



1. Project Data

Project ID P116680	Project Name ENERGY EFFICIENCY	
Country Armenia	Practice Area(Lead) Energy & Extractives	
L/C/TF Number(s) TF-12163	Closing Date (Original) 30-Jun-2015	Total Project Cost (USD) 10,660,000.00
Bank Approval Date 27-Mar-2012	Closing Date (Actual) 30-Jun-2016	
	IBRD/IDA (USD)	Grants (USD)
Original Commitment	1,820,000.00	1,820,000.00
Revised Commitment	1,816,845.65	1,816,845.65
Actual	1,816,845.65	1,816,845.65

Prepared by Richard L. Berney	Reviewed by Fernando Manibog	ICR Review Coordinator Christopher David Nelson	Group IEGSD (Unit 4)
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2. Project Objectives and Components

a. Objectives

This ICR Review is based on the project objectives as stated in Schedule 1 of the GEF Grant Agreement dated April 20, 2012 (page 7): “to reduce energy consumption of social and other public facilities.” To facilitate this assessment, the PAD’s more monitorable and development outcome-oriented statement of objective will be taken into account (page 3): “The global environmental objective is to decrease greenhouse gas emissions through the removal of barriers to the implementation of energy efficiency investments in the public sector”; thus, this ICR Review will consider both investment and policy outcomes.



b. Were the project objectives/key associated outcome targets revised during implementation?

No

c. Will a split evaluation be undertaken?

No

d. Components

Component 1 - EE investments in public facilities (Appraisal US\$9.4 million, Actual US\$9.8 million):

This component supported EE investments in social and other public facilities, e.g. schools, kindergartens, hospitals, administrative buildings, street lighting. The project was designed to finance primarily insulation of walls, basements and attics, repair/replacement of external doors and windows, window optimization, reflective surfacing of walls behind radiators, as well as improvements/ replacement of boilers and heating systems, replacement of mercury vapor lamps with high-pressure sodium vapor lamps (or light emitting diodes, LEDs) and of incandescent bulbs with compact fluorescent lamps (CFLs).

Component 2 - Technical Assistance: (appraisal estimate US\$3.1 million, Actual 1.5 million). This component was designed to help remove existing barriers to realizing EE potential by supporting the enabling environment for EE in the public sector. It was designed to finance: (a) capacity building of the Government's Renewable Resources and Energy Efficiency Fund (R2E2 Fund), including training and basic audit and monitoring equipment; (b) pipeline development and capacity building of participating public agencies, to address knowledge gaps on EE, build the demand for program financing, and improve the prospects for the sustainability of energy savings generated under the project; (c) policy development support, including efforts to support budgeting, procurement and financing of EE projects in the public sector, as well as select policy measures and energy statistics; (d) analysis of the implementation progress of the 2010-2013 Energy Efficiency Action Plan and elaboration of the 2016-2018 Action Plan; (e) market development and capacity building of various market actors; and (f) project management, including monitoring, reporting and financial audits

e. Comments on Project Cost, Financing, Borrower Contribution, and Dates

Project Cost: Total project cost was US\$11.3 million, or 90% of the appraisal estimate of US\$12.5 million.

Financing: The GEF provided US\$1.8 million, all of which was used. The remaining US\$9.5 million was funded by the Government.

Government Contribution: The Government contributed of US\$9.5 million, US\$0.7 million more than the original appraisal estimate of US\$8.8 million, all of which came from reflows from earlier Bank investment projects.

Dates: The GEF Grant was approved by the Board on March 27, 2012. It became effective on August 10, 2012. The project was restructured in April 2015, when the closing date was extended by one year from June 30, 2015 to June 30, 2016 in order to allow the demonstration investment components to be completed.



3. Relevance of Objectives & Design

a. Relevance of Objectives

The Bank's 2014-2017 Country Partnership Strategy has put major emphasis on enhancing efficient electricity usage through major investments (in FY2015) in upgrading electricity-generating and transmission network facilities to meet the challenge of its ongoing power supply gap. The project's objective of improving energy efficiency (EE) in social and public facilities is fully consistent with this objective. It is also consistent with the GEF Climate Change Focal Area, in particular with GEF Operational Program 5 – Energy Efficiency, and strategic programs under GEF-4: SP1 “Promoting EE Technologies and Practices in Appliances and Buildings.”

Rating

High

b. Relevance of Design

A 2008 World Bank Study had also found that Armenia could save 4.3 percent of its 2009 GDP through Energy Efficiency (EE) investments, and EE investments in public facilities had the highest returns of potential EE investments, with paybacks between two and ten years. This analysis provided the basis for the Government requesting the Bank to support the improvement of EE in public facilities, in partnership with the R2E2 Fund. By combining the GEF and R2E2 funds, the project was able to greatly multiply its impact. The project design focused in choosing subprojects with the highest economic return, by introducing a modified National Competitive Bidding contract that allowed bidders to propose their best technical solutions and then selecting those projects with the highest Net Present Value, rather than the lowest cost.

The two outcome indicators of the results framework -- (i) Energy savings in retrofitted social and other public facilities, and (ii) CO2 emission reductions in retrofitted social and other public through EE investments -- respond directly to the project objectives. A third indicator -- the introduction of regulations, legislative amendments, and guidelines to further promote EE -- was considered to be intermediate, and should have been upgraded to a primary outcome indicator, since it will affect all ongoing EE investments after the project finishes.

Rating

High



4. Achievement of Objectives (Efficacy)

Objective 1

Objective

Reduction in energy consumption of social and other public facilities.

Rationale

Outputs

- Cumulative investments in public facilities: Target \$8.7million, Achieved \$10.2 million
- Number of public sector projects commissioned: Target 85, Achieved 124
- An innovative process was used to choose subprojects based on the Net Present Value of the investment, with electricity savings valued at the estimated long-run marginal cost of electricity supply and/or gas supply, depending on the facility and the heating option used before implementation of the EE measures, rather than a simpler criteria of minimized investment cost per kWh saved.

Outcome:

- The Project achieved 250% of the original target for energy savings in retrofitted social and other public facilities:. [The original target was 216 million kWh saved and the actual achievement was 540 million kWh saved].
- The project achieved a reduction of 145.7 tons CO2 equivalent, almost three times its target of 50.5 tons.

Rating

High

Objective 2

Objective

Removal of barriers to the implementation of energy efficiency investments in the public sector.

Rationale

Output

- The project financed the analysis of the first National Energy Efficiency Action Plan (NEEAP) of the the Ministry of Energy Infrastructures and Natural Resources (MEINR),
- A draft Protocol Decision "On approving the second phase of the Republic of Armenia 2016-2018 Energy Efficiency Action Plan. Outcome Regulations, legislative amendments, guidelines to further



promote energy efficiency” was submitted to the Government for consideration. These regulations are expected to be adopted.

Outcome:

- The government adopted 13 new provisions to the Law on Energy Savings and Renewable Energy which support energy efficiency. These included obligatory EE standards for all public procurement contracts for construction, obligatory EE standards for all new construction procedures for energy audits, net metering for rooftop solar, and appliance labeling. Bank had supported these changes in its policy dialogue and the R2E2 Fund had provided technical support to facilitate their adoption.
- The government adopted the Second National Program on Energy Savings and Renewable Energy (NEEAP 2), which was developed under the technical assistance component of the Project.
- Further demonstrating the sustainability of the support provided by the Project, since the Project closed, a local commercial bank (ACBA Credit Agricole Bank) began providing loans for municipal EE investments with the help of the R2E2 Fund.

Rating
High

5. Efficiency

Economic and Financial Analysis: In total, the R2E2 Fund received 326 applications, of which almost two-thirds failed to meet the eligibility criteria (mostly because of low baseline energy use), and were rejected. The need to reject so many subprojects, increased the project’s transaction costs, particularly in the first years of implementation when the requirements were not fully understood by the subproject applicants, since all had to be properly assessed. The investment cost required to achieve the savings in building upgrades was very low—at only about US\$24.4/m², or about one-half the investment required for Bank projects in other countries. Although the cost per ton of CO₂ emissions reduction of US\$72.2/ton CO₂ was somewhat higher than in projects in other countries, this outcome is a result of Armenia being fortunate enough to have available more natural gas and renewables for baseline heating than do many other countries, so that the CO₂ savings per unit of electricity saved is lower than in other countries. More relevant for the analysis of efficiency is the fact that the cost of the energy savings per kWh over the expected life of the project was quite low, averaging only US\$cents 1.94 per kWh, which is significantly below the cost of generation and distribution. The realized EIRRs ranged from 22% for kindergartens to 57% for street lighting, while the realized FIRRs ranged from 10 to 38 percent, compared with the appraisal's EIRR estimates ranging from 31% for kindergartens to 77% for street lighting. The ERR table in section a, below, uses the lowest of these EIRRs. The realized economic payback periods ranged from 2 to 5 years, and the realized financial payback periods ranged from 3 to 7 years.



Administrative and Implementation Efficiency: The project introduced three modifications in the National Competitive Bidding (NCB) design/works contracts that greatly increased investment efficiency: (i) it specified the minimum energy savings but allowed bidders to propose their best technical solutions in order to maximize energy savings and value to the client; (ii) the selection of subprojects was based on the highest NPV rather than the lowest cost; and (iii) it introduced a performance-based approach by linking contractor payment to the results of a commissioning test. Implementation was negatively affected by low capacity of the construction firms to deal with the new procurement approach. The R2E2 Fund put significant effort into building of construction firms' capacity to handle the new NPV performance-based procurement design. However, the inclusion in the procurement bidding formats of both investment costs and timing of energy savings benefits encouraged bidders to be innovative in their technical solutions to maximize the EE benefits per dollar invested, and resulted in the introduction of new, improved technologies such as the use of condensing boilers and light-emitting diodes.

The subproject pipeline development was very slow, primarily because the results of these first subprojects were needed to demonstrate the benefits of EE investments. There were early setbacks on procurement (first five tenders failed, with one or fewer responsive bids). During the first two years only US\$3.5 million of projects were funded. only 34 projects were approved totaling. After the results of the initial subprojects were disseminated -- and energy tariffs increased -- demand for EE investments grew rapidly. In the last two years of implementation, project size and total funding almost doubled (to US\$6.2 million), so that by the end of the one year extended closing date, the R2E2 Fund lending surpassed its PDO indicator targets..

Efficiency Rating

High

a. If available, enter the Economic Rate of Return (ERR) and/or Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:

	Rate Available?	Point value (%)	*Coverage/Scope (%)
Appraisal	✓	31.00	0 <input checked="" type="checkbox"/> Not Applicable
ICR Estimate	✓	22.00	0 <input checked="" type="checkbox"/> Not Applicable

* Refers to percent of total project cost for which ERR/FRR was calculated.

6. Outcome

Two project development objectives were assessed: reduction in energy consumption of social and other public facilities, which was specified in the Grant Agreement; and removal of barriers to the implementation of energy efficiency investments in the public sector. Both these objectives were highly relevant to the need to improve energy efficiency in the public sector, as were the project design to achieve these objectives and the Outcome



for both (their Efficacy) was Highly Satisfactory. On Efficiency, energy savings per dollar invested was much higher than anticipated at appraisal, with cost per kWh substantially below the cost of new generation. While there were several delays in early implementation and a one year extension of the closing date, extending the project completion from three to four years, in the last two years project funding doubled and all the project's were fully met. Overall, the efficacy and efficiency are judged to be high for this highly innovative project, which has introduced effective new processes for evaluation and financing of energy efficiency project. .

a. Outcome Rating
Highly Satisfactory

7. Rationale for Risk to Development Outcome Rating

The energy savings from the investments in building retrofits are likely be maintained. At an institutional level, the R2E2 Fund is expected to be sustainable at least over the next 3 to 5 years, even without additional capital, as the R2E2 Fund can support investments of US\$1.3 to 1.5 million per year. Sources for longer term funding for expansion is uncertain, since funding after that period will be dependent on other as yet unidentified sources.

a. Risk to Development Outcome Rating
Modest

8. Assessment of Bank Performance

a. Quality-at-Entry

This project was originally designed as an EE component of the 2009 Electricity Supply Reliability and Energy Efficiency Project. It was dropped from this project due to insufficient funds and was then resurrected as a stand-alone GEF Project, with the innovative concept of using resources in the R2E2 Fund that had accumulated as IDA loan repayments of earlier Bank projects. The R2E2 Fund was already administering a number of programs, both Government and donor-financed, in the area of energy efficiency and rural electrification. This use of the R2E2 Fund as both the implementing agency and as the source of Government funding was an excellent fit for this GEF project. The projects introduced three critical new features into the R2E2 Fund's energy saving programs: (i) the introduction of Energy Service Agreements (ESA) Contracts that were classified as long-term service contracts, rather than debt obligations, which a Government entity would not have been allowed to undertake; (ii) subproject selection using Net Present Value based modified National Competitive Bidding design/works contracts that specified the minimum energy savings but allowed bidders to propose their best technical solutions; and (iii) the use of World Bank procurement guidelines for all awarded Energy Service Agreement Contracts. The appraisal team did under-estimated the length of time the



it would take implement these innovations and the subsequent slow start-up necessitated an extension of the Grant's implementation period from three years to four years.

Quality-at-Entry Rating

Highly Satisfactory

b. Quality of supervision

Having delivered a high quality project at entry, the Bank worked closely with the R2E2 Fund in support of its role as implementing agency, and in training the staff in NPV evaluations and Bank procurement methodology. It conducted periodic implementation support missions and provided operational advice and technical support when needed.

Quality of Supervision Rating

Satisfactory

Overall Bank Performance Rating

Satisfactory

9. Assessment of Borrower Performance

a. Government Performance

The Government demonstrated strong commitment to the project. It assigned highly qualified staff to the R2E2 Fund and allocated US\$8.0 from the repayment flows of two closed IDA project for co-financing. The timeliness of this co-financing was satisfactory throughout the project implementation. While it strengthened the EE regulatory framework, the Government has not yet adopted in its Public Procurement Law the NPV-based procurement scheme pioneered under the project.

Government Performance Rating

Satisfactory

b. Implementing Agency Performance

The R2E2 Fund, as the implementing agency, successfully introduced several important innovations including; (i) the introduction and implementation of ESAs; (ii) the use of NPV-based procurement in an industry accustomed to least-cost procurement; (iii) introduction of repayment obligations among clients accustomed to grant-based financing and ensuring full and timely repayment; and (iv) establishment of performance-based payments for contractors who were used to output-based payments. It also provided support to contractors to strengthen their capacity to implement their subprojects, maximize the project's NPV, and act in accordance with the Bank's procurement guidelines. It provided support to the Government for upgrading its institutional and regulatory framework. The R2E2 Fund also implemented aggressive marketing campaigns and an accelerated implementation timeframe, which enabled it to ultimately exceed the targeted indicators. On the negative side, the Fund's financial management rating was downgraded to



Moderately Satisfactory during project implementation due to the deterioration of their contract management and transaction processing system. Although the R2E2 Fund undertook steps to improve their internal controls, the last Bank mission indicated that further improvement was still needed.

Implementing Agency Performance Rating

Satisfactory

Overall Borrower Performance Rating

Satisfactory

10. M&E Design, Implementation, & Utilization

a. M&E Design

The R2E2 Fund established an efficient system for collecting, monitoring and reporting on the project's progress and impacts. It included all the relevant information required for evaluating the Bank's results framework.

b. M&E Implementation

During project preparation and throughout implementation, the R2E2 Fund established its internal M&E capacity and systems for tracking subproject screening results, the pipeline of accepted projects of subprojects, and the commitment and invested amounts for accepted projects.

c. M&E Utilization

The M&E tracking and system was utilized by the R2E2 Fund for reporting project progress and outcomes to the Bank and to the Government, including the identification of subproject delays, as well as repayment progress and defaults. At the completion of each subproject, it was used to evaluate energy savings and CO2 reductions.

M&E Quality Rating

High

11. Other Issues

a. Safeguards

The project triggered environmental safeguard policy OP/BP 4.01, for which it was classified as Category B. An Environmental Management Plan was developed during project preparation, as required, and site-



specific plans were shared with the Bank for approval and publicly disclosed for each individual investment. Stakeholders were given sufficient time and opportunity to share their comments on these plans. The project retained Satisfactory rating on safeguards performance throughout its life. All agreements/permits required for specific works were obtained from the national authorities. Mitigation measures were confined to the proper handling of construction waste and adherence to workplace safety rules. Field supervision of works was performed on regular basis and a good record on environmental monitoring outcomes was kept. No damage to the natural environment has been recorded. Mercury-containing street light bulbs that were replaced with energy-efficient and non-toxic bulbs were sent to adequate municipal storage until relevant facilities for safe destruction/disposal of such waste become available in the country.

b. Fiduciary Compliance

There were no major procurement issues during implementation. The Fund's semi-annual interim financial reports were generally submitted on time and approved by the Bank. Auditors issued unmodified (clean) opinions on the Project's annual financial reports. The Fund also complied with public disclosure requirement of the audited financial statements.

c. Unintended impacts (Positive or Negative)

Beneficiaries tended to do more non-EE improvements after completing the project renovations. Money for these investments came from resources that they previously used to temporarily improve winter comfort. They also invested in buildings that were not covered by the project. The project facilitated access to local bank finance for clients that could legally borrow. Local banks were able to appreciate EE investments made by clients through the Project, and the clients developed a better appreciation of the benefits of EE investments. After the project closed, one of the local banks offered to collaborate with the R2E2 Fund to finance municipal EE investments using its financial resources.

d. Other

NONE

12. Ratings

Ratings	ICR	IEG	Reason for Disagreements/Comment
Outcome	Highly Satisfactory	Highly Satisfactory	---
Risk to Development	Negligible	Modest	Sources for longer term



Outcome			funding are uncertain.
Bank Performance	Satisfactory	Satisfactory	---
Borrower Performance	Satisfactory	Satisfactory	---
Quality of ICR		Substantial	---

Note

When insufficient information is provided by the Bank for IEG to arrive at a clear rating, IEG will downgrade the relevant ratings as warranted beginning July 1, 2006.

The "Reason for Disagreement/Comments" column could cross-reference other sections of the ICR Review, as appropriate.

13. Lessons

The ICR provides the following key lessons, as paraphrased here:

- The creation of a Government institution to implement Energy Service Agreements (ESA) with public sector institutions can be an effective model for introducing and testing the concept of energy savings investments.
- The Energy Service Agreement (ESA): (i) allows public institutions to finance EE without incurring debt, (ii) retains energy cost savings for the duration of the ESA, and (iii) outsources procurement, management and risks to a third party.
- Because ESAs involve long-term investment paybacks, grants are needed to provide both the initial and expansion working capital.
- Net Present Value-based bidding encourages innovation and the introduction of new technologies that can have a significantly impact on cost efficiency.
- A comprehensive M&E program that includes measurement and verification of individual subproject outcomes proved to be an essential element in the successful implementation of the ESAs and NPV-based decision-making. The beneficiary and contractors all monitored subproject performance indicators (indoor temperature, lighting intensity, energy bills, etc.), which helped minimize disputes among the stakeholders.

14. Assessment Recommended?

No

15. Comments on Quality of ICR

The ICR was results-oriented and internally consistent. It was candid in the analysis of the actions of the implementing agency and the reasons for the early implementation delays. It provided well documented quantitative evidence for the energy savings in each of the five categories of subprojects, and economic and financial returns were properly calculated. It would, however, have been more useful for the purpose of evaluating the project as a whole if the ICR had also calculated a weighed average rate of return for the total



investment. The lessons section, which was long and descriptive, could have been less descriptive, and more focused on significant positive and negative lessons learned.

a. Quality of ICR Rating
Substantial