

SECTOR OVERVIEW

A. Background

1. Armenia's energy sector has experienced tremendous change since independence from the former Soviet Union in 1991. The sector was in a critical state in the mid-1990s but is now largely characterized by affordable, reliable electricity service. The availability of electricity service has increased from just a few hours a day in the 1990s to 24 hours a day in 2017, network losses have been reduced from 40% to less than 15%, and sector companies have emerged from heavy dependence on state funding to commercial viability during the same period. Performance in the energy sector has improved dramatically but energy security remains a concern because Armenia has no proven oil or gas reserves and relies on imports from the Russian Federation (via Georgia) and Iran.¹ The Public Service Regulatory Commission (PSRC), an autonomous agency responsible for regulating electricity, has played an important role in the development of the energy sector by licensing companies and setting tariffs and service quality standards in the electricity and gas subsectors.²

2. **Sector structure.** The power system of Armenia is divided into generation, transmission, and distribution systems. The sector has been partially privatized and operates as a "single buyer" model, where the privately owned Electric Networks of Armenia (ENA) has exclusive rights to buy electricity from generators at regulated prices and to sell to end-consumers.³ ENA owns and operates all distribution assets in Armenia. There is no competitive wholesale electricity market. The state-owned High Voltage Electricity Network (HVEN) owns all high-voltage transmission assets in the country.⁴ It is responsible for the transmission of electricity from generators to the distribution network, as well as for cross-border transmissions. The state-owned Electro Power System Operator is responsible for system operations, control, and the centralized dispatch center.⁵ The Settlement Centre, also state-owned, provides metering services and payment settlements at the wholesale level among all market participants (generators, operator, transmitter, and distributor).⁶ The Ministry of Energy Infrastructures and Natural Resources develops primary and secondary legislation and implements investment plans for state-owned enterprises.⁷ The PSRC performs regulatory operations in energy (including regulating tariffs, service quality, and licensing); overseeing compliance with licensee obligations; mediating disputes between licensees and customers; defining electricity market rules; and setting, monitoring, and enforcing quality standards.⁸

3. **Electricity generation.** Generation in Armenia has dropped substantially since its peak in 1988. Several thermal power plants have been delayed and one of the two reactors at the Metsamor Nuclear Power Plant (MNPP) has been shut down. Power generated from the Hrazdan and Vorotan hydropower plant cascades remain important power sources. More than two-thirds of the existing electricity generation capacity and the distribution system have been fully depreciated, allowing the cost of generation to be low. However, substantial investment will be

¹ ADB. 2013. *Energy Sector Assessment, Strategy and Road Map*. Manila.

² ADB. 2014. *Country Partnership Strategy: Armenia, 2014–2018*. Manila.

³ CJSC = closed joint stock company is a legal entity, commonly found in the former Soviet Union, whose shares are distributed among a limited number of shareholders with limited liability.

⁴ International Energy Agency. 2015. *Eastern Europe, Caucasus and Central Asia: Energy Policies beyond IEA Countries*. Paris.

⁵ USAID. 2016. *Armenia Gap Analysis with List of Market Challenges and Legal Barriers*. Washington, DC.

⁶ Inogate – European Union. 2015. *A Review of Energy Tariffs in Inogate Partner Countries*. Brussels.

⁷ Ministry of Energy Infrastructures and Natural Resources of the Republic of Armenia. <http://www.minenergy.am/>.

⁸ Public Service Regulatory Commission. <http://www.psrc.am>.

needed for system renovation and upgrading.⁹

4. MNPP with an installed capacity of 407 megawatt (MW) provides baseload electricity. This plant was scheduled to be retired in 2016, but the reactor's operation has been extended until 2026 because of insufficient replacement capacity (footnote 4). The rehabilitation is expected to cost AMD145.83 billion and is scheduled for 2017 and 2018 (footnote 5). A new 1,000 MW nuclear power plant is planned to be built as a replacement, but no concrete progress has been made. The thermal power plants cover peak periods and baseload power when MNPP is offline for maintenance. Some units of the Hrazdan-5 and all units of the Yerevan combined-cycle power plants generate electricity for export under a gas-for-electricity trade agreement with Iran. Hydropower from the Hrazdan River and other dams (including small hydro) is a stable component of Armenia's electricity system and provides daily load regulation with an installed capacity of 1,200 MW. Small hydro power plants have an installed capacity of about 260 MW, with 164 MW of new capacity licensed for construction. The 130 MW Megri hydropower plant is under construction and is expected to be operational by 2020. Wind power, with an installed capacity of only 2.6 MW, does not play an important role. In 2015, the Ministry of Energy Infrastructures and Natural Resources owned 29% of installed power generation capacity (footnote 4).

5. **Electricity supply and demand.** Armenia produces enough electricity to meet domestic demand, which is about 6,500 gigawatt hours (GWh) annually with average growth of 2% (footnote 5).¹⁰ Armenia's installed capacity is 4,336 MW (2015), of which only 2,589 MW (or 59%) is operating.¹¹ During 2015, domestic demand was met from the following generation sources: 37.0% nuclear, 31.5% thermal, 31.5% hydro generation, and a small amount of imports during peak season (footnote 5). Peak electricity demand is about 1,300 MW and is observed during November through February. Summer peak demand is about 900 MW. There are no seasonal deficits. Household annual consumption is about 35%; large customers (i.e., industry, transport, water supply, and irrigation) account for 30%; and the remaining 35% are public entities and small- to medium-sized businesses. End-user tariffs are differentiated by voltage levels for day and nighttime tariffs, and there are no capacity charges, peak tariffs, or service fees (footnote 6). Per capita consumption in Armenia increased from 1,380 kilowatt hours (kWh) in 2005 to 1,801 kWh in 2014.¹²

6. **Distribution.** ENA's distribution system includes 0.4–110.0 kilovolt (kV) lines and transformers. Access to the grid is close to 100%. ENA serves about 1 million customers (footnote 5). Distribution system losses are about 9.7%,¹³ metering is 100%, and the collection ratio is close to 100%. All customers of 35–110 kV and a large proportion of 6–10 kV customers are integrated into a data acquisition system; 30% of all customers are equipped with electronic meters. In 2014, the system average interruption duration index amounted to 8.81 hours, the system average interruption frequency index had 5.48 interruptions per customer, and the customer average interruption duration index was 1.61 hours (footnote 5).

7. **Transmission.** HVEN's transmission system is well developed. It consists of

⁹ Armenia Renewable Resources and Energy Efficiency Fund (R2E2). 2011. *Renewable Energy Roadmap for Armenia*. Yerevan.

¹⁰ Data based on 2015 average.

¹¹ ADB. 2016. *Report and Recommendation of the President to the Board of Directors: Proposed Policy-Based Loan and Technical Assistance Grant to Armenia for the Infrastructure Sustainability Support Program (Phase 2)*. Manila.

¹² World Bank. Electric Power Consumption.

<https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=AM>. (accessed 13 February 2018).

¹³ Tetra Tech. 2017. *ENA - Modernisation of Distribution Network: Technical Due Diligence Report*. Yerevan.

14 substations of 220 kV and two substations of 110 kV (overall, 33 transformers and a capacity of about 2,500 megavolt-amperes), which were generally rehabilitated in the last 10 years or will be rehabilitated in the next 4 years. Transmission system losses are about 1.8% (footnote 5).

8. **Interconnections.** Armenia's power grid is interconnected with all neighboring countries in the Caucasus region, including connections of 220 kV with Georgia, 220 kV with Iran, 220 kV with Turkey, and 330 kV with Azerbaijan. Armenia and Iran plan to build a third 400 kV power transmission line connecting the two countries' power grids. They are also planning to build a large hydroelectric plant on the Arax River along the Armenian–Iranian border. Armenia is also constructing a fourth 400 kV power transmission line to Georgia. On 13 April 2016, Armenia, Georgia, Iran, and the Russian Federation signed a memorandum of understanding and agreed on a road map to prepare joint energy projects and increase cooperation in the energy sector.¹⁴

9. **Fuel gas supply.** Armenia does not have domestic gas supplies; it imports gas from the Russian Federation and Iran. Gazprom Armenia, a subsidiary of Gazprom operates as a vertically-integrated monopoly in Armenia. It owns 2,000 kilometers (km) of transmission pipeline and 11,000 km of distribution pipeline, as well as about 190 million cubic meters of gas storage capacity. In December 2013, Gazprom Armenia signed an agreement with its parent company Gazprom to import 2.5 billion cubic meters of gas per year from 2014 to 2018. Armenia also imports natural gas from Iran in exchange for electricity supply based on the gas-for-electricity trade agreement between two countries.¹⁵

10. **Sector challenges.** The key problems in Armenia's energy sector are the poor use of the country's substantial renewable energy resources, the low efficiency of thermal power plants, the high operation and maintenance cost, and low reliability of big hydropower plants. The electricity generation, transmission, and distribution assets are old and in poor condition. About 70% of the installed equipment at hydropower plants has been in operation for more than 30 years, and 50% for more than 40 years. Old transmission and distribution infrastructure contributes to energy security problems. Transmission assets are, on average, more than 45 years old and require rehabilitation. The state-owned HVEN has estimated that roughly 33%, or 520 km of the 220 kV network is in very poor condition and requires urgent rehabilitation. Generation, transmission, and distribution infrastructure has deteriorated because of insufficient funding. The rehabilitation of state-owned generation assets has been slow because of limited ability to borrow. Private companies in the sector also find it challenging to invest as much as needed (footnote 1). Armenia fully depends on imports of natural gas, refined oil products, and uranium to produce about two-thirds of electricity output. MNPP is vital for Armenia's energy security, but the plant is old and to be retired in 2026.¹⁶

11. **Opportunities.** The use of renewable energy can be expanded considerably. This would help Armenia increase the production and exports of electricity, diversify the energy supply mix, enhance energy security, and retire the MNPP without disrupting supply. Significant renewable energy potential exists, but the government only recently commenced plans to attract private investors for non-hydro renewable projects. Armenia is estimated to have more than 1,000 MW of technically viable capacity from solar photovoltaic, 300–500 MW from wind, 250–300 MW from unexploited small hydropower plants, and 25 MW from geothermal (footnote 9). The government targets renewables representing 21% of total generation by 2020 and 26% by 2025.¹⁷ Armenia

¹⁴ Energy Charter Secretariat. 2016. *The Role of the Energy Charter in Promoting Electricity Cooperation in the South Caucasus*. Brussels.

¹⁵ Hogan Lovells US. 2017. *Due Diligence Review – Yerevan CCPP Financing*. Washington D.C.

¹⁶ ADB. 2014. *Country Partnership Strategy: Armenia, 2014–2018*. Manila.

¹⁷ Republic of Armenia. 2014. *Scaling Up Renewable Energy Program*. Yerevan.

can increase the efficiency of electricity production, reduce electricity transmission and distribution losses, and improve the reliability of power supply by rehabilitating, upgrading, or replacing decrepit electricity generation, transmission, and distribution assets. It can also improve the interconnection of its power system with that of neighboring countries and expand its cross-border trade in electricity.

B. Policy and Regulatory Framework

12. **Oversight and regulatory bodies.** The Ministry of Energy Infrastructures and Natural Resources governs the power sector, including the development of renewable energy sources such as wind, solar, and geothermal. The PSRC is an independent body that regulates tariffs, license, service standards, and trade provisions for companies in the power sector, as well as other utilities including water, waste, and communications. The State Nuclear Safety Regulatory Commission is the regulator for nuclear energy and the Renewable Resources and Energy Efficiency Fund (R2E2) is responsible for implementing renewable energy projects.¹⁸

13. **Key legislation and policies.** The main legislation for the Armenian power sector is the Energy Law of the Republic of Armenia 2001, which contains provisions for sector structure, the role of sector participants, and rules that govern sector participants and ownership of participants. The Energy Law was modified in 2013 to improve licensing and administrative requirements for captive generation and small solar power plants. It sets out the following key provisions with respect to distribution of power, a licensed activity in Armenia:¹⁹

- (i) the licensee acts as the exclusive licensee to distribute electrical energy to end-consumers within a defined geographical area with an exception for military users that might be supplied via other arrangements;
- (ii) the licensee purchases and sells electricity pursuant to market rules and the terms of the license;
- (iii) the licensee is required to provide connections to end-consumers but can determine the technical conditions for establishing such connections; and
- (iv) in case of license termination or revocation, the PSRC is required to take necessary measures to protect the rights of customers and ensure continuous energy supply.

14. **Tariff structure.** Confidential information deleted.

C. ADB Sector Experience and Assistance Program

15. The interim operational strategy for Armenia of the Asian Development Bank (ADB) from 2006 to 2009 named the energy sector one of the priority sectors for ADB intervention.²⁰ ADB started operations in the energy sector in 2012–2013, with technical assistance for energy infrastructure and private sector lending for power generation (footnote 2). In April 2013, ADB approved a nonsovereign loan (\$25 million) to the International Energy Corporation for the

¹⁸ The scope of renewable energy projects covered by R2E2 includes wind, solar, geothermal, and biomass sources but not hydro or nuclear sources.

¹⁹ Ministry of Energy and Natural Resources of the Republic of Armenia. 2017. *Energy Law of the Republic of Armenia (Section 5, Article 38)*. Yerevan.

²⁰ ADB. 2006. *Armenia: Economic Report and Interim Operational Strategy, 2006–2009*. Manila.

Sevan–Hrazdan Cascade Hydropower System Rehabilitation Project.²¹ In July 2014, ADB approved a sovereign loan in the amount of SDR24,022,000 (\$37 million) to Armenia for (i) HVEN for the rehabilitation of two 220/110 kV substations (Agarak-2 and Shinuhair), and (ii) Electro Power System Operator for the extension of the supervisory control and data acquisition and energy management system.²² In October 2016, ADB approved a sovereign loan of \$90,000,000 to Armenia for the Infrastructure Support Program (Phase 2), which includes the improvement of infrastructure operation and sustainability through reforms in the power sector.²³ That Phase 2 project focuses on (i) developing market rules and structure that allow broader competition and opportunity for cross-border and interstate trade of surplus seasonal power; and (ii) introducing a tariff for ENA, which will allow third parties to access the distribution network, import power, and enable direct contracting between power producers and large customers (footnote 1). In June 2017, ADB also approved a nonsovereign loan of \$80,000,000 to ENA for the rehabilitation of the distribution network.²⁴

16. The country partnership strategy continues the previous strategy and aims to build the energy program in 2014–2018.²⁵ ADB will help enhance energy security by diversifying energy sources and rehabilitating and upgrading electricity transmission and distribution networks. ADB will also help Armenia attract private investment in energy and work with other development partners to expand power trade with Georgia. While private sector operations will finance investments in renewable resources, sovereign operations will (i) support the rehabilitation and upgrading of transmission and distribution infrastructure, and (ii) develop connections with Georgia in cooperation with other development partners. In ADB's knowledge program, technical assistance will focus on renewable energy and reforms to create a strong regulatory environment for private sector investment, while ADB's policy dialogue will stress succession planning for aging assets (footnote 2).

²¹ ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the International Energy Corporation for the Sevan–Hrazdan Cascade Hydropower System Rehabilitation Project in Armenia*. Manila.

²² ADB. 2014. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to Armenia for the Power Transmission Rehabilitation Project*. Manila.

²³ ADB. 2016. *Report and Recommendation of the President to the Board of Directors: Proposed Policy-Based Loan and Technical Assistance Grant for the Infrastructure Sustainability Support Program (Phase 2)*. Manila

²⁴ ADB. 2016. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to Electric Networks of Armenia CJSC for the Distribution Network Rehabilitation, Efficiency Improvement, and Augmentation Project*. Manila.

²⁵ ADB. 2014. *Country Partnership Strategy: Armenia, 2014-2018*. Manila.