



# Development Prospects of Chinese Enterprises in Green Energy Industry in Pakistan



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## **1. Introduction**

Energy is the backbone of socio-economic development. Its availability ensures the expansion of the economy and the enhances production capacity which strengthens the country's economic and political status. Developing states like Pakistan continue to face a formidable challenge in their energy sector. Their energy demands are considerably higher than their energy production. Consequently, states like Pakistan are unable to meet their energy needs which hampers their economic growth and stability.<sup>1</sup>

Energy production in Pakistan is largely relied upon fossil fuels and natural gas which are expensive imported source. These are followed by reliance on hydropower and power production through coal. Lastly, a small percentage of Pakistan's energy mix has been dedicated to nuclear energy production. Considering that Pakistan's current energy mix is so heavily dependent on fossil fuels and imported sources, it has a huge burden on Pakistan's economy. In the Fiscal Year of 2014, Pakistan's, circular debt was around Rs 450 billion. It reached to Rs 1148 billion in 2018. According to the Central Power Purchasing Authority (CPPA), circular debt stood at Rs 2467 billion by March 2022 and is estimated to reach Rs 4 trillion by 2025, demanding the urgency of reforms in the power sector.<sup>2</sup>

There have been frequent efforts to enhance Pakistan's energy sector to ensure that it meets the growing needs of the country. The government has frequently drafted policies and actions plans to align its response in recourse, however, little material progress has been made in the sector. These polices include The National Power Policy 2013, The Power Generation Policy 2015 and Alternative and Renewable Energy Policy 2019. Most of these policies where consumer-centric and tried to solve the problems of energy shortage, load shedding, decrease in the average cost of electricity, transmission and distribution losses, and increase in revenue collection. Recently, the government has also started working on alternative renewable sources of energy especially because of the impacts of climate change that have materialised in the country. Energy generation through fossil fuels is not just costly but also has a huge carbon footprint. Consequently, in 2019 the government drafted the Alternative and Renewable Energy Policy. It objective was to promote the development of renewable resources in the country. This policy tried to develop an environment for renewable power projects, increase the share of green energy capacity to 20 percent by 2025 and 30 percent by 2030 through attracting private capital in the area of green energy.<sup>3</sup>

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<sup>1</sup> <https://www.pc.gov.pk/uploads/plans/Ch19-Energy1.pdf>

<sup>2</sup> [https://www.finance.gov.pk/survey/chapter\\_22/PES14-ENERGY.pdf](https://www.finance.gov.pk/survey/chapter_22/PES14-ENERGY.pdf)

<sup>3</sup> [https://www.finance.gov.pk/survey/chapter\\_22/PES14-ENERGY.pdf](https://www.finance.gov.pk/survey/chapter_22/PES14-ENERGY.pdf)

This report attempts to highlight the prospects of Chinese Enterprises in the Green Energy Sector of Pakistan especially in the current time where the focus of the Chinese government and the Pakistani Government is to promote the inclusion of private actors in the green power generation. It argues that considering the high demand within the energy sector, it will be a fair pitch for Chinese enterprises to enter this market with innovative green energy generation techniques. The report begins with an analysis of the development of energy policy in the context of renewable energy. It then moves towards the financing framework of green energy in Pakistan. Later, it presents past practices and green initiatives taken under CPEC to demonstrate the success of similar ideas in the past. It ends with providing recommendations and mapping the next few steps for the integration of Chinese enterprises in Pakistan's green energy market.

## 2. Energy Policy Development in the Context of Renewable Energy

Within Pakistan, there is a huge potential with regards to renewable energy on fundamentally two grounds. Firstly, this industry has hardly been explored in Pakistan so there exists a huge gap in the market demand and supply which gives a lot of room for new actors to step in and harness the benefits. Secondly, the government of Pakistan has an expressed focus on promoting green energy. For that it has launched the alternative energy policy and other similar initiatives that are attracting private actors and investors to invest in green energy projects in Pakistan. Collectively, these two sides of the coin are together creating the optimum conditions for private investors to join the market.

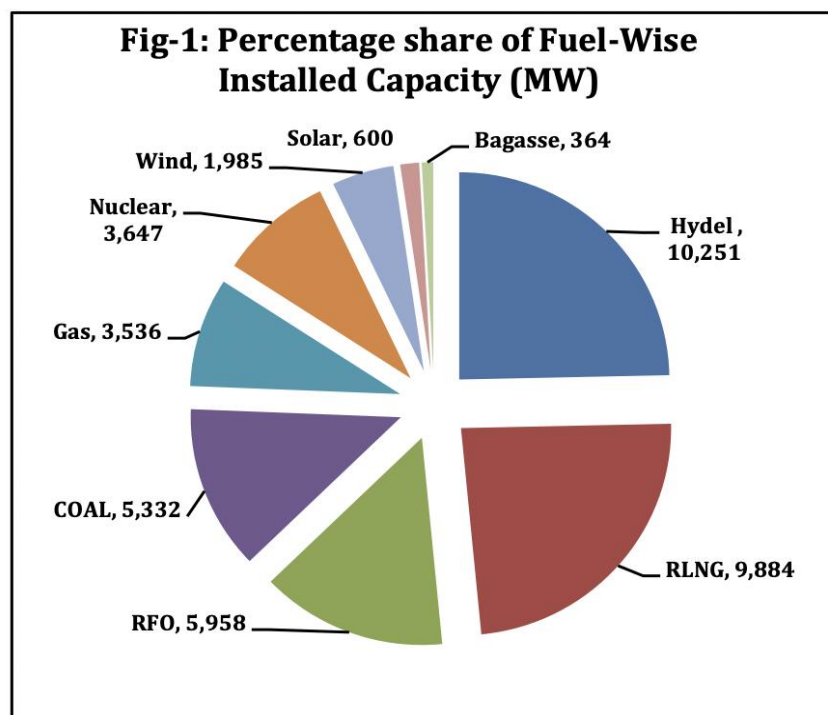


Figure 1

## 2.1. The Lack of Green Infrastructure in Pakistan

Pakistan's current energy mix is heavily relied on fossil fuels and non-renewable sources of energy. There are only few renewable energy infrastructures in the country. The following pie chart presents Pakistan energy mix as of 2022.<sup>4</sup>

Complimentarily, the following table presents the fuel wise infrastructural investment in the Company for the fiscal year 2022.<sup>5</sup>

<b>Table 14.2: Fuel-wise Installed Capacity Breakup JULY-April FY2022</b>		
	<b>Installed (MW)</b>	<b>Percentage (%) Share</b>
Hydel *	10,251	24.7
RLNG**	9,884	23.8
RFO	5,958	14.3
COAL	5,332	12.8
Gas	3,536	8.5
Nuclear***	3,647	8.8
Wind****	1,985	4.8
Solar	600	1.4
Bagasse	364	0.9
<b>Total</b>	<b>41,557</b>	<b>100.0%</b>

\*Karot Hydel Power 2 Units of 360 MW Capacity are running on Commissioning test and are included in Installed Capacity.  
 \*\*All KE power plants are operated on Indigenous gas and RLNG as the same is supplied by SSGC on co-mingled basis.  
 \*\*\*Supply from KANUPP was discontinued from August 2021  
 \*\*\*\*Two Wind Power Plants 100 MW Capacity are running on Commissioning test and are included in Installed Capacity.

Source: Ministry of Energy, (Power Division)

Figure 2

This data demonstrates there is a significant shortage of renewable energy infrastructure in the country. Further, the reliance on fossil fuels is disproportionately higher than Pakistan's reliance on renewable sources of energy. This creates a huge demand for renewable resource infrastructure especially with the rise of the impacts of climate change. Fossil fuels have a huge carbon footprint that not only contributes to global warming but issues like air pollution, smog, and multiple respiratory disorders and diseases. The following graph represents the Carbon dioxide emission trend by fuel consumption in Pakistan over the past four decades.<sup>6</sup>

<sup>4</sup> [https://www.finance.gov.pk/survey/chapter\\_22/PES14-ENERGY.pdf](https://www.finance.gov.pk/survey/chapter_22/PES14-ENERGY.pdf)

<sup>5</sup> Ibid.

<sup>6</sup> [https://energyandcleanair.org/wp-content/uploads/2021/07/CO2-Emissions-from-Pakistans-Energy-sector\\_30\\_07\\_2021.pdf](https://energyandcleanair.org/wp-content/uploads/2021/07/CO2-Emissions-from-Pakistans-Energy-sector_30_07_2021.pdf)

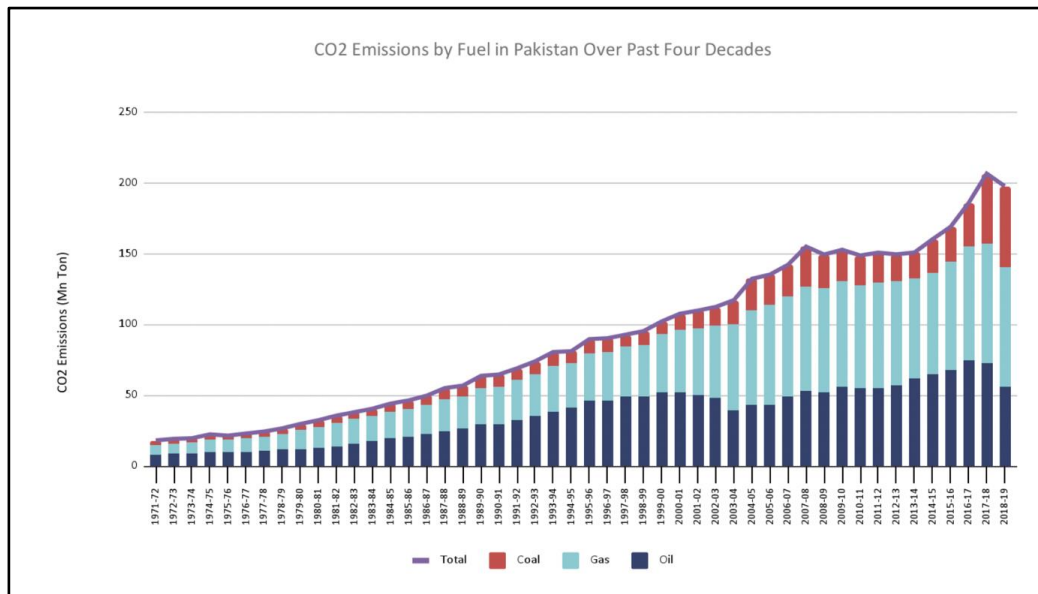


Figure 3

## 2.2. Alternative Energy Resource Policy

High emissions of carbon dioxide are harmful to the environment. Thus, the government of Pakistan has been looking for renewable alternatives which are cheap and sustainable. This intent of the government was first expressed in the number of policies that have guided the renewable energy developments of Pakistan. The first policy in this regard was the Alternative Resources Energy Policy, 2006.<sup>7</sup> ARE Policy 2006 was later replaced by an updated version called Alternative Resources Energy Policy 2019.<sup>8</sup> Figure 5 provides a detailed understanding of the purpose and objectives of the ARE Policies that have been in place in Pakistan. Alternatively, one of the six principles of Pakistan’s Energy Policy of 2021 is Environmental Responsibility. This hints towards the recognition, on a state level, of the need to decarbonize the energy sector of Pakistan for sustainable growth in the country.

<sup>7</sup> Alternative Energy Development Board, 2006. Policy for Development of Renewable Energy for Power Generation Employing Small Hydro, Solar and Wind Technologies, Ministry of Water and Power, Government of Pakistan. Available at <https://www.aedb.org/Documents/Policy/REpolicy.pdf> (Accessed 1 August 2022)

<sup>8</sup> Alternate Energy Development Board, 2019. *ALTERNATIVE AND RENEWABLE ENERGY POLICY 2019*, Government of Pakistan. Available at [https://www.aedb.org/images/Draft\\_ARE\\_Policy\\_2019\\_-\\_Version\\_2\\_July\\_21\\_2019.pdf](https://www.aedb.org/images/Draft_ARE_Policy_2019_-_Version_2_July_21_2019.pdf) (Accessed 1 August 2022)



Figure 4

These policies have been made keeping in mind Pakistan's huge potential in renewable resources. According to the Variable Renewable Energy (VRE) Integration study by the World Bank in 2020, it was suggested that 33-37% of renewable energy projects with only minor improvements in the current system.<sup>9</sup> Another locational study by the World Bank in 2021 identified the renewable energy sources which can be used to provide electricity at specific locations and points in the grid.<sup>10</sup> This study, being very comprehensive, identified the various locations with 2,300 MW of available capacity for the generation of energy through renewable methods.<sup>11</sup>

Renewable energy projects in Pakistan are single-sources with unsolicited bids. These bids are conducted by the government directly.<sup>12</sup> The negotiations with the suppliers who are willing to provide the service is direct and consequently swift and hassle free. Considering the intent of the Pakistani government to promote renewable energy production in the country, these negotiations will be easier to navigate through and fast paced to facilitate private investors interested in the market. However, unsolicited bids often result in poor-quality projects due to the uncompetitive nature of the process. Accordingly, a competitive bidding process is being introduced to improve the efficiency of these projects, and the government announced 1,500 MW of auctions for renewable energy in June-July 2022.<sup>13</sup>

<sup>9</sup> World Bank. 2020. *Variable Renewable Energy Integration and Planning Study. Pakistan Sustainable Energy Series.* World Bank, Washington, DC. World Bank. <https://openknowledge.worldbank.org/handle/10986/34586> License: CC BY 3.0 IGO.

<sup>10</sup> World Bank. 2021. *Variable Renewable Energy Locational Study. Pakistan Sustainable Energy Series.* World Bank, Washington, DC. World Bank. <https://openknowledge.worldbank.org/handle/10986/35113> License: CC BY 3.0 IGO.

<sup>11</sup> Ibid

<sup>12</sup> <https://www.cgdev.org/blog/unsolicited-bids-power-projects-role-multilateral-development-banks>

<sup>13</sup> Hasnain, K. Dawn News, 26<sup>th</sup> June 2022. *Multiple electricity buyers' market launched.* Dawn.com/news/1696759/multiple-electricity-buyers-market-launched.



In pursuit of this intent to shift to green sources of energy, Pakistan's government has recently announced that it will convert 300 MW coal-fired power plant in Gwadar to a solar power plant.<sup>14</sup> It has further expressed the intent to introduce 14,000 MW of solar power through various incentives from 2022 onwards across Pakistan, with a special focus on various regions in Baluchistan. These projects are both on macro and micro levels. For instance, the government is also looking to converting diesel-operated or conventional tube wells, use for irrigation, into solar-powered tubewells. It is expecting to add solar facility to all public sector buildings and small solar projects on 11kV feeders are also simultaneously under consideration.<sup>15</sup> These initiatives are prime opportunities for Chinese investors working under the banner of CPEC and otherwise who can assist with their investment and expertise.



*Figure 5 AEDB Wind Power Plant*

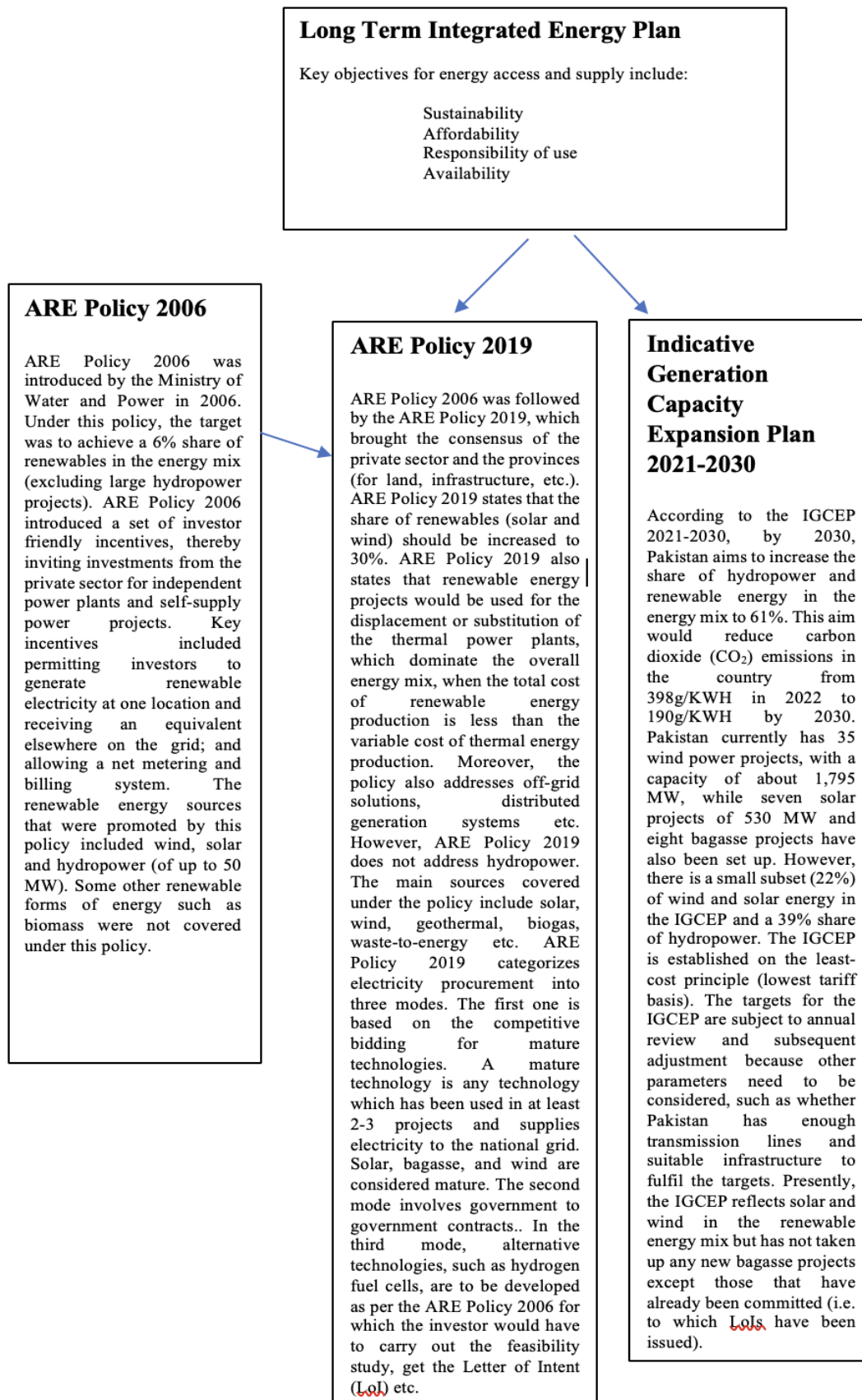
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<sup>14</sup> Mustafa, K. The News, 23rd August 2022. *Solar plant to replace the 300MW Gwadar coal power project.* .

<https://www.thenews.com.pk/print/976586-solar-plant-to-replace-300mw-gwadar-coal-power-project#:~:text=The%20project%20was%20conceived%20under%20the%20CPEC%20and%20approved%20in%202016&text=ISLAMABAD%3A%20The%20Power%20Division%20has,formal%20construction%20had%20not%20started.>

<sup>15</sup> Dawn, 7th July 2022. *PM Shehbaz says govt working on comprehensive plan for transition to solar power.*

<https://www.dawn.com/news/1698666>



### 2.3. Incentives on Energy Projects

Another favourable aspect of the Green Energy Sector is its low tariffs. Presently, the tariffs range between 2.6-3.2 cents/kWH.<sup>16</sup> For biomass, NEPRA had an upfront tariff in 2013 of around Rs. 10.4/kWH.<sup>17</sup> Later on, in 2017, this was revised to around Rs. 7/kWH.<sup>18</sup> Hence, the government is bringing noticeable concessions in the tax regime associated with green energy to promote its growth and to attract private investments in the sector.

China and Pakistan's cooperation in the green sector is particularly beneficial because of the optimum conditions available to harness an easy initiation of new green projects in Pakistan. Pakistan not only provides an untapped market opportunity but also is geographically well-equipped to sustain renewable energy projects. At the same time Chinese expertise in the construction of solar panels and the efficient and cheap transport of these panels to Pakistan through CPEC create the best possible infrastructure in place to facilitate private actors in investing in the green energy sector in Pakistan. China can aid Pakistan through knowledge sharing and technology transfer via CPEC projects. This would help Pakistan in achieving localisation of manufacturing of renewable technologies, especially in the solar power sector.

To add the cherry on the top, Pakistan has incentivized solar PVs. There is no sales tax or custom duty on solar PVs. Rather the State Bank of Pakistan offers a refinancing facility of 6% for the end-user.<sup>19</sup>

The Government of Pakistan (GoP) has taken multiple initiatives to increase the uptake of renewable energy, such as the rooftop solar project in 2015.<sup>20</sup> Initially, there were complaints regarding the vendors' unavailability as well as the poor quality of equipment. However, after the AEDB stepped in, 190 vendors were acquired.<sup>21 22 23</sup> The AEDB also introduced certification regulations in 2018, which rely on the licensing and support of the Pakistan Engineering Council (PEC). The PEC is given standards and guarantees for the various components like infrastructure that they must fulfil.<sup>24</sup> These regulations were updated in 2021 and will ensure that any investments under CPEC with the aim of introducing local manufacturing in the renewable energy sector would meet minimum quality standards for solar PVs.<sup>25</sup>

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<sup>16</sup> These figures were provided by Mr. ShahJahan Mirza, Managing Director Private Power Infrastructure Board and Chief Executive Officer Alternative Energy Development Board during the Capacity Building Workshop on "Green Financing Guidelines for CPEC Energy Projects" held in Islamabad on the 2nd of June, 2022.

<sup>17</sup> National Electric Power Regulatory Authority, 2013. *TRF-UTB Upfront Bagasse 29-05-2013 5152-54*. NEPRA.  
<https://nepra.org.pk/tariff/Tariff/Upfront/TRF-UTB%20Upfront%20Bagasse%2029-05-2013%205152-54.PDF>

<sup>18</sup> National Electric Power Regulatory Authority, 2017. *UGTBPP-2017 Upfront Biomass 15-12-2017 20345-20347*. NEPRA.  
<https://nepra.org.pk/tariff/Tariff/Upfront/Biomass/UGTBPP-2017%20Upfront%20Biomass%2015-12-2017%2020345-20347.PDF>

<sup>19</sup> Infrastructure, Housing and SME Finance Department, 2019. *State Bank of Pakistan*. Circular No. 10, 2019.  
<https://www.sbp.org.pk/smfcd/circulars/2019/C10.htm>

<sup>20</sup> Reve, 2015. *Pakistan to pull solar power into grid*, January 7, 2015. Reve <https://www.evwind.es/2015/01/07/pakistan-to-pull-solar-power-into-grid/49772>

<sup>21</sup> [https://www.aedb.org/images/List\\_of\\_Certified\\_Installer\\_C-1\\_31-08-2022.pdf](https://www.aedb.org/images/List_of_Certified_Installer_C-1_31-08-2022.pdf)

<sup>22</sup> [https://www.aedb.org/images/List\\_of\\_Certified\\_Installer\\_C-2\\_31-08-2022.pdf](https://www.aedb.org/images/List_of_Certified_Installer_C-2_31-08-2022.pdf)

<sup>23</sup> [https://www.aedb.org/images/List\\_of\\_Certified\\_Installer\\_C-3\\_31-08-2022.pdf](https://www.aedb.org/images/List_of_Certified_Installer_C-3_31-08-2022.pdf)

<sup>24</sup> Alternative Energy Development Board, 2018. *AEDB Certification Regulations 2018*. AEDB.  
<https://www.aedb.org/images/AEDBCertificationRegulations2018.pdf>

<sup>25</sup> Alternative Energy Development Board, 2021. *AEDB Certification Regulations 2021*. AEDB.  
[https://aedb.org/images/AEDB\\_Certification\\_Regulations\\_2021.pdf](https://aedb.org/images/AEDB_Certification_Regulations_2021.pdf)

The government is also making efforts to improve the stability of the national grid by making the Supervisory Control and Data Acquisition (SCADA) system available by 2024.<sup>26</sup> Supervisory Control And Data Acquisition (SCADA) is an online system that allows automatic repairs of the grid. Additionally, the Private Power Infrastructure Board (PPIB) is trying to develop the PPP (public-private partnerships) model as there are many opportunities for collaborations between the public and the private sector. These initiatives are expected to stabilise the grid and contribute to the upscale of renewable energy under CPEC.<sup>27</sup>

The government is determined to increase renewable energy investments within the existing policy regime in the form of tax exemptions, assurances, and guarantees like government takeover protection, forced media protection, change in law protection, change in tax protection, foreign exchange reliability and stability protection etc.

### **3. Financing Framework of renewable energy in Pakistan**

For the success of renewable energy initiatives, it is important that there is an effective financing framework in place that can induce the growth of the renewable energy sector. In that regard, the State Bank of Pakistan introduced a financing scheme for renewable energy in 2016. This scheme offered monetary incentives for both large and small scale renewable energy projects including wind, solar, bagasse, bio-fuels, geothermal and hydropower between the range of 1 MW and 50 MW. The financing bracket for this scheme was to a maximum of 6 billion for a single project. Refinancing or payment of the loan could be done over 12 years with an interest rate of 6%.

Furthermore, in 2017, the State Bank also introduced guidelines to mitigate bank threats from climate related risks in which it directed banks to incorporate a green financing scheme within their functioning to enhance resource efficiency and the loss of money due to the effects of climate change. This was in relation to the increased probability of large financial defaults arising directly out of climate related threats. The SBP specified that it would require an effective identification, monitoring, reporting and mitigation of environmental risks from banks and development finance institutions. There were other key features of these guidelines that are particularly relevant for the purpose of this report listed in the table below.

<b>Aspects of the Guidelines</b>	
<b>1</b>	A green banking policy highlighting how environmental considerations are an essential aspect of the banks' activities.
<b>2</b>	Establishment of internal procedures to identify, assess, mitigate, monitor and report on environmental risks.
<b>3</b>	Green financing for scaling up renewable energy, improving energy efficiency and promoting other environmentally friendly practices.
<b>4</b>	Mitigation of adverse environmental impacts arising out of banks' own operations.

<sup>26</sup> National Electric Power Regulatory Authority, 2022. *R.O 1166 (I)-2022 dated 25-07-2022.pdf*. NEPRA. [https://nepra.org.pk/tariff/Tariff/Notifications/2022/July/S.R.O%201166%20\(I\)-2022%20dated%2025-07-2022.pdf](https://nepra.org.pk/tariff/Tariff/Notifications/2022/July/S.R.O%201166%20(I)-2022%20dated%2025-07-2022.pdf)

<sup>27</sup> Ibid

5	Periodic review and reporting of banks' overall environmental risk.
6	The environmental risk management should be forward looking and make use of contingency planning. It should also be applicable to both current and new exposures, with differentiated identification of risks based on spatial and topographical factors.
7	Client compliance with the legal and regulatory requirements related to environment and climate protection should be ensured, and non-cooperative clients should be assigned higher risk ratings.
8	Banks should develop assessment criteria detailing both the client's environmental risk based on past record, as well as the environmental risks pertaining to the specific transaction.
9	A green banking office has to be established in every bank and headed by a green banking manager

Apart from these guidelines, the State Bank has also provided the environment and social risk management policy and procedure in 2018. This policy and procedure was to complement the existing guidelines to ensure that banks become more considerate of the environment and shift towards green financing. The policy called for the development of an environmental and social management system (ESMS) for mitigation of the environmental and social risks from financing activities. Other measures that were asked to be adopted included better screening and identification procedures to find out investment opportunities that favor green development. The following are certain important schemes and policies from the state bank that have helped in the construction of a progressive green financing framework in Pakistan.

### **3.1.Revised Financing Scheme for Renewable Energy, 2019**

Recently, the State Bank has revised its financing scheme for renewable energy. The scheme was extended for another 3 years and divided into three different categories depending on the type of the users. For the first category, the maximum loan amount was Rs. 6 billion for renewable energy projects of between 1 MW and 50 MW. A maximum of 1 billion loan can be given to wind and solar vendors/suppliers certified under AEDB regulations who form the second category. The third category includes projects of less than 1 MW which can get the maximum refinance of Rs. 400 million.

### **3.2.Green Bond Guidelines, 2021**

The Securities and Exchange Commission of Pakistan has recently introduced the green bond guidelines. These guidelines have attempted to introduce financial instruments that can assist in combatting climate change. Green bonds can be utilized for financing renewable energy, improving energy efficiency, controlling pollution, protecting the environment etc. Individuals who are willing to get these bonds are required to disclose environmental sustainability objectives, how these objectives can be translated to the mitigation of potential adverse impacts of climate change, and how the funds would be utilised, and a system of checks and balances to ensure the funds would be used for the purpose that they are meant for.

The face value of the sukuk/green bond is Rs. 5000, which is also the minimum amount required for the subscription of the sukuk/green bond. The Water and Power Development Authority introduced its first green bond under the guidelines. The Indus Bond was floated to raise \$500 million at a 7.5% interest rate. The bond was massively oversubscribed as the proceeds from floating the green bond were \$3 billion. Many other bodies within Pakistan are ensuring the formulation of the green bonds which offers a very constructive process for the financing of green initiatives.

### **3.3.Foreign investment through multilateral bank deals**

CPEC has offered a very fundamental opportunity for transnational investments in Pakistan. It has incorporated a wave of green transportation and agriculture investments through multilateral bank deals. Chinese enterprises can use this existing framework to materialize resources from China for investment in Pakistan. Furthermore, there is a huge role of international organization in this regard as well like the Asian Development Bank, the World Development Bank, the Green Climate Fund and other such organization that are funding different sustainable projects in Pakistan. For instance, recently the green climate fund has provided investment for constructing a solar park in Pakistan to the Ministry of Climate Change, Pakistan. Similarly, agricultural demonstration farms have also been established where Pakistan has received a \$1bn grant from China. Multilateral financing has a number of advantages. With a concrete framework, multilateral financing institutions would be more likely to engage with local communities in an extensive stakeholder engagement process.

### **3.4.Special Credit Line from Government of China**

Recently, GoP has submitted an MoU to Chinese Government for preferential credit line for Chinese Companies those will win bids in Pakistan for Solar Power Plants. However, it needs to be formalized further. Green energy initiatives under CPECChina-Pakistan Economic Corridor's (CPEC) economic and political importance has been regarded globally. Pakistan and China have collectively benefitted from the construction of the CPEC in different sectors including energy. However, one problem raised during the second phase of the construction of the CPEC has been its carbon foot-print. Bilaterally, China and Pakistan recognized the need to ensure a green CPEC. Consequently, many green initiatives have been started as part of CPEC. These initiatives, especially those relating to energy production, can be categorised according to their nature. There are three basic renewable energy resources that are currently being harnessed by various CPEC projects (8725MW, 17 Billion USD). Out of total 17,045MW (US\$ 33 Billion), 8725MW (50 percent) belongs to pure renewable power projects including Hydel, Solar and Wind. Details have been mentioned in below table;

<b>Sr.</b>	<b>Name (Completed)</b>	<b>Cost M \$</b>	<b>Timeline</b>	<b>Policy Terms</b>
<b>1</b>	400 MW Quaid-e-Azam Solar Park	520	Aug2016	IPP, AEDB 2006 Policy
<b>2</b>	50MW Hydro China Dawood Wind	113	Apr 2017	IPP, AEDB 2006 Policy

<b>3</b>	100 MW UEP Wind Farm	250	Jun2017	IPP, AEDB 2006 Policy
<b>4</b>	50 MW Sachal Wind Farm	134	Apr 2017	IPP, AEDB 2006 Policy
<b>5</b>	100 MW Three Gorges Wind Power	150	Jun2018	IPP, AEDB 2006 Policy
<b>6</b>	720 MW Karot HPP	1,740	June 2022	IPP, PPIB 2002 Policy
<b>Total: 1420MW, 6 Projects, 3 B USD</b>				
<b>Sr.</b>	<b>Name (Under Construction)</b>	<b>Cost M \$</b>	<b>Timeline</b>	<b>Policy Terms</b>
<b>1</b>	884 MW Suki Kinari HPP	2,000	Nov2024	IPP, PPIB 2002 Policy
<b>Total: 884MW, 1 Projects, 2 B USD</b>				
<b>Sr.</b>	<b>Name (In pipeline)</b>	<b>Cost M \$</b>	<b>Timeline</b>	<b>Policy Terms</b>
<b>1</b>	700.7 MW Azad Pattan HPP	1,650	2026	IPP, PPIB 2002 Policy
<b>2</b>	1,124 MW Kohala HPP	2,408	2027	IPP, PPIB 2002 Policy
<b>3</b>	600 MW Quaid-e-Azam Solar Park	781	2024	IPP, AEDB 2019 Policy
<b>4</b>	50 MW Cacho Wind Power Project	75	2026	IPP, AEDB 2019 Policy
<b>5</b>	50 MW Western Energy (Pvt.) Ltd.	75	2026	IPP, AEDB 2019 Policy
<b>Total: 2524MW, 5 Projects, 5 B USD + 3997MW of Balance part will also be renewable Power Projects</b>				

The above-mentioned details clearly showing that how much importance has been given to green and clean energy which will gradually be adding electricity in national grid as per respective construction timelines. After completion, this 8725MW will be 50% of Pakistan's current average demand. The following sections provide details of these green initiatives and their potential in the coming years.

#### 4. Green energy initiatives under CPEC

China-Pakistan Economic Corridor's (CPEC) economic and political importance has been regarded globally. Pakistan and China have collectively benefitted from the construction of the CPEC in different sectors including energy. However, one problem raised during the second phase of the construction of the CPEC has been its carbon foot-print. Bilaterally, China and Pakistan recognized the need to ensure a green CPEC. Consequently, many green initiatives have been started as part of CPEC. These initiatives, especially those relating to energy production, can be categorised according to their nature. There are three basic renewable energy resources that are currently being harnessed by various CPEC projects. The following sections provide a list of these green initiatives and their potential in the coming years.

##### 4.1. Wind Energy

The global wind atlas identifies a huge potential for wind energy in the southern and western region of Pakistan. Projects of CPEC have started looking to harness this wind energy to meet Pakistan's demand. Table 1 presents a list of wind projects in their different phases of construction. Table 2,3,4,5 and 6 present the detailed data regarding each wind energy project.

<b>Completed Projects</b>	
<b>Project Name</b>	<b>Power Generation Capacity (MW)</b>
<b>50 MW Hydro China Dawood Wind Farm, Gharo, Thatta</b>	50
<b>100MW UEP Wind Farm, Jhimpir, Thatta</b>	100
<b>50MW Sachal Wind Farm ,Jhimpir, Thatta</b>	50
<b>100MW Three Gorges Second and Third Wind Power Project</b>	100
<b>Under Construction Projects</b>	
<b>Project Name</b>	<b>Power Generation Capacity (MW)</b>
<b>50MW Cacho Wind Power Project</b>	50

*Table 1*



<b>Projects Details: 100MW Three Gorges Second and Third Wind Power Project</b>	
<b>Primary Energy Input</b>	Wind
<b>Technology</b>	Wind Turbine
<b>Installed Capacity (MW)</b>	100
<b>Location</b>	Jhampir, Thatta
<b>Estimated Cost (US \$ Million)</b>	150
<b>Financing</b>	Independent Power Producer (IPP)
<b>Total Jobs Created</b>	180
<b>Total Local Jobs Created</b>	159
<b>Total Jobs Created During the Construction of this Project</b>	750

Table 2

<b>Projects Details: 50 MW Cacho Wind Power Project</b>	
<b>Primary Energy Input</b>	Wind
<b>Technology</b>	Wind Turbine
<b>Installed Capacity (MW)</b>	50
<b>Location</b>	Jhampir, Thatta
<b>Financing</b>	Independent Power Producer (IPP)
<b>Total Jobs Created During the Construction of this Project</b>	150

Table 3

<b>Projects Details: 50MW Sachal Wind Farm ,Jhimpir, Thatta</b>	
<b>Primary Energy Input</b>	Wind
<b>Technology</b>	Wind Turbine
<b>Installed Capacity (MW)</b>	50
<b>Location</b>	Jhampir, Thatta
<b>Estimated Cost (US \$ Million)</b>	134
<b>Financing</b>	Independent Power Producer (IPP)
<b>Total Jobs Created</b>	25
<b>Total Local Jobs Created</b>	17
<b>Total Jobs Created During the Construction of this Project</b>	450

Table 4

<b>Projects Details: 100MW UEP Wind Farm, Jhimpir, Thatta</b>	
<b>Primary Energy Input</b>	Wind
<b>Technology</b>	Wind Turbine
<b>Installed Capacity (MW)</b>	100
<b>Location</b>	Jhampir, Thatta
<b>Estimated Cost (US \$ Million)</b>	250
<b>Financing</b>	Independent Power Producer (IPP)
<b>Total Jobs Created</b>	54
<b>Total Local Jobs Created</b>	39
<b>Total Jobs Created During the Construction of this Project</b>	900

Table 5

#### 4.2.Solar Energy

Under CPEC, Pakistan has recently constructed the Quaid-e-Azam Solar Park in Bahawalpur. This park is using P.V. solar technology to generate green and clean energy to power the development activities of CPEC. The plant is expected to produce 1000 MW of electricity and creates around 231 permanent jobs, out of which 220 people were recruited locally. During its construction, around 1200 jobs were generated that also benefitted the local community by providing them temporary means of sustenance. Many Chinese enterprises have taken a prominent role in establishing this power plant. They have not only provided the raw material and basic expertise, but have also invested in the construction of this power plant. This power plant is a huge sustainable step to end the energy crises in Pakistan and provide energy to the rural areas of south Punjab. It has liquidated the industries of south Punjab by offering them cheap energy that can be used to increase production. Collectively, this project is another plausible contribution of the Chinese businesses in Pakistan and must be publicized for its efficacy and sustainability.

Furthermore, the Alternate Energy Development Board (AEDB) is pursuing 22 solar projects with cumulative capacity of 890 MW. Of these, 6 solar projects are operational and generating more than 400 MW of solar power. The details of these projects is provided below according to their status.<sup>28</sup>

<sup>28</sup> <https://www.aedb.org/ae-technologies/solar-power/solar-current-status>



Figure 6 Quaid-e-Azam Solar Power Project

### Completed Projects

Sr. No.	Name of Projects	Capacity (MW)	Location	Date of Completion
1.	Quaid-e-Azam Solar Power (Private) Limited	100	Quaid-e-Azam Solar Park, Bahawalpur	15 July 2015
2.	Appolo Solar Development Pakistan Limited	100	Quaid-e-Azam Solar Park, Bahawalpur	31 May 2016
3.	Best Green Energy Pakistan Limited	100	Quaid-e-Azam Solar Park, Bahawalpur	31 July 2016
4.	Crest Energy Pakistan Limited	100	Quaid-e-Azam Solar Park, Bahawalpur	31 July 2016
5.	Harappa Solar (Private) Limited	18	Harappa, Sahiwal	14 October 2017
6.	AJ Power (Private) Limited	12	Addi Kot, Khushab	13 December 2017

Sr. No.	Name of Projects	Capacity (MW)	Location
1	Zorlu Solar Pakistan (Pvt.) Limited	100	Quaid-e-Azam Solar Park, Bahawalpur
2	Siachen Energy Limited-I	100	Thatta, Sindh

### Under Consideration Projects

Name of Project	Capacity	Location	Expected COD
Zhenfa Pakistan New Energy Company (Pvt.) Limited	100	Layyah, Punjab	May, 2022
Meridian Energy (Pvt.) Ltd	50	Sukkur, Sindh	Dec, 2022
HND Energy (Pvt.) Limited	50	Sukkur, Sindh	Dec, 2022
Helios Power (Pvt.) Limited	50	Sukkur, Sindh	Dec, 2022

Sr. No.	Name of Projects	Capacity (MW)	Location
1.	Access Solar (Private) Limited	11.52	Pind Dadan Khan
2.	Access Electric (Private) Limited	10	Pind Dadan Khan
3.	Safe Solar Power (Private) Limited	10.275	Dharanwala, Bahawalnager

### 4.3. Hydro Power Energy

As part of the CPEC phase 1, many hydropower projects were started in Pakistan by different Chinese enterprises which have helped Pakistan fight its energy deficit to a greater extent. These also helped in sustainable growth and increase in energy production in an environmental friendly manner.

### 4.3.1. Karot Hydro Power Project

One of the flagship projects of the CPEC is the Karot Hydro Power Plant. The Karot Hydro Power Plant is a flagship project that speaks high of the bond between Pakistan and China. It is a hydropower plant built on river Jhelum at the dual boundary of District Rawalpindi and Kotli. The estimated cost of investment is around \$ 1720 million and the plant is expected to produce 3.2 billion kilowatts of energy every year. It is expected to be completed by April 2022.



A major share of this project is owned by China Three Gorges South Asia Investment Limited. It is supervised by the Private Power and Infrastructure Board and the Ministry of Energy in Pakistan. This project created around 4870 jobs. The Karot power project is a huge step in Pakistan energy sector as it will assist the country in meeting its energy shortages. Its success has been recognized by the International Finance Cooperation (IFC) of the World Bank Group that has invested and bought shares in the powerplant.

IFC's investment is a testament to the international community positive effects of the Karot power project. It shows that Chinese contributions in Pakistan are recognized and valued on the global level. Such products deserve to be publicized as they will enable China to gain social support in Pakistan's community. Chinese enterprises will be understood for their good intentions if they continue to highlight their positive contributions to Pakistan's economy.

Another aspect of the Karot Hydropower project which is worth celebrating is its focus on sustainable development. It uses a renewable energy source, water, to generate cheap and clean electricity without adding to the carbon footprint. This clean electricity will be used to facilitate industrial and domestic activities, thus assisting Pakistan in achieving sustainable development. Other hydropower projects are provided in the tables below.

Completed Projects	
Project Name	Power Generation Capacity (MW)
720MW Karot Hydropower Project, AJK/Punjab	720
Under Construction Projects	
Project Name	Power Generation Capacity (MW)
884MW Suki Kinari Hydropower Project, KP	870
1124MW Kohala Hydropower Project, AJK	1124
700.7MW Azad Pattan Hydropower Project, AJK/Punjab	700.7

## **5. Green Belt and Road Initiative**

The Green BRI is a China-led international effort to transform the Belt and Road Initiative in a green project throughout the world. To achieve this, the Chinese Government had demonstrated a promise for green investment and research to include the best environment friendly practices in the construction of the BRI. Projects through this transforming initiative connect to the UN Environment Program's (UNEP) Medium-Term Strategy that looks at resource efficiency, climate change, healthy and productive ecosystems, environmental governance, etc. These ultimately tie into several of the 2030 UN Sustainable Development Goals, which acts as a "blueprint to achieve a better and more sustainable future for all".

As these efforts have unfolded, the Chinese government has constructed a Belt and Road Initiative Green Coalition which facilitates states and other corporate BRI actors to research and adopt strategies that are environment friendly. Apart from the BRIGC, a Green BRI Lab and the Green BRI center are also working to develop environmental friendly techniques. As elaborated above, the Chinese government has taken huge steps towards supporting the development of Green Energy within Pakistan as well under the banner of the Green BRI. Many Pakistani stakeholders including think-tanks, research institutes and labs are part of the BRIGC and are constantly working to develop environmental friendly characteristics. Wilton Park has recognized the efficacy of the Green BRI project and have celebrated Chinese efforts in Pakistan in promoting Green Energy.

This opens a huge room for opportunity for Chinese Enterprises that can benefit from the acquiesce of the government as well as Pakistan's potential for Green Energy, which is elaborated in the sections below.

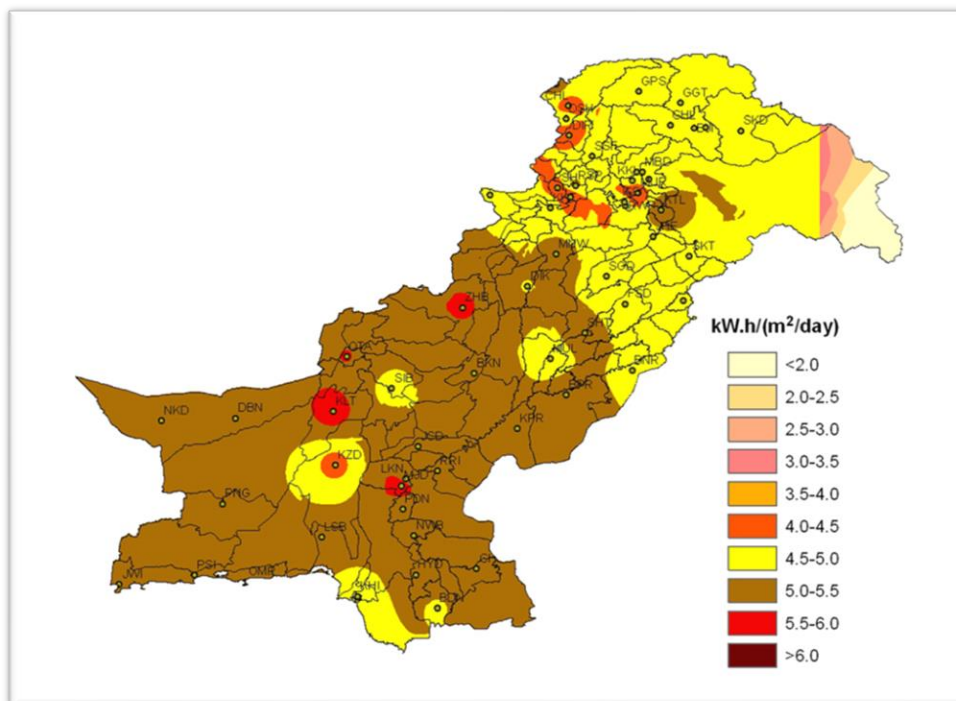
## **6. Mapping Pakistan's potential for renewable energy**

### **6.1. Pakistan's Renewable Energy Potential**

Favourable conditions, assisting policies, clear intent of the government, tax and tariff breaks, and the presence of a competitive transport infrastructure are all counterproductive until Pakistan has a clear and accepted potential to generate renewable energy. Hence, it is integral to demonstrate Pakistan potential in producing Green Energy through wind, solar, and hydro power sources.

### 6.1.1. Solar Energy

According to a recent study by the World Bank, Pakistan has a huge potential in solar energy. Pakistan can meet its energy demand by utilising just 0.071 percent of the country's area. It receives a total of nine and a half hours of sunlight every day which is explanatory of the huge potential in this sector for Pakistan. Solar radiation intensity remains favourable from March to October throughout the country. Figure 6 shows the distribution of sunlight across different regions of Pakistan.<sup>29</sup> The average solar radiation intensity ranges from 1500 W/m<sup>2</sup>/day to 2750 W/m<sup>2</sup>/day in the regions of southern Punjab, Sindh and Baluchistan regions across seasons. In an area of 100 m<sup>2</sup>, 45 MW to 83 MW power per month may be generated in the above mentioned regions which is extremely favourable for Pakistan.



### 6.1.2. Wind Energy

The potential for Pakistan to generate wind energy is unprecedented. The coastal belt of Sindh and Baluchistan offer a huge opportunity for the construction of wind parks that can help Pakistan meet its energy deficit. According to the Alternative Energy Development Board of Pakistan and the by Pakistan's Meteorological Department wind data collected at Pakistan's coastal belt at 60km (Gharo-Keti Bandar) and 180km long has an exploitable potential of 50,000MW of electricity generation through wind turbines. Currently there are 24 private wind projects operating, producing approximately 1235MW. In addition to this, 12 wind projects with cumulative capacity of 610 MW have achieved financial close and are under construction.

<sup>29</sup> [https://www.researchgate.net/publication/258071342\\_Solar\\_energy\\_potential\\_in\\_Pakistan](https://www.researchgate.net/publication/258071342_Solar_energy_potential_in_Pakistan)

The huge potential of Pakistan due to its wind corridors must be substantially harnessed by China Pakistan partnerships. Chinese enterprises can explore this sector and its huge potential through investments in Wind turbine parks.

### **6.1.3. Hydro Energy**

Home to many rivers that are naturally flowing downstream with a constant current, the topography of Pakistan enable it to host many large and small hydro power projects. Small hydropower projects are mainly located in the remote areas of Pakistan particularly North of country. The government of Pakistan considers these small hydropower projects as clean and inexpensive source of energy. Primarily, these projects are awarded and approved by provincial governments to developers. At present 128 MW of small hydro projects are operational, whereas projects of 877 MW are under implementation. At present 128 MW of small hydro projects are operational, whereas projects of 877 MW are under implementation.

Chinese enterprises have a huge potential in this regard as well. Small hydro projects can be built in the northern regions of Pakistan and inaccessible rural areas that have significant water springs and flowing river channels that can be sources of energy for the production of electricity for these areas. It will not only benefit local populations but also assist the development of economy.<sup>30</sup> The international trade administration of the United States has dedicated Pakistan's investment profile to the renewable energy sector. It already recognizes that investments in green energy in Pakistan and fundamentally fruitful and beneficial. Hence, it is encouraging local enterprises of America to invest in this sector in Pakistan. Chinese enterprises will have a comparative advantage over American counterparts primarily because the long association between China and Pakistan. Further, it is also helpful as China Pakistan also share a cultural and people to people bond which can be very affective in partnership of Chinese enterprises in the green sector of Pakistan.

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<sup>30</sup> <https://www.trade.gov/country-commercial-guides/pakistan-renewable-energy>



## **7. Some Success Stories**

### **7.1. Hyrdo China Dawood Wind Power Project**

Hydrochina Dawood Wind Power Project (referred to as Dawood Wind Power Project) is one of the first 14 key energy development projects under the China-Pakistan Economic Corridor (CPEC). Dawood Wind Power Project is located in Karachi, Pakistan. The total installed capacity of Dawood Wind Power Project is 49,500 kW, and the designed annual power generation is 130 million kWh. The clean electrical energy produced every year by the project can power 100,000 households in Pakistan and reduce carbon emissions by 122,000 tons per year. The project achieved its Commercial Operations Date on 4th April, 2017. Up to October 2022, Dawood Wind Power Project has safe operated 2,036 days and continuously delivered about 649 million kWh of clean electrical energy into Pakistan national grid. Presently the project hired more than Pakistan 70 locals; majority of jobs have been provided to local people. Dawood Wind Power Project is making contribution to solving the power shortage, economic development, environmental improvement and people's living standards in Pakistan.



## **7.2. Diamer Basha Dam**

Diamer Bhasha Dam is located in the Indus river in the north of Pakistan. It is a roller-compacted concrete (RCC) gravity dam with 272-meter height, the designed concrete casting quantity of 18.7million m<sup>3</sup>, the designed open excavation quantity of 23.9million m<sup>3</sup> and installed capacity 4500 MW. It is the tallest and largest roller compact concrete (RCC) dam in the world under construction, playing a significant role in the entire country. The gross storage capacity of the reservoir will be ten billion cubic meters. After it is completed, it could not only generate electricity and store water, but improve Tarbela dam's service life & working efficiency, it will provide the whole country with 18 billion kilowatt-hours of electricity each year, boost the development of tourism in the northern region, reduce the cost of electricity consumption per capita, decrease national imports on energy, and provide more environmental-protection power resources. The construction of the project will provide nearly 20,000 jobs and drive Pakistan's economic growth.



## **7.3. Hydro China ZhenFa Solar Power Project**

Hydrochina ZhenFa Solar Power Project (referred to as ZhenFa Solar Power Project) it is a landmark energy project in Punjab. ZhenFa project is located in Leia, Punjab, Pakistan. The main contents of the project are: procurement, installation, commissioning, testing and trial operation of photovoltaic field and 132KV substation, as well as 2-year warranty operation and maintenance. The project achieved its Commercial Operations Date on 13<sup>th</sup> April, 2022. Up to November 2022, ZhenFa solar Power Project has safe operated 210 days . Presently the project hired more than Pakistan 30 locals; majority of jobs have been provided to local people.

ZhenFa Solar Power Project is making contribution to solving the power shortage, economic development, environmental improvement and people's living standards in Pakistan.



## **8. The Way Forward**

Recognising the potential of Pakistan's green sector, it is integral for Chinese Industries to invest in the sector for reaping the benefits. In that regard the following is suggested:

### **8.1. Leverage partnerships for impact – Public Private Partnerships**

To ensure proper impact, Chinese enterprises can initiate partnerships with the government sector. These partnerships can also be done with other donor agencies like the World Bank and the Asian Development Bank. For instance, recently, the Asian Development Bank has invested in various Grid Modernisation projects in Nepal. Similar projects are required in Pakistan, which is further explained in the section below. Chinese industries can engage in partnerships with the international actors in similar projects to ensure funding opportunities/

Public Private Partnerships in the Green Energy Sector will also be incredibly helpful. Consequently, Public-private cooperation in renewable energy sources should be encouraged by the government. Pakistan can create a low-carbon industry by having domestic carbon emissions trading channels created through the cooperation of municipal and provincial financial and information councils, energy protection and emissions-reducing organizations, and other streamlined departments, using a framework where provinces and major cities would implement their low-emissions initiatives and trading processes. Similarly, Public Private Partnerships can be done to ensure technological development in this sector. Government can assist markets by establishing a clear policy framework that offers long-term benefits in cutting greenhouse gas emissions and that continuously promotes new technologies that strengthen environmental performance. the government of Pakistan must exhibit caution when developing policies that promote growth at the expense of environmental sustainability. Pakistan should impose stricter environmental rules to limit the consequences of environmental deterioration as it grows substantially. Pakistan should concentrate corporate sector efforts to improve energy efficiency and cut down on environmental pollution while also enabling financiers to fund more in businesses with a greater focus on the atmosphere and ecological investment.

The best aspect of a Public Private Partnership is that it assists in corporate sectors to pursue their fiscal interests while the government can also at the same time ensure public welfare.

### **8.2. Grid modernization**

Grid Modernization is the process of upgrading the electricity grid to make it more efficient and resilient. It includes a variety of changes, such as accommodating new technology, new forms of electricity generation and distribution, installing smart meters, updating grid infrastructure, integrating renewable energy sources, and more. There are many reasons why grid modernization is important. One is that it can help to make the grid more resilient in the face of extreme weather events, which are becoming more common due to climate change. Another reason why grid modernization is important is that it can make it easier to integrate renewable energy sources into the grid—a vital tool in combating climate change. For the purposes of this paper, the second reason for ensuring grid modernization is important.

There are a lot of different types of changes that can help modernize the grid, including:

- Installing smart meters to help grid operators get real-time data on electricity use.
- Integrating renewable energy sources like solar and wind into the grid.
- Incorporating new technologies like microgrids to help grid operators manage electricity supply and demand.
- Introducing new technologies like grid-scale battery storage to help balance electricity supply and demand and increase resiliency and flexibility—especially in times of high demand.

In Pakistan, the current situation is really poor. Not only is the technology being used outdated but also there are a lot of theft issues. Furthermore, the meters in use are mostly manual even in bigger cities. Chinese enterprises can invest in grid modernization in Pakistan which will prepare Pakistan. This would result in the bankability of renewable energy projects and make it easier for large scale transmission expansions. Further, having a modern grid would attract considerable investor confidence thus ensuring that the investments in this sector increase. Digital Grid Technologies include:

- Smart Grid Technologies
- Distributed Energy Resources (DERs)
- Energy Storage
- Renewable Energy integration
- Electric Vehicles and EV charging stations

Within the working of making a modern grid, it is important that Chinese Enterprises take part in Public Private Partnerships (PPP). These partnerships will ensure not only ensure that the investment in green energy is revitalized by reducing grid loss, it will also ensure that Chinese enterprises benefit from the process equally. There are many international and national examples that support PPP in Grid Modernization. Internationally, Asian Development Bank approved the Electricity Grid Modernization Project (the project) amounting to \$156 million on 26 November 2020 financed by ADB's concessional OCR. It is expected that this project will result in improving the improve reliability, efficiency, and financial sustainability of electricity supply in Nepal. The ongoing project includes three main outputs: (i) electricity transmission capacity in project areas strengthened and modernize; (ii) electricity distribution system in project areas strengthened and modernized; and (iii) capacity of Nepal Electricity Authority (NEA) to implement its Corporate Development Plan strengthened. Nationally, the grid station in Nooriabad through a PPP. The grid station would add power to the national grid generated through wind power plants in the Jhimpir wind cluster.

### **8.3. Technology Transfer**

The Chinese Green Energy sector is celebrated world-wide. It is already leading in the renewable energy sector across the world. The Chinese government places a priority on investing in renewable energy primarily because it enables the country to tackle problems of air and water pollution, and mitigate risks of socio-economic instability. Consequently, Chinese enterprises can transfer the leading Chinese technologies in Pakistan to result in efficient generation of electricity from renewable resources.

China is now the undisputable global leader of renewable energy expansion worldwide, and the IEA forecasts that by 2021, more than one-third of global cumulative solar PV and onshore wind capacity will be located in China. This technology, like many others, can be brought to Pakistan for generating electricity from solar energy.

### **8.4. Joint Working Group on Green Development**

To ensure the success of green projects it is important to construct a Pakistan- China joint working group (JWG) that specifically deals with the transformation of CPEC projects into green and environment-friendly projects. Within this working group, there can be experts from different fields relevant to the construction of green projects as well as representatives and higher officials of the two governments alongside representatives of different stakeholders. This will ensure that a wholistic and complete policy is adopted towards the construction of Green Projects.

There are many examples of such groups across the world. For instance, the international climate financing issues are dealt with the Joint EFC-EPC Working Group (JWG). There is also a European Green Deal Senior Working Group, a UN PRME working group on climate and environment, and an Open Working Group by the UN on Sustainable Development Goals. These Working groups have proven to be a great success and it is expected that a JWG between Pakistan and China for green CPEC projects will help focus climate resilient efforts in a more efficient manner.

### **8.5. Replicating International Models**

Internationally, there are many green energy projects that have been completed by Chinese enterprises that can be replicated in Pakistan. Examples of these include the world's first offshore floating solar power plant technology employed in the Taiwan Strait by the China's State Power Investment Corporation (SPIC) and Norwegian company Ocean Sun. This project has intended to lower the cost of production of energy and reduce the carbon footprint of generating energy. Such a project can also be replicated here in Pakistan not only in the Arabian Sea but also in the various lakes around Pakistan that receive a lot of sunlight.

Similarly, China has also invested in construction of the Cauchari Solar Powerplant located in the Puna Plateau in Argentina. This power plant is located 13,000 feet above sea level. Similar plants can be created in the northern regions of Pakistan where there is not just abundant sunlight but days are usually long enough to harness considerable amounts of energy. Another examples to learn from is the Olkaria Geothermal Plant about 50 miles downtown Nairobi. Geothermal energy is a fairly unpopular source of energy in Pakistan and can be harnessed in collaboration with Chinese enterprises. Considering that this sector has not yet been explored in Pakistan, it offers a untapped market that should be explored. In Brazil, China Three Gorges (CTG), the world’s largest hydropower provider with operations across 47 countries, controlling 14 out of a total of 48 hydro-plants in Brazil, amounting to 8% of the nation’s total hydropower capacity, as well as 11 wind farms. A similar approach should be taken in Pakistan as well where renewable energy should be the main focus.

### 8.6. Updating the IGCEP

The government has recently passed the Indicative Generation Capacity Expansion Plan 2040. The IGCEP has failed to truly replicate Pakistan’s potential in renewable energy. Although the generation additions till 2040 have included the solar energy component but most reliance is still on fossil fuels including coal both local and imported, petroleum and other sources that have a huge carbon footprint. The IGCEP must be updated in light of the need to increase dependence on renewable resources like solar, wind, geothermal, biogas and other resources that reduce Pakistan’s carbon footprint. The reliance on Nuclear energy must also be reduced as it has pertinent risks with regards to radiation leakage that can affect the environment. The following graph demonstrates the current additions which are suggested to be changed.

