**PROJECT DESIGN DOCUMENT FORM
FOR SMALL-SCALE CDM PROJECT ACTIVITIES (F-CDM-SSC-PDD)
Version 04.1**

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Efate Geothermal Power Project Phase 1
Version number of the PDD	01
Completion date of the PDD	10/11/2012
Project participant(s)	Kuth Energy Ltd, Australia and Department of Energy and Mines, Vanuatu
Host Party(ies)	Vanuatu
Sectoral scope(s) and selected methodology(ies)	Sectoral Scope: 01; Energy Industries (renewable - / non-renewable sources) Methodology: AMS-I.D.: Grid Connected Renewable Electricity Generation
Estimated amount of annual average GHG emission reductions	19,237 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

Vanuatu has been the subject of geothermal prospecting since the 1970s. In April 2009, Australian company, Kuth Energy Ltd., obtained two prospecting licenses on the island of Efate, Vanuatu. Licenses are issued to its Vanuatu-incorporated subsidiary Kuth Energy (Vanuatu) Ltd under the Vanuatu Geothermal Energy Act 1987. Kuth Energy has the exclusive right to exploit any geothermal resources discovered within the licence areas.

Kuth Energy has conducted initial geochemical and geophysical studies, and intends to develop a 5 MW (gross) geothermal power plant in first phase at Takara, Efate Island and sells electricity to Union Electrique du Vanuatu (UNELCO). UNELCO is a private electricity utility company providing electricity to Port Vila and surrounding areas under a concession agreement.

The electricity generated will be exported by a transmission system which would comprise an 11/60 kV generation substation, a single 60 kV transmission circuit and 60/20kV interconnection substation at Tagabe. The transmission system would be developed by a third party.

Secanrio Prior to the Implementation of the Project Activity

Electricity supply throughout Vanuatu is dominated by diesel based generation resulting in very high tariff. Vanuatu's national electrification rate is only 28%, reflecting low affordability and accessibility. Efate accounts for 86% of utility power generation in Vanuatu, and 73% of utility customers.

Electricity is provided by UNELCO, under a concession agreement that will run until 2031. A portion of Efate remains outside the UNELCO concession, and is not served by grid electricity. Some areas within the UNELCO concession are also currently without electricity supply. Nearly 30% of households on Efate currently do not have an electricity connection. UNELCO operates 23 MW of diesel capacity and 3 MW of wind power capacity.

Baseline Scenario

Baseline scenario for the proposed project activity is electricity generation from diesel fired power plants.
The proposed project activity will improve electricity supply in the region, reduce the cost of electricity and increase grid electricity supply to part of Efate which is not currently electrified. The project activity is a greenfield renewable energy project and is expected to result in 19,236 tCO_{2e} emission reductions per annum and 134,652 tCO_{2e} emission reductions during the first crediting period

The project activity is expected to reap following sustainable benefits to the host country:

Social:

- Ø The primary benefit of the project activity to Vanuatu will be reduced unit cost of electricity generation in the coming years. This will have a positive impact on overall economy.

- Ø Electricity in Vanuatu is mainly generated using costly to run and highly polluting diesel generators. Geothermal energy will reduce country reliance on imported diesel and improve energy security.

- Ø The project will increase share of renewable energy in Vanuatu which is less than 10% currently.

Environment:

- Ø The exploitation of geothermal energy does not produce NOx or SOx, and will produce substantially less GHG emissions compared to fossil fuel generated electricity.

Economy:

- Ø Jobs, training and income generation during construction and operation through direct employment.
- Ø Compensatory benefit through improved services and infrastructure and support of livelihoods programmes.
- Ø Improved Access to electricity.
- Ø Income generation opportunities generated from increased human activity in the area.

Technology:

- Ø The project will also involve technology transfer. The training of local staff for the Project will provide them with new skill sets.

A.2. Location of project activity
A.2.1. Host Party(ies)

Vanuatu

A.2.2. Region/State/Province etc.

Efate Island

A.2.3. City/Town/Community etc.

Port Vila

A.2.4. Physical/ Geographical location

Kuth has selected Takara, Site C in exhibit for initial development.

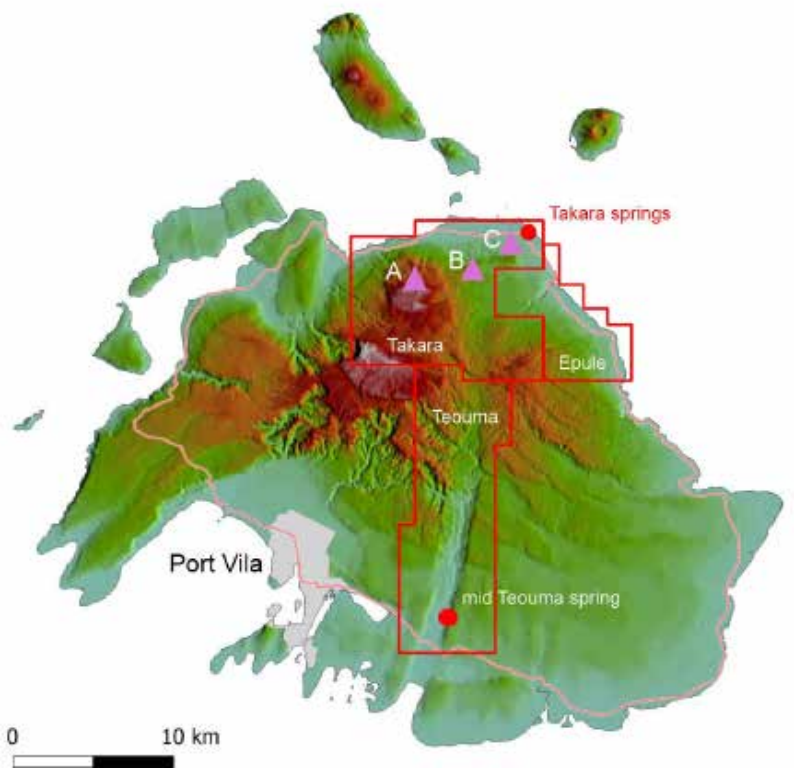

Figure1: Takara Geothermal Sites

The project geographical coordinates are: 17° 32' 28.95" S and 168°26'08.83"E

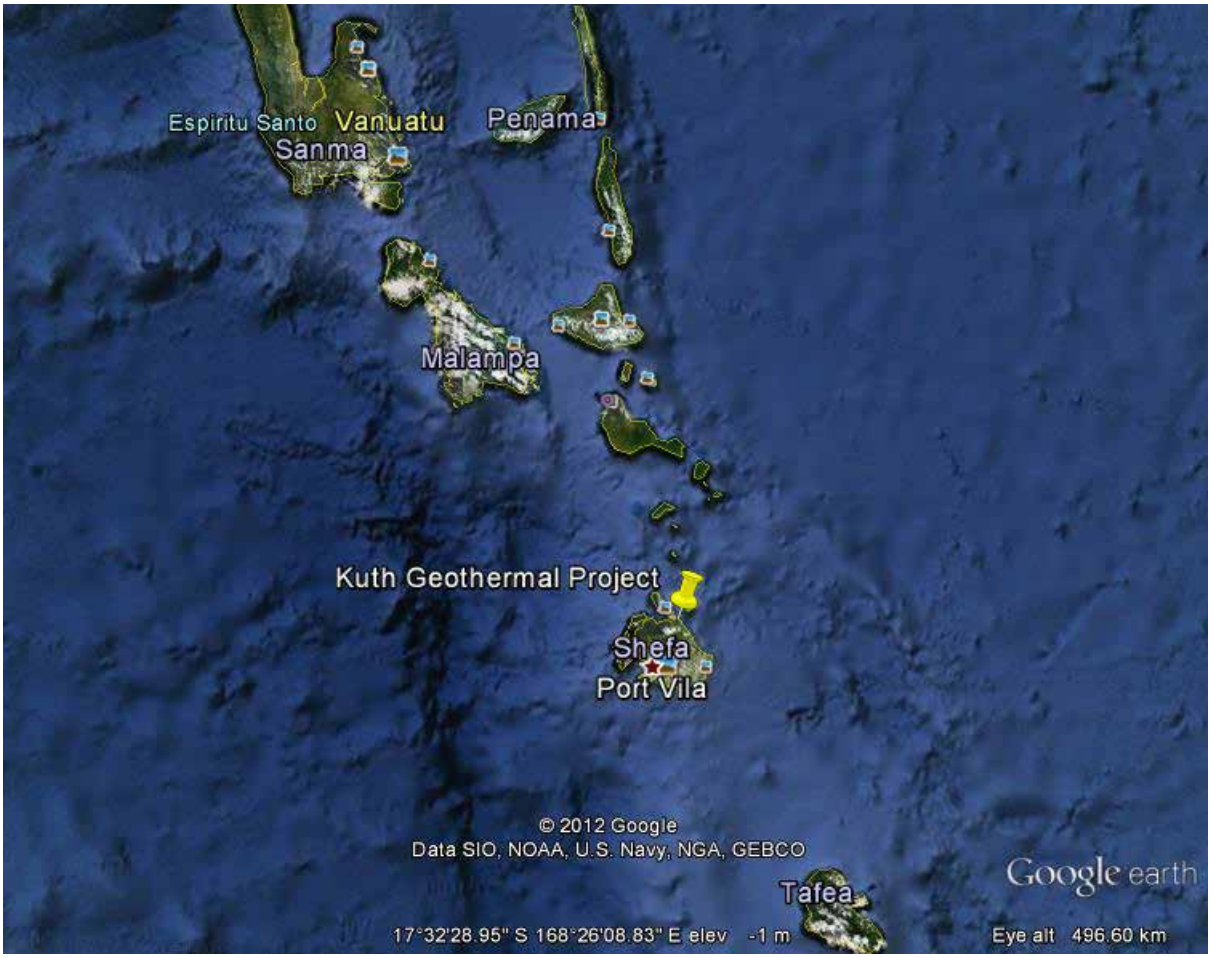

Figure2: Kuth Hydropower Project

A.3. Technologies and/or measures

Technology Description:

Based on the various studies carried out and considering the resource temperatures at Takara (150ºC base case, 190ºC best case), a binary cycle technology has been identified as the most appropriate technology for the project. In binary cycle power plant hot water is passed through a heat exchanger. This technology allows for considerable control over plant output. With binary cycle geothermal power plants, pumps are used to pump hot water from a geothermal well, through a heat exchanger, and the cooled water is returned to the underground reservoir. A second "working" or "binary" fluid with a low boiling point, typically a butane or pentane hydrocarbon, is pumped at fairly high pressure through the heat exchanger, where it is vaporized and then directed through a turbine. The vapor exiting the turbine is then condensed by cold air radiators or cold water and cycled back through the heat exchanger.Binary cycle power plants are closed-loop systems and virtually nothing (except water vapour) is emitted to the atmosphere.

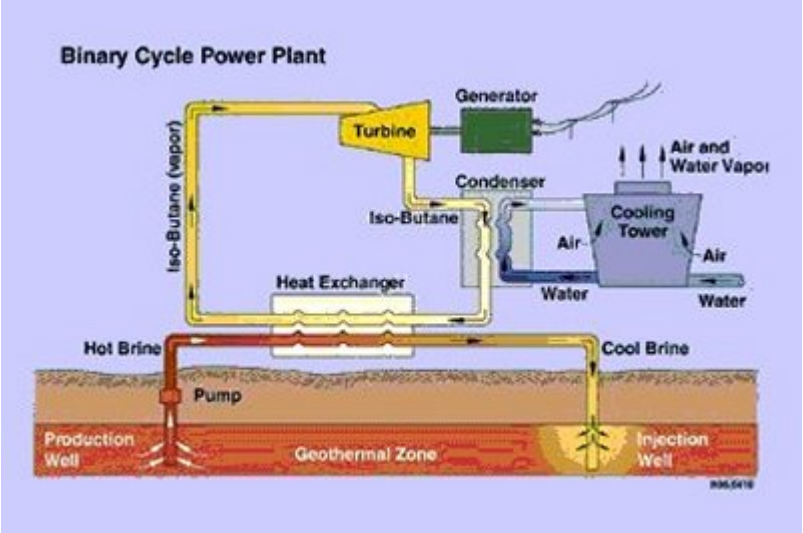

Figure3: Binary Cycle Power Plant

The estimated plant load factor for the project activity is 0.8[1] .The expected age of the turbines used in project activity is 25 years[2]. Net electricity generation of the project will be measured and monitored through the use of onsite metering equipment at the outgoing feeders. There are two systems, one main and the other one is the backup system which is located near the main system.The electricity supplied to the grid and the electricity imported from the grid will be cross-checked with the records of electricity sold and purchased. The maximum allowable error of the meters will not exceed ±0.25% of full scale.
The key technical features of project are listed below:

- Number of Generator - 1
- Turbine Type – Binary turbine generation set
- Installed Capacity – 5000 kW(5MW)
- Plant net output - 4344 kW
- No. of exploration wells – 4 (2 production wells and 2 injection wells)

This technology is technically sound and environmentally safe as is demonstrated by similar installations around the world. Project activity will involve technology transfer to Vanuatu. Knowledge transfer will be ensured through a comprehensive training for the Kuth's operation and maintenance personnel. The training shall cover the configuration and maintenance of all Equipment and systems of the Project designed and supplied by the Contractor.

[1] Based on Feasibility Study Report
[2] Industry Standards

Figure 2: Conceptual Plant layout

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Vanuatu (host)	Kuth Energy (Vanuatu) Ltd	No

A.5. Public funding of project activity

The project activity does not receive any public funding for its financing.

A.6. Debundling for project activity

According to "Guidelines on Assessment of Debundling for SSC Project Activities" paragraph 2, the following results into debundling of large CDM project:

"A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

• With the same project participants;
• In the same project category and technology/measure;
• Registered within the previous 2 years; and
• Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point."

The project activity is not a de-bundled component of a large project activity as there is no small scale CDM project activity or an application to register another small-scale CDM project activity by Project Proponent (PP) in the same project category and technology in the last two years within 1 km of the project boundary of the proposed small scale project activity.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

The project activity uses the following approved baseline and monitoring methodology and available at the UNFCCC website:

Title	Reference	Version
Grid Connected Renewable Electricity Generation[3]:	AMS-I.D., EB 61	Version 17
Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion[4].	EB 41 Annex 11	Version 01
Tool to calculate the Emission factor for an electricity System[5]	EB 63, Annex 19	Version 2.2.1

B.2. Project activity eligibility

<table>
<tr><th colspan="2">Applicability Criteria with AMS-I.D.</th><th>Project Applicability</th></tr>
<tr><td>1</td><td>This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass:[6]
(a) Supplying electricity to a national or a regional grid; or
(b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.</td><td>The project activity involves renewable energy generation unit specifically a geothermal unit that will supply electricity to the Port Vila Grid. Thus the Project Activity complies with the applicability criteria.</td></tr>
<tr><td>2</td><td>Illustration of respective situations under which each of the methodology (i.e. AMS-I.D., AMS-I.F. and AMS-I.A.[7]) applies is included in Table 2.
<table>
<tr><th></th><th>Project type</th><th>AMS-I.A.</th><th>AMS-I.D.</th><th>AMS-I.F.</th></tr>
<tr><td>1</td><td>Project supplies electricity to a national/regional grid</td><td></td><td>√</td><td></td></tr>
</table></td><td>The project supplies electricity to Port Vila Grid. Thus the project complies with the applicability criteria of AMS-I.D.</td></tr>
</table>

[3] http://cdm.unfccc.int/filestorage/V/9/L/V9LRSXKP24Q7YT6HZDUBO3C0ING8AJ.1/EB61_repan17_Revision_AMS-I.D_ver17.pdf?t=QlV8bTZrdTQ2fDBxrixMDU9A-EHoJXRXBdUg

[4] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf

[5] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf

[6] Refer to EB 23, annex 18 or the definition of renewable biomass.

[7] AMS-I.D. “Grid connected renewable electricity generation”, AMS-I.F. “Renewable electricity generation for captive use and mini-grid” and AMS-I.A. “Electricity generation by the user”

	2	Project displaces grid electricity consumption (e.g. grid import) and/or captive fossil fuel electricity generation at the user end (excess electricity may be supplied to a grid)			√	
	3	Project supplies electricity to an identified consumer facility via national/regional grid (through a contractual arrangement such as wheeling)		√		
	4	Project supplies electricity to a mini grid[8] system where in the baseline all generators use exclusively fuel oil and/or diesel fuel			√	
	5	Project supplies electricity to household users (included in the project boundary) located in off grid areas	√			
2	This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition[9]; (c) involve a retrofit[10] of (an) existing plant(s); or (d) involve a replacement[11] of (an) existing plant(s).					The project activity shall install a new geothermal power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant). Thus the Project Activity complies with the applicability criteria (a)
3	Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: · The project activity is implemented in an existing reservoir with no change in the volume of reservoir; · The project activity is implemented in an existing					NA

[8] The sum of installed capacities of all generators connected to the mini-grid is equal to or less than 15 MW.

[9] A capacity addition is an increase in the installed power generation capacity of an existing power plant through: (i) the installation of a new power plant besides the existing power plant/units, or (ii) the installation of new power units, additional to the existing power plant/units. The existing power plant/units continue to operate after the implementation of the project activity.

[10] Retrofit (or Rehabilitation or Refurbishment). It involves an investment to repair or modify an existing power plant/unit, with the purpose to increase the efficiency, performance or power generation capacity of the plant, without adding new power plants or units, or to resume the operation of closed (mothballed) power plants. A retrofit restores the installed power generation capacity to or above its original level. Retrofits shall only include measures that involve capital investments and not regular maintenance or housekeeping measures.

[11] Replacement. It involves investment in a new power plant or unit that replaces one or several existing unit(s) at the existing power plant. The installed capacity of the new plant or unit is equal to or higher than the plant or unit that was replaced.

	reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; · The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	
5	If the new unit has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel[12], the capacity of the entire unit shall not exceed the limit of 15 MW.	The project activity being harnessing geothermal energy has no non-renewable component and has 100% renewable component. Hence this condition is not applicable to the project activity.
6	Combined heat and power (co-generation) systems are not eligible under this category.	There is no Combined heat and power (co-generation) in the project activity. Thus the Project Activity complies with the applicability criteria.
7	In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct[13] from the existing units.	The project activity does not that involve the addition of renewable energy generation units at an existing renewable power generation facility. Hence this condition is not applicable to the project activity.
8	In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The project activity does not seek to any retrofit or replacement. Hence this condition is not applicable to the project activity.

B.3. Project boundary

According to the paragraph 15 of the small scale methodology AMS-I.D. Version 17 ***"The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system[14] that the CDM project power plant is connected to."***

Figure below presents a schematic view of the project boundary for the project activity:

[12] A co-fired system uses both fossil and renewable fuels.

[13] Physically distinct units are those that are capable of generating electricity without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered "physically distinct".

[14] Refer to the latest approved version of the "Tool to calculate the emission factor for an electricity system" for definition of an electricity system.

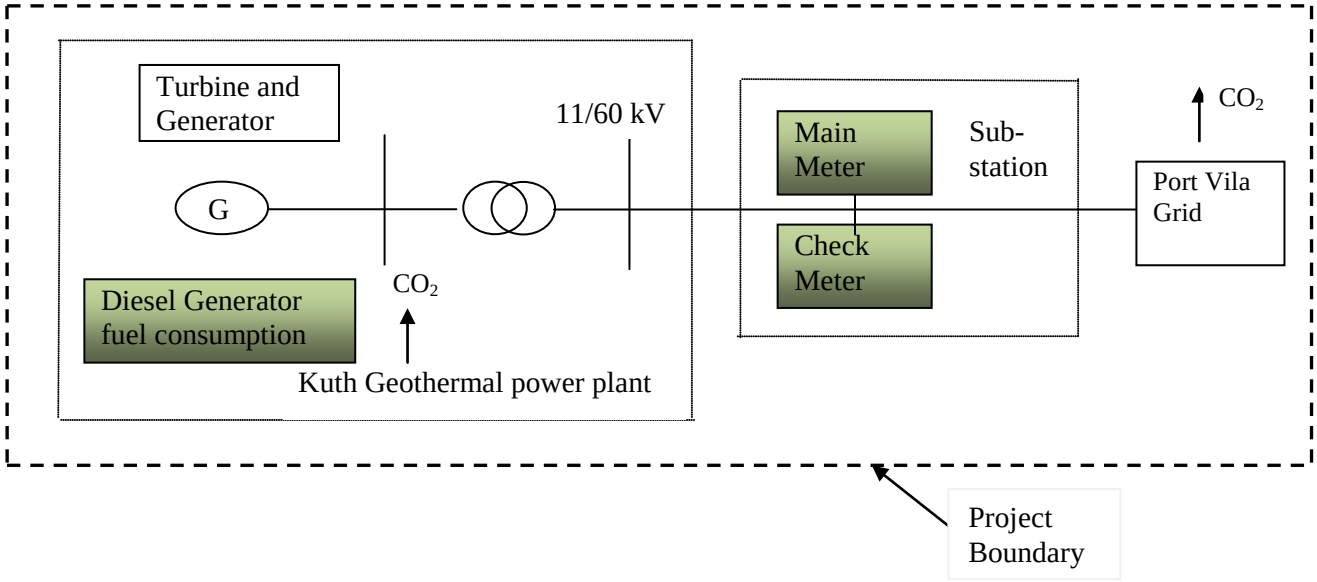

Figure 3: Project Boundary

Scenario	Source	Gas	Included/ Excluded	Justification/Explanation
Baseline scenario	Electricity Delivered to the grid by the project activity that otherwise would have been generated by the operation of grid connected power plants and by the addition of new generation sources.	CO_2	Included	Main Emission Source.
		N_2O	Excluded	Not Significant. Excluded for simplification and conservativeness.
		CH_4	Excluded	Not Significant. Excluded for simplification and conservativeness.
Project activity	Emissions associated with combustion of fossil fuel associated with operation of project	CO_2	Included	Included
		N_2O	Excluded	Not Significant. Excluded for simplification and conservativeness.
		CH_4	Excluded	Not Significant. Excluded for simplification and conservativeness.
	Fugitive	CO_2	Included	Main emission source

	emissions from non-condensable gases contained in geothermal steam.	N_2O	Excluded	Minor emission source
		CH_4	Excluded	Minor emission source

B.4. Establishment and description of baseline scenario

As per applicable methodology AMS-I.D. version 17, EB 61 paragraph 10: *the baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.*

Electricity supply throughout Vanuatu is dominated by diesel generation. For the Port Vila concession, UNELCO operates 23 MW of diesel capacity and 3 MW of wind power capacity. In absence of the project activity in baseline scenario equivalent electricity would have been generated by existing grid connected power plant and addition of new diesel fired power plants.

Data used to determine the baseline emissions:

"Tool to calculate the emission factor for an electricity system" provides procedures to determine parameters considered in the baseline calculation as presented in table below:

Parameter	Unit	Description	Source of data to be used
$EG_{BL,y}$	MWh	Net electricity supplied to the grid	Electricity meter
$EF_{CO2,grid,y}$	tCO_2/MWh	CO_2 Emission Factor of the grid in year *y*.	Feasibility Study Report for the project prepared for World Bank

B.5. Demonstration of additionality

Project additionally can be demonstrated using "Guidelines for Demonstrating Additionally of Micro-Scale Project Activities" (EB 68, version 04)**.**

As per the paragraph 2 of the guidelines:

Project activities up to 5 MW that employ renewable energy technology are additional if any one of the below conditions are satisfied:

(a) The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ)of the host country

(i) SUZ is a region in the host country (zone, municipality or any other designated official administrative unit) identified by the Government in official notifications for development

assistance including for planning, management, and investment satisfying any one of the following conditions using most recent available data:

- § The proportion of population with income less than USD 2 per day (PPP) in the region is greater than 50%;
- § The GNI per capita in the country is less than USD 3000 and the population of the region is among the poorest 20% in the poverty ranking of the host country as per the applicable national policies and procedures;

(ii) In cases where, based on the recommendation of the designated national authority of the host country, the SUZ in the host country has been approved by Executive Board (hereinafter referred to as the Board) of the clean development mechanism (CDM), the list of such SUZ shall be maintained on the UNFCCC website (e.g. at <http://cdm.unfccc.int/DNA/submissions/index.html>). In the case of these SUZ listed on the CDM website there is no need for the project proponents to provide proofs as indicated in paragraph (a) above.

(b) The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone of the host country identified by the government before 28 May 2010;

(c) The project activity is an off-grid activity supplying energy to households/communities (less than 12 hours grid availability per 24 hrs is also considered off-grid for this assessment);

(d) The project activity is designed for distributed energy generation (not connected to a national or regional grid) with both conditions (i) and (ii) satisfied;

(i) Each of the independent subsystems/measures in the project activity is smaller than or equal to 1500kW electrical installed capacity;

(ii) End users of the subsystems or measures are households/communities/small and medium enterprises (SMEs). (e) The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.

The following conditions shall apply for DNA recommendations:

(i) Specific renewable energy technologies/measures refers to grid connected renewable energy technologies of installed capacity equal to or smaller than 5 MW;

(ii) The ratio of installed capacity of the specific grid connected renewable energy technology in the total installed grid connected power generation capacity in the host country shall be equal to or less than 3 per cent;

(iii) Most recent available data on the percentage of contributions of specific renewable energy technologies shall be provided to demonstrate compliance with the 3 per cent threshold. In no case shall data older than three years from the date of submission be used;

(iv) Technologies/measures recommended by DNAs and approved by the Board to be additional in the host country remain valid for three years from the date of approval. However, additionality of eligible project activities applying the guidelines remains valid for the entire crediting period;

(v) DNA submissions shall include the specific grid connected renewable electricity generation technologies that are being recommended and provide the required data as indicated above (e.g. wind power, biomass power, geothermal power, hydropower).

According to the United Nations, Vanuatu is classified both as a Least Developed Country (LDC) and Small Island Developing State (SIDS)[15]. Hence proposed project, which is having installed capacity of 5 MW is considered to be automatically additional as per the above EB guidelines.

Also project activity faces technological barriers such as availability of skilled labour, capacity for O&M etc.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

Emission Reductions

The Emission Reductions are calculated by using the following algorithm:

$ER_y = BE_y – PE_y - LE_y$

Where,
ER_y: Emission Reductions in the year y (tCO_2e)
BE_y: Baseline emissions in the year y (tCO_2e)
PE_y: Project emission in year y (tCO_2e)
LE_y : Leakage Emissions in year y (tCO_2e)

Baseline emissions:

$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$

Where,
$EG_{BL,y}$: Quantity of net electricity supplied to the grid in year y (MWh)
$EF_{CO2, grid,y:}$ CO_2 Emission factor of the grid in year y (tCO_2/MWh)

As the latest 3 year data is not available, the weighted average emissions (in tCO_2/MWh) of the current generation mix as per AMS-I.D. paragraph 12b has been calculated. Based on latest available data (2010) $EF_{grid, OMaverage,y}$ = 0.61 tCO_2e/MWh. Please refer Annex 4 for further details.

Project Emissions:

$PE_y = PE_{FF,y} + PE_{GP,y}$

Where:
PE_y Emission from reservoir expressed as tCO_2e/yr
$PE_{FF,y}$ Project emissions from fossil fuel consumption in year y (tCO_2/yr)

$P_{GPF,y}$ Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO_2e/yr)

[15] http://www.un.org/special-rep/ohrlls/sid/list.htm

$PE_{FF,y}$ shall be calculated as per the latest version of the 'Tool to calculate project or leakage CO2 emissions from fossil fuel combustion'. For ex-ante emissions this has been assumed to be zero.

$PE_{GP,y}$ is calculated as follows:

$$PE_{GP,y} = (W_{steam,CO2,y} + W_{steam,CH4,y} * GWP_{CH4}) * M_{steam,y}$$

Where:

$PE_{GPF,y}$	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO_2e/yr)
$W_{steam, CO2, y}$	Average mass fraction of carbon dioxide in the produced steam in year y (tCO_2/t steam)
$W_{steam, CH4, y}$	Average mass fraction of methane in the produced steam in year y (tCH_4/t steam)
GWP_{CH4}	Global warming potential of methane valid for the relevant commitment period (tCO_2e/tCH_4)
$M_{steam,y}$	Quantity of steam produced in year y (t steam/yr)

Leakage Emissions:

For CPA's not transferring energy generating equipment from another activity, the leakage is considered as zero.

B.6.2. Data and parameters fixed ex ante

B.6.3. Ex-ante calculation of emission reductions

Baseline Emissions:

$BE_y = EG_y * EF_{CO2,grid,\ y}$
= 31536 MWh * 0.61 (tCO_2/MWh)
= 19,236

Project Emissions:

$PE_y = PE_{FF,y} + PE_{GP,y}$
Where
$PE_{FF,y} = 0$ As any use of fossil fuel is not envisaged in the project activity.
$PE_{GP,y} = 0$ As project used binary system in which no steam is released to the atmosphere.

Leakage Emissions:

$LE_y = 0$

Emission Reductions

$ER_y = BE_y – PE_y - LE_y$
$= 19,236 – 0 – 0$
$= 19,236\ tCO_2\ e$

B.6.4. Summary of ex-ante estimates of emission reductions

Year	Baseline emissions (tCO_2 e)	Project emissions (tCO_2 e)	Leakage (tCO_2 e)	Emission reductions (tCO_2 e)
Year 1	19,236	0	0	19,236
Year 2	19,236	0	0	19,236
Year 3	19,236	0	0	19,236
Year 4	19,236	0	0	19,236
Year 5	19,236	0	0	19,236
Year 6	19,236	0	0	19,236
Year 7	19,236	0	0	19,236
Total	134,652	0	0	134,652
Total number of crediting years	07			
Annual average over the crediting period	19,236	0	0	19,236

B.7. Monitoring plan
B.7.1. Data and parameters to be monitored
(Copy this table for each data and parameter.)

Data / Parameter	$EG_{BL,y}$
Unit	MWh/year
Description	Quantity of net electricity supplied to the grid in year y
Source of data	Electric meter readings located at the project site
Value(s) applied	31,536
Measurement methods and procedures	Measurement will be undertaken using electricity meter.
Monitoring frequency	Continuous monitoring, hourly measurement and monthly recording
QA/QC procedures	The meter(s) will be subject to maintenance and calibration according to manufacturer standard. On site staff will receive training in CDM monitoring and the maintenance requirements of the electricity meters. Data measured by the meter(s) will be cross checked using electricity sales receipts. The accuracy of the measurement is ensured through annually calibration by a qualified party as per appropriate national/international standard.
Purpose of data	Calculation of baseline emissions
Additional comment	Data will be archived at least for two years after the end of the crediting period, or the last issuance of CERs, whichever occurs later.

Data / Parameter	$FC_{i,j,y}$
Unit	Mass or volume unit/y
Description	Quantity of fossil fuel type i (diesel) fired in the captive power plant (j) in the year y
Source of data	On-site measurements
Value(s) applied	0
Measurement methods and procedures	As small tanks will be used, rulers will be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge will be calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift). Data archiving would be done both electronically and on paper records The Data will be stored for at least 2 years after last crediting period.
Monitoring frequency	Measuring equipment will be calibrated annually at appropriate intervals according to manufacturer specifications.
QA/QC procedures	The consistency of measured fuel consumption quantities will be cross-checked by an annual energy balance that is based on purchased quantities and stock change. The calibrations would be done as per manufacturer's specifications.
Purpose of data	The parameter will be used to calculate relevant project emissions
Additional comment	-

Data / Parameter	NCV_i
Unit	GJ/tonne
Description	Average net calorific value of fossil fuel type i (diesel) used in the period t
Source of data	The following data sources to be used a) Supplier data b) If a) is not available, measurement by PP c) If a) is not available, regional or national default values will be taken for liquid fuels d) If a) is not available, IPCC default values at the upper limit of the uncertainty at a 95% confidence interval.
Value(s) applied	43.3 (IPCC default value)
Measurement methods and procedures	For (a) and (b) Measurements to be undertaken in line with national or international fuel standards and at each fuel delivery. In case of (c), appropriateness of the values will be reviewed annually. In case of (d), any revisions of the IPCC Guidelines will be taken into account. Data archiving would be done both electronically and on paper records. The Data will be stored for at least 2 years after last crediting period
Monitoring frequency	For a) and b) at each fuel delivery For c) annually For d) whenever revision takes place.
QA/QC procedures	Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards
Purpose of data	The parameter will be used to calculate relevant project emissions
Additional comment	-

Data / Parameter	$EF_{CO2\ i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in the period *t*
Source of data	The following data sources to be used a) Supplier data b) If a) is not available, measurement by PP c) If a)is not available, regional or national default values will be taken for liquid fuels d) If a) is not available, IPCC default values at the upper limit of the uncertainty at a 95% confidence interval.
Value(s) applied	Diesel 0.0748 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2,table 1.4 (Upper limit of the uncertainty at a 95% confidence interval)
Measurement methods and procedures	For a) and b): The CO_2 emission factor should be obtained for each fuel delivery, from which weighted average values for the period t should be calculated In case of (c), appropriateness of the values will be reviewed annually. In case of (d), any revisions of the IPCC Guidelines will be taken into account. Data archiving would be done both electronically and on paper records. The Data will be stored for at least 2 years after last crediting period
Monitoring frequency	For a) and b) at each fuel delivery For c) annually For d) whenever revision takes place.
QA/QC procedures	For a) and b): Measurements should be undertaken in line with national or international fuel standards. For a): If the fuel supplier does provide the NCV value and the CO_2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO_2 factor should be used. If another source for the CO_2 emission factor is used or no CO_2 emission factor is provided, options b), c) or d) should be used.
Purpose of data	The parameter will be used to calculate relevant project emissions
Additional comment	-

Data / Parameter	$EG_{,y}$
Unit	MWh
Description	Net electricity generated and delivered to the grid by all power sources serving the system
Source of data	Feasibility Study Report of project prepared for World Bank
Value(s) applied	Refer Appendix 4
Measurement methods and procedures	The data will be as provided by government agency or UNELCO Data archiving would be done both electronically and on paper records .The Data will be stored for at least 2 years after last crediting period
Monitoring frequency	Annually
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	--

Data / Parameter	$EF_{CO2,grid,y}$
Unit	tCO_{2e}/MWh
Description	Grid Emission Factor
Source of data	Feasibility Study Report of project prepared for World Bank
Value(s) applied	0.61
Measurement methods and procedures	Based on the latest available data (2010) the weighted average emissions (in tCO_2/MWh) of the current generation mix has been calculated
Monitoring frequency	Annually
QA/QC procedures	Data archiving would be done both electronically and on paper records .The Data will be stored for at least 2 years after last crediting period.
Purpose of data	Calculation of baseline emissions
Additional comment	--

Data / Parameter	$M_{steam,y}$
Unit	Tonnes
Description	Quantity of steam produced in year y (t steam/yr)
Source of data	On-site measurement
Value(s) applied	Not Available
Measurement methods and procedures	The quantity of steam produced will be recorded daily by means of a Venturi flow meter located at the upstream of the turbine and which is adjusted for any losses (e.g. brine)
Monitoring frequency	Data will be monitored continuously and condensed to half hour values. Daily figures will be built according to the methodology by accumulation of data
QA/QC procedures	Calibration: following the technical specification/requirement of the manufacturer but a least every three years
Purpose of data	Calculation of project emissions
Additional comment	-

Data / Parameter	$W_{steam,CO2,y}$
Unit	tCO_2/t steam
Description	Average mass fraction of carbon dioxide in the produced steam in year y
Source of data	Field sampling & measurement
Value(s) applied	Not Available
Measurement methods and procedures	Non-condensable gases sampling will be carried out in production wells and at the steam field-power plant interface using relevant national/international standard for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO_2 and CH_4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H_2S) and carbon dioxide (CO_2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analysed using gas chromatography to determine the content of the residuals including CH_4.
Monitoring frequency	The non-condensable gases sampling and analysis should be performed at least every three months and more frequently, if necessary.
QA/QC procedures	Following relevant national or international standards
Purpose of data	Calculation of project emissions
Additional comment	

Data / Parameter	$W_{steam,CH4,y}$
Unit	tCH_4/t steam
Description	Average mass fraction of methane in the produced steam in year y
Source of data	Field sampling & measurement
Value(s) applied	Not Available
Measurement methods and procedures	Non-condensable gases sampling will be carried out in production wells and at the steam field-power plant interface using relevant national/international standard for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO_2 and CH_4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H_2S) and CO_2 dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analysed using gas chromatography to determine the content of the residuals including CH_4.
Monitoring frequency	The non-condensable gases sampling and analysis should be performed at least every three months and more frequently, if necessary.
QA/QC procedures	Following relevant national or international standards
Purpose of data	Calculation of project emissions
Additional comment	

B.7.2. Sampling plan

Project activity does not involve any sampling for the determination of parameter values for calculating GHG emissions.

B.7.3. Other elements of monitoring plan

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Purpose: To ensure that the approved monitoring methodology is correctly implemented in order to enable the accurate and transparent determination of avoided emissions.

A CDM Project Manager will be assigned to oversee implementation of project monitoring plan. Competency requirements for the position of Project Manager will be defined and applied to ensure that the Project Manager is able to implement the monitoring procedures. Additional competencies, e.g. for the maintenance and calibration of the meters, will be sourced externally where necessary.

Calculation of emissions reduction

The data required to calculate baseline emissions and project emissions will be fed into a spreadsheet which will calculate the emission reductions according to the formulae described above, using the defined default values. The spreadsheet will be regularly audited to ensure it is operating correctly.

Quality control

Data will be compared from month to month using trend analysis to show where parameters have deviated significantly from preceding or following values. Any values identified as being unusual in this manner will be rechecked.

Accuracy and calibration of instruments

All meters will be maintained to ensure a high level of accuracy. The exact specifications of each meter will be determined during the detailed design of the project. Thereafter the meter accuracies will be included in this procedure and steps taken to maintain those levels of accuracy.
All key meters will be subject to a quality control regime that will include regular maintenance and calibration. A record will be maintained showing the location and unique identification number of each meter, the calibration status of that meter (when last calibrated, when next due for calibration) and who performs the calibration service. Calibration certificates will be retained for all meters until two years after the end of the crediting period.

Archiving of data

The monitoring team will periodically archive data to a secure and retrievable storage format on a periodic e.g. weekly basis. Calibration records may be archived by scanning and storage in an accessible electronic format. These data will be stored until 2 years after the end of the crediting period.

Document Control

The Project Manager will implement a document control system that ensures that the current versions of necessary documents are available at the point of use. All documents must be maintained in English with local translations because English is the formal language of the CDM.

Audit function and management review

The Project Manager will arrange for an audit of the management system periodically and at least once per year. The auditor will not be involved in the daily operation of the mine and if necessary, may be sourced from a third party. The auditor will assess the implementation of the monitoring procedure and the preparation of the monitoring report. Audit findings, and steps taken to address findings will be recorded and reviewed in a Management Review meeting (convened at least annually) at which time the effectiveness of these procedures will be reviewed and necessary changes implemented.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

January 2014

C.1.2. Expected operational lifetime of project activity

30 years

Crediting period of project activity

Type of crediting period

Renewal Crediting Period (First)

C.1.3. Start date of crediting period

2016

C.1.4. Length of crediting period

7 years 0 months

SECTION D. Environmental impacts
D.1. Analysis of environmental impacts
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The Environmental Protection and Conservation Act of Vanuatu, No. 12 of 2002 and amended in 2010, focuses on conservation, sustainable development and management of the environment.
Under definitions found in Part 1, springs, ground water and geothermal water are all included and subject to the Act. The Act pertains to all activities that:

- Impact or are likely to impact the environment of Vanuatu, and
- Require any license and or approval under any law

It specifically includes any activities that could result in pollution of water resources, contamination of land or unsustainable use of renewable resources.

A Preliminary Environmental Assessment (PEA) is required for all activities subject to the Act. With reference to the project activity the purpose of the PEA is to determine if there is a need for an EIA for the drilling activity. A PEA was conducted for the project activity and the Department of Environment has confirmed that no EIA is required at current stage and has approved request for 1st stage of drilling activity.

During the PEA Impacts on the Physical Environment and Impacts on the human Population were studied for the project activity. From the study it is concluded that only potential significant impacts from the project activity would be noise, runoffs and wastes generated from the operations.
It is also recommended that at this stage no further environment analysis is required for the project activity.

However the project activity is required to comply with below terms and conditions:

- The drilling operator must avoid unnecessary clearing of vegetation except within the area designated for the drilling equipment and operations, storage areas and camping sites for labourers including other associated facilities.
- The Takara village community must be consulted and be informed of the drilling operations and the substantial noise level at certain time intervals. Agreement must be made with the

communities on the operational times, which will be 24 hours a day and 7 days a week, including holidays if that is acceptable to the people in the community of Takara.

- If an agreement is established on the times for operations, drilling activities must be carried out during those working hours to avoid unnecessary noise heard in the village.
- The village must be informed of night time operations.
- Acquisition of land must be obtained prior to commencement of any activities.
- All form of wasted must be properly managed; no wastes (solid, sewage etc.) are allowed to be disposed of anywhere within the project land premises;
- The Department of Water Resources must be consulted if water is to be obtained from any nearby water body or underground water, and
- The operators must also comply with the measures outlined in the Vanuatu Geothermal project Exploration Drilling document to mitigate environmental impacts.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

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Kuth Energy in collaboration with the Energy Department, Government of Vanuatu has held several consultations with the stakeholders during conceptualisation as well as during the feasibility assessment studies and development of geothermal power framework.

The various elements of stakeholder consultation have included:

- involvement of local and national authorities in the planning and design phases of the project;
- consultation with land owners;
- publicity via local media (Tok Pok Shows);
- facilitation of community consultation events; and

E.2. Summary of comments received

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The majority of comments received during the stakeholder consultations were positive. Stakeholders cited employment, community aid, education and tourism as benefits of the project's construction. Some of the other comments included mainly about the land issues, hot water/steam discharge from the plant, and odors.

Queries were also made with regards to GHG emissions and related global climate change. A brief explanation of the greenhouse effect and its potential impacts was given. Some stakeholders were of the impression that the CDM of the Kyoto Protocol appears to be loophole to assist industrialised countries avoid decreasing GHG emissions within their own countries. In response, a brief explanation was given on the pros and cons of emission trading under the Kyoto Protocol. In addition, various questions on the operation of geothermal power were also raised and were addressed by technical experts.

E.3. Report on consideration of comments received

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In response to the stakeholder comments PP made further presentations to the community and explained the composition and nature of steam by-products of the geothermal. It was also informed that the plant will comply with all national and sectoral regulations regarding air safety, will operate as approved in the EIA, and will comply with the required guidelines. It is also clarified that geothermal fluid produced by the wells is re-injected entirely into the injection well and no fluid is discharged to the surface.

SECTION F. Approval and authorization

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Letter of Approval from each Party to be involved in the project activity will be made available at the time of submitting the PDD to the validating DOE.

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Appendix 1: Contact information of project participants

Organization	Kuth Energy
Street/P.O. Box	C/- Barrett & Partners, 1st Floor, B & P House, Lini Highway,
Building	
City	Port Vila
State/Region	
Postcode	
Country	Vanuatu
Telephone	+678 7744657
Fax	+678 22317
E-mail	tim.hewatt@kuthenergy.com
Website	www.kuthenergy.com
Contact person	Tim Hewatt
Title	Kuth Vanuatu Representative
Salutation	Mr
Last name	Hewatt
Middle name	
First name	Kuth
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Appendix 2: Affirmation regarding public funding

The project activity does not involve any public funding. Declaration for same will provided at time of validation

Appendix 3: Applicability of selected methodology

Applicability of selected methodology is discussed in section B.2 of PDD. The project activity meets the applicability criteria of the methodology.

Appendix 4: Further background information on ex ante calculation of emission reductions

The data below represents latest available data for 2010.

Power Plant	Generation in kWh	Sp. Diesel Consumption (g/kWh)	Diesel Consumption (TJ)	Emissions (tCO_2)
GR2	115,501	233.03	1.16	85.76
GR3	17,300	232.72	0.17	12.83
GR4	-	0	0.00	0.00
GR5	-	0	0.00	0.00
GR6	166,600	230.86	1.65	122.55
GR7	539,900	231.87	5.38	398.88
GR8	4,368,700	223.08	41.91	3105.27
GR9	3,368,300	223.22	32.33	2395.69
GR10	812,250	209.8	7.33	542.98
GR11	609,077	208.76	5.47	405.14
4 CUMMINS	2,303,366	251.92	24.95	1848.90
GR1 Tag	19,814,821	211.46	180.17	13350.73
GR1 coconut oil	79,990			
GR2 Tag	21,152,724	207.03	188.31	13953.60
GR 2 coconut oil	491,351			
Wind Power generation	5,388,875			
Total	**59,228,755**			**36222**
Average OM EF (tCO_2e/MWh)				**0.612**

Appendix 5: Further background information on monitoring plan

The monitoring information for the project has been included in section B.7.2 of the document

Appendix 6: Summary of post registration changes

Not Applicable

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History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for small-scale CDM project activities" (EB 66, Annex 9).
03	EB 28, Annex 34 15 December 2006	· The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.
02	EB 20, Annex 14 08 July 2005	· The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. · As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
01	EB 07, Annex 05 21 January 2003	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		