Completion Report

Project Number: 43456-023
Loan Number: 2671
Grant Number: 0218
July 2020

Kyrgyz Republic: Power Sector Improvement Project

Asian Development Bank

CURRENCY EQUIVALENTS

Currency Unit – som (Som)

		At Appraisal (30 August 2010)	At Project Completion (31 July 2018)
Som1.00	=	$0.02196	$0.01469
$1.00	=	Som45.52	Som68.0705
$1.00	=	SDR0.6593	SDR0.7126

ABBREVIATIONS

ADB	–	Asian Development Bank
AMDA	–	automated metering and data acquisition
CWRD	–	Central and West Asia Regional Department
DMF	–	design and monitoring framework
EA	–	executing agency
EMP	–	environment management plan
EPP	–	Joint-Stock Company Electric Power Plants
GWh	–	gigawatt hour
ICB	–	international competitive bidding
IEE	–	initial environment examination
LAR	–	land acquisition and resettlement
LARP	–	land acquisition and resettlement plan
MOE	–	Ministry of Energy
MOEI	–	Ministry of Energy and Industry
NEGK	–	Joint-Stock Company National Electric Grid of Kyrgyzstan
NEHC	–	Joint-Stock Company National Energy Holding Company
O&M	–	operation and maintenance
OPGW	–	optical ground wire
PAM	–	project administration manual
PCBs	–	polychlorinated biphenyls
PCR	–	project completion review
PIU	–	project implementation unit
PMC	–	project management consultant
SCADA	–	supervisory control and data acquisition
SCIESU	–	State Committee on Industry, Energy and Subsoil Use
SDR	–	special drawing right

NOTES

(i) The fiscal year (FY) of the Government of the Kyrgyz Republic and its agencies ends on 31 December. “FY” before a calendar year denotes the year in which the fiscal year ends, e.g., FY2020 ends on 31 December 2020.

(ii) In this report, “$” refers to United States dollars.

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Director General	Werner E. Liepach, Central and West Asia Regional Department (CWRD)
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BASIC DATA

A. Loan and Grant Identification

1.	Country	Kyrgyz Republic
2.	Loan and grant number and financing source	Loan 2671-KGZ (COL) Grant 0218-KGZ (ADF)
3.	Project title	Power Sector Improvement Project
4.	Borrower	Kyrgyz Republic
5.	Executing agency	National Electric Grid of Kyrgyzstan and Ministry of Energy of the Kyrgyz Republic
6.	Amount of loan	SDR11,010,000 ($16,700,000 equivalent)
	Amount of grant	$28,100,000
7.	Financing modality	Project loan and grant

ADF = Asian Development Fund, COL = concessional ordinary capital resources, SDR = special drawing rights

B. Loan and Grant Data

1.	Appraisal	
	– Date started	26 May 2010
	– Date completed	14 June 2010
2.	Loan and grant negotiations	
	– Date started	23 August 2010
	– Date completed	24 August 2010
3.	Date of Board approval	27 September 2010
4.	Date of financial agreement	8 December 2010
5.	Date of loan and grant effectiveness	
	– In financing agreement	6 February 2011
	– Actual	15 June 2011
	– Number of extensions	two
6.	Project completion date	
	– Appraisal	31 December 2013
	– Actual	31 July 2018
7.	Loan and grant closing date	
	– In financial agreement	30 June 2014
	– Actual	31 July 2018
	– Number of extensions	three
8.	Financial closing date	
	– Actual	9 January 2019
9.	Terms of loan	
	– Interest rate	1% per annum during grace period and 1.5% per annum thereafter
	– Maturity	32 years
	– Grace period	8 years

10. Terms of relending

– Interest rate	1.5% per annum
– Maturity	25 years
– Grace period	5 years
– Second-step borrower	National Electric Grid of Kyrgyzstan

11. Disbursements

a. Dates – L2671 & G0218

Initial Disbursements	Final Disbursements	Time Interval
20 April 2012	4 December 2018	80 Months
Effective Date	**Actual Closing Date**	**Time Interval**
15 June 2011	31 July 2018	85 Months

b.1 Amount (SDR) – L2671

Category	Original Allocation (1)	Increased during Implementation (2)	Cancelled during Implementation (3)	Last Revised Allocation[1] (4=1+2–3)	Amount Disbursed (5)	Undisbursed Balance[2] (6 = 4–5)
1.Goods	4,417,000	(744,990)		3,672,510	3,671,646	864
1B.Goods		781,990		781,990	729,058	52,932
2.Works	4,219,000	1,450,000		5,639,000	5,429,717	209,283
3.Consulting Services	1,055,000	(168,000)		916,500	898,039	18,461
4.Unallocated	1,319,000	(1,319,000)				
Total	**11,010,000**			**11,010,000**	**10,728,459**	**281,541**
$ Equivalent	16,700,000				15,496,759	391,550

( ) = negative.
1. The last loan proceed reallocation was made on 8 May 2018.
2. The undisbursed amount was cancelled at loan financial closure.

b.2 Amount ($) – G0218

Category	Original Allocation (1)	Increased during Implementation (2)	Cancelled during Implementation (3)	Last Revised Allocation (4=1+2–3)	Amount Disbursed (5)	Undisbursed Balance[1] (6 = 4–5)
1.Goods	11,300,000	(1,882,875)		9,417,125	9,411,476	5,649
1B.Goods		3,325,814		3,325,814	2,682,542	643,272
2.Works	10,600,000	2,275,000		12,875,000	12,670,771	204,229
3.Consulting Services						
3A.Project management support	1,200,000	(171,000)		1,029,000	1,019,304	9,696
3B.Capacity development and advisory services	1,500,000	(46,939)		1,453,061	1,438,995	14,066
4.Unallocated	3,500,000	(3,500,000)				
Total	**28,100,000**			**28,100,000**	**27,223,088**	**876,912**

1. The undisbursed amount was cancelled at grant financial closure.

C. Project Data

1. Project Cost ($ million)

Cost	Appraisal Estimate	Actual
Foreign Exchange Cost	39.27	33.59
Local Currency Cost	16.73	13.00
Total	**56.00**	**46.59**

2. Financing Plan ($ million)

Source	Appraisal Estimate	Actual
Implementation Costs		
Borrower financed	8.22	2.11
ADB financed (loan)	16.70	15.50
ADB financed (grant)	28.10	27.22
Total implementation cost	**53.02**	**44.83**
Interest during construction costs		
Borrower financed	2.98	1.76
ADB financed (loan)		
ADB financed (grant)		
Total interest during construction cost	**2.98**	**1.76**

ADB = Asian Development Bank.

3. Cost Breakdown by Project Component for Loan and Grant ($ million)

Component	Appraisal Estimate	Actual
A. Base Cost		
1. AMDA	6.90	7.15
2. Substation rehabilitation	17.99	20.83
3. Communication and SCADA	12.60	13.08
Subtotal (A)	**37.49**	**41.03**
B. Consultancy		
1. Consultants	3.00	2.39
2. NEGK capacity development	1.00	0.92
3. Settlement mechanism study	1.00	0.49
Subtotal (B)	**5.00**	**3.80**
C. Taxes and Duties	**5.53**	
D. Contingencies	**5.00**	
E. Financial Charges during Implementation	**2.98**	**1.76**
Total (A+B+C+D+E)	**56.00**	**46.59**

AMDA = automated metering and data acquisition, NEGK = Joint-Stock Company National Electric Grid of Kyrgyzstan, SCADA = supervisory control and data acquisition.

4. Project Schedule

Item	Appraisal Estimate	Actual
Date of contract with consultants		
Recruitment of PMC	Q3 2010–Q4 2010	Q4 2010–Q4 2011
Implementation	Q1 2011–Q4 2013	Q1 2012–Q4 2014
Recruitment of individual PMCs	NA	Q3 2015–Q4 2015
Implementation	NA	Q4 2015–Q3 2018
Recruitment of Settlement Study Consultant	Q4 2010–Q1 2011	Q4 2011–Q1 2012
Implementation	Q2 2011–Q1 2012	Q2 2012–Q2 2013
Recruitment of NEGK Capacity Building Consultant	Q4 2010–Q1 2011	Q4 2011–Q2 2012
Implementation	Q2 2011–Q1 2012	Q3 2012–Q3 2013
Completion of engineering designs		
Substation Rehabilitation Design	Q2 2011–Q2 2011	Q1 2012–Q3 2012
AMDA, SCADA and OPGW Design	Q1 2011–Q3 2011	Q1 2012–Q2 2013
Equipment and supplies (Lot 1)		
Procurement	Q3 2011–Q4 2011	Q3 2012 – Q1 2013
Date of award	Q4 2011	5 Mar 2013
Delivery of equipment	Q1 2012–Q4 2012	Q2 2013–Q3 2018
Equipment installation	Q1 2012–Q4 2013	Q4 2014–Q3 2018
Turn-key Contract (Lot 2)		
AMDA, SCADA and OPGW Development		
Procurement	Q3 2012–Q4 2012	Q2 2013–Q2 2015
Date of award	Q4 2012	14 Jul 2015
Completion of work	Q1 2012–Q4 2013	28 Feb 2018
Installation		
Reconstruction works of CDO NEGK started	Q1 2012–Q4 2013	30 Jul 2017
Rehabilitation of transmission line and installation of OPGW Phase 1 completed	Q1 2012–Q4 2013	16 Nov 2016
Rehabilitation of transmission line and installation of OPGW Phase 2 completed	Q1 2012–Q4 2013	17 Sep 2017
Installation and commissioning of the whole metering system completed	Q1 2012–Q4 2013	26 Nov 2017
Beginning of start-up	Q1 2012–Q4 2013	28 Feb 2018

PMC = project management consultant, Q = quarter, NA =not applicable, NEGK = Joint-Stock Company National Electric Grid of Kyrgyzstan, AMDA = automated metering and data acquisition, SCADA = supervisory control and data acquisition, OPGW = optical fiber ground wire, CDO = central dispatching office.

5. Project Performance Report Ratings

	Ratings[a]	
Implementation Period	**Development Objectives**	**Implementation Progress**
27 September 2010–31 December 2010	Satisfactory	Satisfactory
	Single Project Rating[b]	
1 January 2011–30 June 2011	On track	
1 July 2011–31 March 2012	Actual Problem	
1 April 2012–30 June 2012	Potential Problem	
1 July 2012–31 December 2012	Actual Problem	
1 January 2013–31 December 2013	On track	
1 January 2014–30 September 2014	On track	
1 October 2014–31 December 2014	Potential Problem	
1 January 2015–31 March 2015	On track	
1 April 2015–30 June 2015	Potential problem	

1 July 2015–31 December 2015	On track
1 April 2016–31 December 2016	On track
1 January 2017–31 December 2017	On track
1 January 2018–31 July 2018	On track

[a] Project performance report ratings are based on a different method than that used for overall assessment of the project at completion. After 2011, only one rating is available

[b] Based on new rating system for evaluation of project performance using e-Operations.

D. Data on Asian Development Bank Missions

Name of Mission	Date	No. of Persons	No. of Person-Days	Specialization of Members
Loan consultation*	26 May–14 June 2010	5	39	e, e, i, o, d
Consultation**	14–19 October 2010	3	18	a, o, c
Consultation**	18–23 May 2011	2	12	a, o
Inception**	20 July–4 August 2011	3	45	a, i, o
Consultation**	13–18 October 2011	2	12	i, o
Consultation**	14–18 November 2011	4	20	i, e, o, c
Consultation**	16–20 January 2012	3	15	e, y, o
Review 1**	13–24 February 2012	3	66	e, y, o
Review 2**	11–15 June 2012	4	20	e, y, a, o
Review 3**	10–14 December 2012	3	15	e, y, o
Review 4**	29 January–8 February 2013	3	30	e, y, o
Review 5**	15–22 April 2013	5	40	d, e, y, a, o
Review 6**	28 October–1 November 2013	2	8	y, o
Review 7**	25 February–7 March 2014	5	55	e, y, o, a, o
Review 8**	29–30 May 2014	2	4	e, o
Review 9**	30 June–11 July 2014	4	48	e, e, n, o
Midterm review**	22–26 September 2014	3	15	e, o, o
Review 10**	21–27 January 2015	3	16	e, o, o
Review 11**	13–17 April 2015	5	23	e, e, p, o, a
Review 12**	3–7 July 2015	3	15	e, o, a
Review 13**	11–18 April 2016	4	32	e, e, o, a
Review 14**	29 September–7 October 2016	6	48	o, e, e, e, o, a
Review 15**	15–27 June 2017	7	91	e, e, o, e, e, o, a, d
Review 16**	14–24 November 2017	5	55	e, e, o, o, a
Completion review	13 March–2 April 2019	5	75	a, c, o, n, r

* The loan consultation mission was upgraded to fact-finding mission.

** mission combined with other projects in the area.

a = project analyst, c = staff consultant, d = director, e = energy specialist, i = investment specialist, n = environment specialist, o = project implementation officer, p = portfolio management specialist, r = resettlement specialist, y = young professional.

I. PROJECT DESCRIPTION

1. At the request of the Government of the Kyrgyz Republic, on 27 September 2010 the Asian Development Bank (ADB) approved a loan of SDR11.01 million ($16.7 million equivalent) and a grant of $28.10 million for the Power Sector Improvement Project.[1] The project was designed to boost energy security, energy efficiency, and regional power trade. The expected impact of the project was stronger reliability of national and regional power supply in the Kyrgyz Republic and Central Asia. The expected outcome was better operational efficiency of power utilities. The project was intended to benefit the people of the Kyrgyz Republic through a more transparent, accountable, and efficient energy sector. Since the rural poor were the first to be cut off from the electricity supply during winter power shortages, reducing system losses and improving the reliability of the power supply would particularly benefit the poor.

2. At appraisal, the project included the following physical components, carried out by Joint-Stock Company National Electric Grid of Kyrgyzstan (NEGK) as the executing agency for the project's physical components: (i) installing an automated metering and data acquisition (AMDA) system for the national electricity transmission network, (ii) rehabilitating facilities in more than 50 electricity transmission substations, and (iii) developing a supervisory control and data acquisition (SCADA) system linking seven major substations. The Ministry of Energy (MOE) was the executing agency for the nonphysical components, which comprised: (i) recommending a suitable settlement mechanism for wholesale electricity transactions, and (ii) improving the financial management capacities and strategic business plans of NEGK. The investment cost of the project was estimated at $56.0 million, to be financed by an ADB loan of $16.7 million, an ADB grant of $28.1 million, and government counterpart funds of $11.2 million equivalent.

II. DESIGN AND IMPLEMENTATION

A. Project Design and Formulation

3. The Kyrgyz Republic has abundant hydropower resources. More than 90% of the country's energy is generated by 16 hydropower plants, with the rest generated by two thermal combined heat and power plants. The Kyrgyz Republic was the largest net power exporter within the Central Asian Power System during 1990s and 2000s, through summer exports of surplus hydropower which accompanied by discharging water for downstream countries to meet their irrigation needs. However, load shedding was common during years when the river water levels and discharge were low due to hydrologic fluctuations. Such a supply pattern called for increased regional power trade to balance supply and demand. At appraisal, the reliability of the power supply in the country was hindered by (i) high system losses (6% transmission loss and 26% distribution loss in 2009); (ii) obsolete, inefficient, technology; (iii) power cuts caused by dilapidated equipment in use since the Soviet era, and (iv) poor governance and financial management. These factors, along with dramatically increased national demand, were keeping power exports—and export revenues—low, starving the country of resources to import fuel for the combined heat and power plants during winter.

4. Although the entire energy sector required modernization, the government prioritized rehabilitation of key generation, transmission, and distribution assets; reducing losses; and more effective governance to improve commercial operations and restore people's confidence in the energy sector and ensure socioeconomic stability. To achieve this, the government issued the presidential decree "Fuel and Energy Sector Transparency Initiative" on 20 July 2010, which

[1] ADB. *Kyrgyz Republic: Power Sector Improvement Project*. Manila.

increased transparency and accountability in the sector. Energy security, through expansion of generating capacity, was also a priority but the medium-term solutions addressed by this project were to improve system efficiency and reliability and increase regional power trade.

5. The project was aligned with ADB's Strategy 2020 and ADB's Energy Policy.[2] The latter focused on energy efficiency, cutting fossil fuel use, promoting energy security and access, and boosting regional cooperation. The project was also aligned with the government's Country Development Strategy, 2009–2011,[3] which prioritized the energy sector. The Joint Country Support Strategy, 2007–2010, prepared by major development partners and ADB, supported the Country Development Strategy.[4] Although other development partners were engaged in the energy sector during 2000–2010, ADB decided to reenter the sector to help meet the sector's large financing needs. The project was also congruent with the energy strategy agreed under the Central Asia Regional Economic Cooperation Program.

6. ADB provided technical assistance (TA) and conducted due diligence in 2010 to design and formulate the project.[5] The TA contributed to achieving the performance targets of the project. The due diligence confirmed that the technical risks were low and that NEGK had experience developing and implementing similar rehabilitation projects funded by development partners. To minimize risks, the project included trainings, support, and warranties in the two contract packages (para.23). Supervision consultants would ensure quality, compliance with technical specifications, cost efficiency, durability, safety, safeguards, financial management, internal control, reporting, and auditing. Operation and maintenance (O&M) risks would be mitigated through capacity building of NEGK and inclusion of sufficient spare parts.

7. During and after implementation, the project was found to be highly relevant to the National Strategy of Sustainable Development (NSSD) of the Kyrgyz Republic, 2013–2017[6] and ADB's country partnership strategy for the Kyrgyz Republic, 2013–2017.[7] The project effectively contributed to meeting the government's objectives and ADB's country partnership strategy at completion, as envisaged. Meanwhile, the project generated positive socioeconomic impacts during and after project implementation (paras. 45–46). The study on the settlement mechanism and the capacity building program for NEGK has substantially increased the institutional capacity of the energy sector and the relevance of the project. The project design and monitoring framework, with results, is in Appendix 1.

B. Project Outputs

8. **Physical components**. At appraisal, the project was to (i) install an AMDA system for the national electricity transmission network (ii) rehabilitate facilities in more than 50 selected electricity transmission substations, and (iii) develop a SCADA system linking seven major substations. Upon completion:

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[2] ADB. 2008. Strategy 2020: *The Long-Term Strategic Framework of the Asian Development Bank, 2008–2020*. Manila; and ADB. 2009. *Energy Policy*. Manila.
[3] Government of the Kyrgyz Republic. 2009. *Country Development Strategy, 2009–2011*. Bishkek.
[4] ADB, Swiss Agency for Development and Cooperation, Department for International Development of the United Kingdom, United Nations agencies, and World Bank. 2007. *Joint Country Support Strategy, 2007–2010*. Manila.
[5] ADB. 2009. *Technical Assistance to the Kyrgyz Republic for the Transmission and Distribution Meter Project*. Manila. Approved on 30 October 2009 for $225,000 and closed on 31 July 2010. During preparation, the project was renamed as Power Sector Improvement Project.
[6] President of the Kyrgyz Republic. 2013. *National Strategy of Sustainable Development for the Kyrgyz Republic, 2013–2017*. Bishkek
[7] ADB, 2013. *Country Partnership Strategy, Kyrgyz Republic, 2013–2017*. Manila.

- The AMDA system linking 190 NEGK substations with the facilities of Joint-Stock Company Electric Power Plants was installed and commissioned, including site survey, design, supply materials, system development, and partial reconstruction of foundations and towers.

- Facilities of 118 NEGK substations were rehabilitated, which substantially exceeded the target of 50 substations, by replacing run-down circuit breakers and instrument transformers.[8]

- The SCADA system was developed and commissioned, including site survey, design, supply, and installation of the communication and SCADA system, which linked eight major substations with the NEGK central control center and the Chuy regional standby control center via fiber optic cable.

9. During implementation, suppliers and contractors carried out quality control in accordance with their contractual requirements. The project management consultant (PMC) and individual consultants assessed and supervised the quality of the equipment and works to ensure that specifications had been met. To strengthen coordination and quality control, ADB engaged a metering expert during 2012–2013 to check the compatibility of the system designs with the existing grid network and the settlement center design. No significant defects or quality problems were reported during the defect liability period.[9] The ADB project completion review (PCR) mission observed that the equipment and facilities were of good quality, the AMDA and the SCADA systems were operating, and routine maintenance was in place to keep the facilities and systems in good condition. A summary of the features of the project outputs is in Appendix 2.

10. **Nonphysical components**. At appraisal, the nonphysical outputs were a suitable settlement mechanism for wholesale electricity transactions recommended; NEGK's corporate and financial management capacity developed; and NEGK's strategic business plan prepared.

- **Settlement mechanism.** A consultant team under MOE management produced a study on the settlement mechanism.[10] The study covered aspects of settlement center design, drawing on international experience, including technical specifications policy recommendations, and a road map for implementing the settlement mechanism. Stakeholders and relevant development partners attended a workshop in April 2013 to discuss and disseminate the study results, and the consultant conducted an overseas study tour to Armenia and Spain in May 2013 to share the best international practices of settlement operations and procedures with the relevant Kyrgyz energy sector officials and specialists.

- **Capacity building and business plan.** A consulting team recruited under the project conducted the capacity-building activities for NEGK. The consulting team conducted in-depth survey and analysis of the existing institutional framework and management and financial capacity of NEGK, prepared a performance improvement business plan developed under the program, and provided recommendations for future development.

[8] On 10 November 2017, ADB approved the government's request to utilize the loan and grant savings of $3.8 million to purchase additional equipment for substation rehabilitation through a contract variation. Additional 12 substations were rehabilitated increasing the total number of rehabilitated substations from 106 to 118.

[9] 1.5 years for the equipment contract, and 3.5 years after issuing takeover certificates for turnkey contract.

[10] AF-Mercados EMI. 2013. *Final Report—Study on the Wholesale Electricity Transaction Settlement System*. Bishkek.

The consultant delivered the final report to NEGK in July 2013.[11]NEGK has been using the business plan to enhance its corporate, human resources and financial management.

C. Project Costs and Financing

11. At appraisal, the total project cost was estimated at $56.0 million equivalent, including base costs for physical and nonphysical components, contingencies, and financial charges during implementation. At completion, the total project cost was $46.6 million equivalent, which was about 16.8% lower than that estimated at appraisal. The project cost savings comprised $5.5 million from tax exemptions; $1.2 million from consulting service savings; and $1.2 million from reduced financial charges, mainly because of delayed loan disbursements. Meanwhile, actual costs increased by $2.8 million for substation rehabilitation because of additional equipment procured, and $0.7 million for the AMDA/SCADA subcomponent, mainly because of price escalation. All increased costs were covered by the project contingency and the loan and grant savings. Appendix 3 compares the details of the project costs at appraisal and at completion.

12. At appraisal, the project was to be financed by an ADB loan of SDR11.01 million ($16.7 million equivalent, or 29.8% of the total project cost), an ADB grant of $28.1 million (50.2%), and counterpart funds of $11.2 million equivalent (20.0%). During implementation, tax was exempted while NEGK fully financed installation of substation equipment. Because of the tax exemption, NEGK's reduced costs for equipment installation, lower financial charges, and the partial cancellation of the loan and grant proceeds at financial closure, the project financing at completion was $15.5 million equivalent from the ADB loan (33.3% of the project cost), $27.2 million from the ADB grant (58.4%), and $3.87 million equivalent from the counterpart funds (8.3%). The detailed comparison of the project financing at appraisal and at completion is in Appendix 4.

13. The ADB loan and grant were approved on 27 September 2010 by the ADB Board of Directors and the financing agreement signed by the Government of the Kyrgyz Republic and ADB on 8 December 2010. The effectiveness of the financing agreement was postponed twice, becoming effective on 15 June 2011 (para. 17). The ADB loan was relent by the Ministry of Finance to NEGK as per a subsidiary financing agreement signed on 16 February 2012.

D. Disbursements

14. The ADB loan and grant were disbursed in accordance with ADB's *Loan Disbursement Handbook* (2007, as amended from time to time). ADB's direct payment procedures were used to disburse the loan and grant proceeds to the suppliers, contractors, and consultants based on approved contracts and actual implementation progress. The first disbursement for both the loan and the grant was made on 20 April 2012 for the advance payment to the consultant.[12] Because of initial implementation delays (paras. 16–18), loan and grant disbursement progress was slow in 2012—only $0.40 million from the loan and $0.91 million from the grant were disbursed. Disbursements started to catch up and peaked in 2013, comprising $5.50 million from the loan and $9.66 million from the grant.

15. The project was completed and the loan and grant closed by 31 July 2018. The loan and grant accounts were financially closed on 9 January 2019. Loan proceeds of SDR10,728,459

[11] GIEG and Lahmeyer International. July 2013. *Power Sector Improvement Project – Consulting Services for Corporate & Financial Management Capacity Building of NEGK*. Bishkek.
[12] Signing the subsidiary financing agreement was a disbursement condition for releasing ADB funds.

($15,496,759 equivalent) and grant proceeds of $27,223,088 were disbursed. The undisbursed amounts of $391,550 for the loan and $876,912 for the grant were cancelled on the same day. Appendix 5 outlines the actual disbursements of the ADB loan and grant proceeds, while Appendix 6 summarizes the actual contract awards.

E. Project Schedule

16. At appraisal, it was envisaged that the project would be implemented from January 2010 to December 2013. The loan and grant closing dates were extended three times. The first extension, to 30 June 2016, was to compensate for the delay in the loan and grant becoming effective, the delay signing the subsidiary financing agreement, and delays in overall project progress.[13] When it became clear that there were substantial project savings, the EA requested to use those savings to upgrade additional substations under the project. ADB approved a second extension of the loan and grant closing date, to 31 December 2017, and a third extension to 31 July 2018 to enable the completion of the additional scope and fully utilize project savings.[14] Loan and grant proceeds were reallocated several times to transfer unallocated amounts and to reallocate loan and grant savings to the goods and works categories.

17. The financing agreement's effectiveness was delayed for about 4 months and signing the subsidiary financing agreement was delayed for about 13 months because of changes in the government and because of the government's lengthy internal procedures. Under advanced contracting, recruitment of the PMC began in October 2010. The PMC contract was awarded in November 2011; it was delayed by more than 1 year because of disputes over the contract terms. The ADB mission in June 2012 found that the bidding documents for the physical components had not been prepared on time, which pushed back the entire procurement schedule. The equipment supply contract for rehabilitation of substations was awarded in March 2013. The supplier delivered the equipment under the original scope by 17 December 2014. NEGK installed the equipment using its own resources, supervised by the supplier by 31 December 2017. Additional equipment was procured using the loan savings, with the contract amendment signed in October 2017. Additional delays were experienced in procurement for the AMDA/SCADA turnkey contract, caused by difficulties revising the bidding documents and a prolonged bid evaluation process. The turnkey contract was awarded in July 2015. By November 2017, most of the equipment for the substation rehabilitation had been installed; the optical ground wire (OPGW) and SCADA installation works were complete; the wholesale meters for the AMDA system had been delivered and installed; and the mobile laboratory had been manufactured. Eventually, the turnkey contract was fully completed, with the certificate issued on 28 February 2018 and additional equipment for substation rehabilitation substantially installed before 31 July 2018.

18. Consultant recruitment for the settlement mechanism study and the capacity building program was also delayed. The contract was awarded on 16 February 2012 for the settlement mechanism study, and on 2 April 2012 for NEGK capacity building. The settlement mechanism consultant conducted a workshop on outcomes on 16 April 2013 and organized a study tour to Armenia and Spain in May 2013. The study was completed, and the final report submitted, in June 2013 (footnote 10). Under the capacity building program, the consulted conducted a ministerial workshop on improving the financial management of NEGK on 18 April 2013. The

[13] ADB (Central and West Asia Regional Department [CWRD]). 2013. *Power Sector Improvement Project—Request for Approval of Extension of Loan and Grant Closing Date*. Memorandum. 8 March.

[14] ADB (CWRD). 2015. *Power Sector Improvement Project—Request for Approval of Extension of Loan and Grant Closing Date and Minor Change in Project*. Memorandum. 8 April.
ADB (CWRD). 2017. *Power Sector Improvement Project—Request for Approval of Extension of Loan and Grant Closing Date, Reallocation of Project Proceeds and Minor Change in Project Scope*. Memorandum. 31 October.

consulting service for the capacity building program was fully completed in July 2013 upon delivery of the final report (footnote 11).

19. Appendix 7 compares the actual implementation schedule with the schedule at appraisal, and Appendix 8 contains a chronology of the main events.

F. Implementation Arrangements

20. The MOE was the executing agency for the nonphysical components and also was responsible for overall supervision of project implementation.[15] NEGK, as the executing agency for the physical components, assigned its existing project implementation unit (PIU) to oversee execution of the physical components.[16] A procurement capacity assessment at appraisal revealed that the country's procurement system was weak and that NEGK's capacity was also limited. At appraisal, NEGK's PIU had only three professional staff (a procurement specialist, an engineer, and an accountant), and the MOE's PIU had just two professional staff. Staff requirements for the NEGK's PIU, with clear responsibilities, were provided in the project administration manual. The PMC function would be outsourced to an international consulting firm to assist NEGK in project management and supervision. The financing agreement had a covenant requiring the executing agencies to make available qualified and experienced staff for project implementation.

21. During implementation, ADB missions found that the PIUs of NEGK and the MOE remained weak and had limited understanding of ADB procedures and limited English language ability. ADB suggested to the government strengthening the capacity of the PIUs, and a staff consultant hired by ADB was retained to assist the PIUs in recruiting additional consultants. Meanwhile, NEGK's PIU enhanced its project implementation capacity through training on ADB procurement and disbursement policies and procedures conducted by ADB, adding more staff (e.g., project manager, PIU head, electrical engineer, economist, translator, environment specialist, and other staff from other NEGK technical departments where needed) and recruiting external individual consultants to support project management and implementation (para. 22). The project was the first energy project of its kind financed by ADB and managed by NEGK. The staff of the executing agencies and the PIUs gained substantial experience and NEGK's capacity to implement and manage such projects improved. Appendix 9 contains the project organizational chart.

G. Consultant Recruitment and Procurement

22. Three consulting service packages were prepared—the PMC, the consultant for the settlement mechanism study, and the consultant for the NEGK capacity building program. Under advance contracting, recruitment of the three consulting services commenced in October 2010 using quality- and cost-based selection in accordance with ADB's Guidelines on the Use of Consultants (2010, as amended from time to time). Disputes over contract terms related to the payment of the corporate income tax and the proportion of home and field work inputs led to the PMC contract being awarded about six month later than projected in November 2011 with a service period of 36 months terms. The PMC commenced its work in January 2012. During implementation, NEGK repeatedly complained to ADB review team members that the PMC's work was of low quality, characterized by slow bidding document preparation, inadequate field time,

[15] During implementation, the government restructured the MOE and renamed it the Ministry of Energy and Industry (MOEI); the executing agency function for the nonphysical components remained with the MOEI.
[16] NEGK had a PIU in place for a project financed by the Islamic Development Bank.

and a poor working relationship with NEGK. This had a negative impact on the project's progress and financial management. The PMC contract was completed in December 2014 and was not extended, even though the project was still ongoing. To support project management and supervision of the physical works, three individual consultants (one international and two national) were recruited (contracts signed in November–December 2015 and in August 2017).[17] For the settlement mechanism study and the capacity building program, recruitment followed quality- and cost-based selection. The contracts were awarded to international firms on 16 February 2012 for the settlement study and on 2 April 2014 for the capacity building program. Consultants completed most tasks specified in the terms of reference. The performance of most consultants was satisfactory; however, the performance of the PMC was only partially satisfactory.

23. Contracts for the physical components were procured through two contract packages: lot 1 for equipment supply and lot 2 for turnkey and works, in accordance with ADB's Procurement Guidelines (2010, as amended from time to time), using international competitive bidding procedures. The supply contractor was to design, manufacture, and supply equipment for substation rehabilitation; the turnkey contractor was to design, manufacture, supply, install, and commission the AMDA and SCADA systems and stringing of the OPGW. During implementation, the ADB mission found that the turnkey contract was complex and discussed with NEGK a change to a two-stage procurement procedure, which was not accepted. The procurement procedure issue and revision of the bidding documents extended the overall procurement period. Eventually the supply contract was awarded on 5 March 2013 (15 months delay) and the turnkey contract was awarded on 14 July 2015 (30 months delay). The procurement delays pushed back overall project implementation substantially. Using the loan and grant savings, more equipment for substations was supplied through a contract amendment approved by ADB. Both contracts for the physical components were also extended. Overall, NEGK rated the performance of the contractors for the physical components satisfactory. The packages of ADB-financed contracts, with actual costs, are summarized in Appendix 10.

H. Safeguards

24. **Environmental safeguards.** At appraisal, the project was categorized B for environment. During the TA (footnote 5) NEGK prepared an initial environmental examination in August 2010 in accordance with ADB's Safeguard Policy Statement (2009). The project passed State Ecological Expertise required by the government, which concluded that the major anticipated impact on the environment would come from the disposal of replaced electrical equipment. An environmental management plan (EMP) was prepared accordingly that provided guidance on testing, handling, and disposal of polychlorinated biphenyls (PCBs).[18] The EMP required that noncontaminated transformer oils be treated in NEGK's oil treatment facility and reused.

25. NEGK submitted an updated initial environmental examination on 25 June 2014, which was endorsed by ADB and the State Agency on Environmental Protection and Forestry on 8 July 2014 and posted on the ADB and NEGK websites. NEGK, with assistance from the PMC, supervised EMP implementation and prepared 10 semiannual environmental monitoring reports, which were disclosed on the ADB and NEGK websites. As advised by ADB missions, no work would proceed on equipment containing oil. For the PCB testing, NEGK established an oil testing commission composed of a team of specialists, and testing started in June 2016 on oil in the current and voltage transformers being replaced. After the PMC's contract ended, NEGK recruited

[17] Comprising an international SCADA/communication expert, a national environment expert, and a national electrical engineer. The national environment expert was replaced in August 2017.

[18] Oil in equipment to be replaced may contain PCBs (a persistent organic pollutant), which if confirmed would require expensive and specialized disposal.

a national environment specialist to supervise EMP implementation and prepare monitoring reports. MOE recruited another environmental specialist who procured portable test kits and trained NEGK staff to facilitate PCB testing. PCB testing continued in 2018 for the additional equipment installation. No cases of PCB contamination were identified.

26. **Involuntary resettlement.** The project was classified category B for involuntary resettlement at appraisal, in accordance with the ADB Safeguard Policy Statement. The project investments would be implemented mostly in NEGK's central and regional headquarters and in existing substations where land acquisition and resettlement (LAR) impacts were not envisaged. Access to land plots was required only for stringing OPGW over the existing transmission towers to develop a modern communication system. Limited temporary LAR impacts, such as crop losses during installation, were identified. The turn-key contractor prepared a LAR framework in accordance with ADB's Safeguard Policy Statement which was disclosed on ADB's website. The LAR framework also required that on-site installation works would not begin until the endorsed LAR plan was fully implemented.

27. During implementation, NEGK and the turnkey contractor prepared six land acquisition and resettlement plans (LARPs) and three due diligence reports. NEGK carried out public consultations with affected households and local officials during preparation of the LARPs and due diligence reports. All LARPs and due diligence reports were approved by ADB and disclosed on the NEGK and ADB websites. NEGK established a grievance redress mechanism at the central office and regional divisions. Upon project completion, 174 (100%) of affected persons had received compensation totaling Som990,355.20 for temporary crop impacts on 25 hectares of affected area. NEGK did not receive any complaints from affected persons who expressed satisfaction with the compensation and some expressed gratitude to the government, NEGK, and ADB for implementation of protective measures of the social safeguard policy that (i) provided for restoration of any kind of damage for actual land users; (ii) implemented before site works start; and (iii) covered all affected persons regardless of formality/informality of their rights. According to surveys conducted by NEGK, no vulnerable and/or severely affected households were identified. NEGK financed the implementation of the LARPs through its own funds and implemented them in cooperation with its regional divisions. NEGK prepared a semiannual social monitoring reports which were timely disclosed on the NEGK and ADB websites.

28. **Indigenous peoples.** The project was not expected to affect indigenous peoples as defined under ADB's *Safeguard Policy Statement*. The project covers most of the country. The majority of the population are Kyrgyz. The ethnic minorities comprise Russians, Uzbeks, Kazakhs and others. These ethnic groups do not differ in their needs or levels of power demand, and all benefit equally from the project.

I. Monitoring and Reporting

29. The borrower and executing agencies complied with all loan covenants for the project, and the MOE and NEGK, as the executing agencies, carried out the project in conformance with sound administrative, financial, engineering, environmental, and social practices. During implementation, the MOE and NEGK provided adequate oversight, coordination, and financial support to implement the project. They incorporated and implemented environmental and social mitigation measures in the contracts as required by the respective loan covenants. Since project completion, NEGK has been carrying out O&M of the facilities and systems created under the project using clear institutional arrangements and regular financial allocations.

30. The executing agencies submitted audited project financial statements with an auditor's

opinion to ADB as required, although for some periods they were submitted with delays (maximum 2.7 months). The auditor's opinion on NEGK's project financial accounts was qualified during 2013–2016 because of a single item that could not be resolved until the end of the project.[19] Another issue identified in the auditor's qualified opinion for FY2017 revolved around whether $598,000 of project funds were used for the intended purposes. NEGK resolved this issue to the satisfaction of the auditor, resulting in an unqualified opinion for the final period (FY2018). The MOE had substantially completed its planned project activities by 2013; it completed an additional activity started in 2016 (engaging an environmental expert specialized in PCBs, with the last disbursement on 12 Jan 2017). The auditing firm duly audited the MOE's project accounts for 2012–2017.

31. In 2017 the State Committee for Industry, Energy and Subsoil Use was established and replaced the Ministry of Energy and Industry as the new energy sector authority.[20] However, as all planned project activities had been completed, the new authority did not undertake any transactions or claim any disbursements before the financial closure of the project; therefore, no audits were conducted on its accounts. The executing agencies prepared and submitted the project progress reports to ADB generally on time. NEGK prepared the required project completion report and submitted it to ADB on time. However, compliance with some covenants was delayed—mainly, covenants concerning submission of progress and audit reports. Appendix 11 summarizes the status of compliance with major loan and grant covenants.

III. EVALUATION OF PERFORMANCE

A. Relevance

32. The project is rated *relevant*. It was relevant at appraisal and remained so at completion. The intended project outcome of better operational efficiency of energy companies was closely aligned with the government's strategy of increasing energy security and expanding the electricity supply by rehabilitating key existing assets, improving system efficiency and reliability, and increasing regional power trade. Energy security is a top priority and a lever for political and socioeconomic stability for the Kyrgyz Republic, and one of key preconditions for inclusive and sustainable economic growth. The project supported the government's development plans and ADB's country partnership strategy for the Kyrgyz Republic, 2013–2017, which focused on supporting sustainable and inclusive growth and regional cooperation.

33. The project enabled the government and NEGK to gain valuable experience in project financing and implementation, as well as pro-poor and sustainable economic development. The project's capacity-building component significantly boosted the capabilities of NEGK staff. The project was well-designed and formulated, and ADB provided technical assistance (footnote 5) and due diligence, while ADB staff consultants were retained to support preconstruction activities. During implementation, the project scope was amended to reflect actual needs and to fully utilize the ADB loan and grant; this increased scope enhanced the project relevance at project completion. Overall, the project was relevant to the government's development objectives and

[19] The amount of €21,820 was recognized as an excessive payment to a substation equipment supplier because of a difference between the technical specifications of the bidding documents and the contractor's proposal during the bidding. The amount was finally deducted from the substation equipment supplier's invoice, which could only be issued at the end of the project.

[20] The Government of the Kyrgyz Republic. 2015. *About Organization Measures in Connection with New Structure of the Government of the Kyrgyz Republic*. Bishkek. (Resolution number 768) and Government of the Kyrgyz Republic. 2016. *On the State Committee for Industry, Energy and Subsoil Use of the Kyrgyz Republic*. Bishkek. (Resolution number 373)

plans, and to ADB's country partnership strategy and lending policy.

B. Effectiveness

34. The project is rated *effective* in achieving its outcome and outputs. Aside from implementation delays, the AMDA and SCADA systems were developed and commissioned as planned at appraisal. A total of 118 NEGK substations (out of 197) were rehabilitated, which is more than the 50 substations planned at appraisal (partly attributed to the utilization of project savings). However, it was still not enough to fully achieve the target because rehabilitation works addressed only most critical needs while 140 substations out of total 197 have been operating over 25 years. Nevertheless, the project's physical outputs have improved the efficiency and transparency of electricity generation, transmission, and distribution in the country, as well as increased the electricity supply. The project's nonphysical outputs, settlement mechanism study and capacity building program, have significantly enhanced institutional capacity within the energy sector. The settlement center was established in 2015 and has been equipped with ADB support through the Power Sector Rehabilitation Project.[21] The NEGK capacity building consultant conducted a ministerial workshop on improving the financial management of NEGK, which was attended by representatives of the government and power companies and covered governance, internal audit, cost control, information systems, human resources, and organization. NEGK's business plan developed under the project has been put into effect.

35. Most of the impact and outcome targets were fully or substantially achieved. Net electricity exports were 1,213 GWh in 2017 and 753 GWh in 2018; although this is lower than the impact target of 3,000 GWh in 2017, the shortfall can mainly be explained by rapidly increasing domestic demand,[22] combined with a decrease in demand for electricity from neighboring countries (which have expanded generation capacity substantially). The project significantly met the impact target of reducing grid outages and the outcome targets of reducing transmission and distribution losses. Grid outages declined from 62 times in 2009 to 34 times in 2018, compared with a target of 30 times. From 2009 to 2018, aggregate transmission and distribution losses declined from 31.7% to 18.02%, which saved 2,820 GWh in 2018; this enabled the Kyrgyz Republic to sign a power-purchase agreement under the Central Asia – South Asia (CASA) 1000 project to export 1,000 GWh of electricity starting in 2023 to Pakistan and Afghanistan. Transmission losses declined from 5.7% in 2009 to 5.32% in 2018, against a target of 4.7% in 2014, while distribution losses more than halved from 26% in 2009 to 12.7% in 2018. The partial achievement of the transmission loss reduction target was mainly caused by the overall dilapidated status of the electricity transmission assets in the country.

36. The PCR mission found that the AMDA system has started to collect precise data from a variety of metering points, which is being used for monitoring electricity generation, transmission, and distribution. Upon full functioning of the settlement center, the AMDA system will be used to monitor electricity flows and settle payments between energy companies based on set electricity tariffs, moving away from long-established nontransparent practices. The SCADA system will be expanded to connect the control center with more NEGK substations—from eight substations to 20 substations. The effectiveness of the project will be gradually improved as the settlement center and SCADA systems are implemented more widely.

[21] ADB. 2012. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Grant to Kyrgyz Republic: Power Sector Rehabilitation Project*. Manila.

[22] 15% growth in residential electricity consumers from 2007 to 2017, accompanied by 67% growth in residential consumption.

37. Project implementation complied with the environment safeguards specified in the loan and grant covenants. The monitoring and analysis results for the environment impacts concluded that the contractors had generally implemented the environment measures and that NEGK, with assistance from the PMC and the individual consultants, had properly implemented the EMP and complied with ADB's environment safeguard policies.

C. Efficiency

38. The project is rated *efficient* in achieving its outcomes and outputs. The economic internal rate of return (EIRR) of the project was reevaluated using a methodology similar to that used at appraisal, with updated data. The economic benefits were recalculated comparing the "with-project" and "without-project" scenarios, with benefits comprising, mainly (i) reduced O&M costs for the substations; (ii) enlarged electricity supply for both domestic consumption and export; and (iii) improved environment. The EIRR was recalculated at 17.7% for the project, compared with 24.4% at appraisal. The lower EIRR at completion was mainly due to the longer-than-planned project implementation period and a smaller reduction in transmission losses than projected at appraisal. The recalculated EIRR is still above the ADB recommended discount rate of 12% at appraisal (and 9% currently). The project is economically viable. The sensitivity analysis results indicated that the project continued to be economically viable if a 20% maintenance cost increase were to be combined with a 20% benefit reduction. In that case, the EIRR would be still 13.3% for the whole project. The details of the economic reevaluation are in Appendix 12.

D. Sustainability

39. The project is rated *likely sustainable*, considering the following factors.

40. **Energy sector development**. Relying predominantly on hydroelectricity, the energy sector in 2013 was characterized by (i) poorly maintained old assets operating beyond their economic life, (ii) poor supply reliability and service quality, (iii) a substantial increase in household consumption in the years leading up to 2013 because of expanding real estate construction and switching from consumption of coal and gas to electricity for heating, (iv) looming power shortages, especially in winter, (v) inadequate capital and O&M spending by utilities because of inadequate cost recovery and high losses, (v) substantial direct subsidies (low tariffs) to residential customers and indirect subsidies to energy companies, and (vi) inefficient energy use by consumers. Electricity customers in the country have historically paid one of the lowest residential tariffs in the world, and tariffs were well below actual costs because of affordability and social considerations. Rehabilitation of old assets operating beyond their economic life was an urgent need, and the project contributed in renovating NEGK's assets and improving its management capacity to attain the project outcome and outputs for stronger electricity supply reliability and better operational efficiency.

41. In 2013 the government started reforming the energy sector. It implemented the Action Plan for Reforming the Energy Sector with the support of development partners and established an independent regulator. The MOE was abolished in 2015, with the State Committee for Industry, Energy and Subsoil Use assuming its policy making functions. The Joint Stock Company National Energy Holding Company (NEHC) was established in January 2016 to manage energy companies. The government developed and adopted a Medium-Term Tariff Plan for 2014–2017 and increased both residential and commercial tariffs, which improved the performance of energy companies. The government is developing a new tariff plan to gradually increase electricity tariffs and bring them up to cost-recovery levels by 2021. The project modernized NEGK's SCADA and AMDA systems which improved transparency and accountability of electricity metering by NEGK

and other energy companies and significantly reduced losses. NEGK's AMDA system has been serving as a major provider of reliable metering data for the settlement center. However, sector reform has slowed and needs further commitment from the government's as well as the support of development partners.

42. **Operation and maintenance of the project facilities**. The systems and facilities created under the project are being operated and maintained by NEGK, which is one of the six major energy companies under NEHC.[23] NEGK revenues are allocated from total electricity revenue based on the transmission tariff established by the sector regulator. The revenues are used mainly for O&M, urgent investments, financial charges, and debt service. NEGK allocates regular budget and maintains sufficient staff at its headquarters in Bishkek to operate the AMDA and SCADA systems. The SCADA system connects the NEGK central control center and the Chuy regional standby control center via fiber optic cable with eight major substations in the north and will connect 20 substations in future. Real-time data of electricity flows and status of substations and transmission lines are reported, analyzed, displayed, and used to guide repairs and rapid restoration of electricity. The settlement center issues the data collected from the AMDA meters for analysis of electricity generation, transmission, distribution, and consumption. The equipment installed at the 118 substations is operated and maintained by the substations; NEGK provides them with budget allocations and spare parts for proper maintenance. A laboratory contains equipment, financed by the project, to carry out regular testing of the meters.

43. NEGK's O&M allocations increased from Som564 million in 2008 to Som1.435 billion (about $20.5 million) in 2018, while the O&M requirements of the project assets was $0.7 million (3.4% of the total allocation) in 2018. The financial sustainability of NEGK is supported by the government, NEGK's major shareholder, which considers the company a strategic asset by law and provides financial incentives such as concessional lending and restructuring of its overdue borrowings. It is also expected that the government tariff policy will be aimed at achieving cost recovery to go along with sector reform, modernization of energy companies' management, and increased electricity export revenues. This will substantially improve NEGK's financial status and profitability. The government has cancelled and rescheduled sector debt in the past, where needed, and as the ultimate owner of large energy companies including NEGK will continue to serve as the financial guarantor of publicly held sector enterprises. The project is therefore considered *likely sustainable*.

44. **Financial reevaluation of the project**. The PCR team carried out a financial reevaluation of the project using a similar methodology to that used at appraisal and updated data. NEGK provided ADB with actual O&M costs and revenues during 2016–2018. The financial internal rate of return (FIRR) of the project was reevaluated at 2.40% before tax and 1.44% after tax, which was based on actual capital costs, prevailing O&M costs, and projected revenues at existing tariff levels. The recalculated FIRR was much lower than that estimated at appraisal (7.83%), which was mainly due to the prolonged implementation schedule, the failure of the project to fully achieve the output target of reduced transmission losses, and overestimation of revenues at appraisal. However, the recalculated FIRR is higher than the weighted average cost of capital (WACC) of 0.67% recalculated at project completion. Therefore, the project is still considered financially viable. Additionally, the FIRR was subject to sensitivity tests. Combining a 20% increase in O&M costs with a 20% decrease in revenue, the FIRR was at -1.99% before tax and -2.99% after tax. A tariff increase planned by the government will increase the FIRR. Details of the financial reevaluation are in Appendix 13.

[23] One national electricity generation company, one national electricity transmission company, and four regional electricity distribution companies.

E. Development Impact

45. The project's development impact is rated *satisfactory*. At appraisal, a quick impact assessment of the project was carried out, which concluded that the general population would benefit from a transparent, accountable, and efficient power sector. Since the rural poor are the first to be cut off from the power supply during winter power shortages, system loss reduction and stronger supply reliability would particularly benefit the poor. The project covered existing substations and transmission lines. There were no adverse social impacts except nominal crop losses during installation of the OPGW at the existing transmission towers.

46. Hydropower generation is one of key growth drivers for the country. Annual electricity exports have fallen by more than 50% compared with 2007 because of increased domestic demand, reflecting economic growth and higher living standards. Improved efficiency in electricity transmission has increased the reliability of the power supply and reduced electricity losses. An indirect impact of the project on industrial and SME growth is assessed in the economic analysis of the project (Appendix 12, para.12).

F. Performance of the Borrower and the Executing Agency

47. The performance of the borrower and the executing agencies is rated *partially satisfactory*. The borrower was the Kyrgyz Republic. The executing agencies were the MOE for the nonphysical components and NEGK for the physical components. Related government agencies—namely, the Ministry of Finance and the Ministry of Energy—actively participated in coordination and supervision of the project, and NEGK put institutional arrangements in place to facilitate the project. The NEGK's PIU was fully staffed, with sufficient technical support from NEGK departments. NEGK provided counterpart funding of $3.87 million equivalent for equipment installation, compensation to affected persons, and financing charges. Project implementation complied with all loan and grant covenants. Upon completion, institutional and financial arrangements were in place for O&M of the project facilities and the AMDA and SCADA systems. However, the substantial implementation delays experienced by the project were partially the result of government restructuring and inefficient internal approval procedures.

G. Performance of the Asian Development Bank

48. ADB's performance is rated *satisfactory*. The project was initially administered from ADB headquarters. From 2015, the Kyrgyz Republic Resident Mission administered the project. ADB effectively identified and resolved issues during implementation through (i) project review meetings between the borrower, the executing agencies, and ADB; and (ii) regular review missions. During implementation, ADB fielded 25 project review missions, including an inception mission in June 2011, a midterm review mission in September 2014, and the PCR mission in March 2019. ADB mission teams swiftly identified issues affecting the project and provided key inputs in preparing action plans to expedite the project. ADB's project team and consultants provided regular training and capacity support on project management and safeguard policy compliance to NEGK and PIU staff, the consultants, and the contractors. ADB approved documents in a timely manner during processing and implementation, and promptly processed all claims for payment. To facilitate project implementation, ADB extended the loan and grant closing date three times. The government recognized the important contribution of ADB missions in providing advice and technical support on all aspects of the project.

H. Overall Assessment

49. Overall, the project is rated *successful*. The project was *relevant* to government development objectives and ADB's country partnership strategy. The project was properly designed and implemented with minor changes in scope to meet actual project needs and use project savings. The project was *effective* in achieving its outcome and outputs, supporting sustainable economic growth, and enhancing NEGK management capacity. The recalculated EIRR indicated that the project is economically viable. The project was *efficient* in achieving its outcome and outputs based on the results of the economic reevaluation. The recalculated FIRR confirmed that the project was financially viable. At completion, the project had improved the efficiency of electricity transmission, supported economic development, and generated significant socioeconomic benefits. The project was *likely sustainable* given its contributions to improving the performance of the energy sector and strengthening institutional and financial arrangements to ensure proper O&M of the systems and equipment created under the project.

Overall Ratings

Criteria	Rating
Relevance	Relevant
Effectiveness	Effective
Efficiency	Efficient
Sustainability	Likely sustainable
Overall Assessment	**Successful**
Development impact	Satisfactory
Borrower and executing agency	Satisfactory
Performance of ADB	Satisfactory

ADB = Asian Development Bank.
Source: Asian Development Bank.

IV. ISSUES, LESSONS, AND RECOMMENDATIONS

A. Issues and Lessons

50. **Implementation delay**. Although the risk of implementation delay was identified at appraisal, and mitigation measures incorporated in the project design, the project nonetheless experienced substantial delays, including (i) delayed loan effectiveness and signing of the subsidiary financing agreement, (ii) protracted recruitment and poor performance of the PMC, (iii) delayed procurement of the supply and turn key contracts, (iv) slow implementation of PCB testing, and (v) scope changes to purchase more equipment using the loan savings. Future projects should ensure sound project preparation at appraisal through clear financing arrangements; sufficient advance procurement activities; streamlined government approval of subsidiary financing agreements; adequate training and technical support for executing agencies and PIU staff, especially for those who are not familiar with ADB's policies and procedure; and prompt identification of issues and development of action plans to address those issues.

51. **Utilization of loan and grant proceeds**. Rehabilitating energy assets and strengthening energy security requires significant assistance from development partners. However, some of the loan and grant proceeds were not fully utilized and were cancelled at financial closure. The major reasons for this were (i) about 10.8% of the loan and grant proceeds was reserved as "unallocated" at appraisal, and this needed to be reallocated during implementation; and (ii) all loan and grant proceeds were relent to NEGK as a loan.[24] Considering its debt burden and the cost of capital, NEGK was not willing to fully use the loan. For future projects, counterpart funds can cover the

[24] The grant was re-lent to NEGK as a loan. NEGK pays higher financial charges according to the relending terms.

project contingency to avoid loan and/or grant reallocations. The executing agency can prepare contingent subprojects that can be financed by loan or grant savings, if any. In situations where sector reform is ongoing parallel to the project, financing arrangements between the government and state-owned-enterprises need to be sound; one suggestion in cases where electricity tariffs are low is for the government to use equity contributions to energy companies instead of relending to improve their financial sustainability.

52. **Bidding documents and procurement**. Contracting and procurement issues delayed project implementation. During contract negotiation and implementation with the PMC, resolving payable taxes, reimbursement expenses, and the proportion of home and field work inputs postponed the contract signing and delayed the work. Other factors that delayed the procurement included bidding document revisions and selecting the procurement method for the lot 2 turnkey contract also. Such issues could have been prevented through enhanced preconstruction activities and/or by recruiting experienced experts to more accurately estimate project costs and prepare sound bidding documents during project preparation.

B. Recommendations

53. The project design included rehabilitation of NEGK's some major substations and did not cover all 197 substations most of which are operated for more than 25 years (para.34). Besides, the SCADA and OPGW systems have linked only eight major substations in the northern part not covering the southern part of the country. For future projects, a system approach is advisable for designing of transmission projects to achieve more solid targets and benefits for the energy sector. Besides, the establishment and operationalization of the settlement center were not included in the project scope, and it may raise a technical compatibility issues between the AMDA and settlement center, so it is recommended to design and implement the AMDA and settlement center within the scope of a single project.

54. **Future monitoring.** The project did not include a project performance monitoring program. No survey or assessment was carried out to collect information and analyze the project's development impacts. At appraisal, it was claimed that the poor population would benefit most from the improvement of electricity transmission and the expansion of the electricity supply. A monitoring program should have been designed to collect information on the project impacts, especially on the poor, women, and children. ADB and the government should use lessons and experiences from this project to enhance the development impact of subsequent projects and maximize benefits for the poor.

55. **Further action**. For improving the project benefits, the government should follow up and ensure the settlement center is properly operationalized and accompanied with respective changes in the legal and regulatory framework of the energy sector. Besides, NEGK's implementation of the business plan shall be monitored to fully achieve the target for enhancing NEGK's capacity building and financial management.

56. **Timing of the project performance evaluation report**. It is recommended that the Independent Evaluation Department of ADB will prepare the project performance evaluation report (PPER) in 2022, by which time the project facilities and the SCADA and AMDA systems will have been fully operational for at least three years, while the settlement center has also been fully functioning for two years. By then, project evaluators will be better positioned to assess efficiency improvements brought about by the project, the physical condition of facilities, the quality of O&M, and other project-related benefits and socioeconomic impacts.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Indicators and Targets	Project Achievements
Impact Stronger reliability of national and regional power supply	Net export from the Kyrgyz Republic increases to 3,000 GWh in 2017 from 2,230 GWh during 2000–2008 (average)	***Substantially achieved*** Electricity generation increased from 11,083 GWh in 2009 to 15,654 GWh in 2018. Thanks to reduction in transmission and distribution loss by 13.68% from 2009 to 2018, additional 2,821 GWh electricity became available for domestic consumption and export. Due to a rapid increase of domestic consumption from 10,049 GWh in 2009 to 14,724 GWh in 2018 and a decrease of electricity demand by neighboring countries, the net export from the Kyrgyz Republic in 2017 was 1,213 GWh and in 2018 was 752 GWh.
	Substation-related transmission grid outages reduced from 62 times in 2009 to 30 times in 2017	***Substantially achieved*** Substation-related transmission grid outages reduced to 34 times in 2018.
Outcome Better operational efficiency of the power companies	Transmission loss reduced from 5.7% in 2009 to 4.7% in 2014	***Partially achieved*** Transmission loss reduced to 5.32% in 2018 for the whole network.
	Distribution loss reduced from 26% in 2009 to 20% in 2014	***Achieved*** Distribution loss reduced to 12.7% in 2018 for the whole network.
	NEGK receives full payment from DISCOs by 2014	***Achieved*** NEGK receives full payment collected by the DISCOs.
	Up to 63,000 tCO2-equivalent per year reduced	***Achieved*** About 111,948 ton CO_2 equivalent was reduced in 2018.
Outputs (Physical) 1. AMDA linking 190 NEGK substations and EPP facilities commissioned	(Physical) 1. Accurate time-stamped metering data is automatically logged to be used for financial settlement, export/import transactions and loss reduction by 2013.	**(Physical component)** 1. ***Achieved*** The AMDA linking 190 NEGK substations and EPP facilities was installed and commissioned. The metering data are now being used.
2. Over 50 selected	2. 500 kV–6 kV current transformers, voltage	

Design Summary	Performance Indicators and Targets	Project Achievements
substations are rehabilitated	transformers, and circuit breakers are replaced in the selected substations by 2013.	2. ***Achieved*** Total 118 substations were rehabilitated with replacement of transformers, voltage transformers, and circuit breakers instead of 50.
3. SCADA (phase 1: system monitoring) developed for the northern transmission grid system	3. Real-time metering data is used for system operation by 2013.	*3.* ***Achieved*** The SCADA system was commissioned, and real-time metering data are now being used.
(Nonphysical) 1. Suitable settlement mechanism for wholesale electricity transactions is Recommended	(Nonphysical) 1. The study's recommendations are accepted by the government by 2012.	**(Non-physical component)** 1. ***Achieved*** The study on settlement mechanism was carried out and accepted by the government.
2. Stronger financial management capacity of NEGK	2. Audited financial statements prepared in accordance with IFRS are disclosed by 2012.	2. ***Achieved*** Annual audited financial statements were prepared and submitted to ADB.
3. NEGK's business plan is prepared	3. NEGK accepts the business plan by 2012.	3. ***Achieved*** A NEGK business plan was prepared and now under implementation.

ADB = Asian Development Bank, ADMA = automated metering and data acquisition system, EPP = joint-stock company “Electric Power Plants”, DISCO = distribution companies, NEGK = National Electricity Grid of Kyrgyzstan, SCADA = supervisory control and data acquisition

Source: Asian Development Bank

SUMMARY OF PROJECT OUTPUTS

	At Appraisal	Actual Outputs	Quantity and Details
Physical Component			
1	AMDA linking 190 NEGK substations and EPP facilities commissioned	(1) Site survey, design, supply materials and partially reconstruction of foundations and towers.	including 551.79 km of 110-220 kV transmission power line; installation of new optical ground wire (OPGW) and the 16.96 km underground fiber optic cables and joint boxes installation works at 220 kV transmission line (TL): Frunzenskaya-Karabalta 2; Glavnaya-Karabalta, Glavnaya-Chuiskaya, Chuiskaya-Kemin (Bystrovka), Ala-Archa-Kemin, Ala-Archa-Frunzenskaya 2, 110 kV TPL: Bishkek Thermal plant-Parkovaya, Parkovaya-Ala-Archa, Glavnaya-Karagachevaya.
		(2) Site survey, design/supply and installation of the Automated Metering and Data Acquisition system (AMDA)	Installed: type A: 800 pcs, type B: 2000; 1750 pcs -3*57.7/100B-5(10) A and 250 pcs-3*57.7/100B-220/380 (5-50) A meters.
2	Over 50 selected substations are rehabilitated	Improvement of reliability of the Kyrgyz power system by replacing run-down circuit breakers and instrument transformers in the 118 selected substations.	including (i) installation of 151 outdoor metal glad switchgear; (ii) Circuit breakers of 83 pcs-110kV; 29 pcs-220 kV and 8 pcs-550kV; (iii) Voltage Transformers of 117 pcs-6/10 kV;33 pcs-35 kV; 30 pcs-110kV; 78pcs-220 kV and 9 pcs-550kV; (iv) Current Transformers of 117 pcs-6/10 kV;48 pcs-35 kV; 9 pcs-110kV; 117pcs-220 kV and 9 pcs-550kV.
3	SCADA (phase 1: system monitoring) developed for the northern transmission grid system	Site survey, design/supply and installation of the Communications and Supervisory Control and Data Acquisition (SCADA) system	Linking eight major substations: Frunzenskaya 500kV; Ala-Archa 220 kV; Bystrovka 220 kV; Chuiskaya 220 kV, Glavnaya 220 kV; Kara-Balta 220 kV; Parkovaya 110 kV; Karagachevskaya 110 kV. NEGK Central Control Centre and Chuy regional standby control center via fiber optic.
Non-physical component			
1	A study on the settlement mechanism for whole electricity transactions a	The study was implemented by a consultant team under the management of the MOE	Upon completion in 2013, the final study report with four volumes was delivered, which covered the aspects of settlement center design, international experience, and a set of bidding documents, as well as policy recommendations and road map. A workshop was organized in April 2013 to discuss and disseminate the study results. An oversea study tour to Armenia and Spain was conducted in May 2013.
2	A program of building NEGK's capacity in corporative and financial management	The capacity building program was implemented by a consulting team recruited under the project	The consulting team carried out in-depth survey and analysis on the existing institutional framework and management capacity of NEGK, implemented a performance improvement plan developed under the program, and provided substantial recommendations for future development.

AMDA = Automated Metering and Data Acquisition system, NEGK = National Electricity Grid of Kyrgyzstan, OPGW = optical ground wire,
SCADA = Communications and Supervisory Control and Data Acquisition
Source: National Electricity Grid of Kyrgyzstan

PROJECT COST AT APPRAISAL AND ACTUAL

($ million)

Item	Appraisal Estimate			Actual		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
A. Base Cost						
1. AMDA	6.90		**6.90**	7.15		**7.15**
2. Substation rehabilitation	6.79	11.20	**17.99**	7.85	12.95	**20.83**
3. Communication and SCADA	12.60		**12.60**	13.08		**13.08**
Subtotal (A)	**26.29**	**11.20**	**37.49**	**28.08**	**12.95**	**41.03**
B. Consultancy						
1. Consultants[a]	3.00		**3.00**	2.34	0.05	**2.39**
2. NEGK capacity development	1.00		**1.00**	0.92		**0.92**
3. Settlement mechanism study	1.00		**1.00**	0.49		**0.49**
Subtotal (B)	**5.00**		**5.00**	**3.75**	**0.05**	**3.80**
C. Taxes and Duties		**5.53**	**5.53**			
D. Contingencies	**5.00**		**5.00**			
E. Financial Charges during Implementation	**2.98**		**2.98**	1.76		**1.76**
Total (A+B+C+D+E)	**39.27**	**16.73**	**56.00**	**33.59**	**13.00**	**46.59**

AMDA = Automated Metering and Data Acquisition system, NEGK = National Electricity Grid of Kyrgyzstan,
SCADA = Communications and Supervisory Control and Data Acquisition

[a] Includes estimated audit fees of $110,000 for the audit of the annual project financial statements for 2012–2016 to be financed from ADB resources: 56.74% loan and 43.26% grant. Actual audit fee amounted to total of $85,730.

Source: The project administration manual; ADB loan and grant financial information system; National Electricity Grid of Kyrgyzstan.

PROJECT COST BY FINANCIER

Table A4.1: Project Cost at Appraisal by Financier

($ million)

Item	Loan 2671		Grant 0218		Gov./NEGK		Total Cost
	Amount	% of Cost Category	Amount	% of Cost Category	Amount	% of Cost Category	
A. Base Cost							
1. AMDA	6.90	100.0%					**6.90**
2. Substation rehabilitation	2.30	12.8%	13.00	72.3%	2.69	15.0%	**17.99**
3. Communication and SCADA			12.60	100.0%			**12.60**
Subtotal (A)	**9.20**	24.5%	**25.60**	68.3%	**2.69**	7.2%	**37.49**
B. Consultancy							
1. Consultants[a]	2.00	66.7%	1.00	33.3%			**3.00**
2. NEGK capacity development			1.00	100.0%			**1.00**
3. Settlement mechanism study	0.50	50.0%	0.50	50.0%			**1.00**
Subtotal (B)	**2.50**	50.0%	**2.50**	50.0%			**5.00**
C. Taxes and Duties					5.53	100.0%	**5.53**
D. Contingencies	5.00	100.0%					**5.00**
E. Financial Charges during Implementation					2.98	100.0%	**2.98**
Total Project Cost (A+B+C+D+E)	**16.70**	29.8%	**28.10**	50.2%	**11.20**	20.0%	**56.00**
% of Total Project Cost		**29.8%**		**50.2%**		**20.0%**	**100%**

AMDA = Automated Metering and Data Acquisition system, NEGK = National Electricity Grid of Kyrgyzstan,
SCADA = Communications and Supervisory Control and Data Acquisition

[a] Includes estimated audit fees of $110,000 for the audit of the annual project financial statements for 2012–2016 to be financed from ADB resources: 56.74% loan and 43.26% grant. Actual audit fee amounted to total of $85,730.

Source: The project administration manual

Table A4.2: Project Cost at Completion by Financier
($ million)

Item	Loan 2671		Grant 0218		NEGK		Total Cost
	Amount	% of Cost Category	Amount	% of Cost Category	Amount	% of Cost Category	
A. Base Cost							
1. AMDA	2.67	37.3%	4.48	62.7%			**7.15**
2. Substation rehabilitation	6.62	31.8%	12.09	58.1%	2.09	10.1%	**20.81**
3. Communication and SCADA	4.87	37.3%	8.19	62.6%	0.02	0.1%	**13.08**
Subtotal (A)	**14.16**	34.5%	**24.76**	60.4%	**2.11**	5.1%	**41.03**
B. Consultancy							
1. Consultants[a]	1.34	56.0%	1.05	44.0%			**2.39**
2. NEGK capacity development			0.92	100.0%			**0.92**
3. Settlement mechanism study			0.49	100.0%			**0.49**
Subtotal (B)	**1.34**	35.2%	**2.46**	64.8%			**3.80**
C. Taxes and Duties							
D. Contingencies							
E. Financial Charges during Implementation					**1.76**	100.0%	**1.76**
Total Project Cost (A+B+C+D+E)	**15.50**	33.3%	**27.22**	58.4%	**3.87**	8.3%	**46.59**
% of Total Project Cost		**33.3%**		**58.4%**		**8.3%**	**100%**

AMDA = Automated Metering and Data Acquisition system, NEGK = National Electricity Grid of Kyrgyzstan,
SCADA = Communications and Supervisory Control and Data Acquisition
[a] Includes estimated audit fees of $110,000 for the audit of the annual project financial statements for 2012–2016 to be financed from ADB resources: 56.74% loan and 43.26% grant. Actual audit fee amounted to total of $85,730.
Source: ADB loan and grant financial information system; National Electricity Grid of Kyrgyzstan.

DISBURSEMENT OF ADB LOAN AND GRANT PROCEEDS

Table A5.1: Annual and Cumulative Disbursement of ADB Loan Proceeds[a]

($ million)

	Annual Disbursement		Cumulative Disbursement	
year	**Amount**	**% of Total**	**Amount**	**% of Total**
2011	0.00	0.0%	0.00	0.0%
2012	0.40	2.6%	0.40	2.6%
2013	5.50	35.5%	5.90	38.0%
2014	0.32	2.1%	6.22	40.1%
2015	1.43	9.2%	7.65	49.3%
2016	2.44	15.7%	10.09	65.1%
2017	2.93	18.9%	13.01	84.0%
2018	2.48	16.0%	15.50	100.0%
2019	0.00	0.0%	15.50	100.0%
Total	**15.50**	**100.0%**		

ADB = Asian Development Bank.
[a] Includes disbursements to advance accounts.
Source: the ADB loan financial information system

Table A5.2: Annual and Cumulative Disbursement of ADB Grant Proceeds

($ million)

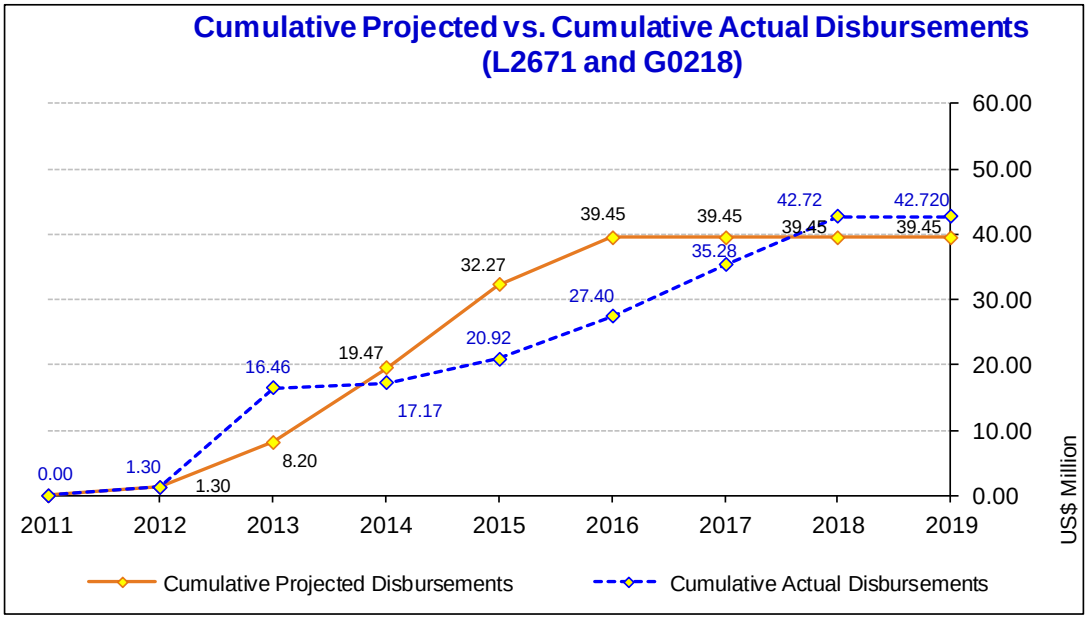
	Annual Disbursement		Cumulative Disbursement	
year	**Amount**	**% of Total**	**Amount**	**% of Total**
2011	0.00	0.0%	0.00	0.0%
2012	0.91	3.3%	0.91	3.3%
2013	9.66	35.5%	10.57	38.8%
2014	0.38	1.4%	10.95	40.2%
2015	2.33	8.5%	13.27	48.8%
2016	4.04	14.8%	17.31	63.6%
2017	4.96	18.2%	22.27	81.8%
2018	4.96	18.2%	27.22	100.0%
2019	0.00	0.0%	27.22	100.0%
Total	**27.22**	**100%**		

ADB = Asian Development Bank.
[a] Includes disbursements to advance accounts.
Source: the ADB grant financial information system

Table A5.3: Contract Awards and Disbursements Projections Changes

Projection Changes	Date	Reason
Version 1 (Project Effectiveness)	15-Jun-2011	
Version 2 (as of Mar-27-2013)	Modified Date 27-Mar-2013	CWEN memo of 18 Mar 2013 approved by DG CWRD based on approval of a 2-year loan and grant extension from 30 Jun 2014 to 30 Jun 2016.
Version 3 (as of Dec-31-2013)	Modified Date 17-Mar-2014	Actualized (Annual)
Version 4 (as of Mar-28-2014)	Modified Date 28-Mar-2014	OSFMD memo of 7 Mar 2014 requesting RDs to input realistic contract award and disbursement projections in eOps, which will be locked by 31 Mar 2014.
Version 5 (as of Dec-31-2014)	Modified Date 18-Feb-2015	Actualized (Annual)
Version 6 (as of Apr-21-2015)	Modified Date 21-Apr-2015	CWEN memo of 8 Apr 2015 approved by DG CWRD based on approval of loan and grant extension from 30 Jun 2016 to 30 Dec 2017.
Version 7 (as of Dec-31-2015)	Modified Date 10-Feb-2016	Actualized (Annual)
Version 8 (as of Apr-26-2016)	Modified Date 04-Apr-2016	Based on email from OSFMD on bank-wide exercise to clean up all contract award and disbursement projections and unlocking eOps for revisions from 1 to 21 March 2016.
Version 9 (as of Dec-31-2016)	Modified Date 27-Feb-2017	Actualized (Annual)
Version 10 (as of Dec-31-2017)	Modified Date 15-Feb-2018	Actualized (Annual)
Version 11 (as of Dec-31-2018)	Modified Date 15-Feb-2019	Actualized (Annual)
Version 12 (Project Closing - Mar-12-2019)	Modified Date 12-Mar-2019	Adjusted (Project Closing)

Figure A5.1: Cumulative Projected vs. Cumulative Actual Disbursements (L2671 and G0218)
($ million)



ADB = Asian Development Bank.
Source: the ADB loan and grant financial information system

CONTRACT AWARDS OF ADB LOAN AND GRANT PROCEEDS

Table A6.1: Annual and Cumulative Contract Awards of ADB Loan Proceeds

($ million)

	Annual Contract Awards		Cumulative Contract Awards	
year	Amount	% of Total	Amount	% of Total
2011	1.05	6.8%	1.05	6.8%
2012	0.00	0.0%	1.05	6.8%
2013	6.63	42.8%	7.68	49.5%
2014	0.05	0.3%	7.73	49.9%
2015	7.59	49.0%	15.32	98.8%
2016	0.18	1.2%	15.50	100.0%
2017	0.00	0.0%	15.50	100.0%
2018	0.00	0.0%	15.50	100.0%
2019	0.00	0.0%	15.50	100.0%
Total	**15.50**	**100%**		

ADB = Asian Development Bank.
Source: the ADB loan financial information system

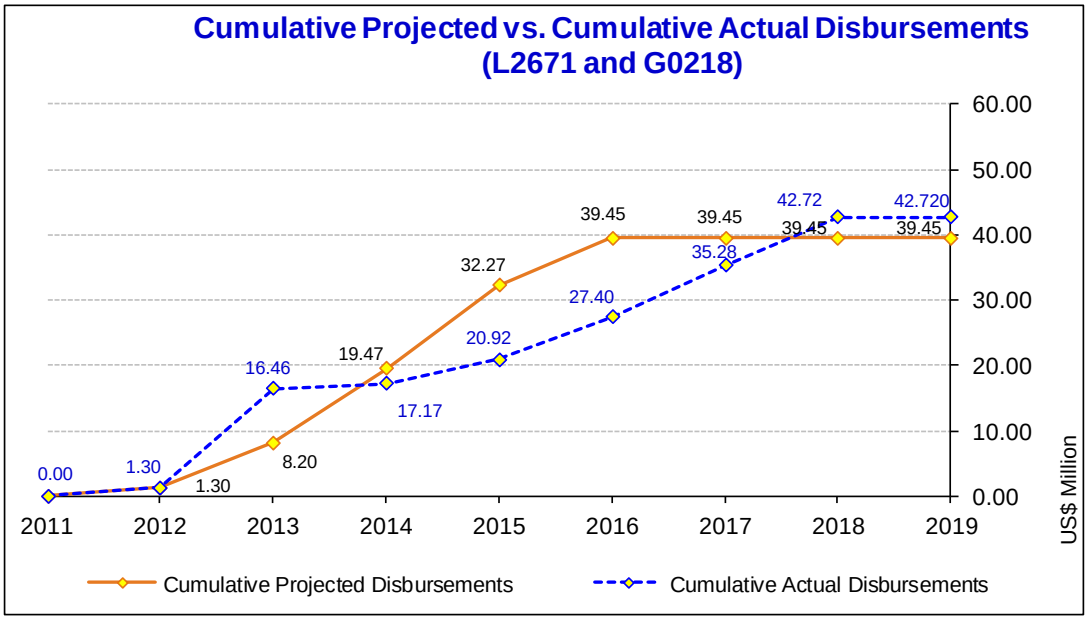
Table A6.2: Annual and Cumulative Contract Awards of ADB Grant Proceeds

($ million)

	Annual Awards		Cumulative Awards	
year	Amount	% of Total	Amount	% of Total
2011	0.80	2.9%	0.80	2.9%
2012	1.41	5.2%	2.21	8.1%
2013	12.12	44.5%	14.33	52.6%
2014	0.04	0.1%	14.36	52.8%
2015	12.80	47.0%	27.17	99.8%
2016	0.06	0.2%	27.22	100.0%
2017	0.00	0.0%	27.22	100.0%
2018	0.00	0.0%	27.22	100.0%
2019	0.00	0.0%	27.22	100.0%
Total	**27.22**	**100%**		

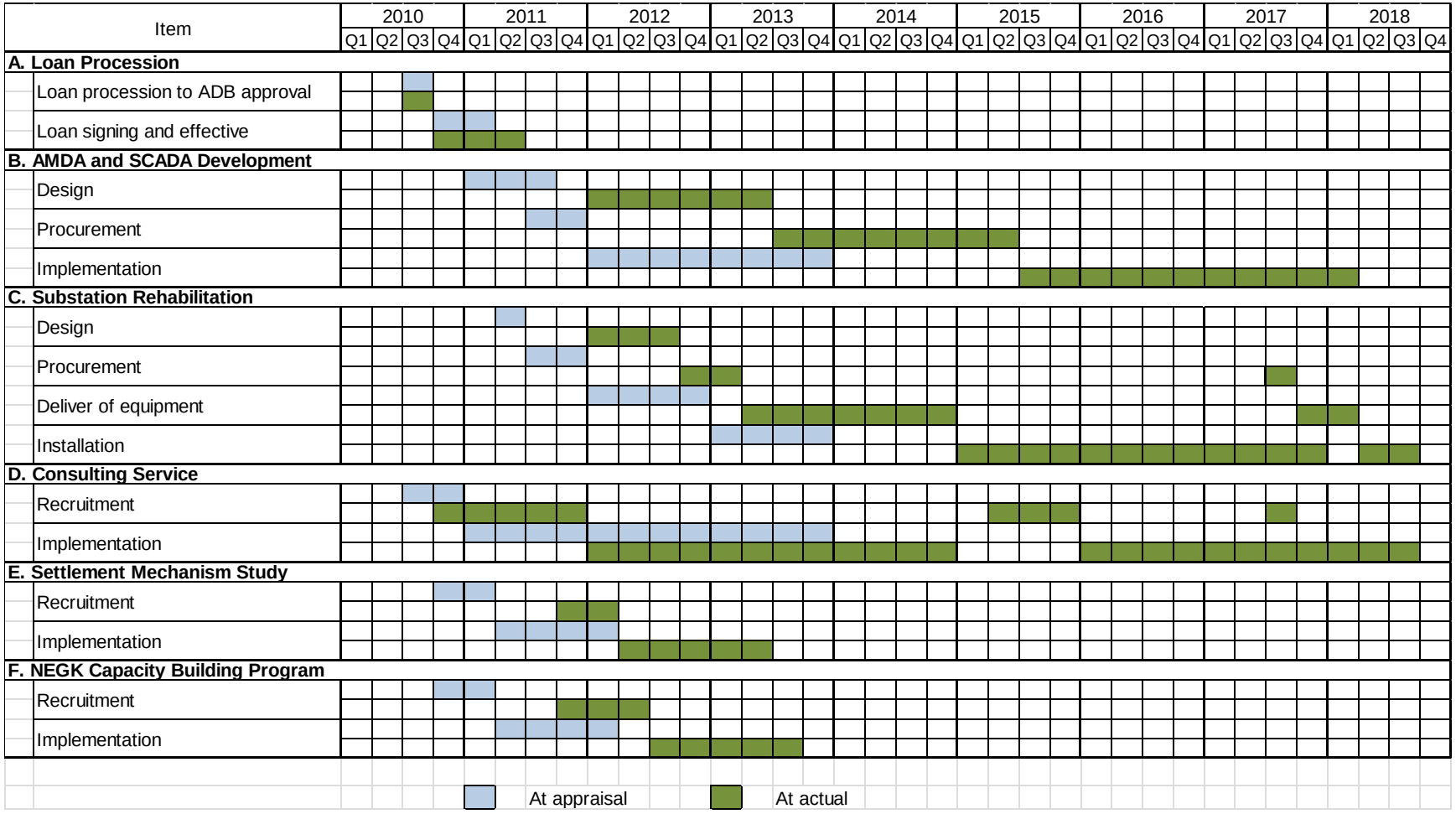
ADB = Asian Development Bank.
Source: the ADB grant financial information system

Figure A6.1: Cumulative Projected vs. Cumulative Actual Contract Awards (L2671 and G0218)
($ million)



ADB = Asian Development Bank.
Source: the ADB loan and grant financial information system

APPRAISAL AND ACTUAL IMPLEMENTATION SCHEDULES COMPARED



AMDA = Automated Metering and Data Acquisition system, NEGK = National Electricity Grid of Kyrgyzstan,
SCADA = Communications and Supervisory Control and Data Acquisition
Source: The Asian Development Bank project completion review mission.

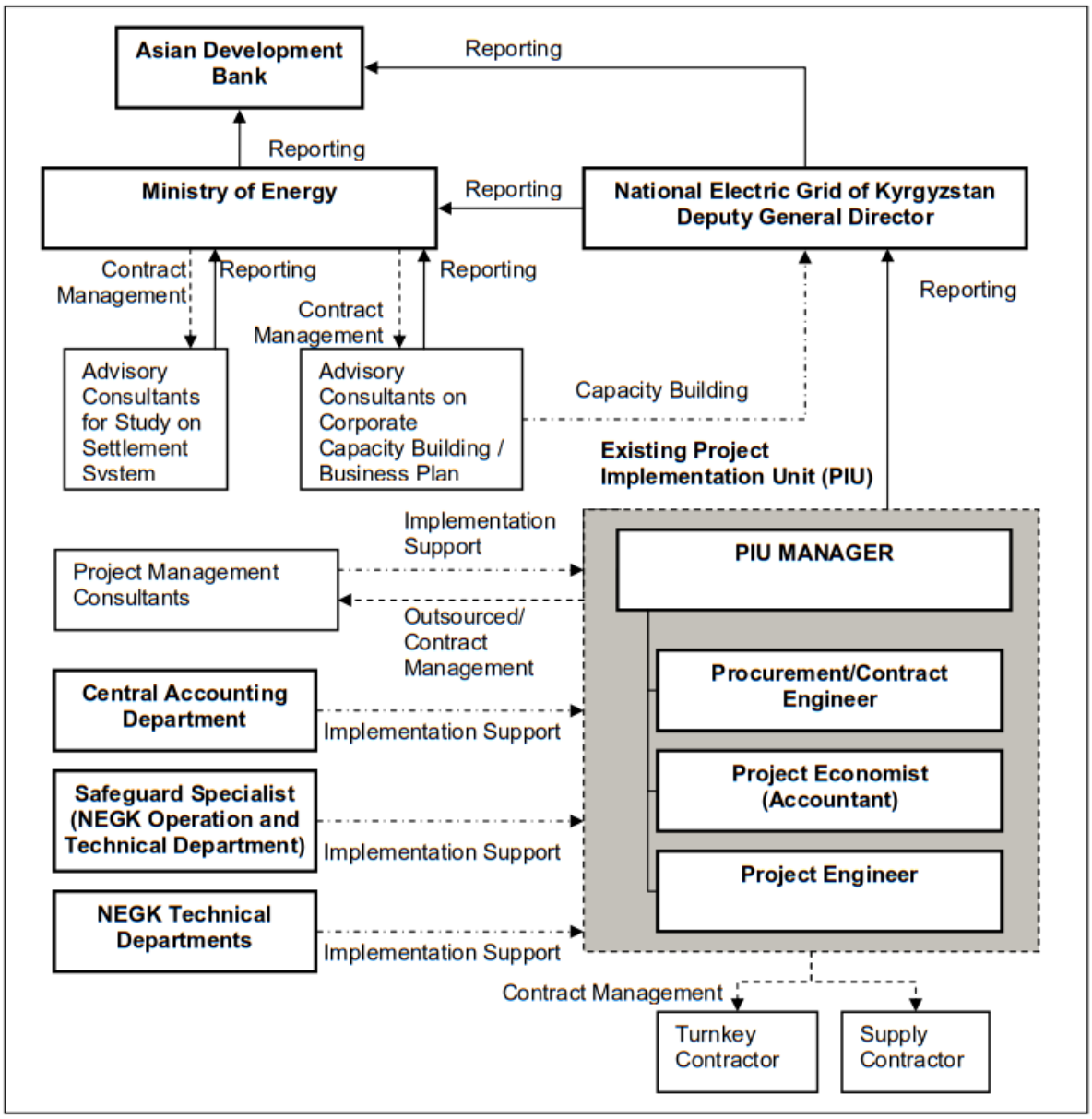
CHRONOLOGY OF MAIN EVENTS

Date	Event
2010	
26 May – 14 June	ADB project appraisal mission
23 – 24 August	Loan/grant negotiation
14 – 19 October	ADB project consultation mission
27 September	ADB approval of the loan and grant
8 December	Signing of the Financial Agreement
2011	
18 – 23 May	ADB project consultation mission
15 June	Actual loan/grant effectiveness
20 July – 4 August	ADB project inception mission
13 – 18 October	ADB project consultation mission
14 – 18 November	ADB project consultation mission
22 November	Contract signed with the project management consultants
2012	
16 – 20 January	ADB project consultation mission
13 – 24 February	ADB project review mission
16 February	Signing of the Subsidiary Financing Agreement
16 February	Contract signed with the consultants for the settlement mechanism study
2 April	Contract signed with the consultants for the NEGK capacity building program
24 April	Initial loan/grant disbursement
11 – 15 June	ADB project review mission
10 – 14 December	ADB project review mission
2013	
29 January – 8 February	ADB project review mission
5 March	Contract signed with the Lot 1 contractor
11 March	ADB approval of the first extension of the loan and grant closing date
15 – 22 April	ADB project review mission
16 April	Workshop on the settlement mechanism study
18 April	Workshop on improving the financial management of NEGK
May	Oversea study tour to Armenia and Spain
28 October – 1 November	ADB project review mission
16 September	Post invitation for bid of the Lot 2 package
31 December	Original project completion date
2014	

Date	Event
25 February – 7 March	ADB project review mission
29 – 30 May	ADB project review mission
23 June	Contract signed with the financial auditor
30 June	Original loan/grant closing date
30 June – 11 July	ADB project review mission
22 – 26 September	ADB project midterm review mission
17 December	Completion of delivery of the original equipment
2015	
21 – 27 January	ADB project review mission
8 April	ADB approval of the second extension of the loan and grant closing date
13 – 17 April	ADB project review mission
3 – 7 July	ADB project review mission
14 July	Contract signed with Lot 2 contractor
12 November	Contract signed with the national electrical engineer
16 December	Contract signed with the international SCADA/communication expert
21 December	Contract signed with the national environment expert
2016	
11 – 18 April	ADB project review mission
29 September – 7 October	ADB project review mission
2017	
15 – 27 June	ADB project review mission
22 August	Contract signed with the national environment expert (replacing)
31 October	ADB approval of the third extension of the loan and grant closing date
10 November	ADB approval of utilization of the loan and grant savings for purchasing more equipment
14 – 24 November	ADB project review mission
31 December	Completion of the installation of the original equipment
2018	
28 February 2018	Completion of the Lot 2 contract with certificate issued
31 July	Completion of installation of the all equipment
31 July	Actual loan/grant closing date
28 November	Final disbursement of the grant proceeds
29 November	Final disbursement of the loan proceeds
2019	
9 January	Actual loan/grant financial closing date
13 March – 2 April	ADB project completion review mission

ADB = Asian Development Bank
Source: The ADB project completion mission

ORGANIZATION CHART OF PROJECT IMPLEMENTATION



Source: The Project Administration Manual

SUMMARY OF CONTRACT PACKAGES FINANCED BY ADB LOAN AND GRANT

PCSS No.	Description/Nature of Works	Contractor/ Consultant/Supplier	Procurement Method	Contract Date	Actual Cost			Financed by
					Total Amount		USD Equivalent ($)	ADB L2671 ($)
					Currency	Amount		
A. Turnkey								
0005	Design, supply and installation of new communication system upgrade, SCADA upgrade	Ak-Ay Electric Dis Ticaret Kollektif Sirketi	ICB	14/07/2015	$	7,537,795	7,537,795	7,537,795
B. Goods								
0002	Procurement of Circuit Breakers, Instrument Transformers, and Switchgear	Alstom Grid Enerji Endustrist A.S.	ICB	05/03/2013	EUR	4,171,259	5,600,848	5,600,848
					EUR	874,845	1,020,838	1,020,838
C. Consulting Services								
0001	Project management consultants	Lahmeyer International GMBH JV with GI	QCBS	22/11/2011	$	637,952	637,952	637,952
					EUR	316,284	408,412	408,412
0006	National environment expert	Taisiia Neronova	ICS	21/12/2015	Som	581,394	8,469	8,469
0007	International SCADA/communication expert	Ryskeldy Turdubaev	ICS	16/12/2015	$	211,850	211,850	211,850
0008	National electrical engineer	Djalilbek Arystanov	ICS	12/11/2015	Som	1,189,726	17,283	17,283
0009	National environment expert	Almaz Asipjanov	ICS	22/08/2017	Som	321,829	4,668	4,668
0004	Project financial audit	CJSC W Jabobs Audit	LCS	23/06/2014	$	48,643	48,643	48,643
		Total (A+B+C+D)					**15,496,759**	**15,496,759**

Table 2.2. Summary of Contract Packages financed by ADB Grant

PCSS No.	Description/Nature of Works	Contractor/ Consultant/Supplier	Procurement Method	Contract Date	Original Contract		Actual Cost			Financed by
							Total Amount		USD Equivalent ($)	ADB G0218 ($)
					Currency	Amount	Currency	Amount		
G07056	Consulting services-project management consultants	Various	ICB	22/11/2011	$	797,616	$	486,390	486,390	486,390
							EUR	241,143	311,226	311,226
G07495	Consulting services for settlement mechanism study	AF Mercados Energy Markets International	ICB	16/02/2012	$	491,904	$	491,904	491,904	491,904
G07657	Consulting services for capacity building of NEGK	Lahmeyer International GMBH	ICB	02/04/2012	$	915,268	$	915,268	915,268	915,268
G09395	Procurement of circuit breakers, instrument transformers, and switchgear	Alstom Grid Enerji Endustrisi A.S.	ICB	05/03/2013	$	12,094,018	EUR	7011741	9,411,476	9,411,476
							EUR	2,298,333	2,682,542	2,682,542
G11778	Project financial audit	CJSC W. Jacobs Audit	LCS	23/06/2014	$	37,087	$	37,087	37,087	37,087
G13660	Design, supply and installation of new communication system upgrade, SCADA upgrade and wholesale metering system	Ak-Ay Elektrik Dis Ticaret Kollektif Sirketi	ICB	14/07/2015	$	12,670,771	$	12,670,771	12,670,771	12,670,771
G14218	Environment expert	Sergey Krivoruchko	ICS	05/11/2015	$	31,824	$	31,824	31,824	31,824
G14552	National environment expert	Taisiia Neronova	ICS	21/12/2015	$	6,387	Som	443,270	6,387	6,387
G14553	International SCADA/communication expert	Ryskedy Turdubaev	ICS	16/12/2015	$	161,520	$	161,520	161,520	161,520
G14554	National electrical engineer	Djalilbek Arystanov	ICS	12/11/2015	$	13,136	Som	912,616	13,136	13,136
G17768	National environment expert	Almaz Asipjanov	ICS	22/08/2017	$	3,557	Som	245,371	3,557	3,557
		Total				**27,223,088**			**27,223,088**	**27,223,088**

ADB = Asian Development Bank, ICB = international competitive bidding, QCBS = quality- and cost-based selection, ICS = individual consultant selection
Source: The ADB loan and grant financial information systems.

STATUS OF COMPLIANCE WITH LOAN AND GRANT COVENANTS

Covenant	Reference in Financial Agreement	Status of Compliance
Particular Covenants in the FA		
In the carrying out of the Project and operation of the Project facilities, the beneficiary shall perform, or cause to be performed, all obligations set forth in Schedule 5 to this Financing Agreement.	FA, Artl. IV. Sec. 4.01	**Complied with**. The project implementation and operation performed all obligation set forth in the Financing Agreement.
(a) The Beneficiary shall: (i) maintain, or cause to be maintained, separate accounts for the Project, including separate accounts for the Loan and the Grant; (ii) have such accounts and related financial statements audited annually, in accordance with appropriate auditing standards consistently applied, by independent auditors whose qualifications, experience and terms of reference are acceptable to ADB; (iii) furnish to ADB, as soon as available but in any event not later than 6 months after the end of each related fiscal year, certified copies of such audited accounts and financial statements and the report of the auditors relating thereto (including the auditors' opinion on the use of the Loan proceeds and the Grant proceeds and compliance with the financial covenants of this Financing Agreement), all in the English language; and (iv) furnish to ADB such other information concerning such accounts and financial statements and the audit thereof as ADB shall from time to time reasonably request. (b) The Beneficiary shall enable ADB, upon ADB's request, to discuss the Beneficiary's financial statements for the Project and its financial affairs related to the Project from time to time with the auditors appointed by the Beneficiary pursuant to Section 4.02(a) here above, and shall authorize and require any representative of such auditors to participate in any such discussions requested by ADB, provided that any such discussion shall be conducted only in the presence of an authorized officer of the Beneficiary unless the Beneficiary shall otherwise agree.	FA, Artl. IV. Sec. 4.02	**Complied with**. (a) The project maintained separate financial account, which was audited annually by independent auditor as required. The audit reports were submitted to ADB. Some audit reports were submitted to ADB with a short delay (max 2.7 months). (b) The EAs enabled ADB to discuss the financial statements for the project and its financial affairs related to the project.
The Beneficiary shall enable ADB's representatives to inspect the Project, the Goods financed out of the proceeds of the	FA, Artl. IV. Sec. 4.03	**Complied with**. The EAs enabled ADB to inspect the project and the goods procured under the project.

Loan and the Grant, and any relevant records and documents.		
Implementation Arrangements		
The Beneficiary shall designate MOE as the Project Executing Agency for Part 2 of the Project and NEGK as the Project Executing Agency for Part 1 of the Project. The Beneficiary, through MOE and NEGK, shall ensure that the Project is implemented in accordance with the detailed arrangements set forth in the PAM. Any subsequent change to the PAM shall become effective only after approval of such change by the Beneficiary and ADB. In the event of any discrepancy between the PAM and this Financing Agreement and/or the Project Agreement, the provisions of this Financing Agreement and/or the Project Agreement shall prevail.	FA, Sch. 5. para. 1	**Complied with**. As arranged, the MOE was the EA for the non-physical component, and NEGK was the EA for the physical component. The project was implemented in accordance with the detailed arrangements set forth in the PAM.
Counterpart Support		
The Beneficiary shall ensure that counterpart funding necessary for the implementation of the Project are made available and released in a timely manner. The Beneficiary shall also ensure that no taxes, duties or other mandatory payments are levied on the Project expenditures within its territory or budgetary allocations are provided to MOE and NEGK to cover the cost of such taxes, duties or similar mandatory payments.	FA, Sch. 5. para. 2	**Complied with.** During implementation, NEGK provided the counterpart fund, totally $3.87 million equivalent. The tax was exempted.
The Beneficiary, through MOE and NEGK, shall ensure that qualified and experienced staff are made available for the effective operation and maintenance of the Project facilities.	FA, Sch. 5. para. 3	**Complied with.** The EAs made available qualified and experienced staff for the project implementation.
Environment		
The Beneficiary, through NEGK, shall ensure that the design, construction, and operation of the Project are in accordance with ADB's Safeguard Policy Statement (2009), the IEE, the EMMP and applicable laws and regulations of the Beneficiary. This includes ensuring that: (a) potential adverse environmental impacts arising from the Project are minimized by implementing the mitigation measures set forth in the IEE and the EMMP, and NEGK allocate sufficient budgetary and human resources for implementing these measures; (b) with respect to Parts 1(a) and 1(c) of the Project, NEGK shall: (i) ensure that the contractor has primary responsibility for implementing the mitigation measures set forth in the IEE and the EMMP and that the contract shall incorporate applicable	FA, Sch. 5. para. 4	**Complied with.** The project design, construction, and operation were in accordance with ADB's Safeguard Policy Statement (2009). NEGK submitted satisfactory updated IEE on 25 June 2014, the IEE was endorsed by the State Agency on Environmental Protection and Forestry on 8 July 2014 and posted on both ADB and NEGK websites. During implementation, the EAs complied with requirements of ADB's safeguard policy and IEE, including those related to PCB.

mitigating measures from the IEE and EMMP; and (ii) monitor and record the mitigation measures identified in the IEE and the EMMP; (c) with respect to Part 1(b) of the Project, NEGK shall: (i) be responsible for implementing the mitigation measures set forth in the IEE and the EMMP; and (ii) monitor and record the mitigation measures identified in the IEE and the EMMP; (d) any handling or disposal of sulfur hexafluoride (SF6) shall be carried out in accordance with international best practice; and (e) any handling or disposal of equipment containing polychlorinated biphenyls shall be carried out in accordance with international best practice, including with respect to the identification, labeling, packaging, storage and disposal of such equipment.		
The Beneficiary, through NEGK, shall ensure that semiannual environmental reports are prepared and submitted to ADB within 3 months from the end of each half of a calendar year.	FA, Sch. 5. para. 5	**Complied with.** The required environment reports were timely prepared and submitted to ADB and posted on the ADB's website.
Land Acquisition and Resettlement		
The Beneficiary, through NEGK, shall ensure that Project implementation shall not involve any land acquisition and/or resettlement impacts within the meaning of ADB's Safeguard Policy Statement (2009), with the exception of limited crop compensation for temporary land acquisition to be identified in the detailed design and implementation of Part 1(c) of the Project where the compensation shall be carried out in accordance with ADB's Safeguard Policy Statement (2009), the LARF, the LARP (to be prepared and agreed upon between the Beneficiary and ADB) and applicable laws and regulations of the Beneficiary. NEGK shall ensure that: (a) the compensation shall be based on the prevailing market rates for the crops; (b) sufficient budgetary resources are **a**llocated for the compensation; and (c) on-site installation work under Part 1(c) of the Project shall not commence until the LARP has been implemented by NEGK, including full compensation to all affected persons by NEGK.	FA, Sch. 5. para. 6	**Complied with.** The involuntary resettlement of the project was categorized B at appraisal in accordance with ADB *Safeguard Policy Statement* (2009). The project investments were implemented mostly in NEGK's central and Chui regional headquarters and existing substations where land acquisition and resettlement (LAR) impacts were not envisaged. Very limited temporary LAR impact such as crop losses took place during project implementation. A LAR framework was prepared, which was disclosed on the ADB's website. The LAR framework also required that on-site installation works should not commence until the endorsed LAR plan is fully implemented. During implementation, NEGK and the contractor prepared LARPs and DDRs which were approved by ADB and disclosed on the NEGK's and ADB's website. Grievance redress mechanism was established at central and local levels. Up completion, 100% of affected persons received compensations. Internal monitoring was carried out by NEGK and total 8 social monitoring reports were disclosed on the ADB's website.
In the event that other land acquisition and/or resettlement impacts are identified during	FA, Sch. 5. para. 7	**Complied with.** Public consultations with affected households

Project implementation, the Beneficiary, through NEGK, shall ensure that such impacts are addressed in accordance with ADB's Safeguard Policy Statement (2009), the LARF, the LARP and applicable laws and regulations of the Beneficiary. This includes ensuring that the LARP is revised in consultation with the affected people and in accordance with the LARF.		and local officials were carried out by NEGK during the LARP/DDR preparation processes. Grievance redress mechanism was established at central and local levels.
Labor Standards		
The Beneficiary, through MOE and NEGK, shall ensure that the contractors comply with core labor standards and applicable laws and regulations on labor and health and safety of the Beneficiary. This includes ensuring that the contractors provide equal pay for equal work, do not employ child labor, provide equal opportunities for men and women, and incorporate applicable workplace occupational safety norms.	FA, Sch. 5. para. 8	**Complied with.** Since the project required minimal construction works and an influx of workers was not expected. During implementation, NEGK ensured that the contractors complied with core labor standards and applicable laws and regulations on labor and health and safety.
Governance and Anticorruption		
The Beneficiary, MOE and NEGK shall comply with ADB's Anticorruption Policy (1998, as amended to date). The Beneficiary, MOE and NEGK: (a) acknowledge that consistent with its commitment to good governance, accountability and transparency, ADB has the right to investigate, directly or through its agents, any alleged corrupt, fraudulent, collusive or coercive practices relating to the Project; and (b) agree to cooperate fully with any such investigation and to extend all necessary assistance, including providing access to all relevant books and records, for the satisfactory completion of any such investigation. The MOE and NEGK shall also ensure that anticorruption provisions acceptable to ADB are included in all contracts financed by ADB in connection with the Project, including provisions specifying the right of ADB to audit and examine the records and accounts of MOE, NEGK and all contractors, suppliers, consultants and other service providers as they relate to the Project.	FA, Sch. 5. para. 9	**Complied with**. Anti-corruption handbooks were submitted to the MOE and NEGK. Anti-corruption provisions were included in all contracts financed under the project. During implementation, the Borrower/Beneficiary, MOE and NEGK complied with ADB's Anticorruption Policy. No non-compliance on ADB's anticorruption policy was reported.
Operational Covenants		
The Beneficiary, through MOE, shall ensure that the EPP: (a) shall not sell or otherwise dispose of facilities in its power plants that are installed with meters and related equipment under the Project if the disposal affect the Project objectives, except as ADB may otherwise agree; and (b) shall grant access to NEGK to operate and maintain	FA, Sch. 5. para. 10	**Complied with.** During implementation, no non-compliance was reported.

these meters and equipment.		
Sector development		
The Beneficiary, through NEGK, shall implement in a timely manner the recommendations on corporate and financial management capacity development for NEGK prepared under Part 2(a) of the Project.	FA, Sch. 5. para. 11	**Complied with**. The NEGK capacity building program was duly implemented, which has effectively increase the NEGK's corporate and financial management capacity.
The Beneficiary, through MOE, shall ensure that a transparent wholesale electricity transaction system is established and operationalized pursuant to the outputs and recommendations prepared under Part 2(b) of the Project.	FA, Sch. 5. Para. 12	**Complied with.** The settlement mechanism study was duly implemented. As recommended, a wholesale settlement center was established in 2015 and is now being developed with ADB support.
The Beneficiary, through MOE, shall ensure that ADB is informed of key power sector policy and restructuring reforms, including reforms pertaining to the tariff policy.	FA, Sch. 5. para. 13	**Complied with.** ADB was informed if any key power sector policy and restructuring reforms. The Medium-Term Tariff Plan for 2014-2017 was approved in 2014 and was implemented.
The Beneficiary, through MOE, shall ensure that: (a) a "cost-of-service" study is carried out and used as the basis to formulate a new tariff policy for achieving financial sustainability for the power sector; (b) formulation of the new tariff policy shall be done in consultation with stakeholders and in a transparent manner; and (c) public awareness programs are conducted to educate the public on the new tariff policy (including financial sustainability for the power sector) and the importance of energy conservation.	FA, Sch. 5. para. 14	**Complied with**. A study was undertaken by MOE with assistance of the World Bank. The government approved the Medium-Term Tariff Plan for Electricity and Heating Sectors for 2014-2017 by ordinance number 660 on 20 November 2014. Heating tariff was increased by 27% effective 1 July 2014. Electricity tariff increased by 10% for residents and by 60% for commercial use effective 1 August 2015. The public awareness campaign was conducted in 2014-2015 under the Public Information Program component of the Power Sector Rehabilitation project financed by ADB.
The Beneficiary, through MOE, shall ensure that technical and commercial losses in the power sector are reduced in accordance with acceptable practice.	FA, Sch. 5. para. 15	**Complied with**. The technical and commercial losses are reduced for both electricity transmission and distribution.
Financial Reporting Standards		
The Beneficiary shall cause NEGK to ensure that the accounts for the Project and its financial statements are prepared and disclosed in accordance with the International Financial Reporting Standards.	FA, Sch. 5. para. 16	**Complied with**. The NEGK awarded external auditor contract to CJSC Jacobs-Audit on 26 June 2014. The project accounts were audited, and the annual audit reports were submitted to ADB and disclosed. However, they were prepared using Cash Basis IPSAS, not in IFRS.
Particular Covenants in the PA		
(a) In the carrying out of the Project, NEGK shall employ competent and qualified consultants and contractors, acceptable to ADB, to an extent and upon terms and conditions satisfactory to ADB.	PA, Artl. II, Sec. 2.03	**Complied with**. (a) Competent and qualified consultants and contractors were selected upon approval of ADB. (b) The consulting services was procured in accordance with ADB's *Guidelines on the Use of Consultants*. The contracts for the physical components were procured

(b) Except as ADB may otherwise agree, all Goods, Works and Consulting Services to be financed out of the proceeds of the Loan and the Grant shall be procured in accordance with the provisions of Schedule 4 to the Financing Agreement. ADB may refuse to finance a contract where the Goods, Works or Consulting Services have not been procured under procedures substantially in accordance with those agreed between the Beneficiary and ADB or where the terms and conditions of the contract are not satisfactory to ADB.		through two contract packages: Lot 1 for equipment supply and Lot 2 for the turnkey and works, in accordance with ADB's *Procurement Guidelines*.
(a) NEGK shall furnish to ADB all such reports and information as ADB shall reasonably request concerning: (i) the Loan and the Grant and the expenditure of the proceeds thereof; (ii) the Goods, Works, Consulting Services and other items of expenditure financed out of such proceeds; (iii) the Project; (iv) the administration, operations and financial condition of NEGK; and (v) any other matters relating to the purposes of the Loan and the Grant. (b) Without limiting the generality of the foregoing, NEGK shall furnish to ADB quarterly reports on the execution of the Project and on the operation and management of the Project facilities. Such reports shall be submitted in such form and in such detail and within such a period as ADB shall reasonably request, and shall indicate, among other things, progress made and problems encountered during the quarter under review, steps taken or proposed to be taken to remedy these problems, and proposed program of activities and expected progress during the following quarter. (c) Promptly after physical completion of the Project, but in any event not later than 3 months thereafter or such later date as ADB may agree for this purpose, NEGK shall prepare and furnish to ADB a report, in such form and in such detail as ADB shall reasonably request, on the execution and initial operation of the Project, including its cost, the performance by NEGK of its obligations under this Project Agreement and the accomplishment of the purposes of the Loan and the Grant.	PA, Artl. II, Sec. 2.08	**Complied with**. (a) The project's financial account was audited annually by independent auditor as required. The audit reports were submitted to ADB. However, some audit reports were not submitted to ADB timely. The EAs also enabled ADB to discuss the financial statements for the project and its financial affairs related to the project. (b) The project progress reports were prepared and submitted to ADB generally on time. (c) The required borrower's project completion report was prepared and submitted to ADB on time.

(a) NEGK shall, promptly as required, take all action within its powers to maintain its corporate existence, to carry on its operations, and to acquire, maintain and renew all rights, properties, powers, privileges and franchises which are necessary in the carrying out of the Project or in the conduct of its business. (b) NEGK shall at all times conduct its business in accordance with sound administrative, financial, environmental and social practices, and under the supervision of competent and experienced management and personnel. (c) NEGK shall at all times operate and maintain its plants, equipment and other property, and from time to time, promptly as needed, make all necessary repairs and renewals thereof, all in accordance with sound administrative, financial, engineering, environmental, social, and maintenance and operational practices.	PA, Artl. II, Sec. 2.11	**Complied with**. The systems and facilities created under the project are being operated and maintained by NEGK, which is one of the six major energy companies under NEHC. NEGK receives annual revenues allocated from the total electricity revenue based on the transmission tariff established by the sector regulator. The revenues are used mainly for operation and maintenance, urgent investments, financial charges and debt services. The AMDA and SCADA are being operated and maintained at NEGK's headquarters in Bishkek with regular budget allocation and required staff. The equipment installed at the 118 substations are being operated and maintained by the substations with sufficient spare parts and allocations from NEGK. A laboratory is facilitated with the equipment, financed by the project, to carry out regular testing of the meters.

ADB = Asian Development Bank; DDR = due diligence report, EA = executing agency, FA = Financial Agreement, IEE = initial environment examination, LARP = land acquisition and resettlement plan, NEGK = National Electricity Grid of Kyrgyzstan, MOE = Ministry of Energy, PA = Project Agreement.

Source: The ADB project completion review mission.

ECONOMIC REEVALUATION

A. Introduction

1. The Asian Development Bank (ADB) project completion review (PCR) mission conducted an economic reevaluation of the project using a similar methodology as that applied at appraisal with updated data. In the "without-project" case, it was assumed that the original state of the electricity transmission in the country was retained. In the "with-project" case, the electricity transmission and control facilities were rehabilitated and developed, so that the efficiency and transparency of electricity production, transmission, and distribution substantially improved, and electricity supply enlarged accordingly. Economic benefits were recalculated by comparing the "with-project" and "without-project" cases. The economic internal rate of return (EIRR) for the project was then recalculated.

B. The Project

2. At appraisal, reliable power supply was hindered by (i) high system losses (6% transmission loss and 26% distribution loss in 2009), (ii) inefficient system operation using obsolete technology, (iii) faults caused by dilapidated Soviet-era equipment, and (iv) poor governance and financial management. These factors reduced power exports and related revenue. Since export revenue was used to import costly fuel for combined heat and power plants in winter, reduced summer export led to insufficient domestic supply in winter. While the entire power sector needs to be modernized, the government placed top priority on loss reduction and more effective governance. This was not only necessary to improve commercial operations, but also to regain people's confidence in the power sector and ensure stability. To achieve this, the government issued a presidential decree known as the "Fuel and Energy Sector Transparency Initiative" on 20 July 2010. Energy security through expansion of generating capacity was also a priority, but the short-term solutions were to improve system efficiency and reliability, and to increase regional power trade.

3. Upon completion of the project, an automated metering and data acquisition system (AMDA) of the electricity transmission network nationwide was installed and commissioned; a supervisory control and data acquisition system (SCADA) linking eight major substations with a modern optical fiber ground wire (OPGW) system was developed and commissioned; and 118 NEGK's substations were rehabilitated with replacement of run-down circuit breakers and transformers. Such physical project outputs have effectively improved the efficiency and transparency of electricity production, transmission, and distribution. The implementation of the study on the settlement mechanism and the capacity building program have also significantly improved the institutional capacity for the energy sector. As reported by National Electricity Grid of Kyrgyzstan (NEGK), the electricity transmission loss declined from 5.70% in 2009 to 5.32% in 2018 and is expected to reduce further with the full effect of the project in coming years; the distribution loss declined from 26% in 2009 to 12.7% in 2018; and the substation-related transmission grid outages declined from 62 times in 2009 to 34 times in 2018. Meanwhile, the operation and maintenance costs for the rehabilitated substations were substantially reduced. The operation of the settlement center will significantly improve the governance, accountability, and financial management of the whole electricity system in the country.

C. The Project's Contribution

4. Based on data provided by NEGK,[1] electricity transmission, distribution, and consumption

[1] During ADB's project completion mission, some limited data were provided by NEGK.

for the system and project was estimated.[2] In 2018, the electricity transmitted by NEGK was total 14,104 GWh. In the past 5 years (2014–2018), the average increase of the electricity transmission was about 1.7% per year. In the projection, it was assumed that the electricity transmission would not increase for 2019–2037 by using existing transmission facilities. Future generation growth has not been considered in the analysis due to unknown investment costs of future generation capacity extension projects. Meanwhile, along with full utilization of the project outputs and further improvement of the efficiency, the transmission loss would continue to decline from current 5.32% to 4.09% in 2026, and the distribution loss would decline from 12.7% in 2019 to 9.8% in 2026, however, future loss reduction has not been considered either to keep the economic analysis conservative and robust.

5. The project has effectively increased the electricity transmission efficiency, reduced the transmission and distribution losses, and increased reliability and transparency of the whole electricity network in the country. The contribution of the project was estimated in reduction of losses at 0.4% of the total transmitted electricity and 1.2% of distributed electricity (out of 13.3% of total loss reduction in the distribution sector) compared to the continuous increase in losses in the "without-project" case.

D. Project Costs

6. The project investment costs comprised capital expenditures, and operation and maintenance (O&M) expenditures. The actual annual investment costs for the project were used in the economic reevaluation, which included the ADB loan and grant, and the counterpart fund from NEGK. Comparing with the cost estimation at appraisal, the actual project cost was about 16.8% lower, but the project investment period was extended from original 4 years to 7 years (2012–2018). The following table has the actual annual investment costs by fund sources.

Table 12.1: Actual Annual Investment Costs
($ million)

	Loan	Grant	NEGK	Total
2012	0.40	0.91	0.01	1.31
2013	5.50	9.66	0.11	15.27
2014	0.32	0.38	0.21	0.91
2015	1.43	2.33	0.46	4.21
2016	2.44	4.04	1.14	7.61
2017	2.93	4.96	1.44	9.31
2018	2.48	4.96	0.52	7.96
Total	**15.50**	**27.22**	**3.87**	**46.59**

Source: Asian Development Bank financial systems, NEGK

7. The actual O&M cost for 2016–2018 was provided by NEGK, which included the costs for power purchase, materials, staff, insurance, depreciation, tax, and others, but excluded the capital investments and debt services. Such O&M cost was used as the routine maintenance costs in the analysis. The periodical maintenance (major rehabilitation) cost for the SCADA/AMDA systems was estimated at 30% of the capital cost, which would take place in every 5 years. The periodical maintenance cost for the substation equipment was estimated at 20% of the capital cost, which would take place in every 10 years.

[2] The RRP did not provide the details of the projections of the electricity transmission, distribution, and consumption.

E. Project Benefits

8. The project has reduced the transmission loss and improved the working efficiency, as well as increased transparency and accountability of electricity generation, transmission, and distribution. Hence, it has effectively enlarged electricity supply and will bring significant economic benefits in the country.

9. Incremental O&M expenditures. Currently, the Kyrgyz Republic has 197 high-voltage substations for electricity transmission. The facilities of the substations were mostly installed in former Soviet era and already reached their economic life. The equipment was also technologically obsolete which need a large volume of manual work and a high cost of maintenance. Under the project, 118 substations were rehabilitated with replacing dilapidated circuit breakers and instrument transformers, and installation of advanced meters (see Appendix 2). Such rehabilitation has significantly increased the reliability of the electricity transmission system and reduced the O&M expenditures. The staff in the rehabilitated substations reported that the O&M expenditures had reduced at least 50% comparing with that before the project. Meantime, sophisticated systems of SCADA, AMDA, OPGW and laboratory require higher skilled workers to operate and maintain, and incremental O&M costs for this equipment is assumed to be 2% of the equipment cost annually,

10. Enlarged Electricity Supply. Reduced transmission and distribution losses have the effect of enlarging the supply of electricity which is considered as an incremental benefit. It was estimated that the total enlarged electricity supply would be about 184 GWh in 2018 and onward. The project contributions were also estimated by different electricity end-users, by assuming that the end consumptions would be about 20% for commercial use, 36% for industry, 37% for residential building use,[3] and 7% for export.[4] The increased electricity supply has and will generate significant economic benefits in the country. Table 12.2 represents estimations of the project contributions by end-users (enlarged electricity supply). For calculating this benefit in financial terms, the willingness to pay is estimated at Som1.92 ($0.0281) per kWh as the average of the existing commercial tariff (Som2.24) and per unit cost of alternatives (Som1.59) and used as proxy for domestic consumers. The border price of (i) $0.03/kWh which is an average price for exporting electricity over 2016-2018 was used for estimating export benefits for 2018-2021 and (ii) $0.055/kWh which is the price of electricity under the CASA-1000 power purchase agreement for 2022-2037.

Table 12.2: Estimation of the Enlarged Electricity Supply due to the Project from 2018 to 2037

(GWh/year)

Transmission and distribution Increased (1.6% of total)	**Consumption Increased** (after distribution loss)				
	Total	Commercial (20%)	Industrial (36%)	Residential (37%)	Export (7%)
222	**184**	**37**	**66**	**68**	**13**

Source: Asian Development Bank estimation

11. Protected environment. The increased efficiency in the electricity transmission and distribution will enlarge the electricity supply and consumption, which can be also considered as less electricity generation. According to ADB's guideline,[5] a proxy emission factor of 793.74 tons of

[3] ADB. *The Uch-Kurgan HPP Rehabilitation Project – Sector Assessment (Summary): Energy*.
[4] In the last 8 years (2010 – 2017), the average electricity export was about 1,006 GWh per year.
[5] ADB. September 2013. *Guidelines for the Use of ADB's Results Framework Indicators for Core Sector Outputs and Outcomes*. Manila.

CO_2 per GWh was used to calculate the CO_2 reduction based on the enlarged electricity supply by the project.

12. Facilitated industrial and small and medium businesses development. According to ADB's statistics, the total GDP of the country reached Som520,959 million in 2017, among which the industrial sector took about 29.7% but with an increasing trend.[6] With more electricity supply and reliability, the industry development will be better facilitated and promoted. It was calculated that a GWh of electricity supply could support the industrial outputs of at least $0.58 million, among which the contribution of the electricity supply was assumed to be about 10%. The enlarged and secured electricity supply by the project will significantly facilitate and promote the industrial development in the country. ADB's Private Sector Assessment in 2013[7] identified unreliable access to electricity as one of constraints for private sector development. Most of small and medium businesses heavily depend on stable electricity supply, and the project improved its reliability. The benefit associated with development of industrial and SMEs has not been quantified for calculation of EIRR as they are indirect, nevertheless, it demonstrates a positive impact of the project on the national economy.

13. In addition, there are more economic benefits of the project, which are unquantifiable due to data unavailability, like reduction of water releases from the reservoirs, improvement of residential life, promotion of business and agriculture development, decrease of corruption and fraud, etc.

F. Economic Internal Rate of Return and Sensitivity Analysis

14. The standard conversion factor (SCF) of 0.96 has been recalculated after the project completion for converting financial value of domestic inputs to economic costs based on the world price numeraire. Using the SCF, the installation and commissioning costs of local skilled workers during project implementation and annual O&M expenditures after the project have been converted into economic costs. The shadow wage rate factor is not applied as no unskilled workers have been or will be used during and after the project. The SCF has been also used for converting the benefit of enlarged electricity supply to domestic electricity consumers in financial terms.

15. Based on the assumptions and parameters above, the EIRR has been recalculated for a period of 26 years (2012–2037), including 7 years for project implementation and 21 years for operation (with some overlaps of construction and operation periods). For the SCADA and AMDA systems, 10 years of useful life with no residual value were applied. For the substation equipment, 40 years of useful life and 50% of the capital cost added to the last calculation year as the residual value. The EIRR has been recalculated at 17.7% for the project. Comparing with the EIRR at appraisal (24.4%), the lower EIRR at completion was mainly due to longer implementation period and less transmission loss than anticipated. The recalculated EIRR is above the discount rate of 12% recommended by ADB at appraisal (reduced to 9% as of the preparation of this PCR). The project is economically viable. The details of the economic reevaluation are in Table 12.4. The EIRR without environmental benefits is computed at 6.4%, so the contribution of environmental benefits in the aggregate EIRR is substantial.

16. The EIRR was subjected to sensitivity analysis to test different scenarios of O&M costs and benefits. The sensitivity analysis results indicated that the project continued to be economically viable for all tested scenarios. If a 20% maintenance cost increase would be combined with a 20% benefit reduction, the EIRR would be still 13.3% for the project. The

[6] From 25.6% in 2009 to 29.7% in 2017.
[7] ADB. 2013. *Private Sector Assessment Update. The Kyrgyz Republic.* Manila.

sensitivity analysis confirmed that the project has a robust economic viability. The sensitivity analysis also showed that the EIRR was more sensitive to changes in economic benefits. For this reason, NEGK needs to keep good condition of the substation equipment and better use of the SCADA, AMDA and OPGW systems for further increasing the operating efficiency and enlarging the electricity supply. The result of the sensitivity analysis is in the following table.

Table 12.3: Sensitivity of the EIRR

Case	Tests		EIRR (%)	ENPV@12% ($ million)
	O&M Cost	Benefits		
Base Case			**17.7%**	**13.0**
Changes (+/-)	10%		17.5%	12.6
	20%		17.3%	12.1
	100%		16.0%	8.5
		10%	19.5%	17.6
		20%	21.2%	22.3
		-10%	15.8%	8.4
		-20%	13.7%	3.8
	10%	-10%	15.6%	7.9
	20%	-20%	13.3%	2.9
Switching Point	287%		12.00%	0
		-28%	12.00%	0

EIRR = economic internal rate of return, ENPV = economic net present value,
O&M = operation and maintenance
Source: The Asian Development Bank project completion review mission.

Table 12.4: Economic Reevaluation
($ million)

Year	Costs			Benefits				Net Benefit
	Capital	O&M Incr'l Cost	Total	Enlarged Supply	Export	CO2	Total	
2012	1.31	-	1.31					-1.31
2013	15.27	-	15.27					-15.27
2014	0.91	-	0.91					-0.91
2015	4.20	-	4.20	0.92	0.08	1.06	2.06	-2.15
2016	7.58	-	7.58	1.38	0.12	1.59	3.09	-4.49
2017	9.27	-	9.27	2.30	0.20	2.70	5.40	-4,07
2018	7.96	0.14	8.10	4.60	0.40	5.51	10.51	2.41
2019		0.14	0.14	4.61	0.39	5.51	10.51	10.37
2020		0.14	0.14	4.61	0.39	5.51	10.51	10.37
2021		0.14	0.14	4.61	0.39	5.51	10.51	10.37
2022		0.14	0.14	4.61	0.72	5.51	10.84	10.69
2023	6.87	0.14	7.02	4.61	0.72	5.51	10.84	3.82
2024		0.14	0.14	4.61	0.72	5.51	10.84	10.69
2025		0.14	0.14	4.61	0.72	5.51	10.84	10.69
2026		0.14	0.14	4.61	0.72	5.51	10.84	10.69
2027		0.14	0.14	4.61	0.72	5.51	10.84	10.69
2028	11.33	0.14	11.47	4.61	0.72	5.51	10.84	-0.63
2029		0.14	0.14	4.61	0.72	5.51	10.84	10.69
2030		0.14	0.14	4.61	0.72	5.51	10.84	10.69
2031		0.14	0.14	4.61	0.72	5.51	10.84	10.69
2032		0.14	0.14	4.61	0.72	5.51	10.84	10.69
2033	6.87	0.14	7.02	4.61	0.72	5.51	10.84	3.82
2034		0.14	0.14	4.61	0.72	5.51	10.84	10.69
2035		0.14	0.14	4.61	0.72	5.51	10.84	10.69
2036		0.14	0.14	4.61	0.72	5.51	10.84	10.69
2037	-11.14	0.14	-10,99	4.61	0.72	5.51	10.84	21.83
				Economic Net Present Value (ENPV):				13.01
				Economic Internal Rate of Return (EIRR):				17.7%
				Discount Rate:				12%

O&M Exp.= operation and maintenance expenditures; Incr'l = incremental
Source: The Asian Development Bank project completion review mission.

FINANCIAL REEVALUATION

1. The Kyrgyz Republic is rich in renewable energy resources. The electricity sector relies predominantly on hydroelectricity. In 2013, the sector was characterized by (i) poorly maintained old assets operating beyond their economic life, (ii) poor supply reliability and service quality, (iii) recent substantial increase in household consumption because of fuel switching, (iv) looming power shortage, especially in winter, (v) inadequate capital and operation and maintenance spending by utilities because of inadequate cost recovery and high losses, (vi) substantial direct subsidies (low tariff) to residential customers and indirect subsidies to energy companies, and (vi) inefficient energy use by consumers. Rehabilitation of old assets operating beyond their economic life was an urgent need. In 2013, the government started energy sector restructuring and reform. The Ministry of Energy and Industry (MOEI) was abolished in 2015 with policy making functions being replaced by the State Committee for Industry, Energy and Subsoil Use (SCIESU). The National Energy Holding Company (NEHC) was established in January 2016 to manage and coordinate the energy sector companies. Electricity customers in the country have historically paid one of the lowest residential tariffs in the world. The World Bank's study in 2018 concluded that the energy sector in the country was not financially sustainable by considering that the residential electricity and thermal tariff were not reflective of costs and the increasing debt repayment schedule would drive up costs in 2018–2023.[1]

2. In the Kyrgyz Republic, the electricity tariffs are below the actual costs due to affordability and social considerations. In 2010, the tariffs were doubled to Som1.50/kWh. Following the social unrest in 2010, which was partly attributable to the tariff increase, the tariffs were restored to Som0.70/kWh for households and Som1.32/kWh for all other customers. In 2014, the Parliament delegated the function of tariff setting to the independent regulator under the government, which planned to gradually increase the weighted average tariff to Som1.67/kWh by 2017 to achieve cost recovery in accordance with the Medium-Term Tariff Plan (MTTP), 2014–2017.[2] Effective from 1 August 2015, the residential tariff was increased by 10% to Som0.77 per kWh, and effective from 22 June 2017 it was increased to Som2.16 per kWh for residential consumption above 700 kWh, while the commercial consumer tariff was set at Som2.24 per kWh. The government succeeded in raising the residential tariff without social unrest thanks to better public knowledge of the benefits of sector reform after the public information program under the ADB-funded Power Sector Rehabilitation Project, though not all planned increases in 2014–2017 have taken place due to political and social considerations. When the project was closed, the government was preparing a new MTTP.

3. The systems and facilities created under the project are being operated by National Electricity Grid of Kyrgyzstan (NEGK). NEGK is one of the six major energy companies under NEHC and is responsible for electricity transmission in the country as well as energy export and import operations.[3] NEGK receives annual revenues which are allocated from total electricity revenue, to use mainly for operation and maintenance, urgent investment, financial charges and debt services. The AMDA and SCADA are being operated and maintained at NEGK's headquarter in Bishkek with regular budget allocation and required staff. Currently, the SCADA connects NEGK Central Control Centre and Chuy regional standby control center via fiber optic cable with

[1] The World Bank. May 2018. *The State of the Kyrgyz Energy Sector*. ESMAP

[2] Government of Kyrgyz Republic. Decision number 650. 2014. *On the Issues of State Agency on Regulation of the Fuel and Energy Sector of the Kyrgyz Republic*. Bishkek. Government of Kyrgyz Republic. Resolution number 660. 2014. Medium-Term Tariff Plan for 2014–2017. Bishkek.

[3] One national electricity generation company, one national electricity transmission company, and four electricity distribution companies.

13 major substations, including 8 in the north and 5 in the south, and will connect a total of 20 substations in near future. The real-time data of the electricity transmission facilities and electricity being transmitted are reported, analyzed, and displayed. Repair and service restoration needs can be identified quickly. The data collected from the AMDA meters are used for analysis of electricity generation, transmission, distribution, consumption, and losses. The equipment installed at the 118 substations is being operated and maintained by the substations with sufficient spare parts and allocations from NEGK. A laboratory is supplied with the equipment, financed by the project, to carry out regular testing of the meters.

4. During ADB's project completion review (PCR) mission, financial reevaluation of the project was carried out. The financial internal rate of return (FIRR) of the project was recalculated based on actual capital costs of the project, prevailing operation and maintenance (O&M) expenditures and actual revenues of NEGK. The major assumptions used in the FIRR recalculation are as follows:

(i) Annual investment costs included all capital expenditures related to the system development, substation equipment and installation, and consulting services, but excluded the financial charges for the loan.
(ii) The actual O&M expenditures of NEGK in 2016–2018 were used as the basis in the financial analysis, which included the costs for electricity purchase, materials, staff, insurance, depreciation, tax, and others, but excluded the capital expenditures and debt services. It was assumed that such O&M expenditures would increase at the pace proportionally with the electricity transmission.
(iii) As general practice, the lifetime of the systems and equipment were assumed to be 10 years for the AMDA/SCADA systems, and 40 years for the equipment at the rehabilitated substations. The periodical maintenance (major rehabilitation) costs were estimated at 30% of the capital expenditures for the AMDA/SCADA systems, which would take place in every 5 years. The periodical maintenance cost for the substation equipment was estimated at 20% of the capital expenditures, which would take place in every 10 years.
(iv) No residual value was considered for the AMDA/SCADA systems while 50% of the residual value for the substation equipment was added to last year of the reevaluation period.
(v) The actual revenues for NEGK in 2016–2018 were used as the basis in the analysis. It was assumed that 6.4% of the total revenue was contributed by the project due to improved transparency, accountability and operational efficiency, expanded and more stable power supply, enforcement of the revenue collection, and income generation opportunities from optical fiber ground wire system. It was assumed that the revenue level would increase along with the electricity transmission each year during the evaluation period.
(vi) Large debts were borrowed by NEGK in the last few years. A part of the debt was used to supplement the inadequate operating revenues and to keep balance of the operation and debt services, which was considered as an extra fund to the operating revenue.
(vii) The corporate tax rate of 10% was applied to the revenue.

5. The FIRR was calculated for the 25-year period, including 7 years for implementation and 21 years for operation (with some overlap between implementation and operation). Based on above assumptions and estimations, the FIRR was recalculated at 2.40% before tax and 1.44% after tax. The recalculated FIRR was much lower than what estimated at appraisal (7.83%), which was mainly caused by prolonged implementation schedule, partially achieved target of reduction of the transmission loss, and over estimated revenue due to slower than expected tariff increases

than assumed at appraisal. However, the recalculated FIRR for both before and after tax were higher than the weighted average cost of capital (WACC) of 0.67% which was recalculated at project completion. Therefore, the project is still considered financially viable. Table A13.2 presents the cash flows of the FIRR recalculations. Additionally, the FIRR was subject to sensitivity tests. Combining a 20% increase in O&M costs and a 20% decrease in revenue, the FIRR was at -1.99% before tax and -2.99% after tax. The test results indicated that the FIRR was sensitive to the revenue changes (Table A13.1). Therefore, the government should consider increasing tariffs to bolster sector revenues. Meanwhile, NEGK should continuously improve its working efficiency.

Table A13.1: Sensitivity Tests

	Scenarios	FIRR (before tax)	FIRR (after tax)
	Base Case	**2.40%**	**1.44%**
Sensitivity Tests			
1	O&M 10% higher	1.73%	0.75%
2	O&M 20% higher	1.05%	0.03%
3	Revenue 10% higher	3.70%	2.74%
4	Revenue 20% higher	4.94%	3.97%
5	Revenue 10% lower	1.02%	0.08%
6	Revenue 20% lower	-0.44%	-1.38%
7	O&M cost 10% higher & revenue 10% lower	0.31%	-0.66%
8	O&M cost 20% higher & revenue 20% lower	-1.99%	-2.99%

FIRR = financial internal rate of return, O&M = operation and maintenance.
Source: The Asian Development Bank project completion review mission.

Table 13.2: Financial Reevaluation for the Project
($ million)

Year	Costs			Revenue and Profit			
	Capital	**O&M Exp.**	**Total**	**Operating Revenue**	**Other Funds**	**Profit** (before tax)	**Profit** (after tax)
2012	1.30		1.30			-1.30	-1.30
2013	15.16		15.16			-15.16	-15.16
2014	0.70		0.70			-0.70	-0.70
2015	3.98		3.98			-3.98	-3.98
2016	7.31	0.89	8.20	3.19	0.69	-4.33	-4.33
2017	8.93	0.85	9.78	3.48	0.29	-6.01	-6.01
2018	7.44	0.87	8.31	3.78	0.10	-4.43	-4.43
2019		0.89	0.89	3.84	0.10	3.05	2.74
2020		0.90	0.90	3.89	0.10	3.09	2.79
2021		0.91	0.91	3.93	0.10	3.13	2.81
2022		0.92	0.92	3.97	0.10	3.16	2.84
2023	6.9	0.87	7.75	4.01	0.10	-3.63	-3.63
2024		0.88	0.88	4.05	0.10	3.27	2.95
2025		0.89	0.89	4.09	0.11	3.31	2.98
2026		0.90	0.90	4.13	0.11	3.34	3.01
2027		0.91	0.91	4.18	0.11	3.37	3.04
2028	11.3	0.87	12.20	4.22	0.11	-7.88	-7.88
2029		0.88	0.88	4.26	0.11	3.49	3.14
2030		0.89	0.89	4.30	0.11	3.52	3.17
2031		0.90	0.90	4.34	0.11	3.56	3.20
2032		0.91	0.91	4.39	0.11	3.59	3.23
2033	6.9	0.87	7.75	4.43	0.11	-3.20	-3.20
2034		0.88	0.88	4.48	0.12	3.71	3.34
2035		0.89	0.89	4.52	0.12	3.75	3.37
2036		0.90	0.90	4.57	0.12	3.78	3.41
2037	-11.1	0.91	-10.23	4.61	0.12	14.96	13.46
	Financial Net Present Value (FNPV):					10.71	4.56
	Financial Internal Rate of Return (FIRR):					**2.40%**	**1.44%**
	Weighted Average Cost of Capital (WACC):					0.67%	0.67%

O&M Exp. = operation and maintenance expenditures
Source: The Asian Development Bank project completion review mission.

CONTRIBUTION TO ADB RESULTS FRAMEWORK

No.	Level 2 Result Framework Indicator	Target	Revised Target	Aggregate Output	Methods/Comments
Energy					
1	Greenhouse Gas Emission Reduction (tCO_20quiv/yr)	50,000–63,000		111,948 ton CO_2 equivalent reduced in 2018 (first operation year)	Due to decrease in transmission and distribution losses, electricity supply was enlarged, which is considered as less electricity production. A proxy emission factor of 793.73 tons of CO_2 per GWh was used for developing Asia countries, which is recommended in the ADB guidelines.[1]

tCO_2-equiv/yr = tons of carbon dioxide equivalent per year
Source: The Asian Development Bank project completion review mission

[1] ADB. September 2013. *Guidelines for the Use of ADB's Results Framework Indicators for Core Sector Outputs and Outcomes*.