



Fiji Renewable Energy Power Project (FREPP)

Waste to Energy Resource Assessment in Fiji

Report on Options and Recommendations for Effective Implementation of Waste-to-Energy Power Generation in Fiji

November - 2014

Disclaimer: *This report was prepared as a part of “Resource Assessment Study for Waste-to-Energy Resources in Fiji” contracted by the Department of Energy (DoE), Government of Fiji and United Nations Development Programme (UNDP). All information contained herein is obtained from authentic sources believed to be accurate and reliable. This report is based on the data made available by various departments of Government of Fiji, City and Town Councils, Research Institutes, Industry representatives, NGOs and information available in public domain. Reasonable skill, care and diligence have been exercised in carrying out the study and report preparation. This report is not to be deemed as any undertaking, warranty or certificate. Any views or opinions presented in this report are solely those of the author and do not necessarily represent those of the DoE or UNDP. This report is solely for DoE and UNDP and should not be used, circulated, quoted or otherwise referred to for any other purpose, nor included or referred to in whole or in part in any document without prior written consent.*

Acknowledgements

The author would like to thank the UNDP Multi-Country Office in Fiji and the Department of Energy, Government of Fiji for their support and guidance during development of this report.

Abbreviations & Acronyms

| | |
|--------|------------------------------------------------------------------|
| ADB | Asian Development Bank |
| ANZ | Australia New Zealand Bank |
| CDM | Clean Development Mechanism |
| CER | Certified Emission Reduction |
| EU | European Union |
| DoE | Department of Energy (Govt. of Fiji) |
| EMA | Environment Management Act |
| FCC | Fiji Commerce Commission |
| FEA | Fiji Electricity Authority |
| FJD | Fijian Dollar |
| FIT | Feed-in-Tariff |
| FREPP | Fiji Renewable Energy Power Project |
| FSC | Fiji Sugar Corporation |
| GBP | Global Bioenergy Partnership |
| GEF | Global Environment Facility |
| GDP | Gross Domestic Product |
| GHGs | Greenhouse Gases |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| IEA | International Energy Agency |
| IPPs | Independent Power Producers |
| IRENA | International Renewable Energy Agency |
| MSW | Municipal Solid Waste |
| NAMA | Nationally Appropriate Mitigation Actions |
| NMM | New Market Mechanism |
| NECF | National Energy Consultative Forum |
| NEP | National Energy Policy |
| NGOs | Non-Governmental Organizations |
| ODA | Overseas Development Assistance |
| OECD | Organization for Economic Cooperation and Development |
| REN21 | Renewable Energy Policy Network for the 21 st Century |
| RPS | Renewable Energy Portfolio Scheme |
| PREP | Pacific Regional Energy Programme |
| RBF | Reserve Bank of Fiji |
| RE | Renewable Energy |
| SE4All | Sustainable Energy For All |

| | |
|--------|-------------------------------------------------------|
| SEFP | Sustainable Energy Financing Project |
| TWIL | Tropik Wood Industries Ltd. |
| UNDP | United Nations Development Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USP | University of the South Pacific |
| VAT | Value Added Tax |
| WB | World Bank |

Contents

| | |
|-----------------------------------------------------------------------------------------------|-----------|
| CHAPTER-1 | 8 |
| Background | 8 |
| 1.1 Quantification and Assessment of Waste to Energy Resources in Fiji | 8 |
| 1.2 Feasibility of Resources and Sites for Waste-to-Energy Power Generations Facilities | 9 |
| 1.3 Recommendations from Technology Research on Waste-to-Energy in Fiji | 10 |
| CHAPTER-2 | 11 |
| Situational Analysis of Waste to Energy Enabling Environment | 11 |
| 2.1 Institutional Framework | 11 |
| 2.2 Investment Regime and Finance Support Programmes | 13 |
| 2.3 Regulatory and Governance | 15 |
| CHAPTER-3 | 16 |
| Potential Intervention Options for Accelerated Deployment of Waste to Energy Projects | 16 |
| 3.1 Regulations | 16 |
| 3.2 Fiscal Incentives | 17 |
| 3.3 Public Finance | 18 |
| CHAPTER-4 | 20 |
| Potential Sources of Financing for Waste to Energy Projects | 20 |
| CHAPTER-5 | 23 |
| Recommendations on Waste to Energy Implementation in Fiji | 23 |
| References | 26 |

List of Figures

| | |
|-----------------------------------------------------------------------------------------------|----|
| Figure 1: Fiji Energy Sector Institutional Framework (Mainstreaming Report 2014) | 12 |
| Figure 2: Proposed Institutional Framework (NEP 2014) | 13 |

List of Tables

| | |
|------------------------------------------------------------------------------------|----|
| Table 1: Government Budget for Energy in 2012 (SE4ALL 2014) | 14 |
| Table 1: Overview of GBEP Funding Sources (Source: SNV) | 20 |
| Table 2: Overview of Key Funding Sources for Renewables (Source: SNV) | 21 |

CHAPTER-1

Background

The “Resource Assessment Study for Waste-to-Energy Resources in Fiji” under the “Fiji Renewable Energy Power Project (FREPP) intends to quantify and assess the amount of waste resources available in Fiji for power generation and identify technology options for feasible implementation of waste to energy projects. The study aims to:

- Quantify and Assess the Amount and Types of Resources available for Waste-to-Energy (Power generation) in Fiji;
- Assess the Feasibility of Resources and Sites for Waste-to-Energy (Power Generation) Facilities;
- Suggest Technology research and recommendation on Waste-to-Energy options; and
- Recommend Effective Implementation of potential Waste-to-Energy (Power Generation) Facilities in Fiji

The study also aims to develop four reports under the assignment mainly focusing on the above listed objectives. This is the final (fourth) report under the study. A brief background of the three study reports already completed under this study is provided below.

1.1 Quantification and Assessment of Waste to Energy Resources in Fiji

This report focused on quantification and assessment of the amount and types of waste resources available in Fiji for waste-to-energy power generation. The methodology adopted for development of this report involved identification, collection, research and review of relevant national and regional data and reports, national policy and regulatory documents, consultation with relevant stakeholders including line ministries, development partners, electricity utilities, academic institutions, private power producers and NGO’s.

The report included the quantitative and qualitative assessment of various potential wastes resource generated and main characteristics of waste resources from each identified waste streams in Fiji. The key waste stream includes Municipal Solid Waste (MSW); Sewage and Sludge (Waste Water); Livestock Waste; Biomass Waste; Non Hazardous Industrial Organic Waste and Agricultural Crop Residues.

Based on the assessment of waste resources, it appeared that some (MSW, biomass, livestock) of the waste streams identified in Fiji have reasonable potential for power generation. It is envisaged that some of these potential projects could play a valuable role in stand-alone electricity applications and be particularly effective for rural electrification in remote rural areas with no or very limited grid connectivity. On the other hand, waste residues and resources, resulting mainly from medium and large sources and enterprises could provide opportunities for large-scale centralized power generation.

Further, the use of waste resources as substitute for fossil-based fuels might offer many attractive benefits for Fiji. The key socio-economic benefits include private sector investment

opportunities, employment generation, rural electrification and overall poverty alleviation. There are additional benefits to the environment in terms of offsetting the GHG emissions associated with burning fossil fuels and anaerobic digestion of biogenic waste and waste utilization.

1.2 Feasibility of Resources and Sites for Waste-to-Energy Power Generations Facilities

This report (Second under the study) was a macro assessment focusing on estimating the theoretical potential for power generation from the identified waste streams and assessing the feasibility of the available resources for energy generation. The report also discussed on the identified potential waste to energy projects in Fiji including their estimated potential for power generation based on the site survey carried out. The scope of this study did not involve carrying out a detailed techno-economic feasibility assessment for the identified waste streams or the potential projects.

Based on the detailed assessment, in terms of theoretical potential for electricity generation, it appears that biomass waste stream (bagasse & logging and forestry industry residues) has the highest potential followed by MSW and livestock waste.

The two IPPs, Fiji Sugar Corporation (FSC) and Tropik Wood Industries Ltd (TWIL) is currently involved in biomass based waste to energy generation (bagasse & wood residues) and are consuming most of the economically available biomass waste generated by using them as fuel at the existing power plants. Currently there is no excess or surplus biomass waste is available which could be economically collected and transported to the existing project sites. As discussed in the report, collection, handling and transportation costs are the key challenges for utilizing the available biomass resource effectively in Fiji.

Under the MSW stream, Naboro landfill and Vunato Dump in Lautoka seems to have reasonably good potential to generate electricity. The appropriate technology and approach needs to be adopted based on the detailed techno-economic feasibility studies. Also as discussed in the report, for the Vunato dump in Lautoka, the sensitivities and issues related to location of the dump site and available area for waste processing needs to be considered whilst deciding on the appropriate waste to energy technology.

All the potential projects identified for the piggery and the poultry waste under the livestock stream have good potential to generate electricity. The power generated from these potential projects could be used for captive consumption and the excess power can be fed to the grid. The manure from cattle although has the highest potential to generate electricity, due to the grazing pattern adopted in Fijian cattle farms, it is difficult to collect the cattle manure and transport it to a centralized location for processing.

1.3 Recommendations from Technology Research on Waste-to-Energy in Fiji

This report provided an up-to-date assessment of the state of the art waste to energy conversion technologies. Further, the most suitable conversion options were assessed and recommended for the most relevant waste streams including identified potential projects.

Biogas production from anaerobic digestion of organic waste generated from market waste, sewage sludge, piggeries, poultry farms, distilleries and breweries and slaughterhouse waste appeared to be the most promising waste to energy conversion option for Fiji due to the lack of alternative treatment technologies for these waste streams. Conversion technologies such as combustion, CHP and gasification for the production of power and/or heat could be an interesting option for biomass waste stream including logging and forestry industries wastes. As discussed in the earlier reports, the two IPPs, Fiji Sugar Corporation (FSC) and Tropik Wood Industries Ltd (TWIL) are already involved in biomass waste to energy generation (bagasse & wood residues) in Fiji and are consuming most of the economically available biomass waste generated by using them as fuel at the existing power plants. Collection, handling and transportation costs are the key barriers in utilizing the available biomass resource effectively.

Although the conversion potential for agricultural residues are significant in Fiji, similar to the biomass, collection and transportation costs of agricultural residues to a centralized location for electricity generation waste are key barriers due to small land holdings and dispersed nature of the agricultural residues. Given the issues and constraints with using agricultural residues as feed stock for electricity generation, it is suggested that briquetting or pelleting of agricultural residues could be a potential option to make use of large unused quantities of residues.

It is envisaged that this assessment will assist and support in terms of decision-making regarding future investments in the development of waste to energy projects and business in Fiji. The identified potential projects could be of value to decision-making regarding the selection of pilot scale demonstration projects. It is to be noted that the information provided in the report is explorative and is by no means intended to replace dedicated feasibility studies. As discussed in the report, a variety of technology options exist for conversion of waste resources to energy. These options can serve many different energy needs (such as power, heat etc), from large-scale industrial applications to small-scale rural end-uses.

This is the final (fourth) report under the study focusing on providing appropriate recommendations on how to effectively implement waste-to-energy power generation facilities in Fiji.

CHAPTER-2

Situational Analysis of Waste to Energy Enabling Environment¹

The report on quantification and assessment discussed in detail the key stakeholders for the waste to energy sector including their roles and responsibilities. The main stakeholders included Government Ministries and Institutions, Non-Government Organization (NGO), Financial Organizations, Electricity Utility Companies, Academic Institutions, Private Sector (including IPP's) and International Development Partners/Organizations/Donor Agencies.

The report also discussed in detail on the energy and waste to energy sector situation in Fiji including relevant policies and regulatory framework. This section intends to provide a detailed overview of the current institutional, financing and investment environment related to energy sector in Fiji which also is applicable and relevant to waste to energy initiatives.

2.1 Institutional Framework

The energy portfolio in Fiji is currently held by the Ministry of Infrastructure and Transport where the DoE is located. It should be noted that there is no specific act or decree that would define the roles, responsibilities and regulatory functions of the DoE. In November 2006, however, the Fiji Government endorsed its first National Energy Policy and associated strategic action plan, which has since guided the work of the DoE and the development of the energy sector.

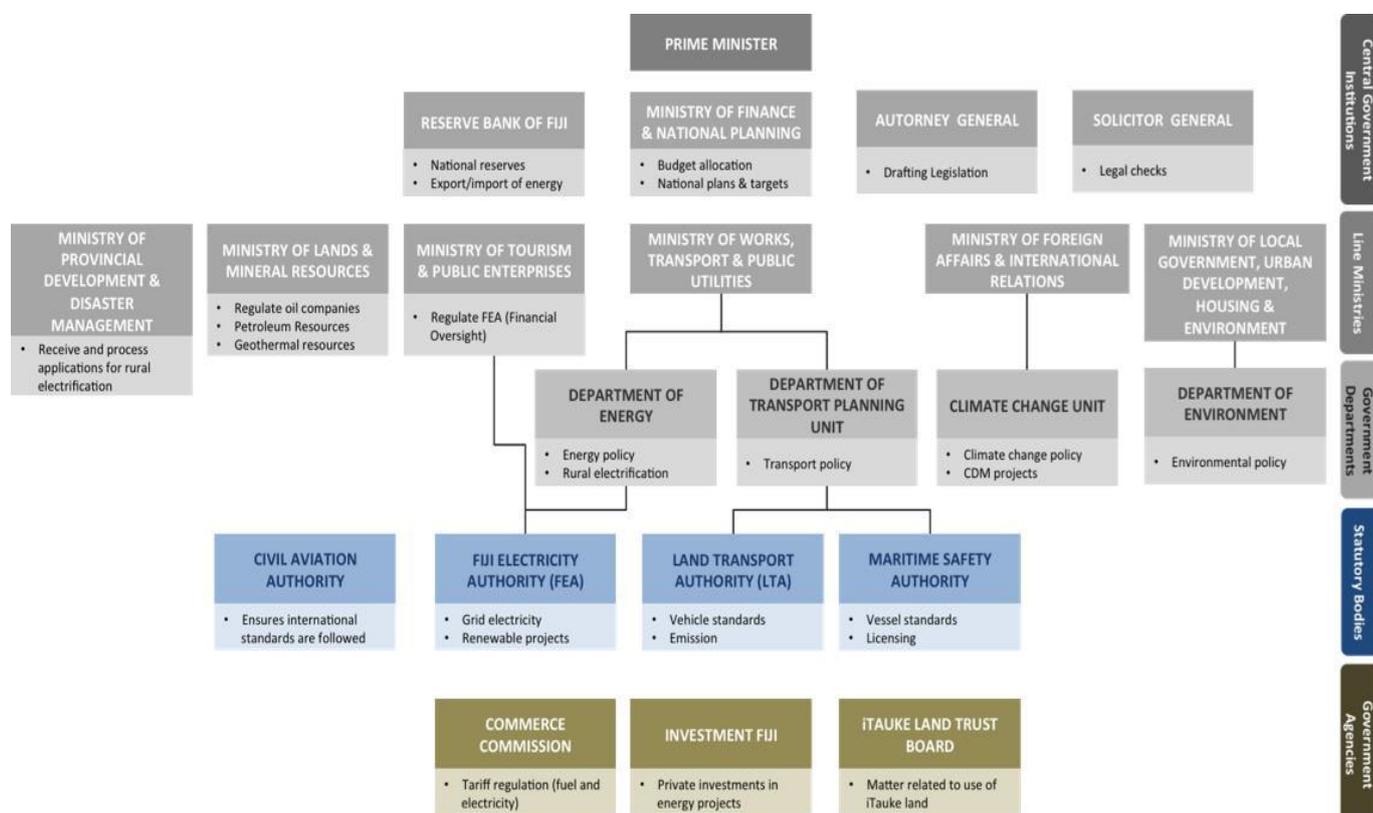
Fiji's current institutional and policy framework for the energy sector is quite complex, with overlapping responsibilities and significant gaps in the areas of coordination, regulation and oversight. Coordination of the various public sector institutions with responsibilities in the energy sector has traditionally been a key weakness of sector governance and implementation of the previous National Energy Policy. Lack of an institution with overall responsibility has also limited the opportunities for broad-based consultation and interaction in energy planning processes with other relevant Government institutions (and external stakeholders including the private sector, civil society, non-Governmental and faith-based organisations and community representatives).

Effective sharing and management of energy information is another serious challenge for sector governance. Numerous recent energy sector studies in Fiji and the wider Pacific region have identified the poor quality of national and regional energy sector data as limiting opportunities for policy, planning, rational decision-making, private investment and future performance improvement. In many cases a culture of restrictive information still prevails. Recently a major review of the 2006 NEP was undertaken with the support of GIZ and UNDP and guided by an advisory committee comprising DoE, Reserve Bank of Fiji (RBF), Ministry of Finance and National Planning, Department of Transport, the Ministry of Foreign

¹ Extracted and Adopted from: Sustainable Energy for All (SE4All): Rapid Assessment and Gap Analysis, Fiji Department of Energy, 2014 and Renewable Energy Readiness Assessment Fiji, Secretariat of the International Renewable Energy Agency (IRENA), 2014

Affairs Climate Change Unit, GIZ and UNDP. The institutional challenges are addressed by the resulting new draft 2014 NEP (awaiting cabinet approval) which aims to implement Fiji Government’s vision for a resource efficient, cost effective, and environmentally sustainable energy sector.

Figure 1: Fiji Energy Sector Institutional Framework (Mainstreaming Report 2014)



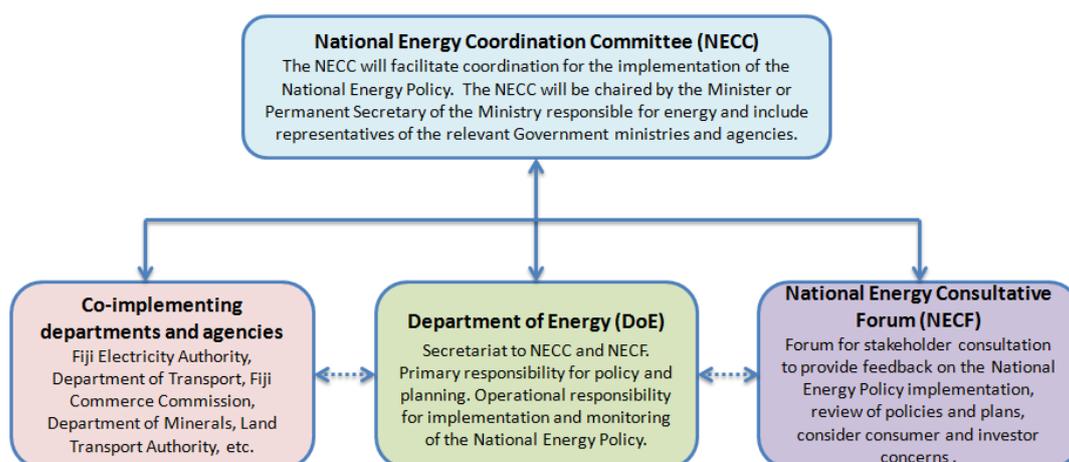
The three objectives of the draft 2014 NEP are to achieve:

1. Affordable energy for all: Ensure that all Fijians have access to affordable and reliable modern energy services².
2. Sustainable energy supplies: Establish environmentally sound and sustainable systems for energy production, procurement, transportation, distribution and end-use.
3. Reduced import costs: Encourage the efficient use of energy and the use of indigenous energy sources to reduce the financial burden of energy imports on Fiji.

In order to fulfil the objectives of the new draft NEP, changes to the institutional framework are also proposed within the new NEP as described in figure below.

² Modern energy services is defined as per the IEA’s World Energy Outlook as “clean cooking facilities, a first connection to electricity (defined as a minimum level of electricity consumption) and then an increasing level of electricity consumption over time”.

Figure 2: Proposed Institutional Framework (NEP 2014)



The new NEP provides for some detail with regard to changes in the institutional set up as outlined above. For the new NEP to achieve its objectives it will be paramount for the Government to decide about the adoption of the NEP and to effect the changes suggested.

The 2014 NEP also includes innovative provisions with regard to a regular consultation process. As well as informal discussions and public consultations on specific proposals, DoE has committed to consult more generally at least twice yearly with representatives of external stakeholders in the energy sector. Measures will be adopted to ensure full and inclusive consultation processes including with private users, communities, civil society and non-Governmental organisations. These consultations will be used to present and receive feedback on on-going activities under the National Energy Policy, progress with implementation of plans and policies and preliminary proposals on new or revised plans and policies. Priority will be given to consumer protection and consumer concerns. The consultations will be conducted through a National Energy Consultative Forum (NECF) modelled on the similar body established for the transport sector. The material presented and minutes of the consultations will be made publicly available.

2.2 Investment Regime and Finance Support Programmes

In contrast to the other PICs, external financial assistance plays a relatively small role in Fiji's economy. Between 2008 and 2010, Fiji received an amount equivalent to 2% of GDP, from Organisation for Economic Co-operation and Development (OECD) countries. In 2008, Fiji received a total of \$40 million in net Official Development Assistance (ODA), of which \$28.6 million was in the form of bilateral grants and \$11.8 million was multilateral assistance. The main traditional bilateral donors are Australia, Japan, and New Zealand, with France and the United States (US) also providing aid in some years. Multilateral aid flows are from the Asian Development Bank (ADB), the European Union (EU), the United Nations (UN), and the World Bank (WB). New donors, such as the People's Republic of China, India, and Malaysia, have been providing significant external credits since 2008.

The ratio of aid to GDP ranged from 2.4% of GDP to almost 5% of GDP in the 1990s, but it has fallen to about 2% of GDP in 2008–2010. In 2006, the EU suspended new aid

programmes while the WB and ADB halted new lending. However, this situation is envisaged to change with the recent general elections and return of democracy to Fiji.

New sources of foreign borrowing have been tapped to offset the decline in financing from Fiji's traditional donors, with official loans for infrastructure development provided by a number of new development partners such as China. However, the number of externally funded projects and programmes in Fiji is small.

The government budget allocation to the energy sector has increased over time and reached 18.9 million FJD in 2012. This funding is allocated to the operation of the DoE and includes government subsidies for the lifeline electricity tariff. It also includes donor contributions from various sources.

Table 1: Government Budget for Energy in 2012 (SE4ALL 2014)

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|-------------------------|--------|--------|-----------|--------|-----------|-----------|
| Total Government Budget | 7061.9 | 8241.9 | 16,748.50 | 8687.7 | 10,010.40 | 27,005.50 |
| Fuel and Energy | 6203.8 | 7030 | 14,195 | 6800 | 6950 | 18,916.70 |

In recent years serious efforts have been made to boost access to financial services. The government is aiming to bring financial services to some 150,000 persons without access through microfinance and financial literacy services.

The Reserve Bank of Fiji (RBF) has introduced a small and medium- sized enterprises loan guarantee scheme, established sector lending ratios, especially with regard to renewable energy and expanded its import substitution and export finance scheme to spur lending. At present commercial banks are required to lend 2% of their combined loan portfolio to renewable energy projects. While this ratio is currently achieved for the entire commercial banking sector through a large FEA loan for the Nadarivatu hydro development, it remains to be seen if this lending requirement will be sustainable and will indeed trigger a broader investment in renewable energy. In addition, the World Bank supports the "Sustainable Energy Financing Project" (SEFP), an initiative purposely designed to provide an incentive package for local banks to encourage more renewable energy and energy efficiency lending. The project does not subsidize investments but facilitates financing of sustainable energy through partial risk guarantees, communication and technical assistance to financial institutions. At present a total of 44 loans have been approved (30 businesses and 14 individuals) who have mainly invested in energy efficiency, solar PV and solar water heating and biofuel production. Total value of the loan portfolio under the SEFP is FJD 12.7 million with ANZ Bank and FJD 5.3 million with the Fiji Development Bank.

Fiji has not been successful in encouraging significant private sector participation in the electricity sector, although Fiji Government has contemplated mobilising private capital for electricity sector investments since 1995. This is largely due to weak sector governance (in particular the lack of a clear regulatory framework for encouraging third party electricity generation), resource information not being made public, and a general weakness in Fiji's business climate.

The international perception of the investment and business climate in Fiji is reflected in the World Bank's 'Ease of Doing Business' Survey. In the category 'starting a new business' the

2012 survey ranked Fiji as no. 138 of 183 surveyed countries, well below the Pacific regional average of 93. Fiji's ranking has weakened for almost all sub-categories between 2011 and 2012 showing a trend towards a less favourable business climate. Only the category trading across borders has seen Fiji being ranked one place higher in 2012. The categories investor protection, access to finance, dealing with construction permits, registering businesses and enforcing contracts have all seen downgrades between 2011 and 2012. This trend is also reflected in the findings of the ADB's Private Sector Assessment of 2011 (Re-invigorating private sector investment) the report states: "The general business climate in Fiji is not conducive to attract sufficient private capital".

The difficulties for private sector investors who want to invest in an IPP project was illustrated both during the National Energy Forum in April 2013 and the National Consultation Workshop in August 2013 where representatives of IPP investors reported their difficulties to bring projects to financial closure. It would appear that the power purchase tariffs that FEA is prepared to offer are insufficient to finance potential energy sector projects.

It is widely expected that the investment climate in Fiji will considerably improve with the current democratic set-up. The ADB for instance has been engaged with the government and offers significant technical assistance to DoE total new lending to Fiji will be in the order of US\$ 250 million. A significant part of this lending could go to the electricity sector. While the current democratically elected Government would probably change investors' perception of sovereign risk in Fiji, it is unrealistic to expect that this alone would trigger significant investment in renewable energies. An efficient framework is needed that creates a level playing field and an effective enabling environment for private investors, both small scale (distributed generation) and large scale (Independent Power Producers).

2.3 Regulatory and Governance

In 1996, the DoE with support from an EU funded regional project (Pacific Regional Energy Programme - PREP) called for an expression of interest from prospective IPP developers as the government of the day saw the need to broaden financing of generation projects by tapping into the internationally fast developing IPP market. More than 70 expressions of interest were received and consultants evaluating these expressions rated about 50% of the proposals interesting and technically feasible. The proposals included biomass, hydro, wind and solar energy. Subsequently, a number of prospective IPP investors have presented themselves but while FEA has signed five power purchase agreements with potential IPPs, none of these projects have achieved financial closure to date. These projects include three biomass, one used oil and one mini-hydro project.

According to prospective investors, the reasons for this poor performance of IPPs include:

- Power purchase tariffs are significantly below avoided cost of FEA's thermal generation, and thus cannot render IPP projects financially viable;
- Unclear situation with regard to FCC ruling on minimum tariffs;
- Complex and costly approval procedures;
- Self-regulating of FEA with regards to grid access;
- Difficulties to access financing; and ,
- Difficult or no access to relevant information.

CHAPTER-3

Potential Intervention Options for Accelerated Deployment of Waste to Energy Projects

It is to be noted that most of the potential interventions for accelerated deployment of waste to energy projects are similar to that for other renewable energy technologies as they share common barriers and issues. According to International Energy Agency (IEA), policy design for the support of renewable energy (also includes waste to energy) should reflect four fundamental principles:

- The removal of non-economic barriers, such as administrative hurdles, obstacles to grid access, poor electricity market design, lack of information and training, and the tackling of social acceptance issues;
- The need for a predictable and transparent support framework to attract investments;
- The introduction of transitional incentives, decreasing over time, to foster and monitor technological innovation and move technologies quickly towards market competitiveness;
- And the development and implementation of appropriate incentives guaranteeing a specific level of support to different technologies based on their degree of technology maturity, in order to exploit the significant potential of the large basket of renewable energy technologies over time.

A renewable energy supportive scheme around the world appears to have a number of different options that they can use to promote waste to energy. A mix of instruments is envisaged to be the key to their success. Deployment policies are commonly classified into four categories: fiscal incentives; public finance; regulations; and access policies which have been discussed in detail below.

3.1 Regulations

Feed-in Tariff

According to Renewable Energy Policy Network for the 21st Century (REN21), Feed-in Tariffs (FITs) are the most widely used policy in the world for accelerating renewable energy deployment, accounting for a greater share of renewable energy development than either tax incentives or other policies. The Feed-in Tariff system sets a price that is guaranteed over a certain period of time at which power producers can sell renewable electricity into the grid. Some policies provide a fixed tariff while others provide fixed premiums added to market- or cost-related tariffs. Feed-in tariffs are expressed in national currency per kWh or national currency per MWh.

FITs guarantees the energy producer a premium energy price over a certain period of time. It is important that the tariff level and time period are chosen to motivate investors by providing security of income during part of the installation's lifetime; the tariffs are therefore normally guaranteed for a number of years. As feed-in tariffs are centrally set and paid by

the government, the cost of the scheme is met by public money and is, effectively, spread across society. As each renewable energy generation project is unique, differentiation of FIT payments to account for these differences can ensure that a variety of technologies and project sizes come online.

Renewable portfolio standards (RPS)/ quota obligations and tradable certificates

These require electric utilities to provide renewable electricity to their customers, typically as a percentage of total energy use. It does this by establishing the proportion of electricity supply that must be produced from eligible renewable energy sources. The obligation is typically imposed on electricity producers. The implementation of an obligation system usually involves a penalty for not complying with the obligation. RPS relies almost entirely on the private market for its implementation.

Some countries have incorporated a tradable certificate system under the quota obligations with certificates which can then be sold. The interested parties in a trading scheme can either choose to fulfil the quota by renewable energy generation or purchase certificates in order to meet the obligation. The prices of these certificates are determined by the level of quota obligation, the size and allocation of penalty charges, and the duration of the eligible credits.

Net Metering

Net metering allows homes or businesses to sell renewable electricity they generated in excess of their use at wholesale or retail prices. Customers pay only for the net electricity used. However, net metering has limited capacity to expand the generation of renewable electricity as the price paid for excess electricity in net metering is not high enough to attract investment in renewable electricity facilities as compared to FITs. Also many net metering schemes have participation limits and grid connection standards which act as obstacles for expanding the renewable market.

3.2 Fiscal Incentives

These incentives mainly include policies which are focused on cost reductions and improvement of the relative competitiveness of renewable energy technologies. Some of the key measures may include capital grants, third-party finance, investment tax credits, property tax exemptions, production tax credits, sales tax rebates, etc. Taxes on fossil fuels also improve the competitive position of renewable energy. Specific regulatory policy instruments are tax incentives such as investment tax credits, production tax credits or reductions in sales, energy, carbon, VAT, etc.

Grants

This is a monetary assistance that does not have to be repaid and that is bestowed by a government for specified purposes to an eligible recipient. Grants are usually conditional upon certain qualifications as to the use, maintenance of specified standards, or a proportional contribution by the grantee or other grantor(s). Grants (and rebates) help reduce system investment costs associated with preparation, purchase or construction of renewable energy (RE) equipment or related infrastructure. In some cases, grants are used to create

concessional financing instruments (e.g., allowing banks to offer low-interest loans for RE systems).

Rebate

Rebate is a one-time direct payment from the government to a private party to cover a percentage or specified amount of the investment cost of a RE system or service. Typically rebates are offered automatically to eligible projects after completion, not requiring detailed application procedures.

Tax credit (production or investment)

The credits provides the investor or owner of qualifying property with an annual income tax credit based on the amount of money invested in that facility or the amount of energy that it generates during the relevant year. These allow investments in RE to be fully or partially deducted from tax obligations or income.

Tax reduction/exemption

This is an incentive through reduction in tax to the purchase (or production) of RE or RE technologies which includes but not limited to sales, value-added, energy or carbon tax.

3.3 Public Finance

Tendering/Bidding Scheme

Under this system the government encourages deployment of renewable electricity systems through providing competitive bids for power purchase agreements for example from waste to energy projects. Government accepts the lowest priced bids until the point that targeted level of generation is reached. This system also contains an element of a pricing law, in that the winners of the bids are guaranteed to sell their generated electricity to utilities at the price proposed by the winning bids. Some of the key issues include unreliability of tendering process, complex bidding process etc.

Financial Subsidies

RE including waste to energy power plants are often capital intensive and thus governments may offer financial subsidies for renewable electricity technologies in terms of specific grants, or grants set as a percentage of total investment. Investment subsidies are the oldest and yet still a very common type of support mechanisms and are often politically feasible and easy to administer.

Investment

This is a kind of financing provided in return for an equity ownership interest in a RE company or project. Investments are usually delivered as a government-managed fund that directly invests equity in projects and companies, or as a funder of privately managed funds (fund of funds).

Guarantee

Guarantees are a risk-sharing mechanism aimed at mobilising domestic lending from commercial banks for RE companies and projects that have high perceived credit (i.e., repayment) risk. Typically a guarantee is partial wherein it covers a portion of the outstanding loan principal with 50 - 80% being common.

Loan

Loans are type of financing provided to a RE company or project in return for a debt (i.e., repayment) obligation. Normally for RE projects loans are provided by government, development bank or investment authority usually on concessional terms (e.g., lower interest rates or with lower security requirements).

CHAPTER-4

Potential Sources of Financing for Waste to Energy Projects

Apart from some specific financing sources, most of the potential sources for financing waste to energy initiatives generally fall under the same umbrella of RE financing targeting other renewable energy technologies. Lately multiple finance institutions have started offering both debt and equity finance for waste to energy initiatives across Africa and Asia. However, the situation is not very similar in the Pacific. Even though waste to energy technologies has been developing rapidly across the globe, Pacific countries still often find it difficult to finance such initiatives or programmes. Some of the financing support initiatives currently available in Fiji have been discussed under the investment regime and financial support programme section of this report.

Currently, most financing opportunities available in the developing world for waste to energy are going through a learning curve on new technologies which the developed countries went through during the initial period of renewable energy market development in Europe and North America. Several international finance institutions including banks and equity funds offer financial support of various sizes and investment scope, towards sustainable and renewable energy projects. In addition to private, commercial funding sources, some donor agencies are also establishing a presence as funding entities by establishing own special-purpose funds or teaming up with existing local funding institutions. In many countries development finance through development partners is also available which could be used by projects to close the financial gap of project.

The Global Bioenergy Partnership (GBP) publication on Financing Options for Bioenergy³ provides comprehensive information on financing options for waste to energy initiatives covering multilateral funds, national initiatives and foundations, as well as some region-specific sources providing everything from R&D finding, to feasibility assessment support to project finance

Table 2: Overview of GBEP Funding Sources (Source: SNV)

| Institution/Programme/Fund | Type of funding | Notes |
|---------------------------------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EUEI - Partnership Dialogue Facility (PDF) | Facilities in the range of EUR50,000 – EUR200,000 for each single activity | Projects are financed in developing countries, with special focus on Africa (sub-Saharan African countries preferable) |
| European Investment Bank (EIB) | Concessional loans | The EIB finances both large and small-scale investment projects |
| Global Environment Facility (GEF) Trust Fund - Climate Change focal area | Grants and concessional loans | The GEF operates as a mechanism for international cooperation providing funding to meet the incremental costs of projects to achieve agreed global environmental benefits in climate change (among other focal areas) |
| Renewable Energy and Energy Efficiency Partnership (REEEP) Programme Call | Grants or co-funding | REEEP projects concentrate small- scale interventions with potential for large knock-on effects |

³ http://www.globalbioenergy.org/uploads/media/1004_GBEP_-_Financing_options_for_bioenergy_projects_23april_web.pdf

| | | |
|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| World Bank - Clean Technology Fund (CTF) | Concessional loans, grants, guarantees and investment plans for government programmes | CTF aims to promote scaled-up financing for demonstration deployment and transfer of low carbon programmes and projects with a significant potential for long term GHG emissions |
| World Bank - Forest Investment Programmes (FIP) | Concessional loans, grants, guarantees | The fund aims to promote sustainable forest management, which is a pre-requisite for the use of forestry waste and by-products as feedstock for bioenergy |
| World Bank - Scaling Up Renewable Energy in Low Income Countries Program (SREP) | Concessional loans, grants, guarantees | Supports bioenergy projects or programmes that improve energy access for rural populations |
| AEF: Access to Energy Fund –Energy for growth | Project finance (not specified) | The Fund aims to connect 2.1 million people in developing countries by 2015 by providing financing for projects involved in the generation, transmission or distribution of energy |
| Development Finance Facility (FMO) | Direct investment and indirect investment (through other financial institutions) and co-financing | The FMO's Sustainable Energy Strategy supports projects that generate energy based on a renewable energy sources, including biomass-to-energy projects, biomass (including biofuel) based cogeneration and waste-to-energy projects (incl. waste based landfill and sewage gas) |
| develoPPP .de | Not specified | The PPP provides targeted support in involving private enterprises in those sectors where there is a particular need for action as well as special opportunities |
| International Climate Initiatives (ICI) | Grants, loans | Part of Germany's official development assistance which aims to promote a climate friendly economy and climate adaptation |
| KfW Bankengruppe - DEG Invest | Loans, mezzanine finance, equity capital and guarantees | DEG's intention is to promote economic development and raise people's living standards in Germany's partner countries |
| KfW Bankengruppe - Initiative for Climate and Environmental Protection (IKLU) | Concessional loans and subsidies | Runs a special facility for renewable energies and energy efficiency |
| Shell Foundation – Climate change programmes | Grants, loans, guarantees and other vehicles | Supports the growth of start-up businesses that provide electricity using bioenergy technologies such as biomass gasification and biogas |

Table 3: Overview of Key Funding Sources for Renewables (Source: SNV)

| Institution name | Type of Funding | Notes |
|----------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clean Energy Development and Finance Centre (CEDFC) | Not clear (CEDFC still under development) | The CEDFC will provide technical and financial support for renewable energy and gas projects while promoting US private-sector participation in the sector |
| Green Climate Fund | Grants and concessional loans | Not yet operational; should include private sector facility that enables it to directly and indirectly finance private sector |
| US Export-Import Bank | Debt | Renewable energy programme with more accessible terms for renewable projects; project must include US technology import |
| African Carbon Asset Development (ACAD) Facility | Grants | A public-private partnership spearheaded by UNEP-Risoe in cooperation with Standard Bank; supported by the German Federal Environment Ministry |
| Africa Enterprise Challenge Fund (AECF) | Grants and concessional loans | AECF is running the REACT program, which is a special funding window to incentivise private sector investment in clean energy |
| African Development Bank's Sustainable Energy Fund for Africa (SEFA) | Grants, equity | Aimed at enhancing commercial viability and bankability of smaller-size renewable energy and energy efficiency projects; two funding windows (dates yet to be released) |

Carbon finance could be another potential source of financing for waste to energy projects in developing countries, although several restrictions do apply. The Clean Development Mechanism (CDM) of the Kyoto Protocol is now very limited in terms of attractiveness. This is due to the fact that post 2012, Certified Emission Reductions (CERs) are mostly preferred

from least developed countries, and in any case the current CER price is too low to provide useful support to most projects.

However, clean energy projects with a substantial development dividend may earn a premium under Gold Standard Scheme. This can be the case under a CDM or voluntary certification scheme. Regardless of the carbon market segment targeted, the expected revenues from climate finance should be carefully weighed with the costs associated with developing carbon certification under any chosen scheme.

The proposed new international climate framework could possibly bring in new climate finance mechanisms, but will most likely become operational no earlier than 2015 and include NAMAs (Nationally Appropriate Mitigation Actions), NMMs (New Market-based Mechanisms) and REDD+ (Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks).

CHAPTER-5

Recommendations on Waste to Energy Implementation in Fiji

As discussed in the earlier reports under this study, stakeholder consultations were carried out in three stages. The first round of consultations was held during July 2014 during quantification and resource assessment of waste to energy resources. A questionnaire survey among the potential waste to energy project stakeholders was done during August 2014 which included questions on the stakeholder's opinions and recommendations on existing institutional setup; policy instruments and/or legislation addressing renewable energy/waste to energy and issues and barriers at the waste to energy project development level. Further, a stakeholder consultation workshop was also organized during October 2014 to discuss on the study outputs. Key recommendations and feedback obtained during the stakeholder consultations were also taken into consideration whilst identifying the policy issues and potential areas for intervention.

The major constraints identified for implementation of waste to energy projects during the study were low awareness and lack of appropriate information on waste to energy; inadequate technical capacities to develop real projects; low availability of financial services; insufficient institutional capacity as well as unspecific and unfavourable policy frameworks. It was also observed that the capacities and requirements to deal with risks associated with waste to energy initiatives among key stakeholders remains generally low, both in public and in private sector.

It is envisaged that accelerated deployment of waste to energy initiatives requires effective policy support which is comprehensive, sustained and has realistic targets including minimal investment risks. Although it is hard to decide and conclude on the policy type which can achieve this most consistently, it is observed that feed-in tariffs often perform well. However, it is also observed that the available research on impact of other policies is small, and successful examples of non-feed-in tariffs policies do exist. Stakeholders also agree that interventions which focus on only one support mechanism, but fail to address the broader context of non-economic barriers, are unlikely to perform well.

As discussed earlier, the Government has carried out a major review of its policy framework in a consultative process involving all key stakeholders. The new National Energy Policy has been developed (awaiting cabinet approval) together with a strategic action plan and a legislative gap analysis. The NEP puts a strong emphasis on private sector led development of renewable energy resources, which could potentially benefit deployment of waste to energy initiatives in Fiji. Development partners such as ADB have already taken up major recommendations of the new policy and have allocated funding for follow up measures such as strengthening of regulatory functions of DoE.

In Fijian context, feed-in-tariff is believed to be the appropriate renewable policy that could mitigate the IPP and investment risk in energy sector. Non-economic barriers can significantly hamper the effectiveness of policies and drive up costs, irrespective of the type of incentive scheme. Hence, Fiji has to set a well-designed feed-in- tariff policy that meet

local objectives, social aspects and electricity sector characteristics of the country. It is to be noted that waste to energy supportive scheme should not be considered separately from other renewable energy initiatives.

Deployment of waste to energy initiatives in Fiji is also envisaged to have direct linkages to NEP and associated legislation. Even though Fiji has a reasonable good waste to energy potential it still lacks a clear regulatory framework and credible regulatory authority to implement feed-in- tariffs. Hence it is recommended that before starting any formal action toward implementation of feed-in-tariff mechanism, Fiji Government has to approve and implement the NEP and associated legislation. The NEP is believed to have the legal ability to promote renewable energy and present supportive policies.

The Fiji Renewable Energy Readiness Assessment carried out by IRENA details on the high regulatory risk with regards to IPP investment in Fiji. These risks are also appropriate and applicable to waste to energy initiative development in Fiji. The tariff issue has been singled out as a major obstacle by potential IPP investors. In a recent ruling on new tariffs, the Fiji Commerce Commission (FCC) increased the minimum tariff that FEA should pay for firm power to FJD 0.33 per kWh. This feed-in tariff is significantly below avoided cost of thermal generation, which the FCC assessed to be FJD 0.61 per kWh. The power purchase tariff is also uniform for all FEA grids although some grids such as Ovalau are 100% diesel fired and would therefore allow much more margin for a feed-in tariff. An option for the future would be to consider different power purchase tariffs (feed-in tariffs) for different locations around Fiji.

As discussed in earlier reports, the waste to energy resource is not evenly distributed in Fiji and hence it is recommended that the feed-in-tariff should respect the abundance of the resource across the country. Experience in other countries observe that differentiating feed-in-tariff for waste to energy resource offers differentiated payments to projects in areas with a different cost of production. It is done to encourage development in a wider variety of areas, which can bring a number of benefits both to the grid and to society.

It is also observed that there is a lack of appropriate mechanism within the Government to identify and prioritize investment opportunities in waste to energy sector. There is a need to look into other line ministries and partners who have developed their own processes of identifying and prioritizing investment opportunities. Efforts should also be focused on creating a level playing field and an enabling environment that would allow the government's objective to attract private sector capital to the waste to energy sector to materialise.

Apart from the feed-in-tariff options, it is also recommended to consider specific bonus payment schemes to encourage various kinds of waste to energy technologies, as well as performance based incentives for waste to energy projects. These incentives can target specific waste streams that are in abundance and can allow a diversity of operators (farmers, industries, public entities) to profitably participate in generation of renewable electricity.

Currently, there is no effective IPP framework in place that would attract the urgently needed private capital into renewable energy based power generation which also includes the waste to energy initiatives. FEA has been operating as a State-owned Enterprise (SOE) and also has determined the conditions for potential private sector participants without effective regulatory oversight. There is a general consensus that the power purchase tariffs offered by

FEA to date have not been sufficient to attract private investors or IPPs and power generation project approval criteria are not clear.

Apart from the public sector, Fiji's power sector will need significant investment over the next decade mainly through private sector investment. Absence of a clear regulatory framework for encouraging private sector investment on power generation has resulted in lack of interest among potential IPP's to invest in renewable power generation.

Currently, formulation of an Independent Power Producer (IPP) and Investment Framework for developers of renewable energy power generation projects in Fiji is in progress under the FREPP initiative. It is envisaged that the framework to be developed will assist in creating an enabling environment for private sector investment in the power sector including implementation of successful large-scale renewable energy power (and waste to energy) projects by project developers and also for the successful establishment of IPPs.

One of the key concerns raised from the stakeholders was on not having an appropriate institutional set up focusing on utilizing the waste to energy resources in Fiji. The Department of Environment is mainly responsible for waste management issues while the Department of Energy provides policy, advice, regulation and enforcement. Coordination of the various public sector institutions with responsibilities in the waste to energy has traditionally been a key weakness. The stakeholders are also of the view that it would be immensely beneficial to improve the co-ordination within the relevant Government line ministries, FEA, development partners and other stakeholders for development and deployment of waste to energy initiatives.

A national body coordinating all the activities related to waste management including waste to energy initiatives is believed to be the need of the day. The National Waste Management Authority proposed under the solid waste management strategy could potentially broaden its scope and focus to be the responsible entity for all the other waste streams including deployment of waste to energy initiatives.

The purpose of the Waste Management Authority could be expanded to focus on all the issues related to key waste streams in Fiji, to identify all the problems of each stakeholder and determine solutions; to be responsible for providing a waste management and utilization service (including waste to energy) throughout Fiji, to all urban and rural communities.

References

- Economic Consulting Associates (2013), Review of the Fiji National Energy Policy - Draft Energy Policy, July.
- Economic Consulting Associates (2013b), Review of the Fiji National Energy Policy - Draft Strategic Action Plan, August.
- Government of Fiji (2013), Draft Fiji National Energy Policy, July
- Government of Fiji (2014), Sustainable Energy for All (SE4All): Rapid Assessment and Gap Analysis, April.
- HYDEA (2011), National Policy and Operational Waste Management Strategy Options
- International Renewable Energy Association (IRENA) (2014), Renewable Islands: Settings for Success, June.
- International Renewable Energy Association (IRENA) (2014), Renewable Energy Readiness Assessment Fiji, April.
- International Renewable Energy Association (IRENA) (2012), Evaluating Policies in Support of Deployment of Renewable Power, November.
- National Renewable Energy Laboratory (NREL) (2009), Assessment of Biomass Resources in Liberia, April.
- SNV Netherlands Development Organisation (SNV) (2014), Biomass Waste-to-Energy Toolkit for Development Practitioners, October.
- United Nations Development Programme (UNDP) (2012), The National Bioenergy Strategy for Lebanon. January.