

SECTOR ASSESSMENT (SUMMARY): ENERGY

A. Sector Road Map

1. Sector Performance, Problems, and Opportunities

1. Amid substantial political uncertainty and upcoming elections in the fourth quarter of 2023, Pakistan faces significant economic challenges.¹ After extended discussions, the International Monetary Fund (IMF) and the Government of Pakistan reached a staff-level agreement on a \$3 billion Stand-By Arrangement (SBA) on 29 June 2023.² The SBA follows the \$6.7 billion program that expired in June 2023 and aims to stabilize Pakistan's economy after several external shocks, preserve macroeconomic stability, and encourage financial support from partners. The focus is on restoring proper foreign-exchange market functioning and aligning the fiscal year (FY) 2024 budget with the IMF program goals. The backdrop for the discussions has been an acute balance of payments crisis in Pakistan, depleting foreign reserves and contributing to a substantial devaluation of the Pakistani rupee. Gross domestic product growth for FY2022 and FY2023 is estimated to have been only 0.3%, substantially limiting the fiscal space for the government. Coupled with an inflation rate of 38.0% in May 2023, the headwind for the overall economy remains significant. The SBA with the IMF is considered an important step for Pakistan to provide a policy anchor and a framework for financial support from multilateral and bilateral partners, thereby improving the foreign liquidity situation and averting an outright sovereign default. However, with the upcoming elections and the SBA's limited 9-month tenor, the economic and political uncertainty persists. The full and timely implementation of the SBA will be critical for its success considering the difficult challenges.

2. With the ongoing challenges in Pakistan's overall macroeconomic situation, the power sector faces immense challenges. These are primarily because of high import dependency in the power mix and the rising prices of imported fuel and commodities. Despite having significant indigenous resources such as hydropower and renewable sources, the country relies heavily on thermal generation from imported fuel for power generation, with about 64% of the power generation mix comprised of imported fossil fuels in the past 3 years. Moreover, since 2013, 70% of the added independent power producers have been using imported fuels under the take-or-pay power purchase agreements. As a result of the increase in generation by 13,298 megawatts (MW) between 2016 and 2021, capacity payments charged in United States dollars have increased significantly, and these were further intensified in terms of Pakistan rupees because of the local currency's devaluation at nearly 47%.³ With a low share of renewable energy at 28.1% in FY2022 and a significant rupee devaluation, costs of generation have surged, leading to high consumer-end tariffs. Technical and commercial losses remain high, contributing to circular debt.⁴ Furthermore, floods in July and August 2022 caused damages and losses of PRs17.4 billion (\$81 million) in the power sector, affecting the distribution network and causing interruptions in supply from the national grid.⁵

¹ This sector assessment summary is based on the sector knowledge and operational experience of the Asian Development Bank (ADB) in Pakistan.

² International Monetary Fund. 2023. [IMF Reaches Staff-level Agreement with Pakistan on a US\\$3 billion Stand-By Arrangement](#). Washington, DC.

³ Capacity payments are payments agreed by the government as part of the power purchase agreement to be paid to private power producers against the available capacity irrespective of use.

⁴ In Pakistan, circular debt is a public debt, which is a cascade of unpaid government subsidies resulting in the accumulation of debt on distribution companies. When it happens, the distribution companies cannot pay independent power producers who, in turn, are unable to pay fuel-providing companies, thus creating the debt effect prevalent in the country's energy sector.

⁵ Government of Pakistan, Ministry of Planning, Development and Special Initiatives. 2022. [Resilient Recovery, Rehabilitation, and Reconstruction Framework: Pakistan \(4RF\)](#). Islamabad.

3. The installed electricity generation capacity had increased to 41,557 MW as of 2022.⁶ To effectively evacuate electric power from power generation facilities, the national grid and distribution networks of the National Transmission & Despatch Company Limited (NTDC) and distribution companies have grown regarding the length of transmission lines over the last 5 years (Table 1). However, the transmission and distribution system has not kept pace with the capacity of nearly 15,000 MW added during 2017–2021. Despite investments carried out for capacity enhancements in the transmission and distribution networks, the transmission and distribution losses averaged about 18.0% in the last 5 years compared with the 15.3% target of the National Electric Power Regulatory Authority (NEPRA). More than one-fourth of electricity generated is lost because of poor transmission and distribution infrastructure, theft, faulty metering, and inadequate energy accounting.⁷ During FY2020, out of 121,691 gigawatt-hours (GWh) of energy generated in the country, an aggregated sum of 29,900 GWh (23.7%) was lost during its transmission, distribution, and delivery to end consumers (including nontechnical losses) as sales were recorded at 92,791 GWh only. The share of domestic consumption in the total sales was recorded at 51%, commercial at 7%, industrial at 23%, agriculture at 10%, and other consumers at 9%.⁸ With the additional 10,000 MW of generation capacity in the pipeline, peak demand in the NTDC system is projected to increase from 30,231 MW in 2020 to 32,276 MW in 2027 (footnote 6).

Table 1. Length of Transmission and Distribution Lines
(ckm)

| Year | 500 kV | 220 kV | 132 kV | 66 kV | 33 kV | Total |
|------|--------|--------|--------|-------|-------|--------|
| 2016 | 5,113 | 9,632 | 28,726 | 7,365 | 1,456 | 52,292 |
| 2017 | 5,127 | 10,063 | 25,691 | 7,025 | 2,362 | 50,268 |
| 2018 | 5,618 | 10,478 | 26,844 | 6,182 | 2,362 | 51,484 |
| 2019 | 6,290 | 10,928 | 27,775 | 5,994 | 2,362 | 53,349 |
| 2020 | 7,470 | 11,281 | 29,327 | 6,046 | 2,362 | 56,486 |

ckm = circuit kilometer, kV = kilovolt.

Source: National Electric Power Regulatory Authority.

4. The transmission system that is already overloaded faces further pressures with weaker parts failing with increasing frequency, throwing additional load on the remaining parts, and thus creating a vicious circle of unreliability. The significant addition to the generation capacity with prudent utility practices must be followed in planning investments in the transmission system to ensure the capacity to absorb additional renewable energy and the reliability and quality of supply to provide to distribution companies. Transmission assets should be operated and maintained following best practices and deploying state-of-the-art technologies. This will ensure that demand can be met at the required quality of service, with minimum transmission losses. Poor availability of transmission assets, especially at peak times, causes poor quality of supply to distribution companies and higher transmission losses, may require load shedding, and causes frequent blackouts as witnessed in the nationwide blackout in January 2023. NTDC needs to maintain the higher availability levels and lower loss levels by investing in new equipment for maintenance, streamlining maintenance procedures, and investing continuously in new transmission lines and substations; and utilizing modern and state-of-the-art technologies to increase system efficiency and reliability, provide additional transmission capacity to evacuate renewable energy, and reduce carbon dioxide (CO₂) emissions as committed in Pakistan's nationally determined contributions (NDCs).

5. Inefficient and unreliable electricity supply further hinders access to grid electricity of about 34% of the population and is one of the main constraints to inclusive sustainable growth. In 2021, according to the International Energy Agency, Pakistan's per capita consumption of electricity was

⁶ National Electric Power Regulatory Authority (NEPRA). 2022. [State of Industry Report 2022](#). Islamabad.

⁷ The transmission and distribution losses of distribution companies for FY2017 were 17.95% against the NEPRA target of 15.3%.

⁸ NEPRA. 2021. [Indicative Generation Capacity Expansion Plan \(IGCEP\) 2021–30](#). Islamabad.

516 kilowatt-hours in 2020, with only 80% of the population in the country having access to electricity.⁹ The number will be much lower in rural areas. About 29% of urban and 71% of rural households are energy poor; whereas 55% of households are in multidimensional energy poverty (2014–2015).¹⁰ The high energy cost and unreliable energy supply disproportionately affect women and poor households. The energy crisis exacerbates women's time poverty by increasing the time needed for domestic tasks like cleaning, cooking, and laundry; and reducing the productivity of home-based workers. In Pakistan, about 90% of rural and 50% of urban households use biofuels as their main or supplementary source of energy for cooking, lighting, and operating appliances. Women are responsible for collecting, transporting, processing, and storing fuels. The availability of electricity has a significant impact on gender roles, particularly for women who are typically responsible for managing and using electricity in households. Thus, there are many opportunities to seize and gaps to be filled in Pakistan's power sector to serve the people with an adequate, affordable, reliable, and sustainable supply of electricity.

6. Pakistan's vulnerability to climate change and disasters triggered by natural hazards presents a significant challenge to sustainable and reliable electricity supply. The country is ranked eighth globally and highest in the region for climate change vulnerability, with estimated costs of \$6 billion–\$14 billion per year over 2015–2055 because of extreme weather events and changes in precipitation and water regimes.¹¹ These changes have reduced water availability for hydropower generation and caused infrastructure damage, increased energy demand, and affected the efficiency of nuclear and thermal power plants. Pakistan's greenhouse gas (GHG) emissions are low by global standards—CO₂ emissions grew from 182.73 million tons in 1990 to 361.98 million tons in 2012.¹² The significant increase in GHG emissions, particularly CO₂, is mainly attributed to the burning of fossil fuels for electricity generation, transport, and manufacturing.¹³ Introducing more renewable energy from solar, wind, geothermal, and biomass sources into the generation mix, and municipal waste; energy efficiency; waste management; and carbon capture can help mitigate climate change. On the adaptation side, the measures can include strengthening the transmission and distribution infrastructure to make it climate-resilient and able to withstand natural hazards, such as floods.

2. Government's Sector Strategy

7. In Pakistan, many of the solutions attempted were suboptimal and short-term. Integrated energy planning across all subsectors and long-term planning for generation and transmission and distribution networks are essential for the efficient development of the power sector. Moving toward an integrated sector development approach, the government has issued the National Electric Policy 2021 and is implementing its energy sector reform agenda (outlined and sequenced) in the policy.¹⁴ The approval of an integrated energy plan is under stakeholders' consultations and is expected to be finalized in 2023. The government has developed reform action plans with the support of major development partners. A large part of these reform efforts will be on optimizing the use of tools that were developed in previous efforts and will focus on the recurring financial sustainability issues.

8. For the first time, comprehensive planning has been carried out in Pakistan in the form of the Indicative Generation Capacity Expansion Plan (IGCEP), which includes expansion planning studies and is updated annually to retain accuracy in the wake of changing dynamics. Based on the IGCEP, a Transmission System Capacity Expansion Plan (TSEP) has been developed and is pending NEPRA's approval. The IGCEP and TSEP will be revised each year for a 10-year rolling window

⁹ International Energy Agency. [Pakistan](#) (accessed 30 April 2023).

¹⁰ A. Awan, F. Bilgili, and D. B. Rahut. 2022. [Energy Poverty Trends and Determinants in Pakistan: Empirical Evidence from Eight Waves of HIES 1998–2019](#). *Renewable and Sustainable Energy Reviews*. 158 (C).

¹¹ M. A. A. Khan et al. 2011. [Pakistan National Economics and Environmental Development Study](#). Islamabad.

¹² World Resources Institute. [Climate Watch](#) (accessed 30 April 2023).

¹³ The energy sector is the largest contributor to GHG emissions (46% in 2012).

¹⁴ Government of Pakistan, Ministry of Water and Power. 2021. [National Electricity Policy, 2021](#). Islamabad.

leading toward a more integrated system planning. The government aims to reduce dependence on imported fuels and focus on indigenous hydropower and renewable resources, create a sustainable and reliable transmission system, accelerate private sector participation in supply chain investments, divest assets, and secure financial sustainability through stronger reforms and policy support from development partners. To support IGCEP and TSEP implementation, the Asian Development Bank (ADB) through the Technical Assistance to the Islamic Republic of Pakistan for Preparing Sustainable Energy Projects (FTRTA – 9756) supports NTDC with the preparation of the Transmission Master Plan to prioritize investments in the transmission network to meet the growing demand.¹⁵ The terms of reference for the Transmission Master Plan development are being finalized with the relevant departments of NTDC, and the procurement is expected to be launched in the fourth quarter of 2023.

9. In 2021, Pakistan updated its Climate Action Plan, the NDCs, to reduce emissions and limit temperature increases.¹⁶ The updated NDCs were submitted to the United Nations Framework Convention on Climate Change at the 26th session of the Conference of the Parties (COP26). They aim to reduce 50% of harmful emissions by 2030, with 15% being unconditional and 35% requiring international support. Pakistan prioritizes mitigation goals conditional to external funding, such as producing 60% of energy from renewable resources and transitioning 30% of transportations to electric vehicles by 2030. Additionally, Pakistan's Ten Billion Tree Tsunami Programme sequesters 148.76 metric tons of CO₂ equivalent over 10 years.¹⁷ These mitigation goals align with Pakistan's vision of sustainable development and a climate-resilient state. The 2021 Pakistan NDCs also sets the increase in grid efficiency and upgrade of the transmission network to enable renewable energy as a climate mitigation priority. Following the floods that occurred in 2022, the government, with the support of the international development community, developed a comprehensive Resilient Recovery, Rehabilitation, and Reconstruction Framework to guide and strategize the recovery, rehabilitation, and reconstruction of the country (footnote 5). This strategic policy appeals to a comprehensive approach to investing in sustainable and natural hazards-resilient infrastructure, including in the energy sector.

B. Major Development Partners: Strategic Foci and Key Activities

10. The major development partners in Pakistan's energy sector are ADB, Agence Française de Développement (AFD), the European Union, the European Investment Bank, the Islamic Development Bank, Japan International Cooperation Agency (JICA), German development cooperation through KfW, the United States Agency for International Development (USAID), and the World Bank. The Asian Infrastructure Investment Bank and the Export–Import Bank of Korea are new entrants in the sector. Table 2 presents the major development partners in Pakistan's power transmission projects.

11. ADB is Pakistan's largest financier in the energy sector, providing financing assistance for power generation, transmission, distribution, renewable energy development, and energy efficiency; and supporting the government in transforming the country's energy sector following market-based principles.¹⁸ AFD, JICA, KfW, USAID, and the World Bank support the transmission network enhancement. AFD and KfW also focus on renewable energy and energy efficiency as well as small to medium-scale hydropower plants, power substations, and off-grid solutions. USAID's ongoing support mainly emphasizes the development of efficient systems in all subsectors of the energy sector.

¹⁵ ADB. 2019. [Technical Assistance to the Islamic Republic of Pakistan for Preparing Sustainable Energy Projects](#). Manila (TA 9756-PAK).

¹⁶ Government of Pakistan. 2021. [Pakistan Updated Nationally Determined Contributions 2021](#). Islamabad.

¹⁷ Government of Pakistan, Ministry of Climate Change and Environmental Coordination. 2019. [Ten Billion Tree Tsunami Programme](#). Islamabad.

¹⁸ Since 2005, ADB has provided about \$34.4 billion to finance sovereign loan commitments, nonsovereign operations, and technical assistance projects in the country.

The Islamic Development Bank is supporting energy generation projects and providing a facility to the government to purchase petroleum products.

Table 2: Major Development Partners (Power Transmission only)

| Development Partner | Project Name | Duration | Amount (million) |
|-------------------------------|---|-----------|------------------|
| ADB | MFF Power Transmission Enhancement Investment Program | 2008–2017 | \$810.00 |
| | MFF Second Power Transmission Enhancement Investment Program (tranches 1–3) | 2017–2026 | \$625.00 |
| Germany (through KfW and GIZ) | Ghazi Road Gas-Insulated Substation, Punjab | 2008–2019 | €11.30 |
| JICA | Punjab Transmissions Lines and Grid Stations Project | 2008–2020 | \$126.00 |
| | National Transmission Lines and Grid Stations Strengthening Project | 2010–2019 | \$257.00 |
| USAID | Transmission Lines for Wind and Hydro Power Projects | 2014–2016 | \$7.63 |
| World Bank | Central Asia South Power Transmission Trade Project (IDA) | 2014–2020 | \$198.00 |
| | National Transmission Modernization Project | 2017–2024 | \$425.00 |

ADB = Asian Development Bank, GIZ = Deutsche Gesellschaft für Internationale Zusammenarbeit, IDA = International Development Association, JICA = Japan International Cooperation Agency, MFF = multitranche financing facility, USAID = United States Agency for International Development.

Source: ADB.

C. Institutional Arrangements and Processes for Development Coordination

12. ADB, as the largest and anchor development partner, facilitates the interaction between the energy sector development partners by hosting regular meetings to coordinate policy dialogue and discuss sector and project issues. ADB has effectively partnered with other development partners to (i) continue its strategic role in meeting the government's sector priorities underpinned by the availability, affordability, and sustainability of energy; (ii) synergize interventions; and (iii) capitalize on best practices. It is crucial to maintain coordination and synergy for the relevance, efficiency, and effectiveness of investments and reforms. ADB will continue to lead donor coordination through NTDC focus group discussions and monthly meetings to coordinate efforts on NTDC's financial viability and institutional strengthening.

D. ADB Sector Experience and Assistance Program

13. ADB's support to the Pakistan power sector employed an integrated approach that has included investments in projects related to conventional and renewable energy generation, energy efficiency, and power transmission and distribution, as well as providing program support for institutional and regulatory reforms. The Sector Assistance Program Evaluation (SAPE) conducted by ADB's Independent Evaluation Department, while acknowledging ADB's contribution to increasing the power system's reliability and efficiency and initiating important sector reforms, highlighted the limited progress in integrated system planning focusing on transmission and distribution systems strengthening and expansion.¹⁹ The SAPE recommendations have been incorporated in the proposed Power Transmission Strengthening Project. The proposed project responds to strategic recommendations 3 and 4 and operational recommendations 6 and 8 of the SAPE for the energy sector in Pakistan as well as the management responses.

14. ADB's ongoing support for Pakistan's power transmission subsector through the Second Power Transmission Enhancement Investment Program targets improving the stability and increasing the capacity of the power transmission grid as a prerequisite for meeting an increased demand of electricity and for further deploying renewable sources.²⁰ The proposed project is a logical

¹⁹ Independent Evaluation Department. 2019. [Sector Assistance Program Evaluation: Pakistan—ADB's Support to Pakistan Energy Sector \(2005–2017\)](#). Manila: ADB.

²⁰ ADB. 2016. [Second Power Transmission Enhancement Investment Program](#). Manila.

continuation of this holistic approach and is designed based on lessons learned in the previous projects, notably the high importance of creating transmission capacity to increase the transmission of renewable energy for a reliable and efficient power supply; reducing technical losses by replacing aged infrastructure; strengthening NTDC's financial viability, institutional, project management, and safeguards capacity; and gender mainstreaming at the corporate and project levels.

15. Previous ADB transmission sector projects in Pakistan have had limited gender elements but have improved living standards and reduced women's time poverty (footnote 20). The proposed project will continue the effective gender mainstreaming efforts initiated under the Pakistan Second Power Transmission Enhancement Investment Program (Tranche 4) approved in December 2022. The proposed project incorporates gender actions for women at the service (NTDC) and beneficiary (energy recipients) levels, including technical capacity building, livelihood generation skills training, and gender-inclusive workplace policies. ADB is also providing technical assistance to strengthen NTDC's gender capacity through policy development and technical skills training for female personnel.²¹

16. To address the sector challenges, reduce the demand–supply gap, promote economic growth, and achieve environmental sustainability, the government aims to increase power generation to over 45,000 MW by 2025 and raise the share of indigenous sources to more than 50%—in line with Pakistan's *Vision 2025*, which prioritizes sufficient, reliable, clean, and cost-effective energy for sustainable economic growth.²² Aligned with the IGCEP 2021–2031;²³ the National Power Policy, 2013;²⁴ and the National Electricity Policy 2021 (footnote 14); the proposed project aims to improve energy access in the country, where only 80% of the population has access to electricity and rural areas face greater challenges (footnote 9). The project will deploy state-of-the-art high-efficiency, high-temperature, low-sag conductors that can withstand higher operating temperatures, reduce electricity losses, and transport more electricity compared to standard technology. The project design envisages strengthening the transmission pylons to withstand floods and extreme weather events. The project also involves the use of drones equipped with state-of-the-art sensors to monitor project construction and inspect and maintain transmission lines after project completion.²⁵

17. The project will support women's participation in nontraditional fields, such as the energy sector, through technical and office-based employment, the provision of small energy equipment, and training on livelihood and income-generating skills with the productive use of energy for women of project communities. An improved and reliable electricity supply will further boost economic opportunities for the project's communities, particularly for women. The 2021 Pakistan NDCs set the increase in grid efficiency and upgrade of the transmission network to enable renewable energy as climate mitigation priorities. The proposed project will help achieve the government's NDC target of a 35% decrease in GHG emissions by 2030, against the business-as-usual baseline.

18. Through private and public sector operations, ADB will continue to (i) work for leveraging its interventions to bring much needed funds for modern energy (including improving governance and addressing the accumulation of circular debt) for inclusive growth in a socially (inclusive of effective gender mainstreaming), economically, and environmentally sustainable way within a changing regional, global, and technological context; and (ii) foster the transfer of knowledge of technologies, regulation, and best practices between Pakistan and the region.

²¹ ADB. 2022. [Subproject 6: Strengthening Gender Capacity of Pakistan's National Transmission Company](#). Manila.

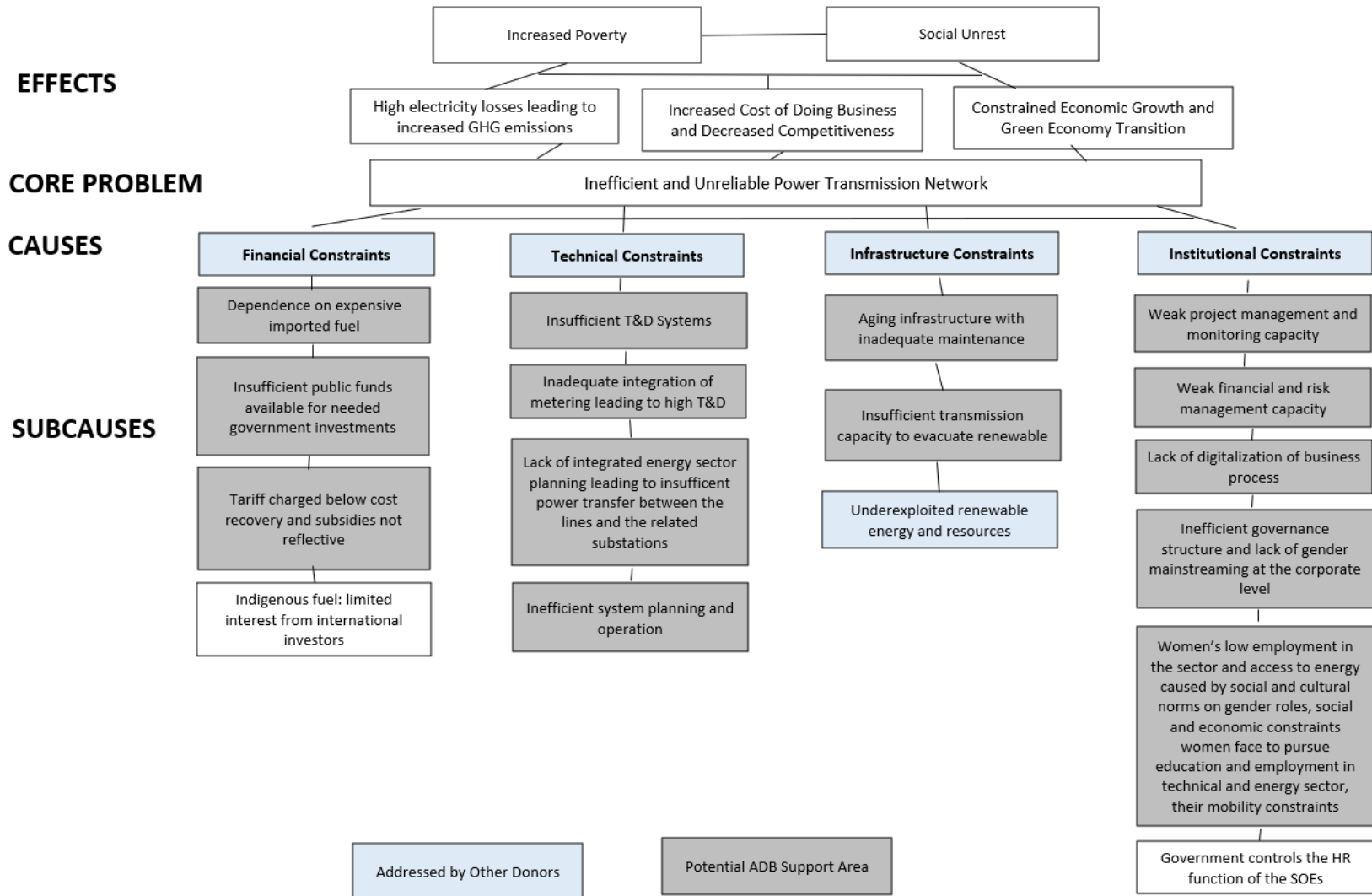
²² Government of Pakistan. 2014. [Pakistan Vision 2025: One Nation, One Vision](#). Islamabad.

²³ Government of Pakistan, NTDC. 2021 [Indicative Generation Capacity Expansion Plan 2021–2031](#). Islamabad.

²⁴ Government of Pakistan, Ministry of Water and Power. 2013. [National Power Policy, 2013](#). Islamabad.

²⁵ This will enable the early detection and mitigation of potential risks to the power transmission network, thereby enhancing the safety of maintenance personnel.

Problem Analysis Diagram for Energy



ADB = Asian Development Bank, GHG = greenhouse gas, HR = human resources, SOE = state-owned enterprise, T&D = transmission and distribution.
 Source: ADB.