

PROJECT BRIEF

HARNESSING WIND POTENTIAL: A LOOK INTO WIND POWER PROJECT AT GHARO-JHIMPIR WIND CORRIDOR

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Introduction

Pakistan is blessed with abundant wind energy resource distributed across the province of Khyber Pakhtunkhwa, Sindh and Balochistan. In Sindh, Gharo-Jhimpir wind corridor alone carries an immense potential of over 11 GW of electricity production.[9] The wind corridor in Sindh was mapped by United States Agency for International Development (USAID) through U.S. National Renewable Energy Laboratory (NREL) in collaboration with Pakistan Meteorological Department (PMD) and Alternate Energy Development Board (AEDB) in 2007, and thereafter it became part of Global Wind Atlas.[15] It covers roughly an area of 60KM x 170KM [15]and houses about 24 wind power projects. The following map, displaying the province-wise wind potential of Pakistan, show how rich Balochistan, Khyber Pakhtunkhwa and Sindh are in terms of their potential to produce wind energy.

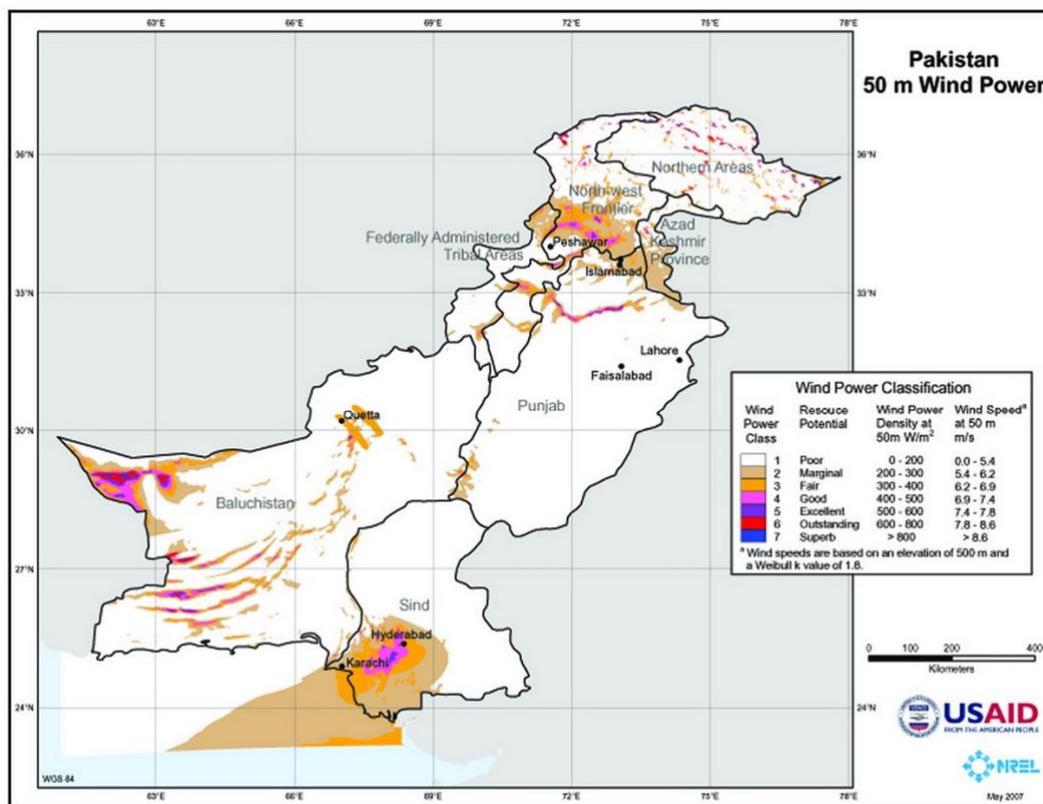


Figure 1: Wind Resource Potential Map

Source: <https://www.aedb.org/ae-technologies/wind-power/wind-re> [15]

The Government of Sindh has been quite proactive in exploiting the wind resource, particularly in the Gharo-Jhimpir Wind Corridor. The Sindh government has allocated vast land to Alternate Energy Development Board (AEDB) for the development of wind farms through private sector's participation. So, the initial allocation of 23,645 acres of land in district Thatta happened in 2005 on the basis of sublease by AEDB to 15 prospective wind independent power producers (IPPs).[12] Similarly, after 2005, 10,330 acres of land were allocated to an additional seven (7) IPPs to setup projects on a build-own-operate basis.[12]

Unlike fossil fuel-based power generation, the wind power causes zero greenhouse gases emissions. However, since these projects require vast areas of land, an assessment of the social and ecological impacts of wind power generation is vital to their sustainability. This project brief covers the benefits of wind power development in the wind corridor and any arising social and environmental concerns, by studying the 49.5MW wind power project setup by Fauji Fertilizer Company Energy Limited (FFCEL). FFCEL is the first wind power project company that inaugurated the Gharo-Jhimpir wind corridor along with Zorlu Enerji. For the purpose of this project brief, we have reviewed the Environment Impact Assessment (EIA) of the wind project by FFCEL, alongside secondary research, and discussions with local activists, and consultants engaged with the wind power projects in the Gharo-Jhimpir Wind Corridor.

Project Description

Project Ownership

FFCEL, established as an unlisted public company with the purpose of installment and operation of a wind power generation facility, is a wholly owned subsidiary of Fauji Fertilizer Company. The project company is financed with 80% debt arranged by the local banks and 20% equity investment from Fauji Fertilizer Company (FFC).

Project Timelines

The project was developed over a period of three years with conception in 2010 and commercial operations achieved in 2013. The project received its power generation license in August 2010 and tariff determination in November 2010. After achieving financial close by mid of 2011, the site was then handed over for construction activities, with the completion of the first wind turbine's erection in January 2012, and the last wind turbine by July 2012. The project started selling power to the National Transmission and Dispatch Company (NTDC) on May 16, 2013.

Project Technology

The wind farm¹ consists of 33 Nordex S77 wind turbines of 1.5MW capacity each, with hub height of 80 meters, generating a total gross capacity of 49.5MW and net capacity of 46.85MW. The generated power is evacuated at 132KV voltage level, through a double circuit 132KV transmission line —5KM in length— to Hyderabad Electricity Supply Company (HESCO) load center from FFCEL substation. The expected project life is 20 years and the generation license has also been granted for the same period from commercial operations date (COD).

Project Capacity Factor

The power plant's reference tariff at COD has been determined on the basis of 33.12% net plant capacity factor producing an annual output of 143.559 GWh. Any output beyond 143.559 GWh is arranged to be sold at 10% of the applicable indexed tariff for the particular period.

¹ The cluster of wind turbines in the same location to produce electricity

Project Costs and Tariffs

The total project costs allowed in the tariff determination accounts for EPC and non-EPC costs of US\$ 133.502 Million (Rs. 12.087 billion). A levelized tariff of Rs. 13.6927/kWh was approved at the time of reference tariff determination. However, based on true up costs at the time of COD, the levelized tariff was revised to Rs. 14.965/kWh.

Project Contracts

The project achieved its financial close on June 28, 2011 after signing the following agreements:

- Land sublease agreement with AEDB
- Financing agreements with project equity and debt sponsors
- Energy Purchase Agreement with NTDC
- Engineering, Procurement, and Construction contract and Operations and Maintenance (O&M) contract with a joint consortium of Nordex and Descon Engineering Pakistan
- Implementation Agreement with the Government of Pakistan

Project Location and Land

The power project is located in Jhimpir, near Nooriabad, district Thatta. This location lies in the southeastern part of Pakistan, between Hyderabad and Karachi, approximately 100 KM inland from the coast. The terrain of the area is mostly plain, semi-desert and has traces of vegetation. The nearest population centers are Jhimpir town 2.5KM away (south east) and Nooriabad 22KM away (north west). A total of 1283 acres of land through sublease from AEDB has been acquired by FFCEL at a rental cost of USD 0.245 million.

Figure 2, 3, 4, and 5 below show the project site, access to the project site, project terrain and plant layout.



Figure 2: Access to the Project Site

Source: Google Maps



Figure 3: Project Terrain (mix of hard and rocky ground with bushes here and there)

Source: Project's EIA

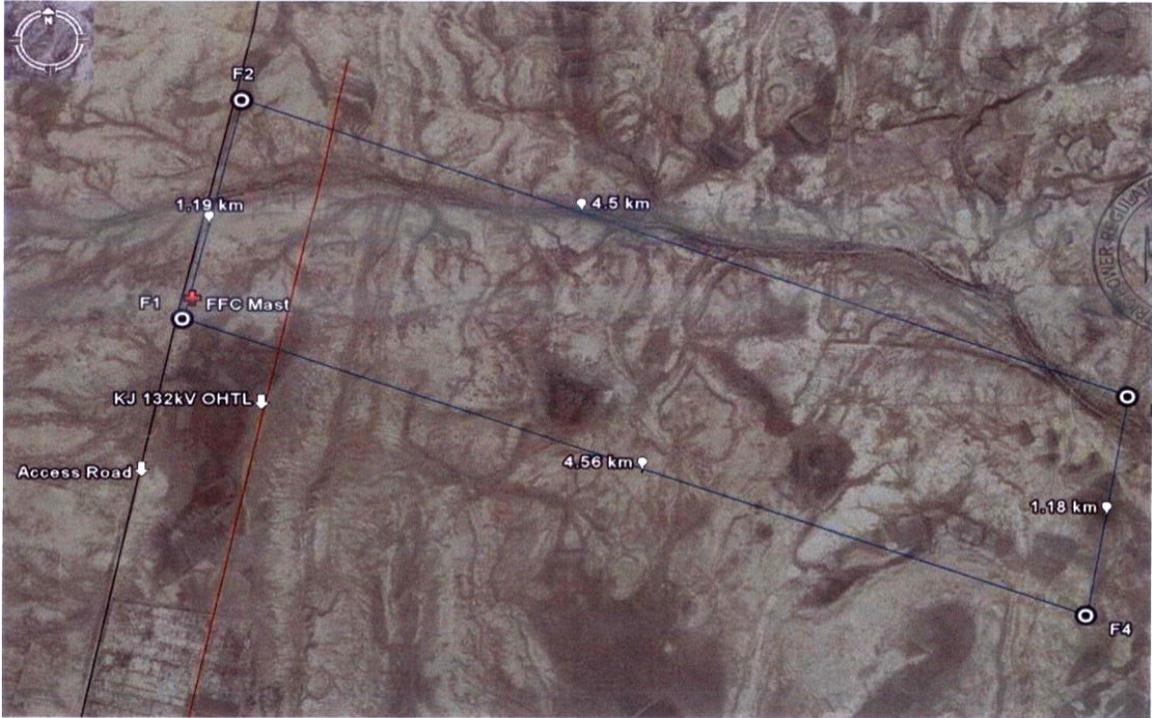


Figure 4: Project Site Layout
 Source: NEPRA Approved Generation License Application



Figure 5: Google Map View of the Project Site

Benefits of Wind Power Projects

Clean Energy Credits

The carbon footprint of wind power projects at generation stage is zero, i.e. no fuel is burnt to produce 1 kWh of electricity. Thus, mechanisms have been developed worldwide to capture the clean energy benefit of these renewable energy projects in the form of carbon credits, renewable energy certificates or renewable energy credits and carbon offsets. Businesses which have carbon footprint can purchase these credits and offset their carbon footprint with renewable energy produced somewhere else. The renewable energy projects in Pakistan are also required to follow this process and proceeds from these credits are then shared with the power purchaser. The renewable energy producing companies first register with Clean Development Mechanism (CDM) Executive Board and then they are allowed to sell their credits in the European Union market. To date, over 18 wind projects in Pakistan have registered under this mechanism and AEDB reports 709,287 credits as approved from wind power projects and 929,280 credits are under the process of approval.[3]

Plummeting Energy Prices

The utility scale wind power projects have experienced significant cost reductions over the past decade. The LCOEs for onshore wind projects dropped by 56.18% from 2010 to 2020 globally and in Pakistan the average LCOE of utility scale onshore wind is estimated at USD 0.035/kWh. Figure 6 displays the plummeting global LCOEs for newly commissioned utility scale solar, concentrated solar, offshore and onshore wind power projects.

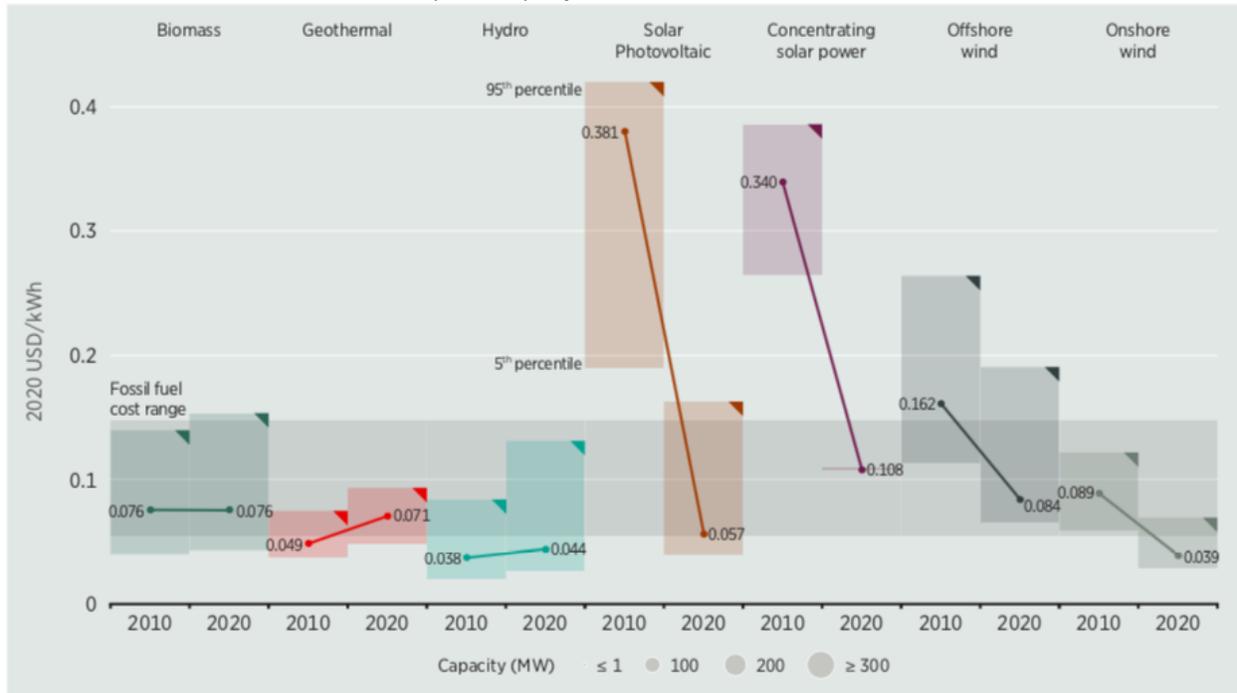


Figure 6: Global LCOEs from Newly Commissioned Renewable Energy Projects

Source: IRENA Renewables Cost Database [7]

These decreasing prices are making the energy produced from renewable energy projects economically cheaper than energy produced from fossil fuels-based power plants. Therefore, helping the energy sector to achieve financial sustainability and energy security. This can be explained through following two key financial benefits:

No Capacity Payments

The first financial benefit is no requirement to be paid capacity payments, unlike the case with fossil fuels-based generation sources. All the upfront cost that is incurred on a wind power project is translated into Rs/kWh terms in the tariff determinations as an energy component which is to be paid only when the project is supplying energy.

No Expenditure on Fuel Procurement

There is no fuel that is to be purchased on an ongoing basis for power generation in the wind projects, thus a greater reliance on wind energy can reduce exposure to international fuel prices and price volatility. The implications of which have recently had a heavy toll on the current government, where it had to procure Liquefied Natural Gas (LNG) at an exorbitant price of USD 30/mmbtu (million British thermal unit) in December 2021, as compared to USD7-10/mmbtu in 2019, and USD 2/mmbtu in 2020. [8]

Potential for Sector Coupling²

Electrification of energy uses — be it heating, cooling, lighting, cooking, manufacturing or transportation — will serve as an important transformation to fully utilize the potential of energy produced by renewable energy projects. Often due to mismatch of load demand profiles with the resource availability profiles, the power from renewable energy projects face curtailment. However, the “could be” produced energy has ability to power different energy uses, which in the absence are fulfilled by for example domestic gas in the case of cooking and heating during winters when gas availability faces major challenge. Not only the government deals with defaults on LNG imports by international contractors, but also buy expensive LNG from spot markets. Therefore, wind and solar power projects present immense opportunity to benefit from their zero fuel prices characteristic and use of excess electricity produced through electrification of energy uses in various sectors.

Challenge of Wind Curtailment

The wind power projects in the Gharao-Jhimpir wind corridor have frequently faced curtailment during the past many years. This curtailment in turn has resulted in financial woes for the wind power projects in the corridor. First, they are denied dispatch leading to no energy payments, despite being available and carrying the “must-run” status. Second, their ability to repay debt sponsors gets jeopardized. The must-run conditionality applies to wind and solar power projects because a) whenever the resource is available the power will be generated b) the tariff arrangements and policies are also as such that they only get payment for energy dispatched and

² Sector coupling refers to the idea of interconnecting (integrating) the energy consuming sectors - buildings (heating and cooling), transport, and industry - with the power producing sector.[2]

are not compensated for their capital cost through capacity payments like the fossil fuels based power plants. However, in the past, despite the mandatory dispatch requirement in RE Policy for Power Generation 2006, EPAs, and Power Acquisition Requests (PARs)³, wind generation is curtailed by National Power Control Center (NPCC) and not dispatched to NTDC.[5] Thus, neither the capacity factors based on which the tariffs were determined have been realized nor all the documentation in place that guarantees offtake has been honored. Furthermore, during the period of curtailment, government favored power generation from fossil fuels-based units stating the reasons of more system stability and proximity to the load center.[5] Whereas wind energy is not only the clean source of power generation, but also does not carry any burden of capacity payments.

Environmental and Social Impacts

Impacts on Local Livelihoods

Land use before setup of FFCEL

Although the land acquired for the project belongs to the provincial government and has been leased to AEDB for development of wind power projects, it has been in use by the locals for grazing of their livestock. Even people from nearby villages across the Keenjhar lake bring their animals here for grazing purposes during the monsoon season. There is not a significant impact on grazing activities, as the total area utilized for the erection of wind turbines is usually 2-3% of the acquired land for the project. Therefore, the rest of the area is available for grazing activities. The acquired land is considered not suitable for farming due to its hard and rocky terrain.

Employment opportunities for locals

The livelihoods of the locals are mainly dependent on labor. With development of the wind corridor with wind power projects, the opportunities for labor increased in the area. FFCEL created jobs for the locals during the construction and operation phases of the project. However, the local activist reports difficulty in hiring of locals, because usually wind companies contracted their construction works and the hired contractors would bring their own work force. As a consequence, protests happened from the platform of the local social movements such as Kohistan Bachaiyo Committee, Kohistan Rajuni Ittehad and Jhimpir Social and Welfare Development organization. In order to put the protests to rest, employment opportunities were then offered to a few main faces of the protests, as the local activist recounts.

Moreover, the jobs offered post construction phase did not belong to the management tier and mostly involved either clerical work or related to gardening and secure keeping of the project site.

³ NEPRA obtained confirmation from NTDC prior to award of tariffs to wind power projects that the off-take of power generated from wind projects will be ensured (the necessary infrastructure for evacuation will be in place) by NTDC through Power Acquisition Requests (PAR). NTDC thus issued PAR in favor of each wind power project. (Ghumman 2020)

Nonetheless, the local activist acknowledged that a few people from Thatta are working in the upper ranks of the company. The project company also hired community liaison officers (CLOs) which as a principal should be from the local community. As part of their job description, they bring community's concerns to the company's management and work for their redressal. The process followed for hiring is the same as company's overall hiring process. However, the local activist shared that the CLOs posts by the wind companies in the corridor were advertised as a mere tick-box exercise, and the person for job would be hired beforehand mostly based on nepotism. To further disappointment, CLOs rarely communicate with locals in their native language, and visit mostly on rotational basis, so there remains a trust deficit in the community.

Impacts on Mobility of Locals

There are no restrictions on mobility near the power plant. The locals can take the shortest routes through the power plant area, or use the access roads built by FFCEL. Whereas access to artificial ponds that usually develop after the rainy season, upon which locals and their livestock used to rely for water needs, are often blocked.

Impacts on Water Resources

Keenjhar (Kalri) Lake is the nearest water body to the project site, about 5KM away towards southeast. It is one of the largest freshwater lakes in Pakistan. Other than this lake, no major waterbodies exist in proximity of the project site. The project's EIA eliminates any possibility of impact on the lake water during construction and operation phase, stating the route taken for construction material transport is northwest to the project site and also no wastewater disposal is required in the case of wind power projects.

However, in 2012, on 14th and 15th April, thousands of dead fish, snails and bivalves were found floating on the surface of water near the conflux of Keenjhar Lake and Haroolo Drain. Local community also reported the killing of four cows, jackals and a number of turtles due to the contaminated water of the Haroolo Drain.[6]



Figure 7: Dead fish at the Keenjhar Lake

Source: <https://www.dawn.com/news/711571/toxic-drain-kills-fish-pollutes-keenjhar-lake>.



Figure 8: Keenjhar Lake, Jhampir

Source: Google Maps

The suspected sources of water contamination were Nooriabad Industrial Zone and possible contamination from construction activities at FFCEL's project site. However, the project director of FFCEL, maintained the position of no possible contamination from wind power project. It was alleged that the company used blasting technique for construction and employed toxic chemicals for the purpose. However, FFCEL carried out digging for preparation of bases for erection of wind turbines, as is a globally used technique. The digging was carried out up to a maximum of 3 meters depth using machinery and groundwater lies at the depth of 100 meters.[11] The results of investigative scientific report, carried out by Science and Upper Atmospheric Research Commission Pakistan (SUPARCO) in collaboration with Sindh Environment Protection Agency, Sindh Irrigation Department and World Wide Fund for Nature Pakistan, ruled out the possibility of contamination of the lake water by construction works at FFCEL.[10] It was concluded that the drastic event occurred after the lake being regularly poisoned by industrial chemical waste.

No incident of such gravity has not been repeated since 2012. However, locals face difficulty in procuring water for their domestic needs. The sources of water they rely on include water from the handpumps, rainwater collected in the artificial ponds and water tankers arranged by the wind companies. The water from handpumps is usually brackish and even the water from deep hand pumps tastes bitter, possibly because of coal reserves as shared by the local activist. The rainwater collected by the locals in the artificial ponds also gets filled with dust because of the movement of vehicles of wind project companies. If the company's appointed *wadera* (locally influential man) is reached to provide the allocated water tankers, he delays the request and only provides one tanker instead of four or five tankers.

Impacts on Flora and Fauna

The company's EIA reports no impact on local vegetation as the area is mostly barren with few self-growing stunted bushes and water table lying as low as 115m. The scarce water availability in turn does not attract major wildlife except for native reptiles in the area. However, the local activist shares the concern about the disturbance of wildlife habitats by comparing the environment of the corridor prior to its development with current scenario of increased mobility, lighting and economic activity in the area.

The impact on avifauna has been the most concerning, he added. The incidents of collisions of birds with the wind turbines are very frequent. The EIA, on the other hand, only states that no endangered species are found in the area, without going into detail of the species of birds that use the route and could be affected with the wind turbines. Moreover, there is no mention of any mechanism to track the collisions of birds, study bird's habitats, scenarios of possible disturbances to their routes and recovery of injured birds, as Regional Environmental Assessment Study of Gharo Wind Energy Corridor requires.



Figure 9: Dead Common Buzzard and Indian Vulture after collision with wind turbines

A research work studying the Jhampir wind corridor wildlife, however, lists down the species of birds that are resident and birds that pass the area in different seasons. The area supports grey partridges, chestnut bellied and Lichtenstein sand grouses, pigeons, doves, bee-eaters, mynahs, shrikes, nightingales, Indian robin, purple sunbird, black drongo, black kite, house sparrow and house crow.[4] Endangered species of the area include houbara bustard, Indian Vulture, Pallas fish, eagle, greater spotted eagle and common buzzard.[4] Figure 9 above shows the dead Indian Vulture and common buzzard after collision with the turbines' rotating blades.

Impacts on Health and Education

The wind companies appoint a local person, usually a *wadera*, for disbursement and use of funds for the betterment of local community under Corporate Social Responsibility (CSR). However, this whole process is reported to be corrupted by the local activist. He shared that as per the law, the CSR funds should be invested on local communities' development but a portion of it is passed on to the district government and the remaining is expended through the appointed *wadera*. The *wadera* reports full utilization of funds, but in reality, expends little on the local community, that too after when they repeatedly make requests. For example, if the *wadera* is obligated to provide five water tankers with funds available to him by the company, he only provides one to the

community, and rest of the funds go in his own pocket. Similarly, if a public hearing is to be organized, the *wadera* hires 20 to 30 people or as many required for the hearing, and it is then shown that the participatory exercise has been successfully done and matters have been resolved, but that all belies the reality.

However, with FFCEL, the experience of local community has been better. Of all the wind companies in the corridor, they have actively worked for the development of Jhimpir town and nearby villages. FFCEL along with its O&M partner Nordex, launched a PKR 9.4 million CSR program in 2012. The program targeted health, education, agriculture, provision of safe drinking water and improved road access in the villages of Khameeso Shoro, Umer Chang, Sulaiman Palari and Jhimpir town.

Health Initiatives

As part of the program the Basic Health Unit (BHU) in Jhimpir town was rehabilitated and upgraded. FFCEL added three (3) room Gynae and Dental ward in the BHU and provided beds and equipment as well. The maternity facility at the BHU has served a real need of the town, as otherwise in the case of emergency, locals used to rush to either Thatta, Hyderabad, or Karachi. The facility is functional with a lady doctor and few midwives, however, not well maintained by the local government.

Educational Initiatives

Primary school for girls and boys in the villages of Khameeso Shoro and Sulaiman Palari were rehabilitated with construction of children's play areas, renovation of washrooms and provision of drinking water through hand pumps installed within the school. Higher secondary school in Jhimpir town was also renovated and available buses were repaired to serve as pick up service for female students from nearby villages. They also reopened two private schools and hired few teachers there.

A technical training institute was also established by FFCEL in collaboration with Nordex and Descon Engineering Pakistan offering a one-year technician training program specific to O&M of the wind turbines. The first batch of 15 students was inducted into the institute in 2017.



Figure 10: Technical Training Institute by FFCEL

Agriculture Initiatives

The company designed an uplift program for native farming community and distributed fertilizer bags to local farmers as well in collaboration with district government Thatta in 2012.

Drinking Water Initiatives

FFCEL provided the town of Jhampir with an additional water supply. The water filtration plants were also installed in nearby villages of Khameeso Shoro, Village Umer Chang and Village Suleman Palari. Each filtration plant has a storage capacity of 4K gallon water and a backup generator.

Road Network and other Improvements

As part of the program, roads in the nearby villages were improved and a 2KM road in village Umer Chang was rehabilitated. The travel time, therefore, has shortened for the locals. The individual households in the nearby villages were also provided with solar panels, which serve the purpose of lighting 2-3 bulbs and charging mobile phones.

These extensive improvements were done mostly during the initial years of operations of FFCEL. However, now the development activities by FFCEL have paced down, as other wind projects which share the corridor are also running their respective CSR plans.

What can be done better?

Environmental Monitoring

Impacts of wind power projects on the wild life of the area, however negligible, need to be taken care vigilantly. The Regional Environmental Assessment Study of Gharo Wind Energy Corridor outlines mechanisms for better assessment of birds disturbed by the wind turbines. It requires that at least data be gathered for one year on birds that pass the route, how often they collide, which species pass during what times of the year and whether they are endangered or not. Since the Keenjhar lake is near the project site, the possibility of birds crossing the area is more likely than not. Therefore, the wind companies in the corridor including FFCEL, should make careful assessment of impacts on the birds and take necessary actions if required. Moreover, efforts should be made to ensure that the wildlife belonging to the area is protected and their habitats are not disturbed. The EIA of FFCEL states that the project site is open to be used by the native wildlife, as the actual area utilization of wind turbines is 2-3% of the acquired land.

Educational Awareness Campaigns

It has appeared from our discussions with the locals that even though the primary schools exist in every nearby villages, the ratio of students upgrading to secondary school is hardly over 10 percent for girls and for boys it is around 70%. For higher secondary education, institutes exist in the Jhampir city, and with renovation of bus service, the female students have improved access to them. However, a detailed analysis is required to determine causes for their lower participation in higher secondary education. Another reported concern is the quality of education provided at the educational institutes and frequent absence of teachers. The wind project companies can work on this aspect of community development to promote higher secondary education and carry out

initiatives for access of quality education to the girls and boys of community, with a greater emphasis on girls' education.

Social Governance

The development of Gharo-Jhimpir Wind Corridor to harness the immense potential of available wind resource can be done sustainably if the project companies continue to engage with the local communities, however, with few considerations in view. First and foremost, the development should be fair and equitable, benefitting all members of the local communities with an augmented focus on women of the areas. They are often neglected in community level decision making and consultations on the premise of their privacy and gender. But efforts should be made to bring their voices forward by appointing female CLOs along with male CLOs, and also making sure they can communicate in their language so that trust can be built.

Moreover, the access to economic opportunities should be made transparent, where members of the community can apply for opportunities with certainty that project companies will follow defined hiring processes to the letter. The project companies should also ensure proper accountability of the resources disbursed through the appointed officers, otherwise only those in charge will continue to benefit while the real needs will continue to be uncommunicated and unaddressed. The erection of wind turbines preserves the sanctity of the environment by releasing no greenhouse gases emissions, hence, it should be ensured that the interests of the local communities are also preserved.

The wind farms in the corridor are fortunately being developed on land that has no prior human settlements, and nearby towns are at a mandated distance of at least 2.5KM away. Otherwise, the intensity of impacts from displacement and resettlement can be gruesome for local communities if not addressed with adequacy and empathy. Furthermore, the communities' grievances redressal mechanism should be made accessible, so that if the appointed persons are not working in the interest of the community, they can reach out to the company. A proper governance of these projects can make them more sustainable from a socioeconomic perspective and can lead to the uplift of communities in real terms.

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