Report Number: ICRR0022961

1. Project Data

Project ID P131592	**Project Name** SREP-Supported Extended Biogas Project
Country Nepal	**Practice Area(Lead)** Energy & Extractives

L/C/TF Number(s)	Closing Date (Original)	Total Project Cost (USD)
TF-16552	31-Dec-2019	4,179,325.64
Bank Approval Date	**Closing Date (Actual)**	
27-Aug-2014	31-Aug-2021	

	IBRD/IDA (USD)	Grants (USD)
Original Commitment	7,900,000.00	7,900,000.00
Revised Commitment	7,900,000.00	4,179,325.64
Actual	4,179,325.64	4,179,325.64

Prepared by	Reviewed by	ICR Review Coordinator	Group
Hassan Wally	Vibecke Dixon	Ramachandra Jammi	IEGSD (Unit 4)

2. Project Objectives and Components

a. Objectives

The Project Development Objective (PDO) of the Supported Extended Biogas Project (SREP) as articulated in the Project Appraisal Document (PAD, paragraph 19) was identical to the one in the Grant Agreement (page 5) and aimed to:

"promote large off-grid biogas energy generation in Nepal."

Parsing the PDO. The PDO will be parsed based on the following two outcomes under the same objective as follows:

Outcome 1: To promote the generation of off-grid biogas for thermal application from large-scale biogas projects.

Outcome 2: To promote the generation of off-grid biogas-based electricity.

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

Yes

Did the Board approve the revised objectives/key associated outcome targets?

No

c. Will a split evaluation be undertaken?

No

d. Components

The PDO was supported by the following two components:

1. Market Development Enabling Environment -Technical Assistance (appraisal cost: US$1.0 million, amount after restructuring: US$1.50 million, actual cost: US$1.26 million). This component included three main activities as follows:

(a) Identification and Pre-Feasibility Studies. Launch of a transparent, web portal (bilingual in Nepali and English) for applications from existing companies to identify and invest in large biogas sub-projects. Sub-projects should focus on harnessing organic waste. Applicants must agree to follow SREP principles, which permits the import of technology, requires leveraging funds from other sources, and also includes compliance with the Environmental and Social Framework. The published Government of Nepal (GoN) subsidy policy would apply to sub-projects to “buy-down” the initial capital cost required, with levels of subsidy varying depending on the nature of the sub-project. Regardless of the type of sub-project sponsor, all sub-projects would be evaluated to ensure that the sub-project would perform effectively and sustainably.
(b) Detailed Feasibility Studies. Nepali companies’ would request for TA support to carry out the detailed feasibility study would be supported on a cost-sharing TA basis.
(c) Post Construction Third Party Verification. The Alternative Energy Promotion Center (AEPC) would appoint a technical review committee (TRC) to meet monthly and evaluate sub-projects received. Minutes of the meetings would be published on AEPC’s website. Separate TA support would be provided to AEPC for periodic evaluation of lessons learned from the ongoing large biogas program.

2. Financing of Investments (appraisal cost: US$6.90 million, amount after restructuring: US$6.23 million, actual cost: US$2.79). AEPC would use government funds as per its published subsidy policy, to provide a capital cost buy-down and thereby to achieve financial closure for competitively selected large biogas investments led by the private sector. The plants would likely to be sustainable as the private sector undertakes design, construction, financing, and operation and maintenance. SREP funds would be drawn

down by AEPC after the plant is commissioned and operational and would serve to reimburse AEPC for a portion of the capital cost buy-down it has already provided. By this method, SREP would only financing plants that work. SREP funds would be provided as a Subsidy Payment, which would be a partial reimbursement of the eligible subsidy under GoN's Feb 2013 Subsidy Policy.

Revised Components
A new Component 3 **(Project Management Support, amount after restructuring: US$0.17 million, actual cost: US$0.13 million)** was added to clarify that capacity building and support to AEPC on all aspects of project management and implementation including monitoring and evaluation (M&E) would be covered through the first restructuring in 2016. Additional fund allocation to support capacity development and AEPC's Project Implementation Unit (PIU) was made through the second restructuring in August 2019 and the fourth restructuring in April 2020.

Component 2 (Financing of Investments), Subcomponent 2(b): subsidy payment for the partial financing of selected demonstration sub-projects was added.

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

Project Cost. The project cost was estimated to be US$35.50 million. This amount was revised downwards to US$14.80 million. The actual cost according to the ICR Data Sheet (page 2) was US$7.75 million.

Financing. The project was financed through a Grant worth US$7.90 million from the Scaling Up Renewable Energy Program in Low Income Countries (SREP) Multi-donor Trust Fund. The actual amount disbursed was US$4.18 million or about 53% of the estimated amount (ICR Data Sheet, page 2).

Borrower Contribution. The borrower was expected to contribute US$27.60 million of counterpart funds. This was revised downwards to US$6.90 million. The actual amount according to the ICR Data Sheet (page 2) was US$3.57 million.

Dates. The project was approved on August 27, 2014 and became effective three months later on November 24, 2014. The Mid-term Review (MTR) was conducted on January 19, 2018, which was about three years and two months after effectiveness. The PAD did not include a specific date for the MTR. However, since the project was designed as a five year operation, conducting the MTR after three years into implementation was reasonable given that the project was extended for twenty moths. The project was expected to close on December 31, 2019. The closing date was extended for twenty months to close on August 31, 2021. The ICR did not report an explicit reason for the twenty months extension.

The project was restructured four times, all of which were Level 2 restructuring, as follows:

1. On July 13, 2016, when the amount disbursed was US$0.33 million, in order to modify the Results Framework, change in components and cost and reallocate funds between disbursement categories.

2. On August 28, 2018, when the amount disbursed was US$1.20 million, in order to modify the Results Framework, change in components and cost, reallocate funds between disbursement categories, change in disbursements arrangements, and change in Legal Covenants.

3. On November 14, 2019, when the amount disbursed was US$1.94 million, in order to extend the project's closing date from December 31, 2019 to August 31, 2021.

4. On April 7, 2020, when the amount disbursed was US$2.02 million, in order to modify the Results Framework, change in components and cost, reallocate funds between disbursement categories, and change in disbursements arrangements.

Rationale for Changes and the implication on the Original Theory of Change (ToC). The PDO indicators were unchanged, the target values for PDO Indicators 1 and 2 (off-grid biogas and electricity generated) were revised thrice through restructurings. These revisions were relevant to reflect the total biogas generated for thermal application in Year five of implementation for PDO1 and to correct an overestimation of the end target for PDO2. Through restructurings, a new component (Management Support) was added to support capacity development and strengthen the PIU capacity. Changes also included streamlining the approval process of biogas projects to expedite disbursement through the introduction of milestone-based disbursements to resolve the gap between physical progress of sub-project construction and actual disbursement. Streamlining of the approval process facilitated the sub-project progress and contributed to increase the number of sub-projects operated by the project (ICR, paragraph 21). Overall, the changes introduced were relevant and strengthened the causal links between the financed activities and outcomes, which would contribute to the achievement of PDO and longer-term outcomes.

3. Relevance of Objectives

Rationale

Context at Appraisal. Nepal's total electricity installed capacity was 706 MW (mainly through hydropower) which was supplemented by purchases from India. However, the country was facing an energy crisis of unprecedented proportions as the installed capacity plus supplements from India were inadequate to meet demand. This results in forced load shedding for prolonged periods with attendant economic consequences. Nepal had very good potential for expanding biogas production. Biogas can be used on-site for cooking, for industrial thermal heating processes (e.g. steam production), and also to produce electricity in retro-fitted generators that can use both diesel and biogas. Recovery of Biogas for productive uses also contributes to climate change mitigation (PAD, paragraph 6).

Previous Bank experience. The World Bank is investing in Biogas technologies as part of the climate finance on the mitigation and adaptation side. In developing countries such as the Burkina Faso, Philippines, Nepal and Rwanda, the Bank supported the development of biogas projects, which are crucial to the collection of waste that can be transformed into renewable energy sources.

Consistency with Bank Strategies. At appraisal, the PDO was in line with the Bank's Country Partnership Strategy (CPS, FY2014–2018). Specifically, the pillar of "Increasing Economic Growth and Competitiveness", and in particular the Outcome of "Improved access to, supply of, and reliability of growth-enhancing infrastructure and services in strategic sectors." The project also aimed to pilot and demonstrate

the economic, social, and environmental viability of low carbon development pathways which was a stated impact objective for SREP.

At completion, the PDO remained in line with the current Country Partnership Framework (CPF, FY2019–2023). Specifically, Focus Area 2 "Private Sector-Led Jobs and Growth". The PDO was also in line with Objective 2.1 “Improved power generation capacity and access to electricity” under Focus Area 2. The PDO encompassed increased off-grid biogas-based electricity generation, which directly contributes to power supply through renewable energy solutions. The project also involved private sector engagement and helped lower investment risk, through facilitating investment in the large biogas sector by providing capital cost buy-down of sub-projects in combination with AEPC’s subsidy policy. The importance of private sector engagement in the sector was emphasized under Objective 2.1, and further contributed to Objective 2.4 “Improved regulatory environment for competitiveness” through enhancing the investment climate in the large biogas sector in the country, and Objective 2.5 “Improved income opportunities” through creating job opportunities to construct and operate biogas plants for developers and service providers.

The PDO was also in line with the SREP objective to “pilot and demonstrate, as a response to the challenges of climate change, the economic, social and environmental viability of low carbon development pathways in the energy sector by creating new economic opportunities and increasing energy access through the use of renewable energy."

Consistency with Government Strategies. At appraisal, the PDO was in line with National Rural and Renewable Energy Program (NRREP). Specifically, the NRREP component for "Business Development for Renewable Energy and Productive Energy Use."

At completion, the PDO remained in line with Nepal’s National 15th Periodic Plan (FY2019/20–2023/24), which aimed to install 500 large biogas plants and 0.2 million units of small biogas digesters that can reduce the annual import of 40,000 MT (Metric Ton) of liquefied petroleum gas (LPG).

Summary of Relevance of Objectives Assessment. While the PDO was aligned with the CPF Objective 2.5 “Improved income opportunities” and the SREP objective of “creating new economic opportunities,” this aspect was not "adequately incorporated into the PDO or PDO outcome indicators, which focused only on the amount of biogas energy generation (ICR, paragraph 25)." The ICR (paragraph 25) correctly pointed out that "commercial viability and sustainability of the operation is key for ensuring longer-term impact, capturing the creation and development of a market as a result of the project’s intervention in the PDO or PDO outcome indicators should have enabled further alignment with the CPF and the SREP objective." Furthermore, the PDO and the PDO outcome indicators failed to reflect or capture the gender co-benefits aspect, which was emphasized in both the CPF and the SREP. Capturing the gender co-benefits would have reflected more alignment with the CPF and SREP impact objective. Finally, the PDO formulation is at input level (to promote biogas generation). The two expected outcomes identified are at a higher level in the results chain than the PDO formulation itself. Therefore, the PDO formulation does not capture the full range of expected project results.

Based on the above-mentioned assessment, Relevance of Objectives is rated Substantial. This rating reflects minor shortcoming related to the market development and gender co-benefits aspects, which were not reflected in the PDO.

Rating
Substantial

4. Achievement of Objectives (Efficacy)

OBJECTIVE 1

Objective
To promote large off-grid biogas energy generation in Nepal.

Rationale
Original Theory of Change (ToC). The reconstructed ToC in the ICR has a better formulated PDO (expected result at PDO level) than the PDO formulation of the project. To achieve the stated objective, the project would finance selected large biogas investments led by the private sector and provide technical assistance to develop biogas markets. In addition, while it was not captured in the activities under the components, Intermediate Results Indicator (IRI) 2 envisaged trainings provided to companies to evaluate and appraise large sub-projects upon request. These activities were expected to create and operate off-grid commercial and municipal generation plants using off-grid biogas, and increase the capacity of the private sector to commission large biogas sub-projects. This was expected to promote large off-grid biogas energy generation in Nepal. In the longer term, the project would contribute to (a) increased energy access and energy use from renewable energy sources, (b) reduction in GHG emissions through displacement of fossil fuels, and (c) creation of a new market and economic opportunities in the large biogas sector, in line with the CPS and SREP objective.

Revised ToC. The revised ToC was identical to the original one, except that it included a project management support activity under a new component to emphasize capacity building and support to AEPC on all aspects of project management and implementation, including M&E. These activities were expected to strengthen the capacity of the public and private sectors to commission large biogas sub-projects. Also, the revised ToC reflected that financing was made available for demonstration sub-projects by AEPC, and the approval process of sub-projects financed was streamlined to facilitate sub-project progress and contributed to increase the number of sub-projects operated by the project. These changes strengthened the causal links toward outcomes.

Critical Assumption that underpinned the achievement of the stated Objective:

1. Availability of a pre-existing sub-projects pipeline.

2. Companies are expected to retain contents of training courses and lessons learnt.

3. Sub-projects are expected to remain commercially viable post completion.

The activities in the original ToC and revised ToC were connected to the stated outcomes in a plausible causal chain. The stated assumptions were logical and realistic.

Outputs

The following outputs were reported by the ICR (Annex 1) unless referenced otherwise:

Component 1 (TA)

- 640 large biogas proposals (570 commercial and 60 municipal) were submitted for investment evaluation (original target: 400, revised target: 350, both targets exceeded).
- 40 companies were trained to evaluate and appraise large biogas sub-projects (target: 8, exceeded). While this target was exceeded, the ICR (paragraph 31) noted that "knowledge retention from the trainings were found to be insufficient due to the frequent human resources turnover in the sector, which resulted in the lack of adequate knowledge of technical designs and operation and maintenance (O&M), even at the Project closing."

Component 2 (Financing of Investments)

- 193 commercial off-grid generation plants were created and operated by the project (target: 340, not achieved). This under achievement was attributed to significant implementation delay of the project (ICR, paragraph 30).
- One municipal off-grid generation plants was created and operated by the project (target: 10, not achieved).

Outcome

1. To promote the generation of off-grid biogas for thermal application from large-scale (over 12 m3) biogas projects. By project completion, and as a result of the project's financial and the TA support, a total of 17,777,395 m3 of biogas was generated by thermal application sub-projects which represented about 111% of the final target of 16,050,186 m3 (baseline was zero as there were no large-scale biogas plants at appraisal, ICR paragraph 28). This result demonstrated that the project was successful in introducing and promoting novel biogas technologies in the country.

2. To promote the generation of off-grid biogas-based electricity. By project completion, a total of 4.94 Giga Watt hour (GWh) of electricity was generated from off-grid sources by sub-projects financed and supported by the project, which represented about 110% of the final revised target of 4.5 GWh, but was significantly lower than the original target of 30 GWh (the baseline was zero as there was no electricity generation from biogas at appraisal, ICR paragraph 29). This amount represented about 110% of the final target of 4.5 GWh and exceeded the last two revised targets (2.23 GWh and 4.5 GWh), but fell short of the original and the first revised targets (30 GWh and 5.73 GWh). According to the ICR (Annex 7), the original target value (30 GWh) for PDO Indicator 2 was overestimated. While the increase in total biogas-based electricity generation as a result of the project's intervention did not reach the level that was expected at appraisal, the ICR noted that the improvement in the electricity supply situation in the country decreased the interest among developers to implement biogas plants for electricity generation. Hence, the target for biogas electricity generation was reduced. Also, 193 commercial sub-projects were commissioned against the target of 340 and 1 municipal sub-project was commissioned against the target of 10. The ICR (paragraph 30) noted that an additional 11 large sub-projects were under construction.

A notable achievement by the project was the creation of a large biogas market in the country. This did not exist prior to the project intervention when biogas generation was for captive use only, at the household

scale. A 2019 market assessment showed that the number of projected large biogas plants was 346, and the expected total biogas generation and electricity generation were estimated as 30,056,582 m3 per year and 2.07 GW per year (ICR, paragraph 32).

Summary of Efficacy Assessment. The project exceeded its target on biogas generation (PDO outcome 1) and exceeded its revised target on electricity generation (PDO outcome 2). However, the project target on the number of sub-projects operated (Intermediate Outcome indicator 1) and on increased capacity (intermediate outcome indicator 2) were not achieved. As noted above the project had a positive impact on market creation. This suggests that key outcomes in biogas and electricity generation and the number of large biogas plants are expected to be further achieved. Therefore, the efficacy with which the PDO was achieved is rated Substantial despite some shortcomings.

Rating
Substantial

OVERALL EFFICACY
Rationale
Overall Efficacy is rated Substantial. The project exceeded its target on biogas generation (PDO outcome 1) and exceeded its revised target on electricity generation (PDO outcome 2). However, the project the target on the number of sub-projects operated (Intermediate Outcome indicator 1) and on increased capacity (intermediate outcome indicator 2) were not achieved. As noted above the project had a positive impact on market creation. This suggests that key outcomes in biogas and electricity generation and the number of large biogas plants are expected to be further achieved.

Overall Efficacy Rating

Substantial

5. Efficiency
Economic and Financial Analysis (EFA)

ex ante

- The results of the economic analysis of ten biogas sub-projects ready for financing indicated benefit cost ratios of over 2.0 and economic internal rates of return (EIRRs) close to 30%.
- Carbon cash flows were not taken into account.

ex post

- Economic analysis of 200 thermal application sub-projects (190 already commissioned and 10 under construction) had a net present value (NPV) US$51.2 million and the estimated EIRR was 58%. The NPV of the five electricity generation sub-projects (four already commissioned and one under construction) was US$26.4 million and the EIRR was 165%. Combining both thermal and electricity generation sub-projects, the NPV was US$77.6 million and the EIRR was 83%.
- GHG emission reduction. Substituting biogas for Liquified Propane Gas (LPG) would reduce carbon dioxide emissions by approximately 3,600 MT per year, while using biogas instead of diesel to generate electricity would reduce emissions by a further 1,600 MT per year for a total reduction of approximately 5,200 MT annually. The present value of these savings using the 'Low' shadow price of carbon would be US$2.5 million, while the value using the 'High' shadow price would be US$4.9 million.
- Implementation Efficiency. Sub-project construction was slow and experienced delays which resulted in many of the project impacts not being included in the ex post assessment. The implementation of sub-projects was further disrupted with the COVID-19 restrictions which put activities on hold for 12 months (ICR, paragraph 36). The project experienced frequent turnover of Task Team Leadership, and was restructured three times to modify design and the indicator targets. For a small operation, such events increased supervision costs to reach11% of the total disbursed amount, which suggested inefficiency (ICR, paragraph 36). Finally, the project disbursed only 53% of the approved amount.

Summary of Efficiency Assessment. The ex post EIRR at 83% was solidly above the ex ante rate at 30%. However, efficiency suffered from three notable shortcomings: first, the project suffered from implementation delays and was extended by twenty months, second, at 11% of total cost, supervision costs were relatively high, and third, the project disbursed only 53% of the estimated amount at appraisal despite the twenty months extension. Therefore, efficiency is rated Modest.

Efficiency Rating

Modest

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	✓	30.00	0 ☑ Not Applicable
ICR Estimate	✓	83.00	0 ☑ Not Applicable

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

6. Outcome

Relevance of Objectives was rated Substantial. Overall Efficacy was rated Substantial. The project exceeded its target on biogas generation (PDO outcome 1) and exceeded its revised target on electricity generation (PDO outcome 2). However, the target on the number of sub-projects operated (Intermediate Outcome indicator 1)

and on increased capacity (intermediate outcome indicator 2) were both not achieved. Efficiency was rated Modest. While the ex post EIRR at 83% was solidly above the ex ante rate at 30%, efficiency suffered notable shortcomings including significant implementation delays, relatively high supervision costs (11% of total disbursed amount), and low disbursement (only 53% of the estimated Grant amount was disbursed despite a twenty months extension).

Based on the ratings for the three criteria (Relevance of Objectives, Overall Efficacy, and Efficiency), the overall Outcome rating of the project is Moderately Satisfactory.

a. Outcome Rating

Moderately Satisfactory

7. Risk to Development Outcome

The ICR discussed two main risks that could potentially impact the development outcome of this project:

1. The risk related to the continued operation and commercial viability of the biogas sub-projects. The longer-term outcomes and impacts of the project are contingent on continued production of electricity and biogas as well as maintaining the biogas market in Nepal after graduation of the Bank's support and subsidy by the GoN. According to the ICR (paragraph 72) "several sub-project developers expressed concerns with their ability to continue maintaining and operating the sub-projects on their own, given their insufficient understanding of technical designs and O&M mechanism, and their limited ability to procure requisite expertise, manpower, technology, and spare parts in the local Nepalese market in an efficient and cost-effective manner." There are concerns with regards to full commercial viability of sub-projects and sustainability of the operation. While the project's support in combination with AEPC's subsidy contributed to the market creation and development toward the commercialization in the sector, cost-sharing support was transitional until the private sector became familiar with the technology and risk perceptions were reduced. Therefore, until full and sufficient market development is realized, further support by the Bank and/or AEPC is required. According to the ICR (paragraph 72) further support on the large biogas sector through another project is currently planned by the Bank.

2. The risk related to the need for regulatory clarity and policy change to better support the biogas market in Nepal. Biogas applications in Nepal are expected to expand beyond thermal and electricity generation into transportation use. Using biogas as a transport fuel could constitute an important client market for biogas producers and help improve the country's energy autonomy. However, regulatory issues related to this application are not clear in Nepal. Therefore, an improved regulatory framework is needed to create a better enabling environment for biogas uses. This will consequently improve the sustainability of the development outcomes achieved by this operation (ICR, paragraph 73).

8. Assessment of Bank Performance

a. Quality-at-Entry

The Government of Nepal sought to promote private investment in large biogas plants, by providing initial limited TA and cost-sharing grant support from the public sector, with support from external partners (PAD, paragraph 7). While the PDO of the project was in line with SREP goals and the Bank's country partnership goals, it was poorly formulated (see section 3 for more details). The project design aimed to introduce large biogas plants, which were successful in neighboring countries but not in Nepal, despite good potential. The design featured a transitional cost-sharing investment support and technical assistance (TA) support, using the World Bank-administered US$7.9 million tranche of SREP grant.

The design aimed to enhance incentives, and manage risks of poor design or inferior workmanship during construction. In turn, this was expected to conserve SREP resources to be used only for functioning plants, and not for poorly designed or nonfunctioning plants (ICR, paragraph 5). A notable design shortcoming was the lack of capacity building and trainings to the PIU and stakeholders as these were not properly included as activities. This shortcoming had a cascading effect on the project as implementation suffered delays, the project required restructurings, the full achievement of the targeted number of sub-projects commissioned was hindered, and the private sector suffered from sustainability issues (ICR, paragraph 45). Also, the sub-projects approval process was redundant, and the original disbursement mechanism was not aligned with physical progress for larger sub-projects, which led to slow disbursement. These shortcomings were later addressed through restructuring.

Six main risks were identified at appraisal relating mainly to stakeholders capacity, governance and project related risks. The PAD included a number of mitigation measures that were logical. While the risk related to limited stakeholder capacity was identified at appraisal and the need for training was noted, such support was not appropriately included either in the activities under components or outcome indicators (ICR, paragraph 68).

M&E design suffered from shortcomings related to the Results Framework (RF). Specifically, the RF lacked critical indicators, suffered a disconnect in terms of the logical sequence between the intermediate results indicators (IRIs) and the PDO indicators, combined with inaccurate and /or overestimation of targets (see section 9a for details).

Based on the above-mentioned assessment, Quality at Entry is rated Moderately Unsatisfactory. This rating reflected significant shortcomings related to a poorly formulated PDO, weaknesses in the design of components and activities including not incorporating sufficient risk mitigation measures, M&E design weaknesses, and an inefficient mechanism for disbursement of project funds.

Quality-at-Entry Rating

Moderately Unsatisfactory

b. Quality of supervision

This project experienced external challenges during implementation. These included a severe earthquake in April 2015 followed by a fuel crisis, and finally COVID-19 restrictions in 2020. These external events delayed the implementation of sub-projects and slowed down disbursements. In addition, Nepal has a challenging mountainous geography that made supervision of individual sub-projects difficult. The Bank

conducted 11 supervision missions. According to the ICR (paragraph 69) the "team generally demonstrated expected levels of supervision and quality reporting through implementation." The team worked to address design issues and facilitate implementation toward achievement of the PDO. Most importantly, the team addressed design shortcomings through restructurings to incorporate additional support on TA and capacity development. Also, critical delays in disbursement were addressed by redesigning the disbursement mechanism. In addition, the Bank team's presence in Nepal helped establish a good working relationship with APEC, which facilitated addressing the disbursement issue.

However, there were a number of shortcomings. Social safeguards was rated satisfactory throughout implementation despite that it suffered from delayed and insufficient compliance. Also, the frequent turnover of TTLs delayed redesigning the project and according to the ICR (paragraph 69) "the project lost some of its momentum, such as with regard to gender co-benefits monitoring." Finally, the Bank's decision could have been more flexible on the project extension when there was a request by the client-and given the COVID-19 related disruptions. However, the Bank decided not to extend the project, as it was running for about seven years and had been extended for 20 months. While a more flexible consideration could have been given to further support sub-projects and provide extensive TA utilizing the unused funds, Bank support to Nepal would continue through the SREP-funded Private Sector-led Mini-grid Energy Access Project (P149239). This project would accommodate the support for biogas sub-projects. The ICR (paragraph 70) noted that this alternative approach was acceptable to the client.

Quality of Supervision is rated Moderately Satisfactory. This rating reflects moderate shortcomings. While supervision worked to improve the design, this was done with delay, and there were gaps in the safeguard compliance and reporting. Finally, the project implementation could have benefited from a more flexible Bank decision on project extension.

Summary of Bank Performance Assessment. Quality at Entry is rated Moderately Unsatisfactory. This rating reflected significant shortcomings related to weaknesses in the design of components and activities including not incorporating sufficient risk mitigation measures, M&E design weaknesses, and an inefficient mechanism for disbursement of project funds. Supervision is rated Moderately Satisfactory. This rating reflected moderate shortcomings. While supervision worked to improve the design, this was done with delay, and there were gaps in the safeguard compliance and reporting.

Therefore, and based on the above-mentioned assessment and ratings, Bank Performance is rated Moderately Satisfactory.

Quality of Supervision Rating
Moderately Satisfactory

Overall Bank Performance Rating
Moderately Satisfactory

9. M&E Design, Implementation, & Utilization

a. M&E Design

- The PAD did not include a Theory of Change (ToC) or results chain. Nevertheless, the ICR included an ex-post ToC that was constructed based on the PDO, the project activities and the results indicators as reported in the PAD. Overall, the ToC in the ICR reflected the relation between the project inputs, outputs, outcomes and long-term outcomes. While the PDO was poorly formulated, the reconstructed ToC included a better formulation of Objectives. However, the original ToC lacked dedicated PIU and stakeholders capacity building activities. This was later addressed during implementation by the addition of a new component.
- The PDO was assessed through two PDO outcome indicators: 1. Off-grid biogas generated for thermal application; and 2. Off-grid biogas electricity generated. While the two indicators were directly linked to the PDO, the target for the first indicator mistakenly reflected total installed capacity by Year five rather than total biogas generated for thermal application in Year five, and the target for the second indicator was overestimated.
- The Results Framework (RF) included four intermediate results indicators (IRIs). These indicators while connected to the PDO suffered from some design issues, for example, while the small (12 m3) biogas sub-projects and large (100 m3) biogas sub-projects were counted the same in the RF, despite the huge difference in terms of the impact of the sub-projects and the effort to develop the sub-projects. This resulted in a situation where the project achieved its PDO targets but fell short on its intermediate outcome indicators. Also, the targets for IRIs 3 and 4 were not set during preparation and were set during the restructuring. The RF also lacked indicators to assess capacity development of the AEPC and the private sector, for example, the number of developers or municipalities trained for novel biogas technologies and O&M, or the number of AEPC PIU staffs trained to review sub-project proposals were not captured as IRIs (ICR, paragraph 55).
- The original design M&E framework did not allow an ex post quantification of the logical sequence toward the development impact. The RF design should have reflected that the achievement of IRIs (quantifying outputs and/or intermediary outcomes) combine toward achieving the PDO outcomes, which would allow an ex post quantification of the logical sequence toward the development impact. The RF also did not capture human capital elements to further understand the project's longer-term effects, since the aim was to support the ability of the Nepalese stakeholders, including the Government and private sector, to commission larger biogas projects on their own in future (ICR, paragraph 55).
- Overall, M&E design suffered from shortcomings related to the Results Framework (RF). Specifically, the RF lacked critical indicators to assess improvement in capacity, suffered a disconnect in terms of the logical sequence between the IRIs and PDO indicators, combined with inaccurate and /or overestimation of targets.

b. M&E Implementation

- M&E implementation was handled by AEPC. According to the ICR (paragraph 57), AEPC had insufficient M&E capacity and insufficient funds to support M&E activities. This delayed M&E implementation.
- The lack of M&E funds and limited AEPC capacity continued until it was addressed by the Bank through the restructuring in July 2016. However, an M&E expert was only recruited in 2017, three years into effectiveness (ICR, paragraph 59).
- The AEPC provided periodical reporting on the RF indicators. A database management system was established in Excel format to manage the data and monitor the progress. M&E was carried

out in each stage of the sub-project cycle based on the information available in the testing and commissioning reports, feasibility study reports, and post-completion verification reports, as well as the consolidated information in the meter reading report and the monitoring reports.

- Verification of the M&E data by third-party financial and technical consulting firms was only done at a later stage of implementation. This was to ensure the output amount and quality and end-use applications matched what was reported through AEPC.
- Periodic evaluation on lessons learned from sub-project pipeline reviews was not recorded (ICR, paragraph 55).
- Restructuring and revision of targets. The targets for both PDO indicators were revised three times. Also, the target value for IRI 1 (number of large biogas proposals submitted for investment evaluation) was revised downward from 400 to 350 to reflect the latest cost calculations. The target values of IRIs 3 and IRI 4 (number of off-grid biogas and/or electricity generation plants created and made operational by the project) were newly set as 340 (commercial) and 10 (municipal), as they were not set in the original RF. Revision of targets was necessary to reflect the situation on the ground, for example, the target for PDO outcome 2 was reduced from 30 GWh at appraisal to 4.50 GWh by 2020. This reduction reflected the improvement in electricity supply in the country over final couple of years of the project. Consequently, interest among developers to implement the biogas plants for electricity generation was reduced.

c. M&E Utilization

- According to the ICR (paragraph 61) M&E data was used to ensure optimal impact through restructurings to some extent. Data was also used to justify restructurings of the project to better reflect the impact. For example, target values for PDO indicators were revised, reflecting the shift in developers' interest from electricity generation to thermal application sub-projects, and the change in average sub-project size.

Summary of M&E Quality Assessment. M&E design suffered from notable shortcomings that were partially corrected during restructuring. M&E implementation suffered from delays due to lack of funds and limited capacity. M&E utilization was limited for a project that aimed to promote new technologies. Overall, it was not possible to capture the capacity element, timely verify the accuracy of the data collected, capture the causal links in the ToC, and assess the longer-term impact of the project (ICR, paragraph 62). Therefore, the overall quality for M&E is rated Modest.

M&E Quality Rating

Modest

10. Other Issues

a. Safeguards

The Environmental risk rating of the project was Category B (Partial assessment). The project triggered a total of six safeguard policies, five environmental and two social safeguard policies as follows: (a) Environmental Safeguards: Environmental Assessment (OP/BP 4.01), Natural Habitats (OP/BP 4.04), Forests (OP/BP 4.36), and Physical Cultural Resources (OP/BP 4.11),(b) Social Safeguards: Involuntary

Resettlement (OP/BP 4.12) and Indigenous Peoples (OP/BP 4.10). The activities proposed were expected to be small and would not cause any significant adverse social impact on the community from land acquisition and resettlement. The potential positive environmental impacts from Waste-to-Energy activities to be supported under the project included better reuse of waste, cleanliness and better waste management. The adverse environmental impacts envisaged includes foul odor, air pollution, risks of disease spread, contamination of water bodies, occupational and community health & safety risks in and around the facility, land pollution, and GHG emission (PAD, paragraph 26). To mitigate any adverse impacts, a social management framework (SMF) and an Environmental Management Framework (EMF) were prepared. The SMF included a Resettlement Policy Framework (RPF), a framework for Vulnerable Community Development (VCDF), gender development (GDF) and community consultation and disclosure (CCDF). These documents were disclosed in country on December 13, 2013 and in Bank's InfoShop on December 16, 2013.

Compliance with Environmental Safeguards. The environmental safeguard rating of the project was downgraded in 2018 from satisfactory to moderately satisfactory. Biogas sub-projects below 100 m3 per day of biogas production were considered Category C, and those above 100 m3 per day being considered Category B. Category B sub-projects were required to have an Environmental and Social Impact Assessment (ESIA) and SREP clearance, and Category C sub-projects were required to have an Environmental and Social Management Plan (ESMP). The ICR (paragraph 63) noted that some issues were raised with regards to the quality of safeguard documents and monitoring performance. Also, at the later stage of implementation there were concerns regarding the planning of plants in areas at risk of flooding; health and safety concerns regarding the transport of biomass feedstock. There was an explosion during the transportation of compressed biogas that resulted in material property damage.

Compliance with Social Safeguards. Social safeguards rating was maintained as satisfactory throughout implementation despite delays and insufficient compliance (ICR, paragraph 69). The grievance redress mechanism (GRM) was prepared and disseminated to all sub-projects, but with a delay in its establishment (it was established only in 2018). The ICR (paragraph 64) noted that the "actual functioning and accessibility of the GRM, as well as efficiency in uptake and resolution of complaints, remained weak." Although a grievance was received in October 2018 with regard to a supposed miscommunication between the developer and a construction company regarding the subsidy, and fully addressed and closed in November 2018.

The ICR did not include an explicit statement on compliance for any of the triggered safeguard policies.

b. Fiduciary Compliance

Financial Management (FM). FM was strengthened by hiring the FM consultant in March 2015. FM reports were generally submitted on time. However, there were issues relating to slow disbursement rate owing to slow implementation progress, delays in submission of the Project's external audit reports, delays in conducting internal audits, and the frequent turnover of FM consultants (ICR, paragraph 66). The ICR (paragraph 66) reported that compliance with two Grant Agreement FM-related legal covenants was delayed. The ICR did not comment on the status of the final audit reports.

Procurement. According to the ICR (paragraph 65) procurement activities were "compliant with the World Bank rules." There were delays in the recruitment of a procurement specialist and procurement of non-

consultant services. Also, the client's capacity was lacking to keep Systematic Tracking of Exchanges in Procurement (STEP) updated and process procurements on time (ICR, paragraph 65). This situation was remedied and as implementation progressed the client capacity improved and STEP was properly updated on time.

c. Unintended impacts (Positive or Negative)

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d. Other

The Project produced around 88,000 MT of organic fertilizer per year and substituted 0.6 million LPG cylinders per year, both of which had to be imported from India prior to the project. Agri-based industries in Nepal benefitted from the project's biogas production to generate electricity and meet the captive energy demand of their respective businesses. Lastly, the GoN initiated approaching and leveraging funding from other donor partners to scale up implementation of the large biogas plants in the country (ICR, paragraph42).

11. Ratings

Ratings	ICR	IEG	Reason for Disagreements/Comment
Outcome	Satisfactory	Moderately Satisfactory	Efficiency was rated Modest.
Bank Performance	Moderately Satisfactory	Moderately Satisfactory	
Quality of M&E	Modest	Modest	
Quality of ICR	---	Substantial	

12. Lessons

The ICR included four lessons. The following two are emphasized with some adaptation of language:

1. For an innovative pilot project that aims to introduce a new technology in the country involving the private sector, the Bank's support combined with the government's subsidy mechanism are useful for initial market creation through cost buy-down and risk-sharing. Projects aiming to create a market for a new technology need to incorporate critical elements into the project's design and supervision arrangements to ensure a transition towards commercial market viability after the project period. For an innovative pilot project that aims to introduce a new technology in the country involving the private sector, the Bank's support combined with the government's subsidy mechanism are useful for initial market creation through

cost buy-down and risk-sharing. This increases interest from private developers on a new technology and help create a market. However, it takes time to fully develop a new market where the requisite expertise and technologies can be obtained locally in a cost-effective manner. Therefore, the Bank's extended support is needed for market development beyond the project's completion and the graduation from the subsidy to ensure that the sub-projects will continue to be commercially viable. In particular, a longer implementation period, flexible project design, and/or hands-on supervision ideally with the Bank team's in-field presence are helpful arrangements to proactively respond to the changing needs in the sector over the project period until the market is sufficiently developed.

2. If M&E design does not include a Results Framework (RF) with indicators that capture the causal links toward the PDO outcomes, accurate assessment of project outcomes will be challenging. For an operation supporting sub-projects whose amount of energy output, construction period, and capital outlay significantly vary depending on their size, such differences should be well considered when designing the RF, indicators, and disbursement arrangements. One of the main rationales for developing the RF is that it enables quantifying the value of the funds invested in activities and how they translate into development impacts across a ToC. Given this, an intermediate indicator that only counts the number of sub-projects developed under the operation and does not take into account the sub-projects' outputs is not sufficient to capture the causal link toward the PDO outcomes or longer-term impacts. Future operations will need to either prepare separate intermediary indicators by project size or better model the causal link across the ToC. Furthermore, the disbursement arrangement should reflect the difference in nature between larger and small sub-projects.

13. Assessment Recommended?

No

14. Comments on Quality of ICR

Quality of Evidence. The ICR acknowledged that the M&E system was problematic. That said, enough data was generated to track the progress of activities and the achievement of the PDO.

Quality of Analysis. The ICR provided clear linking between evidence and findings to the extent possible and used the evidence base to serve the arguments under the different sections, in particular the discussion on outcomes. However, improvement in capacity was not assessed due to the absence of indicators to directly measure this element.

Lessons. Lessons reflected the project experience and were based on evidence and analysis.

Results Orientation. The ICR included a comprehensive discussion on the achievement of the PDO. The discussion was adequately balanced between reporting on the achievement of outcome indicators and what the project actually achieved on the ground.

Consistency with guidelines. The ICR successfully used the available data to justify most of the assigned ratings. Discussion of outcomes was adequate. The efficiency analysis provided good justification on the validity of the project investments.

Conciseness. The ICR provided comprehensive coverage of the implementation experience and candidly reported on shortcomings. Reporting on safeguards did include an explicit statement on compliance. The ICR did not report on the status of the final audit report nor did it state an explicit reason for the twenty months extension. Finally, the ICR Data Sheet (page ii) noted a fifth project restructuring on June 11, 2020, when the amount disbursed was US$2.25 million. However, the ICR did not report a reason(s) for this restructuring nor was it discussed in the main text. In a further communication, the project team explained that there were only four restructurings during implementation and the fifth project restructuring reported in the data sheet was a system glitch. The team also explained that there are no requirements either in the Bank's Guidance on ICR or FM manual to report status of the final audit report in ICR.

Overall, the Quality of the ICR is rated Substantial, but with minor shortcomings.

a. Quality of ICR Rating
Substantial