



ISSUE BRIEF

Transforming the Power Sector in Developing Countries: Geopolitics, Poverty, and Climate Change in Pakistan

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INTRODUCTION

The 2019 visit of Pakistan Prime Minister Imran Khan to Washington and his July 22 meeting with US President Donald Trump focused attention—at least briefly—on both the prospects for peace in Afghanistan and broader South Asia regional security issues. Energy security is an important aspect of the geopolitics of the region, and while it is common to focus on India as the third-largest primary energy user in the world after China and the United States, Pakistan also is significant, given its growing economy and large population of 207 million. From a geopolitical standpoint, though, Pakistan takes on more importance amid rising great power competition, rivalries among China, Russia, Iran, India, and the United States in the region, and specifically as China expands its presence through its Belt and Road Initiative (BRI) and the China-Pakistan Economic Corridor (CPEC).

Pakistan's politics has been tumultuous with rival parties struggling for power. Khan's August 2018 election as prime minister has ushered in a new political era in Pakistan. His Pakistan Tehreek-e-Insaf (PTI) party, which defeated the outgoing Pakistan Muslim League-Nawaz and Pakistan People's Party for seats in the legislature, has already faced many challenges, including a slowing economy and continuing energy crisis.¹

Pakistan is a poor country, with a per capita gross domestic product (GDP) of US\$1,909 in early 2019,² and 58 million people lack access to electricity. With growing incomes, population, and urbanization, energy demand is increasing,

The Global Energy Center promotes energy security by working alongside government, industry, civil society, and public stakeholders to devise pragmatic solutions to the geopolitical, sustainability, and economic challenges of the changing global energy landscape

1 "A man, no plan: How will Imran Khan govern?," *The Economist*, August 2, 2018, <https://www.economist.com/asia/2018/08/02/how-will-imran-khan-govern>.

2 Shahbaz Rana, "Per capita income shrinks 8.2% in PTI first year," the *Express Tribune*, May 12, 2019, <https://tribune.com.pk/story/1970984/2-per-capita-income-shrinks-8-2-ptis-first-year/>; "Per capita income hits \$1909," *The Daily Star*, March 20, 2019, <https://www.thedailystar.net/business/news/capita-income-hits-1909-1717606>.



Miner Mohammad Ismail, twenty-five, digs in a coal mine in Choa Saidan Shah, Punjab province, Pakistan, April 29, 2014. Workers at this mine dig coal with pick axes, break it up and load it onto donkeys to be transported to the surface. Source: REUTERS/Sara Farid

placing pressure on domestic resources. Despite the existence of indigenous natural gas, renewable, and coal resources, Pakistan has become more dependent on imported oil, gas, and—recently—coal resources. Although it is a small emitter of carbon dioxide (CO₂), unlike India or China, Pakistan is likely to increase its greenhouse gas emissions, depending on the fuel choices and investments it makes. The turn to embrace coal is an emerging concern in the broader Asian context and in the wake of the Paris Agreement on Climate Change, which Pakistan ratified. Its Nationally Determined Contribution (NDC) affirmed its desire to join the global effort to mitigate and adapt to rising emissions, including from the power sector that is the leading source of Pakistan's emissions.

Poor countries often suffer the most from climate change, and Pakistan has long been experiencing the direct effects of severe climate events like floods and heat waves. In 2018,

Pakistan was hit with heavy monsoon rains, reported to have been the heaviest in thirty-eight years.³ In 2019, the nation experienced a record heat wave as the monsoon rains were delayed, with an all-time high temperature of 120 degrees Fahrenheit recorded June 2-3 in Jacobabad in Sindh province.⁴

Although the international donor and private investment community has had a substantial engagement with Pakistan's energy sector for many years, considerable obstacles remain in reforming the energy sector and mobilizing critical energy investments. The security environment, especially outside the Punjab and Sindh provinces, is problematic, and the large and pervasive circular debt problem described later has deterred investors. US-Pakistan relations have been strained over Pakistan's harboring of the Haqqani network, a Sunni Islamist insurgent group involved in the Afghan war; Trump's suspension of military and security assistance; and

3 "Pakistan: Floods leave at least six people dead in Lahore," *Al Jazeera*, July 4, 2018, <https://www.aljazeera.com/news/2018/07/pakistan-floods-leave-people-dead-lahore-180704092439151.html>.

4 "2019 heat wave in India and Pakistan," Wikipedia, accessed November 2019, https://en.wikipedia.org/wiki/2019_Indo-Pakistani_heat_wave.

the enhanced US defense partnership with India. Khan’s visit, however, seems to have improved relations between the nations, with the development of a common understanding of the need for a negotiated peace in Afghanistan as well as enhanced energy cooperation.⁵

This report is the third country analysis in the Atlantic Council’s “Transforming the Power Sector in Developing Countries” series. This series, initiated following the historic Paris accord of 2015, considers the political economy of implementing the Paris targets and commitments, focusing on the obstacles and strategies for decarbonization of the important power sector. The initial report presented a generic framework and strategic action plan for power-sector transformation, and subsequent reports have applied this approach to both specific countries, such as China and Indonesia, and issues. This analysis turns to South Asia and attempts to tie together the geopolitical dimensions of the energy transformation process with the severe poverty and climate change challenges faced by Pakistan. A separate companion issue brief examines nearby Bangladesh.

CRITICAL CHALLENGES

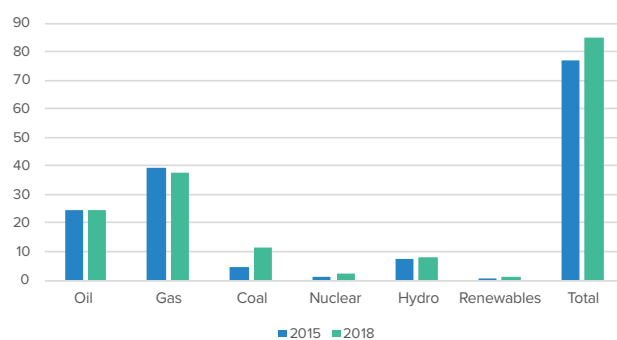
As a large developing country, Pakistan faces a wide range of problems, especially related to overcoming poverty and improving the health, education, and employment opportunities for low-income groups. The energy sector is critical to progress in addressing these problems, but inadequate investment, unreliable energy supplies, weak governance, and poor fiscal management of the sector have been major constraints. The problem of creating a viable energy sector that can mobilize the needed investments and support sustainable economic growth is a fundamental challenge. This section examines the position of Pakistan with respect to five common challenges affecting power-sector transformation, as identified in the initial strategy report, namely: (1) meeting growing energy demands and moving to a cleaner energy mix; (2) improving governance and transparency; (3) increasing affordability and access; (4) addressing environmental degradation and climate change; and (5) achieving power-sector financial viability.

Meeting Growing Energy Demand and Moving to a Cleaner Energy Mix

Pakistan’s economy over the past five years has been growing at more than 4 percent and reached 5.2 percent in 2018. Although primary energy consumption in 2018 grew by 5 percent, primary energy growth has historically lagged behind economic growth.⁶ Between 2007 and 2017, the average rate of primary energy growth was 2.7 percent, compared with a 3.8 percent average annual increase in GDP.⁷

Pakistan depends principally on oil and gas for over 70 percent of its primary energy⁸ and has become increasingly dependent on oil and gas imports. Although Pakistan has some domestic crude oil production (about 90 thousand barrels per day in 2018), this only accounts for 18 percent of total oil consumption.⁹ The growing oil-import bill puts great pressure on budgets and reserves. The International Monetary Fund (IMF) estimates Pakistan’s 2017-18 oil imports at US\$14.6 billion, or about a quarter of total estimated current account imports, and 2019-20 imports are expected to be at least US\$17 billion. The depreciation of the Pakistan rupee in 2018 added an additional burden to the import bill. Pakistan has had to turn to gas imports as domestic gas

Figure 1: Pakistan: Primary Energy Consumption 2015, 2018 (Millions Tons of Oil Equivalent)



Source: Data drawn from *BP Statistical Review of World Energy*, 2017 and 2019.

5 “President Donald J. Trump Wants to Work With Pakistan to Achieve Peace, Stability, and Economic Prosperity in the Region,” the White House, July 22, 2019, <https://www.whitehouse.gov/briefings-statements/president-donald-j-trump-wants-work-pakistan-achieve-peace-stability-economic-prosperity-region/>.

6 *BP Statistical Review of World Energy 2019*, BP, June 2019, <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2019-full-report.pdf>

7 “Pakistan Real GDP Growth,” CEIC, accessed November 2019, <https://www.ceicdata.com/en/indicator/pakistan/real-gdp-growth>.

8 *BP Statistical Review of World Energy 2019*, BP.

9 “Pakistan: Oil production,” TheGlobalEconomy.com, accessed November 2019, https://www.theglobaleconomy.com/Pakistan/oil_production/; *BP Statistical Review of World Energy 2019*, BP.

consumption has grown (by 7 percent in 2018) and outpaced domestic production. Pakistan's indigenous gas production has stagnated at about 34 billion cubic meters (bcm) in 2018, accounting for 80 percent of domestic consumption.¹⁰

Expansion of electricity generation to meet rising demand and reduce the endemic power blackouts and outages has been a high priority of the Pakistan government. Installed generation capacity has greatly expanded from 23,337 megawatts (MW) in 2014 to 33,836 MW in February 2019, and electricity generation increased by 11 percent from 2017 to 2018.¹¹ Pakistan continues to have a gap, however, of several thousand megawatts in the non-summer months when hydropower output is lower and electricity demand is high.

Although natural gas-fired generation provides the largest share of electricity output, Pakistan has significant hydropower production, some nuclear power, and increasing renewable energy generation. (See Figure 2.) We examine more closely the transformation and diversification challenge in the strategic priorities section.

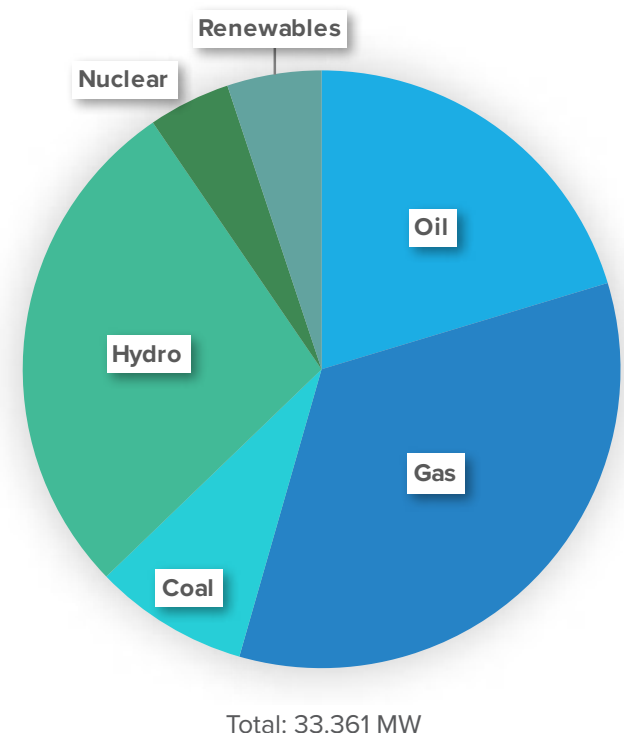
Improving Governance and Transparency

Although Pakistan has made progress in developing its institutions in the energy and power sectors, much remains to be done to improve their governance and transparency. A separate professional energy regulatory body, the Pakistan National Electric Power Regulatory Authority (NEPRA), has been in place since 1997; however, it still needs to improve its autonomy, authority, and accountability, becoming less dependent on the Ministry of Energy.

The evolution of energy institutions in Pakistan has been shaped by the relationship between electricity and water. The priority of water management in Pakistan and the construction of Tarbela and other major dams and hydropower plants led to the development of a combined Ministry of Water and Power, while the development of the large Sui and other gas fields was overseen by a separate Ministry of Petroleum and Minerals. As thermal power generation expanded in the 1980s and 1990s, state utility company Water and Power Development Authority (WAPDA) was unbundled, with WAPDA retaining hydropower. At the same time, four separate state thermal companies were established in 1998, along with a separate authority for electricity transmission—the National

Transmission and Dispatch Company (NTDC). A Central Power Purchasing Agency (CPPA), responsible for billing and financial settlements, was separated from NTDC in 2015, heightening transparency in power transactions and financial relations. In the major Karachi electricity market, the main supplier is K-Electric, formerly the Karachi Electric Power Corporation. For several years, K-Electric had been a target of acquisition by China's Shanghai Electric Company, but the majority shareholder, the Dubai-based Abraaj Group, collapsed in 2019.¹² Separately, many privately owned electricity generating companies (IPPs) are involved in the thermal, hydro, and renewable subsectors and have established a Pakistan Independent Power Producers Association.

Figure 2: Pakistan: Installed Electricity Generation by Fuel (Percent 2017/18)



Source: Data drawn from *Pakistan's Power Future*, Institute for Energy Economics and Financial Analysis (IEEFA).

¹⁰ BP *Statistical Review of World Energy 2019*, BP.

¹¹ "Electricity sector in Pakistan," Wikipedia, accessed November 2019, https://en.wikipedia.org/wiki/Electricity_sector_in_Pakistan; BP *Statistical Review of World Energy 2019*, BP.

¹² For further reporting on this situation, see: Ghulam Abbas, "K-Electric-Shanghai deal at risk after Abraaj founder arrested," *Pakistan Today*, April 12, 2019, <https://www.pakistantoday.com.pk/2019/04/12/abraaj-founder-arif-naqvi-managing-partner-arrested-on-fraud-charges/>.

It was then-Prime Minister Shahid Abbasi, a former minister of petroleum from the Pakistan Muslim League, who in his brief tenure succeeded in establishing the Ministry of Energy, which combined the Ministry of Petroleum and Natural Resources and the Power Division of the Ministry of Water and Power, in August 2017. It remains to be seen whether this institutional restructuring will improve governance and transparency. Given the close relationship between electricity and gas, both indigenous and imported, the creation of a single ministry may help achieve better planning and coordination between the oil and gas and power sectors.

In general, energy policy and governance has been quite fragmented in Pakistan, involving the Pakistan Ministry of Finance, the Planning Commission, the provincial governments, as well as the state energy organizations. Major decisions on energy policy and investment are usually reviewed and approved by the Economic Coordination Committee, chaired by the prime minister. Former Prime Minister Nawaz Sharif tried to improve coordination in the sector through an interagency energy group and brought in from abroad a Pakistani with experience working in Western companies as his energy adviser. Upon his election as prime minister, Khan assumed the position of minister of energy as well as minister of the interior, but in September 2018 he appointed Omar Ayub Khan, also from the PTI party, as minister of energy. The prime minister also created the Task Force on Energy Reform, which is headed by his energy adviser, Naseem Babar.¹³

Increasing Affordability and Access

As a largely rural country, Pakistan faces major challenges in providing affordable and reliable electricity to its population. As mentioned above, 58 million people lack access to electricity, and the challenge is particularly acute in rural areas, where only 54 percent have access.¹⁴ Pakistan's progress in expanding access has been slower compared to some other countries. For example, nearby Bangladesh boosted its access level to 88 percent in 2017 from 55 percent in 2010,¹⁵ and more recent estimates are as high as 95 percent.

Pakistan aspires to achieve universal electricity access by 2030 and priority towns in each province have been identified.¹⁶ Pakistan's rural electrification programs are heavily focused on grid expansion by the various regional distribution companies, many of which are constrained in their ability to finance grid expansion, especially in the remote and sparsely populated areas of Baluchistan and tribal areas. Decentralized renewable systems are beginning to be introduced, but not at the same scale as in Bangladesh, where several dozen nongovernmental organizations (NGOs) and private companies are marketing these systems for household and village applications.

Tackling Environmental Degradation and Climate Change

Pakistan and the South Asia region as a whole face enormous environmental challenges due to the geographical and ecological situation, population growth, and urban pressures. Pakistan's population is expected to grow to 309 million by 2050.¹⁷ As a result, water and energy will become critical to its survival.

Key to Pakistan's future is the Indus River basin and system, both for irrigation and as a water supply for major urban centers in the east and south. The basin is subject to regular flooding and cyclones. In 2010, Pakistan suffered especially severe flooding that seriously damaged the electricity system and caused an estimated US\$25.3 billion in costs, or 5.4 percent of GDP.¹⁸

The Global Climate Risk Index ranks Pakistan as the seventh most affected country during the period 1997-2016, with 141 severe climate events incurring estimated losses of US\$3.8 billion.¹⁹ In Pakistan, these events have included droughts and heat waves (e.g., 1998-02 and 2014-17) and glacial-lake outburst floods in the northern mountains.

Pakistan's initial submission in the run-up to the Paris Climate Summit, the Intended Nationally Determined Contribution (INDC), presents a useful summary of the threats that Pakistan is facing from climate change:

13 "Pakistan to take another \$1.4 bln loan to curb power sector arrears," Reuters, February 15, 2019, <https://uk.reuters.com/article/pakistan-power/pakistan-to-take-another-14-bln-loan-to-curb-power-sector-arrears-idUKL3N20A2SE>.

14 *Tracking SDG7: The Energy Progress Report 2019*, World Bank, May 2019, <https://trackingsdg7.esmap.org/data/files/download-documents/2019-Tracking%20SDG7-Full%20Report.pdf>

15 Ibid.

16 See: "Sustainable Energy For All (SE4ALL)," United Nations Development Programme in Pakistan, accessed November 2019, <https://www.pk.undp.org/content/pakistan/en/home/projects/SE4ALL.html>

17 "Pakistan 2050," PopulationPyramid.net, accessed November 2019, <https://www.populationpyramid.net/pakistan/2050/>; "Bangladesh 2050," PopulationPyramid.net, accessed November 2019, <https://www.populationpyramid.net/bangladesh/2050/>.

18 David Eckstein, Vera Künzel, Laura Schäfer, *Global Climate Risk Index 2018*, German Watch, November 9, 2017, <https://germanwatch.org/en/node/14987>.

19 Ibid.

Many sectors, activities, and target groups are vulnerable to the threats of climate change in Pakistan. These among others include: increased variability of monsoon; rapid recessions of glaciers of Hindu Kush-Karakoram in the Himalayas; threatening water flows in the Indus River System; increased siltation of downstream water reservoirs; increased risk of floods and droughts; heat-stressed conditions in arid and semi-arid regions leading to reduced agriculture productivity; intrusion of saline water in the Indus delta affecting coastal ecology and fishery production, and increased cyclonic activity in the coastal belt due to high sea surface temperatures.²⁰

While these climate impacts have taken their toll, Pakistan emits quite small amounts of CO₂, i.e., only about 0.6 percent of global energy CO₂ emissions.²¹ Pakistan's INDC reports energy emissions in 2015 of 185.97 metric tons (MT) out of total emissions of 405 MT. BP estimates that Pakistan's energy CO₂ emissions rose in 2018 to 195.7 MT, a 3.8 percent increase over 2017.²² Overall, energy-related CO₂ emissions are projected to increase to 898 MT in 2030. Pakistan's conditional commitment at Paris was, however, to reduce overall emissions by 20 percent from the projected 2030 levels if an estimated investment of \$40 billion were forthcoming for abatement actions in energy, industry, and agriculture.²³ Meeting this reduction target will require major changes in strategy and financing, which will be discussed later in this document.

Achieving Power-Sector Financial Viability

The establishment of a financially sound power sector in low-income developing countries is a common problem, and Pakistan is continuing to struggle to reduce losses, improve collections, and rationalize tariffs. The power crisis

in Pakistan has received much attention including front-page stories in major Western papers. The shortage of power supplies coupled with a large deficit in collections and pervasive circular debt²⁴ has represented a persistent political problem stemming back to well before the Sharif and Khan governments. At the root of the problem is both high technical and commercial losses and especially nonpayment by the government and its state companies.

The issue of losses and inadequate collections is problematic in most of Pakistan's ten electricity distribution companies, which had average losses of 17.95 percent in 2016-17, with three reporting losses of over 30 percent.²⁵ (See Figure 3.) Although estimates vary, the cumulative debts of the power system, including the shifting circular debt among state gas companies, power distribution companies, independent power producers, consumers, and the government's Central Purchasing Agency, have continued to build up over the years and were estimated to have reached a cumulative level of 1.55 trillion Pakistan rupees (abbreviated as Rs and the amount equivalent to US\$11.7 billion) as of June 2018,²⁶ with the average tariff of Rs11.70/kilowatt hour (kWh), well below the determined power supply cost for 2018-19 of Rs15.53/kWh.²⁷ Although the early 2019 level was widely reported at Rs1.4 trillion, one independent analysis places the "official-designed" circular debt at Rs829 billion as of July 2019, not including loans of the Syndicated Term Finance Facility, which if added would total about Rs1.8 trillion.²⁸

The government, with donor support, has sought to reduce payment arrears and has tried to cap the overall level of circular debt. As much as Rs600 billion of this debt has been parked in a state holding company, the Power Holding Private Ltd. (PHPL).²⁹ Private power producers, through the Independent Power Producers Advisory Council (IPPAC), have disputed

20 *Pakistan Intended Nationally Determined Contributions (INDCs)*, Ministry of Climate Change, Government of Pakistan, November 8, 2016, <http://www.moccl.gov.pk/moccl/userfiles1/file/INDC%20PAKISTAN%20-zero%20draft-.pdf>

21 *BP Statistical Review of World Energy 2019*, BP.

22 *Ibid.*

23 *Pakistan's Intended Nationally Determined Contribution (PAK-INDC)*, United Nations Framework Convention on Climate Change, November 4, 2016, <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Pakistan%20First/Pak-INDC.pdf>

24 The IMF describes circular debt as the cash flow shortfall incurred in the power sector from the nonpayment of obligations by consumers, distribution companies, and the government. *Pakistan: IMF Country Report No. 19/212*, International Monetary Fund, July 2019, <https://www.imf.org/~media/Files/Publications/CR/2019/1PAKEA2019001.ashx>

25 *State of the Industry Report 2017*, National Electric Power Regulatory Authority, 2017, <https://nepra.org.pk/publications/State%20of%20Industry%20Reports/State%20of%20Industry%20report%202017.pdf>

26 *Pakistan's Power Future: Renewable Energy Provides a More Diverse, Secure and Cost-Effective Alternative*, Institute for Energy Economics and Financial Analysis, December 2018, http://ieefa.org/wp-content/uploads/2018/11/Pakistans-Power-Future_December-2018.pdf

27 *Ibid.*

28 Amjad Hafeez, "Circular Debt in Power Sector of Pakistan: Impacts; Causes and Solutions," October 2019, https://www.researchgate.net/publication/336265271_Circular_Debt_in_Power_Sector_of_Pakistan_ImpactsCauses_and_Solutions

29 Drazen Jorgic, "Pakistan says curbing power sector debt, seeks energy investors," Reuters, January 30, 2019, <https://www.reuters.com/article/pakistan-power-minister/pakistan-says-curbing-power-sector-debt-seeks-energy-investors-idUSL5N1ZU0IK>.

the effectiveness of government efforts, highlighting a rising circular debt, claiming that their share was Rs254 billion in 2017. These independent power producers have long-term power-purchase agreements with government entities that have been criticized as too costly with their “take or pay” arrangements and, for renewables, high feed-in tariffs, which are designed to promote installation of renewable electricity technologies. In 2017, the government decided to move generally to shorter-term competitively bid tenders (i.e., terms of fifteen years instead of twenty-five to thirty years) and “take and pay” formulas.³⁰

The World Bank and the IMF have reported lower estimated levels of circular debt: the World Bank estimated Rs420 billion, or US\$4 billion, by the end of fiscal year (FY)16, or 1 percent of GDP; and the IMF, Rs514 billion at the end of 2017.³¹ What seems to have occurred is that the government reduced the budgeted power subsidy (from Rs349 billion in 2012-13 to Rs118 in 2016-17), and this contributed to a buildup of circular debt. Besides low tariffs, a major contributing factor to circular debt is the large transmission and distribution (T&D) losses. The target for T&D losses for FY2016-17 was 15.3 percent,

while the reported losses in distribution alone were almost 18 percent, as indicated above. If transmission losses are included, the total difference between electricity generated by the producers and electricity sold by the regional distribution companies (DISCOs) amounted to 21.6 percent of generation in FY2016-17.³² Arrears in the gas sector also have been rising (to a reported US\$1 billion for Sui Northern and Sui Southern gas companies), and the government increased gas prices by 200 percent on July 1, 2019.

In summary, the overall cost to Pakistan of the power sector’s poor economic and financial performance is large. A World Bank report estimates that the total economic cost of power-sector distortions in Pakistan was US\$17.7 billion in FY15, or about 6.5 percent of GDP stemming from the negative impacts (US\$12.9 billion a year) of unreliable electricity to firms and households.³³

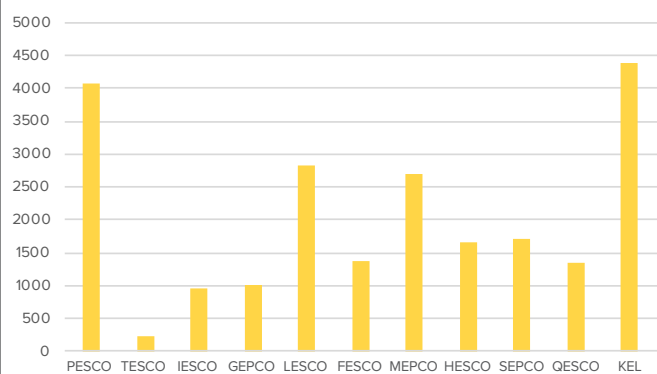
STRATEGIC PRIORITIES

This section presents policy directions that Pakistan should consider taking to address the above critical challenges. It takes the general prescriptive approach from the first report in the series and offers suggestions on specific strategic priorities for Pakistan. These priorities address the following: (1) creating a sound policy, legal, and regulatory environment; (2) developing efficient institutional and market structures; (3) achieving a cleaner and more resilient generation mix; (4) expanding electricity access to the poor and rural areas; (5) collaborating with neighbors on regional electricity and gas networks and markets; and (6) attracting international investment and financing.

Creating a Sound Policy, Legal, and Regulatory Environment

Strategic Priority: *The Pakistan government urgently needs to develop a comprehensive energy plan and formulate legal and regulatory measures that tackle critical reforms in the parastatal energy companies and power market, enhance revenue collection, create a more favorable environment for investment, and accelerate efforts to develop its indigenous renewable energy and gas resource development for its energy security, economic growth, and environmental sustainability.*

Figure 3: Pakistan: Losses in Electric Distribution Companies in 2016-17 (GWh)



Total Losses: 17839.60 GWh
Average Losses: 17.95%

Source: Data drawn from the National Electric Power Regulatory Authority’s *State of Industry Report 2018*.

30 “No more long-term power purchase agreements,” Dawn, December 13, 2017, <https://www.dawn.com/news/1376229>.

31 *Pakistan: IMF Country Report No. 18/78*, International Monetary Fund, March 2018, <https://www.imf.org/~/media/Files/Publications/CR/2018/cr1878.ashx>

32 Ibid.

33 Fan Zhang, *In the Dark: How Much Do the Power Sector Distortions Cost South Asia*, World Bank Group, 2018, <http://documents.worldbank.org/curated/en/462261544568063923/In-the-Dark-How-Much-Do-Power-Sector-Distortions-Cost-South-Asia>

Discussion: The creation of a sound, longer-term energy policy has been difficult as domestic and external political and economic pressures buffet the government. The imperative of addressing short-term energy shortages, the severe budget and financial constraints, and the dramatic swings in international energy prices has made it hard to develop an optimal strategy that balances energy security, economic growth, and environmental sustainability. Pakistan has pursued high-cost, short-term fixes while at the same time accepting billions in large infrastructure loans, notably from China, for coal and nuclear plants that are problematic given the financial difficulties faced by the government and the power sector. Policies to promote domestic renewables and gas development have not received sufficient priority vis-à-vis projects to develop imported coal and liquefied natural gas (LNG).

Increasing power-sector revenues is of critical importance, especially through tariff rationalization and the reduction of both technical and nontechnical losses in the system. Pakistan committed to raise tariffs and reduce circular debt in its July 2019 Extended Fund Facility (EFF) agreement with the IMF, and the IMF released the first US\$1 billion tranche of the US\$6 billion package after Pakistan adjusted tariffs by over 10 percent with further increases planned.³⁴

Developing Efficient Institutional and Market Structures

Strategic Priority: *The Pakistan government should restructure the “single-buyer” system and fully unbundle the power sector while maintaining a priority focus on improving the revenue and financial position of the sector. The privatization of better-performing distribution companies in major cities like Lahore, Islamabad, and Faisalabad should be pursued to improve commercial operations and provide resources for the government.*

Discussion: Pakistan has the potential to develop a more competitive power market, but the highly politicized, single-buyer system (i.e., one in which transmission is controlled by the government), is holding back progress. Although private generation has overtaken public-sector generation, distribution losses are still too high and major investments

in transmission and distribution are needed to keep up with surging power demands. The economic competitiveness of renewables and the potential for distributed gas systems open up new possibilities for a less centralized and more transparent commercial operation of the system.

Policy makers should now begin to unbundle the system fully and move to a bilateral-contracts approach and the introduction of third-party access. In Pakistan, the World Bank’s appraisal report concludes that “The DISCOs and NTDC are not at arm’s length from the Power Division of the Ministry of Energy and remain in an entrenched bureaucratic culture.”³⁵ The CPPA proposal to become a market operator, which has been under review by the National Energy Regulatory Commission, is a positive sign, but further restructuring is needed. In its early days, the Sharif government announced plans to privatize distribution in the major cities of Faisalabad, Lahore, and Islamabad, where incomes and affordability are higher, and initial DISCO privatization was a condition of the previous IMF US\$6.6 extended fund facility. Political opposition, however, kept the Sharif government from pursuing this objective and it was abandoned in 2016. Khan has an opportunity to revive this process, and in March 2019, the minister of privatization indicated that nine distribution companies would be included in the list of state-owned enterprises for privatization along with several generation companies.³⁶ Although experience in other countries shows that losses can be reduced with proper metering, billing, and collections systems and investments, it is clear that the circular debt overhang and government nonpayment obstacles need to be overcome; and political support for strong legal enforcement of collections, including by government entities, and rationalization of tariffs will be essential.

Achieving a Cleaner and Resilient Generation Mix

Strategic Priority: *Pakistan should continue to diversify its electricity mix but reorient efforts to accelerate the move to lower carbon sources and away from oil and coal by focusing on gas, renewables, and increased energy efficiency. It should seek to facilitate the private investments needed to meet its 30 percent renewables target by 2030 and ensure that the transmission investments required to integrate these sources into the grid are*

34 See: “IMF Executive Board Approves US\$6 billion 39-Month EFF Arrangement for Pakistan,” International Monetary Fund, July 3, 2019, <https://www.imf.org/en/News/Articles/2019/07/03/pr19264-pakistan-imf-executive-board-approves-39-month-eff-arrangement>

35 *Pakistan - First National Transmission Modernization Project*, World Bank Group, November 27, 2017, <http://documents.worldbank.org/curated/en/345091513911668260/Pakistan-First-National-Transmission-Modernization-Project>

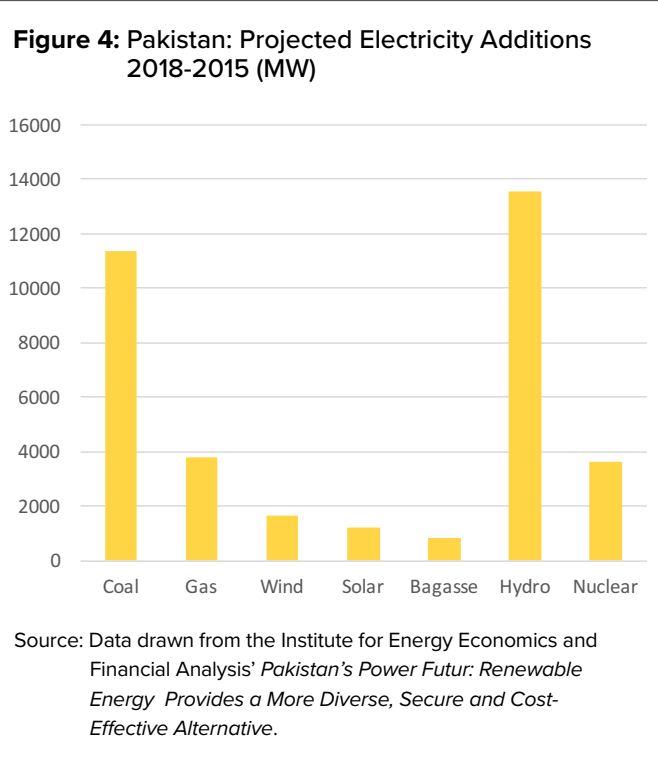
36 The nine companies include: Faisalabad Electric Supply Company Limited (FESCO); Islamabad Electric Supply Company (IESCO); Lahore Electric Supply Company (LESCO); Gujranwala Electric Power Company Limited (GEPCO); Multan Electric Power Company Limited (MEPCO); Peshawar Electric Supply Company Limited (PESCO); Hyderabad Electric Supply Company Limited (HESCO); Quetta Electric Supply Company Limited (QESCO); Sukkur Electric Power Company (SEPCO). Israr Khan, “Govt to privatise 49 public sector concerns,” International The News, March 7, 2019, <https://www.thenews.com.pk/print/440589-govt-to-privatise-49-public-sector-concerns>

realized and carefully coordinated with generation-expansion plans. Given the declining costs of renewables, its favorable solar resources, and high electricity access requirements, Pakistan should give greater priority to minigrids and distributed solar-power systems for towns and villages.

Discussion: Pakistan has ambitious plans to expand electricity-generation capacities. Currently, Pakistan’s installed capacity stands at about 34,282 MW and Pakistan’s target is to increase generation capacity to about 50,000 MW by 2022 and 62,186 MW by 2025.³⁷ Meeting peak load, estimated at over 25,000 MW in 2019, is a problem, exacerbated by transmission and distribution limitations. To address the frequent outages and rising electricity demands, Pakistan has turned heavily to imported natural gas and coal.

Natural Gas: Pakistan has already achieved significant reductions in oil generation, especially through substitution of natural gas, with both the level and share of oil declining from 30.22 terawatt-hours (TWh) (26.49 percent) in 2017 to 14.32 TWh (11.54 percent) in 2018.³⁸ The substitution of gas for oil has substantially reduced Pakistan’s fuel import bill by more than US\$2 billion.³⁹ Pakistan has rapidly increased the use of gas in its power generation since the initiation of LNG imports in March 2015. In March 2018, gas power generation accounted for 43 percent of total power generation (3,013 gigawatt hours), with LNG providing 19 percent and domestic gas 24 percent. Three major new gas power plants in Punjab province, totaling 3.6 gigawatts (GW), accounted for the significant increase.⁴⁰

Pakistan has two floating storage regasification unit (FSRU) LNG facilities at Port Qasim, the Excelerate/Nakilat 3.8 million metric tons per annum (mmtpa) FSRU at the Engro Elengy Group terminal, and a 5.7 mmtpa unit owned by Pakistan LNG Terminals Ltd. The main LNG import contracts are for supplies from Qatar. The Cabinet Economic Coordination Committee in July 2019 endorsed planning for a third terminal, and other



projects by major oil companies including Shell, Exxon, and Total have been proposed.⁴¹ LNG imports are expected to grow with estimated levels of 14 million metric tons (mmt) by 2022 and 21 mmt by 2025, up from just 6.7 mmt last year.⁴²

Pakistan’s focus on LNG and gas-fired power generation has opened new opportunities for US LNG exports and investment by the private sector. General Electric has a long-standing presence in Pakistan and plays a major role in Pakistan’s power system, with its technologies providing as much as 25 percent of Pakistan’s total generation. This work includes new gas units, both large and small gas field units, steam systems, and wind turbines.⁴³

37 *Pakistan’s Power Future: Renewable Energy Provides a More Diverse, Secure and Cost-Effective Alternative*, Institute for Energy Economics and Financial Analysis.

38 “Electricity Generation Mix of Pakistan (2018),” Power Pakistan, January 22, 2019, <https://powerpakistan.home.blog/2019/01/22/electricity-generation-mix-of-pakistan-2018/>.

39 Shardul Sharma, “Pakistan Saves Big By Using Imported Gas For Power Generation: Report,” Natural Gas World, July 3, 2018, <https://www.naturalgasworld.com/pakistan-saves-big-by-using-gas-for-power-generation-report-62442>

40 Shardul Sharma, “Gas-Fired Power Climbs in Pakistan,” Natural Gas World, March 22, 2018, <https://www.naturalgasworld.com/gas-based-power-generation-climbs-in-pakistan-59790>.

41 Shardul Sharma, “Pakistan Takes Forward Plan For Third Import Terminal,” Natural Gas World, July 4, 2019, <https://www.naturalgasworld.com/pakistan-takes-forward-plans-for-third-import-terminal-71104>.

42 Joseph Murphy, “Pakistan Ditches Lng Tender: Press,” Natural Gas World, October 15, 2019, <https://www.naturalgasworld.com/pakistan-ditches-lng-tender-press-73794>.

43 “GE, CPGHC & HUBCO Achieve Key Milestones to Power Pakistan,” GE, March 27, 2019, <https://www.genewsroom.com/press-releases/ge-cpghc-hubco-achieve-key-milestones-power-pakistan>.

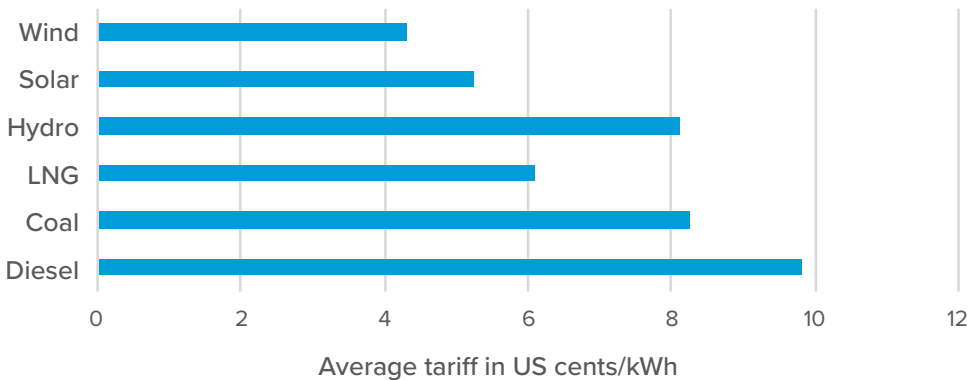
Coal: Despite environmental concerns and its Paris NDC commitment to reduce projected CO₂ emissions, Pakistan is counting on coal to play a significant role in the nation's future power mix, with a combination of both coal imports as well as domestic resource development. Pakistan has 6.6 GW of coal plants under construction, with coal capacity additions totaling 11,353 MW projected for 2025. The Pakistan Vision 2030 targets installed coal capacity of 19,910 MW by 2030, representing 19 percent of the projected installed generation mix.⁴⁴ Estimates foresee Pakistan's imports of coal rising from about 12 million metric tons (mmt) in 2018 to 30 mmt in 2020 and 40 mmt in 2025. Imports will increase to meet the needs of two new, large coal plants at Sahiwal and Port Qasim.

Pakistan is therefore moving rapidly to implement its policy decision to develop almost from scratch a coal power industry with all the attendant infrastructure requirements for import and transport. Although this follows the trend in some other South and Southeast Asia nations, there are serious questions about the viability of this strategy from both economic and environmental standpoints even though both the Sahiwal and Port Qasim coal plants are efficient and use super-critical coal combustion technology.⁴⁵ In Pakistan, one recent study using data from the energy regulator shows (see Figure 5) that both renewables and gas are less costly than coal (with wind at 4.3 cents per kWh, solar at 5.3 cents, gas at around 6 cents, and hydro averaging a little over 8 cents,

compared with 8.4 cents for super-critical coal. Plants such as the China Huanang coal plant at Sahiwal have been given a power purchase agreement price of 8.36 cents per kWh.⁴⁶ These investments create long-term obligations and the coal plants may become stranded assets, potentially obsolete and weighing on balance sheets as renewable energy costs decrease and the costs of climate change increase.

Nuclear: Important developments are evident in global nuclear markets as Russia and China seek to expand their political and economic influence in developing regions through the export and state financing of nuclear power plants. China and Russia are building over 60 percent of the nuclear reactors currently under construction in the world today.⁴⁷ Pakistan is thus far the only foreign country operating Chinese commercial nuclear reactors. Chinese nuclear engagement with Pakistan dates to 1993, when the China National Nuclear Corporation (CNNC) began construction of the first of four small Chinese CNP300 nuclear reactors at its Chashma complex in central Pakistan, with commercial operation in 2000, 2011, 2016, and 2017. As it pursued export opportunities, China in 2015 began to construct near Karachi two of its larger, indigenous-designed Hualong One plants (1,000 MW each), the first and only Chinese Generation III plants thus far to be built outside China. They are expected to be completed by 2021 and 2022 and will be an important showcase, together with the four Hualong One plants under

Figure 5: Average Determined Levelized Tariffs in Pakistan by Power Source, as of 2018



Source: Data drawn from the Institute for Energy Economics and Financial Analysis' *Pakistan's Power Future: Renewable Energy Provides a More Diverse, Secure and Cost-Effective Alternative 2018*.

44 "Pakistan — the hottest market for South African coal," Dawn, February 6, 2018, <https://www.dawn.com/news/1387570/pakistan-the-hottest-market-for-south-african-coal>.

45 Super-critical coal plants operate at higher efficiencies than sub-critical plants (about 44 percent thermal efficiency, compared with 33 percent) due to higher temperatures and pressures and they produce fewer emissions and waste heat. See: Bethel Afework, Jordan Hanania, Kailyn Stenhouse, and Jason Donev, "Supercritical coal plant," Energy Education, last updated June 25, 2018, https://energyeducation.ca/encyclopedia/Supercritical_coal_plant.

46 *Pakistan's Power Future: Renewable Energy Provides a More Diverse, Secure and Cost-Effective Alternative*, Institute for Energy Economics and Financial Analysis.

47 For discussion of Chinese and Russian nuclear activities, see: Atlantic Council Task Force on US Nuclear Energy Leadership, *US nuclear energy leadership: Innovation and the strategic global challenge*, Atlantic Council, May 20, 2019, <https://www.atlanticcouncil.org/in-depth-research-reports/report/us-nuclear-energy-leadership-innovation-and-the-strategic-global-challenge-2/>.

construction and ten planned plants in China.⁴⁸ CNNC is building these units with reported financing from a US\$6.5 billion loan in 2014 from the Chinese Export-Import Bank.⁴⁹ A third Hualong One unit for the Chashma complex is at the tender stage, but it is unclear whether the financing has been finalized. Pakistan envisions 8,800 MW of nuclear capacity by 2030, providing 20 percent of its electric power.⁵⁰

Although nuclear energy is a small part of Pakistan's power mix, these huge projects create a long-term financial, technological, and energy dependency on China and its authoritarian system and state companies. They reduce transparency in the sector and raise concerns about safety and security. Pakistan, like India, has not signed the Nuclear Non-Proliferation Treaty, but the nation is a member of the International Atomic Energy Agency (IAEA). In 2018, Pakistan established a four-year joint program with the IAEA to work on ensuring the safety and security of the new plants.⁵¹ The economics of the new plants are still unclear, but given the reported size of the loans, it is reasonable to estimate that the plants in Pakistan will cost about US\$4,000 per installed kW, assuming they are completed on schedule. Even with high capacity factors, they will likely be among the highest cost power generation units.

Renewables: Interest and investment in renewable energy have picked up over the past four or five years. However, excluding large hydropower capacity, renewables only accounted for 4 percent of Pakistan's generation in 2018.⁵² As pointed out in the Renewable Readiness Assessment by the International Renewable Energy Agency (IRENA), Pakistan has substantial wind energy potential (i.e., 6.9

to 8.6 meters per second in the Sinh corridor and solar resource potential, and international companies from many countries are establishing facilities, particularly in the Sindh and Punjab provinces.⁵³ Chinese companies have been major investors in wind projects, accounting for 397.5 MW, or 36.8 percent of the new wind power capacity developed in Pakistan between 2014 and 2018.⁵⁴ In total, 1,500 MW of wind, solar, and bagasse (a biowaste) had been installed as of 2017, and NEPRA projected in 2017 that more than 3,500 MW of these sources will be added by 2024-25.⁵⁵ A July 2019 report of the US Commercial Service indicates that a 400 MW installation at the Quaid-e-Azam Solar Park is operating, with expansion planned, and an additional twenty-four solar projects of different scale are producing 550 MW of power.⁵⁶ At least six bagasse plants of 201.1 MW are in operation.⁵⁷ Besides its large hydropower potential, Pakistan has many favorable sites for small hydro projects; 877 projects are underway and will add to the current generation of 128 MW.⁵⁸

The Khan government has recently announced ambitious plans to increase the share of renewable energy in total power generation to 30 percent by 2030, including wind, solar, small hydro, and biomass. The new plans are expected to expand renewable capacity by as much as 7,000 MW by 2025 to around 20 percent of generation.⁵⁹ In addition, there is a target to raise the share of large-scale hydro (more than 50 MW), currently around one-fourth of the country's electricity supply, to 30 percent by 2030.⁶⁰ Reaching 60 percent renewable and hydro generation by 2030 would be a tremendous achievement and counter the growing trend of fossil-fuel imports.

48 "Nuclear Power in China," World Nuclear Association, last updated October 2019, <https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-power.aspx>.

49 "China's Global Energy Finance: Energy Sources 2016," Boston University Global Development Policy Center, accessed November 2019, <https://www.bu.edu/cgef/#/2016/Country-EnergySource>

50 "China 'to build third Hualong One nuclear reactor' in Pakistan," *South China Morning Post*, November 25, 2017, <https://www.scmp.com/news/china/diplomacy-defence/article/2121532/china-build-third-hualong-one-nuclear-reactor-pakistan>

51 "Strengthening and Enhancing Capabilities of Pakistan's National Institutions to Support a Safe, Reliable and Sustainable Nuclear Power Programme," International Atomic Energy Agency, accessed November 2019, <https://www.iaea.org/projects/tc/pak2007>.

52 *BP Statistical Review of World Energy 2019*, BP.

53 *Renewables Readiness Assessment: Pakistan*, International Renewable Energy Agency, April 2018, <https://www.irena.org/publications/2018/Apr/Renewables-Readiness-Assessment-Pakistan>.

54 "Chinese equity investments in energy reshape South and Southeast Asia – Greenpeace analysis," Greenpeace International, July 29, 2019, <https://www.greenpeace.org/international/press-release/23446/chinese-equity-investments-in-energy-reshape-south-and-southeast-asia-greenpeace-analysis/>

55 *State of Industry Report 2017*, National Electric Power Regulatory Authority.

56 "Pakistan Country Commercial Guide: Pakistan - Renewable Energy," Export.gov, October 7, 2019, <https://www.export.gov/article?id=Pakistan-Renewable-Energy>.

57 Ammara Khan, "35 renewable energy projects completed costing \$3.5b," *Technology Times*, December 31, 2018, <https://www.technologytimes.pk/35-renewable-energy-projects-3-5b/>.

58 "Pakistan Country Commercial Guide: Pakistan - Renewable Energy," Export.gov.

59 Faseeh Mangi, "Pakistan plans renewables for a fifth of energy supplies by 2025," *Al Jazeera*, July 23, 2019, <https://www.aljazeera.com/ajimpact/pakistan-plans-renewables-energy-supplies-2025-190723074101381.html>.

60 "Pakistan To Set 30% Plus 30% Renewable Energy Target By 2030," World Wind Energy Association, April 2, 2019, <https://wwindea.org/blog/2019/04/02/pakistan-to-set-30-plus-30-renewable-energy-target-by-2030/>.



Fishermen return from their day of fishing at KhuttiKun New Island, Taluka Mirpur Sakro, Thatta District, Sindh province in Pakistan. Construction of the roads as part of the wind energy project has made the sea more accessible for them to fish and make a better living. Source: Flickr/Asian Development Bank

Pakistan has been moving to further its investments in hydropower, which has long been a pillar of the electricity system, accounting for between 25 percent and 30 percent of nationwide generation, depending on water availability. Pakistan's installed hydro capacity reached 9,389 MW in 2018 with the commissioning of the 108 MW Golen Gol 2, the 1,410 MW Tarbela Fourth Extension, and the 969 MW Neelum Jhelum projects. Work is beginning on the large World Bank-funded 4,320 MW Dasu project, which has experienced major delays due to land issues, and the government has announced an 800 MW Mohmand Dam project on the Swat river in the Khyber Pakhtunkhwa Province. Pakistan is experiencing historically low water flows, and the potential for further climate impacts may affect this important subsector, despite the value of the projects in terms of increasing water storage and management capacity.⁶¹

Expanding Electricity Access to Poor and Rural Areas

Strategic Priority: Pakistan should develop a high-priority program to support private entrepreneurial and NGO efforts to commercialize solar power systems in rural areas and ensure high standards for reliability and service. They should encourage banks to lend for these projects as well as facilitate cooperation between solar system providers and the regional distribution companies, especially on technology interface issues for minigrids and microgrids. Pakistan should consider the adaptation of the Bangladesh Infrastructure Development Company Limited (IDCOL) public-private partnership model, which has been so successful in mobilizing over \$500 million in donor funding for widespread installation by private organizations of off-grid solar photovoltaic systems.

61 Elizabeth Ingram, "Hydro activity in Pakistan: Looking back at 2018 and forward into 2019," Hydro Review, January 2, 2019, <https://www.hydroworld.com/articles/2019/01/hydro-activity-in-pakistan-looking-back-at-2018-and-forward-into-2019.html>

Discussion: Pakistan is taking steps to introduce solar power to rural villages. The World Bank has approved a new project, the Sindh Solar Energy Project, that will finance 200,000 solar home systems and larger grid-connected units.⁶² Pakistan needs to tap private entrepreneurial talent in developing these programs and ensure that sound technical standards are adopted. It can learn from other experiences in South Asia and East Africa, where substantial commercialization of both solar home systems and minigrids is occurring.

Collaborating with Neighbors on Regional Electricity and Gas Networks and Markets

Strategic Priority: *Pakistan should continue to pursue diversification of its electricity and gas imports from Central Asia, promoting peaceful relationships and advancing economic development while resisting Iranian pressure to expand electricity and gas import from Iran.*

Discussion: Attempts at energy cooperation in South Asia have been a challenge given the conflicts and historical legacies. A few signs of progress are emerging, however, as Pakistan pursues overland imports of electricity and gas in addition to its major focus on maritime imports of LNG and coal for power.

Pakistan has long been eyeing the potential for electricity and gas imports from Central Asia. For more than a decade, the Turkmenistan-Afghanistan-Pakistan-India (TAPI) gas pipeline and the CASA-1000 electric transmission line projects have been pursued to bring gas from Turkmenistan and hydro-generated power from Tajikistan and Central Asia. Turkmengas leads the TAPI consortium, which includes the Afghan Gas Corp., Pakistan's Interstate Gas System Ltd., and India's state-owned Gail. Construction started on the 1,840 km, \$10 billion project in Turkmenistan in December 2015 and in Afghanistan in February 2018. It will supply 33 bcm of gas from the large Galkynysh gas field in Turkmenistan to the border with India, with Pakistan and India taking up to 14 bcm each and Afghanistan 5 bcm. Commercial contracts are under negotiation among the four companies, with possible financial closure by the end of 2020. The Asian Development Bank (ADB) has been a major supporter of the project, but Chinese and South Korean banks are financing the development of the Galkynysh field and the processing plants. The United States has consistently taken the position that the project's commercial viability depends

on the openness and willingness of international petroleum companies to be involved in the upstream development. Turkmenistan has, however, moved ahead to develop the field itself and expand production to 40 bcm by 2025.⁶³ With the continuing conflict in Afghanistan, there are clearly risks to the project. The Taliban have stated assurances of protecting the pipeline despite the history of fighting to control Farah, a western province and city adjacent to Herat, near the Iranian border where the pipeline will traverse.⁶⁴ The pipeline will also pass through Quetta in Pakistan's Baluchistan province, where militant and terrorist groups operate, thereby adding to pipeline security risks. The outcome of ongoing negotiations among the Taliban and the Afghan government, with US, Chinese, and Russian involvement, will likely be critical to the project's fate and the attitude of India toward continued participation.

Another long-pursued project is the CASA-1000 high-voltage, direct current (HVDC) electricity transmission line that will bring seasonably available hydropower from Tajikistan and the Kyrgyz Republic through Afghanistan to Pakistan. The World Bank is the major financier, but additional funders include the Islamic Development Bank, the European Bank for Reconstruction and Development, the United Kingdom, and the United States. Although construction began in May 2016, progress has been slow, especially in Tajikistan contracts. The main components of the project include:

- 500 kilovolt (kV) alternating current (AC) line from Datka (in the Kyrgyz Republic) to substation Sugd (477 kilometers, or 296 miles, away, in Tajikistan);
- 1,300 MW AC-DC converter station at Sangtuda (Tajikistan);
- 750 km HVDC line from Sangtuda to Nowshera (Pakistan); and
- 1,300-megawatt DC-AC converter station at Nowshera.⁶⁵

Power purchase agreements have been completed between the participating national transmission companies, and commercial operations are expected to begin in 2022.

The ADB did not support CASA-1000, instead pursuing the Turkmenistan-Afghanistan-Pakistan (TAP) project—a

62 "Solar Energy to Help Meet Pakistan's Power Demand," Energy Sector Management Assistance Program, October 24, 2018, <https://www.esmap.org/node/170462>

63 "Turkmenistan in process of TAPI gas pipeline construction," *AzerNews*, August 14, 2018, <https://www.azernews.az/region/136182.html>.

64 Catherine Putz, "TAPI Moves Into Afghanistan, Taliban Promise to Protect the Project," *the Diplomat*, February 27, 2018, <https://thediplomat.com/2018/02/tapi-moves-into-afghanistan-taliban-promise-to-protect-the-project/>.

65 "About CASA-1000: Realizing the CASA-1000 Vision," CASA-1000, accessed November 2019, <http://www.casa-1000.org/MainPages/CASAAbout.php>.

500 kilovolt (kV) electricity transmission project that would use the same route as the TAPI pipeline and potentially would allow larger power flows than CASA-1000. The TAP framework agreement was signed in May 2018 and has two main phases: the first phase—to be completed by 2021—will use the existing infrastructure under the ADB-financed Turkmenistan-Uzbekistan-Tajikistan-Afghanistan-Pakistan (TUTAP) power interconnection project, which aims to export power from Turkmenistan to Afghanistan and Pakistan. The second phase—to be completed by 2022—will transfer power from Turkmenistan through the border of Serhetabad (in Turkmenistan) and Torghundy into Herat, Kandahar, and Spin Boldak in Afghanistan, and export to Chaman and Quetta in Pakistan.⁶⁶

Another factor in the regional equation is, of course, Iran. That nation has proclaimed its desire to be a regional electricity hub with exports to the Caucasus through Armenia and Azerbaijan, and to Central Asia through Turkmenistan, and directly to Turkey, Afghanistan, and Pakistan. Iran's power exports generated US\$3.37 billion in revenue between September 2013 and May 2017, according to a Pakistan press report citing Iran's Energy Ministry, with Iraq ranking as the largest market (1,400 MW per year).⁶⁷ Although Iran's electricity exports to Afghanistan and Pakistan are presently only about 130 MW, Iran has indicated its readiness to provide as much as 3,000 MW to Pakistan.⁶⁸ The current confrontation with the United States—and US sanctions on Iran—pose a problem for Pakistan's pursuit of this option as well as Pakistan's long-delayed import of natural gas from Iran. The latter project, which dates over a decade, envisioned the completion of an 8 bcm pipeline. Although Iran has finished its segment, Pakistan has not proceeded with its leg due to US pressure and sanctions, and Iran has threatened to take the issue to the International Court of Justice in The Hague.⁶⁹

Attracting Domestic and International Investment and Financing

Strategic Priority: *Pakistan needs to step up its efforts to improve the financial position of its power sector, reduce quasi-fiscal deficits, and increase the efficiency of the state energy companies if it is to attract the capital and financing needed to meet the growing electricity demands. The*

emphasis should be on attracting private capital, and the government should be more careful in assuming external state loans from China and other sources that exacerbate the public debt position and increase CO₂ emissions. The gas and renewable energy subsectors should be given highest priority since they are both economically viable and can attract private equity and debt financing. With growing energy demands from rapid urbanization, greater attention should be given to improving energy efficiency, especially through building envelope, appliance, and HVAC system standards, and incentives for building owners to invest in modern energy-management systems. Improvement in the transparency, professional capability, and credibility of NEPRA will be increasingly important to assuring sound and sustainable financial investments in the sector.

Discussion: Although the recent slowdown in Pakistan's economy has raised concerns, the energy sector continues to attract considerable interest from private and state investors, donors, and international financial institutions (IFIs). Prime attention has focused on the expansion of Chinese financing for infrastructure, including energy, under the BRI. Substantial international criticism, including disparaging comments on China's "debt trap" diplomacy, lack of transparency, and state-dominated nonmarket approach from senior US administration and congressional leaders, has been aimed at China's US\$62 billion CPEC program to construct roads, mines, power plants, ports, and other infrastructure. The official CPEC website as of July 2019 contained fifteen priority energy projects involving over 11,000 MW of new capacity, US\$16 billion in estimated investment, several coal mines, and two major high-voltage transmission lines.⁷⁰ These projects do not include the more than US\$6 billion of financing for the nuclear plants that China is building near Karachi and planned for Chasma or the ongoing US\$10 billion port development at Gwadar in Baluchistan, which China has leased for forty-three years and which may become important for future oil and coal imports. There has also been speculation that China intends to use Gwadar port for its naval expansion, especially in light of China's agreement to sell Pakistan eight submarines.⁷¹ China is sending thousands of workers to Pakistan for these projects, posing a challenge for Pakistan security officials. The Sahiwal coal-fired power plant was commissioned in May 2017 after being constructed

66 "Power Interconnection Project to Strengthen Power Trade Between Afghanistan, Turkmenistan, Pakistan," Asian Development Bank, February 28, 2018, <https://www.adb.org/news/power-interconnection-project-strengthen-power-trade-between-afghanistan-turkmenistan-pakistan>.

67 "Iran to increase electricity export to Pakistan, Afghanistan," the *Nation*, April 9, 2018, <https://nation.com.pk/09-Apr-2018/iran-to-increase-electricity-export-to-pakistan-afghanistan>.

68 Abhishek G. Bhaya, "Analysis: Iran emerges as regional electricity hub with Pakistan Afghanistan export plans," *CGTN*, April 8, 2018, https://news.cgtn.com/news/3263544f326b7a6333566d54/share_p.html

69 "Islamabad May Halt Iran-Pakistan Gas Pipeline Project Due To U.S. Sanctions," *Radio Farda*, May 12, 2019, <https://en.radiofarda.com/a/islamabad-may-halt-iran-pakistan-gas-pipeline-project-due-to-u-s-sanctions/29936275.html>.

70 "CPEC-Energy Priority Projects," China Pakistan Economic Corridor, accessed November 2019, <http://cpec.gov.pk/energy>.

71 Maria Abi-Habib, "China's 'Belt and Road' Plan in Pakistan Takes a Military Turn," *New York Times*, December 19, 2018, <https://www.nytimes.com/2018/12/19/world/asia/pakistan-china-belt-road-military.html>

in twenty-two months. The Pakistan government allocated US\$1.71 billion in the 2017-18 budget for CPEC projects.

Significant vehicles for Chinese government energy finance include the two so-called policy banks—the China Development Bank and the Chinese Export-Import Bank. A Boston University dashboard that tracks energy financing from these institutions reports US\$19.098 billion in Chinese energy loans from these banks to Pakistan during 2014-18, mainly for nuclear, coal, and hydro projects.⁷²

This major borrowing comes at a time when Pakistan is already facing an elevated current account deficit and a ballooning external public debt estimated by the IMF at US\$105.8 billion in March 2019.⁷³ Public and public-guaranteed debt is projected by the IMF to increase to US\$234 billion in 2019-20,⁷⁴ in part driven by the CPEC-related outflows (loan repayments and profit repatriation). Pakistan's current Chinese debt is estimated to be US\$15 billion in public loans and US\$6.7 billion in commercial finance obligations.⁷⁵ This weakening external financial position will be a major challenge and require significant external resource mobilization to meet the debt-service obligations, as the IMF pointed out in approving the US\$6 billion EFF. Pakistan officials have argued that official debt to China is limited since many of the projects involve commercial loans and foreign direct investment by Chinese companies, and official debt is only a small portion of the overall national debt of US\$100 billion and the annual investment program of the government.⁷⁶

International criticism of Chinese actions goes beyond the long-term financial dependency aspects and political ramifications of these projects to include the environmental and climate change impacts of its lending for coal projects and the weak environmental standards in the hydro and other projects. Pakistan has been a major focus of Chinese

international coal financing. The Overseas Development Institute's June 2019 report estimated that Group of Twenty (G20) countries provided coal financing and subsidies of US\$16 billion during 2016-17, with China and Japan accounting for 87 percent of this amount. Pakistan received US\$3.975 billion from China during this period.⁷⁷ Boston University's China's Global Energy Finance tracker indicates that coal was a major part of the US\$3.3 billion in Chinese funding from the Chinese Development Bank and Chinese Export-Import Bank during 2017.⁷⁸ The contradiction of China seeking to reduce coal's role domestically through the substitution of gas, renewables, and nuclear and its aggressive support for overseas coal plants is quite stark and reflects the political influence of the large Chinese state industrial companies.

This trend in encouraging coal use is alarming in terms of both global efforts to combat climate change and reduce CO₂ emissions and in terms of Pakistan's future policy direction. Chinese officials indicate that they are just responding to the desires of the country officials that view coal as the least-cost option. The evidence increasingly (see Figure 5) shows, however, that renewables and gas are competitive and certainly less expensive if environmental, health, water, and other factors are considered.

Chinese support for overseas coal projects contrasts with the position of the IFIs, which are supporting hydro, gas, and other renewable energy projects. For example, the World Bank is a major donor in Pakistan and is supporting a US\$425 million National Transmission Modernization project, a Tarbela Fourth Extension Hydro project of US\$390 million (which provides additional funding to the original US\$840 million Tarbela extension loan), a US\$588.4 million Dasu Hydro Stage 1 project, and a US\$100 million Sindh Solar Energy Project.

72 "China's Global Energy Finance: Energy Sources 2016," Boston University Global Development Policy Center.

73 "Pakistan External Debt," CEIC, accessed November 2019, <https://www.ceicdata.com/en/indicator/pakistan/external-debt>.

74 "IMF Executive Board Approves US\$6 billion 39-Month EFF Arrangement for Pakistan," International Monetary Fund, July 3, 2019, <https://www.imf.org/en/News/Articles/2019/07/03/pr19264-pakistan-imf-executive-board-approves-39-month-eff-arrangement>

75 State Department Acting Assistant Secretary for South and Central Asia Alice Wells, "A Conversation with Ambassador Alice Wells on the China-Pakistan Economic Corridor," public conversation, event at the Wilson Center, Washington, DC, November 21, 2019, <https://www.wilsoncenter.org/event/conversation-ambassador-alice-wells-the-china-pakistan-economic-corridor>.

76 Raghuvir Srinivasan, "Worries over Pakistan debt to China are overstated: Imran Khan's adviser," *the Hindu*, May 2, 2019, <https://www.thehindu.com/news/international/worries-over-pakistan-debt-to-china-are-overstated-imran-khans-adviser/article27015135.ece>

77 *G20 coal subsidies: Tracking government support to a fading industry*, the Natural Resources Defense Council, the International Institute for Sustainable Development, and Oil Change International, June 2019, <https://www.odi.org/sites/odi.org.uk/files/resource-documents/12744.pdf>.

78 "China's Global Energy Finance: Energy Sources 2016," Boston University Global Development Policy Center.



The new Gomal Zam Dam generates 17.4 MW of power, enough energy to supply electricity to 39,000 households.
Source: Flickr/US Embassy Pakistan

Although the Asian Development Bank did finance the US\$900 million Jamshoro coal plant in Pakistan, over the objections of the Obama Administration and other countries, it has since focused on noncoal projects in transmission, distribution, renewable energy, and energy efficiency.⁷⁹ Over the period 2005-17, ADB provided US\$6.2 billion for energy in Pakistan, accounting for 28 percent of its operations in the country.⁸⁰

Of the bilateral donors active in the sector, the US government, through the US Agency for International Development (USAID), Overseas Private Investment Corporation (OPIC), and the US Department of Energy, has provided energy assistance and financial support to the power sector and US

investors over many decades. This assistance has helped finance both human and physical infrastructure from hydro facilities to thermal power plants, electricity distribution improvement, rural electrification, and more recently wind projects and transmission investments in Pakistan's Sindh province. Since 2011 alone, USAID-financed projects have added over 3,500 MW of electricity to Pakistan's national grid. This includes 1,049 MW of generation capacity from new and rehabilitated hydro and thermal power plants and 2,505 MW of transmission and distribution capacity. Improving the performance of the distribution companies also has been a central focus of USAID programs, helping to realize through loss-reduction efforts 212 MW in distribution capacity and the recovery of over US\$429 million in revenue.⁸¹

79 *Pakistan: ADB's Support to Pakistan Energy Sector (2005–2017)*, Asian Development Bank, January 2019, <https://www.adb.org/sites/default/files/evaluation-document/397216/files/sape-pakistan-energy.pdf>.

80 "ADB Support Key to Strengthen Pakistan's Energy Sector: Independent Evaluation," Asian Development Bank, February 12, 2019, <https://www.adb.org/news/adb-support-key-strengthen-pakistan-s-energy-sector-independent-evaluation>

81 "Pakistan: Energy," United States Agency for International Development, last updated November 20, 2019, <https://www.usaid.gov/pakistan/energy>.

Although Pakistan, with its favorable renewable resource potential and feed-in tariff policies, has been relatively successful in attracting project financing from both private and public sources, it will need to further improve the investment climate if it is to realize the new, ambitious targets of the Khan government. An important aspect will be the implementation of a major renewable energy auction system that has become the global norm, as they move away from rigid feed-in tariffs. These efforts should be coordinated with broader power-sector restructuring, and plans are developing to allow direct sales of power from renewable generators to industrial consumers. Investment in transmission capacity will be critical and the World Bank and others are working with the government to consider options for both siting and financing. Opening up some transmission projects to private investors is certainly an option that should be evaluated.

CONCLUSION

South Asia, with its rapidly growing energy sector, is poised to play an expanding role in global energy markets and geopolitics. This issue brief has focused on Pakistan, which faces challenges in meeting rising energy demands and addressing security, poverty, and climate change issues. The intensifying great power competition among the United States, China, and Russia is playing out in this region, and the energy sector is one critical arena. The United States has long-standing strategic interests in the region, given US investment in aiding a peaceful and viable Afghanistan as well as mitigating tensions and potential conflict between the nuclear states of Pakistan and India. China is expanding its influence in the region and has made Pakistan a top focus of its Belt and Road Initiative and the China-Pakistan Economic Corridor, with its heavy investment in electric power and infrastructure projects.

Energy is critically important to raising Pakistan's per capita income levels and achieving universal electricity access is an important objective. Faced with rising energy demands from increasing urbanization, incomes, and population, Pakistan has increased its reliance on fossil fuel imports despite the fact that, according to the US Geological Survey, it has petroleum resources of 164 million barrels of oil and 24.6 trillion cubic feet of natural gas.⁸² Although this paper has not discussed the upstream oil and gas sector, Pakistan should consider ways to further investment in domestic exploration and development of these resources.

Pakistan's power-sector diversification program concentrates on expanding coal generation from both imported and domestic sources. The planned scale-up of coal generation from almost nothing a few years ago is very troubling and adds to international concerns that countries, especially in Asia, are not seriously implementing their Paris agreement commitments to mitigate CO₂ emissions.

United Nations (UN) Secretary-General António Guterres, in his closing remarks at the UN Climate Conference in New York on September 23, 2019, called for countries to stop building coal plants after 2020.⁸³ Although this call is highly aspirational and not very realistic in terms of Pakistan's situation, Pakistan's leaders would be wise to reorient their policies away from coal and greatly ramp up their renewable energy, energy efficiency, and gas and LNG development efforts, as the new Khan government targets seem to suggest. Improving the financial viability of the power sector and ameliorating the circular debt problem are vitally important to attracting the needed investment for projects and establishing credible power off-take agreements.

Pakistan can build on the success it has had in attracting investment in wind and solar development to complement its large hydro development program and ensure that investments in transmission are made to accommodate this expansion. International financial institutions and US and European donors should continue to encourage this direction while raising with high-level Chinese officials the issue of its aggressive coal project financing. Given the growing climate change impacts of storms and stresses on water resources, it is critical for Pakistan to elevate both mitigation and adaptation in its policies and budget and investment priorities.

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82 Christopher J. Schen et al., "Assessment of Undiscovered Oil and Gas Resources in the Lower Indus Basin, Pakistan, 2017," United States Geological Survey, 2017, <https://pubs.usgs.gov/fs/2017/3034/fs20173034.pdf>.

83 "Secretary-General's remarks at closing of Climate Action Summit [as delivered]," United Nations, September 23, 2019, <https://www.un.org/sg/en/content/sg/statement/2019-09-23/secretary-generals-remarks-closing-of-climate-action-summit-delivered>

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