Policy Brief #88

Renewable Energy Investments for China Pakistan Economic Corridor (CPEC) Energy Projects
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<td>Alternative and Renewable Energy</td>
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<td>Build-Operate-Transfer</td>
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<td>CO2</td>
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<td>CoP27</td>
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<td>CPEC</td>
<td>China Pakistan Economic Corridor</td>
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<td>CTBCM</td>
<td>Competitive Trading Bilateral Contracts Market</td>
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<td>EPA</td>
<td>Environmental Protection Agency</td>
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<td>Environmental and Social Impact Assessment</td>
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<td>GoP</td>
<td>Government of Pakistan</td>
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<td>GW-</td>
<td>GigaWatt(s)</td>
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<td>Indicative Generation Capacity Expansion Plan</td>
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<td>IPPs</td>
<td>Independent Power Producers</td>
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<td>KP BOIT</td>
<td>Khyber Pakhtunkhwa Board of Investment and Trade</td>
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<td>KWH</td>
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<td>LEED</td>
<td>Leadership in Energy and Environmental Design</td>
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<td>Letter of Intent</td>
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<td>Letter of Support</td>
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<td>MW</td>
<td>MegaWatt(s)</td>
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<td>National Electric Power Regulatory Authority</td>
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<td>Sustainable Development Goal</td>
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<td>Special Economic Zones</td>
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<td>VRE</td>
<td>Variable Renewable Energy</td>
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Abstract

This policy brief provides an overview of the renewable energy investments under the China Pakistan Economic Corridor (CPEC), issues with renewable energy uptake in Pakistan, and prospects and opportunities under CPEC. It then suggests as to how the renewable energy investments can be scaled up under CPEC, and the best practices Pakistan can learn from China to increase access to renewable energy investments. Some of the key recommendations of this policy brief include the development of a research-based policy development, advisory, and action plan by the CPEC Authority to scale up renewable energy investments under CPEC, holding spectrum auctions for solar projects to achieve vertical integration, and to undertake transfer of technology and knowledge sharing from China under CPEC to achieve indigenisation of solar manufacturing.
Introduction

Currently, Pakistan is facing an energy crisis. The energy demand-supply gap reached around 7,500 Megawatts (MW) in April 2022 due to spiralling fuel and coal prices (‘Power shortfall’ 2022). The rise in power sector circular debt to almost PKR 4.2 trillion in December 2022 (‘Circular debt soars’ 2022) due to delayed payments to power producers and non-targeted and unbudgeted subsidies, has further aggravated this gap. Thus, load-shedding remains a persistent problem in Pakistan.

Another pertinent side to the energy crisis of Pakistan is its reliance on non-renewable sources of energy like coal, oil, and gas. The unsustainable energy mix of the country is costly, not only in terms of the heavy reliance on imported fuels, but also in terms of the climatic risks that it entail. Climate change is a fast-materialising reality that continues to threaten Pakistan. On the one hand, it is affecting the weather patterns, and on the other adverse events are affecting marginalised communities and the biodiversity of the country, as can be witnessed by the recent flooding affecting Sindh, Khyber Pakhtunkhwa and Balochistan provinces (‘Pakistan flooding’ 2022). Therefore, a quick transition to renewable energy is essential.

Pakistan needs to scale up renewables in its energy mix. The present electricity needs of the country (Expanding Renewable Energy 2020) may be met by solar photovoltaic (solar PV) power generation on just 0.071 per cent of its total land area. Furthermore, 10.7 per cent of the windiest regions of Pakistan have an average wind speed of 7.87 m/s, which can also generate a significant amount of electricity. Despite these favourable endowments, Pakistan had an installed capacity of these two sources of 1,735 MW in 2021. By scaling up variable renewable energy (VRE) to 30% by 2030, the country can save up to $5 billion over the next 20 years (‘Expanding Renewable Energy’ 2020).

Pakistan can take lessons from the best practices of China regarding renewable energy. China Pakistan Economic Corridor (CPEC) provides an opportunity for Pakistan to diversify its energy mix, increase the share of renewables, increase energy access, and reduce dependence on imported fuels. The first phase of CPEC was energy based while the second phase involves infrastructure-based projects and Special Economic Zones (SEZs). CPEC is the single largest corridor of energy investments in Pakistan. Therefore, it is a mean to scale up renewable energy investments in the light of the commitments made by Pakistan and China at CoP 26.
Objectives

In view of the above, this policy brief:

• gives an overview of the renewable energy sector of Pakistan in terms of the policies, initiatives, and investments;
• identifies different policy instruments that can be used to scale up public and private sector investments in renewable energy under CPEC;
• Provides recommendations and lessons from China regarding its best practices and incentives for renewable energy financing.

Current status of renewable energy sector

There have been a number of policies that have guided the renewable energy developments of Pakistan. The first policy was the Alternative and Renewable Energy (ARE) Policy 2006. ARE Policy 2006 was subsequently superseded by the ARE Policy 2019.

ARE Policy 2006

ARE Policy 2006 was introduced by the Ministry of Water and Power in 2006 (Alternative Energy Development Board (AEDB) 2006). Under this policy, the target was to achieve a 6% share of renewables in the energy mix (excluding large hydropower projects). ARE Policy 2006 introduced a set of investor-friendly incentives, thereby inviting investments from the private sector for independent power plants and self-supply power projects. Key incentives included permitting investors to generate renewable electricity at one location and receiving an equivalent elsewhere on the grid; and allowing a net metering and billing system. The renewable energy sources that were promoted under this policy included wind, solar and hydropower (of up to 50 MW). Some other renewable forms of energy such as biomass were not covered under this policy.

ARE Policy 2019

ARE Policy 2006 was followed by the ARE Policy 2019 (Alternative Energy Development Board (AEDB) 2019), which brought the consensus of the private sector and the provinces (for land, infrastructure, etc.). ARE Policy 2019 states that the share of renewables (solar and wind) should be increased to 30%. ARE Policy 2019 also states that renewable energy projects would be used for the displacement or substitution of the thermal power plants, which dominate the overall energy mix, when the total cost of renewable energy production is less than the variable cost of thermal energy production. Moreover, the policy also addresses
off-grid solutions, distributed generation systems, etc. The main sources covered under the policy include solar, wind, geothermal, biogas, waste-to-energy, etc. ARE Policy 2019 categorises electricity procurement into three modes. The first one is based on competitive bidding for mature technologies, while the second mode involves government-to-government contracts. In the third mode, alternative technologies, such as hydrogen fuel cells, are to be developed as per the ARE Policy 2006.

**Indicative Generation Capacity Expansion Plan 2022-2031**

According to the Indicative Generation Capacity Expansion Plan 2022-31 (IGCEP 2022-2031), Pakistan aims to increase the share of hydropower and renewable energy in the energy mix to 60% by 2030 (National Transmission and Despatch Company [NTDC] 2022). This would reduce carbon dioxide (CO2) emissions in the country from 398g/KWH in 2022 to 190g/KWH by 2030. As of June 2022, Pakistan had 36 wind power projects, with a capacity of about 1,845 MW, while 7 solar projects of 600 MW and 9 bagasse projects of 364 MW have also been set up. IGCEP is established on the least-cost principle (lowest tariff basis). The targets for the IGCEP are subject to annual review and subsequent adjustment because other parameters are dynamic and subject to temporal change, such as whether Pakistan has added enough transmission lines and suitable infrastructure to meet the targets laid out in the earlier iterations of the IGCEP.

![The IGCEP Generation Mix 2030 (MW)](image)

The government plans to introduce more than 10 GW of solar projects by 2031, while installed wind energy generation capacity is expected to reach 5.8 GW by 2031.
According to the Variable Renewable Energy (VRE) Integration study by the World Bank (2020), the current grid system of Pakistan can incorporate about 33-37% of renewable energy projects with small improvements. Another locational study by the World Bank (2021) identified the renewable energy sources, which can be used to provide electricity at specific locations and points in the grid. The study identified locations with 2,300 MW of available capacity.

Most of the renewable energy projects in Pakistan are single source based and are termed “unsolicited.” Unsolicited bids are those in which the government directly negotiates with the supplier offering to develop the power project without engaging with any other suppliers. Unsolicited bids often result in poor-quality projects due to the uncompetitive nature of the process. Accordingly, a competitive bidding process, formally called the “Competitive Trading Bilateral Contracts Market” (CTBCM), has been launched to improve the efficiency of these projects ('Multiple electricity' 2022).

In the first stage, bidding is being conducted solely for users with the Letter of Intent (LoI). AEDB invited those LoI users to compete for capacity worth around 1,500 MW. These projects are set to be commissioned by mid-2024. Under the CTBCM, the only risk of the supplier defaulting is that the bulk power consumer (BPC) would have to pay for electricity from the grid at the marginal price, which would be the highest rate at that hour.

The cost of renewable energy production has also declined in a short period. Owing to climate change considerations, renewable energy technologies have developed so rapidly that tariffs have shrunk. In 2014, the tariffs for solar projects were worth 17 cents/kWH (National Electric Power Regulatory Authority (NEPRA) 2014). In the 100 MW Zhenfa solar project in Layyah district (Punjab) that was completed in April 2022, the tariffs were down to 3.74 cents/kWH (NEPRA 2022). For biomass, NEPRA had an upfront tariff in 2013 of around Rs 10.4/kWH (NEPRA 2013). Later, in 2017, this was revised to around Rs 7/kWH (NEPRA 2017).

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1 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.
Box 1. Large hydropower projects under CPEC- Potential and drawbacks

China Three Gorges (CTG) is committed to 6 GW worth of energy projects in Pakistan, with three wind and three hydropower projects currently in operation or under development. The Kohala hydropower project by CTG is a $2.4 billion project. It has been financed with almost $700 million in equity and around $1.8 billion in debt. It also has a long payback period of 18.5 years with a 6-year construction and 12.5-year repayment period. Environmental concerns, policy inconsistency and political instability in Pakistan have delayed the completion of the project from 2018 to 2022.\(^2\)

As the example highlights, there are certain chronic issues plaguing large hydropower projects. These include biodiversity impacts, precipitation variability due to global warming, and stranded asset risks. Hydropower projects in Pakistan raise substantial returns on investment; however, projects are beset by multiple delays, which adversely affects their payback period. Exchange rate volatility, project risks, and long repayment periods makes investments in hydropower projects a risky proposition.

Moreover, large hydropower projects are costly, with cost outlays in the billions of dollars, and often result in environmental impacts and land conflicts. Long gestation periods are another big drawback of hydropower projects. There needs to be an investment for a number of years prior to construction, unlike solar and wind projects, which can be completed within months. These factors reduce the efficacy of hydropower projects.

Issues with renewable energy uptake in Pakistan

Despite its enormous potential, solar panels are unaffordable for many people. Bank loan approvals for solar financing can take up to six months, thereby discouraging investment. In the case of solar tube wells, the government has promised subsidies with the aim of solarizing 1.2 million tube wells (‘Govt plans’ 2022). However, due to lack of regulations and information access, investors often have to bear the full amount.

Additionally, there are challenges related to policy and regulatory uncertainty with renewable energy uptake in Pakistan. For instance, as Pakistan is now entering a competitive tariff regime, investors have shifted their focus to cutting costs. Owing to delayed payments to Chinese Independent Power Producers (IPPs), investors

\(^2\) This information was provided by Mr. Noman Sohail, Manager Project Development, China Three Gorges South Asia Investment Limited (C-SAIL) at the Focus Group Discussion on “Renewable Energy Investments for CPEC” on the 26th of July, 2022.
find it difficult to reduce costs by investing in research and development (R&D).

Renewable energy costs are not the sole factor determining investments in the renewable energy sector. Lack of coordination between the federal and provincial governments as well as renegotiation of tariffs have adversely impacted investors’ confidence. As the tariffs are being revised on a monthly basis, investment decisions based on the changing tariffs may be perceived as higher risk, thus, adversely affecting investors’ investment decision.

Moreover, financing for new solar developers is constrained as they are generally perceived as higher risk by investors when making the investment decision. Owing to the high capital cost, the lack of development experience of the project developer often results in limited financing opportunities.

Furthermore, renewable energy projects have energy intensity issues while lithium ion batteries for solar PVs are problematic as they need to be replaced after every 2-3 years. Solar power projects also result in land-use concerns as approximately 5-10 acres of land are required on average to generate 1 MW of electricity (Ong et al. 2013, p. 6).

Box 2. Challenge of indigenising production of solar PVs in Pakistan

One of the largest solar manufacturers from China, LONGi Solar, upon the request of the local investors, is willing to undertake transfer of technology (ToT) and brand name to initiate indigenous manufacturing of solar PVs. However, investors require local raw materials for the manufacturing of solar PVs. All raw materials are imported, including tempered glass, making only the assembly of solar PVs possible. Multiple industries need to be aligned before Pakistan can set up its own solar manufacturing plant.

Similar to the issue with solar PVs, there are also land-use concerns with wind energy. For example, the average area requirement for wind power plants in the US is estimated to be between 34.5 and 56.9 hectares/MW (Denholm et al. 2009, p.10). Reverse tariff bidding implies a new model for investors to stay competitive. Previously, investors got substantial returns, such as a Return on Equity (ROE) of 17% for wind and solar projects in the cost plus tariff regime before reverse tariff bidding was introduced (NEPRA 2016). Although investors do have the capability to

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3 This box is based on information provided by Mr. Ali Majid, General Manager, Pakistan Xi’an LONGi Silicon Materials Corporation during the Capacity Building Workshop on “Renewable Energy Investments for CPEC Energy Projects” held in Islamabad on the 2nd of June, 2022.
cut the cost of production to meet this tariff, there is no clear cut policy framework for the projects to proceed, creating risks regarding revenue assurance and sustainability.

There are other issues such as base load issues and intermittency challenges with VRE technologies. As a result, a complete transition towards renewable forms of energy is difficult to achieve.

Prospects and opportunities for renewable energy uptake under CPEC

There exists huge potential for renewable energy uptake under CPEC as solar and wind-based projects are not only relatively inexpensive but have a low merit order, which gives such projects a guarantee in terms of dispatch purposes.

Moreover, CPEC also presents an opportunity for indigenizing production of solar PVs. LONGi Solar began operations in 2000, and with the help of the Chinese government, it is now one of the largest producers of solar PVs in China. 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. To scale up access to solar, the Government of Pakistan (GoP) has incentivised solar PVs. The government imposes no sales tax and customs duties on solar PVs, and the SBP offers a refinancing facility of 6% for the end-user (State Bank of Pakistan (SBP) 2019).

The government also aims to introduce 14,000 MW of solar power through various incentives from 2022 onwards, with a special focus on developing solar projects in Balochistan and converting diesel-operated or conventional tube wells into solar-powered ones. Solarisation of all public sector buildings and small solar projects on 11kV feeders is also under consideration (‘PM Shehbaz says’ 2022). Pakistan can open up this solarisation initiative to Chinese investors under CPEC to expedite the solarisation process.

Multiple initiatives have been taken to increase the uptake of renewable energy such as the rooftop solar project initiated in 2015 (Saeed 2015). Initially, there were complaints regarding the unavailability of vendors as well as the poor quality of equipment. However, after the AEDB stepped in, 190 vendors were acquired. AEDB also introduced certification regulations in 2018, which rely on the licensing and support of the Pakistan Engineering Council (PEC). PEC is given standards and guarantees for the various components of the solar PVs that they must meet (AEDB 2018). 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 (Alternate Energy Development Board 2021).

Additionally, the government is making efforts to improve the stability of the national grid by making the Supervisory Control and Data Acquisition (SCADA) system available by 2024 (NEPRA 2022). SCADA is an online system that allows automatic repairs of the grid. The initiative is expected to stabilise the grid and contribute to the upscale of renewable energy under CPEC.

The government is determined to increase renewable energy investments under CPEC 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, stability protection, etc.

**Policy recommendations**

The following policy recommendations are aimed at providing a system to scale up the intake of renewables under CPEC:

- CPEC Authority should provide a research-based policy development, advisory, and action plan to build an ecologically friendly and green CPEC and to scale up renewable energy investments.
- Environmental and Social Impact Assessment (ESIA) needs to be strengthened. The standard format of the ESIA needs to be adapted and should give due consideration to all possible alternatives (including the no project option).
- Pakistan Environmental Protection Agency (PEPA) needs to be strengthened via legislation to ensure it has the power to enforce environmental protection measures that have been enacted.
- NEPRA should introduce green metering systems and there should be a third-party certification process for the technical requirements of the system to ensure timely information regarding the time and extent of energy being used to cut down on energy consumption.
- There is a need to start indigenous manufacturing of solar PVs in Pakistan to reduce the dependency on imported and expensive PVs and increase the uptake of solar PVs in the country. Any future agreements with Chinese stakeholders under CPEC should be undertaken with a special emphasis on transfer of technology, knowledge sharing and the establishment of local solar manufacturing plants.
- For solar manufacturing in Pakistan, AEDB should launch spectrum auctions
similar to 3G and 4G technologies introduced by Pakistan Telecommunications Authority (PTA). Investors require information regarding the current, medium-term, and long-term situation before bringing in any investment and such auctions would provide a clarity to investors as well as a mechanism to achieve vertical integration for solar manufacturing.

- Implementation of IGCEP will provide a guarantee to investors. Since revenue increase is not possible in a competitive tariff regime, reduction of costs can only occur with the availability of good sources of supply. Investors can be provided guarantees with respect to the sources of supply if the government adheres to the IGCEP.
- Use of solar PVs as part of the construction material of rooftops would also help scale up access to renewables under CPEC.

**Conclusion**

Given the vulnerability of Pakistan on both the climate and economic fronts, it is critical to address how Pakistan can redirect Chinese investments to green, sustainable, and decarbonised alternatives. A green and sustainable CPEC would act as a role model for BRI investments in other countries, help in achieving sustainability targets regarding climate change and environmental conservation, and promote economic growth in Pakistan.

The case for renewable energy investments under CPEC is very strong as Pakistan wants to have a sustainable energy basket, which can also address its energy security concerns. Furthermore, the roadmap for SDG 7 requires greater certainty in the energy sector and China has expressed its commitment to develop a framework for green energy development to help Pakistan achieve its sustainability goals. Thus, CPEC can help Pakistan make the transition towards renewables and fulfil its climate commitments.
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