

## SECTOR ASSESSMENT (SUMMARY): ENERGY<sup>1</sup>

### Sector Road Map

#### 1. Sector Performance, Problems, and Opportunities

1. Tajikistan's power system has an installed capacity of 5,356 megawatts (MW) comprising eight large and a few small hydropower plants (4,737 MW), and three fossil fuel-fired combined heat and power plants (418 MW). In 2013, internal power generation was 16.9 billion kilowatt-hours (kWh) with an internal consumption of 13,400 billion kWh.<sup>2</sup> The high reliance on hydropower generation results in a power surplus in summer and a deficit in winter. However, certain parts of the Tajikistan transmission grid still suffer from transmission bottlenecks in the wake of the disconnection from the Central Asian Power System in November 2009.

2. Since 1990 till today, the production and consumption of electricity has declined. Consumption declined by one-third, primarily as a consequence of the lack of available electricity. Power is supplied for just a few hours per day in the winter. Power cuts are frequent, even in large cities, and power assets have aged beyond their economic life. According to the power sector regional master plan prepared in 2012 under the Central Asia Regional Economic Cooperation program, nearly 80% of all generation and transmission assets in Tajikistan need to be replaced.<sup>3</sup> The master plan estimated that a \$4 billion investment is needed in the next 10 years to maintain the system, eliminate winter deficit, and ensure grid reliability. Low tariffs, poor collection, system losses, low-quality maintenance, and inadequate management add to the sector's poor performance. Development of new capacity has been slow in part because of (i) the significant resources needed to develop hydropower plants and associated transmission assets, and (ii) lack of regional cooperation due to issues regarding the sharing of river water.

3. The winter energy deficit results in human suffering and is a significant impediment to economic growth and development. Resolution of this problem will require (i) improving the efficiency of existing assets; (ii) negotiating commercial trading arrangements with Tajikistan's neighbors; and (iii) attracting private investment to develop coal, gas, and hydroelectric power.

4. **Hydropower.** Tajikistan is the eighth richest country in the world in terms of hydropower resources, with approximately 220 terrawatt-hours (TWh) technically recoverable. Hydropower plants generate about 98% of the country's electricity. The biggest hydropower plants operated by the vertically integrated state power utility Barki Tojik are Nurek (3,000 MW), Sangtuda 1 (670 MW), Baipaza (600 MW), Golovnaya (240 MW), Sangtuda 2 (220 MW), and Kairakum (126 MW). Sangtuda 1 and 2 are recently constructed power plants with financing coming from the Russian Federation and Iran, respectively.

5. **Thermal resources.** Tajikistan has substantial explored and proven reserves of coal and some potential reserves of gas, only a small fraction of which have been exploited. There are close to 740 coal deposits with total coal reserves of over 4 billion tons. There is sufficient coal for coal-fired power plants to complement hydropower generation and produce some hydrothermal synergy. Tajik coal has a high calorific value in the range of 6,680–8,460 kilocalories per kilogram. The current average price of coal is estimated at TJS200 per ton. Construction of the 400 MW coal-fired Dushanbe 2 combined heat and power plant is ongoing (capital cost is estimated at \$526 million). The first phase (50 MW) was completed in January 2014, another 50 MW will be commissioned in November 2014, and it will be expanded by

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<sup>1</sup> This summary is based on Asian Development Bank (ADB) sector knowledge and operational experience in Tajikistan.

<sup>2</sup> Ministry of Energy and Water Resources.

<sup>3</sup> ADB. 2009. *Technical Assistance to Tajikistan for the Power Sector Regional Master Plan*. Manila.

another 300 MW by November 2016. The government also signed a memorandum of understanding with the Malaysian company HOS International Trading for construction of the 300 MW Shurov combined heat and power plant (estimated cost \$300 million). Construction is planned to start in 2015, with completion scheduled in 2017.

6. The country's accessible oil and gas have been almost entirely exhausted. Tajikistan's proved reserves of crude oil are estimated at 12 million barrels, and its proved reserves of gas at 5.6 billion cubic meters. Most of the country's potential gas reserves (85%) are located in the south; the prospected gas reserves require complex boring to a depth of 5–7 kilometers. In 2013, Tajikistan imported 383 thousand tons of petroleum products, of which 47% was imported from the Russian Federation. Import of natural gas from Uzbekistan was suspended in December 2012. Since then, the import of natural gas has been partially replaced with import of liquid petroleum gas and reached 214,000 tons in 2013. Prices for all petroleum products are deregulated with no state subsidy.

7. **Renewable resources.** Around 10% of the population lives in remote mountainous areas far from centralized power grids. Since the climate of Tajikistan is favorable for abundant solar energy, the use of its existing potential may satisfy up to 10%–20% of energy demand in Tajikistan.<sup>4</sup> However, due to the high costs, there are no industrial-scale public or private solar energy installations planned or constructed. The penetration of solar energy technologies is limited to several off-grid installations throughout the country. The levelized cost of electricity from solar photovoltaic panels is estimated to be \$0.220, while the current electricity tariff for households is equal to \$0.025. Such a low tariff is not sufficient to cover even minimal maintenance costs, so the sustainability of such investments cannot be assured. Similarly, the generation of electricity for small remote villages using small wind turbines does not seem a practical solution due to an even higher levelized cost of electricity (\$0.450).<sup>5</sup>

8. **System losses.** Total transmission and distribution system losses were around 22% in 2013, of which transmission system technical losses accounted for 5%. Distribution system losses are 17% and have remained virtually unchanged since 2006. Barki Tojik does not recognize commercial losses and therefore applies norms for technical losses to the amount of energy received into the distribution networks from transmission. These are unreliable figures and probably understated due to the absence of proper methodology and a metering system.

9. Reduction of nontechnical losses is a priority for the government, which has already begun to address the issue. The turnkey contract for installation of supervisory control and data acquisition system and associated telecommunication system, financed by the Asian Development Bank (ADB), was awarded in September 2014.<sup>6</sup> The World Bank and the European Bank for Reconstruction and Development (EBRD) are financing the installation of the retail (end user) meters in the two biggest load centers, Dushanbe and Khujand. The remaining metering gap is the bulk electricity metering from generation, through transmission and up to retail meters. There is a need for the installation of wholesale meters and an associated billing system, which will enable the management of Barki Tojik to (i) account for all electricity flows and associated costs; (ii) quantify technical and nontechnical losses at the wholesale level of the entire grid, and plan actions for their reduction; and (iii) support the utility restructuring by defining clear borders between generation, transmission, and distribution.

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<sup>4</sup> United Nations Development Program. 2013. *Tajikistan Rapid Assessment and Gap Analysis—Sustainable Energy for All*. Dushanbe.

<sup>5</sup> International Renewable Energy Agency. 2012. *Renewable Power Generation Cost*. Abu Dhabi.

<sup>6</sup> ADB. 2010. *Report and Recommendation of the President to the Board of Directors: Proposed Grant to the Republic of Tajikistan for the Regional Power Transmission Project*. Manila.

10. **Electricity tariff and subsidy.** The government has fixed energy prices at a rate generally lower than required to fully recover costs. In 2006, the weighted average tariff was \$0.006/kWh. It was increased in phases to \$0.015/kWh by December 2008, with subsequent incremental tariff increases. In April 2012 tariff increases (22% for the households and 25% for industry) brought the weighted average tariff to \$0.020/kWh. The latest 15% tariff increase became effective from 1 July 2014. The government plans further tariff increases.

11. The most pressing problem requiring the government's attention is indirect cross-sector energy subsidies, which distorts the pricing structure. Reducing the subsidies will make funds available for energy sector development and for social sector programs. Tariff methodology and regulatory environment is supported by ADB and EBRD.

12. **Governance and institutional issues.** Governance is an increasingly important sector issue. Weak governance results in inefficient utility operations, power theft, illegal power connection, reduced billing and collections, and nonpayment of arrears. These practices open the way for massive waste. Institutional weaknesses in the sector have affected decisions on investments and electricity tariffs. Barki Tojik has sufficient technical capacity but requires stronger capacity for planning, power operations, and financial management.

13. **Billing and collection.** The financial situation of Barki Tojik has been adversely affected by increased receivables for power supply. In January 2014, Barki Tojik receivables were more than TJS1,078 million. The main delinquent accounts were those of the former Ministry of Land Reclamation and Water Resources (TJS263 million) and pumping stations (TJS261 million). Barki Tojik lacks essential systems required to support management operations. It also lacks a computerized customer billing system to support management control collections.

## 2. Government's Sector Strategy

14. **Policy.** The government's energy security policy aims to provide reliable, adequate, and affordable energy for domestic consumption and for national economic growth in a socially, economically, and environmentally sustainable manner. The policy aims to (i) provide access to energy for all; (ii) maximize energy savings through rational energy use; (iii) improve sector performance by commercializing utility operations; (iv) attract private investment in energy sector development; (v) increase energy exports on a commercial basis; and (vi) undertake energy sector reform, capacity building, and governance.

15. **Strategy.** To achieve the policy objectives, the government strategy calls for a dual approach, with a focus on (i) domestic energy, including electricity, gas, and heating, to satisfy the needs of households, industries, and manufacturing through a series of policy and investment measures; and (ii) export markets, focusing on the significant potential to contribute to economic growth through electricity exports. The government's priority is to expand hydropower-generating capacity to meet domestic demand and to increase exports. The government also actively encourages development of the domestic gas and coal subsectors and coal-based power generation. The government recognizes that the management and development of the power subsector must be improved to address the deteriorating infrastructure, inadequate capacity, weakened institutions, and governance issues.

16. **Financing options for energy development.** The investment climate and business environment remain poor and have failed to attract the private sector investment due to pervasive government interference, constrained institutional capacity, and limited access to finance. Recognizing that infrastructure improvements are important to serve the needs of the population and to attract the foreign direct investment needed for development of Tajikistan's natural resources, the government is engaged in and seeking assistance in formulating

appropriate policies and sound strategies. The government understands that investment decisions made over the next 5 years will be critical in determining the security of the country's energy supplies. To meet the large investment needs, the government is seeking assistance from ADB and other development partners to extend the needed investment funds and provide new financing instruments to enhance the provision of private capital, goods, and services.

### **3. ADB Sector Experience and Assistance Program**

17. ADB supports clean and environmentally sustainable energy operations, modernization of transmission and distribution facilities, and sector reforms. ADB is the largest multilateral development partner involved in Tajikistan's energy sector. Since 1998, six projects have been approved, totaling \$373 million.<sup>7</sup> In addition, 10 technical assistance grants totaling \$9 million have been provided for project preparation, institution building, and policy advisory activities, including for (i) improvements to Barki Tojik's institutional structure, operational efficiency, and financial performance; and (ii) development of regional energy trade with neighboring countries.

18. The overall performance of Barki Tojik with regard to ADB project implementation has been satisfactory. Recruitment, procurement, technical implementation, and reporting under previous projects have been managed reasonably well. However, Barki Tojik has not met the financial covenant ratios in the grant agreements of the ongoing projects. Based on the auditor's report, while Barki Tojik's financial management is improving, there is further room for improvement, which requires assistance from international financial institutions.

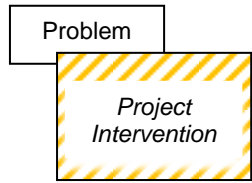
19. **ADB's strategic sector vision and sector operational performance improvement program.** The government plan calls for strengthening the sector's institutions and legal and regulatory framework. In 2011, the government initiated a three-phase (commercialization, separation, privatization) restructuring process of Barki Tojik. The first phase, commercialization, is supported by ADB through the Sector Operational Performance Improvement (SOPI) program (footnote 8). The program addresses governance, financial management, control and audit, legal and regulatory frameworks, management systems, organizational structure, and technical operations. On 11 June 2013, the government approved the restructuring action plan and the new structure of Barki Tojik, which established three departments (generation, transmission, and distribution) under the same legal entity. Heads of these three departments have been appointed, and formation of the new structure, based on international practices of modern power utilities, is ongoing. The detailed action plan, prepared by SOPI consultants, was approved by the government in March 2014. SOPI consultants continue to be engaged by assisting Barki Tojik in implementation of the action plan.

20. **Future ADB interventions.** ADB will continue helping Tajikistan to improve its energy security so it can meet domestic energy needs and expand economic growth. ADB investments will focus on (i) development of capacity to support sector restructuring and reforms of utility operations, (ii) modernization of generation and transmission assets, and (iii) system operations and loss reduction.

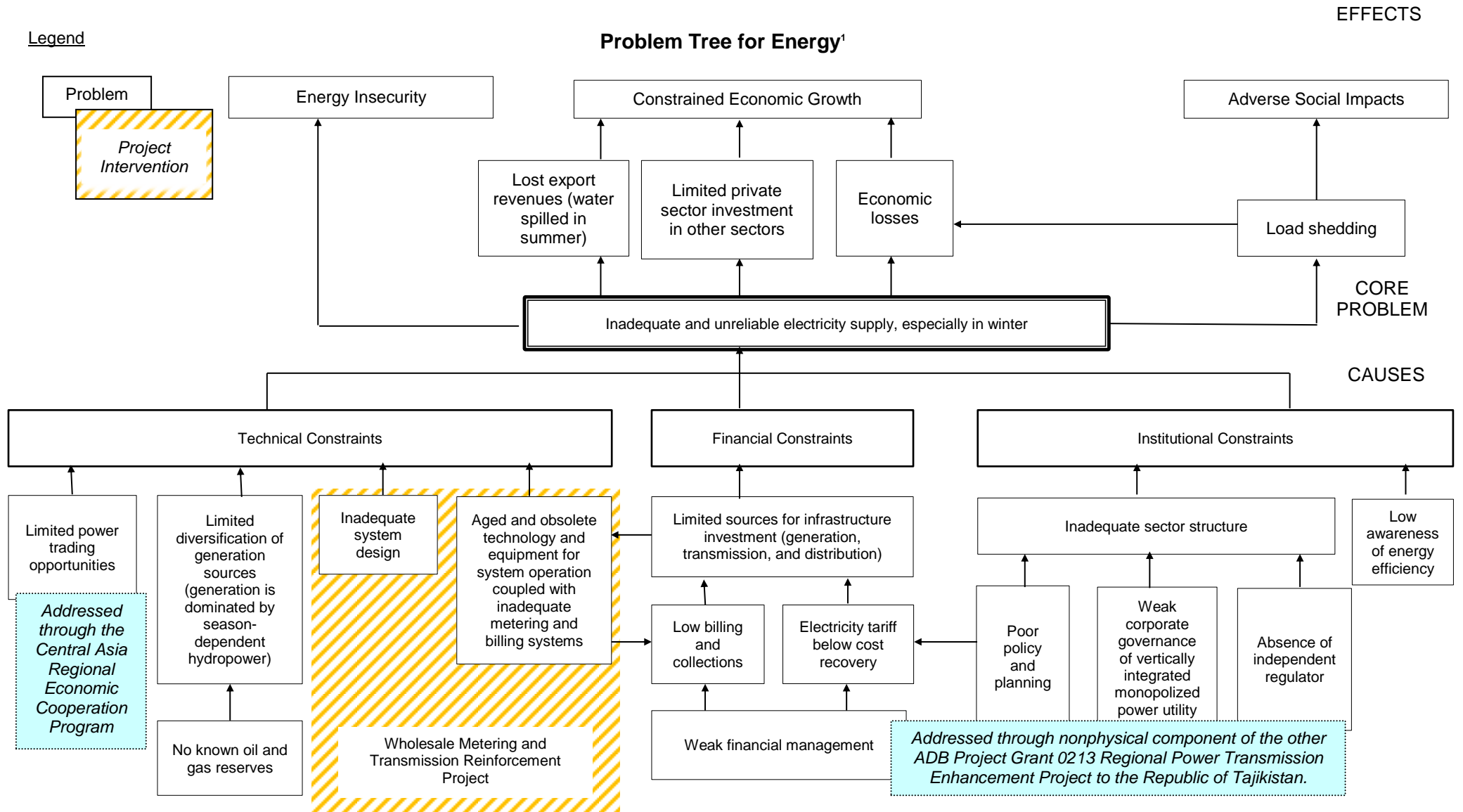
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<sup>7</sup> ADB. 2000. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Republic of Tajikistan for the Power Rehabilitation Project*. Manila; ADB. 2002. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Republic of Tajikistan for the Emergency Baipaza Landslide Stabilization Project*. Manila; ADB. 2006. *Report and Recommendation of the President to the Board of Directors: Proposed Loans, Technical Assistance Grants, and Administration of Loan to the Islamic Republic of Afghanistan and the Republic of Tajikistan for the Regional Power Transmission Interconnection Project*. Manila; ADB. 2008. *Report and Recommendation of the President to the Board of Directors: Proposed Grant to the Republic of Tajikistan for the Nurek 500 kV Switchyard Reconstruction Project*. Manila; ADB. 2010. *Report and Recommendation of the President to the Board of Directors: Proposed Grant to the Republic of Tajikistan for the Regional Power Transmission Project*. Manila; ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Grant to the Republic of Tajikistan for the Golovnaya 240-Megawatt Hydropower Plant Rehabilitation Project*. Manila.

Legend



**Problem Tree for Energy<sup>1</sup>**



<sup>1</sup> The problem tree covers the electricity sector only.  
Source: Asian Development Bank.

### Sector Results Framework (Energy, 2015–2019)

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
<p>Improved energy security and expanded regional electricity trade</p> <p>Sustainable financial performance in electricity sector</p>	<p>Winter deficit decreased to 1.0 TWh by 2019 (2013 baseline: 2.7 TWh)</p> <p>Annual summer electricity exports reach 3.0 TWh by 2019 (2013 baseline: 0.9 TWh)</p> <p>Weighted average end user electricity tariffs increased to \$0.035 by 2019 (2013 baseline: \$0.020)</p>	<p>Energy infrastructure is expanded, modernized, and efficiently managed</p>	<p>626 MW of power generation constructed or rehabilitated from 2015 to 2019</p> <p>230 km of 110–500 kV transmission grid developed or rehabilitated from 2015 to 2019</p> <p>14 high-voltage substations and switchyards of 220–500 kV rehabilitated or constructed from 2015 to 2019</p> <p>Electricity sector total losses reduced to 14% by 2019 (2013 baseline: 22%)</p> <p>By 2019, state power utility company restructured into three legally independent entities responsible for power generation, transmission, and distribution</p>	<p><b>Planned key activity areas</b></p> <p>Power generation plants (33% of funds)</p> <p>Electrical power transmission (53% of funds)</p> <p>System operations and loss reduction (11% of funds)</p> <p>Policy and regulation (3% of funds)</p> <p><b>Pipeline projects with estimated amounts</b></p> <p>Wholesale Metering and Transmission Reinforcement Project (\$54 million)</p> <p>Power Sector Development Project (\$34 million) and PPTA (\$1 million)</p> <p><b>Ongoing projects with approved amounts</b></p> <p>Wholesale Metering and Transmission Reinforcement Project (PPTA, \$1 million)</p> <p>Golovnaya 240 MW HPP Rehabilitation Project (\$136 million)</p> <p>Regional Power Transmission Project (\$122 million)</p> <p>Nurek 500 kV Switchyard Reconstruction Project (\$54.8 million)</p>	<p><b>Planned key activity areas</b></p> <p>Improvement of governance and operational efficiency in electricity sector</p> <p>Upgrade of power generation infrastructure</p> <p>Strengthening of power transmission grid</p> <p>System operations and loss reduction</p> <p><b>Pipeline projects</b></p> <p>Wholesale meters and billing system installed in 196 high- and medium-voltage substations by 2019</p> <p>90 km of new 220 kV transmission line constructed by 2019</p> <p><b>Ongoing projects</b></p> <p>Two new 220 kV transmission lines totaling 140 km constructed and energized</p> <p>Nine substations and switchyards of 110–500 kV rehabilitated and energized</p> <p>SCADA system installed</p> <p>252 MW of Golovnaya HPP rehabilitated</p> <p>New organizational and business process structures of power utility established</p>

ADB = Asian Development Bank, HPP = hydropower plant, km = kilometer, kV = kilovolt, MW = megawatt, PPTA = project preparatory technical assistance, SCADA = supervisory control and data acquisition, TWh = terawatt-hour.

Source: Asian Development Bank.