Validation Report
September 2020

Federated States of Micronesia: Yap Renewable Energy Development Project

Reference Number: PVR-701
Project Number: 44469-013
Loan Numbers: 3004 and 3005

Independent Evaluation ADB

Raising development impact through evaluation

ABBREVIATIONS

ADB	–	Asian Development Bank
ADF	–	Asian Development Fund
CO_2	–	carbon dioxide
DMF	–	design and monitoring framework
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
FSM	–	Federated States of Micronesia
GAP	–	gender action plan
GHG	–	greenhouse gas
GWh	–	gigawatt-hour
ICS	–	integration and control system
kW	–	kilowatt
kWh	–	kilowatt-hour
MTR	–	midterm review
O&M	–	operation and maintenance
PARD	–	Pacific Regional Department
PCR	–	project completion report
RRP	–	report and recommendation to the President
tCO_2e	–	tons of carbon dioxide equivalent
WACC	–	weighted average cost of capital
YSPSC	–	Yap State Public Service Corporation

NOTE

In this report, "$" refers to United States dollars.

Director General	Marvin Taylor-Dormond, Independent Evaluation Department (IED)
Deputy Director General	Veronique Salze-Lozac'h, IED
Director	Nathan Subramaniam, Sector and Project Division (IESP)
Team Leader	Lawrence Nelson Guevara, Senior Evaluation Officer, IESP

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PROJECT BASIC DATA

Project number	44469-013	**PCR circulation date**	5 Dec 2019	
Loan numbers	3004, 3005	**PCR validation date**	Sep 2020	
Program name	Yap Renewable Energy Development Project			
Sector and subsector	Energy	Conventional energy generation Renewable energy generation—solar Renewable energy generation—wind		
Strategic agenda	Environmentally sustainable growth Inclusive economic growth			
Safeguard categories	Environment		B	
	Involuntary resettlement		B	
	Indigenous peoples		C	
Country	Federated States of Micronesia		**Approved** ($ million)	**Actual** ($ million)
ADB financing ($ million)	**ADF:** 4.36	**Total project costs**	11.16	10.19
	OCR: 4.68	**Loan**		
		L3004	4.68	4.68
		L3005	4.36	3.90
		Borrower	2.12	0.70
		Beneficiaries	0.00	0.00
		Others	0.00	0.00
Cofinancier		**Total cofinancing**	0.00	0.00
Approval date	20 Jun 2013	**Effectiveness date**	22 Sep 2013	26 Nov 2013
Signing date	24 Jun 2013	**Closing date**	31 Dec 2017	27 Aug 2019
Project officers		**Location**	**From**	**To**
	A. Maxwell	ADB headquarters	Jan 2012	Oct 2013
	M. Trainor	ADB headquarters	Nov 2013	Mar 2018
IED review director	N. Subramaniam, IESP			
Team leader	L. N. Guevara, Senior Evaluation Officer, IESP*			

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.
*Team members: A. Baño-Leal (Quality reviewer), F. De Guzman (Senior Evaluation Officer) and D. Corderi and C. Mason (Consultants)

I. PROJECT DESCRIPTION

A. Rationale

1. Yap is one of the four states within the Federal States of Micronesia (FSM), with a total population of 11,400 in 2013. The existing power generation for the main island was 100% dependent on imported diesel, leaving the economy very vulnerable to fuel price shocks. Due to the remoteness and high diesel transport costs, fuel imports represented about 15% of Yap's gross domestic product in 2008. The dependence on diesel and its high cost translated into high electricity generation costs, reaching $0.54/kilowatt-hour (kWh) in 2011. Given the existing high energy costs and exposure to fuel price volatility, the state adopted a policy to increase wind and solar power generation. Converting the existing power generation to renewable energy was expected to result in fuel savings, stabilize power tariffs, and reduce the state's exposure to diesel price volatility.

2. The Asian Development Bank (ADB) approved the Yap Renewable Energy Development Project in June 2013 for $11.2 million.[1] This project was to support the Yap State Public Services Corporation (YSPSC), the public utility responsible for power generation in the state, in developing renewable energy and ensuring a stronger supply-side energy efficiency of the electricity grid. The project was to include the (i) construction of 1.4 megawatts of wind power, (ii) construction of about 300 kilowatts (kW) of grid-connected solar power, (iii) installation of a 1.8 megawatts diesel generator to improve the efficiency of power generation facilities, and (iv) capacity building of YSPSC and the communities.

B. Expected Impacts, Outcomes, and Outputs

3. The project's expected impact was improved energy security of Yap and the intended outcome was increased amount of clean and renewable energy supplied by the YSPSC to Yap. There were four major expected outputs: (i) installation of wind power generation by YSPSC, (ii) installation of solar power generation by YSPSC, (iii) improvement in efficiency of diesel power generation by YSPSC, and (iv) efficient project management services.

C. Provision of Inputs

4. The project was approved by the ADB Board of Directors in June 2013, the agreement was signed in the same month. It became effective in November 2013, 2 months later than planned. The project closed in August 2019, almost 2 years after the target of December 2017. One extension of loan closing date was approved.[2] The project completion report (PCR)[3] stated that physical components were operational by March 2018, 10 months later than planned (June 2017). However, this is inconsistent with the commissioning date of the wind component. It is also unclear when the wind component became fully operational.[4]

5. At appraisal, the total project cost was estimated at $11.2 million. ADB planned to finance $9.0 million from ordinary capital resources ($4.7 million) and special funds resources ($4.4 million), and the State Government of Yap to finance $2.1 million. At completion, actual project costs were $10.3 million, where ADB financed $8.5 million and state government contributed $1.8 million. The PCR stated a lower final cost, and the costs by component was different from those in the appraisal. The main differences were as follows:[5] (i) the decrease in the price of solar photovoltaic technologies offered in the market; (ii) only three wind turbines

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[1] ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Loans to the Federated States of Micronesia for the Yap Renewable Energy Development Project.* Manila.

[2] An extension of the loan closing date from 31 December 2017 to 31 December 2018 was approved in November 2017. The PCR did not provide any information about additional extensions, yet the project financial closing was in August 2019. The Pacific Regional Department (PARD) informed IED that while the physical works of solar and diesel components were completed prior to the original loan closing date of 31 December 2017, there was a failure caused by a manufacturer for one of the wind turbines (i.e., vibration issue), which necessitated reprogramming and fine-tuning of the integration and control (ICS) system. This was a key condition for the commissioning of the wind component. The loan closing date was, therefore, extended by 1 year—from 31 December 2017 to 31 December 2018—to ensure that the ICS has been fully functional for a certain period of time. The wind component was completed and fully integrated into the ICS by the second quarter of 2018, 6 months prior to the revised loan closing date. The project was financially closed on 27 August 2019.

[3] ADB. 2019. *Completion Report: Yap Renewable Energy Development Project (Federated States of Micronesia)*. Manila.

[4] According to the PCR, the physical completion of phase 1 was in October 2018, but no date was presented for phase 2. Footnote 3.

[5] Project cost estimates were based on the PCR's cost estimations. Footnote 3, para. 13, Table 1.

instead of the planned five were installed, but site costs increased (from $118,000 to $500,000[6]); and (iii) two diesel generators were purchased instead of one. The PCR presented the following changes in project costs by components: (i) solar power generation decreased by $0.5 million, (ii) diesel energy increased by $1.2 million, (iii) wind power generation decreased by $1.2 million, and (iv) consultant costs increased by $0.4 million. While project costs at completion were lower, it is noted that contingencies amounted to $1.4 million at appraisal. ADB's total disbursements amounted to $8.6 million, equivalent to 94% of the originally committed amount.[7] The initial disbursement was in July 2014 and the final disbursement was in August 2019. Annual disbursements were lower than projected in the first 2 years, reaching a cumulative disbursement of 4% in 2015 (against the planned 33%). Cumulative disbursements caught up with projections in 2016 (around 60%) but took another 3 years to reach 100% (with full disbursements planned in 2017). For consulting services, Entura—a design and supervision consulting firm—was contracted in 2014.[8] The PCR did not provide the total number of person-months of consultancy services utilized by the end of the project.

6. The project was category B for the environment. An initial environmental examination was prepared, together with an environmental management plan. The project was rated category B for involuntary resettlement and category C for indigenous peoples. Although the project did not involve physical displacement of people or structures, the wind farm required the acquisition of 7.5 hectares of land and a resettlement plan was prepared. A gender action plan (GAP) was also prepared for the project.

7. ADB supported the project through a regional capacity development technical assistance to assess the project's technical, economic, financial, safeguard, gender, and implementation and procurement arrangements.[9] The findings of the assessments were incorporated in the report and recommendation of the President (RRP).[10]

D. Implementation Arrangements

8. Project implementation arrangements were carried out as planned. YSPSC, the 100% state-owned utility, was the executing agency. A steering committee comprising representatives from government ministries was created to oversee YSPSC, which in turn engaged a consulting firm to support project implementation.

9. The consulting firm, engaged through project funds, was responsible for (i) evaluating the original project design, (ii) supporting procurement, and (iii) supervising the contractors during implementation. The consultants helped mitigate YSPSC's low financial and procurement capacity, and the limited technical capacity of local contractors.

10. According to the PCR, 19 of the 22 loan covenants were complied with.[11] The two covenants that were not complied with were: (i) the GAP was not implemented as planned,

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[6] The PCR stated that rental costs of the wind site were $25,000 per year and were included as capital expenditures. Footnote 3.

[7] Disbursement was 100% for ordinary capital resources (OCR) funds and 89% for the Asian Development Fund (ADF).

[8] ADB. 2013. *Yap Renewable Energy Development Project.* Manila.

[9] ADB supported the preparation of the project. ADB. 2009. *Technical Assistance for Strengthening the Capacity of Pacific Developing Member Countries to Respond to Climate Change (Phase 1).* Manila.

[10] ADB. 2012. *Strengthening the Capacity of Pacific Developing Member Countries to Respond to Climate Change (Phase 1): Yap Renewable Energy Project*. Consultant's report. Manila (TA 7394-REG).

[11] The PCR provided limited evidence and justification for the compliance with covenants.

particularly the training for women; and (ii) no website was established for the project. On the requirement to award a maintenance and training contract for a period of 3 years, only partial compliance was achieved.[12]

II. EVALUATION OF PERFORMANCE AND RATINGS

A. Relevance of Design and Formulation

11. The PCR rated the project highly relevant. The rating was based on the project outcome's alignment with government plans for the energy sector.[13] In 2012, FSM established a national target to generate 30% of its power from renewable sources by 2020. Yap further established a target of 50% renewable energy generation by 2030.[14] The PCR also emphasized the project's alignment with ADB's strategy for the Pacific which prioritizes energy sector development.[15]

12. Project design was deemed appropriate by the PCR. The PCR noted that the project was innovative as it pioneered the introduction of a hybrid renewable energy generation technology design in the State of Yap. Subsequent investments in renewable energy generation were further undertaken in the states of Kosrae and Yap.[16] It is noted that project design was revised during implementation to optimize energy generation from renewable energy and diesel[17] and maintain grid stability. As a result, the renewable energy generation targets were revised downwards. Furthermore, the decision to phase in the wind component was considered appropriate to manage risks.[18]

13. The PCR assessed the indicators of the design and monitoring framework (DMF) and the data sources as appropriate to assess project performance. Although not clearly documented by the PCR, the DMF's targets were updated after the midterm review (MTR) mission,[19] considering project design changes, mainly in the wind component. The main indicators that were updated were diesel imports (reduced from 25% to 17%), renewable energy generation as a percentage of the total (from 22% to 17%), the annual reduction in carbon dioxide (CO_2) emissions (from 3,000 to 2,040 tons of CO_2 equivalent), and annual wind power generation (from 2.1 gigawatt hour (GWh) to 1.4 GWh). This validation notes that, at appraisal, the definition of indicators was not clear if achievements were considered for project investments only.[20] The PCR presented disaggregated information on results attributable to the project and other investments[21]. Also, it was unclear how the annual CO_2 emissions reduction were calculated[22].

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[12] Contracts were instead awarded for these periods: (i) 10 Sept 2018 to 31 Mar 2019, and (ii) 1 May 2019 to 1 May 2021.
[13] Federated States of Micronesia. 2012. *Energy Policy: Volume I.* Palikir.
[14] Yap State Energy Action Plan included the project as one of the priority activities.
[15] ADB. 2016. *Pacific Approach, 2016−2020*. Manila.
[16] ADB. 2019. *Report and Recommendation of the President to the Board of Directors: Proposed Loans to the Federated States of Micronesia for the Renewable Energy Development Project.* Manila.
[17] Given existing energy expansion plans.
[18] According to the PCR, it was decided during implementation to install the initially planned five turbines in two phases—two turbines in phase 1 and three turbines in phase 2—conditional on observed performance of phase 1 turbines. "The choice to install the turbines in two phases was due to the lack of data on wind conditions during the initial project design" (footnote 3).
[19] ADB (Pacific Department). Midterm Review Mission to the Federated States of Micronesia: Yap Renewable Energy Development Project. Memorandum of Understanding. 27 November (internal).
[20] Most indicators are defined as the performance of YSPSC, however there were other investments that were done during the period of analysis.
[21] Particularly the 200 kW solar PV investment financed by the Pacific Environment Community.
[22] Neither the RRP (footnote 1) nor the PCR (footnote 3) explicitly provided the assumptions for the calculating the CO_2 emissions. In fact, the baseline appears to be incorrect as it should be 0.

14. This validation acknowledges that at appraisal, the project was aligned with ADB's strategy for the Pacific,[23] which included the energy sector as an operational priority, and with ADB's 2009 Energy Policy[24] through the promotion of renewable energy and energy efficiency. The project was also aligned with FSM's priorities to achieve its National Determined Contribution in reducing greenhouse gas (GHG) and saving diesel import expenditures.

15. While the PCR noted that the hybrid renewable energy generation technology design is deemed innovative for Yap, this validation views that the technology is already widely available and, thus, cannot be considered innovative. This validation further notes that some adjustments to the project design were introduced during implementation to accommodate external factors, such as the World Bank's project to add diesel generation capacity. Other design changes were, however, within ADB's control and could have been anticipated, notably for the wind component.[25] The integration and control system (ICS) to guarantee system stability was not included in the original design, while the assessment of wind availability and the site for the wind farm were incomplete.[26] The required regulatory approvals, such as that from the Federal Aviation Administration, were also not considered during project design.[27] Consequently, this resulted in additional project implementation delays.

16. On the whole, this validation is of the view that while the intended project outcomes were aligned with country and ADB's priorities, the project design had some deficiencies that should have been foreseen during the appraisal stage. Based on this, the validation assesses the project relevant.

B. Effectiveness in Achieving Project Outcomes and Outputs

17. The PCR rated the project effective as two out of the three target indicators for outcomes were achieved. For project's outputs, one out of two targets were achieved for the wind's output indicators. The rest of the output indicators (two for the solar component, one for diesel generation efficiency, and two for project management services) were not achieved.

18. On the outcome of increased amount of clean and renewable energy supplied by YSPSC, two out of three targets were achieved, as follows: (i) YSPSC achieved the revised target of 17% renewable energy generation;[28] (ii) the average diesel generation efficiency was only 13.7 kWh/gallon, which is below the target of 14.6 kWh/gallon and even below the baseline of 13.8 kWh/gallon;[29] and (iii) the PCR claimed that the 3,000 tons of CO_2 equivalent (tCO_2e) target for CO_2 emissions reduction was achieved. On outputs, the results were as follows: (i) on wind power generation—the total energy generated reached 1.5 GWh, which met the revised target of

[23] ADB. 2009. *Pacific Approach, 2010−2014*. Manila.
[24] ADB. 2009. *Energy Policy*. Manila.
[25] This is based on the project inception report by the design and supervision consultants.
[26] The site for the wind turbines had a historic heritage. It also needed to be checked for unexploded ordinance.
[27] Approval from the Federal Aviation Administration on the location of the towers had to be obtained prior to finalizing bidding documents.
[28] The PCR noted in para. 47 that reducing the appraisal target of 22% to 17% was due to less wind turbines being installed than planned (825 kW versus 1,400 kW).
[29] PARD argued that this outcome was substantially achieved since the project met 90% of the diesel efficiency target. PARD acknowledged that there was no increase in diesel efficiency after the project due to the diesel technology change—using highspeed (instead of the originally planned medium-speed) diesel generation engines—to adapt to the load changes and maximize the use of renewable energy generation (see Appendix).

1.4 GWh,[30] but the other target related to tourism activity at the project site was not achieved; (ii) on solar energy generation—the generation of 0.35 GWh solar energy was below the target of 0.44 GWh, while the other target related to training activities was also not achieved; (iii) on diesel power generation efficiency—the target was achieved with 58,623 gallons of diesel saved, exceeding the planned 58,000 gallons; and (iv) on efficient project management services—while training was provided for the project management unit staff and YSPSC management, the annual targets for project management services were not met as the contract awards and disbursements were delayed.[31]

19. The PCR provided information on the implementation of the social and environmental safeguards-related plans, although some of the results were missing. The project did not result in permanent physical or economic displacement at the 6.3 hectares of land for wind turbines. Five households and 29 persons were affected. The total land acquisition and resettlement budget was estimated at $586,000. The monitoring report of June 2016 revealed that several consultations were conducted with village and municipal chiefs, landowners, and community members. Compensation and land acquisition were completed satisfactorily, and environmental impacts and mitigation measures were adequately addressed. No environmental and safety accidents were reported. The PCR estimated that the project had reduced 3,470 tCO_2e but the target and actual values reported were not calculated appropriately[32] and not based on the Federal Aviation Administration's harmonized conversion factors.[33] The actual value of the reduction in CO_2 emissions was recalculated at 1,666 tCO_2e—slightly above the revised target of 1,658 tCO_2e.[34] Finally, the monitoring reports from 2015 to 2018 showed no environmental and social grievances received from stakeholders and affected communities.

20. There was limited information in the PCR to assess the achievement of GAP targets. In general, the PCR considered implementation of the GAP unsuccessful as only three out of the five targets were achieved with only 30% women participating during the consultations for the wind and solar components, which is below the target of 40%. The executing agency had 30% women in the team hired for local construction contracts, and these women received training as well.

21. This validation notes that there were shortcomings in meeting the expected project outcomes and outputs.[35] While the target outcome of renewable energy generation was achieved,

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[30] The mid-term review revised the output indicator for wind generation to "YSPSC generates 1.4 GWh per annum of wind power by December 2016," but the PCR did not clearly indicate the revised target in the DMF at completion.

[31] The PCR (footnote 3, para. 48) stated that "the planned output of efficient project management services, as measured by compliance with contract award and disbursement projections, was not met." The DMF also reported that "contract awards and disbursements were delayed in line with actual program." Based on subsequent consultation with PARD, it was pointed out that the contract awards and disbursements were substantially met based on the revised target such that by the end of 2015, the project awarded 165% of the target and by 2017, project disbursement was 88% (see Appendix).

[32] The PCR seem to have calculated emissions reduction based on total electricity production, rather than on the diesel production displaced by the project.

[33] ADB. 2017. *Guidelines for Estimating Greenhouse Gas Emissions of Asian Development Bank Projects*. Manila.

[34] This was calculated based on the actual and planned total production from renewables added by the project, and the savings in parasitic diesel load. The conversion factor of 0.779 tCO_2/megawatt-hour (equivalent to Papua New Guinea–Popondetta grid) was taken from the ADB 2017 Guidelines for Estimating Greenhouse Gas Emissions and is similar to the one used in the PCR.

[35] PARD pointed out that the project is effective based on the satisfactory assessment on development impact (para. 30), and the achievement of outcomes and outputs. IED noted that based on the 2016 Evaluation Guidelines, achievement of impact is not a measure of effectiveness. Moreover, achievement of outcomes and outputs should constitute at least 80% of the target. Thus, the achievements at both the outcome and output levels do not merit an effective rating.

the diesel generation efficiency did not meet the expected efficiency targets, resulting in fewer fuel savings than planned. On outputs, the solar power generation was below target and, therefore, not achieved while the other two were only partly achieved. These are the (i) tourism activity that forms part of output 1, which was not completed; and (ii) the contract awards and disbursement targets under output 4, which were delayed. Based on these shortcomings, this validation assesses the project less than effective.[36]

C. Efficiency of Resource Use

22. The PCR rated the project less than efficient. An estimation of the economic internal rate of return (EIRR) was conducted at project completion but also updated several assumptions and data used in the EIRR analysis at project design. Economic benefits associated with GHG reductions were included in the EIRR calculation at completion, but not at appraisal. Economic analysis was conducted both at component and project levels. At project level, the EIRR at completion was 3.3% (4.4% with carbon benefits), which is much lower than the estimated 12.9% at appraisal. Reasons for the differences are: (i) the sharp decline in the price of diesel (24% lower than at appraisal), (ii) diesel energy generation efficiency was much lower (13.1 kWh/gallon) than expected (14.6 kWh/gallon) and investment costs were 75% higher, (iii) wind capacity installed was 30% lower after the project's redesign, and (iii) solar energy generation was lower than projected. At component level, the biggest EIRR differences were found in diesel energy generation (-2.4% vs. 15.6%) and in wind power generation (6.2% vs. 11.5%).

23. The PCR did not include an assessment of process efficiency, but several delays were noted in the project schedule section (PCR, para. 18). The PCR stated that delays in implementation occurred due to the following: (i) the project's original design was revised by the design and supervision consultants, requiring additional clearance from ADB before procurement; (ii) there were delays in the procurement of goods for the solar component and access to roof sites, resulting in delays of more than 3 years; (iii) the diesel component had a 2-year delay as additional coordination was needed with a World Bank energy project[37] that was also providing a diesel generator;[38] and (iv) the wind component was delayed as approval on the location of the towers was needed from the Federal Aviation Administration prior to finalizing the bidding documents, additional safety checks must be performed at the construction site, and there were technical problems with one of the turbines and in the integration with the ICS (footnote 2). Project closing was delayed by almost 2 years (para. 4) and costs were 8% lower than planned due to the project redesign. On the whole, process efficiency was low as the project had a total of 3.5 years delay from the start of operations to the actual project completion.

24. As the estimated EIRR at completion is lower than 6% and the process efficiency was low, this validation assesses the project inefficient.

[36] PARD disagrees with this validation's assessment of effectiveness (see Appendix).

[37] World Bank. 2014. *Project Appraisal Document No.1016: International Development Association Project Appraisal Document on a Proposed Grant in the Amount of SDR 9.4 Million (US$14.4 Million Equivalent) to the Federated States of Micronesia for an Energy Sector Development Project*. Washington, DC.

[38] This process caused a 1-year delay in finalizing bid documents. An agreement had to be reached on the specifications of the generators to be procured such that operation and maintenance (O&M) was minimized. The operation of the energy system was efficient given the power generation added by the World Bank project.

D. Preliminary Assessment of Sustainability

25. The PCR rated the project likely sustainable.[39] At completion, the financial internal rate of return (FIRR) and the weighted average cost of capital (WACC) were estimated for project components and the entire project. Similar assumptions[40] were used and data[41] from the analysis conducted at project design were updated. The project FIRR at completion was 6.5%, which is much lower than the estimated 13.0% at appraisal, but this is above the recalculated WACC of 2.73%[42]. The reasons for the differences in estimation were the same as explained in the efficiency analysis (para. 22). The recalculated FIRRs for the solar (9.0%) and wind (8.7%) components were higher than those of the diesel generators (5%).[43] All FIRRs were above the WACC.

26. On institutional sustainability, YSPSC has extensive experience in the operation and maintenance (O&M) of diesel generators. In terms of O&M capacity for the acquired energy generation assets, the PCR claimed that YSPSC was trained in the O&M of solar and wind technology. In addition, a maintenance contract for the wind turbines is in place for 2 more years. It is plausible that the YSPSC is transitioning for the operation of the renewable generation assets as the completion report for the counterpart World Bank project noted that the diesel generators have been run at their limits (i.e., reducing their useful life) to accommodate wind energy fluctuations.[44]

27. On YSPSC's financial capacity to cover O&M expenditures of the assets developed through the project, Appendix 11 of the PCR provided a projected financial performance for YSPSC from 2019 to 2037 (footnote 3). This assumed that tariffs will increase 1% annually and that no grants will be received. The resulting net operating margins were low (from 0.1% to 2% of operating revenues) and the debt-service coverage ratio was, on average, above 2. However, there was no information provided on audited statements from 2013 to 2019 to validate the assumptions used both in the RRP and the PCR. However, past audited statements from 2008 to 2011 presented in the RRP indicated that YSPSC's operating revenues were below operating expenses and that YSPSC received operating grants (an average of 25% of the operating expenses). While previous assessments suggested that the existing electricity tariffs do not cover the full costs (footnote 43), and there is a cross-subsidy scheme in place,[45] YSPSC is state-owned, and it is plausible that it will be backed by the government in case of balance shortfalls.

28. Based on the YSPSC's financial and institutional viability and the financial viability of the project, this validation assesses the project likely sustainable.

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[39] The PCR rated the project likely sustainable (footnote 3, paras. 60–61). However, the overall ratings table (footnote 3, p. 13) indicated the project as "most likely sustainable," which could be a typographical error.
[40] Financial benefits accrue from fuel savings as no service coverage and/or capacity expansion occurred.
[41] These were mainly project costs, fuel prices, and actual power generated.
[42] WACC at appraisal was 1.86%.
[43] This result seems inconsistent with the EIRR result (–3%), it is unclear how this FIRR was calculated as this validation did not have access to the FIRR calculations at completion.
[44] World Bank. 2020. *Energy Sector Development Project–Federal States of Micronesia: Implementation Completion Report*. Washington, D. C.
[45] The RRP mentioned that tariffs were cross-subsidized, i.e., higher government tariffs are supposed to compensate for lower residential tariffs (footnote 1).

III. OTHER PERFORMANCE ASSESSMENTS

A. Preliminary Assessment of Development Impact

29. The PCR rated the project's development impact highly satisfactory. While the RRP expected the project to contribute to reduce poverty—mainly by stabilizing power tariffs and providing income-generating opportunities, the PCR reported that no local households were employed for project construction. No further information is provided on poverty reduction, and it is acknowledged that the project had no impact on electrification as almost 100% of the population has access to electricity in Yap's main island. The PCR presented evidence on the achievement of DMF's impact indicator that is related to energy security. It estimated that diesel usage was reduced by 30%, exceeding the revised target of 17%. The project also contributed to increasing renewable energy installed and in reducing GHG.

30. This validation finds that impacts were positive based on the evidence presented in the PCR. The PCR indicated that the project was responsible for 88% of the GHG reduction, however, this cannot be fully attributed to the project. More details should have been provided on the better-than-expected result, considering the nonachievement of the related diesel generation efficiency targets. The impact on improved energy security and poverty reduction were also not beyond expectations even if the project pioneered renewable energy and has the majority share on diesel generation in the state. Nevertheless, this validation assesses the project's development impact satisfactory.

B. Performance of the Borrower and Executing Agency

31. The PCR rated the performance of the borrower and the executing agency satisfactory. This assessment was based on the ownership and responsibility that was practiced throughout the project preparation and implementation. YSPSC's contributions to project management, counterpart funding provision, procurement, and installation were acknowledged. Weaknesses were also identified as YSPSC was behind schedule in awarding contracts, which resulted in project delays.

32. The commitment of the government and YSPSC to the project is acknowledged. However, some minor shortfalls were found during project design stage and implementation. At project design stage, it seemed that the intention to install another diesel generator (which was ultimately funded by the World Bank) and the Pacific Environment Community solar project could have been communicated and incorporated into the original design. Ultimately, this required a reassessment during implementation and, together with the slow procurement, this contributed to project implementation delays. This validation assesses the performance of the borrower and executing agency satisfactory.

C. Performance of the Asian Development Bank

33. The PCR rated the performance of ADB satisfactory. It noted that ADB complied with its obligations during project preparation and implementation in a timely and quality manner, maintaining collaborative relationships with the government, YSPSC, and the World Bank. ADB conducted five missions during project implementation and actively communicated with the executing agency. It also provided information on supervision and problem resolution activities during implementation as required. The GAP and its targets were revised during MTR and ADB approved a loan extension to accommodate necessary changes in the wind energy component.

34. This validation notes some aspects that were not carefully assessed at appraisal. These are (i) the existing energy generation projects of the Pacific Environment Community and the World Bank), (ii) the implementation requirements for the wind component (para. 14), and (iii) the need to include technologies to integrate renewables in the electricity system. However, this validation also notes that ADB exerted all efforts to coordinate with the World Bank on the latter's addition of a diesel generator to the Yap's power grid. The World Bank's intervention was unanticipated and beyond the control of ADB. Notwithstanding, ADB continued to collaborate with the World Bank and the government to agree on common specifications and bidding documents for the ADB-funded and the World Bank-supported diesel generator procurement processes. The supervision and implementation activities presented also seemed appropriate and ADB was able to respond adequately by conducting a project redesign through a second due diligence during project implementation. On the whole, this validation assesses ADB performance satisfactory.

IV. OVERALL ASSESSMENT, LESSONS, AND RECOMMENDATIONS

A. Overall Assessment and Ratings

35. The PCR rated the project successful as it was highly relevant, effective, less than efficient, and is likely sustainable. Under the core criteria, this validation assesses the project relevant, less than effective, inefficient, and likely sustainable. The project was relevant to the government's development objectives and to ADB priorities, but design flaws were found. It was less than effective because of shortfalls in achieving the outcomes and outputs related to diesel generation efficiency, solar generation, and other project outputs.[46] The project was inefficient, as the sharp decline in the price of diesel and the lower-than-expected energy generation performance resulted in an EIRR lower than 6%; process efficiency was also low due to delays in project implementation. Finally, the project is likely sustainable. Although some concerns remain on its institutional capacity to perform O&M activities on renewable energy and its integration to the grid, the estimated FIRR at completion was above the WACC. Overall, this validation assesses the project less than successful.

Overall Ratings

Validation Criteria	PCR	IED Review	Reason for Disagreement and/or Comments
Relevance	Highly relevant	Relevant	The project had design deficiencies in the wind power output capacity.
Effectiveness	Effective	Less than effective	Outcomes related to diesel generation efficiency and solar power were not achieved as planned. Other project outputs were not achieved.
Efficiency	Less than efficient	Inefficient	The estimated project EIRR is less than 6% due to (i) substantially low fuel price; (ii) higher investment costs but lower-than-expected diesel energy generation efficiency; (iii) lower-than-designed wind capacity installed; (iv) lower- than-

[46] PARD is of the view that the project outcome and the physical investment outputs were substantially achieved, however, the nonphysical component targets were not met (see Appendix).

Validation Criteria	PCR	IED Review	Reason for Disagreement and/or Comments
			projected solar energy generation; and (v) 3.5 years delay due to delays in procurement, coordination, technical due diligence, commissioning, and final payment processing.
Sustainability	Likely sustainable	Likely sustainable	
Overall Assessment	**Successful**	**Less than Successful**	
Preliminary assessment of impact	Highly satisfactory	Satisfactory	Achievements were not beyond expectations.
Borrower and executing agency	Satisfactory	Satisfactory	
Performance of ADB	Satisfactory	Satisfactory	
Quality of PCR		Satisfactory	Para. 42.

ADB = Asian Development Bank, EIRR = economic internal rate of return, IED = Independent Evaluation Department, PCR = project completion report.
Source: ADB (IED).

B. Lessons

36. The main lessons identified in the PCR can be summarized as follows: (i) have a detailed energy system modeling, data gathering, and wind site assessment during project design to avoid the need to revise the project during implementation; (ii) undertake a prequalification of procurement packages at preparation stage and factor this in the project schedule, particularly for new technologies; (iii) explore ongoing and planned sector developments with the borrower and donors at the early stages of project preparation to ensure coordination and optimization of energy investments; (iv) ensure the inclusion of adequate O&M and training contracts for renewable technologies when an executing agency's capacity is weak; (v) mitigate the lack of internal auditing capacity of the executing agency by engaging external auditors, particularly for small utilities; and (vi) consider both upward and downward movements in fuel prices when undertaking economic and financial sensitivity analysis, particularly in the valuation of fuel saving benefits.

37. This validation builds on the key lessons identified by the PCR and suggests the following additional lessons:

38. **Country level lesson.** The major energy security aspect contemplated in the state had to do with affordability, i.e. the need to save on fuel costs. Given this priority, alternative demand side management measures could have also been contemplated by the project. Integrating renewable energy in the country's system also poses challenges to energy security in terms of reliability. This was translated into a tradeoff between fuel efficiency and grid stability.

39. **Sector level lesson.** There are challenges in integrating intermittent renewable energy sources in the electricity system without affecting grid stability. While electricity storage and grid control technologies can help improve grid stability, technical constraints still require diesel generation capacity to balance the fluctuations of solar and wind energy sources.

C. Recommendations for Follow-Up

40. Based on the PCR's recommendations, this validation suggests to monitor the following: (i) the evolution of renewable energy generation and the potential to increase capacity; and (ii) YSPSC's capacity to manage renewable generation assets, ensure adequate O&M, and raise sufficient revenue to cover expenses.

V. OTHER CONSIDERATIONS AND FOLLOW-UP

A. Monitoring and Reporting

41. The PCR presented data collected through the completion report mission. The PCR considered that DMF indicators and sources of data were appropriate. This validation finds that some indicators could have been established more accurately to assess the benefits attributable to the project. Given the nature of the project, this validation finds that energy generated by wind and solar should have been chosen as an outcome performance indicator. At the output level, installed generation capacity is a more appropriate indicator. The outcome indicator of CO_2 emission reductions had a baseline inconsistent with the target and its definition. The estimated target was inconsistent with ADB's guidelines. At the output level, the training indicators should have measured the number of people trained rather than the number of trainings. Finally, additional performance indicators for YSPSC could have been included, such as its operating margins or its cost of energy generation.

B. Comments on Project Completion Report Quality

42. This validation views that the PCR could have been more detailed in collecting information about the project and presenting it in a consistent manner. The following aspects needed to be improved: (i) further discussion on the project's shortcomings at the beginning of the document rather than at the lessons learned section; (ii) the documentation of the DMF's indicators was confusing and inconsistent throughout the document, such that changes in targets were not clearly cited as per MTR's revisions; (iii) little justification was presented to support the assessment on compliance with loan covenants; (iv) further documentation on safeguard implementation and results should have been provided, but no appendix was provided; (v) little evidence was provided to support the sustainability rating beyond the calculation of the FIRR; and (vi) there were some inconsistencies in documenting the project schedule and implementation. Nevertheless, this validation views that the report gathered all relevant information and data, documented the facts, and presented the ratings with adequate justifications, following the guidelines. The PCR was also candid in the economic analysis and introduced a counterfactual analysis to better explain the reasons behind the low EIRR, among others. On the whole, this validation assesses the quality of the PCR satisfactory.

C. Data Sources for Validation

43. Data sources for this validation were the PCR, the RRP and associated linked documents, technical assistance documents, and back-to-office reports and aide memoires relating to loan review missions and MTR mission. The Pacific Approach 2010–2014 and 2016–2020, and the Federated States of Micronesia's Energy Policy were also reviewed.

D. Recommendation for Independent Evaluation Department Follow-Up

44. This validation does not recommend further IED follow-up.

APPENDIX: LINKED DOCUMENT

PCR Validation Report: Federated States of Micronesia—Yap Renewable Energy Development Project

Tables on PARD's Assessment of Output Achievement, and Revised Contract and Awards Disbursement Schedule

https://www.adb.org/sites/default/files/evaluation-document/636311/files/output-achievement-assessment-and-revised-cad.pdf