ECONOMIC AND FINANCIAL ANALYSIS

A Background and Methodology

1. The financial analysis assesses the financial viability and sustainability of the Provincial Renewable Energy Project. The project includes a 750-kilowatt (kW) run-of-river hydropower plant[1] and 9.7 kilometers (km) of transmission line between the powerhouse and nearby Auki.

2. The financial analysis has been prepared in accordance with Asian Development Bank (ADB) guidelines.[2] It covers assessment of the financial internal rate of return (FIRR) and of the financial net present value (FNPV) of the project. The analysis is based on differential cash flows, i.e., it compares future revenue and cost streams in "with-project" and "without-project" scenarios to derive the FIRR and FNPV calculations. The FIRR is then compared with the weighted average cost of capital (WACC)[3] to assess the financial viability of the project, and its impact on the financial performance and financial management capacity of the implementing agency, Solomon Islands Electricity Authority (SIEA).

3. The economic analysis has been carried out in accordance with ADB guidelines.[4] It estimates the economic internal rate of return (EIRR) for the project. The EIRR is based on incremental economic cash flows; i.e., the difference between "with-project" and "without-project" cash flows. These streams of cash flow are estimated by projecting cash flows over the economic life of the project. The analysis also estimates the economic net present value (ENPV) of the project, using a discount rate, or economic opportunity cost, of 12%. Some economic costs and benefits derive from the financial costs and benefits and are converted to economic costs and benefits by excluding transfer payments such as taxes. In addition economic costs and benefits arising from nontradable components are converted to economic prices using a standard conversion factor.

B. Assessment of Financial Internal Rate of Return and Financial Net Present Value

4. **General assumptions.** The financial analysis was made on these assumptions: (i) a 30-year economic life of the project; (ii) no residual value at the end of the 30-year period; (iii) all costs based on 2013 constant prices, i.e., prices are in real terms; (iii) zero corporate taxation because SIEA is exempt from tax under the Electricity Act; (iv) an unchanged tariff setting methodology, i.e., tariffs are set nationally and consist of a base price calculated as year *t-1* average tariff increased by 90% of the year *t* consumer price index, and a fuel adjustment charge[5] and (v) since this is a run-of-river system, back-up diesel generation of about 1% is considered.

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[1] The physical infrastructure will be sized for 750 kW capacity including intake structure, headrace canal, penstock, and powerhouse, but initially only two 250 kW generators will be installed. Another 250 kW generator will be fit into the spare generator bay once load growth increases.

[2] Asian Development Bank (ADB). 2005. *Financial Management and Analysis of Projects.* Manila.

[3] The cost of capital is measured as the government's cost of capital given ADB's loan and grant mix, as well as the government's own funds.

[4] Asian Development Bank. *Guidelines for the Economic Analysis of Projects*. Economics and Development Resource Center, 1997.

[5] The fuel adjustment consists of 95% of the difference in fuel prices between year t and t-1 multiplied by a fuel efficiency factor, i.e., an assumed liter per kilowatt of fuel use. For the purpose of the analysis, fuel prices are assumed to increase 1.85% per year in real terms. The real fuel price increase is based on the analysis of the Energy Information Agency.

5. **Weighted average cost of capital**. The WACC has been calculated in real terms[6] for two entities: the Government of Solomon Islands, and SIEA as the implementing agency. This is because according to Solomon Islands law,[7] state-owned enterprises are entitled to borrow funds from the government for revenue generating projects at quasi-commercial rates and conditions. The law also mandates the government to compensate SOEs for activities related to community service obligations. As a consequence, the WACC for the government is lower than that for SIEA.[8] For the purpose of the analysis the WACC for SIEA has been considered. Table 1 shows the detailed WACC calculations.

Table 1: Weighted Average Cost of Capital

	Item	Loan to SIEA	Loan to SIEA	Grant to SIEA	Total
A.	Amount ($ million)	6.0	4.5	4.5[a]	15.0
B.	Weighting	40%	30%	30%	
C.	Nominal cost	4.00%	1.00%	10.00%	
D.	Tax rate	…	…	…	
E.	Tax-adjusted nominal cost [C*(1-D)]	4.00%	1.00%	10.0%	
F.	Inflation rate	4.1%	4.1%	4.1%	
G.	Real Cost [(1+E)/(1+F)-1)]	(0.1%)	(3.0%)	5.7%	
H.	Weighted component of WACC	0.0%	0.0%	1.7%	
Weighted Average Cost of Capital (Real)					**1.7%**

… = not applicable, ( ) = negative, SIEA = Solomon Islands Electricity Authority, WACC = weighted average cost of capital.

[a] Includes $1.5 million grant and $3 million counterpart financing.

6. The FIRR of the project is 9.6%, with an FNPV of $17.9 million. The WACC for SIEA is 1.7%, which is lower than the FIRR. A sensitivity analysis of the FIRR was carried out to test the robustness of the results. The variations in costs and revenues considered in the analysis, and the changes in FIRR and FNPV triggered by the variations are summarized in Table 2.

Table 2: Sensitivity Analysis

Scenario	FIRR	FNPV ($million)
Base Case	9.6%	17.9
10% increase in costs	8.2%	15.4
10% reduction in revenues	8.7%	15.5
10% increase in costs and 10% reduction in revenues	7.5%	13.2

Source: Project preparatory technical assistance, consultant's estimates.

[6] To calculate the WACC in real terms, the cost escalation factors as published by ADB's Economic Research Department have been used (source http://lnadbg1.asiandevbank.org/erd0004p.nsf/).

[7] State-Owned Enterprise Act, 2007.

[8] The WACC for the government is 1.1%. The methodology used to calculate it was the same as the one shown in Table 1. Negative rates are counted as zero.

C. Financial Impact on Implementing Agency's Performance

7. SIEA is a state-owned enterprise, incorporated on 1 January 1969 under the Electricity Act (1996). It is also governed by the provisions of the State-Owned Enterprise Act, 2007. Under the provisions of both acts, SIEA is required to operate on a commercial basis ensuring that "total revenues are sufficient to meet its total outgoings". Furthermore, the State-Owned Enterprise Act stipulates that the government can instruct state-owned enterprises to perform community service obligations upon grant transfer for the said obligations, and also that the audited financial statements must be presented within 3 months of the end of the financial year.

8. SIEA is a vertically integrated utility, responsible for generation and distribution of electricity in the capital Honiara and in eight provincial centers. During the last reported financial period ending 31 December 2012, SIEA had a turnover of SI$414 million, made a net profit of SI$63 million, had an asset base of SI$516 million, and employed 193 people. SIEA has a customer base of 14,200—11,000 domestic customers, 72 industrial customers, and about 3,100 commercial and other customers, including schools and churches. Honiara accounts for 88% of total sales. All generation is thermal based,[9] and total system losses (after auxiliary consumption of 3% of gross generation) are 22%, of which more than half are considered non-technical losses.

9. SIEA's financial performance has considerably improved over time, but it only became profitable in 2011. Before, it had incurred losses of SI$13 million in 2006 and of SI$37 million in 2007. The cash flow position had deteriorated and bank overdrafts were needed to fund core operations. In 2008, losses were SI$17 million, but in April 2008, the government agreed to a debt restructuring scheme through which approximately SI$200 million owed by SIEA to the government was written off SIEA's books. In return, SIEA wrote off SI$32 million in debts owed to SIEA by government entities. Receivables of SI$32 million were written off in 2009, which was the main contributor to SIEA's losses of SI$9 million that year. In 2010, losses amounted to SI$70 million because the escalation of the outstanding receivables from government entities, mainly Solomon Islands Water Authority (SIWA), resulted in SIEA making a provision for bad debts of SI$57 million. The SIWA bad debt was the major contributor to the losses reported in 2010. In May 2012, a debt settlement agreement was signed between the two parties for SIEA to convert SI$7.5 million of outstanding dues into a loan to be repaid by SIWA over a period of 8 years starting on 1 January 2013, at zero interest rate. SIEA turned profitable in 2011, reporting profits of SI$53 million in 2011 and of SI$63 million in 2012.

10. The analysis assessed the impact of the project on SIEA's projected financial performance. The assumptions used in the projections are:

(i) Sales grow by 1.2% per year.
(ii) SIEA implements the proposed project as well as a SI$250 million investment program. The investment program is half funded by commercial debt and half by SIEA's own funds.
(iii) Labor expenses related to generation and distribution grow at 5% per year. Other expenses grow with inflation.

[9] The installed capacity of SIEA was 30 megawatts (MW), of which the Lungga power station supplying Honiara, the capital, accounted for 22 MW (76%). The actual (de-rated) capacity was 24 MW. SIEA generation facilities are in Auki (0.7 MW), Gizo (0.8 MW), Buala (0.2 MW), Kirakira (0.2 MW), Lata (0.2 MW), Malu'u (0.1 MW) and Tulagi (0.4 MW). The SIEA facility in Noro (3.6 MW) is not operational and power to the area is supplied through an agreement with SolTuna to purchase power, entered into from August 2012. SIEA has two hydropower facilities in Buala and Malu'u, but they are not functioning (one due to a land dispute, the other because it is out of service).

(iv) SIEA is able to borrow for 32 years at a 6% interest rate. SIEA will commence repayment once the project starts generating revenues.

11. Table 3 summarizes the projected financial performance. It shows that the project positively affects SIEA performance. Total revenues and operating income are projected to increase, with cost of debt service not exceeding 7% of the operating margin. The projected cost recovery ratio is well above 10% for the entire period considered in the analysis. In addition, SIEA is projected to maintain a debt service coverage ratio well above 1.2, which is the sector threshold against which the ratio is usually benchmarked. Liquidity also remains high throughout the period under assessment, with a current ratio well above 1.

D. Financial Management Assessment

12. The financial management assessment was carried out with the aid of the ADB Financial Management Assessment Questionnaire. The assessment covers a broad range of issues ranging from SIEA's legal status and statutory reporting requirements to fund-flow arrangements, staffing, accounting policies and procedures, budgeting, internal controls and internal audit. The questionnaire was administered primarily to the finance department of SIEA.

13. **Organizational structure.** SIEA is governed by a board of directors appointed by the Minister of Mines, Energy and Rural Electrification and the Minister of Finance. The daily operations of SIEA are delegated to the general manager, who is presently an expatriate. The internal audit division reports directly to the board through an audit committee. An expatriate chief financial officer heads the finance division of SIEA. The chief accountant is in charge of the general ledger and the accounts payable ledger, and the deputy chief accountant is in charge of fixed assets and tariffs. There is also an accountant (revenue) who is in charge of accounts receivable. Separate officers are in charge of the accounting aspects of the ongoing Solomon Islands Sustainable Energy Project, funded by the World Bank, and of the payroll, and there is an information technology officer.

14. The accounting system is computerized on MYOB, an off-the-shelf accounting software, for the general ledger. SIEA uses two other systems alongside MYOB. Napier Computer Software (NCS) is used for billing and invoicing of conventional meters and for the payroll. Suprema software is used for the prepaid metering system. NCS was also used for the general ledger before migrating to MYOB. The NCS and Suprema systems are costly to maintain due to annual licensing costs and support fee. There are no immediate plans to migrate to an integrated software platform such as Oracle.

15. **Financial reporting.** Results are reported monthly to the SIEA board. The 2012 final accounts were prepared off system using MS Excel spreadsheets by uploading the Trial Balance from MYOB. For many years, the SIEA auditor, the Auditor General, has been giving a disclaimer of opinion on SIEA accounts, meaning that he was unable to give a true and fair view due to lack of audit evidence. For the first time after 5 years, SIEA received an unqualified audit opinion for the 2012 accounts.

Table 3: Projected Financial Performance of the Implementing Agency

	Audited	Projected					
Year ended on 31 December	**2012**	**2013**	**2014**	**2015**	**2020**	**2025**	**2030**
Total revenues (SI$'000)	413,958	464,553	493,551	516,469	651,025	821,219	1,035,907
Total expenses (SI$'000)	351,241	383,373	404,458	431,744	568,179	759,457	1,017,327
Operating income/(loss) (SI$'000)	62,717	80,770	89,093	84,725	82,846	61,762	18,579
Finance income/(cost) (SI$'000)		(520)	(2,680)	(5,826)	(13,473)	(14,610)	(14,017)
Net profit/(loss) (SI$'000)	62,717	80,249	86,414	78,899	69,373	47,151	4,562
Cash-flows from operating activities (SI$'000)	92,759	85,974	123,858	129,300	149,777	149,494	117,876
Cash-flow from financing activities (SI$'000)	…	14,346	45,899	39,233	(6,905)	(15,499)	(16,938)
Cash and cash equivalents at the end of year (SI$'000)	99,823	165,454	233,338	298,342	789,088	1,226,702	1,563,484
Average yield (sales/unit sold)	6.25	6.93	7.28	7.53	8.94	10.62	12.62
Average cost of production (production cost/unit sold)	5.52	5.97	6.25	6.64	8.31	10.42	13.08
Cost recovery	113%	116%	116%	113%	107%	102%	96%
Operating margin	22%	24%	26%	26%	23%	18%	11%
Profit margin	15%	17%	18%	15%	11%	6%	0%
Current ratio	7.31	8.86	9.03	10.38	13.90	14.26	12.35
Debt service coverage ratio	NA	40.4	11.7	6.9	4.5	3.8	2.9
Debt–equity ratio	NA	1:99	7:93	12:88	15:85	12:88	10:90

… = not applicable, ( ) = negative, NA = not available.

16. **Internal auditing**. SIEA has a separate internal audit unit, although at present it consists only of the manager, internal audit and an assistant. Staff constraints have resulted in most of the work being done at the head office in Honiara. An annual work plan has been prepared and high-risk areas are generation, maintenance of the fuel system and safety procedures. In finance, the medium-risk areas are fixed assets, procurement, and petty cash. The areas that internal auditing has to concentrate on are: (i) having internal audit staff physically present at stock verifications and fixed-asset verification, (ii) ensuring proper count and documentation, (iii) auditing accounts receivable and payable ledgers, (iv) auditing the billing system, and (v) ensuring that bank reconciliations are in order. In addition, when performing the audit, the internal auditor should document the internal control system through flow charts and internal control questionnaires, and run dummy transactions through the system to ensure that the stated controls are operational.

17. **External auditing**. SIEA's auditor is the Auditor General of Solomon Islands, who assigns the audit work to a firm of auditors. The auditor has issued a disclaimer of opinion for the years 2008–2011, and cites lack of reconciliations, lack of records, and other shortcomings as preventing him from forming an opinion on the financial statements. However, SIEA's financial statements for 2012 have been given an unqualified (clean) opinion by the auditor, which is a significant achievement.

E. Economic Analysis

18. **Assumptions**. The economic analysis was carried out considering a 30-year lifetime of the asset after commissioning in 2018. All benefits and costs are expressed in constant 2013 (border) prices. Domestic prices were converted to border price equivalents using a standard conversion factor of 0.9, after removing taxes and duties.[10] Tradable goods represent 65% and nontradable goods represent 35% of economic inputs. The estimate is based on an economic classification of the engineering cost components determined during the feasibility study design. A shadow wage rate of 0.8 for unskilled labour was applied to the unskilled labour component of the capital, and operations and maintenance costs.[11]

19. **Economic costs**. The economic costs relate to the stream of capital costs involved in the construction and installation of the hydropower plant, compared with operating and maintaining a diesel-based power generation system.[12] Land cost has not been included in the economic costs. This is because the area where the hydropower plant would be built is mountainous. Agricultural use is not foreseen and not envisioned by the landowners. In addition, the area is remote and difficult to get to, so industrial activity or real estate development is not likely to occur.

20. **Economic benefits**. The primary economic benefit is fuel savings thanks to the replacement of thermal generation with hydropower generation. The fuel received by the Auki power station is handled by a private company, South Pacific Oil. Among the economic benefits,

[10] The standard conversion factor is the same as that used in a similar energy sector project in Papua New Guinea. ADB. 2012. *Report and Recommendation of the President to the Board of Directors for the Port Moresby Grid Development Project in Papua New Guinea*. Manila.

[11] The shadow wage rate is the same as that used in a similar energy sector project.

[12] Fuel savings are valued using charges per liter, net of import duties and taxes, that South Pacific Oil charges to SIEA. The quantity of fuel saved was calculated by assuming decreasing oil use for power generation after full commissioning of the hydropower station in 2018. The value of fuel savings is expressed in 2013 prices and accounts for a real oil price increase of 1.85% per year, based on fuel price projections published by the Energy Information Agency.

we consider the time used by South Pacific Oil to handle SIEA's fuel to be fruitfully reemployed in the economy for other profitable purposes. As no additional power generation capacity is added to the system, benefits are nonincremental.

21. The EIRR for the project is 12.9%, which is higher than the economic opportunity cost of capital of 12%, and therefore the project is economically viable. The ENPV is $0.45 million. Table 4 summarizes economic costs and benefits considered in the analysis. In addition, it is important to note that this is a conservative estimate of the project's economic viability because externalities such as health and climate benefits arising as a result of less carbon dioxide emission have not been included.

Table 4: Summary of Economic Cost and Benefit Streams – Net Cash Flow
(SI$ million)

Year	Capital Cost	Savings in Fuel	Savings in Fuel Handling	O&M Cost	Net Cash Flow
2013					
2014	(6.2)	-	-		(6.2)
2015	(6.6)	-	-		(6.6)
2016	(22.2)				(22.2)
2017	(15.1)				(15.1)
2018	(2.6)	6.4	0.8	-	4.5
2019	(2.6)	6.6	0.8	-	4.8
2020	(0.5)	6.8	0.8	-	7.1
2021	-	7.0	0.8	(1.1)	6.8
2022	-	7.2	0.8	(1.1)	7.0
2023	-	7.5	0.8	(1.1)	7.2
2024	-	7.7	0.8	(1.1)	7.5
2025	-	7.9	0.8	(1.1)	7.7
2026	0.8	8.2	0.9	(1.1)	8.8
2027	-	8.5	0.9	(1.1)	8.3
2028	-	8.8	0.9	(1.1)	8.6
2029	-	9.0	0.9	(1.1)	8.9
2030	0.2	9.3	0.9	(1.1)	9.4
2031	-	9.6	0.9	(1.1)	9.5
2032	-	9.9	0.9	(1.1)	9.8
2033	-	10.3	0.9	(1.1)	10.2
2034	1.0	10.6	1.0	(1.1)	11.5
2035	-	10.9	1.0	(1.1)	10.9
2036	(4.0)	11.3	1.0	(1.1)	7.3
2037	-	11.6	1.0	(1.1)	11.6
2038	-	12.0	1.0	(1.1)	12.0
2039	-	12.4	1.0	(1.1)	12.4
2040	0.8	12.8	1.0	(1.1)	13.6
2041	-	13.2	1.0	(1.1)	13.2
2042	-	13.6	1.1	(1.1)	13.6

Year	Capital Cost	Savings in Fuel	Savings in Fuel Handling	O&M Cost	Net Cash Flow
2043	0.2	14.1	1.1	(1.1)	14.3
2044	-	14.6	1.1	(1.1)	14.6
2045	-	15.0	1.1	(1.1)	15.1
2046	-	15.5	1.1	(1.1)	15.6
2047	-	15.5	1.1	(1.1)	15.6
				EIRR	**12.9%**
				ENPV (US$ million)	**0.45**

( ) = negative, EIRR = economic internal rate of return, ENPV = economic net present value, O&M = operation and maintenance.

22. **Sensitivity analysis.** Sensitivity analysis of the EIRR was carried out using the scenarios presented in Table 5 to evaluate the robustness of the investment to changes in major assumptions. The sensitivity analysis shows that a 10% increase in costs or 10% decrease in revenues, or both, could compromise the economic viability of the project. However, each stress under consideration brings the EIRR only slightly below the 12% threshold. In addition, given that the environmental benefits of the project are not included in the economic analysis, the magnitude of the positive economic impact shown in the analysis can be considered conservative. As a consequence, we deem the project overall economically viable.

Table 5: Economic Sensitivity Analysis

Item	**EIRR** (%)	**ENPV** ($ million)
Base Case	12.9%	0.45
10% increase in costs	11.8%	0.09
10% decrease in revenues	11.7%	0.14
10% increase in costs and 10% decrease in revenues	10.7%	(0.73)

( ) = negative, EIRR = economic internal rate of return, ENPV = economic net present value.