

Validation Report
February 2021

The Kingdom of Bhutan: Rural Renewable Energy Development Project

Reference Number: PVR-764
Project Number: 42252-022
Grant Number: 0228



Raising development impact through evaluation

ABBREVIATIONS

ADB	– Asian Development Bank
BDB	– Bhutan Development Bank
BPC	– Bhutan Power Corporation
DMF	– design and monitoring framework
DOL	– Department of Livestock
DRE	– Department of Renewable Energy
EIRR	– economic internal rate of return
EMP	– environmental management plan
EMR	– environmental management report
FIRR	– financial internal rate of return
GAP	– gender action plan
GHG	– greenhouse gas emission
IEE	– initial environmental examinations
kW	– kilowatt
LPG	– liquefied petroleum gas
O&M	– operation and maintenance
PCR	– project completion report
RSPN	– Royal Society for Protection of Nature in Bhutan
SHS	– solar home system
TA	– technical assistance

NOTE

In this report, “\$” refers to United States dollars.

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PROJECT BASIC DATA

Project number	42252-022	PCR circulation date	4 Nov 2020	
Grant number	0228	PCR validation date	Feb 2021	
Program name	Rural Renewable Energy Development Project			
Sector and subsector	Energy	Electricity transmission and distribution Renewable energy generation - biomass and waste Renewable energy generation - solar Renewable energy generation - wind		
Strategic agendas	Environmentally sustainable growth Inclusive economic growth			
Safeguard categories	Environment		B	
	Involuntary resettlement		B	
	Indigenous peoples		C	
Country	The Kingdom of Bhutan		Approved (\$ million)	Actual (\$ million)
ADB financing (\$ million)	ADF: 21.59	Total project costs	24.91	24.14
	OCR: 0.00	Grant (G0228)	21.59	21.03
		Borrower	3.32	3.11
Approval Date	29 Oct 2010	Effectiveness date	13 Mar 2011	22 Mar 2011
Signing Date	13 Dec 2010	Project completion date	30 Jun 2015	31 Dec 2017
		Financial closing date	—	10 Apr 2019
Project Officers	H. Kobayashi	Location	From	To
	T. Sasaki	ADB headquarters	Feb 2011	Jul 2012
	N. Yoneda	ADB headquarters	Jul 2012	Sep 2014
	T. Shiira	ADB headquarters	Sep 2014	Oct 2015
	S. Kurimoto	ADB headquarters	Oct 2015	Dec 2015
	H. Kobayashi	ADB headquarters	Jan 2016	Jun 2017
	T. Sugimoto	ADB headquarters	Jul 2017	Oct 2017
		ADB headquarters	Oct 2017	May 2019
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ADB = Asian Development Bank, ADF = Asian Development Fund, IED = Independent Evaluation Department, IESP = Sector and Project Division, OCR = ordinary capital resources, PCR = project completion report.

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I. PROJECT DESCRIPTION

A. Rationale

1. Bhutan has abundant renewable energy resources, and most of the country's generated electricity is hydropower. Power exports, of which 70% went to India, comprised more than 40% of the country's revenue.¹ In 2010, a large percentage of the rural population had no access to clean energy. Under the Government of Bhutan's Tenth Five-Year Plan, all rural households were

¹ ADB. 2010. *Report and Recommendation of the President to the Board of Directors: Proposed Grant to the Kingdom of Bhutan for the Rural Renewable Energy Development Project*. Manila.

to have access to electricity by 2013.² In December 2009, rural electrification in Bhutan was at 60% and, following the completion of ongoing programs, about 8,500 households were expected to still need grid-electrification to meet the 2013 target. About 1,900 households would also require off-grid solutions. Despite Bhutan's annual net power surplus, the country had power shortages, particularly during dry winters when hydropower generation was less due to low river flows. Domestic demand for electricity grew at an average annual rate of 17% from 2004 to 2009 and was expected to increase further as customers connect to the grid when ongoing rural electrification programs were completed. Bhutan prepared its renewable energy policy, which was finalized in 2013, targeting the diversification of energy supply through wind, solar, biomass, and small and micro hydropower.³

2. In 2010, about 70% of the country's population lived in rural areas, where kerosene and fuelwood were the main sources of primary energy for cooking and heating, leading to indoor air pollution and health problems. To meet the energy demand of the rural population, there was a need to provide access to clean cooking fuels and technology that could improve energy efficiency consumption and reduce deforestation. The Asian Development Bank (ADB) provided a grant of \$21.59 million from its special funds' resources to support Bhutan in addressing local energy demand and national energy security and contribute to socioeconomic development.

B. Expected Impact, Outcome, and Outputs

3. The project's expected impact was sustained inclusive economic growth by widening access to reliable and affordable clean energy services. Its intended outcome was expanded coverage and mix of clean energy supply in a sustainable manner. In particular, the project was to contribute to achieving 100% rural electrification of all households identified in the Rural Electrification Master Plan 2005 and diversifying energy supply sources to meet a growing demand, particularly during the winter season.

4. The project had four targeted outputs: (i) on-grid rural electrification sourced from hydropower and its related skills training and livelihood improvement activities, (ii) off-grid rural electrification sourced from solar power and its related skills training and livelihood improvement activities, (iii) wind power generation plants, and (iv) domestic biogas plants.

C. Provision of Inputs

5. The project was approved in October 2010 and both grant and project agreements were signed in December 2010. The grant became effective in March 2011. The project was scheduled for completion at the end of June 2015 but was extended twice with a total extension of 30 months.⁴ The first was until 31 December 2016 to improve power reliability within the project area through the construction of a new 132 kilovolts tower-type distribution line, as agreed during ADB's midterm review in October 2013. The second was until 31 December 2017 to support the construction of additional biogas plants due to high demand, and to allow time to make the final

² Royal Government of Bhutan, Gross National Happiness Commission. 2009. *Tenth Five Year Plan, 2008–2013*. Thimphu.

³ Royal Government of Bhutan. *Alternative Renewable Energy Policy 2013*. Thimphu; and ADB. 2008. *Technical Assistance to the Kingdom of Bhutan for Promotion of Clean Power Export Development*. Manila. The policy was finalized in 2013 with support from ADB.

⁴ A first extension was approved in a memo of 6th August 2015 to extend the project by 18 months to 31st December 2016, although the memo indicated 12 months. A second extension was approved on 9th December 2016 to 31 December 2017, which indicated a cumulative extension of 24 months rather than 30.

payment for the construction of the new distribution line.⁵ The project was completed in December 2017.

6. The cost of the project at appraisal was \$24.91 million, with ADB grant financing of \$21.59 million or 86.7% of the total. The government, SNV Netherlands Development Organization, and other stakeholders provided \$3.31 million or 13.3%.⁶ The grant for the on-grid rural electrification component was to be relented to Bhutan Power Corporation (BPC) under a subsidiary financing agreement. The grant for the wind component was to be used as equity capital by BPC, and that for the biogas microfinance was to Bhutan Development Financing Corporation to establish a Biogas Fund.

7. The actual project cost was \$24.14 million, about 3% less than the original estimate. ADB's grant was reduced to \$21.03 million, while the government financed \$3.11 million. The budget was reallocated between the project components based on the agreed changes during the midterm review in 2013. The off-grid solar costs were less than estimated due to the lower number of households targeted for solar home systems (SHS) since many connected to the grid more quickly than expected. The wind power capacity was increased from 360 kilowatts (kW) to 600 kW during the detailed design, adding to the estimated costs at appraisal. The cost of the biogas component increased due to the construction of additional domestic biogas plants—from 1,600 estimated at appraisal to 5,003 at completion.

8. At appraisal and to support the implementation of the biogas program, 72 person-months—36 international and 36 national—of consulting services were envisaged at a cost of about \$0.62 million.⁷ Nine international person-months at a cost of \$0.31 million were also proposed to support the off-grid and wind programs. The total cost of the proposed consulting services was \$0.93 million.⁸ ADB's project completion report (PCR) indicated that \$2.2 million was disbursed for consulting services. The large increase was due to the expanded biogas program, where implementation support cost was at \$1.96 million. The consulting services for the wind program was \$0.15 million lower than the \$0.21 million at appraisal. The remaining consulting services were used for the off-grid component. Neither ADB's nor the government's PCR indicated any figure on actual person-months.

9. The project was classified as category B for environment and involuntary resettlement and C for indigenous peoples at appraisal. The project prepared nine initial environmental examinations (IEEs) and environmental management plans (EMPs) for the six rural electrification subprojects and the biogas, SHS, and wind power pilots. These reports concluded that the activities would have minimal adverse environmental impacts, mainly during construction. All EMPs contained appropriate mitigation measures. One resettlement plan was prepared for an estimated five households affected by the wind power component due to the loss of some land—equivalent to less than 10% of the total. The project did not affect any household due to a change in the wind pilot location. The EMPs and resettlement plan included the establishment of grievance redress mechanisms.

⁵ This also takes into account the unforeseen cancellation of the proposed Energy Plus program (Phase 2), which was planned to support biogas and be funded by the Government of Norway, Department of Renewable Energy (DRE), and Bhutan Development Bank (BDB).

⁶ These included contributions from SNV Netherlands Development for capacity building support (\$0.27 million) and biogas users' upfront equity (\$0.3 million).

⁷ It is unclear if the contribution from SNV Netherlands Development is already included in the \$0.62 million.

⁸ The report and recommendation of the President (RRP) indicated 9 person-months whilst the TA project indicated 3 person-months for the off-grid solar and 7 person-months for the wind component. Thus, a total of 10 person-months.

10. The project was categorized as gender mainstreaming and aimed to increase women's access to affordable and reliable clean energy and technologies in project sites. A gender action plan (GAP) was prepared at appraisal and had five key features: (i) gender review of energy sector programs and policies; (ii) training of 120 village technicians, including 40% women, in on-grid and off-grid electricity operation and maintenance (O&M);⁹ (iii) distribution of 4,500 awareness campaign materials on the safe and productive use of electricity, including SHS; (iv) training of 200 women in energy-based livelihood skills; and (v) incorporation of gender sensitive indicators in the project performance monitoring system, and baseline and end-line data. All were in line with Bhutan's Tenth Five-Year Plan, 2008–2013. The design and monitoring framework (DMF) also planned to provide reliable power supply to 5,075 households, of which 30% were headed by women; and install SHSs for 1,896 households, of which 30% were headed by women.

11. The project was implemented with the Improving Gender Inclusive Access to Clean and Renewable Energy in Bhutan, Nepal, and Sri Lanka project financed by the Japan Fund for Poverty Reduction.¹⁰ The GAP's gender mainstreaming activities were mainly implemented by an international nongovernment organization through its national partner nongovernment organization—the Royal Society for Protection of Nature (RSPN) in Bhutan. The exception was the training of village technicians in on-grid electricity maintenance and off-grid electricity O&M, which was carried out by the Department of Renewable Energy (DRE) and BPC. There was no technical assistance (TA) attached to the project.

D. Implementation Arrangements

12. DRE was the executing agency, replacing the Department of Energy due to a change in mandate brought about by Bhutan's Alternative Renewable Energy Policy 2013. There were four implementing agencies: (i) BPC for the on-grid rural electrification and wind power components, (ii) DRE for off-grid solar rural electrification, (iii) the Department of Livestock of the Ministry of Agriculture and Forests (DOL), and (iv) Bhutan Development Financing Corporation, later renamed the Bhutan Development Bank (BDB) for the biogas component. A project steering committee provided oversight, and a specific biogas steering committee was also established. Both were chaired by the DRE director general. The BPC managing director served as a member of the project steering committee while the BDB managing director and DOL director general were both members of the biogas steering committee. DRE signed a memorandum of understanding that detailed operational arrangements with each implementing agency. The PCR considered the arrangement adequate. The PCR also noted that, as intended at project appraisal, the project was well coordinated with the Japan International Cooperation Agency and the Austrian Development Agency regarding on-grid rural electrification, and with SNV Netherlands Development Organization and the United Nations Development Programme regarding biogas during both the design and implementation phases.

13. Consulting services were contracted to assist in implementation and in addressing technical elements of the projects. These involved the design and bidding for the wind power plant and masts, capacity building, and implementation services for the biogas program.

⁹ ADB (South Asia Department [SARD]). 2015. ADB Review Mission Aide Memoire for Improving Gender-Inclusive Access to Clean and Renewable Energy in Bhutan, Nepal, and Sri Lanka. 8 June (internal). The target was reduced to 20% during the review mission dated 25-30 May 2015 due to the difficulty in finding women interested to be trained and the reduction in the SHS target.

¹⁰ ADB. 2020. *Implementation Completion Memorandum: Improving Gender-Inclusive Access to Clean and Renewable Energy in Bhutan, Nepal, and Sri Lanka*. Manila.

14. There were 70 covenants in the grant and project agreements. The PCR noted that the executing agencies fully complied with all except two related ones—neither BPC nor DRE included direct payments from ADB in their project financial statements. However, these were to be included in an additional audit report to be submitted in November 2020.¹¹ However, this validation identifies another covenant that was partially complied with—the submission of environmental safeguard monitoring reports (EMRs), which was done for each project but not annually as required. The PCR indicated that the “IEE and EMP were implemented accordingly and were not updated during the course of the project as there were no changes in location nor project alignment, and no unanticipated impacts were reported in the EMRs submitted.” There was a change in location of the pilot wind project, but it is unclear if a new IEE was prepared.

15. At project appraisal, the project risks were considered low based on the mitigation measures put in place. The potential risks identified and the associated mitigation measures included: (i) an increase in costs of construction materials and transportation due to higher fuel prices mitigated with price contingencies and estimates based on actual recent relevant bid prices, (ii) delays in construction was to be mitigated by advance contracting and retroactive financing, and (iii) lack of technical and operational management skills for renewable energy deployment was mitigated by using proven technology and including capacity building and implementation support within the project. Any risks associated with operational and financial sustainability were mitigated through a memorandum of understanding between the DRE and the implementing agencies and the government assured additional resources, if required. These measures successfully mitigated the risks although there were some contract- and procurement-related project delays.

II. EVALUATION OF PERFORMANCE AND RATINGS

A. Relevance of Design and Formulation

16. The PCR rated the project relevant. It was aligned with the government’s objectives of providing electricity to all rural households by 2013, as set out in the rural electrification master plan 2005 and in Bhutan’s Tenth Five-Year Plan, and with the government’s objective of improving national energy security through the diversification of renewable sources. Diversification was appropriate given Bhutan’s reliance on run-of-river hydropower, which is seasonal and difficult to control during the dry winter season, and the rural households’ reliance on fuelwood for cooking, which contributed to deforestation and indoor air pollution. The project was aligned with ADB’s (i) energy sector strategy in Bhutan with a focus on operational sustainability, (ii) country strategy and program for Bhutan for 2006–2010, and (iii) results framework.¹² The project’s outputs were designed to complement the efforts of the government and other development partners on rural energy. The PCR indicated that the project was well coordinated with other activities of development partners during design and implementation.

17. This validation notes that the DMF is logical and has appropriate linkages between the outputs, outcome, and impact. The outputs and outcomes were aligned with Bhutan’s energy sector and national development plans while the performance indicators were appropriate and well-defined. However, it is not clear how the project would contribute to the project outcome of

¹¹ According to the PCR, this was due to a misunderstanding on the audit requirement to include direct payments in project financial statements. Under the direct payment procedure, ADB directly paid the contractors based on full supporting documents that BPC and DRE submitted. Neither BPC nor DRE included such payments in their financial statements. The implementing agencies were expected to submit additional audit reports for direct payments by 1 November 2020, subject to coronavirus considerations.

¹² ADB. 2005. *Country Strategy and Program: Bhutan, 2006–2010*. Manila.

BPC's continued financial health including sufficient debt service coverage and net profit generation when the domestic electricity tariff is lower than the cost of production. During implementation, there were minor changes to the approved output targets for the off-grid rural electrification and biogas components.¹³ The number of user manuals to be distributed was reduced from 4,500 to 3,600 due to the revised SHS targets. The proportion of women among the village technicians to be trained was reduced from 40% to 20%; and the target number for domestic biogas plants was increased twice to 4,600 by December 2017.¹⁴ The resulting project design was more relevant following the minor change in scope and targets.

18. At completion, the project remained consistent with the policies and strategies of the government and ADB. In particular, it was aligned with Bhutan's Eleventh Five-Year Development Plan 2013–2018 with a strategic focus on equitable energy sector development across the country,¹⁵ with ADB's Strategy 2030, and the country partnership strategy for Bhutan 2014–2018 by enhancing renewable energy development supporting the pillars of inclusive economic and environmentally sustainable growth.¹⁶ This validation assesses the project relevant since the project was aligned with the government's and ADB's objectives at appraisal and completion, the DMF was logical, and minor changes in the project scope and targets improved the project's relevance.

B. Effectiveness in Achieving Project Outcomes and Outputs

19. The PCR rated the project effective. All five outcome indicators were achieved or exceeded: (i) Bhutan achieved a national electrification ratio of 99.9% in 2015, equivalent to the target of an increase in access to electricity to 100% by 2015; (ii) access to clean renewable energy sources for all off-grid rural households was achieved by 2017 but later than the target of 2015; (iii) BPC's debt service coverage was 4.1, with a net profit of Nu1,281 million in 2017 exceeding the targeted debt service coverage (minimum 1.2); (iv) 153, including 31 women, trained village technicians were deployed exceeding the target of 120; and (v) greenhouse gas emissions (GHG) were reduced by 52,103 tons of carbon dioxide equivalent per year exceeding the target of 25,000 tons. Other than BPC's financial health, the project outcome targets were achieved as a direct result of the project outputs as well as the contributions from other rural renewable energy interventions financed by the government and other development partners.¹⁷

20. The PCR indicated that the project exceeded or achieved all seven output indicators: (i) reliable grid-connected electricity was provided to 5,917 rural households higher than the target of 5,075 rural households by 2015, and all women headed households in the project areas were connected; (ii) 3,932 new and rehabilitated SHS were installed—comprising 1,389 new SHS and

¹³ ADB (SARD). 2014. Minor Scope Changes and Reallocation of Grant Proceeds. Memorandum. 4 March (internal). The total number of SHS was reduced from 4,396 to 3,000 (new and rehabilitated) and the target number of biogas units was increased from 1,600 to 2,700 due to high demand. There was no recorded minor scope approval when the target was increased again to 3,600 before another 1,000 was added to total 4,600 by December 2017, following the ADB review mission in May 2017.

¹⁴ The PCR indicated that this was a result of the reduced SHS but it was due to the difficulties in finding sufficient women to train.

¹⁵ Royal Government of Bhutan, Gross National Happiness Commission. 2013. *Eleventh Five-Year Plan 2013–2018*. Thimphu.

¹⁶ ADB. 2014. *Country Strategy and Program: Bhutan, 2014–2018*. Manila.

¹⁷ Other development partners included Japan International Cooperation Agency and the Austrian Development Agency, which both financed parallel rural electrification projects; SNV Netherlands Development Organization, which established a comprehensive support for biogas and its users (farmers); and the United Nations Development Programme, which provided a comprehensive livelihood program for dairy farmers including cooking stoves based on the pilot biogas plants in coordination with ADB.

2,543 rehabilitated systems—compared to the revised target of 3,000; (iii) 153 village technicians, including 31 (20%) women, received training in on- and off-grid electricity O&M compared to the revised target of 120 including 20% women; (iv) 159 women participated in livelihood improvement programs, compared to the 200 women targeted by 2014—the target was categorized as substantially achieved; (v) 4,000 user manuals, 80 banners, and 40 compact discs on electricity use awareness were distributed and 4,891 participants, including 2,593 women, attended awareness raising activities compared to a revised target of 3,600 distributed user manuals; (vi) a 600 kW (2x300 kW) wind power plant was constructed at Rubessa and connected to the 11 kilovolts grid, higher than the 360 kW target, while three wind masts were installed at Chelela, Rubessa, and Tshimasham by 2016, later than the 2014 target; and (vii) 5,003 domestic biogas plants and seven research and pilot plants were constructed by 2017 compared to the revised target of 4,600 by 2017.¹⁸

21. The project adhered to environmental and social safeguard policies. There were no reported issues or complaints. Its safeguard categories were appropriate. The PCR indicated that no households were relocated due to the change in location of the wind project.¹⁹ As a result, the project was reclassified as C for involuntary resettlement. The PCR also indicated that the implementation of the EMPs was closely monitored. The executing agency's quarterly progress reports included reporting on environmental and social safeguards. The PCR and EMRs indicated that all environmental and social safeguard mitigation measures and plans were satisfactorily implemented. All project components were compliant with Bhutan's and ADB's safeguard regulatory requirements. There were no adverse environmental and social safeguard impacts from the implementation of the project.

22. The project effectively carried out gender mainstreaming measures through completion of all three activities and achievement of the seven gender targets. BPC found it difficult to find women to be trained in the O&M of electricity systems since most women preferred job opportunities in other sectors or were not interested in working in remote areas, attending to customer complaints at night and climbing poles. The RSPN also encountered the similar challenges in finding women to train in energy-based livelihood skills. Despite these challenges, the GAP was successfully implemented with strategic gender benefits related to, among others, gender equality in human development.²⁰ All women-headed households in the project areas had grid electricity or an SHS at project completion. The end-line survey conducted by RSPN showed that the project contributed to improving the lives of many women. Given that the project outcome and output targets were largely achieved or exceeded, that the safeguard performance was satisfactory, and that gender mainstreaming measures were effectively carried out, this validation assesses the project effective.

¹⁸ This validation notes that the biogas component included a subsidy per unit, a microfinance loan, and household training. In addition, 1,300 households still had not received training at project completion.

¹⁹ ADB (SARD). 2013. Consultation and Review Mission to Bhutan: Rural Renewable Energy Development Project. Back-to-office report (BTOR). 13 March (internal). The site of the wind pilot project changed following a review of the wind resource assessments at three sites. The original IEE was carried out for Tsimalakha in Chukha while the agreed site was Rubessa in Wangdue. In this BTOR, ADB required a formal request with environmental clearance and a revised resettlement plan for the changes. The June 2015 EMR for the wind pilot indicated that environmental clearance was obtained from the National Environment Commission in September 2014. It is unclear if any public consultation was carried out on the new site nor if a new IEE was prepared. The EMP was unchanged from the original since it still refers to project affected persons when there were none.

²⁰ Results included: (i) 31 women village technicians (20% of trainees) were trained in the O&M of on-grid and off-grid solar systems; (ii) 2,593 women (53% of participants) were included in the user education program for safety and maintenance awareness; and (iii) 159 women (59% of participants) received skills training to enhance their livelihoods.

C. Efficiency of Resource Use

23. The PCR rated the project efficient, based on the recalculated project economic internal rate of return (EIRR) of 16.9%, which was higher than the 13.9% estimated at appraisal. The PCR indicated that this was due to the increase in project outputs and the cost savings from the use of alternative energy sources. The EIRRs calculated at completion for each project component varied from 13.3% for the SHS to 24% for the biogas component, compared with 28.7% and 14.3%, respectively at appraisal. This validation notes that some of the improvement in the biogas EIRR was due to the increase in the cost of alternative energy saved. However, it is also noteworthy that the assumptions for the quantity of liquefied petroleum gas (LPG) saved for the biogas had doubled since appraisal.²¹ Adopting the same assumption at appraisal, the recalculated EIRR for the biogas component would fall to 13.3%, and the overall project EIRR to 15.9%. The reasons for the reduction in the SHS EIRR at project completion are unclear since the unit capital cost decreased and the benefits were similar, although there was an increase in O&M costs.²² The wind power component was a pilot project.

24. This validation notes that the same incremental approach was used for the economic reevaluation as at appraisal with updated project costs and benefits. In both cases, the benefits of the biogas were calculated from estimated savings in LPG and electricity while the rationale for the biogas was based on savings on fuelwood and reduction in deforestation. The environmental benefits of reduced indoor air pollution, GHGs, and fuelwood use were not quantified. Since biogas owners often save LPG and electricity, this validation sees the approach and methodology adequate.²³ Sensitivity analysis carried out at project completion, including a 20% reduction in the benefits, confirms the overall project's viability.²⁴

25. In terms of implementation, the PCR indicated that the project was twice extended to allow the use of budget savings to improve the power reliability in the project area and to support higher demand for biogas plants. The associated reallocation of the grant proceeds led to its more efficient use. This validation assesses the project efficient.

D. Preliminary Assessment of Sustainability

26. The PCR rated the project likely sustainable. The financial internal rates of return (FIRRs) were recalculated for each project component. However, those for the on-grid and SHS components were negative, which were the same as those at appraisal. The PCR indicated that, although rural electrification had clear economic benefits, the rural domestic electricity tariff in

²¹ This validation could not find the original source for the LPG assumptions. The implementing agencies' PCR (Biogas PCR, DOL, December 2017) indicated that the LPG figures are based on another report: "Success Story: Bio-digesters growing popular in the Country by PIU/BBP."

²² ADB. 2010. *Report and Recommendation of the President to the Board of Directors: Proposed Grant to the Kingdom of Bhutan for the Rural Renewable Energy Development Project*. Manila. Economic Analysis (accessible from the list of linked documents). The economic benefits of SHS were included as the cost savings from the avoided without-project investment and Bhutan's savings in the cost of kerosene and dry cell batteries. However, the high EIRR reflects the benefits of lighting and cell phone communications that can be obtained by providing access to electricity using SHS. It is unclear how the economic value of cell phone communication was included in the calculation and may explain the disparity between appraisal and project completion. The PCR EIRR excel sheets did not provide any additional details.

²³ Bhutan Development Bank Ltd. 2017. *Project Completion Report: Bhutan Biogas Project*. Thimphu.

²⁴ On the same basis as the RRP, using the most sensitive variable, the recalculated EIRR in the sensitivity analysis with a 20% reduction in benefits was 11.5%. If a more dynamic sensitivity analysis is applied and the EIRR is calculated with both a 20% reduction in benefits and such an increase in O&M, a lower EIRR of 10.5% is computed. Since this sensitivity was not tested at appraisal, this validation did not use this EIRR in assessing the project's viability.

Bhutan was lower than the cost of supply, and the calculations show that the estimated savings in kerosene did not cover the costs of the SHS. The FIRR of the biogas component was recalculated at 14% indicating that the component was financially viable since it exceeded its weighted average cost of capital of 1.2%. The FIRR of the wind component was also negative but generated sufficient revenues to cover its O&M costs.

27. The project was designed to ensure sustainability in the on- and off-grid rural electrification components by outsourcing O&M to community-based village technicians. Training was provided to 153 village technicians whose work was supervised and paid for by BPC. The O&M for the wind power plant was outsourced to the contractor, with the participation of BPC engineers, for the first 2 years of operation before being transferred to BPC. The PCR indicated that BPC had the technical and financial capacity to ensure effective O&M for the on-grid rural electrification component, and the government provided an adequate budget for the SHS. Biogas beneficiaries were responsible for the maintenance of their own plants and received technical support from DOL ensuring sustainability.

28. The PCR showed that the financial management of the executing agency and implementing agencies remained satisfactory at project completion. DRE and DOL were government departments with established financial systems. BPC and BDB were government-owned corporations. BPC complied with the financial covenants in the grant agreement. The government ensured BPC's financial sustainability through tariffs subsidized by an energy royalty.²⁵ Prior to 2017, BDB's performance was satisfactory. However, the PCR indicated that BDB suffered a net loss in financial year 2017 due to a high provision made for nonperforming loans, mainly resulting from migration to a new core banking system software.²⁶ The PCR indicated that the BDB immediately carried out measures to improve its financial performance and sustainability, including the government's infusion of equity. Also, it continued to comply with the government's prudential regulations. In terms of environmental impacts, the PCR indicated that there were no significant environmental and social impacts during implementation and the project had substantial positive social and economic impacts on rural households.

29. The PCR indicated that the sustainability of the O&M of each project component had been adequately addressed with funding identified and due to the positive FIRR of the biogas component. The institutions had the necessary managerial and technical competence, and there were no adverse environmental or social impacts. Therefore, this validation assesses the project likely sustainable.

III. OTHER PERFORMANCE ASSESSMENTS

A. Preliminary Assessment of Development Impact

30. The PCR rated the development impact of the project satisfactory. It contributed to the country's socioeconomic development including 99.9% rural electrification and energy diversification. Access to electricity improves the quality of life and contributes to poverty alleviation. Improving access to modern household cooking and heating reduces fuel costs, use of fuelwood, GHG emissions, and deforestation. Additional benefits, particularly for women, include a reduction in illnesses due to improved indoor air quality and reduced time collecting

²⁵ Fifteen percent of the power generation from Bhutan's medium-sized and large hydropower plants is capped and provided as free royalty energy to the government, which then sells it to BPC for a discounted price to provide electricity tariff subsidies mainly to residential consumers.

²⁶ The PCR also indicated that in FY2017, impairment charges and interest on loans increased and that a minimum lending rate was introduced resulting in a reduction of lending rates.

wood for fires. The training provided for village technicians, biogas supervisors and masons, and livelihood vocational training improved the economic prospects for 1,253 people, including 212 women beneficiaries.²⁷

31. The impact of the project was sustained inclusive economic growth through reliable and affordable clean energy services. At project completion in 2017, three of the impact performance targets were largely achieved: the proportion of people living below the national poverty line was 8.2% against the target of 20% by 2015; the forestry area in the country was 21.73 million hectares (71%) against the target of 72.5%; and the biomass consumption in the form of fuelwood, biogas, and briquettes was reduced by 54% during the period 2005–2014, against the target of 30% by 2020. The project contributed to exceeding ADB's results framework targets relating to renewable energy generation and distribution, and rural household connections.

32. This validation notes that one impact target was not achieved. The energy sector share of Bhutan's gross domestic product fell to 13.2% by 2017 against the target of 40% for the same year from 25% in 2007. One other impact target was unlikely to be achieved by 2020—diversification of energy supply sources through renewable energy including solar, wind, and biogas was 0.6 megawatts in 2019 against the target of 70 megawatts equivalent by 2020. Since the project contributed to a reduction in national poverty, in maintaining forestry cover, and the decrease in biomass consumption, this validation assesses the development impact satisfactory.

B. Performance of the Borrower and Executing Agency

33. The PCR rated the performances of the recipient, executing agency, and implementing agencies satisfactory. It indicated that all involved agencies showed strong ownership, commitment, and responsibility during project preparation and implementation. Grant covenants were mostly complied with. Also, ADB's procedures and guidelines were closely followed since DRE and BPC had previous experience of implementing ADB-financed projects. In the first 2 years of implementation, performance was rated as a potential problem due to the actual contract award level being lower than targeted while the level of disbursement was at 100% of set targets. The slow progress in contract awards was due to the faster than anticipated grid electrification, which meant that the households originally targeted for off-grid SHS were already covered by grid connections, and hence progress on the off-grid component was stalled. Consequently, the government agencies modified the project's technical specifications to enhance the effectiveness of its design. ADB approved a minor change in scope covering output targets in the DMF and the reallocation of grant proceeds in March 2014. The implementing agencies' PCRs provided sufficient information on the project activities, except for DRE's PCR, which did not provide adequate details on the project.²⁸ Accordingly, this validation assesses the performance of the government, executing agency, and implementing agencies satisfactory.

C. Performance of the Asian Development Bank and Cofinanciers

34. The PCR rated the performance of ADB satisfactory. ADB fielded 15 review missions, including a midterm review mission in October 2013 during which a detailed action plan to address constraints and accelerate project implementation was agreed upon with the government. ADB demonstrated flexibility in extending the project twice: on the reallocation of funds and on modifications to the output targets upon request of the executing and implementing agencies.

²⁷ Including 153 village technicians (31 women), 281 biogas supervisors (19 women), 550 biogas masons (3 women) and 269 livelihood training participants (159 women).

²⁸ For example, no figures were provided for the number of SHS installed or rehabilitated.

However, the PCR indicated that ADB's performance on financial management was less than satisfactory, noting the lack of ADB financial management staff assigned to the project. This meant that ADB did not regularly discuss the financial audit requirements and issues during implementation. Recognizing this, additional financial management staff were recruited from mid-2018 after project completion.

35. ADB's safeguard work quality was satisfactory at approval, but less than satisfactory during supervision. The back-to-office reports (BTORs) contained limited safeguard information. Only one mission included an ADB staff member with an environment specialization. Between 2011 and 2014, no EMRs were submitted, despite the issue having been raised during the midterm review mission in 2013. Six EMRs were subsequently submitted but did not cover all project activities. The PCR indicated that the subprojects were compliant with Bhutan's National Environment Commission requirements and ADB's safeguard regulatory requirements. No social safeguard monitoring reports were submitted since they were no longer required. At completion, the project was categorized C for involuntary resettlement although the BTORs did not mention this reclassification.²⁹ On the whole, this validation assesses ADB's performance satisfactory.

IV. OVERALL ASSESSMENT, LESSONS, AND RECOMMENDATIONS

A. Overall Assessment and Ratings

36. The PCR rated the project successful for being relevant, effective, efficient, and likely sustainable. The project exceeded its intended outcomes within the estimated cost and the EIRR was higher than at appraisal. This validation also assesses the project successful based on relevant, effective, efficient, and likely sustainable ratings. The project made tangible contributions to rural electrification in Bhutan, while increasing the diversity of the country's renewable energy sources. It had a positive impact on livelihoods and led to further economic opportunities partially due to the training provided.

Overall Ratings

Validation Criteria	PCR	IED Review	Reason for Disagreement and/or Comments
Relevance	Relevant	Relevant	
Effectiveness	Effective	Effective	
Efficiency	Efficient	Efficient	
Sustainability	Likely sustainable	Likely sustainable	
Overall Assessment	Successful	Successful	
Preliminary Assessment of Impact	Satisfactory	Satisfactory	
Borrower and executing agency	Satisfactory	Satisfactory	
Performance of ADB	Satisfactory	Satisfactory	
Quality of PCR		Satisfactory	Para. 43

ADB = Asian Development Bank, IED = Independent Evaluation Department, PCR = project completion report.
Source: ADB (IED).

²⁹ The PCR indicated that ADB raised the concern over the delayed submission of safeguard monitoring reports during missions. However, there is little record of this and only the Aide-Memoire of May 2017 indicates it.

B. Lessons

37. The PCR identified lessons relating to project implementation and specifically to the SHS and the wind components. First, project-related issues can be resolved quickly when there is an appropriate flow of information between agencies. The DRE and BPC had regular meetings to discuss project implementation and appropriate corrective actions were taken on a day-to-day basis in response to implementation challenges. Second, the demand for SHS needs to be based on a more thorough technical assessment of areas where customers could be potentially connected to the grid. Third, DRE's and BPC's close supervision and monitoring of the village technicians work is required to ensure the SHS' sustainability and they should provide technical support and establish controls for the issuance of materials. Fourth, additional environmental safeguard measures proved beneficial to the wind project, where wind turbine blades were marked with red bands to increase their visibility and help reduce bird collisions. There had been no bird strikes recorded.

38. Sector-wide lessons were also identified in the PCR for wind power and gender mainstreaming. First, the successful implementation and operation of the wind power plant provides a useful benchmark for further wind planning in Bhutan. In particular, future wind power projects will benefit from the use of common infrastructure, the experience gained by BPC in implementing and operating the pilot, and further strengthening the technical capacity of BPC to design, implement, and operate wind plants. Second, the difficulty in finding women to train indicated the need for more innovative approaches to attract women. Future ideas summarized in the PCR and the gender review of energy sector programs and policies in Bhutan include: (i) developing programs in schools to encourage more girls and young women to pursue academic courses and careers related to energy, (ii) developing an internship or apprenticeship program within the DRE for women interested in energy sector careers, (iii) raising public awareness on the benefits of gender equality in the energy sector, and (iv) providing innovative energy-based livelihood opportunities for women combined with business development services.

39. This validation notes that the above lessons are appropriate and offers two additional project-level lessons. First, ADB's safeguards requirements are important at appraisal and throughout implementation. Sufficiently trained implementing staff monitor the safeguard elements of all energy sector projects and ensure that these do not trigger adverse effects. Second, sufficient financial management expertise in the ADB project team and missions is necessary to ensure appropriate financial reporting, according to ADB requirements. In addition to these project-level lessons, mainstreaming the formulation of the GAP into all energy access projects, with sufficient attention and support, enhances project impact through measurable changes for women.

C. Recommendations for Follow-Up

40. The PCR recommended that (i) ADB follow up with the executing agency and implementing agencies on the additional audit reports for the direct payments made under the project; (ii) implementing agencies submit regular safeguard monitoring reports throughout project implementation to ensure compliance with environmental and social safeguards and, as necessary, the project team and concerned departments develop a monitoring system and provide environmental and social safeguard requirements training to implementing agencies during project implementation; (iii) resettlement categorization be revised once it is clear that involuntary resettlement impacts were no longer envisaged; (iv) ADB assign a financial management staff during implementation and the project team regularly discuss such requirements; (v) training programs on ADB's financial reporting requirements be provided to the

implementing agencies; and (v) ADB review and harmonize its financial audit requirements with other development partners. This validation has a similar view with these recommendations and adds that clear linkages be made with ADB and other development partners' energy sector investments in Bhutan and their respective project outcomes and impacts.

V. OTHER CONSIDERATIONS AND FOLLOW-UP

A. Monitoring and Reporting

41. The PCR indicated that ADB, DRE, BPC, and BDB conducted regular reviews during project implementation and submitted quarterly progress reports to ADB. Each implementing agency submitted a project completion report, although BPC's report on on-grid rural electrification was submitted more than 19 months after project completion and DRE's report on off-grid rural electrification provided insufficient details to assess what was carried out. Six EMRs were submitted after an initial delay. No further monitoring is required.

42. The government submitted audited project accounts for each financial year and 42% of audit reports were timely while 58% were delayed by 0.5 to 33 months. The PCR indicated that although there were some audit observations, the implementing agencies mitigated them as recommended.³⁰ The auditor provided clean (or unqualified) audit opinions for all financial years over the implementation period. Additional audit reports covering direct payments were expected by November 2020 and should be followed up. The PCR indicated that the assessment of BPC's and BDB's financial management capabilities at appraisal was appropriate.

B. Comments on Project Completion Report Quality

43. The PCR provided a comprehensive description and objective assessment of the project outcome and outputs, and the achievement of its targets. The accomplishment of the environmental and social safeguards and gender mainstreaming measures were succinctly summarized. The PCR adequately described the methodology used to recalculate EIRR and its assumptions, and derived appropriate lessons and recommendations that are useful for future operations. Despite a few errors, this validation assesses the PCR quality satisfactory.³¹

C. Data Sources for Validation

44. The data sources used for this validation included the report and recommendation of the President, the PCR, BTORs and aide-memoires, EMRs, GAP, implementing agencies' PCRs, and the external reports cited.

D. Recommendation for Independent Evaluation Department Follow-Up

45. The PCR recommended that ADB prepare a project performance evaluation report after its circulation, since there are no outstanding works, and the project is operational. This validation also determines that a project performance evaluation report should be carried out following the circulation of the PCR.

³⁰ No details are provided in the PCR as to what the audit observations relate to.

³¹ Para. 5 of the PCR stated that "[t]he project loan modality was appropriate given the defined project investment components and capacity of the executing and implementing agencies" when ADB provided a grant not a loan. The PCR also included an error on the reason for the change in target and the covenant regarding safeguards.