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Transforming Pakistan's Energy Landscape: Insights from European Perspectives and Global Partnerships

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Abstract

Pakistan's power sector finds itself at a watershed that is at once an intersection of geopolitics, poverty, and climate change. Expanding the country's energy infrastructure has been largely through international investment, especially, through the China-Pakistan Economic Corridor (CPEC). But domestic problems, like circular debt, governance inefficiency and, persistent energy poverty, continue to hamper its forward march. In this article, we look at the geopolitical dynamics that shape Pakistan's energy strategy, its complex dependence on coal, and the implications for the country's international climate commitments. The paper also analyses how international actors can influence Pakistan's energy future, as China's growing influence calls for diversification through partnerships with other European countries. The article discusses the European institutions' role in aiding renewable energy initiatives and enhancing governance by taking into account a European perspective related to those initiatives. This analysis draws from the 2020 Atlantic Council report and recent developments to provide an updated assessment of Pakistan's energy skyline. Governance, reforms, transparency, and a move to a cleaner energy mix are recommended as strategic imperatives. It concludes by calling attention to the important balance Pakistan must strike between short term energy requirements and long term environmental responsibility with active international cooperation aimed at strengthening their resilience and energy security.

Keywords: Pakistan power sector, Geopolitics, Climate change, Renewable energy, climate vulnerability, EU perspective

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Introduction

Pakistan's energy sector faces growing demand and energy poverty while transitioning to cleaner energy. In the year 2024, Pakistan's total installed electricity capacity is 42,131 MW, with 6.8% from renewables. Recent projects focus on diversifying the energy mix, reducing reliance on imports while also addressing climate vulnerabilities.[1] For decades, Pakistan's power sector has been at the very heart of our national development goals, despite being one of the nation's most enduring problems. Being home to more than 240 million population, Pakistan is under stress to improve its energy demand management while dealing with circular debt, governance issues, and energy poverty.[2] The country's central role in the geopolitics of South Asia, where important players such as China, India, and the United States intersect, is equally about energy. Rana further points out that international investments such as the China – Pakistan Economic Corridor (CPEC) has helped to address Pakistan's energy shortages somewhat by augmenting its capacity through new forms of infrastructure projects (particularly in coal fired power plants).[3] But coal dependence for Pakistan is a problem, especially, since it became a signatory of international agreements such as the Paris Agreement, which aims to reduce greenhouse gas emissions to prevent damage to the environment.

This article builds on previous work to offer a comprehensive review of the growing power sector in Pakistan. International investments, moreover, through the CPEC in particular, are examined, along with the implications of Pakistan's energy policies for geopolitics, economics, and the environment. Finally, issues relating to governance of the sector are subsequently discussed and ways of transitioning the sector towards a more sustainable and efficient energy mix are suggested.

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1 Ember. "Pakistan's vast solar and wind potential can help tackle its ongoing energy crisis." (2024, October 9). Retrieved from https://ember-climate.org.

2 R. Ichord. Transforming the Power Sector in Developing Countries: Geopolitics, Poverty, and Climate Change in Pakistan, *Atlantic Council*, (2020). ics/statistical-review/bp-stats-review-2019-full-report.pdf.

3 Shabaz Rana. "Per capita income shrinks 8.2% in PTI's first year," *The Express Tribune*, (12 May 2019). https://tribune.com.pk/story/1970984/2-per-capita-income-shrinks-8-2-ptis-first-year/.

Geopolitical Dimensions of Pakistan's Energy Sector

The role of CPEC and Chinese investments

The CPEC serves to be a key driver of the transformation of Pakistan's power sector. Under its Belt and Road Initiative (BRI), China has hugely invested in Pakistan's energy infrastructure, largely for building coal fired power generation. For instance, the Sahiwal Coal Power Project and Port Qasim coal fired plant have played a big role in filling the energy gap.[4] In 2023, coal-based projects like Shanghai Electric's Thar Coal Plant added 1,320 MW to the grid. However, heavy reliance on coal raises concerns about environmental sustainability and geopolitical dependence.[5] The geopolitical and environmental trade-offs of these projects, which can resolve immediate energy deficits, are clear. Energy infrastructure has an important geopolitical significance in the overall regional politics.

China's involvement in Pakistan's energy sector shows how strategically important it is. Operating through CPEC, China has staked its claim as an energy partner of Pakistan. It provides not only financing but also technological knowhow. This relationship has deepened Pakistan's financial dependence on China, with many of these projects funded by Chinese loans Pakistan will be expected to repay over the coming decades.[6] Pakistan's heavy reliance on coal under CPEC projects is likewise causing concern about the country's environmental commitments, while its growing financial ties with China have also created anxieties about Pakistan's energy policies and the relationship contracting out the decision making to a foreign power. This goes against Pakistan's promise in the Paris Agreement to cut carbon emissions and move to cleaner energy.[7] There will thus be a theme of tension between present energy needs and long term sustainability in Pakistan's energy policy in the coming future.

Energy as a geopolitical tool

South Asia is no stranger to energy being wielded as an important tool of geopolitics. Pakistan has a strategic location and hence is a player of key

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[4] Ichord, Transforming the Power Sector in Developing Countries.

[5] Energy Update, "Pakistan's installed electricity capacity reaches 42,131 MW" (12 June 2024). https://www.energyupdate.com.pk/2024/06/12/pakistans-installed-electricity-capacity-reaches-42131mw/.

[6] S. Sharma, Pakistan saves big by using imported gas for power generation. Natural Gas World (2018). Retrieved from https://www.naturalgasworld.com/pakistan-saves-big-by-using-gas-for-power-generation-report-62442.

[7] Ichord. Transforming the Power Sector in Developing Countries.

significance in the regional energy economy, especially vis a vis China, India, and Central Asia. New energy infrastructure built under Chinese supervision not only satisfies Pakistan's domestic energy requirement, but also uplifts its regional strategic value.[8]

At the same time, Pakistan has been trying to diversify the energy sources and decrease its dependence on any single country. Such an initiative is the Turkmenistan – Afghanistan – Pakistan – India (TAPI) pipeline, intended to bring gas from Turkmenistan to South Asia. Geopolitical tensions between India and Pakistan and instability in Afghanistan, however, have postponed the completion of this project.[9] The TAPI pipeline remains delayed due to regional instability, but the CPEC hydropower project, Suki Kinari (884 MW), progressed significantly in 2023.[10] These challenges show how energy and geopolitics are tied indelibly together in South Asia. Moreover, it points to the tenuous balancing act that Pakistan must undertake in order to meet its domestic energy needs and strategic ambitions.

Addressing Energy Poverty and Expanding Access

The scope of energy poverty in Pakistan

Despite having decades of intermittent electricity, millions of people in Pakistan still face energy poverty. According to Ichord, as of 2019, there were about 58 million Pakistanis without access to electricity, mainly in rural areas. As of 2022, 95% of the population has electricity access. Initiatives like net-metered solar installations (1,822 MW in 2024) are expanding rural electrification.[11] Inadequate access to energy resources by rural people has served to widen economic inequality, hampering efforts to provide more people the means to get out of poverty. In order to address energy poverty, the government has introduced programmes of rural electrification and investment in off grid renewable energy solutions.[12] However, progress has been slow, due to governance dilemma, monetary restrictions as well as the lack of coordination between the federal and provincial authorities. The Pakistani energy crisis is not only a case of

[8] Rana. "Per capita income", *The Express Tribune*, 2019.

[9] Ichord. Transforming the Power (2020).

[10] Energy Update, "Pakistan's installed electricity capacity", (2024).

[11] World Bank. Access to Electricity (% of population) – Pakistan (2023). https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=PK.

[12] World Bank. *Tracking SDG7: The Energy Progress Report 2019*. World Bank Group (2019). https://trackingsdg7.esmap.org/data/files/download-documents/2019-Tracking%20SDG7-Full%20Report.pdf.

production but also a case of distribution. Despite greater generation capacity, many areas in the country still lack sufficient distribution of generated power due to an obsolete and incompatible distribution network.[13]

Recent data shows that 95% of Pakistan's population had access to electricity in 2022, leaving approximately 11 million people still without reliable energy, mostly in rural areas. Solar and micro grid projects under initiatives like the Indicative Generation Capacity Expansion Plan (IGCEP) aim to close this gap by 2030.[14]

Renewable energy as a solution to energy poverty

Development of renewable energy sources such as solar and wind are one potential solution to Pakistan's energy poverty in rural areas where extension of national grid is not economically viable. In recent years, Pakistan has made some strides to increase its renewable energy capacity, with the Quaid-e-Azam Solar Park being one of those that feed power into the national grid. While the scale of such projects is smaller than the country's aggregate energy demand, greater investment is needed to achieve the government's ambition of having 30 percent of its electricity consumption originate from renewable energy by 2030.[15] Pakistan's renewable energy share rose to 41% in 2023, driven by hydel (24%) and smaller contributions from wind and solar sources (2.7%).[16] If we expand access to renewable energy in rural areas, not only will it alleviate energy poverty, it will also directly contribute to Pakistan's climate goals because we are reducing greenhouse gas emissions.

Climate Change and Pakistan's Energy Sector

Climate vulnerability

Floods, droughts, and heat waves are among the extreme weather events that regularly occur in Pakistan, one of the most vulnerable countries to climate change. Climate disaster related losses are already piling high on

[13] IMF, *Pakistan: IMF Country Report,* No. 19/212, (2019). https://www.imf. org/~/media/Files/Publications/CR/2019/1PAKEA2019001.ashx.

[14] World Bank, Access to Electricity (2023).

[15] World Wind Energy Association. "Pakistan to set 30% renewable energy target by 2030," (2019). Retrieved from https://wwindea.org/blog/2019/04/02/pakistan-to-set-30-plus-30-renewable-energy-target-by-2030.

[16] Ember. "Pakistan's vast solar and wind potential", (2024).

the country where the 2010 floods cost the economy around $25 billion.[17] Climate stress has taken a toll on Pakistan's energy infrastructure at large, including its hydropower plants, that depend on sustained water flows from the Indus River system. The 2022 floods caused $30 billion in damages, disrupting energy systems and underscoring Pakistan's climate vulnerability.[18] Apart from being directly hit by climate change, Pakistan is also under pressure from the international community to abate its carbon emissions. According to the Ministry of Climate Change in 2016, Pakistan has agreed under the Paris Agreement to reduce its emissions by 20 per cent by 2030 but only on the condition that it receives international support in the form of finance and technology.[19] Yet, without major shifts in Pakistan's energy policies, including reliance on coal for power generation, meeting these targets will be all but impossible.

Transitioning to renewable energy

In order to meet its climate commitments and to protect itself from climate change, Pakistan must accelerate the transition to renewable energy sources. Potential for solar, wind, and hydropower in the country is immense, and it has been largely under utilised. If the government can attract investment and improve governance in the energy sector, the dream of 30 percent of the electricity generated from renewable sources by 2030, although ambitious, is possible.[20] Pakistan targets 60% renewable energy by 2030, supported by IGCEP's roadmap and EU collaborations under the Global Gateway initiative.[21] Besides, Pakistan ought to build renewable energy capacity while focusing on energy efficiency and transmission losses reduction. Nationwide, technical inefficiencies in the transmission and distribution network lost almost 18 percent of the electricity generated in

[17] Ichord. Transforming the Power Sector in Developing Countries.

[18] Ember. "Pakistan's vast solar and wind potential".

[19] Ministry of Climate Change. Pakistan Intended Nationally Determined Contributions, Government of Pakistan (2016). http://www.mocc.gov.pk/moclc/userfiles1/file/INDC%20PAKISTAN%20-zero%20draft-.pdf.

[20] IRENA, Renewables Readiness Assessment: Pakistan. International Renewable Energy Agency, 2018. Visit at https://www.irena.org/publications/2018/Apr/Renewables-Readiness-Assessment-Pakistan.

[21] Pakistan Economic Survey. Private Power and Infrastructure Board: Energy developments in Pakistan 2022–2023. (2023). Retrieved from https://www.finance.gov.pk2023.

Pakistan in 2017.[22] These inefficiencies will need to be addressed to meet the consumers' demand and help reduce the country's carbon footprint.

European Perspective on Pakistan's Energy Transformation

European Union's role in supporting renewable energy in Pakistan

European collaborations, like Germany's KfW funding hydro-power and solar projects, are aligning Pakistan with global green energy goals. The European Investment Bank (EIB) is also supporting renewable initiatives under the Global Gateway, ensuring sustainable energy development.[23] The European Union has played the leading role in addressing climate change and promoting global energy transitions. Within its global outreach, the EU is increasingly shifting focus to South Asia, including Pakistan, in order to encourage cleaner energy pathways. Compared to exporting its significant renewable energy potential to the EU, Pakistan has committed to increasing the share of renewable energy to 30 percent by 2030.[24] Renewable energy projects in developing countries such as Pakistan have been carried out with a number of European countries and financial institutions alongside the European Investment Bank (EIB). Funding has been provided for projects to support solar, wind, and hydropower, in an effort to reduce reliance on fossil fuels.

The EU Global Climate Change Alliance (GCCA) offered both financial and technical assistance to developing countries to help them implement their strategies on climate mitigation and adaptation.[25] Also, European corporations are looking to invest in the energy sector of Pakistan. Independent renewable energy companies—solar panels, windmills, and smart grid technologies— could play a big role in helping to develop Pakistan's infrastructure. For example, based on handling renewable energy technology, Germany, one of the EU leaders, can come together with Pakistan to enhance solar and wind projects. Pakistan would be able to benefit from Europe's technological advances and, at the same time,

[22] NEPRA, *State of the Industry Report*, National Electric Power Regulatory Authority (2017). Retrieved from https://nepra.org.pk/publications/State%20of%20Industry%20Reports/State%20of%20industry%20report% 202017.pdf.

[23] Ember, "Pakistan's vast solar and wind potential", (2024); See also https://www.eib.org/en/projects/region/asia-pacific.

[24] IRENA, Renewables Readiness Assessment, 2018.

[25] European Commission, The European Green Deal, (2019). Retrieved from https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en.

contribute towards Paris Agreement that requires it to cut down on emission.

Climate change collaboration: Lessons from the European Green Deal

Pakistan can learn valuably from the European Green Deal, which seeks to make Europe the first climate neutral continent by 2050. According to the Green Deal, energy systems in general should be decarbonized and renewable energy capacity should be increased and energy efficiency improved, areas in which Pakistan can learn from Europe.[26] European expertise in 'financing' of green energy projects can be useful for structuring Pakistan's Nationally Determined Contributions (NDCs) under the Paris Agreement. The Pakistan experience with carbon pricing and emissions trading systems could also be modelled on Europe's to penalise emissions and boost the development of markets for clean energy. In addition, European countries have solid skills in controlling renewable energy in national grids as well as managing regulatory environment for the purpose of pro-green investment. Pakistan can develop its own regulatory frameworks which would support the growth of renewable energy, with support from European institutions.

Balancing China's influence with European partnerships

To counterbalance reliance on Chinese coal projects, Pakistan has strengthened ties with Europe. Projects funded by European institutions, emphasizing governance and sustainability, diversify Pakistan's energy partnerships.[27] With the China – Pakistan Economic Corridor (CPEC), China's Belt and Road Initiative (BRI) has been one of the largest investment sources to Pakistan's energy sector. Yet, Pakistan's increasing financial reliance on China continues to worry the long term sovereignty of the country and long duration of coal based projects.[28]

Alternative models of the partnership with Pakistan which are based on the longer term environmental and economic benefits can be offered to the European countries, which place a strong emphasis on transparency, governance, and sustainability. In Pakistan's drive to reduce circular debt, increase the transparency in its energy sector, and improve governance,

[26] Ibid.

[27] Energy Update, "Pakistan's installed electricity capacity," 2024.

[28] R. Ichord. Transforming the Power Sector in Developing Countries (2020).

Pakistan is aligned to sustainable development and good governance that make up core elements of the EU. European investment banks EIB and the European Bank for Reconstruction and Development EBRD for example, finance environmental projects (mostly renewable energy and climate adaptation). Engaging with Europe allows Pakistan to diversify its foreign investment sources.

Energy supply chains and European trade

A second fertile area for European cooperation with Pakistan is in the development of sustainable energy supply chains. Secure sources of materials, such as solar panels and wind turbines, have been Europe's priority. Given that European countries are so invested in sustainable, environmentally friendly supply chains for these critical materials globally, many of the mining requirements in several mine areas are of paramount importance to the local and national economies of the host country such as their provision of employments. As Pakistan expands its renewable energy sector, bolstering the relationship with European suppliers and technology providers will be key. Besides, there exist also trade agreements between Europe and Pakistan, including agreements which set environmental sustainability as priority. Pakistan seeks to improve its environmental regulations, in order to benefit from the EU's Generalized System of Preferences Plus (GSP+) which grants tariff reductions to developing countries that meet certain human rights and environmental standards. [29]

Governance and Financial Viability

Circular debt and the financial health of the power sector

Circular debt is one of the major and persistent problems of Pakistan's energy sector and is a major hurdle for the whole power sector in its quest to become financially viable. According to the IMF, circular debt is the cash flow shortfall in the power sector attributable to mismanagement in billing, collections, and payments among consumers, distribution companies, and government.[30] By mid-2019, the circular debt in Pakistan had reached about Rs1.5 trillion (USD 9 bn), a debt that continues to grow year on year.[31] This debt arises from inefficiencies throughout the supply chain: such inability of the distribution companies to collect full payments from consumers thus translates to revenue shortfalls which are incurred and

[29] European Commission, The European Green Deal, 2019.

[30] IMF, *Pakistan: IMF Country Report,* 2019.

[31] Ibid.

cannot be paid by the distribution companies to power producers. Of course, the producers cannot meet their financial obligations to fuel suppliers. The result is a vicious cycle which, in turn, worsens the financial health of the sector. A large part of these losses can be attributed to technical losses in transmission and distribution networks; hence transmission losses are about 18% in some regions.[32] Multiple reform attempts have tried to fix the circular debt, but they have resulted in failure; the investment needed to fix Pakistan's economy has been choked and the national budget further stressed. This situation is further complicated by the fact that the government has a policy of subsidizing energy costs to consumers, reducing the revenues of energy producers and distributors.[33]

Governance reforms in the energy sector

Issues of governance in Pakistan's power sector extend far beyond the problems of financial inefficiencies. It includes the broader political and institutional structures of which the sector is a part. Efforts to do this have been hampered by weak regulatory oversight, political interference in tariff setting, and resource allocation. The National Electric Power Regulatory Authority (NEPRA) was set up in 1997 to be the regulatory body of the power sector and it has often found it difficult to establish its independence and implement much-needed reforms.[34]

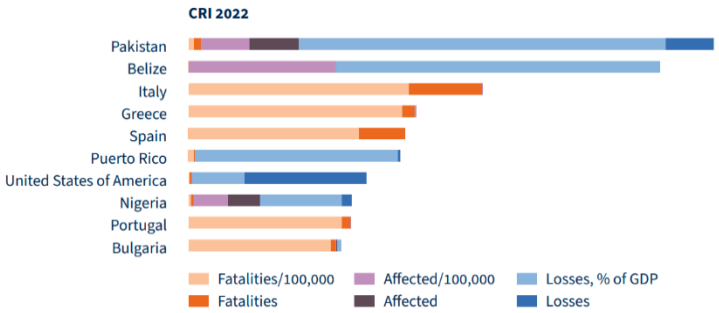
The close relationship between government and state owned energy companies is a significant part of the governance challenge. For example, the energy industry has been ravaged by a crisis that has been helped along by political interference in setting tariffs, resulting in artificially low energy prices. Moreover, despite efforts to privatise distribution companies in big cities such as Lahore and Islamabad, political resistance has been encountered and those efforts have not been fully fulfilled.[35] Public investment in Pakistan's energy sector needs to be supplemented with private investment, and these governance issues need to be addressed to encourage private investment for the long-term sustainability of the sector. First step to improving the governance landscape would be to strengthen

[32] Ichord. Transforming the Power Sector in Developing Countries.
[33] IMF, *Pakistan.*
[34] NEPRA, *State of the Industry Report,* 2017.
[35] Ichord, Transforming the Power Sector.

the autonomy of NEPRA and other regulatory bodies, and have transparency in energy contracts.

Pakistan's climate insecurity

Pakistan is one the world's most vulnerable countries to the impacts of climate change. It is ranked among those most at risk from extreme weather events and natural disasters.[36]



The 10 most affected countries in 2022 - Climate Risk Index 2025[37]

Ranging from the floods, droughts, and heatwaves that have ravaged the country and wrought havoc with its infrastructure, its economy, and its population, it becomes difficult to learn much about how to deal with disasters of this magnitude while they are unfolding. The floods that swept Pakistan in 2010 cost the nation more than $25 billion, or roughly 5.4% of GDP.[38] Agriculture, dependent heavily on the Indus River system, has also been affected by rising temperatures and changing precipitation patterns. Not only has climate related disruptions to water flows affected food security, the availability of water for hydropower generation, a major part of Pakistan's energy mix, has been reduced.[39] Rapid glacier melting in the northern mountains also poses long term risks to the country's water resources and energy infrastructure.

To prevent these vulnerabilities, Pakistan ratified the Paris Agreement in 2016 and submitted its Nationally Determined Contributions (NDCs) to the

[36] "Pakistan ranked most vulnerable to climate change in 2022: Germanwatch," *Dawn*, 12 February 2025. https://www.dawn.com/news/1891272.

[37] Visit at https://www.germanwatch.org/en/cri.

[38] D. Eckstein, V. Künzel, & L. Schäfer. *Global Climate Risk Index 2018,* German Watch (November 2017). https://germanwatch.org/en/node/14987.

[39] Ichord. Transforming the Power.

United Nations Framework Convention on Climate change (UNFCCC). According to which, Pakistan is willing to reduce its greenhouse gas emissions by 20 percent below the business-as-usual level by 2030. Pakistan updated this target to 50 percent in 2021.[40] However, it is conditional on mobilisation of adequate financial and technical support from the international community. But Pakistan's progress on those targets has been slow, especially, because it continues to depend on coal and other fossil fuels for energy generation.

Potential for Renewable Energy Expansion

Although currently dependent upon fossil fuels, Pakistan has significant potential to build up its renewable energy capacity. In regions like Sindh and Baluchistan, the country has some of the most suitable areas in the region for wind and solar energy projects.[41] One of the large scale solar projects in service is the Quaid-e-Azam Solar Park in the Cholistan desert, contributing to the national goal of creating an increasing proportion of Pakistan's energy from renewable resources.[42] Pakistan hopes to fulfill its climate commitments by reducing its carbon footprint and producing 30% of its electricity from renewable sources by 2030.[43] These include solar, wind, and small scale hydropower projects. Nevertheless, mobile power solutions still present challenges to the mobilisation of the required investment and technological know-how necessary to scale up such projects to serve domestic demand in the country. Despite improvements since peak winter, Pakistan's transmission and distribution losses are still among the highest in the region, and inefficiencies in these areas will be critical in connecting the electricity produced to consumers across the country and achieving its climate goals.[44]

Enhancing Governance and Transparency

Improved governance includes privatizing energy distribution and strengthening NEPRA's autonomy. Transparency in contracts is key to attracting foreign investment, particularly from Europe.[45] Improving

[40] Visit at https://interactive.carbonbrief.org/the-carbon-brief-profile-pakistan/index.html.

[41] IRENA. Renewables Readiness Assessment, 2018.

[42] Pakistan's first solar power plant unveiled, *Express Tribune*, May 6, 2015. https://tribune.com.pk/story/881701/pakistans-first-solar-power-plant-unveiled.

[43] World Wind Energy Association, Pakistan to set 30% renewable, 2019.

[44] Ichord, Transforming the Power.

[45] Development of Pakistan, 2023; Pakistan Economic Survey, 2023.

governance and transparency is one of the main strategic priorities of the energy sector of Pakistan. Private investment in the power sector depends upon improving the regulatory environment to enable the power sector to become financially sustainable. It will also establish a strong foundation to enhance the independence of NEPRA and other regulatory bodies for more effective enforcement of tariffs and collection practices and reduce the sector's reliance on government subsidies.[46]

The government should also take measures to enhance financial viability of state-owned distribution companies by resolving the problems of inefficiency in billing and collection processes. Equally, it is important to pursue privatisation, especially, in major urban centers, like Lahore or Islamabad, so that competition can increase and service delivery can improve. Instead, efforts to complement these should be made in order to increase transparency in energy contracts and reduce political interference in tariff setting and resource allocation.

Transitioning to a Cleaner Energy Mix[47]

To meet Pakistan's climate commitments, and as a long-term energy security, it is essential for Pakistan to transition to cleaner energy mix. Though coal has temporarily relieved Pakistan's energy shortages, it should emphasize on renewable energy including solar, wind, and hydropower. Pakistan's Indicative Generation Capacity Expansion Plan aims to replace 59% fossil fuel reliance by increasing renewable sources to 60% by 2030. Projects like Jhimpir Wind Corridor and Thar solar installations are pivotal in achieving this goal.[48] IRENA (2018) states that the government's objective of producing 30% of electricity from renewable by 2030 is ambitious but achievable provided that the required investment and technical expertise can be attracted.[49] Additionally, increasing Pakistan's renewable energy capacity will help cut the country's reliance on fossil fuel imports, strengthening energy self-sufficiency and lowering elements' susceptibility to price movements in worldwide energy markets. Furthermore,

[46] IMF, *Pakistan: IMF Country Report* 2019.

[47] "Transitioning to a Cleaner Energy Mix" refers to the process of shifting a country's energy sources from those that are heavily reliant on fossil fuels (like coal, oil, and natural gas) to a more sustainable combination of energy sources that include renewable options (such as solar, wind, hydro, and geothermal).

[48] Energy Update, "Pakistan's installed electricity capacity." 2024.

[49] IRENA, Renewables Readiness Assessment.

investments in transmission infrastructure and energy efficiency will be crucial in bringing energy to the consumer, and it will help bring down the country's carbon footprint.

Addressing climate challenges

Climate-resilient infrastructure, such as floating solar systems, is vital as Pakistan's vulnerability to climate events like the 2022 floods grows. Collaboration with international bodies ensures funding and expertise for adaptation.[50] Being vulnerable to climate change, climate related risk needs to be high in government's list of priority. This includes making sure we put the necessary mitigation and climate adaptation measures in such as increasing the resilience of our critical energy infrastructure and improving our water management systems.

In addition, the government should take measures to increase public awareness of climate risks and promote of the use of climate smart technologies, in particular, in the agricultural sector.[51] Supporting Pakistan's climate adaptation efforts will have to be an international endeavour. Implementing of its NDCs and building climate resilience will require financial and technical assistance from the international community. To secure the necessary resources to carry out these initiatives, the country will have to engage multilaterally as well as bilaterally.

To incorporate a European perspective into the article on Pakistan's energy sector, several areas can be focused where Europe has been or could be influential. They include:

- *Energy Partnerships and Investments:* In the context of global energy transitions, Europe and, more specifically, the European Union, have influenced the access of cleaner energy, invested in renewable energy across the world, and made international climate commitments. Such European partnerships in Pakistani renewable energy projects could demonstrate how Europe can share its financial support, technology, and diplomacy.
- *Climate Change Collaboration:* In terms of international climate negotiations, the EU has long been a leader. A second opportunity that

[50] Ember, "Pakistan's vast solar and wind potential".
[51] Eckstein, *et al.*, Global Climate Risk Index 2018.

would present a comparative approach would be to explore how Pakistan could adjust its climate objectives to European standards and obtain learnings from Europe's renewable energy transition plans. By the same token, technical and policy exchanges could be found within the European Green Deal as well as cooperation frameworks as "Horizon Europe".

- *Geopolitical Relations:* Europe can offer itself as a balance to China's encroachment on Pakistan's energy sector. In doing so, European development banks such as the European Investment Bank (EIB) and energy transition frameworks in Europe could serve as an alternative partnership which favours transparency, governance, and sustainability.
- *Trade and Energy Supply Chains:* Europe has been prominent in advocating for sustainable supply of critical materials for renewable technologies such as solar panels and wind turbines. Europe is interested in obtaining these materials to help secure Europe's interest in clean energy. It can, therefore, offer the same technologies to Pakistan.

Strategic Recommendations for Pakistan: Integrating European Partnerships

Strengthening climate diplomacy with Europe

Enhancing Pakistan's climate diplomacy with Europe is one of the key recommendations for Pakistan to move forward. Aligning its energy and climate policies with European standards, Pakistan can take advantage of financial and technical assistance and put itself in the center of Europe's global climate initiatives. By engaging with the European Union on forums like the United Nations Climate Change Conference (COP) and regional dialogues it would become possible for Pakistan to avail additional resources for renewable energy along with climate adaptation efforts.

Diversifying energy investments

Pakistan needs to pursue diversification of foreign investment portfolio to reduce its reliance on China and to minimize risks of coal investments. Pakistan's engagement with European financial institutions, like the European Investment Bank, and development of partnerships with European corporations delivering renewable energy will give Pakistan alternatives to coal and speed up its transition to cleaner energy.

Enhancing energy governance through European collaboration

For decades, the European institutions have been developing countries' associates in their progress towards governance reforms, especially, in energy and infrastructure sectors. Collaborating with Europe will help Pakistan make its energy sector more transparent. It will also be an opportunity to resolve the problem of circular debt and make its regulatory frameworks better. The experience of European countries in reforming regulations and developing public private partnerships will be useful in achieving a system of energy that is both more resilient and sustainable in Pakistan.

Conclusion

Pakistan is at the crossroads in energy sector. The energy geography of the country is challenging as it tackles growing energy demand and energy poverty as well as reducing its carbon footprint. Indeed, a challenging geopolitical playbook. Much needed international investments, primarily from China through CPEC, have funded infrastructure development, but in so doing, they have further entrenched Pakistan's financial liabilities to China and, in addition, have brought up challenges to environmental sustainability.

In order to attain long term energy security and meet its climate commitments, Pakistan needs governance reforms, increased transparency, and a fast track to renewable energy. Building a more resilient and increasingly sustainable energy system will depend on addressing circular debt, enhancing energy efficiency, and extending access to renewable energy in rural areas. Pakistan must continue balancing short term energy need with longer term environmental and financial sustainability.

Through the focus on strategic priorities including improving governance and the transition to a cleaner energy mix and addressing climate vulnerabilities, Pakistan can set itself off on the path of a more sustainable and prosperous future. A European perspective on the subject provides enormous potential for Pakistan's energy sector transformation. These lessons on leadership in renewal energy, climate change mitigation, and governance reform offer a path of success for Pakistan in its drive to modernise its energy infrastructure, reduce carbon footprint, and improve governance. Therefore, through increasing European investors, Pakistan can diversify investment sources, improve its regulatory framework, and may have a more sustainable and secure future of energy.