CLEAN DEVELOPMENT MECHANISM

SMALL-SCALE PROJECT DESIGN DOCUMENT (CDM-PDD)

VATURU AND WAINIKASOU HYDRO PROJECTS, FIJI

Prepared by

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July 2005

CONTENTS

A. GENERAL DESCRIPTION OF PROJECT ACTIVITY

A.1 Title of the project activity:

Vaturu and Wainikasou small-scale hydro project

A.2 Description of the project activity:

The proposed project activity is one small-scale hydro project bundling two measures into one PDD. The Vaturu and Wainikasou projects are small-scale run-of-river hydro projects in Fiji implemented by Sustainable Energy Limited (SEL), a joint venture between the Fijian Electricity Authority (FEA) and a hydro project developer, Pacific Hydro Limited (PHL). Total installed capacity of the Vaturu and Wainikasou projects are 3MW and 6.5MW, respectively. For the purposes of this PDD, the bundle of these two measures (i.e. Vaturu and Wainikasou) results into a single small-scale hydro project of 9.5MW installed capacity (the "Project"). There are two separate (not connected) grids servicing the two main islands in Fiji – Viti Levu and Vanua Levu. Both projects are grid-connected and located in the largest of the main islands – Viti Levu.

The Vaturu project is located in Sabeto city in Nandi Province. The Wainikasou project is located at the Central highlands of Viti Levu in an area called Waimala-Naidasiri. The Wainikasou project commenced operations in May 2004, and the Vaturu project commences construction in June 2004 and will start operation in January 2005. The CDM component has been an integral part of the financial package from the early stages of both projects.

Annual emission reductions for the entire project (i.e., Vaturu + Wainikasou) are expected to be 24,928 tCO_2e and are achieved by displacing diesel generation from the national grid. Table 1 below summarises the baseline and project scenarios. Currently, total grid electricity generated in 2003 was made up of 44% diesel and 55% hydro. Additions to the grid for the last 20 years have been exclusively diesel, at an average 85% increase over the last 9 years.

Table 1: Summary of Baseline and Project scenarios

Baseline Scenario	Project Scenario
Generation of 38,000 MWh/year of electricity from diesel-based generating sources	Generation of 38,000 MWh/year of electricity from zero-emissions small-scale hydro projects

The project is helping Fiji fulfil its goals of promoting sustainable development. Specifically, the project:

- Increases employment opportunities to local people both during construction and operation in the area where the project is located, where permanent and reliable sources of employment are scarce;
- Improves roads maintenance and repairs as the project obtains economical stability;
- Diversifies the sources of electricity generation;
- Helps Fijian Government achieve its commitment to environmentally clean and environmentally friendly production.

A.3 Project participants:

- Sustainable Energy Limited (SEL), project developer

Sustainable Energy Limited (SEL) is a joint venture between Pacific Hydro Ltd. (PHL) and the Fijian Electricity Authority (FEA). The Fijian Electricity Authority (FEA) is responsible for the generation, transmission and distribution of electricity in Fiji. This is 100% owned by the Government, and is a statutory authority under the control of the Minister of Energy. The FEA was corporatized in 1998. Pacific Hydro Ltd. is a global hydro project developer, with headquarters in Australia.

- ABN AMRO BANK N.V. London Branch, CER purchaser from an Annex 1 Country

Contact details information on project participants are provided in Annex 1.

A.4 Technical description of the project activity:

A.4.1 Location of the project activity:

A.4.1.1 Host country Party: Fiji

A.4.1.2 Region/State/Province etc.: Viti Levu Island

A.4.1.3 City/Town/Community etc: Sabeto, Nandi Province (Vaturu project). Central highlands of Viti Levu in an area called Waimala-Naidasiri (Wainikasou project).

A.4.1.4 Detailed description of the physical location:

Vaturu project is located at the Nagado Water Treatment works in Sabeto, Nandi Province (Fiji), which is approximately 20 km from Nandi town. As for the Wainikasou project, the site is located on an existing feeder-pipe, which is part of the Monasavu dam.

A.4.2 Type and category(ies) and technology of project activity

According to the simplified modalities and procedures for small-scale CDM project activities, the SEL Small Scale Renewable Energy Projects fall under the Type/Category ID (Renewable Energy Projects / Renewable electricity generation for a grid). The projects conforms to the project category since the nominal installed capacity of Vaturu + Wainikasou projects together are below the 15 MW threshold and the plant will sell its generated electricity for the grid.

The **Wainikasou Project** involves the construction of a 6.5 MW hydroelectric power station to make use of the existing energy potential currently dissipated at one of the valves of the system collecting water from the Wainisavulu Creek. The power station will be constructed alongside the existing valve-house and stilling basin on land available for that purpose. Water is diverted into an intake structure, through a pipeline and drop shaft, creating an operating head of 116 metres. The water then travels through a horizontal penstock into the turbines. A bifurcation also allows water to by-pass the station through a pressure reducing valve. Water from the station or valve then passes into a 10km long tunnel feeding into Lake Monasavu, which in turn supplies water to the 80MW Wailoa power station. The diversion, piping, drop shaft, reducing valve and tunnel are all pre-exiting infrastructure. The design efficiency is 90% at 6.5 MW producing an annual energy average of 18,000MWh.

The **Vaturu Project** consists of a new power station that makes use of the water pressure to develop up to 3MW of renewable electricity, the generation technology is a single horizontal Pelton-type two jet turbine coupled to a generator rated at 3MW. A large water storage at Vaturu Dam provides water to the Nagado Water Treatment Plant via a 17km long pipeline system. Part of the pipeline is being upgraded and provides a gross operating head of 321m. Water is first directed to the power station then the tailwater is gravity fed into the water treatment plant. Energy which had previously been wasted through pressure reduction valves can now be utilised to produce electricity. Water is delivered to the treatment plant all year round so the Vaturu power plant is expected to have a high capacity factor producing an annual energy of 20,00MWh. The plant is 86.8% efficient at design output of 3MW. The project will be constructed by the Proponents and operated by FEA as part of the Fiji electricity interconnected system. The existing power line will be upgraded to 33kV to export power into the system.

A.4.3 Brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by sources are to be reduced by the proposed CDM project activity:

The proposed activity will displace existing and future generation facilities in Fijian national electricity grid. Under the business as usual scenario there would be continuing growth in diesel based electricity generation capacity.

Total emission reductions from the electricity generated by the bundle of the projects are estimated as 523,488 tCO_2e over 21 years (crediting period), which means an average annual emission reduction of 24,928 tCO_2e. For details, please refer to Section E.

A.4.4 Public funding of the project activity:

The project will not receive any public funding from Parties included in Annex I.

A.4.5 Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

According to Appendix C of the simplified modalities and procedures for small-scale CDM project activities, the SEL small-scale renewable energy projects are not part of a larger emission-reduction project.

B. BASELINE METHODOLOGY

B.1 Title and reference of the methodology applied to the project activity:

Project Activity I.D. Renewable electricity generation for a grid.

B.2 Project category applicable to the project activity:

Appendix B of the simplified modalities and procedures for CDM small-scale project activities offers the following two choices for preparing the baseline calculation for this type of project activity:

(a) *The average of the "approximate operating margin" and the "build margin"*

OR

(b) *The weighted average emissions (in kgCO_2/kWh) of the current generation mix.*

Option A is selected for this project because the Vaturu + Wainikasou project will displace mostly fossil-fuel generating sources since they are at the margin of the electricity generation system. From 2001 to 2002 demand for electricity grew by 5% with 623 GWh needed in 2002 in Fiji. With the Wailoa (Monasavu) hydro plant only capable of producing 448 GWh, the FEA has continued to rely on diesel generators to supply the additional electricity demanded. Demand is expected to continue to rise at approximately 5% per annum.

Since the commissioning of the Wailoa hydro project in 1983, only diesel generation has been added to the grid at an average 85% increase over the last nine years. Table 2, for example, presents total generation in Viti Levu for the last nine years separating the hydro and the diesel generation. The table also presents the increases in diesel generation from year to year.

Table 2: Generation in Viti Levu 1994-2003 (MWh)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Hydro (Wailoa)	386,965	382,828	363,218	402,009	417,106	447,771	412,097	460,610	449,253	343,655
Diesel	5,805	12,032	43,140	15,538	51,148	45,087	75,905	69,638	117,763	262,610
% Increase of diesel generation compared to the previous year		107	259	-64	229	-12	68	-8	69	122
Total Generation	392,770	394,860	406,358	417,547	468,254	492,858	488,002	530,248	566,026	606,265

Source: Fijian Electricity Authority (March 2004, obtained through personal communications)

B.3 Description of how the anthropogenic GHG emissions by sources are reduced below those that would have occurred in the absence of the proposed CDM project activity

The Project will result in the reduction of greenhouse gases that would not occur if the project were not implemented. The numerous barriers and risks associated with the implementation of the proposed project activity are identified below clearly demonstrate that this project activity is not the baseline as usual scenario.

According to Attachment A to Appendix B of the simplified modalities and procedures for CDM small-scale project activities evidence to why the proposed project is additional is offered under the following categories of barriers: (a) investment barrier, (b) technological barrier, and (c) prevailing practice. The result is a matrix that summarizes the analyses, providing an indication of the barriers faced by each scenario; the most plausible scenario will be the one with the fewest barriers.

As indicated above, two different scenarios were considered:

1. The continuation of current activities – This scenario represents the continuation of current practices, which is the construction of diesel-based generation plants to expand the generation capacity of the national grid.

2. The construction of two minihydro plants - This scenario is based on the construction of two new small-scale hydro generation plants of a joint capacity of 9.5 MW, to provide electricity to the grid, and therefore diversify the source of supply on the grid.

The barriers were as follows:

- Financial/economical – This barrier evaluates the viability, attractiveness and financial and economic risks associated with each scenario, considering the overall economics of the project and/or economical conditions in the country.

- Technical/technological – This barrier evaluates whether the technology is currently available, if there are indigenous skills to operate it, if the application of the technology is a regional, national or global standard, and generally if there are technological risks associated with the particular project outcome being evaluated.

- Prevailing business practice – This barrier evaluates whether the project activity represents prevailing business practice in the industry. In other words, this barrier assesses whether in the absence of regulations it is a standard practice in the industry, if there is experience to apply the technology and if there tends to be high-level management priority for such activities.

With respect to **financial/economical** barriers, the construction of a new small-scale hydro plant faces this obstacle. Specifically:

- The continuation of current practices (Scenario 1) poses less financial/economical barrier as the construction of diesel plants have been the way of expanding capacity in Fiji for the last 20 years, thus the structure and practices necessary are already implemented.

- The construction of two small-scale hydro plants (Scenario 2) faces specific financial/economic barriers due to the fact that technical/technological innovations carry with them further risk premiums in terms of financing. There are various reasons that make the CERs an integral part of the financial package to overcome the financial/economic barriers under Scenario 2.

    - First, without the additional revenue from the CDM, diesel generation is clearly more economically sound than hydro generation. The capital costs involved in the project pose a barrier, especially considering the high interest rates prevalent in Fiji. According to FEA and SEL, the total capital costs for the Vaturu project are Fiji-$ 12.9 mill, which is Fiji-$4.3 million per MW; and for the Wainikasou project, these are Fiji-$ 13.3 mill, which is Fiji-$2.04 million per MW. These figures are clearly above the capital cost per MW of electricity generated of an average diesel plant, which is about Fiji-$1.3-1.8 mill per MW.

    - Second, the investment environment in Fiji is still risky due to its troubled recent history (e.g., in 2000 a nationalist coup toppled Fiji's democratic government). Conventional lenders, technology providers and project developers require higher returns on projects to mitigate this country risk. Moreover, the price that can be secured under a Power Purchase Agreement (PPA) with the Fijian Electricity Authority (FEA) is not considered adequate to compensate for this risk. In addition, the PPA would be signed with FEA, a government utility; and yet no government guarantees of payment have been offered to SEL.

With respect to the **technical/technological** barrier, this element poses difficulties to the construction of new minihydro plants. Specifically:

- In the case of Scenario 1 (continuation), there are no technical/technological issues as this simply represents a continuation of current practices and does not involve any new technology or innovation.

- In the case of Scenario 2, there are significant technical/technological barriers. Hydropower generation in Fiji is considered to be a risky technology, given the history of droughts in the island (1993, 1994, 1995, 1996 and the last one in 2003). As Table 2 shows above, generation from the Wailoa plant (hydro generation) has varied significantly over the years. The capacity factor (i.e., time the plant was generating electricity) of the plant can be over 60% in a good hydrological year, such as 2001 where the capacity factor was 63%. However, in drought years, such as 1996 or 2003, generation has been particularly low. Specifically, during those years the capacity factor at Wailoa has been lower than 50%, suggesting that investments in hydro plants face important uncertainties. Furthermore, FEA has no hydro construction capacity.

With respect to the barrier related to the **prevailing business practice**, the construction of new mini-hydro plants face obstacles. Specifically:

- The continuation of current practices (Scenario 1) presents no particular obstacles. This practice has been used effectively in the past with good results, and the continued expansion of the grid based on diesel generation presents no real barriers.

- The construction of new minihydro plants (Scenario 2) represents a deviation of current practices. In this regard, the FEA faces some barriers for the development of the Vaturu and Wainikasou projects. These include:
    - A lack of technical expertise in hydro technology development on the island, given that the last hydro plant was commissioned in 1983;
    - Whilst the Fijian Government currently has a strategic objective to increase the renewable energy provision in Fiji, there are no mechanisms in place to support the development of renewables to help developers and the electricity sector overcome the comparative disadvantages of renewables.

Table 3 below summarises the results of the analysis regarding the barriers faced by each of the plausible scenarios. As the table indicates, Scenario 1 faces no barriers, whereas Scenario 2 faces the three barriers identified – the financial/economic, technical/technological and the prevailing business practice barriers.

Table 3: Summary of Barriers Analysis

Barrier Evaluated		Scenario 1 Continuation of current activities	Scenario 2 Construction of minihydro plants
1.	Financial / Economical	No	Yes
2.	Technical / Technological	No	Yes
3.	Prevailing Business Practice	No	Yes

To conclude, the barrier analysis above has clearly shown that the most plausible scenario is the continuation of current practices (continuation of expansion of the grid based on diesel generation). Therefore, the project scenario is not the same as the baseline scenario, and each of these is defined as follows:

- The **Baseline Scenario** is represented by the continued expansion of capacity on the grid based on diesel generation plants. In this Baseline Scenario the project developer expands the generation capacity of the grid approximately on 38,000 MWh/year based on diesel.

- The **Project Scenario** is represented by the construction of two minihydro plants with an installed joint capacity of 9.5 MW. The new plants will generate electricity from a zero-emission generating source, thus resulting in significant GHG emission reductions.

Considering these facts, construction of non-emitting sources of electricity as the Vaturu and Wainikasou projects, is not an electricity market trend. The Project Scenario is environmentally additional in comparison to the baseline scenario, and therefore eligible under the CDM to secure Certified Emissions Reductions (CERs). Pacific Hydro and FEA are therefore seeking carbon revenues through the CDM to help mitigate some, or all, of the risks outlined above. Without these additional revenues, these risks would not be covered and the projects would not be constructed.

With the construction of the Vaturu and Wainikasou plants, supported by the CDM, 38,000 MWh of electricity will be displaced from the grid, therefore potentially reducing 523,488 tonnes of CO_2 emission over a 21-year timeframe.

B.4 Description of the project boundary for the project activity:

The project boundary is defined as the notional margin around a project within which the project's impact (in terms of carbon emission reductions) will be assessed. As referred to in Appendix B for small-scale project activities, the project boundary for a small-scale hydropower project that provides electricity to a grid encompasses the physical, geographical site of the renewable generation source. For Vaturu and Wainikasou this includes emissions from activities that occur at the project location related to the production of electricity from hydropower.

The project boundary for the baseline is defined as the grid level and for the project this only relates to the main island in Fiji – Viti Levu, which is not interconnected with the other islands that make up Fiji. The project boundary for the baseline will include all the direct emissions related to the electricity produced by the power plants that will be displaced by Vaturu and Wainikasou projects.

Conforming to the guidelines and rules for the small-scale project activities, the emissions related to production, transport and distribution of the fuel used in the power plants in the baseline are not included in the project boundary, as these do not occur at the physical and geographical site of the project. For the same reason the emissions related to the transport and distribution of electricity are also excluded from the project boundary.

B.5 Details of the baseline and its development:

B.5.1 **Specify the baseline for the proposed project activity using a methodology specified in the applicable project category for small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities:**

The baseline to be used in calculating the emission reductions from this project is that outlined in the relevant paragraphs of Appendix B (simplified modalities and procedures for small-scale CDM project activities). These are option (a) of paragraph 29 for the grid electricity component.

B.5.2 Date of completing the final draft of this baseline section:

10/06/2004

B.5.3 Name of person/entity determining the baseline:

The entity determining the baseline and participating in the project as the CO_2 Advisor is EcoSecurities Ltd.

C. DURATION OF THE PROJECT ACTIVITY AND CREDITING PERIOD

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity (DD/MM/YYYY):

01/05/2004

C.1.2. Expected operational lifetime of the project activity:

50y-0m

C.2 Choice of the crediting period and related information: *(Please underline the selected option (C.2.1. or C.2.2.) and provide the necessary information for that option.)*

C.2.1. Renewable crediting period (at most seven 7 years per period)

C.2.1.1. Starting date of the first crediting period **(DD/MM/YYYY):**

01/06/2005

C.2.1.2. Length of the first crediting period:

7y-0m

D. Monitoring methodology and plan

D.1. Name and reference of approved methodology applied to the project activity:

The Vaturu and Wainikasou Small Scale Renewable Energy Projects are being submitted as a small-scale bundle project. As described in paragraph 31 of the Simplified Procedures for SSC projects for Type I.D. Projects, the monitoring will consist of metering the electricity generated by the renewable technology

D.2. Justification of the choice of the methodology and why it is applicable to the project activity:

The methodologies were selected as suggested by the Simplified Monitoring Methodologies for small-scale CDM projects. For Type I.D. projects, measuring and recording the amount of electricity generated is the most accurate method of monitoring the project.

D.3 Data to be monitored:

Table 4: Data to be collected in order to monitor emissions from the project activity, and how this data will be archived

ID n°	Data type	Data variable	Data unit	Measured (m), calculated (c) indicated (I)or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
D.3.1	Electricity	Electricity Generation of the Project delivered to the Grid	MWh	M	Daily	100%	Electronic and paper	During the whole crediting period + 2 years	This item will be monitored by meters and through the electricity bill by the distribution company

This monitoring plan contains simplified monitoring requirements to reduce monitoring costs as permitted by small-scale project procedures. Once implemented, the relevant data report will be submitted to a designated operational entity contracted to verify the emission reductions achieved during the crediting period. Any revisions requiring improved accuracy and/or completeness of information will be justified and will be submitted to a designated operational entity for validation. The plan is designed to collect and archive all data needed to:

- Estimate or measure anthropogenic emissions by sources of greenhouse gases occurring within the project boundary during the crediting period as specified in appendix B for the Type/Categories I.D.

- Determine the baseline of anthropogenic emissions by sources of greenhouse gases occurring within the project boundary during the crediting period, as specified in appendix B for the Type/Category I.D.

- Calculate the reductions of anthropogenic emissions by sources by the proposed small-scale CDM project activity, and for leakage effects, in accordance with provisions of appendix B for the Type/Category I.D.

The plan does not include monitoring of any variable regarding leakage since no leakage is expected. Nevertheless, in the case of evidence of any leakage, this plan will be revised in order to include a suitable variable.

D.4. Name of person/entity determining the monitoring methodology:

EcoSecurities Ltd. is the entity determining the monitoring plan and participating in the project as the CO_2 Advisor.
FEA is responsible for operating and maintaining the projects. Operations management is to be carried out by SEL under given parameters, which are documented in the "Operational Guidelines" developed for that purpose.

E. CALCULATION OF GHG EMISSION REDUCTIONS BY SOURCES

E.1 Formulae used:

E.1.1 Selected formulae as provided in appendix B:

No formula is provided for the baseline for Project Category I.D., paragraph 29 a.

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary: *(for each gas, source, formulae/algorithm, emissions in units of* CO_2 *equivalent)*

No formula is used. Emissions by sources are zero since hydroelectric power is a zero CO_2-neutral source of energy.

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities *(for each gas, source, formulae/algorithm, emissions in units of* CO_2 *equivalent)*

This is not applicable as the renewable energy technology used is not equipment transferred from another activity. Therefore, as per the Simplified Procedures for Small-scale Project Activities no leakage calculation is required.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the project activity emissions:

Zero emissions.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHG's in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities: *(for each gas, source, formulea/algorithm, emissions in units of* CO_2 *equivalent)*

Total emissions, E, are given by:

$$E(\text{ton } CO_2/\text{yr}) = \sum_J E_J(\text{ton } CO_2/\text{yr}) \text{ [Equation 1]}$$

Where $E_J = CO_2$ emissions per year of the generation mode *j*, calculated by:

$$E_J \text{ (ton } CO_2/\text{yr}) = PG_J \text{ (MWh/yr)} * CEF_J \text{ (t}CO_2/\text{TJ), [Equation 2]}$$

Where PG_J = electricity generation of power plant *j*

CEF_J = emission capacity of the fuel-fired power plant *j*

Weighted average emission $\langle E \rangle$, representing the emission intensity, is given by:

$$\langle E \rangle \text{ (ton } CO_2/\text{MWh}) = E \text{ (t}CO_2/\text{yr) / } PG \text{ (MWh/yr), [Equation 3]}$$

Where *E* is given by equation (1);

$$PG \text{ (MWh/yr)} = \sum_J PG_J \text{ (MWh/yr)}$$

Equation 3 applies to both the operating margin and build margin cases. The only difference is the set of power plants used in each case.

The emission intensity coefficient, $\langle E \rangle_{baseline}$, is thus obtained as:

$$\langle E \rangle_{baseline} \text{ (ton } CO_2/\text{MWh}) = \{\langle E \rangle_{operating\ margin} \text{ (t}CO_2/\text{MWh)} + \{\langle E \rangle_{build\ margin} \text{ (t}CO_2/\text{MWh)}\} / 2$$

Finally, baselines emissions, $E_{baseline}$, are given by:

$$E_{baseline} \text{ (ton } CO_2/\text{yr}) = \langle E \rangle_{baseline} \text{ (t}CO_2/\text{MWh)} * PEG \text{ (MWh/yr)}$$

Where *PEG* stands for the Project's electricity generation.

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

Refer to the data and steps below to understand how this figure was derived.

Emission reductions of project activity =

0.656 tons CO_2/MWh * 38,000 MWh/year = 24,928 tons CO_2/year

E.2 Table providing values obtained when applying formulae above:

Based on the Project's assumptions and findings in the Feasibility Study the installed capacity of the bundle project will be 9.5 MW. The Vaturu project has an annual electricity generation of 20,000 MWh per year, and the Wainikasou project of 18,000 MWh per year.

Based on the above formulas and collected data the baseline is determined as follows:

<u>Approximate Operating Margin:</u>

$<E>_{\text{operating margin}}$ = 0.65 (ton CO_2/MWh)

<u>Build Margin:</u>

$<E>_{\text{build margin}}$ = .66 (ton CO_2/MWh)

<u>Baseline Emissions:</u>

$$<E>_{\text{baseline}} = (<E>_{\text{operating margin}} + <E>_{\text{build margin}}) / 2$$
$$= (.66 + .65) / 2 = .656$$

Therefore, the baseline emissions are:

0.656 tons CO_2/MWh * 38,000 MWh/year = 24,928 tonnes CO_2/year

Calculations are based on data supplied by the Fijian Electricity Authority. There are no uncertainties in the data submitted by the FEA since they are the electricity utility, and data is accurately gathered and audited.

For the calculations, fuel data was used, which is the most accurate way of estimating the emission reductions achieved by a project. Furthermore, IPCC factors for the carbon content of the fuel were used. These factors are considered to be conservative since they come from the IPCC 1996 Guidelines.

Operating Margin Data:

Plant Name	Technology	Fuel Type	MWh	MW	Fuel Consumption Unit	Fuel Consumption per year	Year Plant Online
Kinoya	Internal Combustion	diesel	132,138	35.51	litres	32,497,208	72,77,01
Vuda	Internal Combustion	diesel	83,282	24.08	litres	20,993,160	76, 01
Nadi	Internal Combustion	diesel	9,265	7.64	litres	2,564,347	68, 70
Sigatoka	Internal Combustion	diesel	4,298	8.88	litres	1,248,977	53 to 03
Deuba	Internal Combustion	diesel	3,926	1.7	litres	1,317,100	54 to 79
Rakiraki	Internal Combustion	diesel	1,808	1	litres	523,500	1997
Korovou	Internal Combustion	diesel	745	1.095	litres	236,970	99 to 04
Rokobili	Internal Combustion	diesel	4,292	3.3	litres	924,281	2003
Monasavu	Internal Combustion	diesel	123	0.155	litres	90,800.00	2003
Vatuwaka	Internal Combustion	diesel	5,106.00	5	litres	1,293,050.00	2003

Source: Fijian Electricity Authority (March 2004, obtained through personal communications)

Build Margin Data – 20% of recent plants built:

Plant Name	Technology	Fuel Type	Fuel Consumption (liters/year)	MWh	Cum Gen	% of capacity	Year Online
Sigatoka 5,6,7,8,9	Internal Combustion	diesel	618,862	2,130	2,130	0.35	2003
Korovou 2+3	Internal Combustion	diesel	157,980	496.67	2,626	0.43	2003
Rokobili	Internal Combustion	diesel	924,281	4,292	6,918	1.14	2003
Monasavu	Internal Combustion	diesel	90,800	123	7,041	1.16	2003
Vatuwaka	Internal Combustion	diesel	1,293,050	5,106.00	12,147	2.00	2003
Kinoya 3,4	Internal Combustion	diesel	19,163,377	77,921	90,068	14.86	2001

Vuda 3,4	Internal Combustion	diesel	10,984,793	43,578	133,646	22.04	2001

Source: Fijian Electricity Authority (March 2004, obtained through personal communications)

Calculation of Emission Factors:

Name	Technology	Fuel Type	kWh	liters/year	kWh /liter	Density (kg/l)	Carbon %	CEF (kg CO2/kWh)	kg CO2
Kinoya	Internal Combustion	diesel	132,138,000	32,497,208.00	4.07	0.83	86.10%	0.644	85,152,759
Vuda	Internal Combustion	diesel	83,282,000	20,993,160.00	3.97	0.83	86.10%	0.661	55,008,587
Nadi	Internal Combustion	diesel	9,265,000	2,564,347.00	3.61	0.83	86.10%	0.725	6,719,384
Sigatoka	Internal Combustion	diesel	4,298,000	1,248,977.00	3.44	0.83	86.10%	0.761	3,272,707
Deuba	Internal Combustion	diesel	3,926,000	1,317,100.00	2.98	0.83	86.10%	0.879	3,451,210
Rakiraki	Internal Combustion	diesel	1,808,000	523,500.00	3.45	0.83	86.10%	0.759	1,371,732
Korovou	Internal Combustion	diesel	745,000	236,970.00	3.14	0.83	86.10%	0.833	620,935
Rokobili	Internal Combustion	diesel	4,292,000	924,281.00	4.64	0.83	86.10%	0.564	2,421,903
Monasavu	Internal Combustion	diesel	123,000	90,800.00	1.35	0.83	86.10%	1.934	237,924
Vatuwaka	Internal Combustion	diesel	5,106,000	1,293,050.00	3.95	0.83	86.10%	0.664	3,388,192
		SUM:	244,983,000	Total kWh				**SUM:**	161,645,333

Sources: Plant data, FEA, 2003

Density - Kemps Engineering Handbook

Carbon % - Kemps Engineering Handbook

Approximate Operating Margin (OM) Calculation:

Total kWh	Total kg CO_2	**OM (tCO_2/MWh)**
244,983,000	161,645,333	**0.66**

Build Margin:

Name	Technology	Fuel Type	kWh	liters/year	kWh/liter	Density	Carbon %	CEF (kg CO2/kWh)	Kg CO2
Sigatoka 5,6,7,8	Internal Combustion	diesel	2,129,640	618,862	3.44	0.83	86.10%	0.761	1,621,612
Korovou 2+3	Internal Combustion	diesel	496,667	157,980	3.14	0.83	86.10%	0.833	413,957
Rokobili	Internal Combustion	diesel	4,292,000	924,281	4.64	0.83	86.10%	0.564	2,421,903
Monasavu	Internal Combustion	diesel	123,000	90,800	1.35	0.83	86.10%	1.934	237,924
Vatuwaka	Internal Combustion	diesel	5,106,000	1,293,050	3.95	0.83	86.10%	0.664	3,388,192
Kinoya 3,4	Internal Combustion	diesel	77,920,859	19,163,378	4.07	0.83	86.10%	0.644	50,213,990
Vuda 3,4	Internal Combustion	diesel	43,577,791	10,984,793	3.97	0.83	86.10%	0.661	28,783,563
		SUM:	133,645,956	Total kWh				**SUM:**	87,081,140

Sources: Plant data, FEA, 2003

Density - Kemps Engineering Handbook

Carbon % - Kemps Engineering Handbook

Build Margin (BM) Calculation:		
Total kWh	Total kg CO_2	**BM (tCO_2/MWh)**
133,645,956	87,081,139.59	**0.65**

Baseline Emission Rate (BER) Calculation		
OM (tCO_2/MWh)	BM (tCO_2/MWh)	**BER (tCO_2/MWh)**
0.66	0.65	**0.656**

Calculation of Emission Reductions:

Emission Reduction Calculations for Vaturu + Wainikasou bundle:

	Year 1
Project Generation (MWh/year)	38,000
Average of Operating Margin and Build Margin CEF:	0.656
Total Emission Reductions:	24,928

F. ENVIRONMENTAL IMPACTS

F.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

Statements of Environmental Impact have been carried out for both the Vaturu and Wainikasou projects. Information contained in these reports suggests that there are no negative environmental impacts expected from the projects. Evidence of this is provided below through extracts from the Statement of Environmental Impact undertaken for Vaturu and Wainikasou by SEL.

Extracts from the Statement of Environmental Impact for Wainikasou follow:

1. "It is proposed to construct a small hydro electric power station to **make use of the existing energy potential** currently being dissipated at the Howell Bunger valve. (…) The existing dispersion valve will remain in operation as a by-pass valve whenever the station is not in operation" (page 2).
2. "There are no existing structures other than FEA facilities and no trees on the site. There are no houses of farm buildings visible from the site. **Construction** of the project will have **no long-term environmental impact**" (page 3).
3. "**Interconnection** to the power grid will be to the new 33kW power line being constructed from Wailoa to the site via the existing road. The project is not expected to create any additional environmental impact from interconnection" (page 5).
4. "**Existing water flows will not be impacted** as all water into the station is returned to the stilling basin for transfer to Lake Monasavu as per the existence practice. The 1 metre high collapsible weir to be built on top of the existing weir will create more storage but this is not expected to effect the long-term operation of Wainisavulu Creek as the system will be essentially run-of-river with normal overflows during the wet season still occurring" (page 5).
5. "**No air pollution** is generated and the station is remote from any existing housing and built-up areas. The generating equipment will be located underground and noise will not be an issue".
6. "Overall, **the project will not create any foreseeable environmental impacts**, while generating needed environmentally friendly electricity, which can be used locally to good effect" (page 5).

Similarly, extracts from the Environmental Impact Statement for Vaturu follow:

1. "The site is within the existing [Public Works Department] PWD water treatment area and has been previously disturbed and graded. There are **no existing structures other than PWD**

facilities and no trees to be affected by the new power station. (…) Construction of the project will have no long-term environmental impact." (page 3).

2. "Interconnection to the power grid will be to the new 33kV Nagado-Vuda power line upgrade. The project is **not expected to create any additional environmental impact from interconnection.**" (page 5).
3. "**Existing water flows** to the [Nagado Water Treatment Plant] WTP **will not be impacted** as water into the station is passed to the WTP with the station acting as a pressure reduction device. By-pass provisions ensure continuous flow into the treatment plant." (page 5).
4. "**No air pollution** is generated and the station is within what is an industrial water treatment complex, remote from any exiting housing and built-up areas." (page 5).
5. "Overall, **the project will not create any foreseeable environmental impacts**, while generating needed environmentally friendly electricity, which can be used locally to good effect" (page 5).

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G. STAKEHOLDERS COMMENTS

G.1 Brief description of the process by which comments by local stakeholders have been invited and compiled:

Extensive stakeholder consultation has been undertaken for both projects: Vaturu and Wainikasou. Specifically, for Vaturu the FEA has consulted the three stakeholders of the project and obtained their approvals for power generation from the Water Treatment Plant. Regarding the landowners, meetings with them were undertaken and their issues addressed, so the "landowners finally agreed to the consent put forward to them by FEA", as described in the stakeholder consultation report for Vaturu. As for the Director of Lands, as per the letter attached to the abovementioned report, the Ministry of Lands "has in principle no objections to FEA's proposal for subleasing", and they are indeed preparing all the documentation required, which will be sent to FEA for their records in due course. As for NLTB, the third stakeholder, no major comments have arisen. Negotiations on the contract will be finalised shortly, which will be based on the results from the positive stakeholder consultation process.

As for the Wainikasou project, the land where the project will be implemented is acquired Native Land by the State. Although no landowners would be involved in the project (i.e., it is State land), consultation was undertaken with the Native Land Trust Board, with positive results. Furthermore, "Fijian protocol was also observed by presenting a traditional yaqona ceremony (sevusevu) to the original owners of the land at Wainikasou and where the transmission line was constructed to connect to the FEA grid. This procedure is normally not recorded as it only portrays a sign of respect to those whom are due", as stated in the Stakeholder Consultation report for Wainikasou. Therefore, stakeholder consultation process was also positive for this project.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

NOT APPLICABLE

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