SECTOR ASSESSMENT (SUMMARY): ENERGY

A. Sector Road Map

1. Sector Performance, Problems, and Opportunities

1. Sector overview. Pakistan’s total primary energy supply increased by 8.55% in 2018 compared with a reduction of 0.21% in 2013. The energy demand is projected to grow by 4%–6% per year up to 2043 (depending on the gross domestic product growth scenario). The increase in primary energy supply is attributable to (i) the introduction of liquefied natural gas (LNG) in the sector, following the signing of the 15-year agreement with Qatar for an annual purchase of 3.75 million tons; (ii) 13 gigawatts of generation added since 2013, with about 70% utilizing imported fuels (including coal); (iii) expedition of the works related to the exploitation activity in Thar coal field; and (iv) the deployment of renewable energy sources. The country’s depleting resources and low rate of discovery of fossil fuels have resulted in Pakistan importing nearly a third of its energy resources in the form of oil, coal, and LNG.

2. Pakistan experienced an average economic growth of 4.8% starting from fiscal year (FY) 2014 (July 2013–June 2014) till FY–2018, Pakistan’s growth trajectory dipped to 1.19% in FY2019 and –0.38% in FY2020, however, FY2021 recorded a healthy 3.94% growth. Energy sector entities, with losses of more than $2 billion per annum, continue to rely on significant regular fiscal transfers and sovereign credit guarantees to maintain their operations, with power distribution companies (DISCOs) being the major recipient—totaling nearly 1.5% of the gross domestic product. The trade and export competitiveness of industry, which was impaired by persistent outages in the past, now face high power costs.

3. Pakistan’s power mix is a combination of thermal, nuclear, hydroelectric, and renewable energy. In FY2021, of the 143,558 gigawatt-hours generated, thermal accounted for 62%, hydro accounted for 27%, nuclear for 7.7% and renewables accounted for 3.15%. Private sector generation plants, with almost 48% of total installed generation capacity (19 megawatts [MW]),

Table 1: Energy Mix in 2020 and 2030

<table>
<thead>
<tr>
<th>Type of Plant</th>
<th>Share of Mix in 2020 (%)</th>
<th>Share of Mix in 2030 (%)</th>
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<tbody>
<tr>
<td>A. Thermal plants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Natural gas</td>
<td>65.0</td>
<td>25.0</td>
</tr>
<tr>
<td>2. Local coal</td>
<td>14.0</td>
<td></td>
</tr>
<tr>
<td>3. Imported coal</td>
<td>3.0</td>
<td>13.0</td>
</tr>
<tr>
<td>4. Residual furnace oil (RFO)</td>
<td>18.0</td>
<td>3.0</td>
</tr>
<tr>
<td>5. Re-gasified liquid gas based technologies (RLNLG)</td>
<td>26.0</td>
<td>9.0</td>
</tr>
<tr>
<td>B. Nuclear plants</td>
<td>5.0</td>
<td>13.0</td>
</tr>
<tr>
<td>C. Hydroelectric plants</td>
<td>26.0</td>
<td>37.0</td>
</tr>
<tr>
<td>D. Renewable resource plants</td>
<td>4.0</td>
<td>25.0</td>
</tr>
<tr>
<td>1. Solar</td>
<td>1.0</td>
<td>9.0</td>
</tr>
<tr>
<td>2. Wind</td>
<td>2.0</td>
<td>14.0</td>
</tr>
<tr>
<td>3. Bagasse</td>
<td>1.0</td>
<td>2.0</td>
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</tbody>
</table>


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contributed about 47%. In 2012, a gap of 700 MW between demand and supply resulted in extensive load-shedding of about 12 hours in urban and industrial areas. Since 2016, significant progress has been made in reducing the gap between supply and demand, primarily through large investments in generation. The bulk of the new investment has been in thermal generation, based on imported fuel. Pakistan has systematically attempted to shift from expensive imported furnace oil to cheaper and more efficient gas generation by importing LNG. These investments resulted in an electricity surplus for Pakistan in 2019, for the first time since 2005. Peak demand in the National Transmission and Despatch Company (NTDC) system is projected to slightly increase from 28,253 MW in 2021 to 29,398 MW in 2026.

4. The country’s power generation mix is deeply skewed toward thermal generation from imported fuel, despite the availability of significant indigenous resources (hydropower, coal, gas, and renewable sources). In 2020, about 60% of the power generation mix comprised imported fuels, with an average generation cost of $0.85 per kilowatt-hour. This imbalance has put severe pressure on the fragile balance of payments, undercut sector governance, consumed sector liquidity, and exasperated the “circular debt” deficit to reach around $13.50 billion (flow and stock) in FY2021. Of the independent power producers (IPPs) added since 2013, 70% utilize imported fuels under take-or-pay power purchase agreements. With the increase in generation of 13,298 MW from 2016 to 2020, the capacity payments charged in United States dollars increased significantly and were accentuated in Pakistan rupees by a devaluation of nearly 47%.

5. On the downstream side, in spite of investments to enhance the capacity of the transmission and distribution (T&D) networks, T&D losses still averaged about 18.0% between calendar years (CY) 2016-2020 compared with the NEPRA target of 15.3%. The electricity generated is lost because of theft, faulty metering, aging T&D infrastructure, and inadequate energy accounting. The energy sector’s inability to recover its full costs over long periods has spilled over to other sectors in the supply chain, including generators, fuel, and equipment suppliers. The cost of energy delivery to consumers (including generation, transmission, and distribution) is nearly 30% higher than the revenue recovered from consumers.

6. Sector structure and reforms. Pakistan’s energy sector has undergone a substantial and protracted reform process, starting in 1992 with a plan to unbundle and privatize the Water and Power Development Authority (WAPDA), the government-owned integrated utility at the time. The Policy Framework and Package of Incentives for Private Sector Power Generation Projects in Pakistan allowed IPP participation in the sector for the first time, and the government created the Private Power and Infrastructure Board to promote private investment in the energy sector. A new energy (electricity) sector regulator—the National Electric Power Regulatory Authority (NEPRA)—was established in 1995 and approved by Parliament in 1997. This was followed by sector unbundling. WAPDA’s hydroelectric generation was separated from the thermal operations, which were split into government-owned generating companies. A new NTDC was set up to manage the grid, and nine (now 10) DISCOs were established to provide electricity to customers in different

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6 Circular debt is the accumulated cash shortfall across the power supply chain as the deficits in power distribution companies (DISCOs) cascade to power generators and fuel suppliers.
7 Capacity payments are the payments agreed by the government as part of power purchase agreements, to be paid to independent power producers (IPPs) against the available capacity irrespective of usage.
8 The refers to the gross billing minus the unrecovered amount and unfunded subsidies.
parts of the country. All 10 DISCOs are fully owned by the government. K-Electric Limited (formally Karachi Electric Supply Company), is responsible for power generation and distribution in the Karachi area and is privately owned and listed on the Pakistan Stock Exchange. The hydropower plants were retained by WAPDA, which now reports to the Ministry of Water Resources after the bifurcation of the Ministry of Water and Power in 2017. The Alternative Energy Development Board was established in May 2003 to facilitate, promote, and encourage the development of renewable energy in Pakistan. Finally, in 2015, the Central Power Purchasing Agency Guarantee Limited was separated from the NTDC to act as the system operator responsible for being the single buyer of electricity from generators and seller to the DISCOs, while the NTDC focused on the management of the T&D system. NEPRA determines tariffs, issues licenses, and regulates and ensures long-term sector sustainability. For an integrated approach to set sector policies, the Ministry of Energy was created in 2018 by combining the Ministry of Petroleum and Natural Resources and the Power Division from the then Ministry of Power and Water Resources.

7. Through an amendment to the Constitution of Pakistan in 2010, each federating unit (province) was empowered to formulate its policy framework for the development of power generation in both the public and private sectors. This has led to the formation of dedicated provincial departments and renewable specialized companies to foster and execute power projects in public, private, and public–private partnership modes with indigenous power resources.

8. Despite these major steps, Pakistan has continued to suffer from inadequate capacity and other constraints, leading to large and frequent blackouts from 2000 to 2017. With aggressive generation expansion under the China–Pakistan Economic Corridor Program since 2017, the sector has transformed from crippling shortages to expensive surpluses. The T&D system has not kept pace with capacity of nearly 15,000 MW added during 2017–2021, with an additional 10,000 MW in the pipeline. At the heart of the impasse is the circular debt crisis as mentioned in para 4. This leads to the sector being periodically bailed out by the government once losses accumulate to intolerable levels, at a high cost to the Treasury. This dynamic has undermined incentives for utilities to improve their efficiency, while discouraging generators from investing in new capacity to address supply shortages. In the meantime, little has been done to accelerate access to electricity to the significant share of the unserved population in rural areas.

9. **Uneconomic electricity pricing and subsidies.** The government does not charge electricity customers the full cost of service and subsidizes DISCOs for the difference between the customer tariff and the tariff determined by NEPRA. The government has paid more than PRs1 trillion in tariff differential subsidies since 2008. The difference between the customer tariff and the cost-recovery tariff, and the delay in determining and applying the cost-recovery tariff, have caused payment arrears to fuel suppliers and IPPs, efficiency losses resulting from insufficient funds for maintenance and augmentation of system capacity, and concerns regarding the creditworthiness of private investors and their financiers. The result is an unsustainable circular debt eroding sector financial sustainability, crippling governance, and cutting infrastructure improvements.

10. **Accountability and transparency.** Concerns about payment to power suppliers, unclear demarcation between federal and provincial investment policies, and lack of transparent payment practices have been cited as an obstacle to enhanced private sector participation in the energy

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10 For example, Peshawar Electric Supply Company (responsible for distribution in Khyber Pakhtunkhwa province) incurred losses of 33.81%, against NEPRA’s target allowable losses of 26.00% in 2016, resulting in a tariff deferential subsidy of about PRs13 billion (the total tariff differential subsidy for all 10 distribution companies was PRs66 billion).
sector. On the other hand, public sector companies are not held accountable for their performance because of lack of transparency in operation and payment mechanisms. The Central Power Purchasing Agency Guarantee Limited provides a transparent settlement system and will develop into a competitive electricity pricing platform, while NEPRA is working on improving public awareness of the energy sector data. However, better access to energy sector data will foster demand for information and a culture of transparency. This will lead to improved monitoring of sector developments by stakeholders.

11. **Climate change.** Pakistan is ranked eighth globally and highest in the region for climate change vulnerability.\(^{11}\) The future cost of climate impacts is estimated to be $6 billion–$14 billion per year over 2015–2055.\(^{12}\) The impacts are largely present in increased intensity and frequency of extreme weather events, unpredictability of precipitation, and changes to water regimes and peak seasonal runoff, caused in part by rapid snow melt and glacier retreat because of rising temperatures. Landslides and erosion result in the siltation of water reservoirs. Changes in rainfall patterns and glacial melt have also reduced the availability of water for hydropower generation. Climate change may also (i) damage the oil, gas, and power infrastructure because of heavy precipitation leading to flooding; (ii) increase energy demand because of higher temperatures; and (iii) affect the efficiency of nuclear and thermal power plants because of warmer air temperatures. Pakistan’s greenhouse gas (GHG) emissions are low by global standards—carbon emissions grew from 182.73 million tons in 1990 to 361.98 million tons in 2012.\(^{13}\) The significant increase in GHG emissions, particularly carbon dioxide, is mainly attributed to the burning of fossil fuels for electricity generation,\(^{14}\) transport, and manufacturing. Renewable energy from solar, wind, geothermal, biomass, and municipal waste; energy efficiency; waste management; and carbon capture can be mitigating actions. The government is committed to reducing 20% of the country’s projected GHG emissions by 2030. The government realizes that energy and agriculture will continue to predominate in GHG emissions therefore has identified as a high priority the adoption of mitigation measures in the energy sector through the development of solar, wind, and hydroelectricity.\(^{15}\)

2. **Government’s Sector Strategy**

12. The sector has inadequate tariffs and inefficient subsidies, high generation costs, unsustainable commercial and technical losses, weak governance, and lack of integrated planning. On assuming office in September 2018, the government constituted an energy task force to address subsector issues in an integrated manner—including upstream planning (power and hydrocarbons), downstream investments, and the implementation of reforms to institutional and governance issues cross-cutting the energy supply chain. The government intends to implement its energy sector reform agenda, outlined and sequenced in the approved National Energy Policy (NEP-2021), and an integrated energy plan currently under stakeholder consultation and is expected to be finalized in FY2022. 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 focusing on prioritizing recurring financial sustainability issues to streamline the tariff notification cycle; strengthening energy accounting; and reducing

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\(^{13}\) World Resources Institute. *CAIT Climate Data Explorer.*

\(^{14}\) The energy sector is the largest contributor to GHG emissions (46% in 2012).

\(^{15}\) PAKISTAN’s Intended Nationally Determined Contribution (INDC), Ministry of Climate Change, Pakistan.
generation costs by inducting solar, wind, and hydropower without capacity charges as well as by addressing the sector's governance and infrastructure constraints. The Circular Debt Management Plan has also been finalized to address the sector's sustainability.

13. The government announced the National Power Policy in 2013, outlining its sector strategy to support the development of hydropower projects and encourage the development of renewables. The Power Generation Policy was announced in 2015 to simplify investment decision-making by local and federal authorities and to identify zones of responsibility in processing and implementing generation projects. The new Alternative and Renewable Energy Policy 2020, and National Electricity Policy 2021 feed into the drafting of the Indicative Generation Capacity Expansion Plan to reduce dependence on imported fuels and focus on indigenous resources, accelerate private sector participation in supply chain investments, divest assets, and secure financial sustainability through stronger reforms and policy support from development partners.

3. ADB Sector Experience and Assistance Program

14. Asian Development Bank (ADB) support to Pakistan’s energy sector has employed an integrated approach that has included investments in projects related to conventional and renewable energy generation, energy efficiency, and power T&D, apart from providing program support for institutional and regulatory reforms. The sector assistance program evaluation conducted by the Independent Evaluation Department acknowledged ADB’s contribution in increasing the power system’s reliability and efficiency, and in initiating important sector reforms, but highlighted the limited progress in strengthening the financial sustainability of the energy sector.

15. ADB has brought new technology and pilot-tested innovative solutions through sovereign and nonsovereign operations. The current portfolio for the energy sector consists of two multitranche financing facilities (MFFs). The transmission MFF supports network expansion while the distribution MFF introduces advanced metering infrastructure in the distribution grid. Each MFF includes an Asian Development Fund loan that supports capacity development and performance improvement. In addition to the MFFs, ADB is supporting the development of renewables through the Access to Clean Energy Program and is financing a 660 MW supercritical coal-fired power plant (the Jamshoro Power Generation Project). On the nonsovereign side, ADB has contributed with the establishment of the first wind and hydropower plants in the private sector, and supported the setting up of the first LNG terminal by the private sector.

16. ADB is working with the government and development partners to implement the $1 billion programmatic approach through the Energy Sector Reforms and Financial Sustainability Program. It builds on earlier policy-based interventions undertaken by ADB and supplemented by development partners. The program assists Pakistan to reduce financial, technical, and governance deficits in the energy sector, which adversely impact sector sustainability and affordability and Pakistan’s fiscal balance and macroeconomic stability. These reforms will be underpinned by a

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16 NEPRA. NEPRA | Power Policies. Islamabad.
19 ADB. Pakistan: Access to Clean Energy Investment Program.
20 ADB. Pakistan: Jamshoro Power Generation Project. The project has set benchmark for safety/environmental standards, and cost through international competitive bidding, and aims to build capacity in the public sector for coal-fired power operations to enable oversight of IPPs.
strong ongoing and future investment project pipeline, totaling nearly $2 billion during 2020–2023, to support the expansion and metering of T&D systems, generation through indigenous resources, and the development of gas infrastructure and storage to bring efficiency and to ensure continuity and safeguard against sudden import price spikes.
Problem Analysis Diagram for Energy

**Core Problem:**
Unsustainable circular debt eroding sector financial sustainability, crippling governance, and cutting infrastructure improvements

**Effects:**
- Suboptimal availability of affordable, reliable, and indigenous energy in grid stifling economic growth
- Pressure on foreign reserves due to fuel imports, capacity, and energy payments to IPPs
- Increased cost of production and decreased competitiveness

**Core Causes:**
- Financial Deficit
  - Limited private sector downstream
  - High dependence on imported fuels with high generation cost
  - Lack of transparency in payment to IPPs
  - Gap between generation cost, tariffs, subsidies, and recoveries
  - Cost of energy delivery (generation + transmission + distribution) > Revenue received (net actual recovery + unfunded)
  - Loss clarity in taxation issues, royalty payments, dispatch merit

- Governance and Institutional
  - Lack of integrated sector master planning
  - Lack of political ownership to undertake decisions
  - Lack of SOEs’ commercialization and autonomy
  - Minimal use to technology and metering to check system losses and improve in SOE ERP systems
  - Lack of systems for competitive procurement of energy

- Infrastructure Deficit
  - T&D infrastructure mismatch with newly added generation capacity
  - Aging infrastructure and fewer maintenance funds
  - Unsustainable technical and commercial losses
  - Fewer indigenous generation projects
  - Insufficient renewable and off-grid solutions
  - Irregular auction of oil and gas exploration rounds
  - Climate resilience of energy

- Regulatory and Policy Deficit
  - No appellate tribunals to challenge regulatory decisions
  - Limited focus on energy efficiency and conservation
  - Lack of provincial consensus on projects
  - Poor fuel mix and sales mix
  - Poor incentives for hydrocarbons E&P
  - Lack of enforcement of testing protocols (efficiency curves, heat rate measurement) for power entities

**3 subprograms in coordination with development partners to focus on:**
(i) securing Financial sustainability, (ii) strengthening governance (institutional and regulatory), and (iii) reinforcing Infrastructure and system improvements

E&P = exploration and production, ERP = enterprise resource planning, IPP = independent power producer, SOE = state-owned enterprise, T&D = transmission and distribution.