



1. Project Data

Project ID P100311	Project Name SB-Solomon Islands Sustainable Energy	
Country Solomon Islands	Practice Area(Lead) Energy & Extractives	
L/C/TF Number(s) IDA-53790,IDA-H4150,IDA-H9130	Closing Date (Original) 30-Dec-2012	Total Project Cost (USD) 11,709,584.21
Bank Approval Date 08-Jul-2008	Closing Date (Actual) 31-Mar-2019	
	IBRD/IDA (USD)	Grants (USD)
Original Commitment	4,000,000.00	0.00
Revised Commitment	12,736,114.44	0.00
Actual	11,709,584.21	0.00

Prepared by Ihsan Kaler Hurcan	Reviewed by Vibecke Dixon	ICR Review Coordinator Ramachandra Jammi	Group IEGSD (Unit 4)
--	-------------------------------------	--	--------------------------------

2. Project Objectives and Components

a. Objectives

According to both the Financing Agreement (p.5) dated July 28, 2008 and the project appraisal document (PAD, p.6), the project objective was “to improve the operational efficiency, system reliability and financial sustainability of the Solomon Islands Electricity Authority through improved financial and operational management, reduction of losses, improved generator and distribution system reliability and increased revenue collection.”



At the Additional Financing (AF) in 2014, the project objective was revised. According to the Financing Agreement for AF (p.5) dated April 1, 2014, the revised project objective was “to improve operational efficiency, system reliability and financial sustainability of the Project Implementing Entity [Solomon Islands Electricity Authority-SIEA].”

Since there is no material difference between the original and the revised project objectives, the revision of the project objective does not necessitate a split rating. The changes in the targets of some indicators do not justify a split rating, either; those changes did not have a material impact on the assessment of the project outcomes.

The project objective will be evaluated as consisting of three objectives:

1. To improve the operational efficiency of the SIEA;
2. To improve the system reliability of the SIEA; and
3. To improve the financial sustainability of the SIEA.

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

Yes

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

No

c. Will a split evaluation be undertaken?

No

d. Components

The project consisted of three components:

A. Management of Solomon Islands Electricity Authority. (*Appraisal cost: US\$1.59 million; revised cost at Additional Financing: US\$4.7 million; actual cost: US\$3.69 million*)

(a) Strengthening the management and operations of SIEA through the appointment of key management staff to oversee the administrative, financial management and commercialization functions of SIEA.

(b) Enhancing management capacity of SIEA through training of key management staff.

B. Financial Operations of Solomon Islands Electricity Authority. (*Appraisal cost: US\$0.57 million; actual cost: US\$0.64 million*)

Implementation of a commercialization program for the SIEA finance department, including: (i) establishment of a new financial management and billing system; (ii) preparation and implementation of a new finance accounting manual; and (iii) provision of training to staff on the new financial management and billing systems and the finance accounting manual.



C. Technical Operations of Solomon Island Electricity Authority. (*Appraisal cost: US\$1.87 million of; revised cost at Additional Financing: US\$14.7 million; actual cost: US\$7.37 million*)

- (a) Increasing the availability of existing electricity generation and improving system reliability through the implementation of a loss reduction program, a planned maintenance program for generation facilities in Honiara, and a distribution reinforcement program within SIEA.
- (b) Strengthening SIEA's capacity to implement the project through the provision of project implementation support, technical and project management training to the staff of SIEA, and establishment of a partnership with the Fiji Electricity Authority for the sharing of knowledge and best practices.

Revised Components

At the time of the Additional Financing in February 2014, additional activities were added to the first and third components as outlined below (see d. Components above for estimated costs at Additional Financing).

A. Management of Solomon Islands Electricity Authority. Following technical assistance activities were added to the project scope:

1. Technical assistance and training on dispatch and control, system planning, and integration of renewable and independent power producers;
2. Support to owner's engineer until mid-2017;
3. Appointment of a Capital Projects Manager for 2014–2017;
4. Finance and due diligence technical assistance;
5. Additional technical assistance support for project management; and
6. Preparation of feasibility engineering services and safeguard studies for renewable energy activities.

C. Technical Operations of Solomon Island Electricity Authority. Four network investments, which were included in SIEA's priority capital investment program for 2014-2017 to improve reliability in the Honiara grid, were added to the project scope:

1. Upgrade of transformer capacity with an additional 5MVA 33 kV/11 kV transformer, addition of a second 33 kV switchboard, and a new system control room and dispatch at Ranadi;
2. A 12.5 MVA transformer and upgrade of switching arrangements at Lungga Power Station;
3. New Zone Substation for transforming 33 kV/11 kV, with a 7.5 MVA transformer at Kola'a Ridge; and
4. Relocation of the second power circuit to supply the residential area to the south of Honiara Airport (Feeder 12 area) by building a new overhead power line and an underground circuit around the airport that links to the East Honiara Substation to the Feeder 12 area.

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

Project Cost: The total project cost was originally estimated at US\$4.50 million. In the first restructuring, due to the availability of co-financing from the Australian Aid (AusAID) and the Global Environment Facility (GEF), new project activities were added and the project cost increased to US\$46.90 million; however, the co-financing from AusAID and GEF did not materialize (see First Restructuring below). An Additional



Financing was approved in February 2014 to finance distribution system investments in Honiara, and the project cost increased to US\$23.40 million. In the last restructuring in April 2018, the project cost was revised down to US\$20.94 million because of the cancellation of some project activities. In March 2019, the project closed with a total actual cost of US\$19.91 million.

Financing: At appraisal, the International Development Association (IDA) grant was estimated at US\$4.00 million. In February 2014, an additional US\$2.00 million IDA grant and US\$11.00 million IDA credit were approved for additional investment activities to improve the reliability of power in Honiara. At the last restructuring, due to the cancellation of some project activities and cost savings, US\$3.30 million was cancelled from the IDA credit, decreasing the credit amount to US\$6.74 million. At project closing in March 2019, the original and additional IDA grants were fully disbursed. The project disbursed US\$5.93 million IDA credit.

At the first restructuring, it was estimated that US\$1.00 million from AusAID and US\$0.9 million from the GEF would be available as co-financing, which did not materialize (see First Restructuring below).

Borrower contribution: At appraisal, the Borrower's contribution was estimated at US\$0.50 million. At the Additional Financing, this increased to US\$6.90 million and at the time of the third restructuring to US\$8.20 million. The ICR (p.2) states that the Borrower's contribution at project closing was US\$8.20 million.

Restructurings: There were four project restructurings, one of which with additional financing.

- **First Restructuring (Level 2 - March 22, 2012):** The project became effective one year after approval because of the lengthy recruitment process of a commercialization manager—a condition for project effectiveness. The project implementation was slow, especially in the commercialization program. Due to these reasons, the project closing date was extended by 18 months from December 30, 2012 to June 30, 2014. This time-extension was also a precondition for co-financing from AusAID in the amount of US\$1.00 million, along with US\$0.90 million from the Global Environment Facility (GEF), which became available from the Sustainable Energy Financing Project. This co-financing would be used to finance new project activities, such as technical assistance for improved financial management and procurement, installation of 40 pole mounted meters for large customers, asset revaluation, and improving rural electricity supply in two selected provinces. However, the processing of the co-financing from AusAID was delayed by (i) an amendment of the Parent Administrative Agreement (PAA) with Australia to extend the closing date; (ii) the necessity of another amendment of the PAA, which was revealed after a further legal due diligence in 2013, to allow the funds to be used for activities in the second and third components of the project; and (iii) the moratorium on Australia signing such an amendment during the federal government's caretaker period leading up to the federal election in September 2013. The GEF co-financing, too, was delayed due to GEF's requests to significantly change the Grant Funding Application on several occasions (Implementation Status and Results Report (ISR) No.6, p.2). In the meantime, as a result of its improved financial viability, SIEA used its own funds to finance the project activities planned for the co-financing. Therefore, in December 2014, it was decided not to proceed with the AusAID co-financing (ISR No.8, p.3) and in June 2015 with the GEF co-financing (ISR No.9, p.4). In this restructuring, the target for the reduction in system losses was revised from 14 percent to 12 percent, which was further revised in other restructurings, too, due to inconsistencies in baseline estimation. Improved availability of reliable technical data during project implementation allowed the



project team to set more realistic targets, as well, but, overall, these changes did not have any material impact on assessing the achievement of project objectives.

- **Second Restructuring and Additional Financing (Level 1 - February 13, 2014):** The project's intervention resulted in an improvement in the financial viability of SIEA, but the reliability of power supply in Honiara, the capital, worsened as a result of increased demand and insufficient investment in the power system. To improve the reliability of power in the largest and the commercial center of the country, an additional US\$13.00 million—US\$2.00 million IDA grant and US\$11.00 million IDA credit—was approved in February 2014. The additional IDA credit was to finance capital investments to strengthen the Honiara grid by addressing the most severe bottlenecks in the power system; the additional grant was to be used for technical assistance activities (see Revised Components above). At this restructuring, the project objective was also revised and the part of the original objective that described the project activities was deleted. Because of the inclusion of new investment activities in the project scope, the environmental category of the project changed from C to B. New intermediate result indicators were added to the results framework to monitor the implementation of new project activities. The baseline and end target of the indicator for network losses was revised from 21 percent to 27 percent and from 12 percent to 14 percent, respectively. Two indicators, i.e., revenue per kWh generated and net profit before tax, were deleted. Lastly, the project closing date was extended by 36 months from June 30, 2014 to June 30, 2017, to allow time for the completion of the new project activities.
- **Third Restructuring (Level 2 - May 1, 2017):** The contract for a new system control room and dispatch center was cancelled due to insufficient time to complete the construction. To utilize a part of the savings from this cancellation, new project activities were added: (i) technical assistance for project management and preparation of feasibility engineering services; and (ii) safeguard studies for renewable energy activities. In this restructuring, duplicate indicators monitoring power outages were deleted. The end target of the system losses indicator was adjusted from 14 percent to 18 percent “to reflect a more realistic end target” (Structuring Paper, p.15). The closing date of the grant and credit agreements signed at additional financing was extended by 21 months from June 30, 2017 to March 31, 2019, to allow time for the completion of the ongoing activities which were delayed due to slow procurement.
- **Fourth Restructuring (Level 2 - April 10, 2018):** US\$3.30 million was saved, due to lower than originally estimated costs of some activities and SIEA's using of its own funds for the Lungga transformer. This amount was cancelled at this restructuring. The indicators, i.e., revenue per kWh generated and net profit before tax, which were deleted in the 2014 restructuring, were added back to the results framework to measure the achievement of the project objective to improve the financial sustainability of SIEA. The end target of the average number of debtor days to collect billed amount was adjusted from 30 days to 35 days to allow customers a five-day late payment margin. Furthermore, the end target of the collection ratio indicator was decreased from 90 percent to 70 percent based on the collection rate of 65 percent at the time of restructuring.

Dates: The project was approved on July 8, 2008 and became effective about one year later on June 25, 2009. The project closing date was extended by a total of 75 months (i.e. 6 years and 3 months) from the original closing date of December 30, 2012 to March 31, 2019. The original IDA grant agreement was closed on June 30, 2017, which was 54 months (i.e. 4 years and 6 months) after the original closing date. The IDA grant and credit agreements for additional financing closed on March 31, 2019, which was 21 months (i.e. 1 year and 9 months) after their original closing date of June 30, 2017. The reasons for these



extensions have been outlined above (see references to the restructurings and the Additional Financing above).

3. Relevance of Objectives

Rationale

The project objectives are highly relevant to the country context in the Solomon Islands. Less than 20 percent of the population has access to electricity with a significant difference between the urban centers and rural areas: in Honoria 64 percent of the population has access to electricity but in the rest of the country only 6 percent, which is mostly through small solar panels. Only 12 percent of households have access to electricity through a grid. The SIEA, a state-owned vertically integrated power utility, has a target of expanding the power generation capacity by an additional 54 MW and its grid coverage to improve the reliability, affordability and sustainability of electricity services. Therefore, despite a marked improvement in SIEA's financial and operational performance as a result of the project's intervention, the sustainability of these outcomes is critical for the development of electricity sector in the country; therefore, the project objectives are still highly relevant to the country context.

The project objectives are substantially aligned with the World Bank (the Bank) strategy defined in the Country Partnership Framework (CPF) FY2018-FY2023 for Solomon Islands. Under the first focus area of "Strengthening the foundations of well-being", Objective 1.1 is defined as "to improve renewable power generation and access to electricity" (CPF, pp.21-22). The CPF does not directly refer to the project's objectives, but this does not make them irrelevant: Having achieved a substantial improvement in the financial and operation performance of the SIEA through the project's intervention, which was the highest priority before any major investments in the power sector, the Bank strategy now focuses on addressing higher level issues in the sector—diversification of generation sources and increasing access to electricity. Therefore, the relevance of the project objectives to the Bank strategy is assessed as substantial.

Following the end of the ethnic tensions in 2003, the Bank was engaged with the Solomon Island authorities on energy sector issues. The weak institutional capacity and the poor financial and operational performance of the SIEA was a major obstacle to address other major power sector related issues in the Solomon Islands. Therefore, as a first intervention to support the power sector and to lay the foundation for a sustainable sectoral development path, the project objectives were sufficiently challenging and relevant to the institutional capacity in the country.

Rating

Substantial

4. Achievement of Objectives (Efficacy)



OBJECTIVE 1

Objective

To improve the operational efficiency of SIEA.

Rationale

Theory of Change

The project design was simple; it was primarily structured around the appointment of experienced professionals to key management and board positions, who would bring in their experience and expertise to reorganize and commercialize SIEA and implement a limited number of project-financed investment activities. The outputs expected from these professionals were listed in the Terms of Reference for each position, but their performance evaluation was linked to the improvements in system reliability and financial sustainability of the utility. There was no outcome defined for the improvement in “operational efficiency,” which was not clearly defined. There was no indicator in the results framework capturing the achievement of this objective.

The project was also to finance a limited number of investment projects, such as rehabilitation of generators, replacement of a switchboard at Honiara Power Station and installation of a new transmission cable from Lungga Power Station to Ranadi Substation. These activities would be expected to improve system reliability, but the achievement of the ambitious targets set for the reduction in the duration and frequency of outages could only be achieved through SIEA’s investments in generation; insufficient generation capacity had been the main reason for outages. Therefore, although a direct causal link could be established from the project inputs and outputs, to the achievement of the project objective “to improve system reliability,” the attribution was weak due to separate investments to be funded by SIEA.

To improve the financial sustainability of SIEA, the project was to support the implementation of the commercialization program, through the appointment of a Commercialization Manager, staff training in finance, establishment of a new financial management and billing system, preparation of a new accounting manual and preparation of a loss reduction study. The expected intermediate outcomes were a decrease in the non-technical loss and an increase in the collection rate, which would consequently lead to higher revenue per kWh generated and net profit before tax. The achievement of this objective could be attributable to the project activities.

There was no change to the theory of change at Additional Financing. The new investments in distribution to be supported by the project would be expected to improve the system reliability, but the achievement of this objective still depended on SIEA’s investment in generation using its own funds. This would be indirectly supported by the project by improving the operational efficiency and financial sustainability of SIEA, which would allow the utility to implement capital investments using its funds.

Outputs

Technical Assistance. The project activities resulted in the following outputs as originally planned: (i) two professional utility line managers on expatriate benefits—General Manager and Commercialization Manager—and a professional external Director of the Board were appointed to strengthen SIEA’s corporate governance; (ii) under the commercialization program, a financial management and billing system was established, and a new accounting manual was prepared; (iii) trainings were provided to the key management staff and operational staff on finance and engineering; and (iv) a loss reduction program, a maintenance program for generation facilities in Honiara, and a distribution reinforcement program were prepared and



implemented. After the Additional Financing, a cost of service and tariff review was conducted, as planned, but a supervisory control and data acquisition system (SCADA) could not be installed; instead, the project contributed to its design.

Outcomes

The State-Owned Enterprise (SOE) Act 2007 and the State-Owned Enterprise Regulations 2010 established the legal framework for commercially managing the SOEs, which “requires the SOEs to operate profitably; imposes a rigorous director selection and appointment process; defines corporate planning and reporting requirements; and establishes a process for the transparent identification, costing, and financing of community service obligations” (Finding Balance 2014, Benchmarking the Performance of State-Owned Enterprises in Island Countries, Asian Development Bank, p.23). The project supported the implementation of the SOE Act through the appointment of experienced professionals to key management positions and a professional external Director of the Board, which was pivotal in the transformation of the SIEA. These professionals, especially the external Board Member, brought in their experience and expertise, such as strategy setting, finance, and corporate governance. The intermediate outcomes achieved as a result of the appointment of these professionals, as reported by the project team, were as follows:

- Improved governance: Establishment of three board sub-committees for audit and finance, human resources, and technical; regular board and sub-committee meetings; board resolutions tracked and reported by the management.
- Improved corporate planning: Preparation of a five-year strategic plan setting out key corporate commitments and outlining a timeline of key dates and milestones for planned major works procurement and project, and development of key performance indicators.
- Improved management functions: Major organizational restructuring based on a human resources review; adoption of new procurement policy; more effective internal audit procedures; development of basic reports to the Board on financial and operational performance as a result of the establishment of an integrated business management system funded by SIEA; development of a business financial model; and introduction of budgetary control systems.
- Increased transparency: Regular issuance of annual reports starting from 2010, which was the first annual report since 1997.

Although the Project Appraisal Document (PAD) did not provide a definition of “operational efficiency”, its meaning could be inferred from the following sentence (PAD, p.7): “The proposed IDA grant will finance specific measures to help SIEA to improve management and operational efficiency, to help it best play the central role in electricity sector development needed in the coming months and years.” Then the question regarding the achievement of this objective would be “At project closing, was SIEA in a position to play a central role in electricity development in the Solomon Islands?” The answer to this question is affirmative. Before the project started, the SIEA was a dysfunctional, bankrupt utility. As a result of the project’s intervention, the utility has now the capacity to plan, raise financing, including its own funds, and implement capital investment programs to diversify its generation mix and increase access to electricity in the country. As a result of the outcomes achieved through the appointment of professionals to key management and the Board positions, the project was successful in improving the management functions of the utility. This was a key element of operational efficiency, and its achievement could be directly attributed to the project’s intervention.



One of the expected outcomes for operational efficiency was to transition away from the expatriate manager to local manager at the end of the project and the commercialization manager position would be abolished at the end of the project. At project closing, the transitioning from expatriate general manager to local general manager did not materialize, and the commercialization manager was renamed as Chief Financial Officer and it was filled by an expatriate professional.

Rating

Substantial

OBJECTIVE 2

Objective

To improve the system reliability of SIEA.

Rationale

Outputs

Technical Assistance. In addition to the technical assistance activities listed under Objective 1 above, a maintenance program for generation facilities in Honiara and a distribution reinforcement program were prepared, and technical training was provided to the engineering staff, as planned. Under Additional Financing, a general manager for capital works was appointed to oversee the investment works.

Investments. Under the original IDA grant, the project supported, as planned, the replacement of a 11kV switchboard at Honiara Power Station, the installation of a 33kV cable from Lungga Power Station to Ranadi Substation and the rehabilitation of cooling systems of the generators at the Lungga Power Station. Major investment activities were implemented, and completed, as planned, under the Additional Financing: (i) construction of a line and an underground circuit around the airport to link the East Honiara Substation to the Feeder 12 residential area—commissioned in November 2018; (ii) upgrading of switching arrangements at Lungga Power Station—not commissioned at project closing; (iii) construction of an additional 5 MVA transformer and an additional switchboard at Ranadi Substation—partially commissioned in December 2018; and (iv) construction of a new zone substation at Kola' Ridge with one 12.5 MVA transformer—commissioned in March 2019. The project would finance a new 12.5 MVA transformer at Lungga Power Station, but SIEA financed this activity from its own funds.

Outcomes

System reliability, or reliability of electricity supply, is directly related to the number and duration of outages in the system. Two indicators in the results framework measured the duration and frequency of outages to capture the improvement in the system reliability:

(a) System Average Interruption Duration Index (SAIDI): This index measures the average duration of customer-minutes of interruption per customer in a year. At appraisal, the duration of outages was 51,840 minutes per year (864 hours), which is a SAIDI 6.48 minutes per customer assuming 8,000 connections in Honiara. The original target was to decrease the total yearly duration of interruptions to 25,920 minutes (432 hours), which is a SAIDI of 3.24 minutes per customer. At the Additional Financing, the actual duration of interruptions per year had already dropped to 7,430 minutes (124 hours); therefore, the target was revised to



a total yearly interruption duration of 2,000 minutes. At project closing the total yearly duration of interruptions was estimated at 1,757 minutes, which is a big drop from the baseline of 51,840 minutes.

(b) System Average Interruption Frequency Index (SAIFI): It is the ratio of total number of customer interruptions in a year to the total number of customers. At appraisal, the baseline was 816 interruptions in a year. The original target was to decrease the total number of interruptions to 360. At the Additional Financing, the achievement was already 155 interruptions per year; therefore, the target was revised to 85. At project closing, the average number of interruptions a customer experienced in a year was a substantially low 17.5.

Both indicators show that there was a significant improvement in the reliability of electricity supply in the SIEA network, which covers Honiara. However, this achievement could not be fully attributed to the project's intervention. Firstly, one of the main reasons for very high SAIDI and SAIFI baselines was the Project for the Improvement of the Honiara Power Supply funded by Japan International Cooperation Agency (JICA), which required frequent and long outages in the system (PAD, p.43). As a result of the investments in the distribution and transmission network financed by the JICA project, the duration and frequency of outages decreased; however, the reliability of the power supply worsened due to the breakdown in generators in Lungga and Honiara power stations (Ex-Post Evaluation of Japanese Grant Aid Project, The Project for Improvement of Honiara Power Supply in Solomon Islands, https://www2.jica.go.jp/en/evaluation/pdf/2011_0607600_4.pdf, p.1). Secondly, to address the generation bottleneck, the SIEA purchased new generators using its own funds (ICR, p.15). Furthermore, it was noted in the PAD (p.43) that the replacement of the peaking plant would be funded by SIEA (PAD, p.43), which was not included in the project scope. As a result of these generation investments, the installed generation capacity in Honiara system increased from 14.9 MW in 2011 to 33.6 MW in 2018, against the peak demands of 13.9 MW and 15.5 MW, respectively. Fourthly, the project's main investment activities funded under Additional Financing to improve system reliability were commissioned only starting from the last quarter of 2018; however, the duration and frequency of outages had already significantly dropped in 2017 when it was recorded at 1,920 minutes (target was 2,000 minutes) and the interruption frequency at 21 (target was 85). Lastly, although the project activities financed under the original grant, such as the replacement of a switchboard at Honiara Power Station, the installation of a transmission cable from Lungga Power Station to Ranadi Substation and the rehabilitation of the cooling systems of the generators at the Lungga Power Station must have had an impact on the improvement of system reliability, as the ICR (p.58) notes, "it's hardly possible to distinguish what percentage of reduced outage results from our project or generator addition" by SIEA using its own capital and funds from other development banks and donors.

On the other hand, SIEA's improved financial position must have played an important role in supporting its capital investments and raising funds from other development banks and donors; but, since the improvement in the financial situation of the SIEA is assessed under Objective 3, the achievement of Objective 2 is assessed within the framework of the relevant investment activities and technical assistance support financed by the project. Therefore, due to weak attribution, the efficacy of the achievement of the second objective to improve the system reliability of SIEA is rated Modest.

Rating
Modest

OBJECTIVE 3



Objective

To improve financial sustainability of the SIEA.

Rationale

Outputs

Technical Assistance. The Commercialization Manager hired by the project funds developed and delivered a commercialization program as planned. Under the original grant, the project supported the commercialization program through finance training to the staff of the Finance Department of SIEA, the procurement of a new financial management and billing system, the preparation of a new accounting manual, and the implementation of a loss reduction program. A cost of service and tariff review was completed after Additional Financing.

Outcomes

Three indicators were selected by the ICR (pp.11-12) to measure the achievement of the project objective “to improve the financial sustainability of SIEA”:

(a) Net profit before tax: At appraisal, SIEA had a loss of SB\$44 million (SBD-Solomon Island dollar), which was about US\$6.2 million. The target was to increase SIEA’s net profit before tax to SB\$25.0 million (about US\$3.5 million). This indicator was deleted at the Additional Financing but was added back to the results framework at the fourth restructuring with a target of SB\$98.0 million (about US\$12.0 million). In 2017, SIEA recorded a net profit before tax of SB\$120.0 million (about US\$15.0 million) and SB\$80.1 million (about US\$10.0 million) in 2018.

(b) Revenue per kWh generated: The baseline was SB\$1.39 per kWh generated and the target set at appraisal was SB\$3.0. Like the previous indicator, this one, too, was deleted at the Additional Financing and added back to the results framework at the fourth restructuring with a target of SB\$4.5 per kWh generated. The achievement was SB\$4.64.

(c) Collection ratio: At appraisal, the collection ratio was 72 percent. The target was set at 90 percent. However, at the fourth restructuring the target was lowered to 70 percent. According to the project paper (Report No.: RES31408, p.5), despite SIEA’s implementation of various measures to improve the collection ratio, such as transitioning a significant number of consumers to cash power—a prepayment system—the collection rate at the time of fourth restructuring was only 65 percent. At project closing, the collection rate stood at 60 percent. The ICR (p.37) notes that there were inconsistencies in the methodology of this indicator: the project team “could not verify that the collection ratio at the start of the project and at the end of the project was measuring what it purported to measure.” The ICR further states that the installation of a newer billing system might be a possible explanation for the difference between the baseline and the actual values for collection rate (ICR, p.37).

The appointment of an experienced professional to the Commercialization Manager position, along with the appointments to the General Manager and external Director positions, was critical in transforming SIEA and improving its financial sustainability. The Financial Manager successfully implemented the commercialization program defined as tasks in the terms of reference for this position (PAD, pp.40-41).

As reported by the project team the introduction of a new financial management and billing system helped SIEA become a more service-oriented and customer-responsive utility while increasing its accountability to



the Board and the government. The improvement in the financial management and billing system would be expected to lead to an increase in the collection ratio, but as discussed above, the collection ratio did not capture this progress. On the other hand, the impact of this improved systems on the financial situation of SIEA is captured by the increase in the revenue per kWh generated.

The project-financed loss reduction program was also critical in improving the financial situation of SIEA. The studies conducted under the loss reduction program determined a very high non-technical loss at 16 percent and recommended mitigation measures, including improved internal auditing. The project team reported that, as a result of these audits, a range of fraudulent activities by some major customers were identified, such as meter bypassing, bribes paid to some SIEA employees responsible for meter reading and disconnections, and collusion of a small number of SIEA back-office staff in fraud. This led to the implementation of smart metering program. Together with transitioning of a majority of the household customers to pre-payment meters, the implementation of the smart metering program for larger customers resulted in a decrease in the non-technical loss contributed to the reduction in the total loss ratio from a baseline of 27 percent to about 17 percent at project closing (for system losses indicator, see Objective 1 above). The decrease in non-technical loss, coupled with an increase in tariff, increased revenue per kWh generated; hence, increased net profit before tax.

Overall, the efficacy of the achievement of the project objective to improve the financial sustainability of SIEA is rated Substantial.

Rating
Substantial

OVERALL EFFICACY

Rationale

The appointment of experienced professionals to key management positions and to the Board as external director was critical in improving the operational efficiency and the financial sustainability of SIEA. These professionals brought in their experience to transform the utility from a dysfunctional, bankrupt situation to a position where SIEA could play a central role in electricity development in the Solomon Islands through improved financial situation, credit worthiness, and institutional capacity in both financial and technical matters. However, at project closing the key management positions were still filled by expatriate managers rather than local members of staff, which was one of the main goals of the project. Although there was weak attribution between the distribution investments financed by the project and the decrease in the duration and frequency of outages, it is evident that the improved financial situation of SIEA allowed the utility to finance capital investments in generation and distribution using its own funds or raising funds from other development banks or donors. Overall, the efficacy of the achievement of the project objective to improve the operational efficiency, system reliability and the financial sustainability of SIEA is rated Substantial.

Overall Efficacy Rating



Substantial

5. Efficiency

Economic Analysis

At appraisal, a “with and without project” economic analysis was conducted. The primary benefit of the project was assumed to be fuel cost savings due to reduction in technical loss. It was assumed that there would be a 5 percent reduction in technical loss in the Honiara network as a result of project investments in metering and distribution rehabilitation between 2009 and 2011 (PAD, p.75). This assumption was problematic because meters, such as pre-payment meters, are useful in decreasing non-technical losses, not technical losses. The economic analysis assumed that the total loss at the Honiara system was 21 percent (13 percent technical and 8 percent non-technical). This assumption was disputed (see next paragraph). Furthermore, the customer savings through reduced requirements for auto-generation back-up systems due to a reduction in outages could not be properly quantified; hence, they were not included in the economic analysis as economic benefits (PAD, p.78). Total project cost excluding price contingencies, operation and maintenance cost, and the cost of diesel fuel were included in the analysis as costs. Assumptions on demand increase and diesel fuel price changes were realistic. The calculations resulted in an Economic Internal Rate of Return (EIRR) of 34.8 percent and a Net Present Value (NPV) of US\$5.6million at a discount rate of 10 percent for a 15-year period. According to these result the entire project was economically justified.

At the Additional Financing, an economic analysis was conducted for the additional four investment activities only. Reduced cost of customer outages was assumed to be the main economic benefit of these investments. The EIRR was estimated at 17.6 percent and the NPV at US\$20.06 at a discount rate of 10 for a 25-year period.

The economic analysis conducted at project closing was more detailed, and the methodology was more robust than the methodologies used at appraisal and additional financing. The economic benefit from avoided fuel cost was estimated at US\$0.3 million at project closing compared to US\$9.0 million at appraisal. The first reason for this difference was the sharp decline in crude oil prices after the 2008 financial crisis. Second reason was the inconsistencies in the estimation of total loss, non-technical loss and technical loss. Based on the data in SIEA’s annual reports, the baseline for technical loss when project implementation started in 2010, was estimated between 10 and 12 percent. Since the average technical loss during project implementation (2010-2018) was 10.42 percent, there was negligible decline in technical loss due to project activities. Therefore, the economic benefit from avoided fuel cost was negligible. On the other hand, the economic analysis also included the economic benefit from reduced outages. In other words, it combined the benefits used separately at appraisal and the Additional Financing. The calculations resulted in an EIRR of 24.3 percent and an NPV of US\$7.12 at a discount rate of 10 percent for a 15-year period. Since these calculations are not comparable to the calculations at appraisal and the Additional Financing, a harmonized NPV for appraisal and Additional Financing analyses was estimated to be US\$18.07 million. A harmonized EIRR could not be estimated due to methodological constraints and lack of sufficient data (ICR, p.62).

Although these calculations show that the project’s achievement of economic benefits was lower than what was estimated at appraisal and the Additional Financing, in light of the all methodological shortcomings and absence of data, the economic analysis at project completion using a more robust methodology and more realistic



baseline assumptions showed that the project's economic viability was consistent with the expectations at appraisal.

Financial Analysis

The PAD gives a brief summary of the findings of the financial analysis conducted at appraisal (PAD, p.79). In that analysis the financial benefits of fuel savings due to reduction in technical losses were assumed to be higher than the economic benefits. Furthermore, it was assumed that there would be no non-technical loss reduction. This analysis resulted in a Financial Internal Rate of Return (FIRR) of 25.5 percent. The weighted average cost of capital (WACC) was assumed to be 10 percent for financial evaluation.

At the Additional Financing, a detailed financial analysis was conducted for the investment activities. It was assumed that the revenues would be generated from a 6 percent reduction in total system losses. It was also assumed that fuel price would increase by 3 percent per year in real terms and the SIEA's electricity by 4 percent in each of 2014 and 2015, and 6 percent thereafter. The FIRR was estimated to be a very high 101.4 percent against a WACC of 1.9 percent. The sensitivity analysis showed that even with a ten percent increase in costs and a 10 percent reduction in revenues, the FIRR would be 59.4 percent. (Project Paper, report No.: 84643-SB, p.32).

Like in the economic analysis, a more detailed and methodologically more robust financial analysis was conducted at project closing. The main financial benefits of the project activities were assumed to be the tariff revenue from incremental power consumption due to reduction of energy losses (both technical and non-technical) and outages. Total project capital investment, fuel and oil cost for the incremental power consumption and the extra operation and maintenance (O&M) costs were taken as the financial costs. The calculations showed an FIRR at 21.8 percent well above the WACC of 3.6 percent estimated at project closing.

Due to the differences in the assumptions of financial analyses at appraisal, the Additional Financing and project closing, an ex-ante/ex-post comparison is not possible. However, the financial analysis conducted at project closing, which had a robust methodology, shows that the project was financially viable.

Operational and Administrative Efficiency

The project's effectiveness was delayed by almost one year due to time required for the search for a Commercialization Manager who could satisfy the qualifications listed in the terms of reference. Because of this delay and the slow start to the implementation of the Commercialization Program, the original IDA grant closing date was extended by 18 months. At time of the second restructuring and the Additional Financing, the project had already disbursed 92 percent of the original IDA loan. On the other hand, there were some moderate shortcomings in the operational and administrative efficiency of the project after the Additional Financing, mostly because of the procurement issues, such as lack of institutional capacity to conduct procurement according to the Bank's guidelines and delayed recruitment of procurement specialist and owner's engineer. Prolonged processing of work permits, visas, and resident permits contributed to the delay in recruitments. This resulted in a project closing date extension of 21 months for Additional Financing, which is captured in the economic and financial analysis.



Overall, despite some moderate shortcomings in operational and administrative efficiency due to the increase in the scope of the project after the Additional Financing, the costs involved in achieving project objectives were reasonable in comparison with the benefits. Therefore, the project's efficiency is rated Substantial.

Efficiency Rating

Substantial

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

	Rate Available?	Point value (%)	*Coverage/Scope (%)
Appraisal	✓	34.80	100.00 <input type="checkbox"/> Not Applicable
ICR Estimate	✓	24.30	80.74 <input type="checkbox"/> Not Applicable

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

6. Outcome

A financially sustainable and operationally efficient SIEA is pivotal in developing generation capacity through renewable energy sources and increasing access to electricity in the country. The project objectives, therefore, were substantially relevant, although the project achieved its objectives and the Bank strategy had moved towards investment projects. Through the appointment of experienced professionals to key management and board positions, the project was highly successful in improving the management and operational efficiency of SIEA, but the transition of these positions to locals did not materialize. The project was substantially successful in improving the financial sustainability of the utility through its support of the Commercialization Program. These achievements must have indirectly had a positive impact on the system reliability, but the system reliability had already significantly improved due to the SIEA's generation investments, before the project-financed distribution investments were completed; hence, due to weak attribution, the achievement of the project objective to improve system reliability was rated Modest. The overall efficacy of the achievement of the three project objectives is rated Substantial. Lastly, despite some moderate shortcomings in operational and administrative efficiency, the project's efficiency is rated Satisfactory due to high economic and financial benefits.

a. Outcome Rating

Satisfactory

7. Risk to Development Outcome



A weakening in government's commitment to the implementation of the State-Owned Enterprises (SOE) Act of 2007 stands out as the major risk to the development outcomes. The Act and its regulations established the legal framework for the commercialization of the SOEs in the country. The project supported the implementation of the activities, within this legal framework, for the improvement of the management and operational efficiency of SIEA. This legal framework requires SIEA, and other SOEs to operate profitably, and also gives the authority to SIEA to disconnect non-paying customers, including government agencies. Without the government's continuous commitment to the enforcement of the provisions of the SOE Act and its regulations, SIEA might become insolvent again.

Sustained high electricity tariffs can encourage commercial and industrial customers, whose loads account for around 70 percent of the SIEA's electricity sales, to self-generate which would result in a sharp drop in SIEA's revenues. Following the tariff review, the average retail electricity tariff in Solomon Islands decreased from US\$0.93 per kWh in 2014 to US\$0.65 in 2018, but it was still the highest tariff in the Pacific region. It is likely that the tariff will remain high for some foreseeable future due to the country's dependence on diesel for electricity generation until the amount of electricity generated from renewable energy sources increases to a substantial level. In addition to high tariffs, if the reliability of electricity supply, too, worsens, then large commercial and industrial customers, including state-owned enterprises, such as Solomon Islands Water Authority, might look for self-generation solutions. This is a risk for the financial sustainability of SIEA.

Insufficient knowledge transferal to local employees can result in continuous reliance on internationally recruited professionals to key management positions, which poses as a risk for the sustainability of the project outcomes in the medium term. The project financed training activities to SIEA staff on finance and engineering, which improved the institutional capacity of the utility. However, one of the main goals of the project was to transition from internationally recruited general manager to local manager, i.e., localization. This did not materialize. Localization is an important aspect of institutional capacity building, which can be achieved through adequate and sustained knowledge transferal. Lack of such capacity can result in a deterioration in the operational efficiency of the utility should it be not possible to fill the positions with international recruits.

8. Assessment of Bank Performance

a. Quality-at-Entry

The project had a low budget, but its strategic relevance was high; it was designed to support SIEA, which was a dysfunctional utility at the brink of insolvency, in improving its management and operational efficiency. The project had a sound approach; it was to be implemented as the first engagement with SIEA to revive the utility so that, if it could achieve sufficient financial and operational capacity, it would be able to implement more complex investments in electricity generation and distribution. However, the project's objective to improve the system reliability was rather ambitious. The investment activities to be financed by the project, such as improvement of cooling systems of generators, replacement of a switchboard and the installation of a 33 kV cable, would not be sufficient to achieve the ambitious targets set for system reliability at appraisal. Implementation arrangements were simple and straightforward. The experienced professionals to be hired by project funds to key management and board positions would also be responsible for the implementation of the project. The methodology used for economic and financial analysis had weaknesses (see section 5. Efficiency). Regarding safeguard policies, the project



was appraised adequately and found to have no environmental impact. Fiduciary aspects were broadly sound and supported by the appointment of a Commercialization Manager with experience in Bank procurement. However, the implementation arrangements did not include the establishment of a dedicated project implementation team. This hampered procurement activities causing delays in project implementation. The project benefited from the experience gained and lessons learned in the successful reorganization of the Fiji Electricity Authority in 2002 through the appointment of five expatriate managers, adoption of a strong financial management system, with a focus on increasing collection rates, introduction of prepaid meters, and long-term human resource planning (PAD, p.8). Bank inputs and processes at appraisal were critical for the success of the project; the Solomon Islands Government approval of the debt restructuring for SIEA was a condition of negotiation. The risks were adequately assessed, and mitigation measures were identified. However, the M&E framework had significant shortcomings that made it somewhat difficult to assess the achievement of the stated objectives and test the links in the results chain.

Quality-at-Entry Rating

Moderately Satisfactory

b. Quality of supervision

Supervision inputs and processes were adequate; there were supervision missions on average every four months. The project's task team leaders were stationed in Sydney, which facilitated a close supervision of the project implementation with the help of the Bank's Honiara office. The project team's supervision of financial management and the safeguard aspects of the project, the latter after the Additional Financing, was adequate. However, despite the project team's close supervision and support, procurement related issues led to project implementation delays. There were frequent changes to the M&E framework without any material effect on measuring the project's outcomes. Although the project team was proactive in restructuring the project and processing Additional Financing to increase the impact of the project on system reliability, this impact was not fully captured at project closing. The Borrower's ICR acknowledges the contribution of the Bank missions to the project as "a monitoring, scrutiny and reporting role on the efficacy of the project" that "further improved the focus of the Management and Board of SIEA" (ICR, p.75).

Quality of Supervision Rating

Moderately Satisfactory

Overall Bank Performance Rating

Moderately Satisfactory

9. M&E Design, Implementation, & Utilization

a. M&E Design

There were shortcomings in the theory of change in showing how the project-financed activities would lead to some of the expected outcomes. In the project appraisal document (PAD), there were inconsistencies in



the classification of the indicators as key-indicators/project outcome indicators or intermediate outcome indicators (PAD, p.7 and 26-28). The results framework did not include any indicator to measure the project outputs, which would lead to the expected outcomes; hence, it was difficult to establish clear causal pathways from project activities to outputs and outcomes. Due to lack of clarity in the project objective “to improve operational efficiency,” the achievement of this objective was not captured by any indicator. Other project objectives, i.e., to improve the system reliability and financial situation were better encompassed by the indicators. The indicators were mostly specific, measurable, relevant and timebound, but there was lack of clarity in how some baselines were estimated, such as the collection rate and system losses, or what methodology was used, such as the methodology used in SAIDI and SAIFI. Some of the indicators were included in the contracts of the General Manager and the Commercial Manager as performance indicators, which were to be reported to the Board and the Bank on a monthly basis.

b. M&E Implementation

There were frequent changes to the M&E framework during project implementation. At the Additional Financing, some key indicators, such as net profit before tax and revenue per kWh generated, were deleted, and targets of some other indicators, such as system losses, SAIDI and SAIFI, were revised to be more ambitious without sufficient explanation why these changes were needed or what methodology was used in determining new targets. Frequent changes in targets did not have any material impact on measuring the achievement of the project objectives; as the ICR (p.37) notes, such changes were “inefficient”. Deleted indicators were added back to the M&E framework at the last restructuring. As noted in the previous section, there were issues with how the baseline data were collected for some indicators. There was lack of clarity about the methodology for the collection ratio, which was, therefore, not included in the ICR’s assessment of the project outcome (ICR, p.36). The weaknesses in the M&E design, such as the lack of output indicators establishing a clear causal pathway from project activities to outputs and outcomes, were not corrected during implementation. Despite shortcomings in the M&E design and early concerns about the quality and detail in reporting (ICR, p.36), the indicators included in the Results Framework were adequately measured and regularly reported. With the introduction of improved information technologies, including SCADA, M&E functions are likely to be sustained.

c. M&E Utilization

M&E findings were monthly reported to the SIEA Board and the Bank’s project team. The M&E findings led to a positive shift in the implementation direction of the project and an Additional Financing in the amount of US\$13.0 million, more than three times of the original IDA grant of US\$4.0 million, was approved in February 2014, to finance major investments in distribution network and some technical assistance activities. Although the M&E data was adequately used to provide evidence for the improvement in the system reliability and financial sustainability of SIEA, insufficient data on project outputs made it difficult to establish attribution between project activities and expected outcomes. On the other hand, since the M&E framework was designed to monitor the overall improvements in the system reliability and financial sustainability of SIEA—regardless of establishing causality with the project activities—the M&E findings showing a substantial improvement in these two aspects of the utility resulted in the development of subsequent interventions, i.e., the Electricity Access Expansion Project-P151618 in 2016 and the Electricity Access and Renewable Energy Expansion Project-P162902, in 2018.



In conclusion, there were significant shortcomings in the design and implementation of the M&E system, making it somewhat difficult to assess the achievement of the stated objectives and test the links in the results chain. This review could assess the achievement of the objectives because of the additional information provided by the project team based on their own observation and the information presented in the annual reports of the SIEA, which were not fully captured by the M&E framework, and the information provided in the Borrower's Implementation Completion Report (ICR, Annex 5). On the other hand, M&E findings were successfully used to inform strategy change, i.e., Additional Financing, and future projects. Despite this achievement in M&E utilization, the overall M&E quality is rated Modest due to significant shortcomings in M&E design and implementation.

M&E Quality Rating

Modest

10. Other Issues

a. Safeguards

At appraisal, the project was classified as Category C under Environmental Assessment (OP/BP 4.01) and no safeguard policy was triggered. At the Additional Financing, the environmental category of the project was raised to B.

Environmental Assessment (OP/BP 4.01): At appraisal, the proposed activities, such as the replacement of distribution feeders, upgrading of transformers, provision of spare parts to generation facilities were not expected to have any environmental impact; therefore, the project was classified Category C under this policy. However, the environmental category of the project was raised to B due to the potential minor environmental impacts of the proposed investment activities under the Additional Financing, such as the construction of new transformers. An Environmental and Social Management Framework (ESMF) was prepared by SIEA and disclosed in the country for public consultation in October 2013. The updated EMSF was disclosed in the country and the Bank's Infoshop in December 2013. The ICR did not provide any issues with the implementation of this policy. There were no major issues reported in the project documents, either.

b. Fiduciary Compliance

Financial Management

SIEA did not have prior World Bank project experience. Financial management support was provided through technical assistance. The Auditor General of Solomon Islands was responsible for auditing SIEA financial reports which were unqualified since 2012. The project financial statements were audited annually by an accounting firm under the supervision of the Auditor General. There were delays in the submission of project quarterly reports due to lack of experienced personnel at SIEA (ICR, p.86). Internal control procedures were adequate. There was no misuse of funds associated with the project. Other than the



undisbursed amount of US\$0.9 million, which was reimbursed to the Bank on September 26, 2019, there was no outstanding financial management issue at project closing.

Procurement

SIEA did not have sufficient capacity to efficiently implement procurement according to the Bank guidelines. Despite the appointment of a Commercialization Manager with experience in procurement guidelines, which was a condition for effectiveness, project implementation was delayed due to lack of procurement capacity at SIEA. The project lacked a dedicated project management team. A procurement specialist was required for the contracts under the Additional financing, but the appointment of the procurement specialist was delayed. The evaluation of contracts took longer than expected and the no-objection submissions to the Bank were not timely. The procurement was adversely affected by the lack of local market capacity and low participation by bidders. Despite these issues, the project was in compliance with the Bank procurement guidelines.

c. Unintended impacts (Positive or Negative)

None.

d. Other

None.

11. Ratings

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

12. Lessons

This review has drawn three lessons based on the ICR incorporating material on lessons listed on page 42 of the ICR.

A robust legal framework and strong political commitment can significantly affect the transformation of state-owned enterprises. The State-Owned Enterprise (SOE) Act of 2007 and its regulations provided a robust legal framework for the improvement of the management and



operational efficiency of the six SOEs in the country, including SIEA. Profitable operation, rigorous director selection and appointment process, corporate planning and reporting requirements, and transparent identification, costing, and financing of community service obligations are regulated by the law. The government's commitment to the implementation and enforcement of the legal framework was strong, which manifested itself through the restructuring of SOE debts and enforcing disconnection of delinquent customers, including government institutions. The legal framework provided a strong foundation for the project to support SIEA in its transformation from an insolvent utility into a financially strong one through management strengthening, and the strong political commitment was an indispensable part of this process.

A simple and focused initial intervention can increase the possibility of achieving the intended outcomes, while laying the groundwork for subsequent more complex interventions. The project originally had a low budget and focused on the improvement of the management and operation efficiency of SIEA, while supporting some limited investment activities to improve system reliability in a short period of time. The intention of the project was clearly defined in the PAD (p.6): "A follow-up Bank operation in the sector may be considered if this program is successful." The project was successful in improving the management and operational efficiency of SIEA; therefore, even during project implementation an Additional Financing was processed to support additional investments in distribution to improve system reliability, and two new projects were approved, i.e., the Electricity Access Expansion Project to increase access to electricity through the distribution and installation of pre-payment meters and the Electricity Access and Renewable Energy Expansion Project.

Appointment of experienced professionals to key management and board positions on a long-term basis rather than hiring short-term consultants can substantially increase the prospect of improving the management and operational efficiency of state-owned economic enterprises in remote island nations. Capital Honiara is more than a three-hour flight away from Brisbane, the closest major city in the region. The island country is not easily accessible to deliver technical assistance support by short-term consultants. In this project, the General Manager, whose expatriate package cost was covered by the project funds for the first three years, stayed with the utility for four years; the first Commercial Manager and his successor as Chief Financial Officer, served for about two years each; and the external Director, whose contribution to the transformation of the utility was critical, served on the Board of SIEA for more than six years. The project design had benefited from the successful reorganization of Fiji Electricity Authority in 2002 through the appointment of five expatriate managers.

13. Assessment Recommended?

No

14. Comments on Quality of ICR



The ICR provided a comprehensive overview of the project. The narrative was relatively candid, predominantly accurate and generally aligned to the project development outcome. It was broadly consistent with the guidelines. Economic and financial analysis was sound, and the methodology was robust.

However, the ICR did not sufficiently explain the causality between project inputs and outputs, and the expected outcomes. The focus was too much on the achievement of the indicators' targets, without providing sufficient evidence to support how the project objectives were achieved through the project's intervention. (Detailed additional information was requested from the project team to fill this gap.) This also adversely affected the quality of analysis; the interrogation of evidence was insufficient to clearly link them to findings. The ICR did not sufficiently explain the changes made at restructurings, such as the US\$1.9 million co-financing from AusAID and GEF and the related project activities proposed at the first restructuring, although key revisions of this restructuring were listed on page 3 of the ICR. The sections on Key Factors Affected Implementation and Outcome, Quality of Supervision and Safeguards were weak; these sections were mostly descriptive and did not follow the requirements of the guidelines. The lessons learned were useful, but there could have been additional lessons specific to project implementation in remote small island nations. The ICR was substantially longer (approximately double the length) than recommended in the guidelines.

a. Quality of ICR Rating
Modest