

## PROJECT IDEA NOTE (PIN)

**Name of Project: Biomass Gasification Power Plant in Samoa**

**Date submitted: 12<sup>th</sup> October 2012**

### **Description of size and quality expected of a PIN**

Basically a PIN will consist of approximately 5-10 pages providing indicative information on:

- the type and size of the project
- its location
- the anticipated total amount of greenhouse gas (GHG) reduction compared to the “business-as-usual” scenario (which will be elaborated in the baseline later on at Project Design Document (PDD) level)
- the suggested crediting life time
- the suggested Certified Emission Reductions (CERs)/Emission Reduction Units (ERUs)/Verified Emission Reduction (VERs) price in US\$ or €/ton CO<sub>2</sub>e reduced
- the financial structuring (indicating which parties are expected to provide the project's financing)
- the project's other socio-economic or environmental effects/benefits

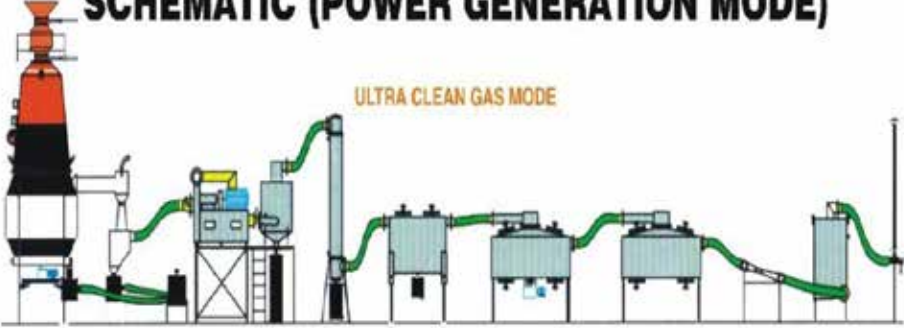
**While every effort should be made to provide as complete and extensive information as possible, it is recognised that full information on every item listed in the template will not be available at all times for every project.**

**A. PROJECT DESCRIPTION, TYPE, LOCATION AND SCHEDULE**

<p><b>OBJECTIVE OF THE PROJECT</b> <i>Describe in not more than 5 lines</i></p>	<p>The Electric Power Company (EPC) of Samoa depends to a large extent on diesel oil fuelled electricity generation to meet the electricity demand in the country. On the Savaii Island in Samoa, 100% of electricity (peak load 2.6 MWe) is generated through combustion of imported diesel fuel. In the proposed project activity biomass gasification technology is identified as a potential renewable energy technology to reduce Samoa's dependence on Green House Gas (GHG) intensive diesel oil. The objective of the proposed project activity is twofold: one to reduce country's reliance on imported diesel oil and second promote use of a new technology in country.</p>
<p><b>PROJECT DESCRIPTION AND PROPOSED ACTIVITIES</b> <i>About ½ page</i></p>	<p>The Government of Samoa through the Ministry of Natural Resource and Environment (MNRE) and the Government of Australia have signed an agreement to implement the Greenhouse Gas (GHG) Abatement pilot project using renewable energy technology (biomass gasification technology), which is included as a priority in the National GHG Abatement Strategy (NGHGAS) 2008-2018. The responsibility for implementation of the gasification technology program has been assigned to the Renewable Energy Division of the MNRE.</p> <p>Biomass gasification power generation offers opportunities for MNRE, EPC and Samoan consumers to develop an additional source of electricity at a cost that is competitive to the current diesel generated power systems. Generating electricity using locally grown biomass will help reduce the cost of power generation that is dependent on imported fuel and at the same time, it will help reduce GHG emissions.</p> <p>For Samoa to gain experience with biomass gasification technology, biomass growing, harvesting and processing, a demonstration project with a capacity of 500 KWe<sup>1</sup> is planned initially at sites identified by MNRE. These facilities will constitute a first step toward larger scale installations in the future. The maximum sustainable plant capacity will be evaluated during the pilot project period.</p> <p>Detailed project implementation plan is provided in Annex 1.</p>
<p><b>TECHNOLOGY TO BE EMPLOYED<sup>2</sup></b> <i>Describe in not more than 5 lines</i></p>	<p>Gasification is a process that converts organic or fossil based carbonaceous materials into carbon monoxide, hydrogen and carbon dioxide. This is achieved by exposing the materials to high temperatures (&gt;700 °C), without combustion, with a controlled amount of oxygen and/or steam. The resulting gas mixture is called <i>syngas</i> (from <i>synthesis gas</i> or <i>synthetic gas</i>) and is used as fuel. The power derived from gasification of biomass and combustion of the resultant gas is considered to be a source of renewable energy. The advantage of gasification is that using the syngas is potentially more efficient than direct combustion of the original fuel because it can be combusted at higher temperatures.</p> <p>The proposed project will use fixed bed, downdraft type gasifier since this type of gasifier has a proven "commercial track record" in hundreds of installations throughout Asia and in other parts of the world. For the expected net 3,433 MWh/year output, Cummins 100% syngas engine/generator set with an ANKUR 850 WBG gasifier system is proposed. Figure below gives a schematic illustration of the proposed gasification system.</p>

<sup>1</sup> In case of budget constraints a smaller 250 KWe capacity may be implemented.

<sup>2</sup> Please note that support can only be provided to projects that employ commercially available technology. It would be useful to provide a few examples of where the proposed technology has been employed.

	<p style="text-align: center;"><b>"ANKUR" BIOMASS GASIFIER SYSTEM</b></p> <p style="text-align: center;"><b>SCHEMATIC (POWER GENERATION MODE)</b></p> 
Greenhouse gases targeted CO <sub>2</sub> /CH <sub>4</sub> /N <sub>2</sub> O/HFCs/PFCs/SF <sub>6</sub> <i>(mention what is applicable)</i>	CO <sub>2</sub>
Type of activities Abatement/CO <sub>2</sub> sequestration	Abatement
Field of activities <i>(mention what is applicable)</i> <i>See annex 1 for examples</i>	Renewable Energy: Biogas(1b)
<b>LOCATION OF THE PROJECT</b>	
Country	Samoa
City	Upolu/Savaii Island
Brief description of the location of the project <i>No more than 3-5 lines</i>	<p>Project site should have at least potential for sustainable biomass supply of 7,000 metric tonne per year for the 500 kWe power plant. The following potential sites for implementation of a biomass gasification demonstration project have been identified by MNRE:</p> <ol style="list-style-type: none"> <li>1. Pupu Pué National Park Area (Upolu Island), 729 ha.</li> <li>2. STEC Plantation (Upolu Island), 2700 ha.</li> <li>3. Land owned by Mr. Leo Salia (Savaii island), 1200 ha.</li> <li>4. Asau-Falelima (Savaii Island), 2500 ha.</li> <li>5. Land owned by Mr. Andrew Ah Liki (Bluebird Enterprises Ltd.) near Asau (Savaii island), 2495 ha.</li> </ol> <p>Sites 2, 4 and 5 offer the best characteristics for demonstration purposes and for future expansion. Site 2 would utilize both coconut husk and wood biomass production. Site 5 would involve privately owned land. A decision needs to be taken on the site selection.</p>
<b>PROJECT PARTICIPANT</b>	
Name of the Project Participant	Electric Power Corporation (EPC)
Role of the Project Participant	b. <b>Owner of the site or project</b>
Organizational category	a. Government

Contact person	Tile Leia Tuimalealiifano
Address	P.O. Box 2011, 5th Floor, TATTE Building, Sogi, Apia, SAMOA
Telephone/Fax	Telephone 685 65401/Fax 685 23748
E-mail and web address, if any	leiat@epc.ws
Main activities <i>Describe in not more than 5 lines</i>	The Electric Power Corporation of Samoa (EPC) was incorporated on 19 December 1972. It is an autonomous State-owned corporation. Its responsibilities covers the generation, transmission, distribution and selling of electricity in Samoa. The EPC now provides power to 96 per cent of the population of Samoa.
Summary of the financials <i>Summarize the financials (total assets, revenues, profit, etc.) in not more than 5 lines</i>	Not applicable as Government Entity
Summary of the relevant experience of the Project Participant <i>Describe in not more than 5 lines</i>	Not applicable as Government Entity
<i>Please insert information for additional Project Participants as necessary.</i>	
<b>EXPECTED SCHEDULE</b>	
Earliest project start date <i>Year in which the plant/project activity will be operational</i>	2015
Expected first year of CER/ERU/VERs delivery	2016
Project lifetime <i>Number of years</i>	10 years
For CDM projects: Expected Crediting Period <i>7 years twice renewable or 10 years fixed</i>  For JI projects: Period within which ERUs are to be earned ( <i>up to and including 2012</i> )	10 years fixed
Current status or phase of the project <i>Identification and pre-selection phase/opportunity study finished/pre-feasibility study finished/feasibility study finished/negotiations phase/contracting phase etc. (mention what is applicable and indicate the documentation)</i>	Feasibility study finished Available document: Biomass gasification Power Generation Plant in Samoa.

<p>Current status of acceptance of the Host Country  <i>Letter of No Objection/Endorsement is available; Letter of No Objection/Endorsement is under discussion or available; Letter of Approval is under discussion or available (mention what is applicable)</i></p>	<p>Project is being developed under voluntary market and need not apply for Letter of no Objection.</p>
<p>The position of the Host Country with regard to the Kyoto Protocol</p>	<p>Has the Host Country ratified/acceded to the Kyoto Protocol?  <u>Yes, 16 Feb 2005</u></p> <p>Has the Host Country established a CDM Designated National Authority / JI Designated Focal Point?  <u>Yes in year 2010</u></p>

**B. METHODOLOGY AND ADDITIONALITY**

<p><b>ESTIMATE OF GREENHOUSE GASES ABATED/ CO<sub>2</sub> SEQUESTERED</b>  <i>In metric tons of CO<sub>2</sub>-equivalent, please attach calculations</i></p>	<p>Annual (if varies annually, provide schedule): <u>2,803</u> tCO<sub>2</sub>-equivalent                  Up to and including 2012: <u>0</u> tCO<sub>2</sub>-equivalent                  Up to a period of 10 years: <u>28030</u> tCO<sub>2</sub>-equivalent                  Up to a period of 7 years: <u>0</u> tCO<sub>2</sub>-equivalent</p> <table border="1" data-bbox="808 1066 1240 1486"> <thead> <tr> <th>Year</th> <th>Emission Reduction (tCO<sub>2e</sub>)</th> </tr> </thead> <tbody> <tr><td>2016</td><td>2803</td></tr> <tr><td>2017</td><td>2803</td></tr> <tr><td>2018</td><td>2803</td></tr> <tr><td>2019</td><td>2803</td></tr> <tr><td>2020</td><td>2803</td></tr> <tr><td>2021</td><td>2803</td></tr> <tr><td>2022</td><td>2803</td></tr> <tr><td>2023</td><td>2803</td></tr> <tr><td>2024</td><td>2803</td></tr> <tr><td>2025</td><td>2803</td></tr> </tbody> </table>	Year	Emission Reduction (tCO <sub>2e</sub> )	2016	2803	2017	2803	2018	2803	2019	2803	2020	2803	2021	2803	2022	2803	2023	2803	2024	2803	2025	2803
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<p><b>BASELINE SCENARIO</b>                  CDM/JI projects must result in GHG emissions being lower than “business-as-usual” in the Host Country. At the PIN stage questions to be answered are at least:</p> <ul style="list-style-type: none"> <li>Which emissions are being reduced by the proposed CDM/JI project?</li> </ul>	<p>CO<sub>2</sub> is the targeted emission reductions by the project activity.</p> <p>The project will result in reduction in diesel based electricity generation, which is the baseline scenario.</p>																						

<p>· What would the future look like without the proposed CDM/JI project? <i>About ¼ - ½ page</i></p>	
<p><b>ADDITIONALITY</b> Please explain which additionality arguments apply to the project: (i) there is no regulation or incentive scheme in place covering the project (ii) the project is financially weak or not the least cost option (iii) country risk, new technology for country, other barriers (iv) other</p>	<p>Project additionally can be demonstrated as per “Guidelines for Demonstrating Additionally of Micro-Scale Project Activities” (EB 64, 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:</p> <ul style="list-style-type: none"> <li>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.</li> <li>b) The project activity is an off-grid activity supplying energy to households/communities (less than 12 hours grid availability per 24 hours day is also considered as off grid. for this assessment);</li> <li>c) The project activity is designed for distributed energy generation (not connected to a national or regional grid) with both conditions (i) and (ii) satisfied;             <ul style="list-style-type: none"> <li>(i) Each of the independent subsystem/measure in the project activity is smaller than or equal to 1500 kW electrical installed capacity;</li> <li>(ii) End users of the subsystem or measure are households/communities/ Small and Medium-sized Enterprises (SMEs).</li> </ul> </li> <li>d) The project activity employs specific renewable energy technologies/measures recommended by the host country DNA and approved by the Board to be additional in the host country</li> </ul> <p>According to the United Nations, Samoa is classified both as a Least Developed Country (LDC) and Small Island Developing State (SIDS)<sup>3</sup>. Hence proposed project, which is having installed capacity of 500 kWe is considered to be automatically additional as per the above EB guidelines.</p>
<p><b>SECTOR BACKGROUND</b> Please describe the laws, regulations, policies and strategies of the Host Country that are of central relevance to the proposed project, as well as any other major trends in the relevant sector.  Please in particular explain if the project is running under a public</p>	<p>Demand for energy has increased in Samoa over the last decade, thus reliable, affordable and environmentally sound energy services and supply is crucial to meeting this demand. Scientific research shows that fossil fuels are depleting at a fast rate consequently there is a need to promote and increase renewable energy investment options and generation across the country. The effective and efficient coordination and management of the energy sector remains the responsibility of the Energy Unit of the Ministry of Finance in collaboration with all the relevant stakeholders.</p> <p>Samoa's National Energy Policy 2007 set the national goal “<i>To increase the contribution of Renewable Energy for energy services and supply by 20% by</i></p>

<sup>3</sup> <http://www.un.org/special-rep/ohrlls/sid/list.htm>

<p>incentive scheme (e.g. preferential tariffs, grants, Official Development Assistance) or is required by law. If the project is already in operation, please describe if CDM/JI revenues were considered in project planning.</p>	<p><i>the year 2030</i>". Renewable Energy is one of the five strategic areas of the <i>Samoa National Energy Policy</i> with the objective to <i>"successfully shift from fossil fuel dependency to Renewable Energy investment"</i>.</p> <p>Renewable Energy is environmentally friendly and cleaner which makes it a better substitute for fossil fuel. Recent studies have shown that there is adequate potential of biomass gasification, biogas, wind, biodiesel and biofuels in Samoa.</p>
<p><b>METHODOLOGY</b> Please choose from the following options:</p> <p>For CDM projects:</p> <p>(i) project is covered by an existing Approved CDM Methodology or Approved CDM Small-Scale Methodology</p> <p>(iii) projects needs modification of existing Approved CDM Methodology</p>	<p>The projects under this programme fall under the scope of following methodology<sup>4</sup></p> <p><i>Type:</i> I. Renewable energy projects</p> <p><i>Category:</i> I.D<sup>5</sup> – Grid connected renewable electricity generation (I.D./Version 17,EB 61)</p> <p>Scope Number: 1</p>

**C. FINANCE**

<p><b>TOTAL CAPITAL COST ESTIMATE (PRE-OPERATIONAL)</b></p>															
<p>Total project costs</p>	<p>Based on the feasibility study the estimated initial cost projections for the 500 kWe project is US\$ 1,360,515. This includes both the purchase and construction costs as well as some contingencies. The details for some of the key cost components are given below:</p> <table border="1" data-bbox="565 1339 1442 1640"> <thead> <tr> <th>Key Components</th> <th>Cost in US\$</th> </tr> </thead> <tbody> <tr> <td>Gasifier system (WBG-400) including installation and commissioning</td> <td>388,395</td> </tr> <tr> <td>Producer gas power plant (2 x 250 kW gas engine/generator set)</td> <td>350,393</td> </tr> <tr> <td>Civil Works</td> <td>126,750</td> </tr> <tr> <td>Vehicles</td> <td>80,000</td> </tr> <tr> <td>Duties and Taxes</td> <td>90,310</td> </tr> <tr> <td>Contingencies</td> <td>123,683</td> </tr> </tbody> </table>	Key Components	Cost in US\$	Gasifier system (WBG-400) including installation and commissioning	388,395	Producer gas power plant (2 x 250 kW gas engine/generator set)	350,393	Civil Works	126,750	Vehicles	80,000	Duties and Taxes	90,310	Contingencies	123,683
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Contingencies	123,683														

<sup>4</sup> Appropriate methodology - I.A/I.F for the project will be decided during PDD preparation once further information is available.

<sup>5</sup> <http://cdm.unfccc.int/methodologies/DB/RSCTZ8SKT4F7N1CFDXCSA7BDQ7FU1X>

<b>SOURCES OF FINANCE TO BE SOUGHT OR ALREADY IDENTIFIED</b>	
Equity Name of the organizations, status of financing agreements and finance (in US\$ million)	Information regarding project funding is not yet available.
Debt – Long-term Name of the organizations, status of financing agreements and finance (in US\$ million)	Information regarding project funding is not yet available.
<b>SOURCES OF CARBON FINANCE</b> Name of carbon financiers that you are contacting (if any)	NA
<b>INDICATIVE CER/ERU/VER PRICE PER tCO<sub>2</sub>e</b> <i>Price is subject to negotiation. Please indicate VER or CER preference if known.</i>	US\$ 8 – 10 (Indicative price range only)
<b>TOTAL EMISSION REDUCTION PURCHASE AGREEMENT (ERPA) VALUE</b>	
A period until 2012 (end of the first commitment period)	N/A
A period of 10 years	US\$ 224,240 – US\$ 280,300
A period of 7 years	N/A

#### D. EXPECTED ENVIRONMENTAL AND SOCIAL BENEFITS

<b>LOCAL BENEFITS</b> E.g. impacts on local air, water and other pollution.	<ul style="list-style-type: none"> <li>The project will be using biomass for power generation. There will be no GHG emission from this project activity.</li> <li>Combustion of biomass in the proposed project does not result in net increase in GHG emissions of CO<sub>2</sub>, CH<sub>4</sub> and NO<sub>x</sub>.</li> <li>There is no fly ash<sup>6</sup> or solid waste from biomass gasification process</li> </ul>
<b>SOCIO-ECONOMIC ASPECTS</b>	
What social and economic effects can be attributed to the project and which would not have occurred in a comparable situation without that project? Indicate the communities and the number of people that will benefit from this project. <i>About ¼ page</i>	<ul style="list-style-type: none"> <li>The project brings additional investment in the area to contribute in meeting increasing power demand of the people.</li> <li>Use of biomass energy for electricity generation instead conventional practice, reduces stress on the economy of the country.</li> <li>The project contributes to diversification of the national energy supply, which is dominated by conventional fuel based generating units.</li> </ul>
What are the possible direct effects (e.g. employment creation, provision of capital required, foreign exchange effects)? <i>About ¼ page</i>	<ul style="list-style-type: none"> <li>The project activity will help to development of plant site which is an isolated rural area.</li> <li>The project contributes for social wellbeing by generating job opportunities during the initial stage of project development, (eg. civil works, construction activity,) and during the operation of the project activity.</li> <li>The project will involves construction of roads to project site which will improve/ strengthen access of the region.</li> </ul>

<sup>6</sup> <http://www.netprorenewable.com/technology.html>



**ENVIRONMENTAL STRATEGY/  
PRIORITIES OF THE HOST  
COUNTRY**

A brief description of the project's consistency with the environmental strategy and priorities of the Host Country  
*About ¼ page*

Sustainable management of natural resources and promoting good land use and management practices are key strategic areas for Samoa's Ministry of Natural Resources & Environment (MNRE).

Although biomass does have the potential to be a significant player in future renewable electricity generation scenarios, it should not be regarded as a simple means to completely replace fossil fuels. Intensive biomass production schemes may compete with natural ecosystems or food production for arable land. A biomass energy system must therefore be managed in a sustainable way, taking advantage of the function of natural systems but minimizing impact on the natural environment. Hence proposed project activity calls for small-scale, biomass-fuelled power generation systems that will be integrated with sustainable forestry management and agro-forestry systems.

As per the Samoa Strategy for the Development 2012-2016, it is a priority to establish an effective coordinated framework to encompass all environmental initiatives as well as harmonize and rationalize all environmental projects to minimize duplication and strengthen sectoral linkages. It is also important to mainstream environment considerations into sector plans and programs, policies and budgetary processes. Hence in the proposed project activity environment considerations were taken into account and are discussed below:

**Gas emissions**

In normal operation, gasifier systems have no gaseous emissions other than those from the exhaust of the engine. Biomass gasifier systems are carbon neutral, as the carbon emissions to atmosphere during the biomass conversion (gasification and consecutive combustion of the producer gas) are balanced by the carbon uptake by the plant materials grown for fuel.

Exhaust emissions such as sulphur and nitrogen oxides from an internal combustion engine running on wood gas are therefore typically lower than for hydrocarbon fuels (e.g. natural gas or diesel).

Some CO emissions are associated with burning of syngas and hence the gasifier will be installed in semi-enclosed buildings (roof with open sides) and adequate natural flow-through ventilation.

**Liquid waste management**

Many small biomass gasifier systems make use of a wet scrubber system to cool and wash the raw syngas. The resulting 'black water' is typically treated to remove solid materials (ash, soot and tars), cooled and re-circulated back to the gasifier. Liquid waste generated will be treated before being discharged to the atmosphere.

**Solid Waste Management**

A by-product of biomass gasification is ash. This ash based on its carbon content can be put to several uses such as used for making charcoal (briquettes), used as raw material for making cement or used as fertilizer for soil.

**Noise**

Noises from an engine running on producer gas are generally lower than that of diesel fuelled engines.

## ANNEX I - Technologies

1. Renewables
  - 1a. Biomass
  - 1b. Biogas
  - 1c. Bagasse
  - 1d. Wind
  - 1e. Hydro
  - 1f. Geothermal
  - 1g. Photovoltaic
  - 1h. Solar Thermal
2. Fossil Fuel Switch
3. Energy Efficiency
  - 3a. Cement Efficiency Improvement
  - 3b. Construction material
  - 3c. District heating
  - 3d. Steel Gas Recovery
  - 3e. Other Energy Efficiency
4. Waste Management
  - 4a. Landfill Gas recovery/utilization
  - 4b. Composting
  - 4c. Recycling
  - 4d. Biodigestor
  - 4e. Wastewater Management
5. Coalmine/Coalbed Methane
6. Oil and Gas Sector
  - 6a. Flared Gas Reduction
  - 6b. Reduction of technical losses in distribution system
7. N<sub>2</sub>O removal
8. HFC23 Destruction
9. SF<sub>6</sub> Recovery
10. Transportation
  - 9a. Fuel switch
  - 9b. Modal switch
11. Others

**Annex 2**  
Project Implementation Plan

8.1 Detailed Implementation Plan by Month	Implementing Responsibility	Professional Source	1	2	3	4	5	6	7	8	9	10	11	12
<b>0.0 Project Approval ( Got and Funding Institution)</b>	MORE		→											
0.1 GoS and MNRE Approval	MNRE		→											
0.2 Budget Approval/ AusAid/ Donor Agreements	Steering Com.		→	→										
0.3 Budget Disbursement	AusAid			→	→									
0.4 Contracting Mechanisms Prepared	MNRE		→	→	→									
<b>1.0 Site Selection and Land Acquisition:</b>	MNRE		→											
1.1 Review of Site Alternatives and Criteria	Steering Com.		→											
1.2 Finalize Site Selection	Steering Com.		→	→										
1.3 Complete All Legal Land use and environment docs	MNRE			→	→	→								
1.4 Complete land use approval process	MNRE			→	→	→								
<b>2.0 Biomass Management Plan and Harvest Schedule</b>	MNRE		→											
2.1 Biomass Production Potential Survey/Verification	Forestry Spec	Univ.of Pacific		→	→	→								
2.2 Productive Forest Management Plan	Forestry Spec	Univ.of Pacific		→	→	→								
2.3 New tree planting action plan	Forestry Spec	Univ.of Pacific		→	→	→	→	→	→	→	→	→	→	→
2.4 Tree Harvest and Collection Plan	Forestry Spec	Univ.of Pacific		→	→	→	→	→	→	→	→	→	→	→
<b>3.0 Negotiate PPA with EPC</b>	MNRE		→											
3.1 Draft Power Purchase Agreement (PPA)	MNRE Legal	Local	→											
3.2 Review and Finalize PP Agreement	PPA Expert	External	→	→										
<b>4.0 Select Project Design and Implementation Professional Planning Team</b>	MNRE	Local	→											
4.1 Project Manager and Supervisor	Project Mgt	Consultant	→	→	→									
4.2 Architect and Civil Works Designer	Architect/Eng	Consultant	→	→	→									
4.3 Biomass Plantation and Harvesting Survey and Plan	Forestry Spec	Univ.of Pacific	→	→	→									
4.4 Gasification Technology and Systems Professional	Equip. Manufact.	Tech provider	→	→	→									
4.5 Technical Operational Training Services	Equip. Manufact.	Tech provider		→	→									
4.6 Project Evaluation and Monitoring Services	Prof. Evaluator	Ausaid Evaluation	→	→	→									
4.7 Power Plant Operations, Management and Reporting	EPC	EPC/Private Sector	→	→	→									
4.8 Project Accounts and Audit	MNRE	Private Auditor	→	→	→									
4.9 Project Contracting and Legal	MNRE	Lawyer	→	→	→									

Detailed Implementation Plan		Implementing Responsibility	Professional Source	1	2	3	4	5	6	7	8	9	10	11	12	
<b>5.0 Prepare Site Master Plan, Maps, Drawings, and Layouts</b>		MNRE		→												
5.1	Access routes and parking plan	Eng Planner	Consultant				→	→								
5.2	Services (Power and Water) Plan	Eng Planner	Consultant				→	→								
5.3	Topography/Drainage Map	Eng Planner	Consultant				→	→								
5.4	Vegetation and Soils Map	Eng Planner	Min/Agric-MNRE				→	→								
5.5	Existing Buildings Location Plan	Eng Planner	Consultant				→	→								
5.6	New Building Location Plan	Eng Planner	Consultant				→	→								
5.7	Building External Dimension and Location Plan	Eng Planner	Consultant				→	→								
5.8	Security Fence Location	Eng Planner	Consultant				→	→								
<b>6.0 Complete building layoutplans and designs (External and Internal)</b>				→												
6.1	Biomass receiving and off-loading area	Architect/Eng	Consultant				→	→								
6.2	Biomass Cutting and Wood Chipping area	Architect/Eng	Consultant				→	→								
6.3	Biomass Covered Storage Building	Architect/Eng	Consultant				→	→								
6.4	Gasifier Reactor and Gas Treatment Building	Architect/Eng	Tech provider				→	→								
6.5	Cooling Tower/Water Treatment/Pond	Manufacturer	Tech provider				→	→								
6.6	Biomass conveyor and transport system	Manufacturer	Tech provider				→	→								
6.7	Gas delivery pipeline	Manufacturer	Tech provider				→	→								
6.8	Engine and Electricity Generation Building	EPC	Local				→	→								
6.9	Electricity Site Distribution System Plan	EPC Electrician	Local				→	→								
6.10	Electricity Grid Connection System Plan	EPC Electrician	Local				→	→								
6.11	Water Services Distribution System	Water technician	Local				→	→								
6.12	Workshop Building	Architect/Eng	Consultant				→	→								
6.13	Covered Vehicle Parking Building with Maintenance Pit	Architect/Eng	Consultant				→	→								
6.14	Admin office/Toilets/changing room/Lunch room	Architect/Eng	Consultant				→	→								
6.15	Waste water/sewerage disposal system	Water/ eng.	Consultant				→	→								
6.16	Landscaping Plan	Gardener	Consultant				→	→								
<b>7.0 Specification and Procurement of Biomass Gasification System Equipment</b>				→												
7.1	Wood cutting and chipping machines	Consultant	External				→	→								
7.2	Wood chip dryer	Consultant	External				→	→								
7.3	Wood chip conveyors	Consultant	External				→	→								

Detailed Implementation Plan	Implementing Responsibility	Professional Source	1	2	3	4	5	6	7	8	9	10	11	12
7.4 Complete Biomass Gasifier system design	Consultant	External			→	→	→							
7.5 100 % Syngas Engine/Generator Set(s)	Consultant	External			→	→	→							
7.6 Associated electrical cabling and water pipe	Consultant	Local			→	→	→							
7.7 Synchronization equipment generator sets	Manufacturer	Tech provider			→	→	→							
7.8 Transformers and gen-set protection equipment	Manufacturer	EPC/Private Sector			→	→	→							
7.9 Grid connection and protection equipment	Manufacturer	EPC/Private Sector			→	→	→							
7.10 Vehicles (Truck, Tractor and Forklift)	Consultant	Local Dealer			→	→	→							
<b>8.0 Advertise Tenders, select and Purchase Project Equipment</b>														
8.1 Biomass Gasifier System ( 250 kWe and 500 kWe)	Procure Comm.	consult/Local			→	→	→							
8.2 Wood cutting, chipping and drying equipment	Procure Comm.	consult/Local			→	→	→							
8.3 250 kWe and 500 kWe syngas engine and generator	Procure Comm.	consult/Local			→	→	→							
8.4 Civil works and building construction	Procure Comm.	consult/Local			→	→	→							
8.5 Vehicles (Truck, Tractor and Forklift)	Procure Comm.	consult/Local			→	→	→							
<b>9.0 Complete Civil Works and building Construction</b>														
9.1 Site preparation, drainage, development and access roads	Const.contractors	local			→	→	→							
9.2 Site paving of collection, storage and parking areas,	Const.contractors	local			→	→	→							
9.3 Buildings and covered areas construction	Const.contractors	local			→	→	→							
9.4 Install and connect water, electrical and sewerage systems	Const.contractors	local			→	→	→							
<b>10.0 Receive, inspect, Install and commission equipment</b>														
10.1 Wood chip processing	Tech provider	External			→	→	→							
10.2 Wood chip dryer	Tech provider	External			→	→	→							
10.3 Conveyor	Tech provider	External			→	→	→							
10.4 Install Biomass Gasifier system (250 and/or 500 kWe output)	Tech provider	External			→	→	→							
10.5 Install 100 % Syngas Engine/Generator Set(s)	Tech provider	External			→	→	→							
10.6 Vehicles (Truck, Tractor and Forklift)	Project Mgt Co.	Local			→	→	→							
<b>11.0 Technical Support and After Sales service</b>														
11.1 Warranty and maintenance service for year 1 and 2	Manufacturer	Tech provider												
11.2 Regular maintenance service visits or consults	Manufacturer	Tech provider												
11.3 Parts supply and delivery service	Manufacturer	Tech provider												
11.4 Minor and major maintenance Gasifire 3,500 hrs/7,000 hrs	Manufacturer	Tech provider												
11.5 Major maintenance Engines 10,000 hrs/20,000 hrs	Manufacturer	Tech provider												

Detailed Implementation Plan	Implementing Responsibility	Professional Source	1	2	3	4	5	6	7	8	9	10	11	12
<b>12.0 Training:</b>														
12.1 Gas engine/generator set technician-operator training	Manufacturer	Distributor												
12.2 Biomass gasifier system operator training	Manufacturer	Tech provider												
12.3 Tree farming training and advisory service	Tree specialist	Univ.of Pacific												