

Wind Energy Potential in Sindh Region

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Abstract

Electricity performs an essential position inside the socioeconomic boom and social prosperity of any country. It is to be taken into consideration because of the fundamental need for human improvement. Nowadays, the low production of power is extreme trouble in Pakistan, which immediately restricts the improvement of the country. 1/3 of Pakistan's populace does not have any electricity inside, the rural regions, and approximately eight to ten hours of load shedding in city regions and is pretty common. Although Pakistan constantly indicates a deficit with inside the conventional sources, however, no development becomes additionally is being made inside the renewable sources consisting of the wind. Therefore, it's far higher to make use of these natural assets on the way to satisfy the power to deliver Pakistan. In this manuscript, our important goal is to study the potential of wind energy in the Sindh region and how much potential we use for our country.

Keywords: Electricity; Load Shedding; Potential; Renewable Sources; Wind

Introduction

This portion assesses the value of the wind sources inside the Sindh region. The authorities of Pakistan have taken firm measures to provoke wind power projects in Pakistan mainly Sindh. Satellite mapping carried out with the aid of using the United States Agency for International Development (USAID) in collaboration with the National Renewable Energy Laboratories (NREL), USA anticipated a gross capability in Sindh province is 43.8 GW out of which 11 GW is usable. Wind power as renewable sources is greater favourable nowadays due to the fact these are surroundings pleasant with zero emissions compared to standard power assets. It is better to make use of those natural assets to meet the power delivery to the country. In this manuscript, my major goal is to observe and outlooks the country's electricity profile scenario vis-à-vis wind power capability characteristics of the most crucial wind corridor with inside the Sindh province [1]. Sindh has around 350 kilometres (km) coastal line for the wind power capability. In this paper, I attempted to estimate the wind power capacity of the Sindh region and what number of wings power makes use of in Sindh with the assist of IPPs.

Due to the depletion of a power source like fossil fuels, there's a multiplied usage inside the non-traditional reasserts including wind power, solar power, and biogas power. Wind Energy is the conversion of wind to electric power. Wind energy is a less expensive form of electricity as compared with coal, fuel line, or fossil gasoline powered plants [2]. Wind power exists over huge geographic areas. Increased deployment of wind strength and energy-efficient strategies has ended in substantial energy security, weather alternate mitigation, and financial benefits. The wind has the capability to generate far more than 1 percent of the entire power of the word. Pakistan generates 6% of power from the wind and 80% of wind power produce from Sindh regions due to the fact air velocity of Sindh is 6 to 11 ms that is efficient for generating energy for a complete year. The bulk of this wind useful resource is derived from the power of the extremely good southwest monsoon system which blows over Pakistan. The wind electricity power plant in Pakistan begins operating with 50 MW ability in Sindh in 2012.

Alternative Energy Development Board (AEDB) and Pakistan Meteorological Department measure the velocity of the wind and

introduce regions for wind electricity plant [3]. Initial surveys executed in the past due to the nineties and early years of this century indicated that coastal regions of Sindh the respectable reviews pick out that in Sindh Province, district Thatta, Karachi, Hyderabad, and Badin potential sites for development, set up, and commissioning of wind farm projects [4]. Sindh has the ability to produce about forty-three GW of wind energy, says the latest United States Agency for International Development (USAID) report (Figure 1).

Potential Calculation

Wind Potential is one of the technologies to count the wind to be used full work the most wind potential may be received from the subsequent equation.

$$\vec{V}_{\omega} = C \left\langle \frac{k'}{k'+2} \right\rangle^{-0.5},$$

Where \vec{V}_{ω} is the maximum wind power k' , C is the dimensionless element and Weibull factor respectively

Average Wind Deviation

As regarding the maximum of the locations, the wind speed constantly changes with altitude, which basically relies upon on parameters terrain roughness and combining of the environment (Figures 2 and 3). The wind velocity deviation with altitude relation is defined as follows:

$$\vec{V}_{avg2} = \vec{V}_{avg1} \left\langle \frac{h_2'}{h_1'} \right\rangle^n,$$

Where, \vec{V}_{avg2} , \vec{V}_{avg1} , are the common wind speeds at h_2' and h_1' altitudes respectively, and the exponent energy is the land surface

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Figure 1: Pakistan 1st 50 MW wind power plant (Zorlu energy Turkish company).

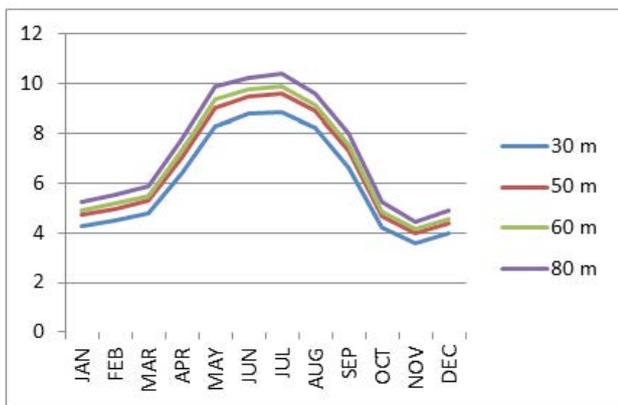


Figure 2: Average wind deviation.

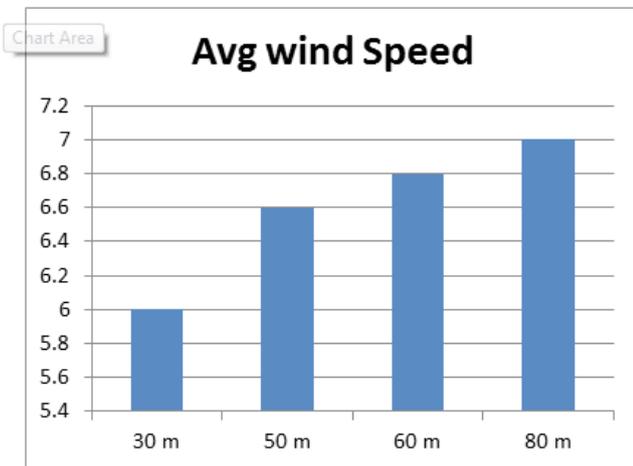


Figure 3: Average wind speed.

roughness environment stability, and its most and minimum limits are the “0.5” and “0.05” respectively

The annual wind velocity at 30 m and 50 m, 60 m, and 80 m, respectively as proven in (Table 1).

Sindh Wind Energy Projects Status

Sindh became assigned a project to the Alternative Energy Development Board (AEDB) to put in force renewable electricity projects especially wind and sun electricity projects. With the contribution of AEDP, there are numerous renewable electricity projects (Figure 4).

Table 1: The status of company project capacity (MW).

S.No	Company Name	Project Capacity (MW)	Status
1	FFC Energy Limited	49.5	Completed
2	Zorlu Enerji Pakistan (Pvt.)	65.4	Completed
3	Three Gorges Pakistan First Wind Farm (Pvt.) Limited	49.5	Completed
4	Foundation Wind Energy II (Pvt.) Limited	50	Completed
5	Foundation Wind Energy –I Limited	50	Completed
6	Sapphire Wind Power Company Limited	52.8	Completed
7	Metro Power Company Limited	50	Completed
8	Yunus Energy Limited	50	Completed
9	Master Wind Energy Pvt. Limited	52.8	Completed
10	Act Wind (Pvt.) Ltd. (Tapal Wind Energy Pvt. Limited)	30	Completed
11	Gul Ahmed Wind Power Ltd	50	Completed
12	Tenega Generasi Limited	49.5	Completed
13	Hydro China Dawood Power Pvt. Limited	49.5	Completed
14	Sachal Energy Development Pvt. Limited	50	Completed
15	UEP Wind Power Pvt. Limited	99	Completed
16	Jhampir Wind Power (Pvt.) Limited	50	Completed
17	Hawa Energy Pvt. Limited	49.5	Completed
18	Hartford Alternative Energy Pvt. Limited	49.3	Completed
19	Three Gorges Second Wind Farm Pakistan Limited	49.5	Completed
20	Three Gorges Third Wind Farm Pakistan (Pvt.) Limited	49.5	Completed
21	Tricon Boston Consulting Corporation Pvt. Limited – A	49.6	Completed
22	Tricon Boston Consulting Corporation Pvt. Limited – B	49.6	Completed
23	Tricon Boston Consulting Corporation Pvt. Limited – C	49.6	Completed
24	ACT 2 Wind Pvt. Limited	50	Under construction
25	Artistic Wind Power Pvt. Limited	50	Under construction
26	Din Energy Pvt. Limited	50	Under construction
27	Gul Ahmed Electric Ltd	50	Under construction
28	Indus Wind Energy Ltd	50	Under construction
29	Lakeside Energy Pvt. Limited	50	Under construction
30	Liberty Wind Power-1 Pvt. Ltd	50	Under construction
31	Liberty Wind Power-2 Pvt. Limited	50	Under construction
32	NASDA Green Energy Pvt. Limited	50	Under construction
33	Metro Wind Power Ltd	60	Under construction
34	Transatlantic Energy Pvt. Limited	48.3	Under construction

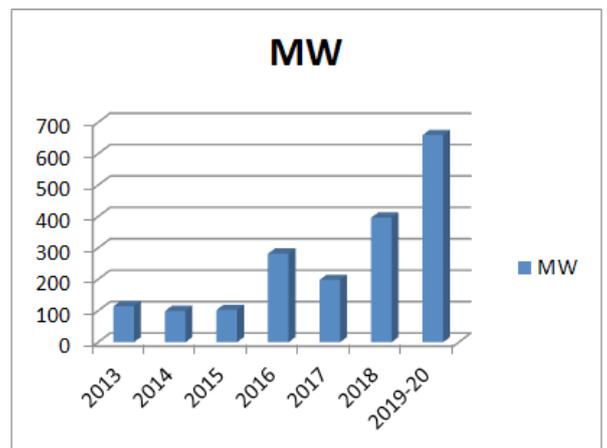


Figure 4: Wind energy potential in Sindh.

Wind Energy Potential in Sindh

Pakistan has a coastal line of 1046 km, of which the Sindh coastal line is almost 250 km that's wealthy withinside the wind electricity source up to 20 GW. The wind velocity reaches around five to twelve m/s in wind corridors of Sindh [5]. A general coastal place of Sindh 9749 km². The common capability factor is 25%, the ability which may be acquired from 1 km² is 18 MW. Thus, the gross capability in Sindh province is 43.8 GW out of which 11 GW is usable.

Alternative Energy Development Board (AEDB) has assigned the land to 23 Independent Power Producer (IPPs) for the production of wind energy. Those projects generate common 50 MW at every location, namely Jhimpir, Lakha, Gharo, Bhambhor, and kuttikun operational wind energy projects in sindh which are with the cumulative potential of 1199MW withinside the winding corridor of Jhimpir and Gharo, Ketu Bandar, the sites of Sindh province (Figures 5 and 6).

Results

The market for wind energy in Pakistan is predicted to grow at a CAGR of greater than 5% within side the forecast duration of 2020-2025. Factors which include supportive government rules and efforts to fulfil power demand the use of renewable to decrease dependency

on fossils are predicted to be massive participants to the growth of the marketplace [6]. The declining expenses of renewable technology are getting competitive with fossil fuel sources, and further subsidies on renewable are driving the renewable marketplace further. On the opposite hand, due to the significant scale of dependency on fossil fuel-based power technology, very much less improvement within side the renewable energy sector in Pakistan, and limited power capability by variable renewable energy sources, there may be a bad effect at the increase of wind electricity.

- Wind power has an enormous capacity in Pakistan. Because of this, Pakistan has proven a CAGR of greater than 40% from 2014-2018, in phrases of set up capability of wind energy, ensuing in greater than a thousand MW of operational wind farms in 2019.
- The authorities of Pakistan is aiming to gain 6% of its electricity generation from renewable via way of means of 2030, aside from hydroelectricity, which turned into predicted at 3% in 2018. Solar and wind are going to be the most important markets within side the coming years.
- In 2019, the Alternative Energy Development Board of Pakistan accorded approval for eleven different wind projects together comprising greater than 500 MW, which can be predicted

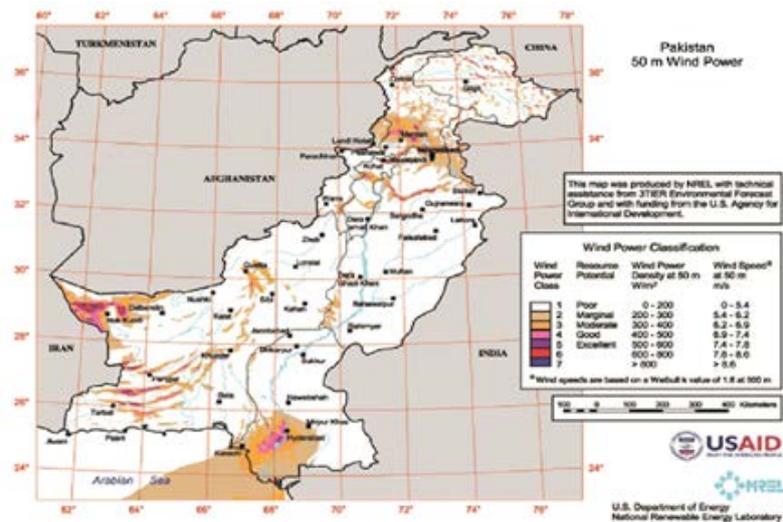


Figure 5: National renewable energy laboratory survey report map.

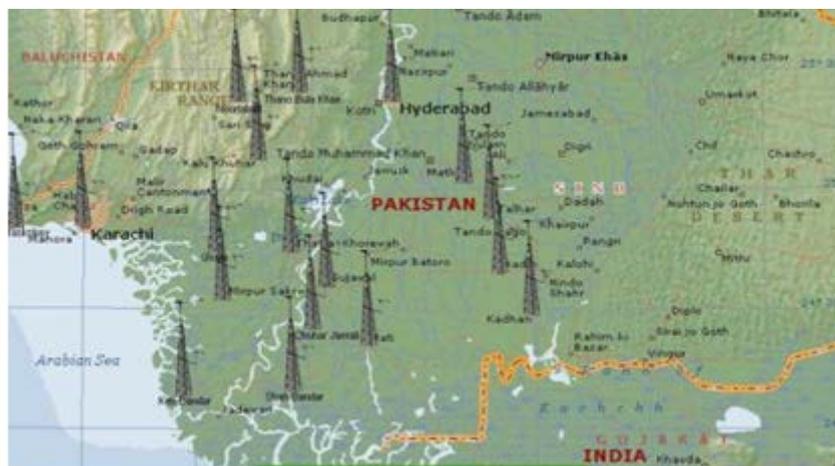


Figure 6: Diagram of study wind corridor.

to be operational within side the forecast duration, using the wind marketplace of Pakistan

Concluding Remarks Renewable energy sources evaluation and electricity output estimation from a hypothetical wind turbine at Gharo have proven that commonly in the course of summertime season six months April-September, there are strong sustainable winds basically from Southwest and in the course of this excessive ability factor of 32-50% might be achieved. Normally in the course of summertime season, warm months nearby power call for are also predicted to be high. However, during the remaining six months the typically slight winds are experienced and commonly during this era local power needs is also low. Annual ability factor of 27% suggest that summertime season six months energy production remains compensating the low electricity output in the course of the last six months and the location is appropriate for setting up commercially viable wind farms

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