Report and Recommendation of the President to the Board of Directors

Project Number: 46416-002
July 2014

Proposed Loan
Armenia: Power Transmission Rehabilitation Project

Asian Development Bank

CURRENCY EQUIVALENTS
(as of 30 June 2014)

Currency unit	–	dram (AMD)
AMD1.00	=	$0.0024
$1.00	=	AMD410

ABBREVIATIONS

ADB	–	Asian Development Bank
EBRD	–	European Bank for Reconstruction and Development
EMS	–	energy management system
EPSO	–	Electro Power Systems Operator
HVEN	–	High Voltage Electric Networks
kV	–	kilovolt
kWh	–	kilowatt-hour
MENR	–	Ministry of Energy and Natural Resources
MW	–	megawatt
NPP	–	nuclear power plant
PIU	–	project implementation unit
SCADA	–	supervisory control and data acquisition

NOTES

(i) The fiscal year of the government and its agencies ends on 31 December.
(ii) In this report, "$" refers to US dollars.

Vice-President	W. Zhang, Operations 1
Director General	K. Gerhaeusser, Central and West Asia Department (CWRD)
Director	R. Stroem, Energy Division, CWRD
Team leader	T. Luo, Senior Energy Specialist, CWRD
Team members	A. Barseghyan, Senior Portfolio Management Officer, CWRD L. Blanchetti-Revelli, Principal Social Development Specialist (Safeguards), CWRD D. Garcia, Project Officer, CWRD F. Golez, Operations Assistant, CWRD L. Nazarbekova, Principal Counsel, Office of the General Counsel T. Tran, Senior Environment Specialist, CWRD J. Wu, Finance Specialist (Energy), CWRD
Peer reviewer	S. Fukushima, Energy Specialist, South Asia Department

CONTENTS

		Page
PROJECT AT A GLANCE		
I.	THE PROPOSAL	1
II.	THE PROJECT	1
	A. Rationale	1
	B. Impact and Outcome	3
	C. Outputs	3
	D. Investment and Financing Plans	4
	E. Implementation Arrangements	5
III.	DUE DILIGENCE	6
	A. Technical	6
	B. Economic and Financial	6
	C. Governance	7
	D. Poverty and Social	8
	E. Safeguards	8
	F. Risks and Mitigating Measures	8
IV.	ASSURANCES AND CONDITIONS	9
V.	RECOMMENDATION	10
APPENDIXES		
1.	Design and Monitoring Framework	11
2.	List of Linked Documents	13

PROJECT AT A GLANCE

1. Basic Data — **Project Number:** 46416-002

Project Name	Power Transmission Rehabilitation Project	**Department /Division**	CWRD/CWEN
Country	Armenia, Republic of		
Borrower	Armenia, Republic of	**Executing Agency**	Ministry of Energy and Natural Resources of the Republic of Armenia

	2. Sector	**Subsector(s)**	**ADB Financing ($ million)**
✓	Energy	Electricity transmission and distribution	23.00
		Energy efficiency and conservation	14.00
		Total	**37.00**

3. Strategic Agenda	**Subcomponents**	**Climate Change Information**	
Inclusive economic growth (IEG)	Pillar 1: Economic opportunities, including jobs, created and expanded	Mitigation ($ million)	0.02
		CO_2 reduction (tons per annum)	20,000
Environmentally sustainable growth (ESG)	Global and regional transboundary environmental concerns	Climate Change impact on the Project	High

4. Drivers of Change	**Components**	**Gender Equity and Mainstreaming**	
Governance and capacity development (GCD)	Institutional development	No gender elements (NGE)	✓
Partnerships (PAR)	International finance institutions (IFI)		
	Official cofinancing		

5. Poverty Targeting		**Location Impact**	
Project directly targets poverty	No	Nation-wide	High

6. Risk Categorization: Complex

7. Safeguard Categorization **Environment:** B **Involuntary Resettlement:** C **Indigenous Peoples:** C

8. Financing

Modality and Sources	Amount ($ million)
ADB	**37.00**
Sovereign Project loan: Asian Development Fund	37.00
Cofinancing	**0.00**
None	0.00
Counterpart	**13.00**
Government	13.00
Total	**50.00**

9. Effective Development Cooperation

Use of country procurement systems	No
Use of country public financial management systems	No

I. THE PROPOSAL

1. I submit for your approval the following report and recommendation on a proposed loan to Armenia for the Power Transmission Rehabilitation Project.[1]

2. The project will upgrade the national power system to improve reliability and efficiency of operations, and enhance transmission capacity. The project includes three main components: (i) expansion of the supervisory control and data acquisition (SCADA) system and energy management system (EMS); (ii) rehabilitation of two 220-kilovolt (kV) substations in Agarak 2 and Shinuhayr;[2] and (iii) support for institutional development, capacity building, and project management. The project will increase the supply of electricity to urban and rural consumers to support inclusive and sustainable economic development.[3]

II. THE PROJECT

A. Rationale

3. Armenia has no proven oil or natural gas reserves. It imports most of its fossil fuel resources from the Russian Federation (through Georgia) and has begun importing gas from Iran. Imports account for about 77% of the total primary energy supply,[4] and natural gas imports from the Russian Federation account for 81% of total energy imports. Strengthening energy security and improving energy efficiency are the country's top priorities. Development of indigenous energy resources and rehabilitation of old and inefficient generation, transmission, and distribution infrastructure are critical to the country's energy security and more importantly to sustainable economic growth.

4. Armenia's power system has a total installed generation capacity of 4,100 megawatts (MW), 74% (3,047 MW) of which is operating. Power generation comprises 31% nuclear, 28% hydropower, and 41% thermal power (using imported natural gas). The country produces enough electricity to meet the annual domestic demand of about 6.0 billion kilowatt-hours (kWh). With a population of 3.3 million, it has an electrification ratio of 100%. It also trades electricity with neighboring countries, with exports of electricity exceeding its imports. In 2013, total electricity output was 7.70 billion kWh. The country exported 1.31 billion kWh, and imported 0.15 billion kWh. Armenia has a competitive advantage in electricity production because of its cheap generation resources and excess capacity, particularly during summer months.[5]

5. Since 2000, the Government of Armenia (the government) has introduced a series of energy sector reforms, which have significantly improved performance. The reforms involved unbundling of the vertically integrated electricity subsector, and privatization of the entire power and gas distribution networks and most generation companies. The Ministry of Energy and Natural Resources (MENR) is responsible for the power subsector, which comprises Electro Power Systems Operator (EPSO) Closed Joint-Stock Company, a privatized distribution company; the state-owned High Voltage Electric Networks (HVEN) Closed Joint-Stock

[1] The design and monitoring framework is in Appendix 1.
[2] The Government of Armenia proposed the rehabilitation of four substations: the Asian Development Bank (ADB) will finance the rehabilitation of two substations, and the European Bank for Reconstruction and Development is expected to finance and administer rehabilitation of two substations at Ararat 2 and Yeghegnadzor on a parallel basis.
[3] The ADB provided project preparatory technical assistance for Preparing the Power Transmission Rehabilitation Project (TA 8198-ARM).
[4] Excluding generation from the nuclear power plant, which is considered a domestic energy source.
[5] Electricity demand in the region is large and growing. Turkey and the southern regions of the Russian Federation (bordering Georgia) currently have an electricity deficit that is expected to grow.

Company, the state-owned system operator; and more than 50 generation companies, most of which are privatized.

6. **Key challenges.** The core problems in the energy sector are the low efficiency of energy resource utilization, and the deteriorating and aging power infrastructure. These are evidenced by the very limited utilization of substantial renewable energy resources,[6] low efficiency of thermal and hydropower plants, relatively large electricity transmission and generation losses, and incomplete realization of electricity export potential.

7. Much of the sector's infrastructure was built during the Soviet era and has deteriorated significantly because of insufficient funding for rehabilitation and maintenance. About 70% of the installed equipment at power generation plants has been operating for more than 30 years, and 50% for more than 40 years. The average age of power transmission assets including substations is 45 years, and distribution assets 32 years. Much of the existing transmission infrastructure has reached the end of its useful life and requires major rehabilitation or replacement to continue reliable operation. Nearly 90% of 220 kV overhead lines require rehabilitation, and about 42% of low-voltage substations are in deficient technical condition.

8. The poor condition of these assets leads to a higher risk of system outages, high maintenance costs, and reduced production efficiency. The inefficiency of power infrastructure results in higher consumption of imported fuels and reduced competitiveness. If the existing transmission network fails, a large power deficit will be incurred in populated areas with considerable social and economic impacts. Additionally, a reliable transmission network with modern equipment is essential to ensure the safe and stable operation of the Armenia Nuclear Power Plant (400 MW),[7] and to enhance power export to neighboring countries.

9. To reduce such impacts, substantial investments in power infrastructure including generation, transmission, and distribution are ongoing. Private sector investment focuses on the rehabilitation of power generation plants and distribution networks, which are owned and operated by the private sector. A part of the high-voltage transmission lines and substations has been partially rehabilitated, and development partner investment for high-voltage transmission lines will continue.[8] The first stage of the SCADA system and EMS is in place in the control center.[9] The systems currently only achieve basic functions and need to be upgraded and expanded to achieve full functionality and efficiency.[10] Investments in substations have not been sufficient given the system rehabilitation requirements, thus limiting system operation and reliability. Expansion of the SCADA system and rehabilitation of the remaining aging transmission assets are urgently required.

10. **Priority areas.** The government's target is to achieve average annual real gross domestic product growth of 6.5% through 2025, and to improve the efficiency of energy

[6] Namely, the small hydropower plants with capacity of less than 10 MW and the wind-power plant.

[7] The Armenia Nuclear Power Plant (NPP) was built in the 1970s–1980s. The government committed to replace the existing capacity of the plant by building a new NPP of about 1,100 MW. As per the government's plan, a new NPP could be operating by 2021, which means that the existing plant will be retired after completion of the new unit. In August 2010, the governments of Armenia and the Russian Federation signed an agreement on construction of a new nuclear power unit in Armenia.

[8] Development Coordination (accessible from the list of linked documents in Appendix 2).

[9] Financed jointly by the Japan Bank for International Cooperation and the World Bank in 1999–2004.

[10] SCADA system hardware should be upgraded and supplemented to support enhanced performance and to provide prerequisites for enhanced functionality. Software should be upgraded to the latest release to meet state-of-the-art EMS functionality and inter-control-center communication capability based on international standard communication protocols.

utilization.[11] The sector's development priority is to upgrade and rehabilitate the transmission networks. A reliable and efficient power supply system is an essential precondition for ensuring achievement of socioeconomic development goals. The government's energy policy strongly supports increased energy security and greater energy efficiency.

11. **Assistance and sector strategy.** The interim operational strategy for Armenia of the Asian Development Bank (ADB) identified the energy sector as a priority sector[12] for ADB intervention.[13] ADB's country partnership strategy for Armenia is expected to be finalized in 2014. ADB operations in the sector have been based on government priorities, aligned with ADB's Midterm Review of Strategy 2020, and Energy Policy 2009.[14] They include (i) rehabilitation of large hydropower generation assets, (ii) rehabilitation of aging transmission and distribution assets, (iii) improvement of cross-border interconnection of power systems, (iv) development of renewable energy, and (v) policy and institutional development. The project is included in ADB's country operations business plan, 2014–2016 for Armenia.[15]

12. The project will increase the efficiency of power system operation and reduce transmission losses, which are essential to improve energy security and reduce greenhouse gas emissions.[16] Rehabilitation of existing substations will improve the reliability and quality of power supply to urban and rural consumers, reduce regional disparities within Armenia, and support inclusive and sustainable economic development. An efficient and reliable power system will facilitate the expansion of cross-border power trade in the region.

B. Impact and Outcome

13. The expected impact will be improved reliability and efficiency of power supply in Armenia. The outcome will be increased operating efficiency of the domestic transmission network.

C. Outputs

14. The project will have three outputs:

(i) **Expansion of the Supervision Control and Data Acquisition (SCADA) system and Energy Management System (EMS).** This includes installation of SCADA hardware and software, communication equipment, and optical ground wire; improvement and upgrading of the load dispatch centers, and training on SCADA and the EMS.

(ii) **Rehabilitation of 220 kilovolt substations in Agarak 2 and Shinuhayr.** Replacement of aging power transformers, circuit breakers, instrument transformers, disconnectors, and control and protection equipment with modern technology in Agarak 2 and Shinuhayr.

[11] To meet the economic growth targets, electricity demand is expected to grow 2%–3% annually in 2015–2025.
[12] ADB. 2006. *Economic Report and Interim Operational Strategy: Armenia, 2006–2009*. Manila.
[13] ADB's involvement in the sector began only in 2012 when ADB approved a technical assistance grant for preparing a power transmission rehabilitation project. In April 2013, ADB approved a nonsovereign loan for the Sevan–Hrazdan Cascade Hydropower System Rehabilitation Project. ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Loan for the Sevan–Hrazdan Cascade Hydropower System Rehabilitation Project in Armenia.* Manila (for $25 million).
[14] ADB. 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank*, *2008–2020*. Manila; ADB. 2014. *Midterm Review of Strategy 2020: Meeting the Challenges of a Transforming Asia and Pacific*. Manila; and ADB. 2009. *Energy Policy.* Manila.
[15] ADB. 2013. *Country Operations Business Plan: Armenia, 2014–2016*. Manila.
[16] It is expected that the project will contribute to reduction of carbon dioxide (CO^2) emission by 20,000 tons equivalent per year.

(iii) **Institutional development, capacity building, and project management.** This includes consulting services for project management and supervision, and capacity building for EPSO and HVEN staff by providing financial, technical, and operational training.

D. Investment and Financing Plans

15. The project is estimated to cost $50 million equivalent (Table 1).[17]

Table 1: Project Investment Plan
($ million)

Item	Amount[a]
A. Base Cost[b]	
1. Expansion of SCADA system and EMS	13.7
2. Substation rehabilitation	23.3
3. Institutional development, capacity building, and project management	5.1
Subtotal (A)	**42.1**
B. Contingencies[c]	**5.7**
C. Financing Charges during implementation[d]	**2.2**
Total (A+B+C)	**50.0**

EMS = energy management system, SCADA = supervisory control and data acquisition.
[a] Includes taxes and duties of $7 million to be financed from government resources.
[b] In 2014 prices.
[c] Physical contingencies computed at 10% of base cost. Price contingencies computed based on ADB's cost escalation factors, includes provision for potential exchange rate fluctuation under the assumption of purchasing power parity exchange rate.
[d] Includes interest rate fixed at 2% throughout loan maturity for Special Funds resources from the Asian Development Fund with no commitment charges for 25 years inclusive of a 5-year grace period.
Source: Asian Development Bank estimates.

16. The government has requested a loan in various currencies equivalent to SDR24,022,000 (equivalent to $37 million) from ADB's Special Funds resources to help finance the project. The loan will have a 25-year term, including a grace period of 5 years, an interest rate of 2.0% per annum during the grace period and thereafter, and such other terms and conditions set forth in the draft loan and project agreements.[18] The financing plan is in Table 2.

17. The government has asked the European Bank for Reconstruction and Development (EBRD) to provide $30 million in parallel to help finance the rehabilitation of two substations at Ararat 2 and Yeghegnadzor. EBRD is considering providing an investment grant up to €8 million[19] and a loan for the remaining part with interest at a London interbank offered rate at plus 1.0% contractual spread and such other terms and conditions set forth in EBRD's legal documents. The repayment term would be 15 years inclusive of a 3-year grace period. The EBRD cofinancing will be under collaborative cofinancing arrangements and will not be administered by ADB.

[17] Does not include EBRD-financed part.
[18] The government will relend the proceeds of the loan to the project implementing agencies—$13.6 million to EPSO and $23.4 million to HVEN. The terms for relending the proceeds of the loan include (i) interest at the same rate as the interest applicable to the loan, (ii) a repayment period and grace period identical to those of the loan, and (iii) EPSO and HVEN will bear any foreign exchange risk of such proceeds of the relent loan.
[19] EBRD's proposed grant will be sourced from the European Union's Neighborhoods Investment Facility.

Table 2: Financing Plan

Source	**Amount** ($ million)	**Share of Total** (%)
Asian Development Bank		
Special Funds resources (loan)	37.0	74.0
Government	13.0	26.0
Total	**50.0**	**100.0**

Source: Asian Development Bank estimates.

E. Implementation Arrangements

18. The implementation arrangements are summarized in Table 3 and described in detail in the project administration manual.[20]

Table 3: Implementation Arrangements

Aspects	**Arrangements**		
Implementation period	December 2014–December 2019		
Estimated completion date	31 December 2019 (30 June 2020 as the loan closing date)		
Management			
(i) Oversight body	Ministry of Finance		
(ii) Executing agency	MENR		
(iii) Key implementing agencies	EPSO and HVEN		
(iv) Implementation units	EPSO and HVEN		
Procurement	ICB	Turnkey contract for expansion of SCADA system and EMS	$11.5 million
	ICB	Turnkey contractor for rehabilitation of Agarak 2 and Shinuhayr substations	$19.4 million
Consulting services (i) Implementation consultant for SCADA system and EMS	QCBS (firm)	48 person-months	$1.2 million
(ii) Implementation consultant for substation rehabilitation	QCBS (firm)	130 person-months	$2.4 million
Advance contracting	Advance contracting for procurement of goods and consulting services is requested.[a]		
Disbursement	The loan proceeds will be disbursed in accordance with ADB's *Loan Disbursement Handbook* (2012, as amended from time to time) and detailed arrangements agreed upon between the government and ADB.		

ADB = Asian Development Bank, EMS = energy management system, EPSO = Electro Power Systems Operator, HVEN = High Voltage Electric Networks, ICB = international competitive bidding, MENR = Ministry of Energy and Natural Resources, QCBS = quality- and cost-based selection, SCADA = supervisory control and data acquisition.

[a] The government has been advised that approval of advance contracting will not commit ADB to subsequently approve the project or to finance the procurement costs.

Source: Asian Development Bank.

19. MENR, the executing agency, has established a project management unit led by the deputy minister. It is responsible for (i) overall project supervision; (ii) coordination of policy, planning, interagency, and aid cooperation; and (iii) provision of government counterpart support.

[20] Project Administration Manual (accessible from the list of linked documents in Appendix 2).

20. EPSO and HVEN will be the implementing agencies. EPSO will be responsible for implementation of the SCADA system and EMS component, and HVEN for the substation rehabilitation components. EPSO and HVEN will each establish a dedicated project implementation unit (PIU) within the existing company structure. Each PIU will comprise at least three counterpart staff, supported by the project implementation consultants. The PIUs will be responsible for day-to-day implementation and preparation of bid evaluation reports, project progress reports, administration of consulting and procurement contracts, applications for withdrawal of funds, and any other reports required by ADB.

21. Procurement of goods and works from ADB loan proceeds will be undertaken following ADB's Procurement Guidelines (2013, as amended from time to time) and a procurement plan developed for the project. The procurement will follow international competitive bidding procedures using standard bidding documents for plants (single-stage, single-envelope).

22. EPSO and HVEN will each employ a project implementation consulting firm. The two firms will provide technical, financial, and administrative support to the PIUs during project implementation. Consultant recruitment will follow ADB's Guidelines on the Use of Consultants (2013, as amended from time to time) and the procurement plan developed for the project. Quality- and cost-based selection with a quality–cost ratio of 90:10 will be the default method for recruiting the consulting firms because of the complexity of the assignment and the application of modern technologies.

23. The project will be implemented from December 2014 to December 2019. The turnkey contracts are expected to be awarded during the second quarter of 2015. MENR and the implementation consultants will prepare a detailed implementation schedule during the preconstruction phase of the project and submit it to ADB.

III. DUE DILIGENCE

A. Technical

24. Expansion and rehabilitation of the SCADA system, the EMS, and substation facilities through the installation of modern digital control and protection systems will significantly improve system reliability and security. Rehabilitation of substation facilities not only helps HVEN deliver power reliably and safely to customers but also reduces transmission losses and lowers operating costs. ADB conducted technical due diligence on the investment proposal and is satisfied with the quality of the cost estimates, operating cost structures, appropriateness of the technology, and the execution plan. The readiness level is high and the technical solutions are assessed to be more cost-effective than the alternatives. Use of the SCADA system and EMS is an international standard practice for power system operators based on proven technology and is considered appropriate in this case. EPSO and HVEN operation and maintenance staff are familiar with the proposed design concepts. EPSO and HVEN have sufficient technical capacity and experienced staff to undertake project implementation.

B. Economic and Financial

25. Rehabilitation of the substations and expansion of the SCADA system and EMS are expected to increase the reliability of the transmission system thereby ensuring energy security. The project adopts a least-cost approach to resolve the issue of aging transmission infrastructure and envisaged increase in system outages and shutdowns. The project is both financially and economically viable.

26. The incremental benefits arising from the project include the avoidance of energy-flow interruption through the substations. The without-project scenario assumes that the number of outages and shutdowns will increase as the equipment ages and is eventually beyond repair. Also, as the substations are part of the overall transmission network, a system approach takes into account the potential impact of outages and/or stoppage of operation of other overused system assets on the energy flow. To value the project benefits, the current transmission tariff of AMD1.28/kWh and operator tariff of AMD0.23/kWh were considered, and the projected tariff was estimated based on projected operation of business and servicing of existing and new loans for investment projects. Incremental operation and maintenance cost is assumed to be 2% of the total capital cost. The financial internal rate of return for the substations rehabilitation component of the project, which is to be carried out by HVEN, is estimated to be 12.8%, exceeding the weighted average cost of capital of 3.0%. The SCADA system and EMS upgrade component is expected to enhance overall system control and improve efficiency. A tariff increase, following the application to the regulator, is expected to cover the investment cost and loan repayment. An incremental recurring cost sustainability assessment found this part of the project, which is to be implemented by EPSO, financially viable with a financial internal rate of return of 3.6%, exceeding the weighted average cost of capital of 2.1%.

27. The economic analysis provides an economic internal rate of return of 18.3%, which compares favorably with the benchmark rate of 12.0% for the economic opportunity cost of capital. The project's assessed economic viability is based on expected streams of benefits arising from avoided interruption of energy flow and incremental costs resulting from the project over 25 years. Benefits arising from the steady delivery of electricity and avoided outages were calculated based on the cost of unserved energy at $0.02/kWh as a conservative measure. Environmental mitigation costs, as part of the investment costs, were considered. No additional land will be required as the rehabilitation and upgrading will be conducted in the existing substations and load center.

28. The sensitivity analysis supports the project economic and financial viability, and shows robustness even under unfavorable circumstances.

C. Governance

29. ADB's Anticorruption Policy (1998, as amended to date) was explained to and discussed with the government, MENR, EPSO, and HVEN. The specific policy requirements and supplementary measures are described in the project administration manual (footnote 18).

30. The financial management assessment of EPSO and HVEN assessed the institutional setup of the companies in accordance with ADB's guidelines.[21] It established that both companies have adequate financial management arrangements in place to process and implement the project. Both EPSO and HVEN have experience in implementing aid-financed infrastructure projects[22] and have undergone capacity-building programs associated with those projects on project account management, financial reporting, and internal control.

31. The procurement capacity of EPSO and HVEN is assessed to be low. The inherent procurement risks are high due to the contract value and technical complexity. However, this

[21] ADB. 2005. *Guidelines on Financial Management and Analysis of Projects.* Manila.

[22] These development partners include EBRD, the Japan Bank for International Cooperation, German development cooperation through KfW, the United States Agency for International Development, and the World Bank. Refer to Development Coordination (accessible from the list of linked documents in Appendix 2).

risk can be mitigated to average, with the support of project implementation consultants and close coordination and guidance provided by ADB.

D. Poverty and Social

32. By increasing the supply of efficient and reliable electricity to the system, the project will increase the reliability of the power supply nationwide, benefiting the poor and neglected regions. Since the rural poor are the first to be cut off from supply during winter power shortages, system loss reduction and stronger supply reliability will particularly benefit the poor and the socially excluded. The project will enhance regional power trade with neighboring countries, which will stimulate economic growth and increase employment opportunities.

E. Safeguards

33. **Environmental assessment.** The project is categorized B for environment under ADB's Safeguard Policy Statement (2009). An initial environmental examination was prepared, including two separate environmental management plans (one each for EPSO and HVEN). The initial environmental examination was disclosed on 14 May 2014 as per ADB public disclosure requirements.[23] EPSO and HVEN have staff responsible for safety but will be assisted by and receive on-the-job environmental training from the project implementation consultants. The ADB loan will cover the cost of implementing the environmental management plans.

34. The project's main environmental impacts would occur mainly during construction as a result of waste generated during equipment replacement and construction for earth-wire replacement. The issues will be related to (i) management of the used oil and grease wastes, including identification and special disposal of polychlorinated biphenyls containing oils; (ii) disposal of scrap metal, old batteries, and other solid wastes; (iii) occupational health and safety measures at the project sites; (iv) proper handling and monitoring of sulfur hexafluoride circuit breakers; and (v) limited air and noise pollution, as well as tree cutting within the rights-of-way. Potential negative environmental impacts during operation include sulfur hexafluoride leakage and electromagnetic fields. The Environmental Management Plan specifies adequate mitigation measures and monitoring plans to cover these impacts. Adequate storage facilities will be constructed at each substation for safe temporary storage of released oils and batteries. Nonpolychlorinated biphenyl oils will be refined for on-site reuse by a licensed company.

35. **Involuntary resettlement.** The project will have no land acquisition issues, as rehabilitation works will be limited to the substation. The project is therefore categorized C for involuntary resettlement under ADB's Safeguard Policy Statement (2009).

36. **Indigenous peoples.** The project is categorized C for indigenous peoples. The project is not expected to affect indigenous peoples as defined under ADB's Safeguard Policy Statement (2009).

F. Risks and Mitigating Measures

37. The project integrated benefits and impacts are expected to outweigh the costs. The government fully supports the project. MENR will coordinate the work of government agencies

[23] Efforts were made to collaborate with EBRD to meet ADB's and EBRD's safeguard requirements. That includes sharing with EBRD the original initial environmental examination prepared to cover all proposed substations, and a letter exchange with EBRD explaining how ADB's and EBRD's responsibilities for safeguard preparation and implementation are allocated.

to ensure that issues, if any, are resolved promptly, and that technologies adopted under the project conform to international standards and best practices that are commercially proven and widely used internationally. EPSO and HVEN have accumulated substantial experience in managing projects in cooperation with international financial institutions. However, each agency remains resource-constrained and its ability to manage multiple large projects is uncertain without the support of external international expertise. Risks were analyzed and deemed acceptable or mitigated. Major risks and mitigating measures are summarized in Table 4 and described in the risk assessment and risk management plan.[24]

Table 4: Summary of Risks and Mitigating Measures

Risks	Mitigating Measures
EPSO and HVEN have weak financial management capacity	Separate accounting will be established and maintained for the project in order to minimize risk. Project supervision consultants will be recruited to assist EPSO and HVEN in supervising the project implementation, recording project costs, preparing withdrawal applications and progress reports. Staff training will be provided to retain institutional knowledge. Loan and project agreements require financial statements and project accounts to be audited in accordance with international standards of auditing by an auditor acceptable to ADB.
EPSO and HVEN have limited project management capacity and lack experience with turnkey contract management	International consultants will undertake project design, bidding preparation support, and evaluation. Project supervision consultants will be recruited to help EPSO and HVEN with project implementation and management.
Unexpected delays for procurement due to governmental approvals	Procurement is at an advanced stage so delay risks are minimized.
The government is unable to address the targets of the sector development plan	Jointly with other development partners, ADB will continue policy dialogue with the government to ensure strong commitment to energy sector development. The government has adopted the Armenia Development Strategy 2025, which addresses physical and nonphysical investments. The government has committed to keep ADB informed of policy reforms including tariff methodologies and implementation progress of its investment plan.
Cash flow from EPSO and HVEN operations is unsustainable to cover capital expenditure, debt obligations, and operation and maintenance costs	The present cost-plus-tariff methodology addresses immediate term needs and existing conditions in Armenia. The tariff regime allows EPSO and HVEN to apply to the independent tariff regulator—the Armenia Public Services Regulatory Commission—to review the tariff methodology periodically. However, tariffs do not cover the full cost of service delivery. Through policy dialogue and analytical work, ADB will continue to encourage the government to raise tariffs to full cost-recovery.

ADB = Asian Development Bank, EPSO = Electro Power Systems Operator, HVEN = High Voltage Electric Networks.
Source: Asian Development Bank.

IV. ASSURANCES AND CONDITIONS

38. The government, EPSO, and HVEN have assured ADB that implementation of the project shall conform to all applicable ADB policies including those concerning anticorruption measures, safeguards, gender, procurement, consulting services, and disbursement as described in detail in the project administration manual and loan documents.

[24] Risk Assessment and Risk Management Plan (accessible from the list of linked documents in Appendix 2).

39. The government, EPSO, and HVEN have agreed with ADB on certain covenants for the project, which are set forth in the loan agreement and project agreement.

40. Notwithstanding any other provision in the loan agreement, no withdrawals shall be made from the loan agreement until ADB has received the relending agreements executed between the government, EPSO, and HVEN.

V. RECOMMENDATION

41. I am satisfied that the proposed loan would comply with the Articles of Agreement of the Asian Development Bank (ADB) and, acting in the absence of the President, under the provisions of Article 35.1 of the Articles of Agreement of ADB, I recommend that the Board approve the loan in various currencies equivalent to SDR24,022,000 to Armenia for the Power Transmission Rehabilitation Project, from ADB's Special Funds resources, with an interest charge at the rate of 2.0% per annum during the grace period and thereafter; for a term of 25 years, including a grace period of 5 years; and such other terms and conditions as are substantially in accordance with those set forth in the draft loan and project agreements presented to the Board.

Bindu Lohani
Vice-President

8 July 2014

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
Impact Improved reliability and efficiency of power supply in Armenia	Per capita consumption of power increased to 3,000 kWh by 2023 (2013 baseline: 2,000 kWh) Annual electricity supply increased to 15,000 GWh by 2023 (2013 baseline: 6,300 GWh) Power system losses reduced to 8% by 2023 (2013 baseline: 12.7%)	EPSO and HVEN annual reports National statistics on per capita power consumption and annual electricity supply published by the Ministry of Energy and Natural Resources EPSO and HVEN project completion reports	**Assumption** Government policy will continue to support energy infrastructure modernization. **Risk** Limited financial support may delay the expansion of power generation and distribution assets.
Outcome Increased operating efficiency of the domestic transmission network	Full compliance with grid code and stability requirements on power system operation set by the regulator by 2020 (2013 baseline: partly complied with) Number of unplanned outages in the 220 kV substations reduced to 5 times per year (2013 baseline, 8 times)	EPSO and HVEN annual reports EPSO and HVEN project completion reports	**Assumption** Timely implementation of transmission rehabilitation projects financed by other financiers
Outputs 1. Expansion of SCADA system and EMS fully implemented 2. Rehabilitation of two 220 kV substations in Agarak 2 and Shinuhayr 3. Institutional development, capacity building, and project management successfully completed	SCADA system and EMS cover 100% of transmission network by 2017 (2013 baseline: partially installed) Substation capacity increased by 250 MVA by 2020 (2013 baseline: 380 MVA) Project implemented on time and within budget PIU staff from EPSO and HVEN trained on ADB procurement and safeguard practices At least 10 operations staff from EPSO and at least 30 from HVEN acquired knowledge and skills regarding SCADA, EMS, and substation operation and maintenance	EPSO and HVEN annual reports EPSO and HVEN records of commissioning EPSO and HVEN annual reports EPSO and HVEN records of commissioning EPSO and HVEN project completion reports	**Assumption** Access to competent contractors and high-quality equipment and material

Activities with Milestones	Inputs
1. Expansion of SCADA system and EMS	ADB ADF:
1.1 Recruit project implementation consultants (Q1 2015)	SDR24,022,000
1.2 Complete bid evaluation and award contract package (Q2 2015)	($37 million equivalent)
1.3 Expand SCADA system and EMS in accordance with the contracts (Q4 2016)	
1.4 Fully commission SCADA system and EMS (Q4 2016)	Government:
	$13 million equivalent
2. Rehabilitation of two 220 kV substations at Agarak 2 and Shinuhayr	
2.1 Recruit project implementation consultants (Q1 2015)	
2.2 Complete bid evaluation and award contract package (Q3 2015)	
2.3 Rehabilitate substations in accordance with the contracts (Q4 2019)	
2.4 Fully commission substations (Q1 2020)	
3. Institutional development, capacity building, and project management	
3.1 Establish project implementation units (Q3 2014)	
3.2 Prepare capacity development plan (Q4 2014)	
3.3 Train PIU staff from EPSO and HVEN on ADB procurement and project safeguard practices (Q4 2014)	
3.4 Train at least 10 operations staff from EPSO and at least 30 from HVEN on SCADA, EMS, and substation operation and maintenance by the contractors and supervision consultants (Q4 2019)	

ADB = Asian Development Bank; ADF = Asian Development Fund; EMS = energy management system; EPSO = Electro Power Systems Operator; GWh = gigawatt-hour; HVEN = High Voltage Electric Networks; kV = kilovolt; kWh = kilowatt-hour; MVA = megavolt-ampere; PIU = project implementation unit; SCADA = supervisory control and data acquisition; SDR = special drawing rights.

Source: Asian Development Bank.

Note: In parallel, the European Bank for Reconstruction and Development (EBRD) will provide $30 million to assist in the financing of rehabilitation of another two substations at Ararat 2 and Yeghegnadzor. The EBRD cofinancing will be under collaborative cofinancing arrangements and will not be administered by ADB.

LIST OF LINKED DOCUMENTS

http://www.adb.org/Documents/RRPs/?id=46416-002-3

1. Loan Agreement
2. Project Agreement
3. Sector Assessment (Summary): Energy
4. Project Administration Manual
5. Contribution to the ADB Results Framework
6. Development Coordination
7. Financial Analysis
8. Economic Analysis
9. Country Economic Indicators
10. Summary Poverty Reduction and Social Strategy
11. Initial Environmental Examination
12. Risk Assessment and Risk Management Plan

Supplementary Documents

13. Financial Management and Performance Assessment
14. Procurement Capacity Assessment
15. Detailed Terms of Reference (draft) for Project Implementation Consultants