SECTOR ASSESSMENT (SUMMARY): POWER

1. Sector Performance, Problems and Opportunities

1. A reliable and sustainable power sector is essential to the economic growth and well-being of Pakistan. Load shedding has become common and severe, leading to civil strife and factory closures. Chronic power shortages are estimated to have reduced gross domestic product (GDP) growth by at least 2% in 2012, and are considered the major cause of the slowdown in large-scale manufacturing, which grew at only 1.2% in 2012 and 2.8% in 2013.[1] Private investments decreased by 4.1% during 2008 to 2013. Despite a huge increase in the power tariff, income from the sale of power was unable to keep pace with the rising cost of imported fuel nor the sector's maintenance needs. Electricity subsidies equaled about 1.8% of GDP in 2013,[2] and significantly reduced the funds available for social welfare and infrastructure. The newly elected government has vowed to resolve the power crisis, and has approved the National Power Policy.

2. **Sector structure and reforms.** Reforms have been ongoing in Pakistan since 1992. The pace of reform has been slow, however, and the expected efficiencies have yet to materialize. The reforms include the unbundling and corporatization of the Water and Power Development Authority to nine regional power distribution companies (DISCOs), four government-owned thermal power generation companies (GENCOs), and a transmission company licensed as a single buyer and seller of electricity—the National Transmission and Despatch Company (NTDC); the Water and Power Development Authority retained hydropower plants. All are fully owned by the government. Karachi Electric Supply Company, which is responsible for power generation and distribution in the Karachi area, is listed on the stock exchange and is privately owned. Privately owned independent power producers (IPPs) generates 56% of the country's power. The National Electric Power Regulatory Authority (NEPRA) was established to determine tariffs, issue licenses and regulate and ensure the long-term sustainability of the sector. The Ministry of Water and Power sets sector policies, including the tariffs paid by electricity customers. The Central Power Purchasing Agency acts as the clearing house and is the single buyer and seller of electricity to the generation and distribution companies (GENCOs and DISCOs). The root causes of the power crisis can be traced to generation capacity, and financial and management issues.[3]

3. **Generation capacity.** Pakistan's electricity supply has not kept up with demand. Demand grew by 81% during 2002–2012, reaching 21,997 megawatts (MW), while installed capacity increased only by 29%. The contribution of hydropower to total generation declined from 72% in the 1980s to 32% in 2012.[4] Currently most power (68%) is thermally generated—comprising domestic natural gas (26%), fuel oil (34%), high speed diesel (1.64%), nuclear (5%), and coal (0.07%)—with the balance made up of wind power (0.01%), and power imports (0.33%).[5] The domestic gas allocation has decreased by 28% from 2008 to 2011.

4. In 2011, electricity shortages averaged around 4,000 MW to 5,000 MW during peak times.[6] In June 2012, total installed generation capacity reached 23,538 MW, with a de-rated capacity of 18,704 MW (15,731 MW during winter). The shortage of funds to pay for fuel oil

[1] ADB. 2013. *Asian Development Outlook 2013 Update: Governance and Public Service Delivery*. Manila.
[2] International Monetary Fund. 2013. *Pakistan: 2013 Article IV Consultation and Request for an Extended Arrangement Under the Extended Fund Facility*. Washington D.C.
[3] ADB. 2012. *Asian Development Outlook 2012: Asia's Confronting Rising Inequality in Asia.* Manila.
[4] Government of Pakistan, National Transmission and Despatch Company. 2012. *Power System Statistics 2011-2012*. Lahore.
[5] Government of Pakistan, National Electric Power Regulatory Authority. 2012. *State of Industry Report, 2012.* Islamabad.
[6] Peak demand in Pakistan occurs from 6 p.m. to 10 p.m. (footnote 5).

and the lack of a natural gas allocation has constrained power generation to 14,000 MW. Pakistan needs to replace and rehabilitate inefficient power plants and change the energy mix to reduce power generation costs. The National Power Policy encourages IPPs to invest in new power plants and to convert old or existing power plants to use less expensive fuels. However, under current economic conditions, the private sector will not be able to provide all of the needed funding. The GENCOs, which make up 52% of installed generation capacity, have lost 25% of their capacity due to insufficient or inadequate maintenance. This has affected the efficiency and available capacity of the GENCOs. Electricity demand is forecast to increase at 5%–6% per year over the next 10 years, or by 32,000 MW by 2020 (footnote 5).

5. Pakistan has a low carbon footprint, largely because of its domestic gas and hydropower resources.[7] The country's estimated per capita carbon emissions are 0.81 tons per year, or just 19% of the world's average, and 0.47% of total global emissions.[8] However, gas reserves have been declining. The 2012 gas policy to encourage new fields and increase production from old fields has yet to produce results. Demand from industry, transport and retail customers has decreased the allocation to the power sector. No large hydropower plants have become operational since 2003. Rising demand and declining domestic supply have increased dependence on imported fuel oils.

6. Pakistan is exploring all its options to increase electricity supply, including through (i) conservation; (ii) energy efficiency measures; (iii) domestic production; and (iv) the import of liquefied natural gas, coal, piped natural gas from Turkmenistan and Iran, and electricity from Central Asia, India and Iran. A comparative analysis of alternative generation in Pakistan for affordable base-load power is shown below. Based on the analysis, coal generation is the best medium-term solution, and large hydropower with storage the preferred long-term solution.

Comparative Analysis of Alternative Generation for Power Plants in Pakistan

Generation Type	Remarks
Nuclear Large-capacity base-load plant. Provides a medium-term solution, requires imported fuel. Generation cost: low.	Under development with assistance from PRC. Concerns include public opinion, and waste management and safety issues. After the Fukushima nuclear accident in 2011, the real cost of nuclear power and safety concerns have been brought into question.
Large Hydro Large-capacity base-load plant. Does not provide a medium-term solution, uses local fuel. Generation cost: low.	Being pursued as a long-term solution. Concerns include long construction period, seasonal fluctuation in water flow and power generation, social safeguard issues, and long distance to load center.[9]
Biomass Limited-capacity, non-base-load plant. Provides a medium-term solution, uses local fuel. Generation cost: low.	Being pursued; size limited, because biomass must be sourced locally to reduce transport costs. Not base load.
Solar and Wind Limited-capacity, non-base-load plant. Provides a medium-term solution, uses local fuel. Generation cost: high.	Being pursued; not base load. Concerns include intermittent availability, relatively expensive generation cost and features.
Furnace Oil Large-capacity base-load plant. Provides a medium-term solution, requires imported fuel. Generation cost: high.	Expensive generation cost resulting from use of imported oil. Pakistan depends on this fuel for 36% of generation; fuel accounts for 75% of total costs. Diversification away from expensive oil to other sources is urgently needed in Pakistan.

[7] The top four primary energy supplies in Pakistan were 47.5% gas, 32% oil, 11.7% hydroelectricity, and 6.7% coal (footnote 5).

[8] International Energy Agency. 2011. *Power Generation from Coal-Ongoing Developments and Outlook*. Paris

[9] Ranking of priority projects are set out in Friends of Democratic Pakistan. 2012. *A Productive and Water-Secure Pakistan*. Islamabad.

Generation Type	Remarks
Natural Gas Large-capacity base-load plant. Provides a medium-term solution (LNG), requires imported fuel. Generation cost: high (LNG).	Domestic natural gas from existing fields is being depleted. Government is encouraging investment to increase production but without results to date. LNG and import pipelines have been delayed; generation cost is relatively high when using LNG.
Coal Large capacity base-load plant. Provides a medium-term solution, uses local fuel. Generation cost: low.	Domestic lignite mines are being explored. Imported low-sulfur coal is available. Cleaner technology can reduce GHG emission compared to lower efficiency power units that use high-sulfur fuel oil.

GHG = greenhouse gas, LNG = liquefied natural gas, PRC = People's Republic of China
Source: Asian Development Bank

7. **Financial issues.** Beginning in 2003, tariff increases were inadequate to cover operational costs. The government increased customer tariffs by 106% from February 2008 to June 2013, but nevertheless subsidized power by about PRs5.79 per kilowatt-hour to cover costs. A monthly fuel adjustment was intended to prevent the subsidy from being affected by fuel price increases, but this has not been achieved, with delays in determination and court challenges. There was a 7-month lag in fuel price adjustment in 2013; depending on the timing of subsidy payments, late payment interest and penalties have been charged. In addition, losses and costs not recognized by NEPRA accumulate at the DISCO level. In FY 2013, the government paid tariff differential subsidies of PRs281 billion and resolved an additional PRs480 billion in payment arrears to IPPs and fuel companies.

8. As part of the government's plan to decrease subsidies in the power sector, the government discussed with the International Monetary Fund that over the next 3 years it will restrict subsidies to low-income customers, improve efficiency and governance, and further reduce costs (footnote 2). The tariffs were increased by 50% for industrial, commercial and bulk buyers in August 2013.

9. **Management issues**. The lack of independence, accountability, and incentives among DISCOs has kept technical and commercial losses high (at 10%–37%). The government is appointing independent board of directors and calling for chief executive officers to increase accountability and select staff based on merit. Performance contracts are also being put in place to enable transparent evaluation. Laws will be amended to criminalize electricity theft by the end of 2013.

10. The limited maintenance funds that are available to GENCOs have made it difficult to improve performance and hold staff accountable. Despite declining efficiency, GENCOs have not petitioned for a tariff revision since July 2007. Under the NEPRA tariff, GENCOs incur losses for every kilowatt-hour (kWh) sold, even if paid in full. To address these losses, GENCO will submit petitions after testing for efficiency and put in place new measuring and testing equipment to improve monitoring and curtail governance issues.

11. In FY2012, total transmission and distribution losses were marginally improved (by 0.41%) and reached 20.46%. About 520 kilometers of 220-kilovolt (kV) transmission lines and two 220-kV substations were added to the NTDC system in FY2012. The transformer capacity of 220-kV substations was also increased by 1,550 megavolt-ampere over the same period. Nearly 6,500 circuit-kilometers of 11 kV lines were added in the DISCOs. DISCOs added 737,000 consumers during FY2012, for a total of 21.05 million customers, 85% of which are residential customers. A total of 10,268 villages have been electrified. However, about 240,000 applications for new connections were still pending as of 30 June 2012 (footnote 5).

2. Government Strategy

12. In July 2013, the Ministry of Water and Power launched an ambitious National Power Policy to support current and future energy needs. The National Power Policy seeks to eliminate load shedding by 2017, (i) reducing the average system-wide generation cost from $0.12 per kWh to $0.10 per kWh by 2018, (ii) decreasing transmission and distribution losses from the current 25%–28% to 16% by 2018, and (iii) increasing revenue collection from 85% to 95% of billing. The government also aims to reduce processing times for all sector functions and operations.

13. The National Power Policy's goals and targets will be achieved by making the power sector operation and development more efficient, competitive and sustainable. Efficiency will be established through promotion of system-wide merit order (e.g., in fuel allocation, dispatch, payments, and the power mix). Transparency will be achieved by providing seamless access to information through public websites, and accountability through hiring of professionals on the basis of competency, the signing of performance contracts, and a zero tolerance approach to corruption and poor performance. Competition will be based on infrastructure development, upfront tariffs, competitive bidding, and key client management. NEPRA will be strengthened and a one-window operation established to facilitate private sector investors. Sustainability will be achieved through the use of low-cost energy, fair treatment of stakeholders, rationalization of consumer tariffs, and demand management through pricing and regulatory instruments.

14. The strategy prioritizes maximizing the impact of various initiatives. In the short term, the government will bring existing but idle or underused power generation capacity online, stop electricity theft, sign performance contracts with sector entities, and ensure transparency in sector governance and management. In the medium term, low-cost gas pipeline, coal, and hydropower projects will be implemented. In the long term, large infrastructure hydropower projects will be completed, and existing high-cost energy projects and contracts will be retired, to ensure more affordable electricity generation. To do this, the government must engage in ongoing monitoring of implementation and ensure it meets the evolving needs of the power sector.

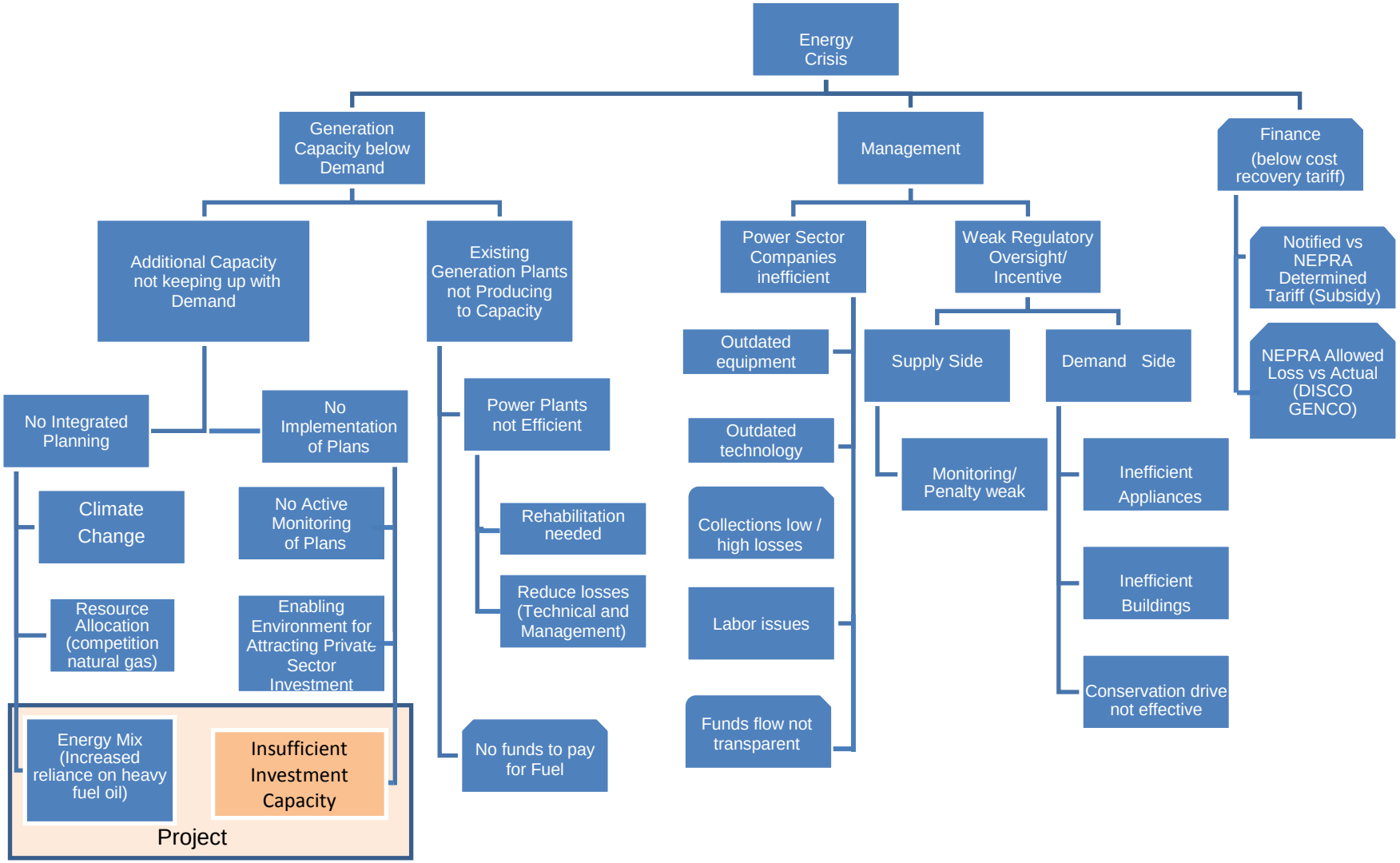
3. Asian Development Bank Sector Experience and Assistance Program

15. **Asian Development Bank interventions**. The Asian Development Bank (ADB) multitranche financing facilities (MFFs) have been approved to finance energy efficiency, transmission, distribution and renewable energy projects that follow sector roadmaps. Each MFF has support loans, funded by the Asian Development Fund, to improve capacity and performance. The ongoing projects aim to reduce carbon dioxide emissions by over 3.5 million tons. As the sector's largest donor, ADB holds regular policy dialogues on reforms, planning and implementation, and provides periodic sector assessments to the International Monetary Fund country reviews upon request.

16. The government and donors developed a framework for resolving the energy crisis through the Friends of Democratic Pakistan Energy Task Force. ADB coordinates a quarterly meeting with major energy donors to discuss the sector's status and projects' progress. This forum enables donors to coordinate closely and engage in policy. Governance issues are being addressed through procurement outsourcing and capacity development. ADB has partnered with Agence Francaise de Developpement in the MFF for Energy Efficiency Investment Program.[10] ADB has also actively sought cofinancing opportunities with other donors, including the Japan International Cooperation Agency and the Islamic Development Bank.

[10] ADB. 2009. *Report and Recommendation of the President to the Board of Directors: Proposed Multitranche Financing Facility and Administration of Cofinancing to the Islamic Republic of Pakistan for the Energy Efficiency Investment Program.* Manila.

Problem Tree for Energy Sector



Sector Results Framework (Pakistan Energy Sector, 2009–2013)

Country Sector Outcomes		Country Sector Outputs		ADB Sector Operations	
Outcomes with ADB Contribution	**Indicators with Targets and Baselines**	**Outputs with ADB Contribution**	**Indicators with Incremental Targets**	**Planned and Ongoing ADB Interventions**	**Main Outputs Expected from ADB Interventions**
Reliable and affordable energy services through the development of indigenous energy resources (hydropower, renewable energy, coal, and gas) and strengthening transmission and distribution networks	Additional 8,400 GWh per annum of power generated from coal by 2019 (baseline: 89,238 GWh, 2010) Decreased HFO share in the power generation mix to 31% by 2019 (baseline: 36%, August, 2012) Increase coal share in the power generation mix to 5% by 2019 (baseline: 0.07%, August, 2012) Reduced NEPRA energy purchase price for Jamshoro TPS by 50% by 2019 (baseline: $0.212 per kWh, June 2012)	Increased efficiency, both technical and financial, of the power and natural gas systems	Installation of two 600-MW supercritical coal-fired units. Bioremediation of contaminated soil; construction of hazardous waste storage facility, effluent pipeline, landfill for colony waste, proper lined evaporation ponds, etc. Installation of emission control devices (FGD) for existing units. Training manuals developed, at least 30 staff (M/F) and 10 trainers trained on coal-fired power plant operation. At least 50 relevant staff (M/F) trained on safeguard, procurement, financial, and technical operation aspects. Inclusion of at least one subject related to coal-fired plant operation in technical schools. Bioremediation of the contaminated soil; construction of hazardous waste storage facility, effluent pipeline, landfill for colony waste, proper lined evaporation ponds, etc. Installation of emission control devices (FGD) for the existing units. At least 50 relevant staff (M/F) trained on safeguard, procurement, financial, and technical operation aspects. Training manuals developed, at least 30 staff (M/F) and 10 trainers trained on coal-fired power plant operation. Inclusion of at least one subject related to coal-fired plant operation in technical schools.	**Planned key activity areas** Subsector development and other renewables (2% of approved funds) Small hydro (20 MW) and below (5% of approved funds) Electrical power transmission (45% of approved funds) Distribution loss reduction (9% of approved funds) Energy efficiency (21% of approved funds) Emission trading and CDM (0.19% of approved funds) Cleaner production (industry) (0.58% of approved funds) Thermal power (16% of approved funds) Tariffs and pricing (0.06% of approved funds) **Pipeline projects with estimated amounts** Jamshoro Power Generation Project ($900 million) Renewable Energy Development Sector Investment Program Tranche 3 ($109 million) **Ongoing projects with approved amounts** MFF Renewable Energy Development Sector Investment Program ($510 million), Tranche 1 ($115 million) MFF Power Transmission Enhancement Investment Program ($800 million), Tranche 1 ($236 million), Tranche 2 ($220 million), Tranche 3 ($243 million) MFF Power Distribution Enhancement Investment Program ($810 million), Tranche 1 ($252 million), Tranche 2 ($242 million), Tranche 3 ($245 million) MFF Energy Efficiency Investment Program ($780 million), Tranche 1 ($60 million)	**Pipeline projects** Two small- to medium-size HPPs constructed. Two supercritical coal-fired power generation units constructed. **Ongoing projects** Small- to medium-size hydropower stations are operational, and feasibility studies and other due diligence work on new renewable energy schemes completed. Transmission lines and substations constructed and rehabilitated. CFLs are introduced in the local market, lamp waste collection and recycling demonstration facility established, and energy efficiency and climate change mainstreamed in national development strategy.

ADB=Asian Development Bank, CDM = Clean Development Mechanism, FGD = flue gas desulfurization, GWh = gigawatt hour, HFO = heavy fuel oil, kWh = kilowatt-hour, M/F = male/female, MFF = multitrance financing facility, MW = megawatt, NEPRA = National Electric Power Regulatory Authority, TPS = thermal power station
Source: Asian Development Bank.