 650 MW.
- Interconnected transmission system has been assumed, however, split bus has been assumed at 132 kV bus bars of Hala Road and T.M. Khan Road 220/132 kV substations as per system requirements.
- The existing, under-construction and already planned WPPs at Jhimpir and Gharo clusters with their interconnection arrangements. The underconstruction 220/132 kV substations, i.e., Jhimpir New (Jhimpir-1) and Gharo New, with their allied transmission lines are assumed to be commissioned.
  - As per information provided by project sponsor, the total gross & net capacity of Trans Atlantic WPP have been assumed as 48.3 MW & 46 MW respectively. The modeling of Trans Atlantic WPP in PSS/E software has been made as under:

- There are a total number of 14 WTGs and two collector groups in the wind farm with each WTG having gross capacity of 3.45 MW and generating power at 0.75 kV which has been stepped up to 33 kV through 3.6 MVA transformer.
- The two collector group comprising of 7 WTGs each have been modeled separately with equivalent gross capacity of 7x3.45=24.15MW and equivalent 0.75/33 kV transformers.
- Each of the two collector groups have been connected through individual 33 kV cables with 33 kV bus bar of the 132/33 kV substation.
- The SVC has been represented at 33 kV bus bar.
- At 132/33 kV substation, the 2 No. 132/33 kV transformers have been modeled separately.
- Other WPPs in the vicinity of Trans AtaIntic have also been modeled according to their own WTG capacities and collector group configuration.
- This interconnection study report is based on the information supplied by M/s Trans Atlantic Energy (Private) Limited and NTDCL is not responsible for the study results on account of any deficiency and/or inaccuracy of the supplied information.

# 3.3 Study Criteria

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

Voltage Limits±5% under normal and ±10% under contingency<br/>conditions. However, voltages at some generation<br/>buses and some substations may be kept upto<br/>+8% under normal operating conditions as per<br/>network<br/>configuration<br/>and/or<br/>system<br/>requirements.



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

power per second, subject to availability of

adequate wind speed at site.

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# 4 **Proposed Interconnection Scheme**

The following integrated interconnection scheme has been proposed for 7 WPPs lying in south of Jhimpir including ACT-2, Gul Ahmad Electric, Din Energy, Zulaikha Energy, Artistic, Cacho and Trans Atlantic, keeping in view their generation capacities, the location, the existing/planned system network in its vicinity, for reliable dispersal of power from 48.3 MW Trans Atlantic Energy Limited (TEAL) WPP to the National Grid:

- A new 220/132 kV Jhimpir-2 substation 3x250 MVA, 220/132 kV transformers.
- 220 kV double circuit (D/C) transmission line, approx. 18 km long, on twinbundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA D/C transmission line at Jhimpir-2.
- 220 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping In/Out of one of the planned Jhimpir New (Jhimpir-1)

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

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

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



# 5 Load Flow Studies

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

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

#### 5.1 Peak Load 2019 Scenario

Load flow study for the peak load condition in 2019 under normal system condition has been carried out with net output of 46 MW from Trans Atlantic WPP and is attached as Exhibit #1.0 & 1.0A. As per load flow study, the power flows on the transmission lines/transformers at/around Trans Atlantic WPP and on the surrounding southern network are given as under:

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

Transmission Line/Transformers	Power Flow (MW)
Cacho WPP – Gul Ahmed Electric WPP 132 kV S/C	80.7
Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C	128.1
Jhimpir-1 – Jhimpir-2 220 kV S/C	167.1
Gharo New – Jhimpir-2 220 kV S/C	118.1
Jhimpir-2 – Jamshoro 220 kV S/C	237.6
Jhimpir-2 – KDA-33 220 KV S/C	377.3
Jhimpir-1 – T.M. Khan Road 220 kV D/C	504.0
3x250 MVA, 220/132 kV transformers at Jhimpir-2	330.9

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

### a. N-1 Contingency Analysis

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

Exhibit #	Contingency Conditions	Remarks
1.1	Trans Atlantic WPP – Din Energy WPP 132 kV S/C out 🗕	Power flows on the other transmission lines and transformers as well as the voltage profile of the system remain within limits.
1.2	Trans Atlantic WPP – ACT 2 WPP 132 kV S/C out	-do-
1.3	1x50 MVA, 132/33 kV transformer at Trans Atlantic WPP out	-do-

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

#### b. Comments on Normal and N-1 Contingency Analysis

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

#### 5.2 Off-peak Load 2019 Scenario

Load flow study for the off-peak load condition in 2019 under normal system condition has been carried out with net output of 46 MW from Trans Atlantic WPP and is attached as Exhibit #2.0 & 2.0A. As per load flow study, the power flows on

the transmission lines/transformers at/around Trans Atlantic WPP and on the surrounding southern network are given as under:

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

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

#### a. N-1 Contingency Analysis

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



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

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#### b. Comments on Normal and N-1 Contingency Analysis

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

# 5.3 Peak Load 2021 Scenario

Load flow study for the peak load condition in 2021 under normal system condition has been carried out with net output of 46 MW from Trans Atlantic WPP and is attached as Exhibit #3.0 & 3.0A. As per load flow study, the power flows on the transmission lines/transformers at/around Trans Atlantic WPP and on the surrounding southern network are given as under:

Transmission Line/Transformers	Power Flow (MW)
Trans Atlantic WPP – Din Energy WPP 132 kV S/C	108.8
Act 2 WPP – Trans Atlantic WPP 132 kV S/C	62.9
Din Energy WPP – Zulaikha Energy WPP 132 kV S/C	156.5
Cacho WPP – Gul Ahmed Electric WPP 132 kV S/C	<b>80</b> .7
Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C	<b>128</b> .1
Jhimpir-1 – Jhimpir-2 220 kV S/C	111.4
Gharo New – Jhimpir-2 220 kV S/C	105.3
Jhimpir-2 – Jamshoro 220 kV S/C	247.4
Jhimpir-2 – KDA-33 220 kV S/C	299.4
Jhimpir-1 – T.M.Khan Road 220 kV D/C	533.4

14

Transmission Line/Transformers	Power Flow (MW)
3x250 MVA, 220/132 kV transformers at Jhimpir-2	<b>330.9</b>

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

#### a. N-1 Contingency Analysis

The load flow studies have also been carried out for N-1 contingency analysis during peak load scenario of 2021 in the vicinity of proposed Trans Atlantic WPP. The results of contingency studies are attached as Exhibit #3.1 to 3.11 and are summarized as under:

Exhibit #	Contingency Conditions	Remarks
3.1	Trans Atlantic WPP – Din Energy WPP 132 kV S/C out	Power flows on the other transmission lines and transformers as well as the voltage profile of the system remain within limits.
3.2	Trans Atlantic WPP – ACT 2 WPP 132kV S/C out	-do-
3.3	1x50 MVA, 132/33 kV transformer at Trans Atlantic WPP out	-do-
3.4	One collector group (7 WTGs) at Trans Atlantic WPP out	-do-
3.5	Gul Ahmed Electric WPP – Jhimpir-2 132 kV S/C out	-do-
3.6	1x250 MVA, 220/132 kV transformer at	-do-

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

### b. Comments on Normal and N-1 Contingency Analysis

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

# 5.4 Conclusions of Load Flow Analysis

The proposed interconnection scheme for evacuation of power from 48.3 MW Trans Atlantic WPP to the National Grid has been found reliable in various operating scenarios under normal and N-1 contingency conditions with no transmission system constraints.



# 6 Short Circuit Studies

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

#### 6.1 Methodology and Assumptions

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

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

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

#### 6.2 Short Circuit Study Results

The short circuit studies have been carried out with proposed Interconnection scheme and by using the above parameters for generator and step-up transformer to compute the maximum three phase and single phase short circuit levels at the switchyard of Trans Atlantic WPP and other substations in its vicinity. The studies

have been carried out for the year 2021-22 with all the existing and planned generation in operation and with interconnected transmission system except 132 kV split buses at 220/132 kV substations of Hala Road and T.M. Khan Road. The results of maximum short circuit studies for the year 2021-22 are summarized as under:

	Maximum Shor	t Circuit Levels	
Name of Faulted Bus Bars	Three Phase (kA)	Single Phase (kA)	
Trans Atlantic WPP 132 kV	9.22	6.26	
ACT-2 WPP 132 kV	7.84	5.09	
Din Energy WPP 132 kV	11.05	7.93	
Jhimpir-2 220 kV	18.96	11.47	
Jhimpir-2 132 kV	15.48	12.01	
Jhimpir-1 220 kV	19.89	11.66	
Jhimpir-1 132 kV	27.59	13.56	

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

Minimum Short Circuit Levels at Trans Atlantic 132 kV Bus

	Minimum Short Circuit Levels				
WTGs in Operation at Trans Atlantic WPP	Three Phase (kA)	Single Phase (kA)			
All WTGs	7.47	4.68			
One WTG	7.35	4.61			



# 6.3 Conclusions of Short Circuit Analysis

It is evident from the short circuit analysis that the induction of Trans Atlantic WPP has no adverse impact on the existing and proposed substations in its vicinity as far as short circuit levels are concerned. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Trans Atlantic WPP are 9.22 kA and 6.26 kA respectively in the year 2021-22 but these are expected to rise due to future grid system expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of Trans Atlantic WPP.

# 7. Transient Stability Studies

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

### 7.1 Study Methodology

The dynamic simulation model of the entire network has been developed in the PSS/E software. The dynamic model parameters of WTG Type-4 used for Trans Atlantic WPP, in the studies are attached in Appendix-5. On the other hand, the dynamic models/parameters of generators, exciters and governors of all the other power plants, already available in Planning (Power) NTDCL, have been used in the studies.

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

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

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

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



• Running simulation up to 10 seconds after fault clearance.

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

- i. Bus frequency and voltage
- ii. WTG (speed, active and reactive power output, LVACR Sensor voltage)
- iii. Line power flows, i.e., P (MW) & Q (MVAR)
- iv. Conventional thermal generator rotor angle

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

Bus Number	Bus Name / Voltage	
81115	Trans ATL / 132kV	
811151	Trans ATL-33 / 33kV	
811154 & 811155	Trans ATL-11 / 0.75 kV	
81114	Act-2 / 132 kV	
81116	Din Energy / 132 kV	
8111	Jhimpir-2 / 132 kV	
811	Jhimpir-2 / 220kV	
9429	Jhimpir-1 / 220kV	
800	Jamshoro / 220 kV	
900	KDA / 220 kV	
530	<b>M</b> .Garh / 220 kV	
90	Hub / 500 kV	

#### 7.2 Transient Stability Analysis Results

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

# (i) For Normal Clearing Time (100 ms)

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

Sr. #	<b>3-Phase Fault</b> Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
1	Trans Atlantic WPP 132 kV	s Atlantic Trans Atlantic WPP – 2 132 kV Din-E132 kV S/C	1	Bus Frequency	
	Bus	Bus	2	Bus Voltage	
		3	WTG collector group Output (P&Q)	Trans Atlantic WPP and NTDCL systems remain	
		4	LVACR	stable.	
			5	Power Flow (P & Q)	
			6	Rotor Angle	
2	Trans Atlantic	Trans Atlantic WPP -	7	Bus Frequency	Trans Atlantic
	WPP 132 kV Bus	ACT2 WPP 132 kV S/C	8	Bus Voltage	NTDCL
		9	WTG collector group Output (P&Q)	systems remain stable.	



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Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
			10	LVACR	
			11	Line Power Flows (P & Q)	
			12	Rotor Angle	
3	Trans Atlantic	One 132/33kV T/F at	13	Bus Frequency	
	Bus	Out	14	Bus Voltage	
			15	WTG collector group Output (P&Q)	Trans Atlantic WPP and NTDCL
		16	LVACR	systems remain stable.	
			17	Power Flow (P & Q)	
			18	Rotor Angle	
4	Trans Atlantic	One Collector Group	19	Bus Frequency	
	WPP 33 kV MV Bus	V comprising of 7 WTGs at Trans Atlantic WPP	20	Bus Voltage	
			21	WTG collector group Output (P&Q)	Trans Atlantic WPP and NTDCL
			22	LVACR	stable.
			23	Power Flow (P & Q)	
			24	Rotor Angle	
5	Jhimpir-2	One 220/132 kV T/F	25	Bus Frequency	Trans Atlantic
	220 kV Bus	at Jnimpir-2	26	Bus Voltage	NTDCL systems remain
		26A	WTG collector group Output (P&Q)	stable.	
			27	Power Flow (P & Q)	
			28	Rotor Angle	
6	Jhimpir-2	Jhimpir-2 - Jhimpir-1	29	Bus Frequency	T <b>ra</b> ns Atlantic

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
	220 kV Bus	220 kV S/C	30	Bus Voltage	WPP and
			30A	WTG collector group Output (P&Q)	NTDCL systems remain stable.
			31	Power Flow (P & Q)	
			32	Rotor Angle	
7	Jhimpir-2 220 kV Bus	Jhimpir-2 - Gharo New	33	Bus Frequency	
		220 kV S/C	34	Bus Voltage	Trans Atlantic
			34A	WTG collector group Output (P&Q)	WPP and NTDCL systems remain
			35	Power Flow (P & Q)	stable.
			36	Rotor Angle	
8	Jhimpir-2 220 kV Bus	Jhimpir-2 - Jamshoro 220 kV S/C	37	Bus Frequency	
	220 NV 203		38	Bus Voltage	
			38A	WTG collector group Output (P&Q)	I rans Atlantic WPP and NTDCL systems remain
			39	Power Flow (P & Q)	stable
			40	Rotor Angle	
9	Jhimpir-2	Jhimpir-2 - KDA-33 220 kV S/C	41	Bus Frequency	
	220 NV DUS		42	Bus Voltage	Trans Atlantic
			<b>4</b> 2A	WTG collector group Output (P&Q)	WPP and NTDCL systems remain
			43	Power Flow (P & Q)	stable
			44	Rotor Angle	
10	Jhimpir-1 220 kV Bus	Jhimpir-1 – T.M. Khan Road 220 kV S/C	45	Bus Frequency	Trans Atlantie WPP and
			46	Bus Voltage	NTDQL systems remain

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
			<b>4</b> 6A	WTG collector group Output (P&Q)	stable
			47	Power Flow (P & Q)	
			48	Rotor Angle	

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

# (ii) For Delayed Clearing Time (180 ms)

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

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	<b>Re</b> marks	
1	Trans Atlantic	Trans Atlantic WPP	49	Bus Frequency		
	WPP 132 kV   Bus	WPP 132 kV Din-E132 kV Bus	Din-E132 kV S/C	50	Bus Voltage	
			51	WTG collector group Output (P&Q)	Trans Atlantic WPP and NTDCL	
		52	LVACR	remain stable.		
			53	Power Flow (P & Q)		
			54	Rotor Angle		
2	Trans Atlantic	Trans Atlantic WPP-	55	Frequency	T <b>rans</b> Atlantic	
	WPP 132 kV	ACT2 WPP 132 KV S/C	56	Bus Frequency	WPP and	

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Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
	Bus		57	WTG collector group Output (P&Q)	NTDCL systems remain stable.
			58	LVACR	
			59	Power Flow (P & Q)	
			60	Rotor Angle	
3	Trans Atlantic WPP 132 kV	One 132/33kV T/F at Trans Atlantic 132 kV	61	Bus Frequency	
	Bus		62	Bus Voltage	
			63	WTG collector group Output (P&Q)	Trans Atlantic WPP and NTDCL
			64	LVACR	systems remain stable.
			65	Power Flow (P & Q)	
			66	Rotor Angle	
4	Trans Atlantic	One Collector Group	67	<b>Bus Frequency</b>	
	MV Bus	at Trans Atlantic WPP	68	Bus Voltage	
			69	WTG collector group Output (P&Q)	Trans Atlantic WPP and NTDCL
			70	LVACR	remain stable.
			71	Power Flow (P & Q)	
			72	Rotor Angle	
5	Jhimpir-2 220 kV Bus	One 220/132 kV T/F at Jhimpir-2	73	Bus Frequency	
		• • –	74	Bus Voltage	Trans Atlantic
			74A	WTG collector group Output (P&Q)	WPP and NTDCL systems
			75	Power Flow (P & Q)	remain stable.
			76	Rotor Angle	l l

26

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Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
6	Jhimpir-2	Jhimpir-2 - Jhimpir-1	77	Frequency	
	220kV Bus	220 kV S/C	78	Bus Voltage	
			79	Power Flow (P & Q)	Trans Atlantic WPP and NTDCI
		2	79A	WTG collector group Output (P&Q)	systems remain stable.
			80	Rotor Angle	
7	Jhimpir-2	Jhimpir-2 - Gharo New	81	Bus Frequency	
	ZZU NV DUS	220 KV S/C	82	Bus Voltage	
			83	Power Flow (P & Q)	WPP and NTDCL
			<b>8</b> 3A	WTG collector group Output (P&Q)	systems remain stable.
			84	Rotor Angle	
8	Jhimpir-2 220 kV Bus	Jhimpir-2 - Jamshoro	85	Bus Frequency	
			86	Bus Voltage	
			86A	WTG collector group Output (P&Q)	Trans Atlantic WPP and NTDCL systems
			87	Power Flow (P & Q)	remain stable.
	<b>æ</b>		<b>8</b> 8	Rotor Angle	
9	Jhimpir-2 220 kV Bus	Jhimpir-2 - KDA-33	89	Bus Frequency	
		220 KV 0/C	90	Bus Voltage	
			90A	WTG collector group Output (P&Q)	I rans Atlantic WPP and NTDCL systems
			91	Power Flow (P & Q)	remain stable.
			92	Rotor Angle	

Sr. #	3-Phase Fault Location	Circuit Outage	Exhibit #	Monitored Variable	Remarks
10	Jhimpir₋1 220 kV Bus	Jhimpir-1 – T.M.Khan Road 220 kV S/C	93	Bus Frequency	
			94	Bus Voltage	
		94A	WTG collector group Output (P&Q)	Trans Atlantic WPP and NTDCL systems	
			95	Power Flow (P & Q)	remain stable.
			96	Rotor Angle	

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

# 7.3 Conclusions of Transient Stability Analysis

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



#### 8 Power Quality Analysis

The power quality analysis is very important for a wind power plant that may cause flicker and distortions in the power supply. These issues become more significant for weak power systems having low short circuit strength. Therefore, power quality analysis including flicker and voltage unbalance, has been carried out with the proposed interconnection scheme of 48.3 MW Trans Atlantic WPP for the worst case scenario of minimum system short circuit levels in 2019.

#### 8.1 Flicker

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

$$\boldsymbol{P}_{st\Sigma} = \boldsymbol{P}_{lt\Sigma} = \frac{1}{S_k} \cdot \sqrt{\sum_{i=1}^{N_{wt}} (\boldsymbol{c}_i(\boldsymbol{\psi}_k, \boldsymbol{\upsilon}_a), \boldsymbol{S}_{n,i})^2}$$
(A)

Where

**S**<sub>n</sub> is the rated apparent power of the WTG

**S**<sub>k</sub> is the short-circuit apparent power at Point of Common Coupling (PCC)

 $\mathbf{N}_{\text{wt}}$  is the number of WTGs connected to the PCC

The value of c ( $\mathfrak{P}_k$ ) may not be greater than 1, therefore for the present **analysis**, the value of 1 for the worst case has been assumed. PCC is the point of common coupling which is 132 kV bus of the switchyard of Trans Atlantic WPP.

For the minimum short circuit case, the system network in the vicinity of 48.3 MW TAEL WPP has been modeled with minimum generation in operation. The short circuit calculations have been done at 0.9 p.u. voltage. The values used in the calculation of flicker are as below:

S<sub>n</sub> = 3.63 MVA N<sub>WT</sub> = 14 S<sub>k</sub> = 1707.06 MVA

Using the above data in Equation (A), we get
$P_{St\Sigma} = P_{It\Sigma} = 0.0079565 = 0.8$  %

Whereas, the acceptable value in IEC Standard is less than 4%. Therefore, the flicker level is far less than the maximum permissible limit which implies that the inverters at 48.3 MW TAEL WPP would not cause any flicker problem during steady state operation even in the weakest system conditions.

#### 8.2 Voltage Unbalance

#### a. Voltage Step-Change

The voltage step-change occurs when only a single WTG is energized. The value of voltage change depends on the impedance of the network from the connection point to PCC. The PCC is 132 kV bus of Trans Atlantic WPP. The Voltage step-change should be less than or equal to 3% and this condition is evaluated by using the following formula:

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

Where

S<sub>wka</sub> is the MVA rating of the inverter S<sub>ke</sub> is the Short Circuit MVA at connection point S<sub>kas</sub> is the Short circuit MVA at PCC

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

 $S_{wka} = 3.63 \text{ MVA}$  $S_{ke} = 418.12 \text{ MVA}$  $S_{kss} = 1681.03 \text{ MVA}$ 

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

 $\Delta V = 0.006522 = 0.65 \%$ 

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

#### b. Voltage Fluctuation

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

$$Volatge \ Fluctuation = \sqrt{\sum \left(\frac{Pwka}{Ske}\right)^2} \le 1/25 \ \text{or} \ 4\% \tag{C}$$

Where

P<sub>wka</sub> is the MW rating of WTG S<sub>ke</sub> is the Short Circuit MVA at PCC

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

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

Voltage Fluctuation = 0.00825 = 0.825 %

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

#### 8.3 Conclusions of Power Quality Analysis

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

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

#### 9 Overall Conclusions and Recommendations

- On the basis of detailed interconnection studies, the following integrated interconnection scheme of the 7 WPPs lying in southern part of Jhimpir including Trans Atlantic WPP, has been found reliable for power evacuation to the National grid:
  - A new 220/132 kV Jhimpir-2 substation 3x250 MVA, 220/132 kV transformers.
  - 220 kV double circuit (D/C) transmission line, approx. 18 km long, on twin-bundled Greeley conductor for looping In/Out of one circuit of the existing Jamshoro – KDA D/C transmission line at Jhimpir-2.
  - 220 kV D/C transmission line, approx. 7 km long, on twin-bundled Greeley conductor for looping ln/Out of one of the planned Jhimpir-1 – Gharo New D/C transmission line at Jhimpir-2.
  - 132 kV D/C transmission line, approx. 50 km long on twin bundled Greeley conductor for connecting all the 7 WPPs including Trans Atlantic WPP with Jhimpir-2. In this scheme, the interconnection of Trans Atlantic WPP includes 132 kV D/C transmission line, approx.
    2 km long, on twin-bundled Greeley conductor for looping In/Out from Transatlantic WPP on the 132 kV single circuit from ACT-2 WPP to DIN Energy WPP.
- (ii) The above proposed interconnection scheme is expected to be completed in Dec. 2019. It is added that the expected timeline of the proposed interconnection scheme may be extended depending on variation in completion of the related activities, i.e., preparation and approval of PC-1, funding arrangement, tendering process, contract award, land acquisition, ROW availability and construction etc.
- (iii) The results of detailed load flow studies for various operating scenarios indicate that the power from Trans Atlantic WPP can be dispersed to the National Grid in a reliable manner during normal and N-1 contingency conditions without any constraints. The voltage profile, line loading.

32

frequency and active/reactive power flow etc. from Trans Atlantic WPP and on the grid are within the NEPRA Grid Code criteria.

- (iv) The results of short circuit studies indicate that Trans Atlantic WPP and its surrounding WPPs have no adverse impact on the existing and proposed substations in their vicinity as far as short circuit levels are concerned. The maximum three phase and single phase short circuit levels at the 132 kV switchyard of Trans Atlantic WPP are 9.22 kA and 6.26 kA respectively in the year 2021-22 but these are expected to rise due to future grid system expansion and a lot of wind power potential in Jhimpir, Gharo and surrounding areas. Therefore, the short circuit rating of 40 kA would be adequate for the 132 kV switchyard equipment of Trans Atlantic WPP.
- (v) The results of transient stability analysis indicate that Trans Atlantic WPP & other power plants in its vicinity and the power system remain stable with no adverse effects after subjected to severe disturbances either on Trans Atlantic WPP or at the other substations in its vicinity. The stability simulations also proved that Trans Atlantic WPP fulfills the LVRT criteria as mentioned in the NEPRA's Grid Code Addendum for WPPs.
- (vi) The important power quality indices like flicker and voltage unbalance have been computed with Trans Atlantic WPP. The study results indicate that the levels of flicker and voltage unbalance are within permissible limits as mentioned in the IEC and other international standards, with the proposed interconnection of Trans Atlantic WPP. It is clearly mentioned that it will be the responsibility of developer of the Trans Atlantic WPP to install the plant and necessary compensating equipment at its switchyard on the basis of detailed design/field testing studies to meet the power quality standards as per requirements of NEPRA Grid Code Addendum for WPPs.
- (vii) It is concluded on the basis of the results of the detailed system studies that the proposed interconnection scheme has no transmission system constraints in power evacuation from Trans Atlantic WPP to the National Grid.

33

- (viii) It is added that the Grid Code Addendum for WPPs is currently under revision and the project sponsor of Trans Atlantic WPP will be required to follow/implement the requirements/recommendations given in the revised Grid Code, after its approval from NEPRA and make necessary additions/modifications in the equipment/substation of Trans Atlantic WPP, if any, in this regard.
- (ix) In view of the huge wind potential at Jhimpir & in its surrounding areas, the power system network around Trans Atlantic WPP will be developed in future. Therefore, there may be possibility of modification in the interconnection arrangement of Trans Atlantic WPP in future, if needed necessary as per system requirements.



# SCHEDULE 1

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.



# Layout of Generation Facility/ Wind Farm



# Coordinates of the Generation Facility/ Wind Farm

S. No.	Longitude	Latitude
A	67°48'01.60"East	24°56'06.94''North
В	67°44'38.87''East	24°58'40.49''North
С	67°47'26.47''East	24°57'51.21''North
D	67°48'40.10''East	24°57'09.33''North
Е	67°48'21.22''East	24°56'41.75''North
F	67°44'42.64''East	24°58'46.01''North
G	67°48'17.45''East	24°56'36.24''North
Н	67°47'58.58''East	24°56'08.66''North
l	67°49'22.11''East	24°56'45.43''North
J	67°48'20.47''East	24°56'34.52''North
K	67°49'25.88''East	24°56'50.95''North
L	67°48'24.25''East	24°56'40.06''North
Μ	67°48'43.12''East	24°43'37.40''North
N	67°49'03.23''East	24°56'17.86''North
0	67°45'14.78''East	24°57'41.79''North
Р	67°47'30.24''East	24'57'56.72''North
Q	67°45'11.01''East	24°57'36.27''North
R	67°48'36.81''East	24°55'39.25''North
S	67°48'59.46''East	24°56'12.34''North
Т	67°48'40.58''East	24°55'44.76''North



# Micro-Sitting of Generation Facility/ Wind farm



UTM Datum:	WGS84 T42N				
Turbine ID	Turbine model	Hub Height (m)	Easting (m)	Northing (m)	UTM zone
WT-1	V126-3.45MW	137	378021	2760169	42
WT-2	V126-3.45MW	137	377777	2760324	42
WT-3	V126-3.45MW	137	377533	2760479	42
WT-4	V126-3.45MW	137	377289	2760634	42
WT-5	V126-3.45MW	137	377045	2760789	42
WT-6	V126-3.45MW	137	376801	2760944	42
WT-7	V126-3.45MW	137	376558	2761099	42
WT-8	V126-3.45MW	137	376070	2761409	42
<u>WT-9</u>	V126-3.45MW	137	375826	2761564	42
WT-10	V126-3.45MW	137	375582	2761719	42
WT-11	V126-3.45MW	137	375338	2761874	42
WT-12	V126-3.45MW	137	375094	2762030	42
WT-13	V126-3.45MW	137	374850	2762185	42
WT-14	V126-3.45MW	137	374607	2762340	42





# Single Line Diagram ( of Electrical System) of the Generation Facility /Wind Farm#



#### Interconnection Arrangement / Transmission Facilities for Dispersal of Power from the Generation Facility/ Wind Power Plant/ Wind Farm of Trans Atlantic (Private) Limited (TAEL)

Project will be connected to

- i.) a new 220/132KV Jhimpir-2 Substation 3x250 MVA, 220/132KV transformers.
- ii.) A 220KV double circuit (D/C) transmission line, approximately 18km long, on twin bundled Greely conductor for looping in/out of one circuit of the existing Jamshoro-KDA D/C transmission line at Jhimpir-2.
- iii.) 220KV D/C transmission line, approximately 7KM long, on twin-bundled Greely conductor for looping In/Out of one of the planned Jhimpir New (Jhimpir-1)-Gharo New D/C Transmission line at Jhimpir-2
- iv.) 132KV D/C transmission line approximately 50KM long on twin bundled Greely conductor for connecting all the 7 WPPs including Trans Atlantic WPP with Jhimpir-2. In this scheme, the interconnection of Trans Atlantic WPP includes 132KV D/C transmission line, approximately 2KM long, on twin-bundled Greely conductor for looping In/Out from Trans Atlantic WPP on the 132KV single circuit from ACT-2 WPP to DIN Energy WPP.



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





# Detail of Generation Facility/ Wind Power Plant/ Wind Farm

#### A. General Information

i.	Name of Applicant Company	Transatlantic Energy Private Limited
i.	Registered/Business Office	130 Bahria Complex III MT Road Karachi, Pakistan
i.	Plant Location	Jhimpir District Thatta, Sindh
V.	Type of Generation Facility	Wind Power

#### B. Wind Farm Capacity & Configuration

i.	Wind Turbine Type, Make & Model	V126 3.45MW
ii.	Installed Capacity of Wind Farm (MW)	48.3
iii.	Number of Wind Turbine Units/Size of each Unit (KW)	14 (3450kW)

### C. Wind Turbine Details

imber of Blades	3
otor Speed	5.6-16.5rpm
otor Diameter	126m
vept Area	12469 m <sup>2</sup>
ower Regulation	Full Scale Converter
ited power at	3.45MW
it-in Wind Speed	3m/s
it-out Wind Speed	22.5m/s
rvival Wind Speed	52.5m/s
tch Regulation	Individual
lades	
ade Length	61.66m
aterial	Fibreglass reinforced epoxy, carbon fibres and Solid Metal Tip (SMT)
eight	5.550kg
ear Box	
/De	Planetary stages + one helical stage
Per Ratio	1:102
eight	35.000 kg
l Quantity	1000-1200
ain Shaft Bearing	Double-row spherical roller bearing
enerator	
)wer	3650kW
oltage	750V
/De	Asynchronous with cage rotor
beed	1450-1550 rpm
nclosure Class	IP54
oupling	Squirrel cage
ficiency	97.4%
/eight	8,050kg
ower Factor	+/- 0.95
aw System	
aw Bearing	Plain bearing system
rake	Motor brake
ear driving device	Multiple stages geared
ieig ow i <u>av</u> iw ral- ear	ght er Factor v <b>System</b> Bearing Bearing te driving device

iv.	Speed	1.4 rpm at output shaft					
f.	f. Control System						
i.	Туре	multiprocessor					
ii.	Grid Connection	Via full scale back-to-back AC-DC-AC power					
		electronics converter					
iii.	Scope of Monitoring	Remote monitoring of more than 300 different					
		parameters, e.g. temperature sensors, pitch					
		parameters, speed, generator torque, wind speed &					
		direction, etc.					
iv.	Recording	Production data, event list, long & short term trends					
g.	Brake						
i.	Design	Three independent systems, fail safe (individual					
		pitch)					
ii.	Operational Brake	Aerodynamic brake achieved by feathering blades					
iii.	Secondary Brake	Mechanical brake located at the output (high-speed)					
		shaft of the gearbox					
h.	Tower						
i.	Type	Steel tubular with flange connections					
ii.	Hub Heights	137m					

#### D. Other Details

i.	Project Commissioning Date (Anticipated)	December 31, 2018
i.	Expected Life of the Project from Commercial Operation Date (COD)	20 years

## Power Curve( Graphic) of Wind Turbine Generator (V126-3.45MW)





Power Curve (Tal	bular) of Wind T	urbine Generator
(Ve	stas V126-3.45N	1W)

Air density [kg/m³]														
Wind speed		21						31						
[m/s]	1.225	0.95	0.975	1.0	1.025	1.05	1.975	1.1	1,125	1.15	1.175	1.2	1.20	1.2/3
3.0	31	13	15	16	18	19	21	22	24	26	27	28	33	34
3.5	97	64	67	70	73	76	79	82	85	88	91	<u>6</u> 4	100	103
4.0	180	129	133	138	143	147	152	157	161	166	171	175	- 84	189
4.5	279	206	212	219	226	232	239	246	252	259	265	272	285	292
5.0	397	297	308	315	324	333	342	351	361	370	379	388	406	415
5.5	539	408	420	432	444	456	468	480	492	504	518	528	551	563
6.0	711	541	557	572	588	603	619	634	650	665	681	୧ତ୍ର	727	742
6.5	914	699	719	738	758	778	797	817	836	855	875	864	933	952
7.0	1151	885	909	933	958	982	1006	1030	1054	1079	1103	1127	1174	1.98
7.5	1419	1090	1126	1155	1185	1214	1244	1273	1302	1332	1361	1390	1448	1477
8.0	1722	1336	1371	1407	1442	1478	1513	1548	1583	1618	1653	1687	1755	1789
8.5	2059	1606	1649	1690	1732	•774	1815	1856	1897	1939	1978	2018	2098	2138
9.0	2434	1909	1958	2007	2056	2105	2153	2200	2248	2295	2342	2388	2479	2524
9.5	2815	2239	2295	2350	2406	2462	2514	2587	2019	2672	2719	2767	2858	2901
10.0	3132	2582	2641	2666	2758	2817	2867	2916	2988	3018	3054	3093	3162	3.03
10.5	3322	2902	2955	3007	3059	3112	3147	3183	3218	3254	3276	3299	3338	3354
11.0	3411	3148	3180	3224	3282	3300	3319	3339	3359	3380	3390	3401	3418	3425
11.5	3443	3320	3340	3360	3380	3400	3408	3417	3425	3433	3436	3440	3444	3446
12.0	3449	3406	3414	3422	3431	3439	3441	3443	3445	3448	3448	3448	3449	3450
12.5	3450	2439	3441	3443	3448	3448	3448	3449	3449	3450	3450	3450	3450	3450
13.0	3450	3447	3448	3448	3449	3450	3450	3450	3450	3450	3450	3450	3450	3450
13.5	3450	3449	3449	3449	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
14.0	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
14.5	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
15.0	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
15.6	3450	2450	3450	3440	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
16.0	3450	2450	3450	3460	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
16.6	2450	3450	3450	3440	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
17.0	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
47.5	2460	0340	2450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
18.0	3450	3450	3450	2450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
18.5	1450	3450	3450	2450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
19.0	2460	1 3460	2450	2450	3450	3450	3450	3450	3450	3450	3450	3450	3450	3450
10 #	3460	2450	2460	2450	2450	2450	3450	3450	3450	3450	3450	3450	3450	3450
13.3	3450	2460	3450	2460	3450	2450	3460	3450	3450	3450	3450	3450	3450	3450
20.0	3450	3450	3160	2450	2480	1 2450	3450	3450	3450	3450	3450	3450	3450	3450
20.5	1 3430	3450	3450	3450	2450	2450	2460	2460	3450	3450	3450	3450	3450	3450
21.0	3450	3450	3450	3400	3450	3450	2450	2460	3450	1 3450	3450	3450	3450	3450
21.5	3450	3450	3450	10400	3400	000	3450	2450	2450	3460	3460	3450	3450	3450
22.0	3450	3450	3450	3450	3450	3450	3450	3400	3450	2460	2450	2460	3450	2440
22.5	3450	3450	3450	3450	3450	3450	13450	1 3400	13400	3400	3400	5400	1 2400	1 3-00

#### 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/ Windfarm of Licensee is given in this Schedule.



# SCHEDULE II

(1).	Total Installed Gross ISO Capacity of the Generation Facility /Wind Farm (MW/GWh)	48.3 MW
(2).	Total Annual Full Load Hours	3388
(3).	Average Wind Turbine Generator (WTG) Availability	97.0 %
(4).	Total Gross Generation of the Generation Facility/Wind Farm (in GWh)	240.81 GWh
(5).	Array & Miscellaneous Losses GWh	12.006 GWh
(6).	Availability Losses GWh	7.2243 GWh
(7).	Balance of Plant Losses GWh	7.2243 GWh
(8).	Annual Energy Generation (20 year equivalent Net AEP) GWh	167.72 GWh (P75)
(9).	Net Capacity Factor	38.29%

#### Note:

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



# ANNEX 🙀 🔔

SITE DETAILS







# **D. PROJECT SITE**







# D.1 GENERAL

Project is located in Gharo-Jhimpir Keti Bander wind corridor; a wind corridor identified and approved by AEDB as one of the areas with high wind speeds. An area covering approximately 1000 acres for establishing 50 MW wind farm in Jhimpir, Dist. Thatta, Sindh, Pakistan has been leased out to the Project by the Government of Sindh.

Pakistan has a considerable potential of wind energy in the coastal belt of Sindh, Balochistan and in the desert areas of Punjab and Sindh. This renewable source of energy has however, not been utilized significantly in the country. Wind data of Pakistan has been collected by the Pakistan Metrological Department and has been analyzed by AEDB. Over a three dozen wind masts have also been installed in various different locations by private companies pursuing wind power projects in the area. As per the collected data, the coastal belt of Pakistan has a wind corridor that is 60 km wide (Gharo ~ Kati Bandar) and 180 km long (up to Hyderabad). This corridor has the exploitable potential of 50,000 MW of electricity generation through wind energy.

The map of Pakistan shown below, developed by USAID, shows the country's wind power corridors along with their classification according to the wind speed.







# D.2 THE LAND

The project is located in North-East of Karachi (Pakistan's biggest metropolitan city). The aerial distance is around 80KM and road distance from Karachi to Project Site is around 120KM. Project lands falls within the Gharo-Keti Bandar wind corridor, which is amongst the best wind corridors of the country. The average wind speed in this wind corridor is more than 7.3 m/s.

The Project Company has the possession of the land and installed its own wind data collection mast in December 2014.

The Site was selected after going through various technical studies of terrain and assessment of wind. The land identification process was driven by the technical, economic and environmental factors to determine location having the lowest combined investment and lifetime operating cost with lowest environmental impact. In addition, the site selection criteria included comparative evaluation of different factors such as site accessibility, land availability and costs, interconnection with the national grid, and geotechnical features.

A preliminary assessment of known land uses and local environmental sensitivities in terms of their likely compatibility with wind development was also evaluated. Due considerations were also given to the availability of open spaces and cultivated or inactive lands, the number of residents and the spacing between them, the number of landowners, the proximity to parks and recognized wildlife habitats, and other factors.

Thus, the Project Company selected the Site mainly due to following factors:

- Project Site is situated in one of the best wind corridors of the world. There are no topographical barriers or features located in or around the Site that may influence air movement;
- Easy access to the Site through well-developed road network thereby reducing environmental impact as well as costs and risks of the Project and future support;
- The land is near to NTDC existing network and thus grid availability is not an issue for project.
- There are no signs of any archaeological sites in or around the Project area.

## **D.3 LAND COORDINATES**

The Project Site coordinates are given below;

S. No.	Longitude	Latitude
А	67°48'01.60"East	24°56'06.94''North
В	67°44'38.87''East	24°58'40.49''North
С	67°47'26.47''East	24°57'51.21''North
D	67°48'40.10''East	24°57'09.33''North
Е	67°48'21.22''East	24°56'41.75''North
F	67°44'42.64''East	24°58'46.01''North
G	67°48'17.45''East	24°56'36.24''North
Н	67°47'58.58''East	24°56'08.66''North
l	67°49'22.11''East	24°56'45.43''North



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J	67°48'20.47''East	24°56'34.52''North
K	67°49'25.88''East	24°56'50.95''North
L	67°48'24.25''East	24°56'40.06''North
M	67°48'43.12''East	24°43'37.40''North
N	67°49'03.23''East	24°56'17.86''North
0	67°45'14.78''East	24°57'41.79''North
P	67°47'30,24''East	24'57'56.72''North
0	67°45'11.01''East	24°57'36.27''North
R	67°48'36.81''East	24°55'39.25''North
S	67°48'59.46''East	24°56'12.34''North
T	67°48'40.58''East	24°55'44.76''North
*	Table: D.1: Land Coc	ordinates

Technical layout of the Project is shown below;



Image D.2: Technical layout of the Project

## **D.4 LAND SURROUNDINGS**

The Site is situated at a distance of 6 km from the population of local villages, decreasing any chances of potential threat to local dwellers. There are no nesting habitats for any large or significant avian populations located in the project area of influence.

Topographically the area is flat with sporadic vegetation like wild grass etc. The land is generally flat. Terrain conditions can be classified as regular in general. There is a seasonal rain drain in the area, which is discharged during monsoon season. The ground and soil conditions are stable for turbine foundations and crane pads.





Due to its close location to Arabian Sea, the area is hot and humid with very low precipitation. This has made the area barren. Since basic amenities were not available in the area hence most of the local population residing in the area migrated to nearby villages which are more than 06 km from the Project Site. There are no permanent structure/ houses and no crop could be cultivated. However, in the rainy season, if there is enough precipitation, a very small portion of the area becomes green as a lot of grass can grow that is used for grazing of cattle. Some of such migrated population comes back with their cattle in summer when there is plenty of rain and enough grass grows for grazing of their animals. Project Company does not intend to fence the boundary; if any cattle come for grazing it will not get disturbed.

## D.5 LOGISTIC

The delivery of equipment and construction of wind project also requires that the terrain be accessible by heavy-duty vehicles (e.g., tractor trailers, cement trucks) and cranes. As there are no steep slopes or deep gullies therefore it will not be difficult to assess and mitigate unacceptable safety risks.

Components of the wind turbine will require transportation to the Site from the delivery point i.e. Port Qasim via National Highway. Project Site is approximately 120 km from the Port Qasim, Karachi. The Project Site is located in the North-East of Karachi. The major track from Karachi to Project Site is through Karachi Hyderabad Motorway M9. The road is multilane till it exits towards Nooriabad. From Nooriabad, a road namely Thatta Thano Bula Khan turns right towards Jhimpir. The road is single semi metalled road. The access route to the Project Site has been reviewed for the delivery of blades, tower, and other components. Route access report is completed by M/s Ecochange (Private) Limited.

The route was surveyed from Port Qasim, Karachi to the Project Site, Jhimpir, Thatta along the road to the site entrance. Two routes have been proposed for delivery of equipment. Track No. 1 on the Google map is shown below. Total track length is 140KM.



Image D.3: Route map of Track No 1 Source: Ecochange (Private) Limited



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Track No 2 length is 120KM which is 20KM less than that of Track No 1. Track No 2 on the Google map is shown below



Image D.4: Route map of Track No 2 Source: Ecochange (Private) Limited

Based on the report, no special precautions would be required in respect of vehicle movements other than adequate traffic management and vehicle supervision by escort vehicle. On the basis of information provided by the EPC Contractor, standard allowable weights would not be exceeded, removing any issues associated with the abnormal load damage. However, 12 KM road near the project site need to be metalled so that vehicles carrying oversized components (blades, tower sections) can move more easily.

Project Company will ensure that adequate warning signs be implemented to warn other road users at critical points along the route.

# **D.6 SOIL CONDITION**

Soil conditions are also favorable for road construction and for installing underground facilities such as wind turbine foundations, fiber-optic communication lines, and electrical conductors.

M/s Pakistan Alternate Engineering Services (PAES) conducted geo-technical investigation of the Project site. Its scope of work included drilling of boreholes, carrying out field tests to obtain adequate subsurface information, collections of soil samples, laboratory testing and preparation of report including





recommendations for foundation design. . The boring work at the Site was accomplished by Rotary Wash Drilling Method, in which the borehole is advanced by constant rotation of the bit and it cuts the material loose. Bentonite was used as drilling fluid. The returning drilling fluid brings up the soil cuttings, which are preserved as disturbed samples for visual identification of the soil. Core samples were collected by using NX core barrel. Stratigraphy of various soil layers at the Site has also been assessed through information / data from drilling, field testing and laboratory test results. In addition to field testing, a number of laboratory tests were also conducted on selected soil samples.

Borehole locations were planned in a manner to obtain fair amount of information about subsoil conditions up to a considerable depth. A total of eight (08) boreholes were drilled at the Site. Depth of each borehole was 15.0 meters below the existing ground level. Laboratory testing of these samples was carried out in the Soil Testing Services Laboratory Karachi.

Geotechnical investigation for TAEL project was carried out in May, 2015. Eight (08) boreholes were drilled as part of the field investigation. Soil and rock samples were also collected during the field investigation.

Following picture shows the location of the eight bore holes;







Laboratory testing of soil and rock samples has been carried out in STS lab and includes natural moisture content, specific gravity, water absorption, density, unconfined compressive strength etc. Chemical characteristics of soil and rock samples have also been assessed through determination of total dissolved solids, sulphate content, chloride content and pH.

The deposition of area mainly consists of the area mainly consists of 'very weak to strong' limestone and 'extremely weak' shale. Groundwater table was not encountered up to explored depth of 15 meters.

Allowable bearing pressures have been given for pad foundations at a depth of 1.5-2.0 meters below existing ground level. Seismic soil profile has been taken as 'SB' for shallow foundations in accordance with UBC-97.

The exposure of underground concrete to aggressive chemicals is found to be 'negligible for soil, sulphates and chlorides which have influenced the selection of cement for underground concreting. Ordinary Portland Cement (OPC) is recommended for WTG foundations.

# D.7 TOPOGRAPHICAL CONDITION

Pakistan Alternate Engineering Services conducted the site topographical survey of the Site. The survey was conducted in order to give the EPC contractor a better understanding about the site conditions and to avoid any unforeseen surprises that could hamper the Project or increase Project cost.

In topographic survey build up area, agricultural land, Un-cultivated land, check bank, drains, track and spot levels etc. are marked. All topographic details have been observed using total station, points are taken as a grid of 20m x 20m or change of surface profile, whichever comes first. The scale for topographic survey is (1:1), Contour Interval is (0.5 m), Scale of Drawings in soft format is (1:1) and Scale for Drawings on Paper is (1:1000).

For topographic survey UTM Coordinates and WGS 84 datum have been used as the reference datum. Two Nos. reference stations have been taken and transferred with GPS (Static Mode) on operational site.

15 Nos. Control Points have been established at project site during survey works. The elevation system relate EGM2008. The GPS Static baseline data have been processed using Stonix GPS processor software.

The terrain of the project area is near to flat and easily accessible through metalled road. Wild trees which are locally known as Berri, Kikkeri & Babbar are found and their wood is used in burning stove for cooking purpose. On other hand sparse quantity of scrubs are and the only water source is the rain. Cattles like Cow, Buffalo, bull, sheep, goat and camels are the source of income for native people. Wild animals like Jackal and wild rabbit are found at survey site as well. Besides snakes and lizards are found during summer season.

The land area covered by wind farm site consists of complex of agriculturally unproductive (rock) land and some poorly grazing (gravely land) (Class VIII, Class VII). The area constitutes





about 30% of the total wind farm area and is incapable for agricultural activities as the soil underneath mainly consists of rocks and gravels. No important features other than some temporary cultivation and huts have been observed during the survey.

The site pictures are given below;



Image D.6: Location No 1









Image D.7: Location No 2

(Cf