

SECTOR ASSESSMENT (SUMMARY): ENERGY¹

Sector Road Map

1. Sector Performance, Problems, and Opportunities

1. **Sector overview.** Afghanistan is among the lowest in electricity usage globally—about 100 kilowatt hours (kWh) per year per capita consumption—with only 30% of its population connected to the grid. Peak demand in 2014 was 750 megawatts (MW), although the unsuppressed demand is estimated at 2,500 MW. In 2014, almost 80% of power was supplied by imported power, and demand in major cities increased by 25%. Although the reliability of the grid has improved significantly since 2002, load shedding is still common and private generators fill the gap. To meet this demand growth, Afghanistan aims to develop a combination of domestic fossil fuel, hydropower, and renewable energy generation projects, through public and private sector participation, complemented by diversified import solutions.

2. Significant renewable energy and fossil fuel resources need to be developed through public and private investments. In 2014, nearly 97% of the country's oil needs were imported. Lack of investments in gas production and transmission infrastructure restricts development of identified gas reserves of 75 billion cubic meters to only 150 square kilometers (km) area. The key challenges are (i) lack of generation capacity, (ii) increasing constraints in transmission and distribution systems, (iii) weak financial management and sustainability of sector entities caused by lack of cost-reflective tariff frameworks, and (iv) inadequate sector regulation.

3. **Inadequate generation capacity.** The total installed generation capacity in Afghanistan is only about 520 MW, including 254 MW (49%) from hydropower resources; 200 MW (39%) from thermal sources (furnace oil, diesel, and gas); and 65 MW (12%) from distributed generators. Imports constitute nearly 80% of the total power balance, and the import bill of energy has increased 14 times from \$16 million in 2007 to nearly \$224 million to 2015. The absence of a water treaty with neighboring countries (five out of six rivers have transboundary issues) and international mining investors renegeing on their contractual obligations impede the development of indigenous hydropower and thermal (gas and coal) power projects.

4. **Missing renewable energy and off-grid development.** Less than 9% of the rural population has access to electricity, while more than 75% of Afghans live in rural areas and 67% of the gross domestic product comes from rural areas. Afghanistan has an estimated 23,000 MW of hydropower resource potential, 67,000 MW of wind potential, and 222,000 MW of solar potential. However, development of such resources to date has been minimal. Harnessing these will improve the country's energy mix and energy security.

5. **Isolated asynchronous power grids.** Afghanistan needs a unified national electricity grid. It has 10 isolated grids or islands supplied by different power systems through 220-kilovolt (kV) and 110-kV links. Different parts of Afghanistan's networks are supplied as passive islands by power fed from Iran, Tajikistan, Turkmenistan, and Uzbekistan. However, because of asynchronous grid operations in these countries, the current network configuration is highly inflexible. Asynchronous networks inhibit efficient power interconnections and trade, so power produced on one network cannot be connected to any of the country's other systems without the installation of back-to-back convertor systems to align power frequency. This impedes efficient

¹ This summary is sourced from publications by the Government of Afghanistan and its development partners, posted on the Interministerial Commission for Energy (ICE) website. <https://sites.google.com/site/iceafghanistan/>

load dispatch and results in a higher probability of blackouts because of lack of reserves and high dependency on feeds from importing countries. Afghanistan's generation is not utilized at full capacity because of constraints in rearranging the loads to build islands. Therefore, bulk export of energy is not possible and the country cannot serve as a transit system for transmitting electricity from Central Asian countries to South Asia.

6. **Low coverage of distribution network.** Low grid connectivity makes a vast difference between rural and urban access. While over 75% of the population in large urban areas like Kabul, Kandahar, Herat, and Mazar-e-Sharif have electricity, less than 10% of the rural population has access to grid-connected power. Nearly 1.2 million customers are connected to the grid, comprising nearly 30% of the country's population. The government, with assistance from development partners, is funding major distribution expansion programs across major load centers of the country. Nearly 200,000 new distribution connections are under implementation and another 100,000 connections are in the planning phase.

7. **High energy losses and low energy efficiency.** The current level of losses is estimated to be about 24%, down from 54% in 2008. Assuming 10% is an acceptable level of technical and commercial losses, the balance of 13.5% is estimated to be worth \$71.2 million a year at \$0.12 per kWh. A reduction in technical and commercial losses is important both in terms of the financial sustainability of Afghanistan Power Utility (DABS) and supplying more power to consumers. DABS is rolling out its annual asset maintenance plan, bulk metering plan, and computerized maintenance management system to arrest system losses.

8. **Uneconomic electricity pricing and high cost.** The average electricity tariff is \$0.8–\$0.12 per kWh, far below what is needed to cover power import generation costs of about \$0.06–\$0.10 per kWh on average, and power transmission and distribution costs for the network of about \$0.07–\$0.10 per kWh. Based on the current energy mix, to be cost-reflective, the tariff is estimated to be around \$0.15–0.18 per kWh.² The cost of operation, maintenance, and new investments is high because of broad security concerns.

9. **Weak legal framework and no market-based policy.** More is required to strengthen capacity and accountability, to ensure clearer explanation of responsibilities and better collaboration across government agencies. The sector's legal framework is weak, and the lack of sector-specific laws and regulations is leading to poor governance and lack of market-based pricing that allows for full cost recovery. These shortcomings must be addressed if the sector is to attract much-needed foreign investment. Sector corporatization is strengthening through the formation of DABS in 2009 and the Afghan Gas Enterprise in 2011. The Electricity Services Act, 2015 defines the roles and responsibilities of sector entities.

10. **Missing development plan for gas.** According to recent studies conducted by the United States Geological Survey and the Afghan Ministry of Mines and Petroleum (MOMP), the total estimated undiscovered technically recoverable natural gas reserves in Afghanistan are 444 billion cubic meters (m³), in addition to already identified reserves of 75 billion m³. The absence of a gas development plan and an investment framework is an obstacle to the funding of projects by the government and development partners because it makes it difficult to identify, harmonize, and sequence expansion programs effectively. Technical assistance (TA) to help Afghanistan develop a gas development master plan funded by ADB is on-going.³

² The cost of diesel generation is \$0.30–\$0.50 per kWh, depending on the size of the equipment.

³ ADB. 2013. *Technical Assistance to the Islamic Republic of Afghanistan for the Gas Development Master Plan*. Manila (TA 8401, \$700,000, approved on 11 July).

11. **Indigenous coal resources not utilized.** The northwest Bamyan province has domestic coal resources. Coal, including the development of a plant to supply electricity to the Aynak copper mining project, could provide a significant source of power. However, implementation has been delayed significantly and the project may not provide the envisaged 200 MW of surplus power to the grid. Similarly, investment linked to the Hajigak iron ore deposit, which had foreseen the development of a power plant of up to 800 MW, remains uncertain.

12. **Regional energy trade hub.** Afghanistan seeks to become a significant energy resource corridor and energy transit hub. Expanding regional electricity trade between Turkmenistan–Uzbekistan–Tajikistan–Afghanistan–Pakistan (TUTAP), the Central Asia South Asia (CASA) power project, and gas imports from Turkmenistan into Afghanistan, Pakistan, and India (TAPI) would provide Afghanistan with transit revenues and energy security through energy offtake in Afghanistan. TUTAP will bring more than 1,500 MW of power to meet the country's demand, CASA will import 300 MW, while TAPI will supply up to 0.5 billion cubic meters of gas per year to Afghanistan.

13. **Planning and financing.** Nearly \$5.0 billion in grant assistance and private sector investment is projected to be provided to the Afghanistan energy sector during 2013–2018. The Inter-Ministerial Commission for Energy (ICE), supported by ADB, has been an effective mechanism for brainstorming and reaching coherent agreements on an investment and governance agenda.⁴ ICE supports collaboration among the government, development partners, and the private sector in (i) sector planning and harmonization to avoid overlapping, (ii) sequencing of investments, and (iii) analytical work related to Afghanistan's energy sector. The International Conferences on Afghanistan held in Tokyo (2012) and London (2014) pledged almost \$16 billion for the country's reconstruction during 2013–2016, of which nearly \$3 billion will be allocated (on-budget) to power sector investments. Out of this, to date, nearly \$800 million has been invested in the energy sector.

2. Government's Sector Strategy

14. The government is implementing the energy sector strategy, road map, policy framework, and envisaged investment plan approved under its National Energy Supply Program (NESP) 2030. NESP integrates the power sector master plan 2012–2032, and gas development master plan 2015–2035, and builds on the Afghanistan National Development Strategy 2008–2013. The Electricity Services Act 2015 provides a legal and regulatory framework, and transparent structure for private sector participation. The NESP prioritizes the development of indigenous generation in parallel with power import infrastructure, completion of the transmission line ring, focus on renewable energy generation, expansion of power distribution networks, and development of gas fields for power and industrial anchors. By 2032, the NESP of nearly \$10.1 billion—funded through government and donor funds, public–private partnerships, and private sector financing—envisages (i) an increase in the electrification rate from 30% to 83% through an integrated transmission network; and (ii) an increase in domestic generation from 20% to 67%, and strengthening power exchange options with neighboring systems.

15. The power utility, DABS, is implementing a robust institutional development and commercialization strategy that includes (i) improved operation and maintenance (O&M) practices in the entire value chain, (ii) revenue protection initiatives, (iii) reforms in procurement and corporate governance, and (iv) business planning. ADB, the World Bank, and the United

⁴ ADB. 2013. *Technical Assistance to Afghanistan for Supporting the Inter-Ministerial Commission for Energy*. Manila (TA 8328-AFG, \$1.5 million, approved on 22 February).

States Agency for International Development are providing capacity support. In total, nearly \$35 million of O&M capacity support programs are being implemented.

3. ADB Sector Experience and Assistance Program

16. ADB is the country's largest on-budget development partner in the energy sector, with cumulative assistance of nearly \$937 million in grants and loans to date. ADB-assisted projects have commissioned more than 630 km of transmission lines, eight substations, 15,000 new power connections, and eight gas wells to generate 2 million m³ of gas per day. Ongoing projects comprising 400 km of transmission lines, four substations, 110,000 new connections, and 4.5 MW of hydropower generation projects are under implementation. Additional support has been provided to strengthen operations and maintenance, project preparation, analytical studies, and capacity development. ADB has led efforts to formulate the NESP and has acted as the development partner focal point in the energy sector.

17. ADB's investment projects include (i) the Afghanistan–Uzbekistan Interconnection, completed in 2008 (\$45.0 million); and (ii) the Afghanistan–Tajikistan Interconnection, completed in 2011 (\$47.0 million)⁵. The ongoing portfolio comprises (i) the Power Transmission and Distribution Project (\$50.0 million);⁶ and (ii) the Energy Sector Development Investment Program—tranche 1 (\$164.0 million), tranche 2 (\$81.5 million), tranche 3 (\$75.4 million), tranche 4 (\$200.0 million), and tranche 5 (\$49 million).⁷ Further, the North–South Power Transmission Enhancement Project (\$216.0 million), was approved in 2013.⁸

18. ADB has provided TA in the sector, including projects to help Afghanistan (i) prepare the power master plan,⁹ (ii) develop an interministerial commission for energy (footnote 4), (iii) develop a gas development master plan (footnote 3), and (iv) develop renewable energy.¹⁰ Implementing energy projects in Afghanistan is difficult and entails additional security costs, capacity constraints, difficult terrain, rebidding, and availability of few international contractors and consultants willing to work in the country. Start-up delays are caused by lack of procurement and social safeguards capacity and difficulties. Implementation is challenging and takes longer because of the fragile post-conflict environment. Over the years, ADB has refined its implementation and project design from lessons learned in earlier projects to achieve results.

⁵ ADB. 2003. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Islamic Republic of Afghanistan for the Emergency Infrastructure Rehabilitation and Reconstruction Project*. Manila (Loan 1997-AFG, \$150 million, approved on 3 June); and ADB. 2006. *Report and Recommendation of the President to the Board of Directors: Proposed Loans, Technical Assistance Grants and Administration of Loan by the OPEC Fund for International Development to the Islamic Republic of Afghanistan and Republic of Tajikistan for the Regional Power Transmission Interconnection Project*. Manila (Loan 2304-AFG, \$35 million and Grant 0230-AFG, \$12 million, approved on 19 December).

⁶ ADB. 2005. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Asian Development Fund Grant and Technical Assistance to the Islamic Republic of Afghanistan for the Power Transmission and Distribution Project*. Manila (Grant 0004/Loan 2165/TA 4579-AFG, approved 14 April).

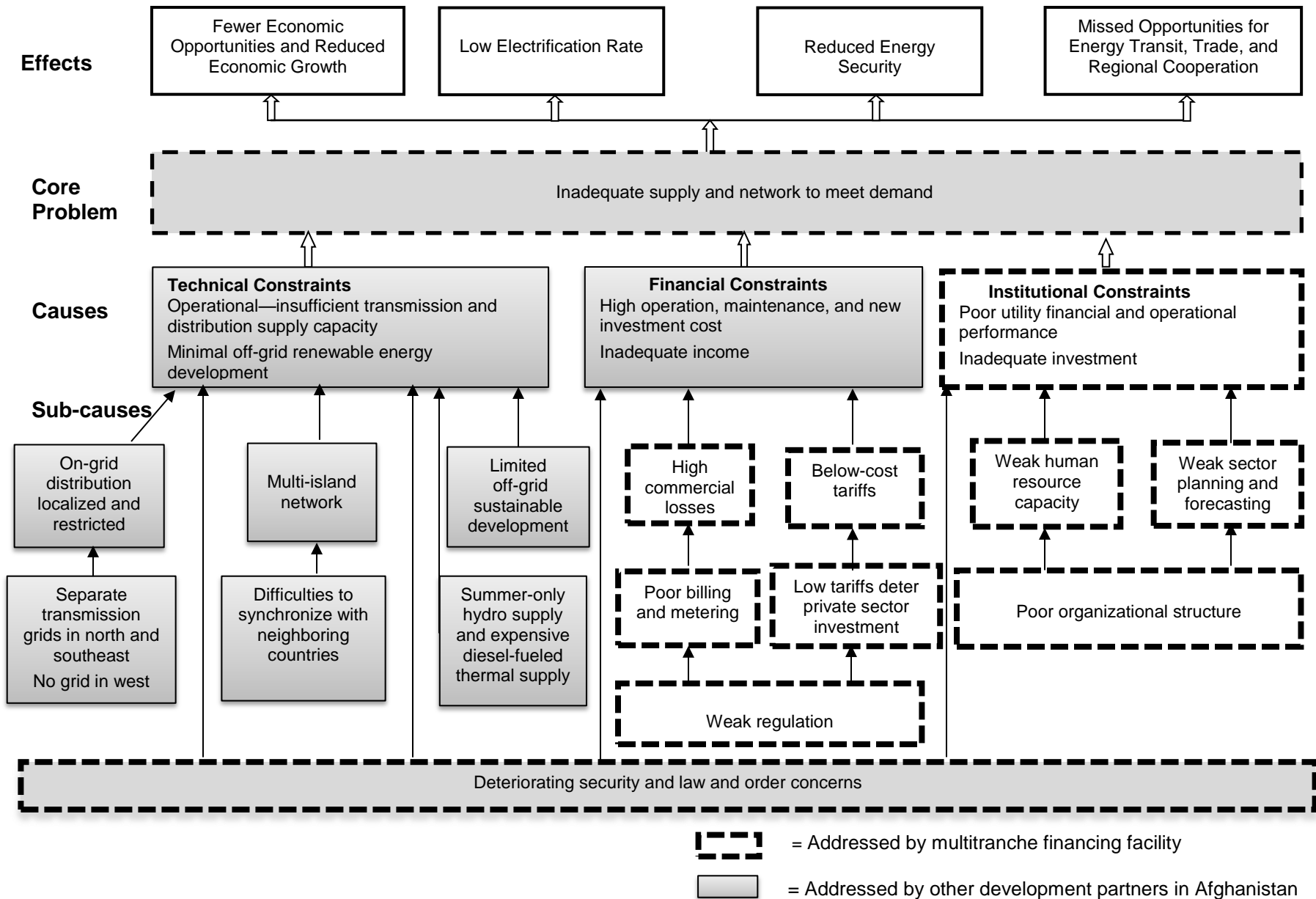
⁷ ADB. 2008. *Report and Recommendation of the President to the Board of Directors: Proposed Multitranches Financing Facility and Administration of Grant to the Islamic Republic of Afghanistan for the Energy Sector Development Investment Program*. Manila (MFF 0026-AFG, approved on 2 December).

⁸ ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Asian Development Fund Grant for the North–South Power Transmission Enhancement Project to the Islamic Republic of Afghanistan for the Energy Sector Development Investment Program*. Manila (G-0374/0375-AFG, approved on 25 November).

⁹ ADB. 2010. *Technical Assistance to Afghanistan for the Power Sector Master Plan*. Manila (TA 7637-AFG, \$1.5 million, approved on 6 November) and ADB. 2010.

¹⁰ ADB. 2014. *Technical Assistance to the Islamic Republic of Afghanistan for Renewable Energy Development*. Manila (TA 8808-AFG, \$1.0 million, approved on 12 December).

Problem Tree for the Energy Sector



Sector Results Framework (Energy, 2015–2017)

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
Sustainable and reliable grid-connected power supply in northern, eastern, and southern Afghanistan	1. Electrification ratio increased from less than 10% in 2007 to 50% in 2017	National power transmission system upgraded, well maintained, and linked with neighboring countries	Power system capable of transmitting additional 300 MW by 2018. (baseline: 300 MW 2011 level)	\$580 million in 2015–2017, 49.2% of total COBP financing, inclusive of \$340 million cofinancing (AIF), of which: CAD 25%, GRO 100%, and RCI 60%	Planned key activity areas Afghanistan power system strengthened to evacuate more power, reduce losses, and distribute additional power
	2. NEPS capacity of supplying 150 MW in 2009 increased to 1,000 MW of connected load by 2017	Transmission lines and substations constructed	650 km of additional transmission lines built in 2018 (baseline: 500 km 2012 level)		
	3. System losses reduced from 50% in 2007 to 30% by 2017	Distribution networks expanded	150,000 new household connections added by 2017 (baseline: 900,000 connections 2012 level)		
	4. Southern provinces of Ghazni and Kandahar are connected to the NEPS system through 220-kV and 500-kV lines	Gas wells rehabilitated	12 gas wells rehabilitated by 2017 (baseline: 0 in 2012)		
	5. Natural gas extraction facilities and infrastructure in the northern provinces of Afghanistan are further developed	Technical and commercial power losses reduced	Technical and commercial losses reduced from 42% in 2012 to 24% in 2017		
		Sector master planning institutionalized	Offices of power and gas sector master planning established and institutionalized by 2017	Planned key activity areas Investments in power generation, transmission, and distribution systems. Investment in gas infrastructure, and systems planning and capacity support Pipeline projects with estimated amounts Energy MFF 2 (\$750 million) Ongoing projects with approved amounts Energy MFF tranche 1 (\$176 million) Energy MFF tranche 2 (\$81 million) Energy MFF tranche 3 (\$78 million) Energy MFF tranche 4 (\$200 million) Energy MFF tranche 5 (\$49 million) North–South Power Enhancement (\$216 million)	Pipeline projects 450 km of 500-kV and 220-kV transmission lines constructed Tariffs increased to match cost of supply and undertake operations and maintenance Ongoing projects 150,000 new household connections added by 2017, compared with 2012 2 gas wells rehabilitated by 2015, from 6 in 2013 Technical and commercial losses reduced from 42% in 2012 to 24% in 2017

ADB = Asian Development Bank, AIF = Afghanistan Infrastructure Trust Fund, CAD = capacity development, COBP = country operations business plan, DABS = Da Afghanistan Breshna Sherkat (Afghanistan's state-owned power utility), GRO = economic growth, km = kilometer, kV = kilovolt, MFF = multitranche financing facility, MW = megawatt, NEPS = North East Power System, RCI = regional cooperation and integration.

Source: Asian Development Bank.