



USAID ENERGY POLICY PROGRAM

STEP 2 – DUE DILIGENCE

POWER DISPERSAL FROM WIND POWERPLANTS AT JHIMPIR



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Acronyms

ADB	Asian Development Bank
AEAI	Advanced Engineering Associates International, Inc.
AEDB	Alternate Energy Development Board
D/C	Double Circuit
ECNEC	Executive Committee of the National Economic Council
EHV	Extra High Voltage
EIA	Environmental Impact Assessment
EMMP	Environmental Monitoring and Mitigation Plan
EPA	Energy Purchase Agreement
EPC	Engineering, Procurement, and Construction
ESIC	Environment and Social Impact Cell
FEC	Foreign Exchange Component
FFCEL	Fauji Fertilizer Company Energy Ltd.
FWEL-I	Foundation Wind Energy Ltd-I
FWEL-II	Foundation Wind Energy Ltd-II
G2G	Government to Government
GOP	Government of Pakistan
GSC	Grid System Construction
GSO	Grid System Operation
GST	General Sales Tax
GWh	Gigawatt Hour
HESCO	Hyderabad Electric Supply Company
IA	Implementation Agreement
IEE	Initial Environmental Examination
IPP	Independent Power Producer
kV	Kilovolt
MW	Megawatt
MWh	Megawatt hour
NPCC	National Power Control Centre
NTDC	National Transmission and Despatch Company
OPGW	Optic Ground Wire
PMD	Pakistan Meteorological Department
REA	Rapid Environment Analysis
TGF	Three Gorges First
TM Khan	Tando Muhammad Khan
USAID	United States Agency for International Development
USG	United States Government
WPP	Wind Power Plant
ZEPL	Zorlu Energy Pakistan Ltd.

Executive Summary

The United States Agency for International Development (USAID) tasked Advanced Engineering Associates International, Inc. (AEAI) to conduct the necessary due diligence concerning the proposed project to provide power dispersal from the wind power plants at Jhimpir, while considering the technical feasibility, cost reasonableness, and overall impact of the project. This due diligence report provides detailed examination of the project activities and an in-depth analysis of additional information essential for a United States Government (USG) decision on funding the project. This document is the second of a two-phased due diligence to implement the transmission grid projects needed for power dispersal from the upcoming Wind Power Plants (WPPs) in Jhimpir.

Pakistan is facing acute shortage of electrical power and requires the injection of new power sources on a fast-track basis. Pakistan is endowed with abundant renewable resources including wind power. Tapping the potential of this renewable energy is of critical urgency to support peak demand.

The transmission project is intended to connect 734MW from WPPs to the national electric grid at an estimated cost of \$42.95 million. Based on the assessment conducted for this report, the project is an attractive option for USAID funding, though not without issues that need to be addressed. It is a high visibility, high priority project for the Government of Pakistan (GOP) that promotes the development of alternate energy in the country and enhances the opportunity of diversifying the energy mix to indigenous renewable wind resources. It will stimulate the economy by creating jobs that use local and foreign resources, as well as building public-private partnerships.

The main tasks involve the construction by early 2016 of three transmission lines and one new 220/132kV grid station. This includes:

- Construction of a double circuit 220 kV transmission line from the 220 kV Jhimpir grid station to the 220 kV TM Khan Road grid station,
- Construction of a double circuit 132kV transmission line from 220 kV Jhimpir grid station to the 132 kV TM Khan grid station,
- Extensions at the 132 kV TM Khan grid station and 220 kV TM Khan Road grid station,
- Construction of a new 220/132 kV Jhimpir grid station, and
- Construction of double circuit 132 kV transmission line for interconnection of WPPs with the new 220/132 kV Jhimpir grid station.

The PC-1 was approved by Executive Committee of the National Economic Council (ECNEC) on July 3, 2014 with a total estimated cost of \$113.91 million (1 US \$ = 99 PKR as of May 2014). Required USAID financing is \$42.95 million for Jhimpir section only which is a standalone project to connect 680MW of WPPs to the national grid. The Asian Development Bank (ADB) is financing \$8.18 million for extension at 500 KV Jamshoro grid station while the remaining \$62.78 million for 220 KV double circuit transmission line and grid station at Ghara is proposed to be financed by the National Transmission and Despatch Company (NTDC)'s own resources and borrowing from local banks.

The project is being executed by NTDC, which is responsible for the design and construction of the required improvements of transmission lines and grid stations. NTDC has surveyed and marked the line routes and also prepared and floated the bidding documents. Most of the contracts have been evaluated and awarded by NTDC and the others will be finalized by May 2015. The load flow studies were conducted on the proposed interconnection scheme and the results support the technical approach to this project. Furthermore, AEA, Inc. has engaged the services of Halcrow Ltd. to conduct the Rapid Environment Analysis (REA) as per the approved IEE in order to determine whether the project complies with GOP and USAID environmental regulations and to recommend necessary mitigation measures to be taken by NTDC during project execution. The right-of-way issues that are common in transmission line projects will be addressed in detail in the REA.

However, the transmission project will have to be completed prior to the commercial operation dates of the generating sources in order to harness the full benefits in a timely manner.

I. Project Overview

Table I: Project Summary

Name of Project	Interconnection Scheme for Dispersal of Power from Jhimpir WPPs
Location	Jhimpir - District Thatta and Jamshoro in Sindh Province, Pakistan
Sponsoring Agency	Ministry of Water and Power, Government of Pakistan
Executing Agency	National Transmission and Despatch Company
Description of the Project	Power dispersal scheme at 132 kV and 220kV transmission level for additional 734 MW upcoming WPPs at Jhimpir wind cluster till the end of 2016.
Scope of the Project	NTDC has requested USAID to support its scope by funding nearly 38% of the entire project cost which will fully fund the transmission lines and grid station at Jhimpir section only.
Benefits of the Project	<ul style="list-style-type: none"> • Improve the voltage profile of Hyderabad Electric Supply Company (HESCO) and NTDC network; • Reduce transmission line losses of HESCO and NTDC network; • Improve reliability of HESCO and NTDC network in the vicinity of the project; • Enable the use of clean electricity generated through efficient use of 734 MW of renewable indigenous wind resources; • Promote the development of alternate energy projects; and • Stimulate the economy by purchasing both local and foreign goods and services and creating jobs for qualified locals in the project area and in the country.
Commencement Date	March 2014
Completion Date	January 2016
Funding	USAID Required Contribution: \$42.95 million NTDC Contribution: \$62.78 million ADB Contribution: \$8.18 million Total: \$113.91 million (per approved PC-1 – 2014)
Mode of Financing	Financing is being requested by NTDC from USAID under Government to Government (G2G) agreement for the evacuation of power from Jhimpir WPPs.
Risks	<ul style="list-style-type: none"> • Right of way • Law and order situation • Delay in custom clearance of imported goods • Delay in implementation of associated wind generation plants

2. Project Details

The GOP is developing the Gharo-Keti Bandar wind corridor (see Figure 1 below) that stretches 60 km along the Arabian Sea coast of Sindh province to more than 170 km inland. NTDC has requested USAID/USG fund the transmission lines for power dispersal by 2016 from 734 MW WPPs, at an estimated cost of \$42.95 million.

The NTDC has developed a transmission expansion plan using load flow studies conducted in PSS/E planning software. These studies took into account the failure or outage of any component in the adjoining transmission system (N-1 contingency) and showed that the proposed transmission interconnection is a viable option for this project. The scope of work to be carried out under USAID funding includes the construction of the following:

1. A 220/132kV new Jhimpir grid station;
2. A new 75 km long (revised length), 132 kV double circuit transmission line from the new Jhimpir grid station to the existing 132 kV TM Khan grid station;
3. A new 84.5 km long (revised length), 220 kV twin-bundled double circuit transmission line from the new Jhimpir grid station to the existing 220 kV TM Khan Road grid station;
4. Extension at the existing 132 kV TM Khan grid station and 220kV TM Khan Road grid station; and
5. A 132 kV double circuit transmission line for interconnection of WPPs with 132 kV Jhimpir new grid station

Figure 1 below indicates the location of the wind projects sites, and Figure-2 illustrates the connection scheme of the whole project. The sections of the transmission lines to be funded by USAID are highlighted in yellow. The project area map is given in **Annex I**.



Figure 1: Project Location

2.1 Interconnection Scheme

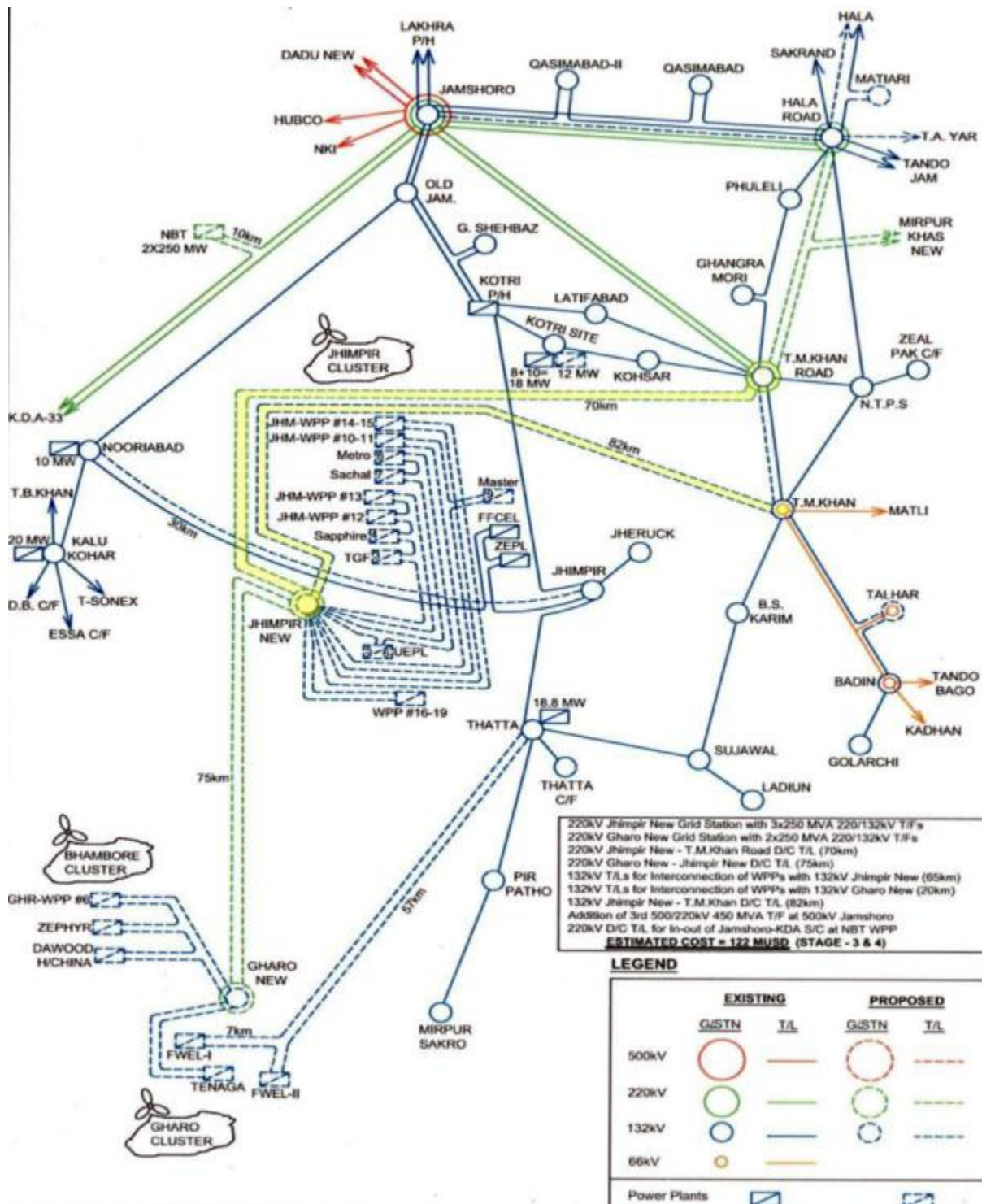


Figure 2: Interconnection Schematic Diagrams

3. Financing Requirements

A PC-I has been approved for \$113.91 million including the Engineering, Procurement, and Construction (EPC) costs and general items consisting of residential buildings, office furniture, equipment and transportation, contingencies and miscellaneous costs involved during construction. There are three funding sources and USAID’s contribution is \$42.95 million for Jhimpir section of the whole scheme which is a standalone section to connect to the grid. USAID contribution is about 38% of total project cost. The cost estimates of the works funded by USAID exclude right of way (ROW) compensation, cost of land for grid station construction, duties, and taxes. The break-down of total estimated costs is given in the **Table 2** below along with contributions from other funding sources.

Table 2: Cost Estimation Break-Down

	Total
PC-I Cost (million \$)	113.91
USAID Required Contribution (million \$)	42.95
NTDC’s Contribution (million \$)	62.78
ADB’s Contribution (million \$)	8.18

The project to be executed under USAID funding targets the evacuation of about 734 MW of wind power from the Jhimpir cluster. A 132 kV transmission line has been planned for the evacuation of four WPPs having the installed capacity of 200 MW. For the remaining 534 MW of WPPs, 220 kV transmission line along with 220/132kV grid station is being constructed to step up the voltage from 132 kV to 220 kV level.

Table 3 below indicates the cost estimates based on the PC-I (column 2). The tendering process was started by NTDC in early 2014 and most of the contracts have already been awarded. The awarded costs are shown (column 3) after deduction of non-payables (ROW, land, duties, and government taxes such as sales tax). Most of the figures provided in column 3 are based on actual awarded contracts costs. Only in a few cases, where contracts for procurement of material have not yet been awarded, the PC-I estimates are used;

Table 3: Cost Estimate for the Project

Sr. No.	Description	PC-I Cost Estimates (million \$)	Due Diligence-2 Cost Estimates (million \$)
		(2)	(3)
1.	220/132 kV new Jhimpir grid station	10.19	12.57
2.	Extension at existing 132 kV TM Khan grid station	0.18	0.20
3.	132 kV double circuit transmission line from new Jhimpir grid station to existing 132kV TM Khan Grid station (PC-I estimated length 82 km; actual revised length 75km)	7.53	8.23
4.	Extension at existing 220 kV TM Khan Road grid station	0.53	0.44*
5.	220 kV Jhimpir – TM Khan Road D/C transmission line (PC-I estimated length 70 km; actual revised length 84.5km)	11.56	15.61
6.	132 kV double circuit transmission line for interconnection of WPPs with 132 kV new Jhimpir grid station (PC-I estimated length 25 km)	2.30	2.63
7.	Miscellaneous	1.16	3.28
Grand Total \$		33.44	42.95

* Cost of material only. Civil works & erection costs have been included in civil works & erection of 220/132kV new Jhimpir grid station.

The figures in the table do not include ROW compensation, cost of land for construction of the 220/132 kV grid station, duties, taxes, and other non-payables. The cost of the Due Diligence – Step 2 estimates has increased by 28%, i.e. to \$42.95 million against PC-I cost estimate of \$33.44 million. This major deviation from PC-I costs is because of the change in transmission line lengths and high cost of civil works due to soil conditions. This 28% increase is only for Jhimpir section which is only 8% of the total approved cost of the PC-I. Therefore, the PC-I revision for USAID funded section is not required as the cost increase can go up to 15% without revising the PC-I.

The methodology and details used to arrive at these cost estimates are covered in detail in the Cost Assessment section.

4. Status of WPPS

Three wind power projects at Jhimpir – Fauji Fertilizer Company Energy Limited (FFCEL) with 49.5 MW capacity, Zorlu Energy Pakistan Limited (ZEPL) with 56.4 MW capacity, and Three Gorges First (TGF) with 49.5 MW have started commercial operation. Similarly, two wind power projects at Gharo – Foundation Wind Energy Limited-I (FWEL-I) and Foundation Wind Energy Limited-II (FWEL-II) with 50 MW each have come on bar and are feeding power into the national grid. The transmission interconnections required for power dispersal from 49.5 MW TGF WPP was completed by NTDC and the WPP began its operation on November 25, 2014. The construction of 76 km long, 132 kV double circuit transmission line needed for power dispersal from FWEL-I (50 MW) and FWEL-II (50 MW) in Gharo to 132 kV Thatta grid station has also been completed by NTDC using its own resources.

As per the updates received from the AEDB and NTDC, 534 MW out of 734 MW at Jhimpir cluster will come on-line by September 2016. An additional 100 MW wind generation is expected to be added at Gharo by 2016. The names of upcoming WPPs at Jhimpir and Gharo are given below:

1. At Jhimpir:

- **Sapphire Wind Power Co. Ltd.** (50 MW) has achieved financial close on July 07, 2014. The expected date of commissioning is December, 2015.
- **Yunus Energy Limited** (50 MW) has achieved financial close on February 09, 2015. The expected date of commissioning is September, 2016.
- **Master Wind Energy Pvt. Ltd.** (50 MW) has achieved financial close on March 27, 2015. The expected date of commissioning is September, 2016.
- **United Energy Pvt. Ltd.** (99 MW) has achieved financial close on March 30, 2015. The expected date of commissioning is September, 2016.
- **Gul Ahmed Wind Power Limited** (50 MW) has achieved financial close on March 27, 2015. The expected date of commissioning is September, 2016.
- **Tapal Wind Energy Pvt. Ltd.** (30 MW) has achieved financial close on March 27, 2015. The expected date of commissioning is September, 2016.
- **Metro Power Company Limited** (50 MW) has achieved financial close on February 20, 2015. The expected date of commissioning is September, 2016.

More upcoming projects at Jhimpir which have not achieved their financial close are given below:

- **Jhimpir Wind Power Limited** (50 MW), Energy purchase agreement (EPA) signed on March 11, 2015. The expected date of financial closing is June, 2015.
- **Hawa Energy (Pvt) Ltd.** (50 MW), Energy purchase agreement (EPA) signed on March 10, 2015. The expected date of financial closing is June, 2015.
- **Sachal Energy Development Pvt. Ltd.** (50 MW), Energy purchase agreement (EPA) signed on February 27, 2015. The expected date of financial closing is June, 2015.
- **China Sunec Energy (Pvt) Ltd** (50 MW), Energy purchase agreement (EPA) has been submitted to BOD for approval. The expected date of financial closing is June, 2015.

2. At Gharo:

- **Tenaga Generasi Limited** (50 MW) has achieved financial close on March 27, 2015. The expected date of commissioning is September, 2016.
- **Hydro China Dawood Power Pvt. Ltd.** (50 MW) has achieved financial close on March 27, 2015. The expected date of commissioning is September, 2016.

One upcoming WPP at Gharo which has not achieved its financial close is:

- **Zephyr Power (Pvt.) Ltd.** The expected date of financial closing is March, 2016. Table 4 provides the status details of upcoming WPPs.

Table 4: Status Details of Upcoming WPPs

Wind Power Project (WPP)	Financial Closing	Expected Commercial Operation Date	WPP Output in MW	Added Transmission capacity in MW	Timeline for Transmission activities
Jhimpir					
Sapphire Wind Power Co. Ltd.	7-Jul-14	Dec-2015	50	A D/C Greeley conductor transmission capacity at 132kV: 260 MW; A DC twin bundled Greeley conductor transmission capacity at 220kV: 600MW	To be completed by January 2016
Yunus Eney Limited	9-Feb-15	Sep-2016	50		
Master Wind Energy Pvt. Ltd.	27-Mar-15		50		
United Energy Pvt. Ltd.	30-Mar-15		99		
Gul Ahmed Wind Power Limited	27-Mar-15		50		
Tapal Wind Energy Pvt. Ltd.	27-Mar-15		30		
Metro Power Company Limited (Cost-plus)	20-Feb-15		50		
Jhimpir Wind Power Limited	June 2015 (Expected)	-	50		
Hawa Energy (Pvt) Ltd.			50		
Sachal Energy Development Pvt. Ltd. (Cost-plus)			50		
China Sunec Energy (Pvt) Ltd			50		
Gharo					
Tenaga Generasi Limited	27-Mar-15	Sep-2016	50	A D/C twin bundled Greeley conductor transmission capacity at 220kV: 600 MW	To be completed by March 2016
Hydro China Dawood Pvt. Ltd.	27-Mar-15		50		
Zephyr Power Pvt. Ltd.	March 2016 (Expected)	-	50		

Additionally, there are eleven (11) wind power projects, having valid Letter of Intent from AEDB, with a cumulative capacity of 774 MW are at various stages of project development and may achieve COD by 2016/2017; depending on tariff, grid and land is made available by NEPRA, NTDC and GOS respectively.

Table 5: Status of Planned WPPs

Sr. No.	Name of Project	Location	Installed Capacity (MW)	Present Status / Expected COD
1	Wind Eagle Pvt. Ltd-I	Jhimpir	50	Approval of interconnection study is awaited.
2	Wind Eagle Pvt. Ltd-II	Jhimpir	50	Approval of interconnection study is awaited.
3	Tricon Boston-A Consulting Corporation Pvt. Limited	Jhimpir	50	Approval of interconnection study is awaited.
4	Tricon Boston-B Consulting Corporation Pvt. Limited	Jhimpir	50	Approval of interconnection study is awaited.
5	Tricon Boston-C Consulting Corporation Pvt. Limited	Jhimpir	50	Approval of interconnection study is awaited
6	Western Energy Pvt. Limited	Jhimpir	50	Approval of interconnection study is awaited
7	Burj Wind Energy Pvt. Limited	Gujju	14	Approval of interconnection study is awaited.
8	Hartford Alternative Energy Pvt. Limited	Jhimpir	50	Approval of interconnection study is awaited.
9	Titan Energy Pvt. Ltd	Jhimpir	10	Approval of interconnection study is awaited.
10	United energy Ltd	Land not allocated	350	Land Not Allocated
11	Trident Energy Pvt. Limited	Land not allocated	50	Land Not Allocated

4.1 Generation Data for the Existing WPPs

EPP has gathered monthly energy data from the FFCEL Jhimpir WPP, which is given in **Table 5** below. Furthermore, the hourly power generation data collected from the National Power Control Centre (NPCC) for random samples from different days in a year is provided in **Annex-II**. Generally, it is observed that wind power generation supports the load demand during the evening peak hours in the peak season of May through August. Monthly energy data are given in **Table 6** below.

Table 6: Monthly Energy Data of FFCEL*

	Net Energy Delivered (MWh) by FFCEL WPP	Monthly Plant Capacity Factor	Maximum Possible Energy (MWh) of one 49.5MW WPP	Pakistan Energy Demand (MWh)	Contribution of one 49.5MW WPP in Pakistan's Energy Demand in %
May 2013	19,838	53.8%	36,828	7,456,630	0.27%
June 2013	14,522	40.7%	35,640	8,507,410	0.17%
July 2013	19,195	52.1%	36,828	9,913,400	0.19%
August 2013	13,983	38.0%	36,828	9,758,780	0.14%
September 2013	10,321	29.0%	35,640	9,398,000	0.11%
October 2013	4,957	13.5%	36,828	8,433,350	0.06%
November 2013	6,529	18.3%	35,640	6,820,650	0.09%
December 2013	7,569	20.5%	36,828	6,903,880	0.11%
January 2014	10,485	28.5%	36,828	6,121,670	0.17%
February 2014	6,447	19.4%	33,264	5,341,870	0.12%
March 2014	6,834	18.6%	36,828	6,087,400	0.11%
April 2014	8,303	23.3%	35,640	6,180,140	0.13%
Year 2013/14	128,983	29.7%	433,620	90,923,180	0.14%

* Based on actual energy data of FFCEL WPP

The survey conducted by Pakistan Meteorological Department (PMD) on wind power potential along the coastal areas of the country indicates a vast potential for harvesting wind energy using currently available technologies. Gharo, one of the sites in Sindh where the wind data have been recorded and studied by PMD, was selected for the feasibility study. The wind measurements at Gharo were carried out during a 24-month period. The annual mean wind speed is estimated to be 6.86 m/s at 50 m above ground level. The annual power density of the area is 408 W/m², which brings the site into the good category of power potential and the area is suitable for large, economically viable wind farms. The annual gross energy production corresponding to the installed capacity of a 49.5 MW wind farm consisting of thirty-three 1.5 MW turbines is around 430 GWh. However, taking into account the wind turbine availability, net losses and wake effects in the wind farm, the net annual energy production is estimated to 135 GWh per year corresponding to a capacity factor of 31%. A typical life of a wind turbine is 20 to 25 years.

5. Cost Assessment

The due diligence step-2 cost estimates in the table below are based on the actual contract prices. In case where the contracts for procurement of material have not yet been awarded, the costs are based on PC-I estimates; and these costs are very close to actual awarded costs. In a few cases, estimates for civil and erection works are derived proportionally on the basis of actual and PC-I estimates. The basis of estimates for each item has also been indicated in its relevant column.

Table 7 illustrates the estimates based on actual awarded costs (column-2) against the PC-I estimate (column-1). The detailed calculation of PC-I estimates are shown in **Annex-III**. The basis for the PC-I cost estimates is given in **Annex-IV**. The General Sales tax (GST) paid to the government on material like cement and steel, forming the main components of the civil works, is not payable to NTDC under the USAID Government to Government (G2G) funding. The crush and sand are exempted from such taxes. This sales tax (column-3) is estimated to be approximately 4.7% of the cost for civil and erection works of the project, as outlined below:

The quantity of cement and steel used in foundations is estimated from the approved foundation drawings of 220 kV D/C transmission line from 220 kV Jhampir to the existing 220 kV T M Khan Road grid station as detailed in **Annex-V**. The total cost of cement and steel is calculated based on WAPDA Schedule of Rates of 2013 and latest market rate. The applicable GST is calculated by applying 17% on total calculated cost of cement and steel. The sales tax figure thus comes out be 4.7% of the price quoted for civil and erection works (detailed in **Annex-VI**).

Column (4) in the table indicates the item wise cost of each component of the project, to be paid after deduction of 4.7% sales tax from the relevant civil works.

Table 7: Project Cost Estimates

Sr. No.	Project Description	PC-I Cost estimates	Due Diligence Step -2 Cost Estimates			
		Total payable Cost*	Actual Bid Price/Estimates including taxes	Taxes	Actual Bid Price/Estimates excluding taxes	Basis of estimates
		(Million \$)				
		(1)	(2)		(4) = (2) –(3)	(5)
1	220/132 kV Jhimpir new grid station					
i)	Land	(0.57)	0.00	0.00	0.00	Not-payable
ii)	220 kV line and transformer bays consisting of transformers, circuit breakers, isolators, C.Ts, P.Ts, L.As, control & protection equipment and other allied equipment.	6.74	5.97	0.00	5.97	Actual
iii)	Twelve 132 kV line bays consisting of circuit breakers, isolators, C.Ts, P.Ts, L.As, control & protection equipment and other allied equipment.	1.71	1.69	0.00	1.69	Actual
iv)	Civil Works and erection	0.86	4.23	0.20	4.03	Actual
v)	Non-residential buildings, office furniture & equipment, transportation & vehicles and residential colony	0.88	0.88	0.00	0.88	PC-I
Subtotal		10.19	12.77	0.20	12.57	
2	Extension at 132 kV TM Khan grid station					
i)	Two 132 kV line bays consisting of circuit breakers, isolators, C.Ts, P.Ts, L.As, control & protection equipment and other allied equipment.	0.16	0.11	0.00	0.11	Actual
ii)	Civil Works and erection	0.02	0.09	0.00	0.09	Estimated
Subtotal		0.18	0.20	0.00	0.20	
3	132 kV double circuit transmission line from Jhimpir new to Existing 132 kV T M Khan grid station (revised 75 km)					
i)	Right of way clearing	(0.83)	0.00	0.00	0.00	Not-payable
ii)	Steel Towers	1.75	1.75	0.00	1.75	PC-I
iii)	Conductor	2.61	2.61	0.00	2.61	PC-I

Sr. No.	Project Description	PC-1 Cost estimates	Due Diligence Step -2 Cost Estimates			
		Total payable Cost*	Actual Bid Price/Estimates including taxes	Taxes	Actual Bid Price/Estimates excluding taxes	Basis of estimates
		(Million \$)				
		(1)	(2)		(4) = (2) –(3)	(5)
iv)	Overhead Ground Wire (OPGW)	0.30	0.23	0.00	0.23	Actual
v)	Insulator strings, hardware, grounding material, stringing & construction equipment and accessories	0.55	0.98	0.00	0.98	Actual
vi)	Civil works and Erection	2.32	2.79	0.13	2.66	Actual
Subtotal		7.53	8.36	0.13	8.23	
4	Extension at existing 220 kV T M Khan Road grid station					
i)	Two 220 kV line bays consisting of circuit breakers, isolators, C.Ts, P.Ts, L.As, control & protection equipment and other allied equipment.	0.48	0.44	0.00	0.44	Actual
ii)	Civil works and erection	0.05	Already included in item I (iv): Contract awarded for civil & erection of 220/132kV Jhimpir new grid station			
Subtotal		0.53	0.44	0.00	0.44	
5	220 kV double circuit transmission line from 220 kV Jhimpir to existing 220 kV T M Khan Road grid station (revised 84.5km)					
i)	Right of way clearing	(0.71)	0.00	0.00	0.00	Not-payable
ii)	Steel Towers	3.00	4.41	0.00	4.41	Actual
iii)	Conductor	4.00	3.61	0.00	3.61	Actual
iv)	Overhead Ground Wire (OPGW)	0.19	0.25	0.00	0.25	Actual
v)	Insulator strings, hardware, grounding material, stringing & construction equipment and accessories	1.07	1.12	0.00	1.12	Actual
vi)	Civil works and Erection	3.30	6.52	0.31	6.21	Actual
Subtotal		11.56	15.91	0.31	15.61	
6	132 kV double circuit transmission line for interconnection of WPPs with 132 kV Jhimpir new Grid station (PCI estimated length 25 km)					
i)	Right of way clearing	(0.25)	0.00	0.00	0.00	Not-payable

Sr. No.	Project Description	PC-I Cost estimates	Due Diligence Step -2 Cost Estimates			
		Total payable Cost*	Actual Bid Price/Estimates including taxes	Taxes	Actual Bid Price/Estimates excluding taxes	Basis of estimates
		(Million \$)				
		(1)	(2)		(4) = (2) –(3)	(5)
ii)	Steel Towers	0.53	0.53	0.00	0.53	PC-I
iii)	Conductor	0.80	0.80	0.00	0.80	PC-I
iv)	Overhead Ground Wire (OPGW)	0.09	0.08	0.00	0.08	Estimated-I
v)	Insulator strings, hardware, grounding material, stringing & construction equipment and accessories	0.17	0.33	0.00	0.33	Estimated-I
vi)	Civil works and Erection	0.70	0.93	0.04	0.89	Estimated-I
Subtotal		2.29	2.67	0.04	2.63	
7	Miscellaneous					
i)	Engineering & consultancy 2% of project cost	0.79	0.82	0.00	0.82	PC-I
ii)	Administration & supervision 1.5% of project cost	(0.59)	0.00	0.00	0.00	Not-payable
iii)	Contingencies	(0.39)	2.18	0.00	2.18	
iv)	In land transportation 1% of equipment cost	0.23	0.22	0.00	0.22	PC-I
v)	Insurance 0.25% of equipment cost	0.07	0.06	0.00	0.06	PC-I
vi)	L/C opening 0.25% of equipment cost	0.07	0.00	0.00	0.00	
Subtotal		1.16	3.28	0.00	3.28	
Grand Total		33.44	43.64	0.68	42.95	

*The bracketed values in column (1) fall under category of non-payable items, therefore are not included in the grand total.

1. In **Table 7** above, column (4) depicts revised cost estimates of the project payable under USG G2G funding. The basis for arriving these estimates is detailed below:
 - **Actual:** The cost based on the actual award costs without duties and taxes.
 - **PC-I:** In case where the contracts for procurement of material have not yet been awarded, the costs are based on PC-I estimates; and these costs in fact are very close to actual awarded costs.
 - **Estimated:** The cost is derived after comparing actual costs against the PC-I estimates of a similar item and revised proportionally in accordance to the price of actual award.
 - **Estimated-I:** The cost is based on actual costs of same material procured for 132 kV double circuit transmission line from the new Jhimpir to the existing 132 kV T M Khan grid station.
 - **Not-payable:** These items are not payable under USG G2G agreements.
2. The cost in Item 5(v) (\$1.12 million) does not include the cost of hardware worth \$0.16 million procured from the country falling in restricted country list.
3. The contract for civil and erection works has been awarded on basis of preliminary route alignment. Final route alignment, detail survey, check survey, layout of tower locations, spotting/staking of towers, and soil investigation for design of foundations is yet to be done by contractor before commencement of work. These activities may result in cost variation or change orders consequent to change in design and route based on soil reports. In accordance with normal practice of NTDC, 15% of the cost of civil and erection works has been kept to cover all this sort of unforeseen expenditures in contingencies (item no 7(iii))
4. The cost estimates for imported items are based on cost and freight (C&F) basis. The transportation of material from Karachi to NTDC warehouses and payment of insurance charges mentioned against item-7(iv) and Item-7(v) are included in payable estimates.
5. The \$42.95 million is the actual estimated amount of the project payable after deduction of duties and taxes and all other items not payable under USG G2G agreements.

6. Role and responsibilities of various departments of NTDC in project Implementation.

Five departments of NTDC play an important role in implementation. These include Planning, Design, Material Procurement and Management (MP&M), Grid System Construction (GSC), and Grid System Operation (GSO). The development and implementation of a project generally involves the following stages:

1. **Project Planning:** Load flow studies conducted in PSS/E planning software leads to project identification and preparation of PC-I. Based on the PC-I, NTDC forms a site selection committee comprised of design and implementation engineers. (Design, Environment and Social Impact Cell (ESIC), and Extra High Voltage (EHV), (GSC))
2. **Project Approval:** Approval of PC-I from planning commission (CDWP/ECNEC).
3. **Project Design:** Evaluate techno-economic viability of the project after conducting detailed design and cost estimates for the project. GSC department conducts preliminary survey and submit data to design. Accordingly, bill of quantities and tender documents are prepared. Complete the evaluation of bids as per GOP/ PPRA procurement rules, submit the bid evaluation report and select the responsive vendor/contractor.
4. **Project Implementation:** Issuance of notification of award by MP&M Department and contract agreements are signed. The GSC department monitors and supervises the construction contractor.
5. **Construction:** Construction begins, and damages, if any, are assessed at the erection stage and compensation payments are made. Environment and social impact cell monitors the environment and social safeguards compliance.
6. **Completion:** Project completion report is submitted on the successful commissioning of project.

The responsibilities of the five departments are briefly explained below:

Responsibilities of Planning Department

1. Preparation of low, medium, and high scenarios for energy and demand forecast for the whole country.
2. Developing Least Cost Generation Expansion Plan by considering reliability indices.
3. Proposing new substations and transmission lines based on Least Cost Generation Expansion Plan.
4. Proposing site and interconnection schemes for power dispersal of all types of new power plants, both in public and private sectors.
5. Preparation of PC-I(s) for NTDC development projects and power dispersal projects.
6. Financing arrangements through International Financing Agencies.
7. Obtaining the approval of PC-I(s) and PC-II(s) from the ministry and competent forums like Central Departmental Working Party (CDWP)/ Executive Committee of the National Economic Council (ECNEC)

Responsibilities of Design Department

1. Complete design and engineering of transmission lines and grid stations up to 220 kV.
2. Engineering of 500 kV transmission lines and grid stations for extension and interconnection works.
3. Preparation and evaluation of procurement documents for goods, works, and services of grid stations and transmission lines.
4. Review and approval of drawings and technical data.
5. Selection and approval of grid station sites, transmission line routes, and profiles.
6. Cost and material estimation for grid stations and transmission lines.
7. Factory testing / Inspection of material.

Responsibilities of Material Procurement and Management (MP&M) Department

1. MP&M under the new setup deals with the procurement activities related to 220 kV and 500 kV transmission systems.
2. Supervise execution of contracts under loan agreements with funding agencies along with loan disbursement.
3. Forwarding a self-contained comprehensive note supported with technical adjudication report (to be prepared by the Engineer) and Evaluation Report to appropriate authorities.
4. Monitoring the receipt of material and equipment in the NTDC warehouses.
5. Issuance of clearance certificates regarding release of retention money/final 10% payment.
6. Having continuous contact with the insurance company for lodging and settlement of claims.
7. Monitoring smooth delivery of material up to the destination

Responsibilities of Grid Station Construction (GSC) Department

1. Manage the construction of 500 kV & 220kV transmission line and grid station projects.
2. Manage the construction of interconnection facilities for Independent Power Producers (IPPs).
3. Maintain liaison between project authorities, funding agencies, and consultants for the smooth running of project.
4. Attend progress review meetings on behalf of NTDC with Government of Pakistan and loan giving agencies.
5. Monitoring progress till commissioning of transmission line and grid stations projects.

Responsibilities of Grid Station Operation (GSO) Department

1. Responsible for operation and maintenance of 500/220 kV grid station and transmission lines.
2. Load management in coordination with NPCC.
3. Assure proper functioning of protective relays and measuring instruments at grid station.
4. Assure proper functioning of all indications and annunciations at grid station.
5. Attendance of emergencies, rehabilitation and maintenance coordination during fault.

7. Project Implementation Plan

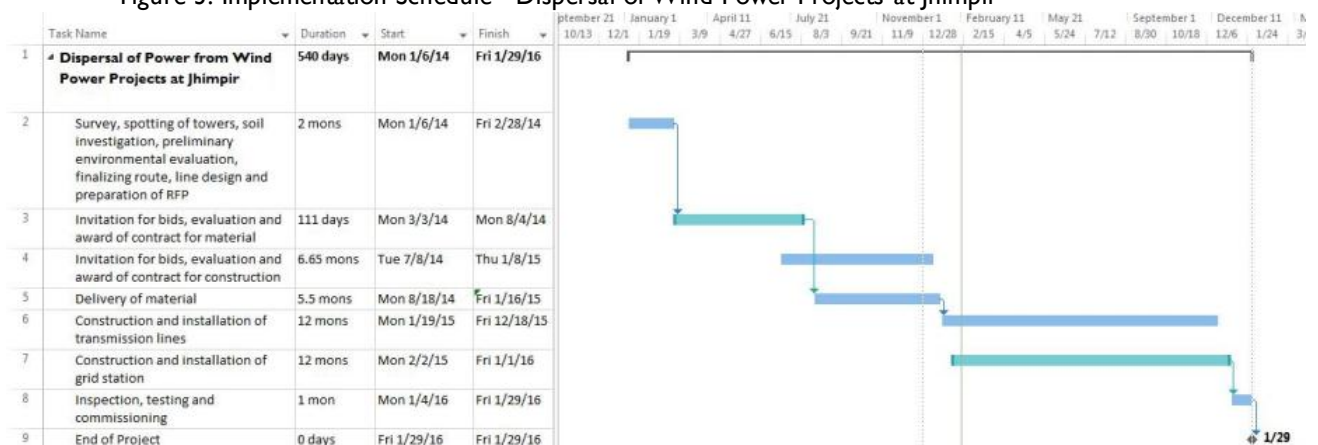
Based on PC-I prepared by planning department of NTDC; and after selection and approval of site and line routes, tender documents were prepared by design department for goods, works, and services of grid stations and transmission lines. The tendering process was started by MP&M NTDC in early 2014 and by now most of the contracts for material and construction works have been awarded. Some of the material for 220 kV double circuit transmission line has also been offered for FAT, whereas remaining material is under manufacturing at different stage

The vender selected for construction will soon start the site activities under administrative control and supervision of GSC staff. Consultant will also be hired for proper execution and monitoring of site activities. GSC staff will maintain liaison between project authorities, funding agencies, and consultants for the smooth running of project. They will attend progress review meetings on behalf of NTDC and monitor progress till commissioning of transmission line and grid station associated with this project.

On commissioning, the grid stations and transmission lines will be handed over to the respective departments for maintenance. The maintenance and operation of 500 and 220 kV Grid stations and the allied transmission lines in the country is the responsibility of the GSO organization of NTDC. The newly constructed 220 kV Jhimpir – TM Khan Road D/C transmission line and 220/132 kV new Jhimpir Grid station falls under the jurisdiction of Chief Engineer GSO Hyderabad NTDC. Hyderabad is one of the four regions of NTDC operating under GM (GSO) Lahore. The HESCO’s GSO department is responsible for operation and maintenance of all 132 kV grid station and transmission lines in their area of jurisdiction , therefore CE (GSO) HESCO Multan will take over maintenance and operation of the 132 kV D/C transmission line from Jhimpir new to existing 132 kV TM Khan GS. They will coordinate with NPCC, for proper functioning of the system. Attendance of emergencies, rehabilitation and maintenance coordination during fault of their respective areas will also be their responsibility.

The planned implementation schedule of this project is provided in Figure 3 below.

Figure 3: Implementation Schedule - Dispersal of Wind Power Projects at Jhimpir



8. Benefits

The benefits of the Proposed Jhimpir WWP include;

- The project will provide a basic electricity infrastructure in rural areas, which will help check large-scale migration of rural labor force to urban centers.
- The project is required to connect 734 MW of WPPs at Jhimpir with the National Grid, by 2016, which will help to address Pakistan's growing energy deficit.
- The proposed transmission improvement project will promote the development of alternate energy and enhance the opportunity of diversifying the energy mix to indigenous renewable wind resources.
- The project will stimulate the economy by purchasing both local and foreign goods and services and creating jobs for qualified locals in the project area.
- It will help promote private investments in wind projects in the region and is a step toward building public-private partnerships.
- The availability of more electricity provides incentive for the establishment of new industries based on local raw materials, creating gainful employment opportunities throughout Pakistan.
- The voltage profile of HESCO and NTDC network will be improved.
- Transmission line losses of HESCO and NTDC network will be reduced.

The reliability of HESCO and NTDC network in the vicinity of the project will be improved.

9. Environmental Assessment

The USAID Energy Office has prepared the Initial Environmental Examination (IEE) of the said project in accordance with 22 CFR 216, which provides a statement of the reasonably foreseeable environmental effects as well as to recommend the Threshold Decision for the construction of the transmission system to service the upcoming wind power plants in Pakistan by the end of year 2016. The IEE covers all activities that are proposed for USG funding so as to ensure environmentally sound project design, planning, and implementation. It satisfies the conditions of the environmental procedures and establishes requirements for further environmental review and related responsibilities for activities not listed under Categorical Exclusions. The topography of the project area is predominantly flat and comprises irrigated plains with crops covering some portion of the area under consideration. Soils are either stratified or deeply homogenized and usually have a weak structure. The climate is characterized by mild temperatures, high velocity south-western winds, low rainfall, and high humidity. Prevailing reserve forests are: Khokar and Katiar reserve forest in TM Khan, and Ketu Mihrani, Thatta, and Khatar reserve forests in Hyderabad. Major tribes of the project area include Mallah Jogi Othar, Kodan, Kalmati Baloch, Junejo, Gabol, Khalifa, Bhagiar, and Khaskheli. The project area is comprised of medium and large scattered settlements and clusters of small villages.

AEAI under the USAID-funded EPP has awarded the contract for providing technical assistance on REA for transmission improvements to Halcrow Pakistan (Pvt.) Limited. The REA is intended to help USAID to survey the environmental and social impacts at the site in a short period of time.

The REA would provide:

- Evaluation and screening of the project in line with GOP and USAID environmental regulations;
- Site and field visits along proposed routes for all the stated requirements, meetings with the stakeholders, collection of environmental and social data and other relevant documents from NTDC;
- The scope for subsequent EA if warranted; if EA is not warranted then the site-specific EDF and Environmental Monitoring and Mitigation Plan (EMMP) will be developed and additional highlighted points may address any incomplete areas in the REA;
- Analysis, summary, and prioritization of relevant environmental concerns, both adverse and beneficial;
- Detailed examination of the security situation and identification of local community leaders who could serve as contact points for ensuring security arrangements;
- Identification of environmental and social impacts that require immediate action; and
- Identification of environmental impacts that require further analysis and investigation.

All transmission line projects are expected to cause environmental impacts mostly during the construction phase with very limited impacts during the operational phase. NTDC is supposed to maintain site records and reports for the project. Right-of-way clearing resulting in top-soil cover, vegetation clearing, and damage to root-stocks, etc., are some issues commonly observed during the construction of transmission lines. The impacts of construction work in the form of dust, smoke, and noise are observed on account of usage of vehicles, machinery and equipment. In case tree cutting is involved for the execution of the project, NTDC will have to coordinate with the concerned forest department for compensation and replantation.

Therefore, during the construction phase, maximum efforts will be made to mitigate all such environmental hazards identified and recommended as a result of the REA.

- Work on the project will be carried out in a manner so that the impact is minimal on natural landscape, forests, crops, wild life, livestock, both private and public buildings, archaeological centers, and buildings of historical significance.

- The construction equipment used on this project will have acceptable noise limits.
- The NEQS (National Environmental Quality Standards) will be followed.
- Adequate safety standards will be followed to minimize hazards to human life and property.
- NTDC's design and protective specifications will provide reliable safety by specifying suitable clearances for transmission lines.
- Proper occupational health and safety practices will be adopted in the installation and maintenance of the project facilities.
- Environmental cost should be included in the project cost and made a part of EMMP or Environmental Impact Assessment (EIA).
- An environmental management plan, health and safety plan, and solid waste management plan will be developed.
- As per GOP Pakistan Environment Protection Act 1997, IEE/EIA Regulations 2000, Schedule II, "Power transmission and distribution greater than 11 kV capacity and installation of grid stations" require an EIA. As per NTDC policies and previous practice, all projects must comply with local legislation whether self-financed or funded by a donor. As per information collected from NTDC, no environmental assessment has been initiated for the project to date.

10. Risks

Possible risks involved include:

- Right of way issues;
- Law and order situation;
- Delay in custom clearance of imported goods; and
- Delay in implementation of associated wind generation plants.

Obtaining transmission right of way can be a big impediment in the timely completion of a transmission project, especially when the line passes through densely populated areas. In this case, the two lines pass mostly through areas with scattered villages, and hence, the right of way should not be a big challenge. REA will determine the intensity of this risk and propose mitigation measures.

Law and order situations prevailing throughout the country could be a risk in the timely execution of the project. The success of this project is closely linked with timely realization of the implementation schedule of all associated wind generation plants and other necessary transmission expansions to be carried out by NTDC and HESCO. Additionally, some procurement risks may arise, such as unnecessary delays vis-à-vis customs clearance for equipment coming at the seaport, issuing letters of credit to the contractors, and long lead time items to meet the schedule, etc., and these need to be factored in. Furthermore, a rapid environment analysis (REA) is nearly completed, and the risks observed by the consultants will be fully explained in that report. The consequences and impact of all identified risks are also mentioned along with a mitigation plan to be followed before the commencement of implementation of the projects.

NTDC will be coordinating with Sindh Environmental Protection Agency to get the NOC for smooth running of the project as per statutory and legal requirements of GOP. Some WPPs may also be delayed in achieving their target financial close and commercial operation dates. To date Sapphire, Yunus, Mater, United, Gul Ahmed, Tapal and Metro Power have achieved their financial close and are under construction. The transmission projects will have to be completed prior to the commercial operation dates of the generating source in order to harness full benefits of the project in a timely manner. There is a need for close coordination throughout the project execution.

11. Recommendations

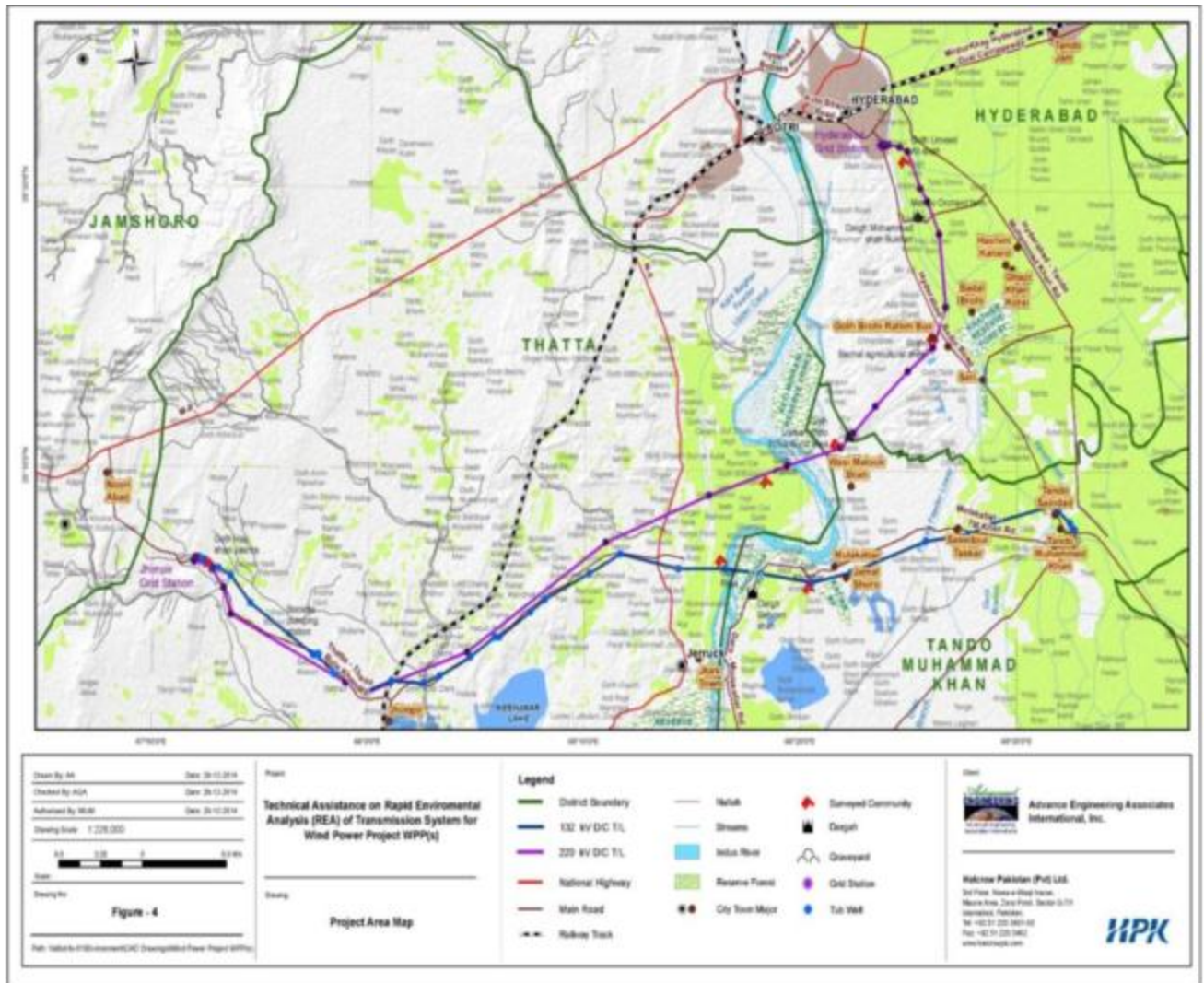
This is a priority project for the Government of Pakistan and the National Transmission and Despatch Company (NTDC). It meets all relevant USAID criteria and is recommended for funding by USAID/USG under the G2G agreement. The proposed transmission improvement project promotes the development of alternate energy in the country and enhances the opportunity of diversifying the energy mix to indigenous renewable wind resources. It will help in supporting the peak load requirement of the HESCO and NTDC electrical network and help reduce severe load shedding problems in Pakistan. Furthermore, this project will create substantial economic gains for the people by creating jobs, particularly in the project area, and in the country generally. Also, it will help promote further private investments in wind projects in the region and is a step towards building public-private partnerships.

Moreover, analyzing the results of load flow studies, financial analysis, and schedules of all associated generation projects, this transmission improvement project is cost effective, impact oriented, and highly visible, and it will be completed on a schedule that helps meet Pakistan's energy crisis.

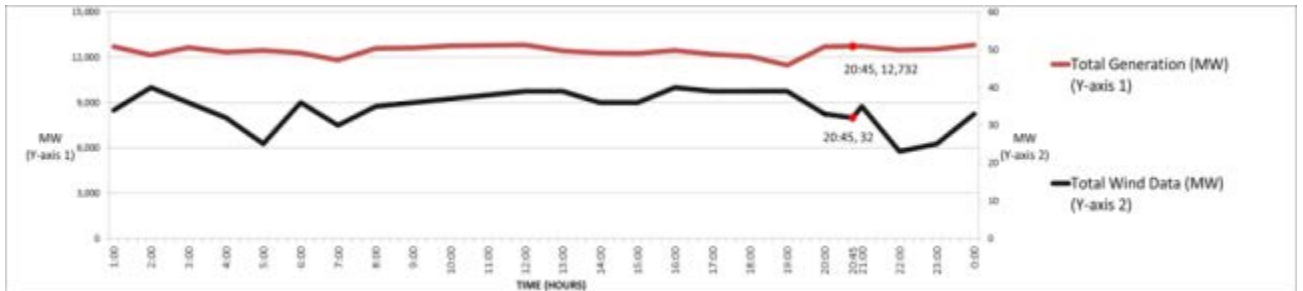
To avoid any delays during the construction stage, NTDC's surveyors may visit the project sites and identify problem areas as soon as possible. The right-of-way issues can be resolved with the help of local influential people. In many cases, local court sessions (Jirgas) are held to inform the locals prior to the commencement of construction so that all future disputes could be identified and resolved in a timely manner, and any required compensation promptly settled. Local law enforcement and district officers can be of great help to settle issues if they arise.

ANNEXES

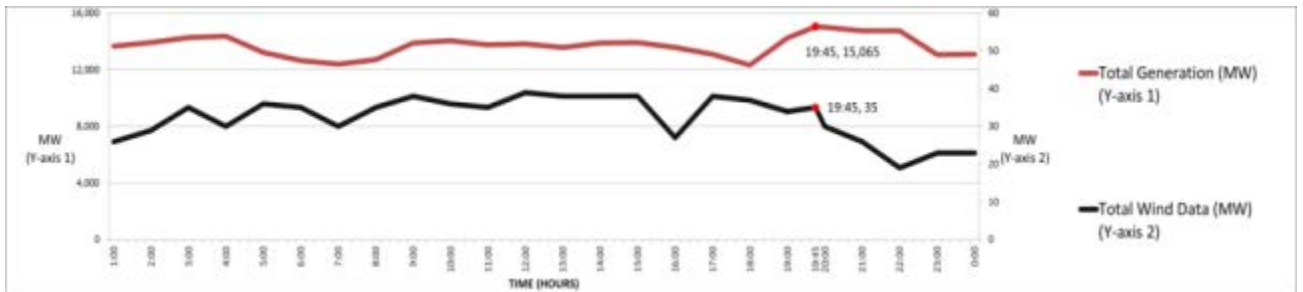
Annex I: Project Area Map



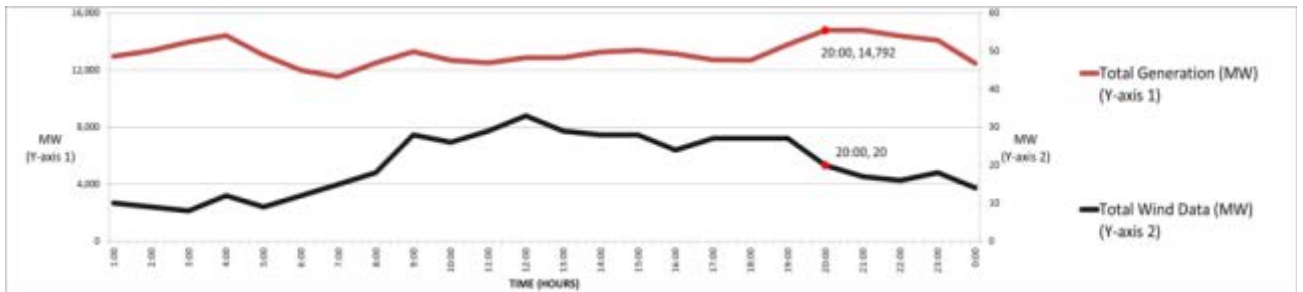
Annex II: Hourly Wind Data Collected from NPCC, Pakistan



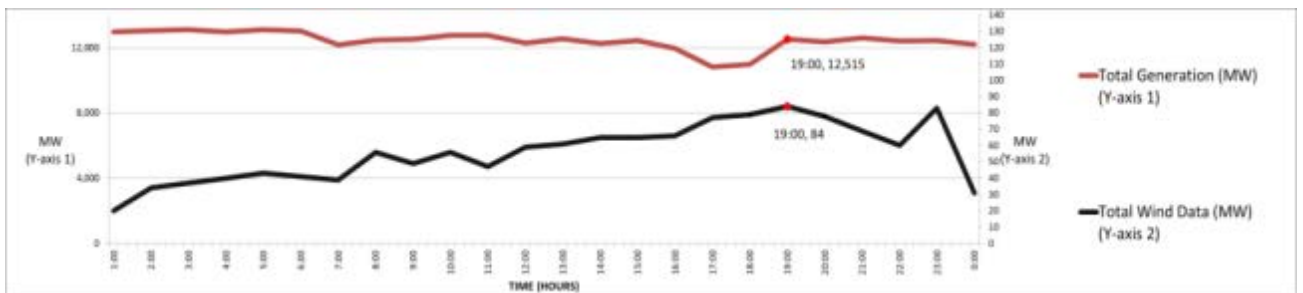
July 01, 2013



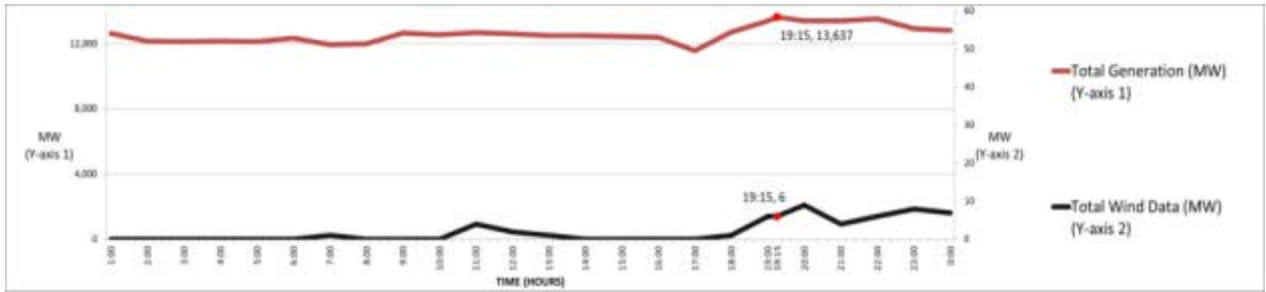
July 16, 2013 (FFCEL)



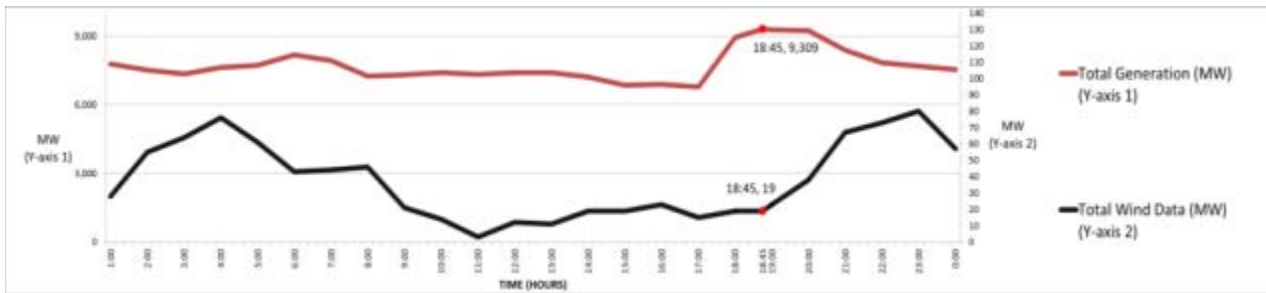
August 06, 2013 (FFCEL)



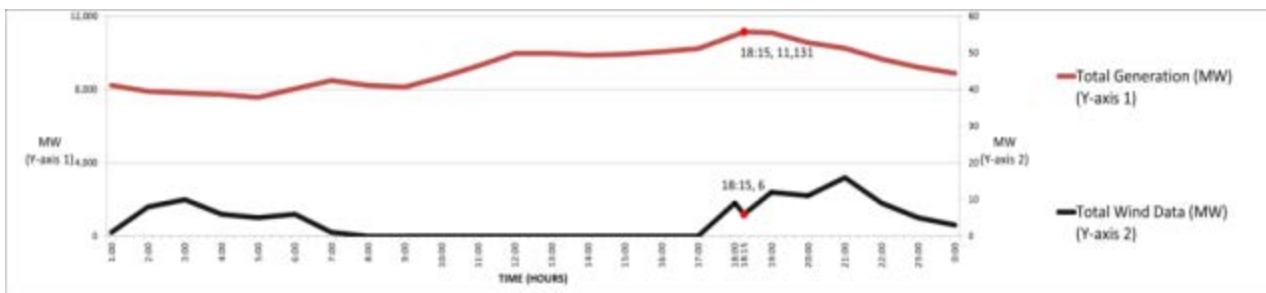
September 15, 2013 (FFCEL and ZEPL)



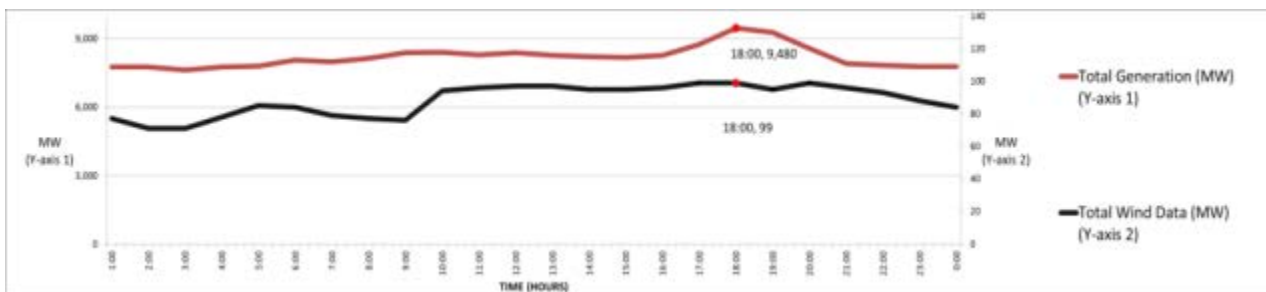
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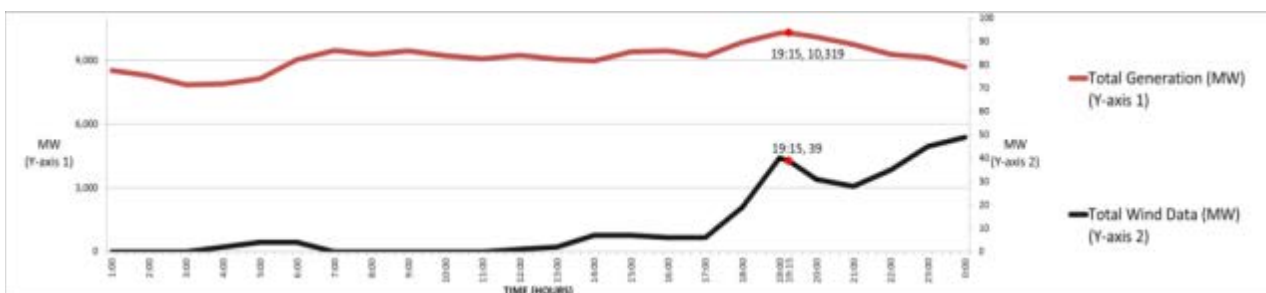
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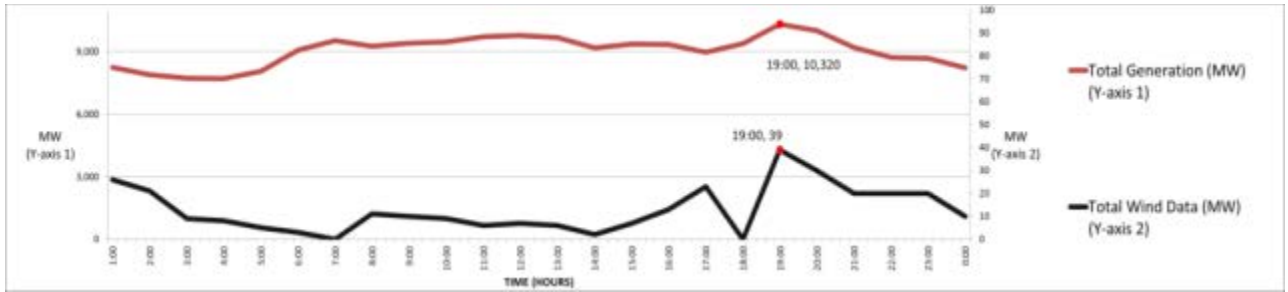
December 16, 2013 (FFCEL and ZEPL)



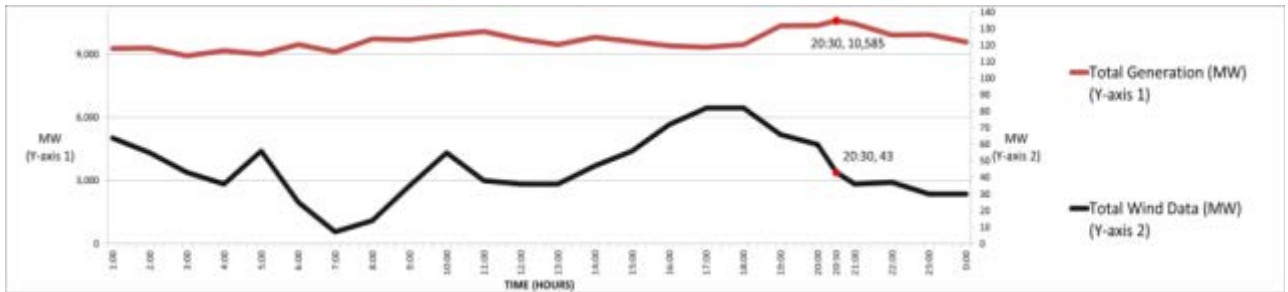
January 01, 2014 (FFCEL and ZEPL)



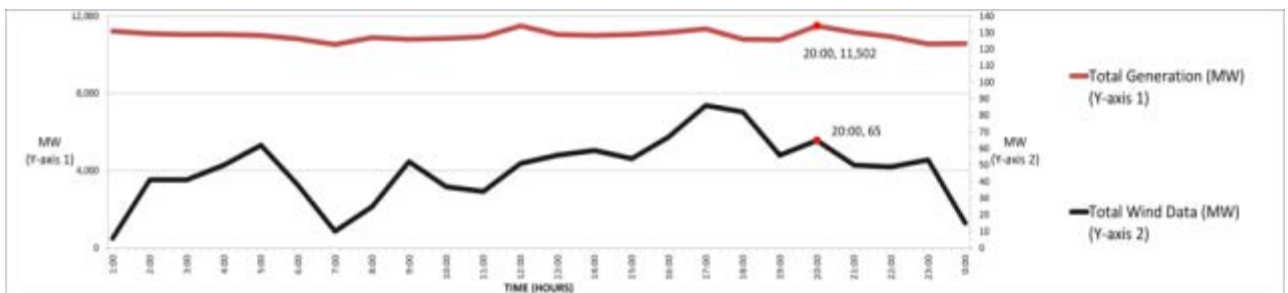
February 18, 2014 (FFCEL and ZEPL)



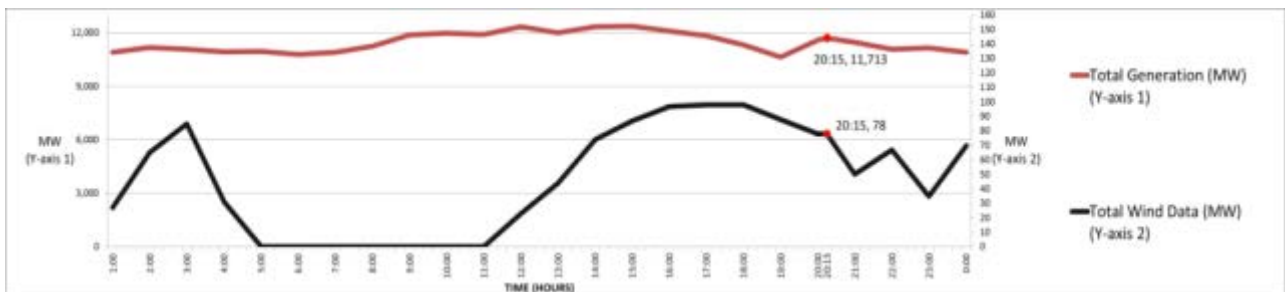
March 02, 2014 (FFCEL and ZEPL)



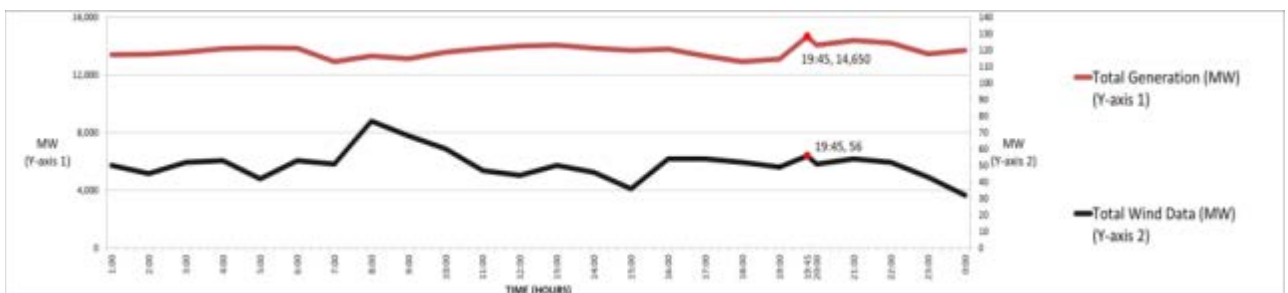
April 13, 2014 (FFCEL and ZEPL)



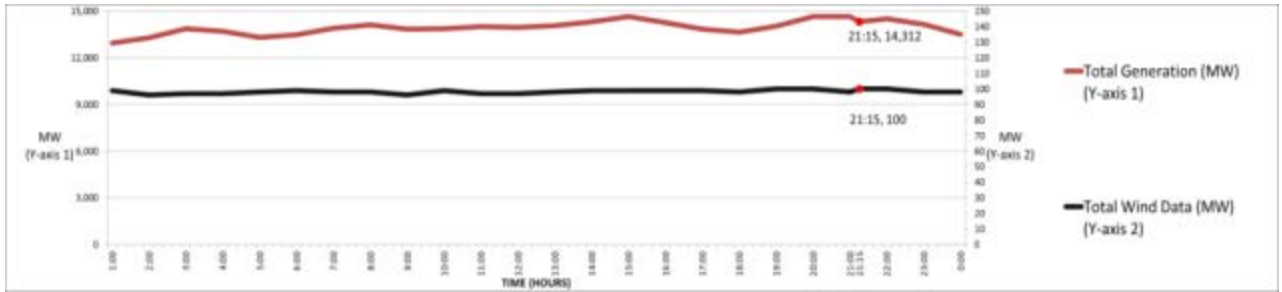
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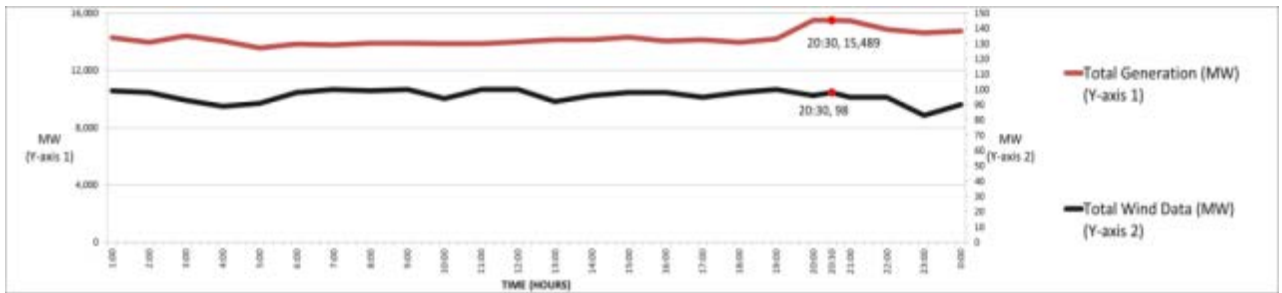
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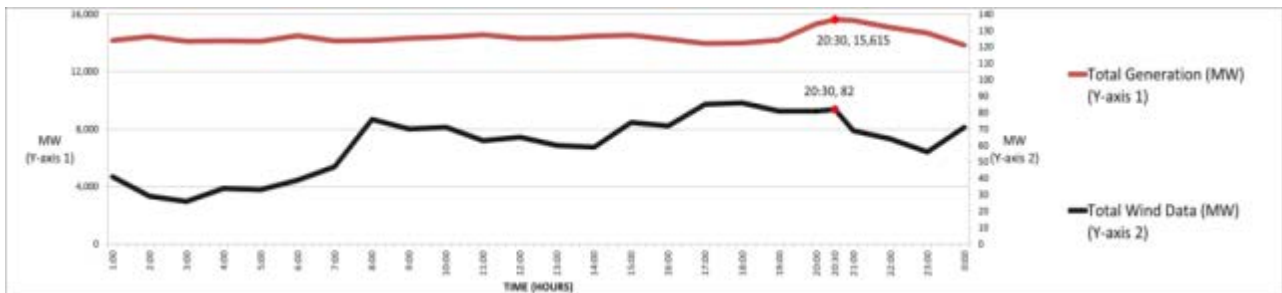
June 18, 2014 (FFCEL and ZEPL)



July 01, 2014 (FFCEL and ZEPL)



July 22, 2014 (FFCEL and ZEPL)



August 12, 2014 (FFCEL and ZEPL)

Annex III: PC-I Cost Estimates

The PC-I prepared by NTDC was approved by Executive Committee of the National Economic Council (ECNEC) on July 3, 2014. The PC-I price of materials was arrived at using the recently executed purchase orders by NTDC for similar material. Each material price was then multiplied with an assumed per annum escalation factor of 6.5%. The bill of quantities of material was determined based on NTDC's preliminary transmission line and grid station design. Details of the sources and contracts for PC-I cost estimation are covered in **Annex-IV**.

The services or goods procured from the local market/resources comprise the local cost. The Foreign Exchange Component (FEC) of the cost estimates applies to goods or services procured from abroad. The foreign exchange rates used to prepare the estimates are based on the rates of the day the PC-I was approved.

The PC-I cost estimates for civil works and erection required for a transmission line are taken generally at 20-25% of the total cost of material, while for the grid stations they are calculated at 10% of the total cost of materials.

The duties on the imported goods and government tax are not payable under USAID G2G funding. The Table below besides indicating the costs of the individual items of the PC-I also identifies and segregates duties and other non-payable items (cost of land, ROW clearance, administration, supervision and contingencies) from the actual cost of the project.

Breakdown of PC-I Costs and Duties and other Non-Payables

Sr. No.	Project Description	PC-I Cost estimate (Million \$)			
		Total Cost	Duties	Other Non-Payable Items	Cost Excluding Non-Payables
		(1)	(2)	(3)	(4)=(1)-(2)-(3)
I	220/132 kV Jhimpir new grid station				
i)	Land	0.57	0.00	0.57	0.00
ii)	220 kV line and transformer bays consisting of transformers, circuit breakers, isolators, C.Ts, P.Ts, L.As, control & protection equipment and other allied equipment.	7.71	0.97	0.00	6.74
iii)	Twelve 132 kV line bays consisting of circuit breakers, isolators, C.Ts, P.Ts, L.As, control & protection equipment and other allied equipment.	1.86	0.15	0.00	1.71
iv)	Civil Works and erection	0.86	0.00	0.00	0.86
v)	Non-residential buildings, office furniture & equipment, transportation & vehicles and residential colony	0.88	0.00	0.00	0.88
Subtotal		11.88	1.12	0.57	10.19

Sr. No.	Project Description	PC-I Cost estimate (Million \$)			
		Total Cost	Duties	Other Non-Payable Items	Cost Excluding Non-Payables
		(1)	(2)	(3)	(4)=(1)-(2)-(3)
2	Extension at 132 kV TM Khan grid station				
i)	Two 132 kV line bays consisting of circuit breakers, isolators, C.Ts, P.Ts, L.As, control & protection equipment and other allied equipment.	0.17	0.01	0.00	0.16
ii)	Civil Works and erection	0.02	0.00	0.00	0.02
Subtotal		0.19	0.01	0.00	0.18
3	132 kV double circuit transmission line from Jhampir new to Existing 132 kV T M Khan grid station (revised 75 km)				
i)	Right of way clearing	0.83	0.00	0.83	0.00
ii)	Steel Towers	1.75	0.00	0.00	1.75
iii)	Conductor	3.13	0.52	0.00	2.61
iv)	Overhead Ground Wire (OPGW)	0.38	0.08	0.00	0.30
v)	Insulator strings, hardware, grounding material, stringing & construction equipment and accessories	0.57	0.02	0.00	0.55
vi)	Civil works and Erection	2.32	0.00	0.00	2.32
Subtotal		8.98	0.62	0.83	7.53
4	Extension at existing 220 kV T M Khan Road grid station				
i)	Two 220 kV line bays consisting of circuit breakers, isolators, C.Ts, P.Ts, L.As, control & protection equipment and other allied equipment.	0.51	0.03	0.00	0.48
ii)	Civil works and erection	0.05	0.00	0.00	0.05
Subtotal		0.56	0.03	0.00	0.53
5	220 kV double circuit transmission line from 220 kV Jhampir to existing 220 kV T M Khan Road grid station (revised 84.5km)				
i)	Right of way clearing	0.71	0.00	0.71	0.00
ii)	Steel Towers	3.60	0.60	0.00	3.00
iii)	Conductor	4.80	0.80	0.00	4.00
iv)	Overhead Ground Wire (OPGW)	0.24	0.05	0.00	0.19
v)	Insulator strings, hardware, grounding material, stringing & construction equipment and accessories	1.25	0.18	0.00	1.07
vi)	Civil works and erection	3.30	0.00	0.00	3.30
Subtotal		13.90	1.63	0.71	11.56

Sr. No.	Project Description	PC-I Cost estimate (Million \$)			
		Total Cost	Duties	Other Non-Payable Items	Cost Excluding Non-Payables
		(1)	(2)	(3)	(4)=(1)-(2)-(3)
6	132 kV double circuit transmission line for interconnection of WPPs with 132 kV Jhimpir new Grid station (PCI estimated length 25 km)				
i)	Right of way clearing	0.25	0.00	0.25	0.00
ii)	Steel Towers	0.53	0.00	0.00	0.53
iii)	Conductor	0.96	0.16	0.00	0.80
iv)	Overhead Ground Wire (OPGW)	0.11	0.02	0.00	0.09
v)	Insulator strings, hardware, grounding material, stringing & construction equipment and accessories	0.18	0.01	0.00	0.17
vi)	Civil works and erection	0.70	0.00	0.00	0.70
Subtotal		2.73	0.19	0.25	2.29
7	Miscellaneous				
i)	Engineering & consultancy 2% of project cost	0.79	0.00	0.00	0.79
ii)	Administration & supervision 1.5% of project cost	0.59	0.00	0.59	0.00
iii)	Contingencies 1% of project cost	0.39	0.00	0.39	0.00
iv)	In land transportation 1% of equipment cost	0.23	0.00	0.00	0.23
v)	Insurance 0.25% of equipment cost	0.07	0.00	0.00	0.07
vi)	L/C opening 0.25% of equipment cost	0.07	0.00	0.00	0.07
Subtotal		2.14	0.00	0.98	1.16
Grand Total		40.38	3.60	3.34	33.44

Annex IV: Basis of PC-I Cost Estimates

Cost Estimate for Grid Station Equipment

Sr. No.	Item	P.O. No.	Date	Placed on	Unit	Unit price		Currency	F.E.C. (Rs)
						Local	F.E.C.		
500 kV equipment									
1	Circuit Breaker	3263 FOR 500 KV LAHORE NEW	06/12/12	M/S CNEEC-FNEPCC(J,V),CHINA	Nos	0.00	13,217,855.00	JY	12,821,319.35
2	Bus Isolator	3263 FOR 500 KV LAHORE NEW	06/12/12	M/S CNEEC-FNEPCC(J,V),CHINA	Nos	0.00	3,147,108.00	JY	3,052,694.76
3	Line Isolator	3263 FOR 500 KV LAHORE NEW	06/12/12	M/S CNEEC-FNEPCC(J,V),CHINA	Nos	0.00	4,405,951.00	JY	4,273,772.47
4	C.Ts	3263 FOR 500 KV LAHORE NEW	06/12/12	M/S CNEEC-FNEPCC(J,V),CHINA	Nos	0.00	1,510,611.00	JY	1,465,292.67
5	CCVT	3263 FOR 500 KV LAHORE NEW	06/12/12	M/S CNEEC-FNEPCC(J,V),CHINA	Nos	0.00	799,365.00	JY	775,384.05
6	500/220kV (750 MVA BANK+1 SPARE UN	3263 FOR 500 KV LAHORE NEW	06/12/12	M/S CNEEC-FNEPCC(J,V),CHINA	Nos	0.00	502,844,985.50	JY	487,759,635.94
7	Lightning Arrestor (420kV Surge Arrestor)	3263 FOR 500 KV LAHORE NEW	06/12/12	M/S CNEEC-FNEPCC(J,V),CHINA	Nos	0.00	566,479.00	JY	549,484.63
8	Shunt reactor (3x37 MVAR)	3076(Package-I) for 500 kV R.Y.Khan	05/13/10		Nos	0.00	238,787,565.50	Jy	231,623,938.54
9	Shunt reactor (1x37 MVAR)	3076(Package-I) for 500 kV R.Y.Khan	05/13/10		Nos	0.00	79,595,855.17	Jy	77,207,979.51
10	PLC	3076(Package-I) for 500 kV R.Y.Khan	05/13/10		Unit	0.00	52,261,362.00	Jy	50,693,521.14
220 kV equipment									
1	Circuit Breaker	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	Nos	0.00	3,882,634.00	JY	3,766,154.98
2	Bus Isolator	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	Nos	0.00	1,422,708.00	JY	1,380,026.76
3	Line Isolator	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	Nos	0.00	1,152,042.00	JY	1,117,480.74
4	C.Ts	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	Nos	0.00	731,951.00	JY	709,992.47
5	CVT	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	Nos	0.00	514,956.00	JY	499,507.32
7	220/132kV, 250MVA Auto T/F	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	Nos	0.00	134,630,036.00	JY	130,591,134.92
9	Lightning Arrestor (198kV Surge Arrestor)	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	Nos	0.00	234,839.00	JY	227,793.83
132 kV equipment									
1	Circuit Breaker	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	set	0.00	1,845,427.00	JY	1,790,064.19
2	Bus Isolator	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	set	0.00	664,595.00	JY	644,657.15
3	Line Isolator	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	set	0.00	764,342.00	JY	741,411.74
4	C.Ts	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	Nos	0.00	486,491.00	JY	471,896.27
5	P.Ts	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	Nos	0.00	395,721.00	JY	383,849.37
6	Lightning Arrestor 120 KV (S. A.)	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	Nos	0.00	396,260.00	JY	384,372.20
7	132/11kV 11/13MVA Aux. T/F	3262 FOR 220 KV GUJRAT	03/01/13	M/S HYOSUNG CORPORATION K	Nos	0.00	31,632,481.00	JY	30,683,506.57

Cost Estimate for 220kV Transmission line equipment

Sr. No.	Item	P.O. No.	Date	Placed on	Unit	Unit price			
						Local	F.E.C.	Currency	F.E.C. (Rs)
1.	TOWERS (Light Angle EG)	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	No	0	1596442.3	JY	1548549.06
	TOWERS (Heavy Angle JKD)	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	No	0	2262896.6	JY	2195009.7
	TOWERS (Suspension EA)	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	No	0	1059377	JY	1027595.69
	TOWERS (River Crossing)	Budgetry Price	01/01/12	Assumed Value	ton	0	2394663.5	JY	2322823.6
2.	CONDUCTOR (Rail)	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	kM	0	401556	JY	389509.32
3	OPGW (with 24 Fibers)	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	kM	0	228222	JY	221375.34
4.	INSULATORS								
	Suspension 80 KN	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	Nos	0	1156	JY	1121.32
	Tension 100KN (FOG TYPE)	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	Nos	0	1444	JY	1400.68
5.	HARDWARE								
	SSB-R	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	Nos	0	4738	JY	4595.86
	STB-R	ADB-15-2007	01/01/12	M/S NEIE China	Nos	0	10150	JY	9845.5
	MS-R	ADB-15-2007	01/01/12	M/S NEIE China	Nos	0	1649	JY	1599.53
	RS-R	ADB-15-2007	01/01/12	M/S NEIE China	Nos	0	442	JY	428.74
	Joint box for OPGW:								
	A-type	HIC-I (Lot-III)	01/01/12	M/S NEIE China	Nos	0	33979	JY	32959.63
	B-type	HIC-I (Lot-III)	01/01/12	M/S NEIE China	Nos	0	33979	JY	32959.63
	OPGW attaching Clamps	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	Nos	0	506	JY	490.82
	SS-ASSEMBLY	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	Set	0	6240	JY	6052.8
ST-ASSEMBLY	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	Set	0	5344	JY	5183.68	
DT-ASSEMBLY	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	Set	0	10689	JY	10368.33	
6.	DAMPERS								
	Stockbridge dampers (SB-R)	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	Nos	0	2025	JY	1964.25
	Dampers for OPGW	3263(Package-II) Loan PK-P61 JICA	12/11/12	220 KV T/L for Gujrat Substation	Nos	0	1228	JY	1191.16
7.	GROUNDING SETS	ADB-15-2007	01/01/12	M/S NEIE China	Nos	0	4823	JY	4678.31

Cost Estimate for 132 kV Transmission line equipment

Sr. No.	Item	P.O. No.	Date	Placed on	Unit	Unit price		Currency	F.E.C. (Rs)
						Local	F.E.C.		
1.	TOWERS								
	Tangent tower	LESCO P.O #52	03/28/11	LESCO	Nos	364903	0	USD	0
	Light Angle tower	LESCO P.O #52	03/12/11	LESCO	Nos	596524	0	USD	0
	Heavy Angle tower	LESCO	03/12/11	LESCO	Nos	745655	0	USD	0
2.	CONDUCTOR (Greeley)	GEPCO STG-4	01/06/11	Gepeco	kM	0	4182.00	USD	414018
3.	OPGW (with 18 Fibers)	HIC-I(Lot-III)	03/19/05	M/S I.C.C.	kM	0	2000	USD	198000
4.	INSULATORS								
	Suspension 80 KN	GEPCO STG-4	01/06/11	Gepeco	Nos	850	0	USD	0
	Tension 100KN	GEPCO STG-4	01/06/11	Gepeco	Nos	1000	0	USD	0
5.	HARDWARE								
	SS-G	GEPCO STG-10-16	04/23/11	GEPCO	Set	0	36.00	USD	3564
	ST-G	GEPCO STG-10-16	04/23/11	GEPCO	Set	0	59.00	USD	5841
	MS-G	GEPCO STG-10-16	04/23/11	GEPCO	Nos	0	22	USD	2178
	RS-G	GEPCO STG-10-16	04/23/11	GEPCO	Nos	0	7	USD	693
	Joint box for OPGW:								
	A-type	HIC-I(Lot-III)	03/19/05	M/S I.C.C.	Nos	0	125	USD	12375
	B-type	HIC-I(Lot-III)	03/19/05	M/S I.C.C.	Nos	0	125	USD	12375
	OPGW attaching Clamps	HIC-I(Lot-III)	03/19/05	M/S I.C.C.	Nos	0	10	USD	990
	SS-ASSEMBLY	ADB-42(Lot-IV)	07/17/08	M/S SARA TURKEY	Set	0	31.16	USD	3084.84
ST-ASSEMBLY	HIC-I(Lot-III)	03/19/05	M/S I.C.C.	Set	0	60	USD	5940	
DT-ASSEMBLY	ADB-42(Lot-IV)	07/17/08	M/S SARA TURKEY	Set	0	178.14	USD	17635.86	
6.	DAMPERS								
	Stockbridge dampers (SB-G)	IPP-01(Lot-VI)	05/22/08	M/s TYCO , GERMANY	Nos	0	17.11	USD	1693.89
	Dampers for OPGW	ADB-42-07(Lot-V)	07/17/08	M/S SA-RA TURKEY	Nos	0	9.03	USD	893.97
7	GROUNDING SETS	LESCO P.O #39	07/16/10	Lesco	Nos	0	41.247	USD	4083.453

Exchange rate: 1 U.S \$ = 117 JY

Exchange rate: 1 U.S \$ = 99 PKR

Annex V: Calculated Quantity of Steel & Cement

LOT -I

Calculated quantity of Steel & Cement

CONSTRUCTION OF 220KV DOUBLE CIRCUIT TRANSMISSION LINE INCLUDING SURVEY FOR TOWER STAKING, INSTALLATION OF CONVENTIONAL & PILE FOUNDATIONS, TRANSPORTATION, ERECTION, STRINGING, TESTING AND COMMISSIONING FROM 220KV JHIMPIR NEW GRID STATION TO 220KV T.M. KHAN GRIDSTATION HYDERABAD FOR EVACUATION OF POWER FROM WIND POWER PLANT AT JHIMPIR

FROM 220KV JHIMPIR NEW G/S TO POINT A (48 KM)

ITEM NO.	DESCRIPTION	UNIT OF MEASUREMENT	ESTIMATED QUANTITY	Steel per footing (KG)	Total steel (KG)	CEMENT Bags/footing	CEMENT (Total) Bags
B.	Foundations						
1)	Reinforced concrete spread foundations in varied soil as well as rock complete with supply of materials including excavation, stub settings, dewatering, shuttering, reinforcement, concreting, curing, backfilling, levelling/grading, slope protection (where necessary) using Portland Cement Type-V conforming to ASTM C-150 including installation of tower grounding for:						
	(a) Suspension Tower Type E-A						
	(i) Foundation Type A-2'	Footings	332	190.25	63163	27.25	9047
	(ii) Foundation Type A-3	Footings	48	306	14688	51.25	2460
	(iii) Foundation Type A-3'	Footings	56	295.75	16562	53.75	3010
	(iv) Foundation Type A-4	Footings	24	324.25	7782	74	1776
	(v) Foundation Type A-4'	Footings	32	369.5	11824	94.75	3032
	(vi) Foundation Type A-5	Footings	4	518.5	2074	183.25	733
	(b) Medium Angle Tower Type E-G						
	(i) Foundation Type G-2'	Footings	12	240.75	2889	39	468
	(ii) Foundation Type G-3	Footings	8	707.75	5662	67.75	542
	(iii) Foundation Type G-3'	Footings	8	643.5	5148	88.75	710
	(c) Heavy angle/Deadend Tower Type JKD						
	(i) Foundation Type D-D	Footings	8	1931.25	15450	125.75	1006
	(ii) Foundation Type W-D	Footings	4	4248.75	16995	306.5	1226
	(iii) Semi-submerged type as per drawing No. PDW/TC-852 9Rev.0)	Footings	4	2211	8844	171.75	687
2)	Reinforcement concrete pile foundations (cast in situ installation) complete with supply of materials etc. using Portland Cement Type -V conforming to ASTM C-150 including installation of tower grounding for all tower types:						
	(a) Reinforced concrete pile caps with chimney grade and stub setting as per drawing No. PDW/TC-294 (Rev.2)	Each	16	3500	56000	216	3456
	(b) Reinforced concrete single pile per footing 1220mm dia without beam & pile cap as per drawing No. PDW/TC-851 (Rev.0)						
	(i) Pile Shaft upto depth of 15 m	Lin. M	120	290	34800	11	1320
	(ii) Pile Shaft upto depth of 20 m	Lin. M	80	290	23200	11	880
	(iii) Pile Shaft upto depth of 30 m	Lin. M	100	290	29000	11	1100
	(iv) Pile Shaft upto depth of 40 m	Lin. M	160	290	46400	11	1760
	(c) Reinforced concrete pile caps with chimney grade and stub setting as per drawing No. PDW/TC-279 (Rev.0)	Each	20	2000	40000	93	1860
	(d) Reinforced concrete single pile per footing 915mm dia without pile cap as per drawing No. PDW/TC-279 (Rev.0)						
	(i) Pile Shaft upto depth of 15 m	Lin. M	180	100	18000	6	1080
	(ii) Pile Shaft upto depth of 25 m	Lin. M	200	100	20000	6	1200
	Total Quantity (Kg and Bags)				438481		37353

Calculated quantity of Steel & Cement

CONSTRUCTION OF 220KV DOUBLE CIRCUIT TRANSMISSION LINE INCLUDING SURVEY FOR TOWER STAKING, INSTALLATION OF CONVENTIONAL & PILE FOUNDATIONS, TRANSPORTATION, ERECTION, STRINGING, TESTING AND COMMISSIONING FROM 220KV JHIMPIR NEW GRID STATION TO 220KV T.M. KHAN GRIDSTATION HYDERABAD FOR EVACUATION OF POWER FROM WIND POWER PLANT AT JHIMPIR FROM POINT A to 220KV T M KHAN ROAD GRID STATION (36.5 KM)

ITEM NO.	DESCRIPTION	UNIT OF MEASUREMENT	ESTIMATED QUANTITY	Steel per footing	Total steel KG	CEMENT Bags/footing	CEMENT (Total) Bags
B.	Foundations						
1)	Reinforced concrete spread foundations in varied soil as well as rock complete with supply of materials including excavation, stub settings, dewatering, shuttering, reinforcement, concreting, curing, backfilling, levelling/grading, slope protection (where necessary) using Portland Cement Type-V conforming to ASTM C-150 including installation of tower grounding for:						
	(a) Suspension Tower Type E-A						
	(i) Foundation Type A-2'	Footings	120	190.25	22830	27.25	3270
	(ii) Foundation Type A-3	Footings	48	306	14688	51.25	2460
	(iii) Foundation Type A-3'	Footings	40	295.75	11830	53.75	2150
	(iv) Foundation Type A-4	Footings	32	324.25	10376	74	2368
	(v) Foundation Type A-4'	Footings	24	369.5	8868	94.75	2274
	(vi) Foundation Type A-5	Footings	8	518.5	4148	183.25	1466
	(b) Medium Angle Tower Type E-G				0		0
	(i) Foundation Type G-2'	Footings	12	240.75	2889	39	468
	(ii) Foundation Type G-3	Footings	8	707.75	5662	67.75	542
	(iii) Foundation Type G-3'	Footings	8	643.5	5148	88.75	710
	(iv) Foundation Type G-4	Footings	8	726.25	5810	111.5	892
	(v) Foundation Type G-4'	Footings	4	905	3620	144	576
	(vi) Foundation Type G-5	Footings	4	1183	4732	292.25	1169
	(c) Heavy angle/Deadend Tower Type JKD				0		0
	(i) Foundation Type D-D	Footings	4	1931.25	7725	125.75	503
	(ii) Foundation Type W-D	Footings	4	4248.75	16995	306.5	1226
	(iii) Semi-submerged type as per drawing No. PDW/TC-852 9Rev.0)	Footings	4	2211	8844	171.75	687
2)	Reinforcement concrete pile foundations (cast in situ installation) complete with supply of materials etc. using Portland Cement Type -V conforming to ASTM C-150 including installation of tower grounding for all tower types:						
	(a) Reinforced concrete pile caps with chimney grade and stub setting as per drawing No. PDW/TC-294 (Rev.2)	Each	72	294	21168	216	15552
	(b) Reinforced concrete beam with pile cap with stub setting as per drawing No. PDW/TC-851 (Rev.0)						
	(i) with maximum length of beam 12 m	Each	0	206	0	16	0
	(ii) with maximum length of beam 14 m	Each	0	206	0	16	0
	(b) Reinforced concrete single pile per footing 1220mm dia without beam & pile cap as per drawing No. PDW/TC-851 (Rev.0)						
	(i) Pile Shaft upto depth of 15 m	Lin. M	360	290	104400	11	3960
	(ii) Pile Shaft upto depth of 20 m	Lin. M	400	290	116000	11	4400
	(iii) Pile Shaft upto depth of 30 m	Lin. M	480	290	139200	11	5280
	(iv) Pile Shaft upto depth of 40 m	Lin. M	480	290	139200	11	5280
	(c) Reinforced concrete pile caps with chimney grade and stub setting as per drawing No. PDW/TC-279 (Rev.0)	Each	20	2000	40000	93	1860

LOT - II

Calculated Quantity of Steel & Cement

CONSTRUCTION OF 220KV DOUBLE CIRCUIT TRANSMISSION LINE INCLUDING SURVEY FOR TOWER STAKING, INSTALLATION OF CONVENTIONAL & PILE FOUNDATIONS, TRANSPORTATION, ERECTION, STRINGING, TESTING AND COMMISSIONING FROM 220KV JHIMPIR NEW GRID STATION TO 220KV T.M. KHAN GRIDSTATION HYDERABAD FOR EVACUATION OF POWER FROM WIND POWER PLANT AT JHIMPIR FROM POINT A to 220KV T M KHAN ROAD GRID STATION (36.5 KM)

ITEM NO.	DESCRIPTION	UNIT OF MEASUREMENT	ESTIMATED QUANTITY	Steel per footing	Total steel KG	CEMENT Bags/footing	CEMENT (Total) Bags
(d)	Reinforced concrete single pile per footing 915mm dia without pile cap as per drawing No. PDW/TC-279 (Rev.0)						
	(i) Pile Shaft upto depth of 15 m	Lin. M	180	100	18000	6	1080
	(ii) Pile Shaft upto depth of 25 m	Lin. M	200	100	20000	6	1200
					0		0
	iii) Reinforced concrete pier/pile cap/pile foundations suitable for all types of soil (cast in situ installation) complete with supply of material etc. Using Portland cement type V conforming to ASTM C-150 including installation of pole grouting as per approved design/drawing for all steel tubular poles type:						
	a) SP-BT Type Pole Foundation as per drawing No. 2878/169/TD/1E217 OR Similar						
	i) Pile shaft 'D' upto 16 m	Lin. M	64	204	13056	11	704
	ii) Pile shaft 'D' > 16m	Lin. M	80	204	16320	11	880
	iii) Reinforced concrete pile cap with chimney	Foundation	2	2847	5694	151	302
	b) SP-BM Type Pole Foundation as per drawing No. 2878/169/TD/1E218 OR Similar						
	i) Pile shaft 'D' upto 16 m	Lin. M	128	207	26496	6	768
	ii) Pile shaft 'D' > 16m	Lin. M	160	207	33120	6	960
	iii) Reinforced concrete pile cap with chimney	Foundation	2	4588	9176	345	690
	c) SP-BH Type Pole Foundation as per drawing No. 2878/169/TD/1E217 OR Similar						
	i) Pile shaft 'D' upto 20 m	Lin. M	160	255	40800	11	1760
	ii) Pile shaft 'D' > 20m	Lin. M	200	255	51000	11	2200
	iii) Reinforced concrete pile cap with chimney	Foundation	2	5779	11558	410	820

Total Steel = 939353 68457

Total Steel Kg **939353** kg
 Total Cement Bag Required **68457** bags

Annex VI: Calculation of Applicable General Sales Tax (GST)

220 kV double circuit transmission line from 220 kV Jhampir to existing 220 kV T M Khan Road grid station (revised 84.5km)

Total steel used in civil works included in Lot-I	=	438481 Kg (Figure from Annex-V)
Total steel used in civil works included in Lot-II	=	939353 Kg (Figure from Annex-V)
Total steel used in civil works (Lot-I & Lot-II)	=	438481 + 939353 Kg
	=	1377834 Kg

Sr. No.	Total Steel (Kg) as per boq	unit rate (PKR)	total COST of steel (PKR)
	(1)	(2)	(3) = (1) x (2)
I.	1377834	88	121,249,392

Total cement bags to be used in civil works included in Lot-I	=	37353 bags (From Annex-V)
Total cement bags to be used in civil works included in Lot-II	=	68457 bags (From Annex-V)
Total cement bags to be used in civil works (Lot-I & Lot-II)	=	37353 + 68457 bags
	=	105810 bags

Sr. No.	Total Cement (Bags) as per Boq Qty	Per Unit Rate	Total Cement (Bags) as per Boq Qty
	(1)	(2)	(3) = (1) x (2)
I.	105810	550	58,195,500

Total amount of Steel and Cement (As per BOQ) = Rs. 121,249,392 + 58,195,500

= Rs. 179,444,892

Total General Sales Tax (GST) @ 17% = Rs. 179,444,892 x 17%

= Rs. 30,505,632

Total Contract Price of LOT-I + LOT-II
(Based on awarded contract prices)

= Rs. 652,000,000

Percentage of total GST on total contract price = $\frac{30,505,632 \times 100}{652,000,000} = 4.7\%$

Annex VII: Photographs



Fauji Fertilizer Company Energy Limited (FFCEL) wind Energy Farm at Jhimpir



Fauji Fertilizer Company Energy Limited (FFCEL) HV Switchyard at Jhimpir

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