STANDING COMMITTEE ON ECONOMIC AFFAIRS

Report on Fiji Electricity Authority

PARLIAMENT OF THE REPUBLIC OF FIJI
Parliamentary Paper No.78 of 2016

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Chair's Foreword

The Standing Committee on Economic Affairs was tasked by Parliament to review FEA's Annual Report 2015.

Presentations by relative stakeholders which included the Fiji Electricity Authority (FEA), Fiji Sugar Corporation Limited (FSC), Department of Energy and Tropik Wood Industries Limited (Tropik Wood) were discussed and deliberated on, and the Committee was pleased to note FEA's strong balance sheet and also their commitment to 90% renewable energy by 2025. In line with this commitment to Sustainable Development Goal 7 the Committee made 5 recommendations to enhance sustainable, renewable and energy production in the areas of hydro, biomass, co-generation, solar, wind, waves and geothermal.

We sincerely hope these recommendations will be useful in assisting FEA and Fiji as a whole, reach their goal by 2025.

I thank the Hon Members involved in the production of this Report and also the Parliamentary Staff who assisted.

On behalf of the Standing Committee on Economic Affairs, I commend this Report to Parliament.

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HON. LORNA EDEN
CHAIRPERSON

Introduction

This report has been prepared after scrutinising the Fiji Electricity Authority (FEA) Annual Report for 2015 which was prepared in accordance with section 25 of the Electricity Act 1966 as well as perusing the oral and written submissions made by relevant stakeholders. The principal activities of FEA are the generation, transmission, distribution and sale of electricity throughout Fiji as governed by the Electricity Act 1966.

The power generation mix for 2015 was 44.90% hydro, 52% diesel and heavy fuel oil, 0.63% wind with the remaining 2.47% provided by the independent power producers (IPPs) namely Tropik Wood and FSC.[1]

The Committee commends the work of FEA based on the report for 2015. It is obvious that FEA is in control of the needs of the country in terms of electricity generation and transmission. The Committee notes its sound balance sheet and a strong team which is entirely made up of locals. FEA continued to display a strong position especially considering that it had recorded a profit after tax amounting to $39.7m for 2015.

[1] FEA Annual Report 2015

List of Recommendations

FEA is well structured to realise its vision for Fiji to provide 90% renewable energy by 2025[2].

The Committee also feels that it is useful to make observations on the way forward in terms of renewable energy and wishes to comment on the various potential sources:

a. **Hydro**
   This is contributing to 44.90% of the total of FEA's output and the Committee recommends that timely maintenance be carried out on existing dams at all times. We also encourage the development and creation of new dams that are in the pipeline.
b. **Biomass**
   The Committee notes the development of biomass at Nabou, a joint venture between a Korean consortium and Tropik Wood (GIMCO, GS Power & DAEWOO) with potential to produce 12MW and net exports at 10MW. The Committee recommends similar models be emulated across Fiji.
   It is believed that biomass is the potential game changer in terms of the way forward to renewable energy.
c. **Co-Generation**
   The Committee has noted the constraints facing Tropik Wood at its Drasa Plant and would recommend that all efforts be made to enable this Plant to be a viable supplier of renewable energy.
   The Committee notes the challenges being faced by FSC in its Co-Generation initiative. FSC in Labasa is able to supply only during the crushing season while the other mills are still negligible. The Committee would urge that we continue on the pathway to enable these mills to be viable suppliers to the National grid which is in line with the FEA Development Plan.
d. **Solar**
   The Committee notes the advancement being made across the country through solar generation and would urge that we continue consistently on this path. The Committee realises that research continues to improve on the quality of the panels and with advanced technology, better and affordable products will be possible for our remote locations.
e. **Wind, Waves, Geo-Thermal**
   The Committee notes the work being carried out in these areas which today are perceived to be uneconomical but would urge that the relevant departments continue to stay abreast of developments going into the future.

[2] FEA Annual Report 2015

Conclusion

The Standing Committee on Economic Affairs has fulfilled its mandate approved by Parliament which was to examine the FEA 2015 Annual Report. The Committee after thorough deliberation has concluded that the above recommendations highlight key areas which if addressed could prove to be beneficial for our economy.

The Committee would urge that we stay true to the Sustainable Development Goal 7 that we have 'affordable and clean energy by 2030'.

APPENDICES

COPIES OF SUBMISSIONS RECEIVED BY THE STANDING COMMITTEE ON ECONOMIC AFFAIRS

Department of Energy Renewable Energy – Current and Future Plans

MINISTRY OF INFRASTRUCTURE & TRANSPORT

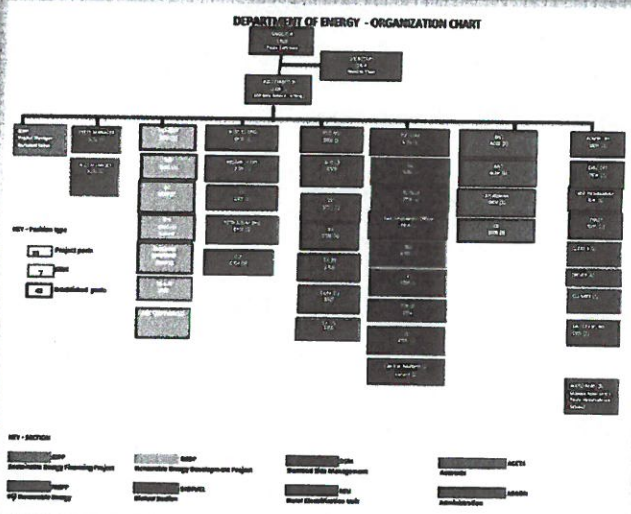
Standing Committee on Economic Affairs

29th November, 2016

OVERVIEW OF PRESENTATION

- The Department of Energy
- Fijis Energy Sector Situation Overview
- Targets
- Key Areas
  - Institutional and Regulatory Frameworks
  - Renewable Energy in Grid Connected Power
  - Renewable Energy in Off Grid Power
  - Financing
  - Renewable Energy in Transport
- Key Points

MINISTRY OF INFRASTRUCTURE AND TRANSPORT – Department of Energy



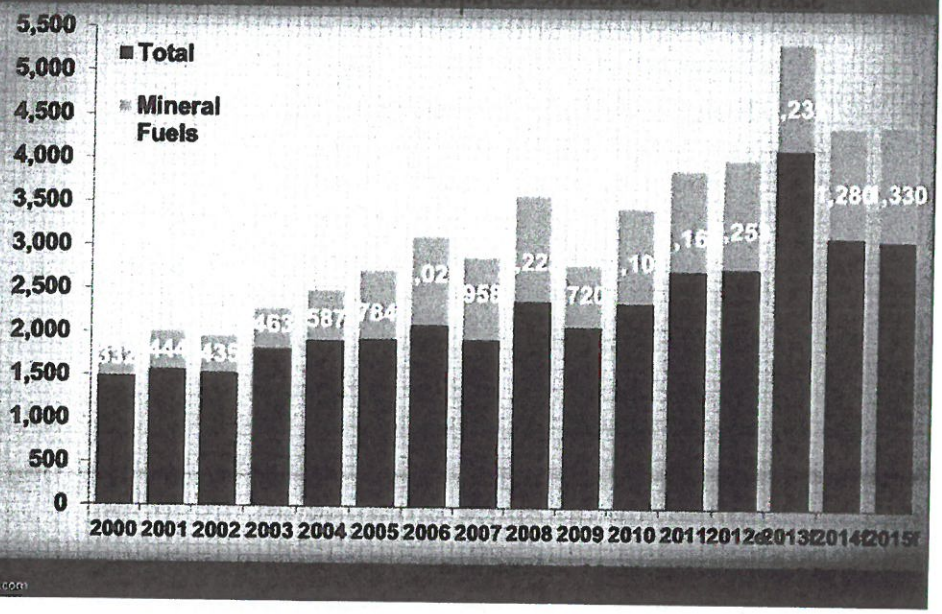
Goal 7 of the UN SDG

GGF of Fiji
Pillar 1 Environment
Building Resilience
Waste Management

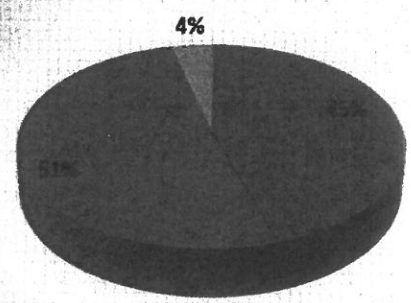
Pillar 3 Economic
Energy Security
Sustainable Transportation
Technology and Innovation

TREND IN VALUE OF OIL IMPORTS

FSM Mineral Fuel Imports Continue to Increase



ELECTRICITY SECTOR – GENERATION MIX

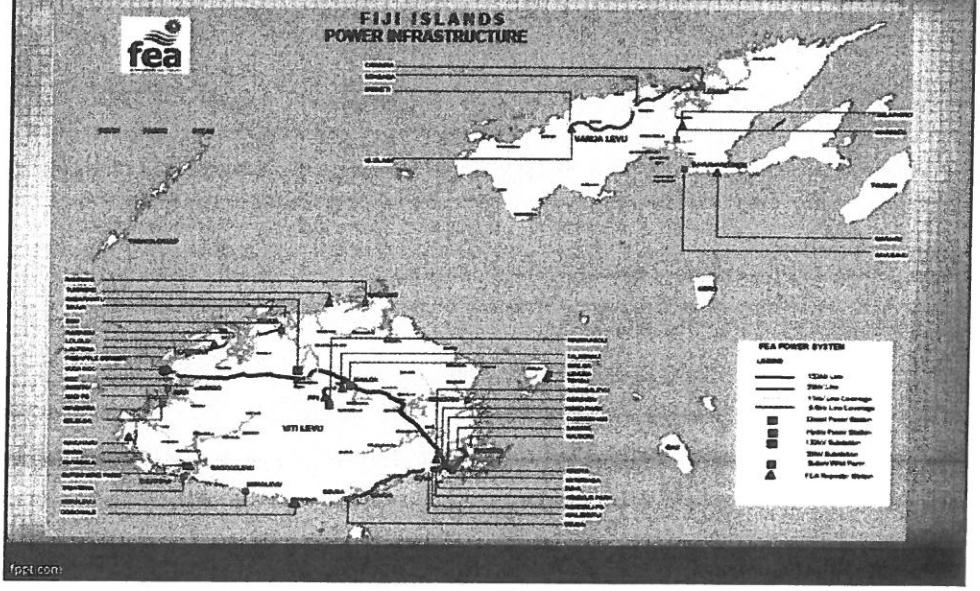


- Hydro
- Diesel/HFO
- Wind/Biomass

Electricity Generation in Fiji by Source (FEA-2014 Data)

fppt.com

POWER PLANTS INSTALLED CAPACITY



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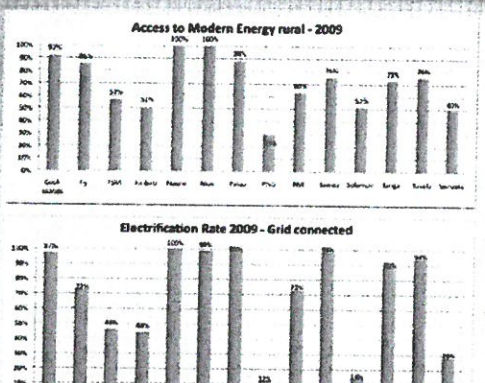
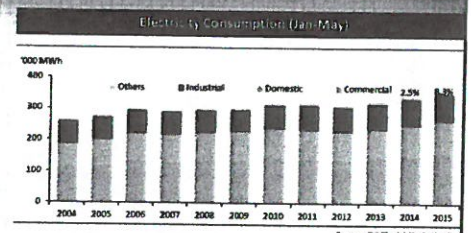
ELECTRICITY SECTOR - GROWTH AND ACCESS



Source: SPC Regional Security Indicator Database



Source: Fiji Electricity Authority

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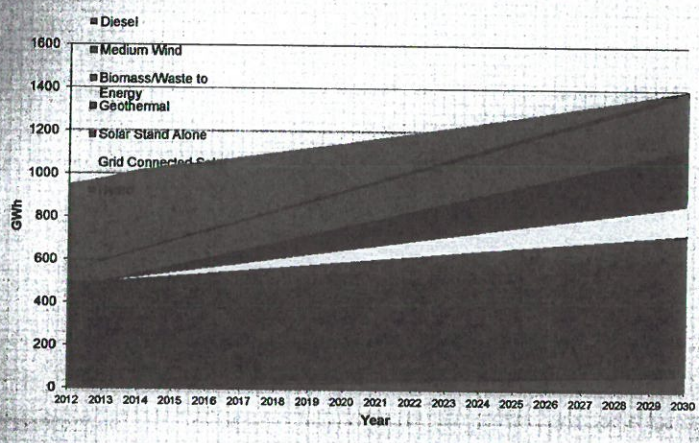
ELECTRICITY SECTOR – FUTURE GENERATION MIX



Electricity Generation in Fiji by Source (FEA-2014 Data)

Tropik Wood Industries Limited

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RENEWABLE ENERGY TARGETS

Indicator	Baseline	Targets		
		2015	2020	2030
Access to modern energy services				
Percentage of population with electricity access	89% (2007)	90%	100%	100%
Percentage of population with primary reliance on wood fuels for cooking	20% (2004)	18%	12%	< 1%
Improving energy efficiency				
Energy intensity (consumption of imported fuel per unit of GDP in MJ/FJD)	2.89 (2011)	2.89 (0%)	2.86 (-1%)	2.73 (-5.5%)
Energy intensity (power consumption per unit of GDP in kWh/FJD)	0.23 (2011)	0.219 (-4.7%)	0.215 (-6.15%)	0.209 (-9.1%)
Share of renewable energy				
Renewable energy share in electricity generation	60% (2011)	67%	81%	100%
Renewable energy share in total energy consumption	13% (2011)	15%	18%	25%

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INSTITUTIONAL AND REGULATORY WORK

- Review of National Energy Policy
- National Electrification Master Plan
- Amendments to Electricity Act (MoE)
- National Biofuel Policy
- National Energy Information System

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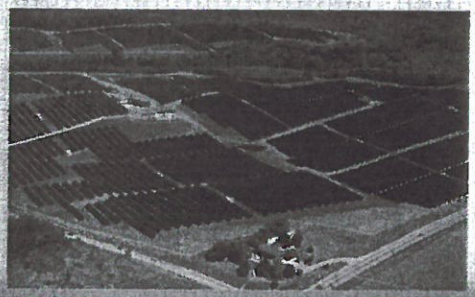
RENEWABLE ENERGY IN GRID CONNECTED POWER – Solar and Wind

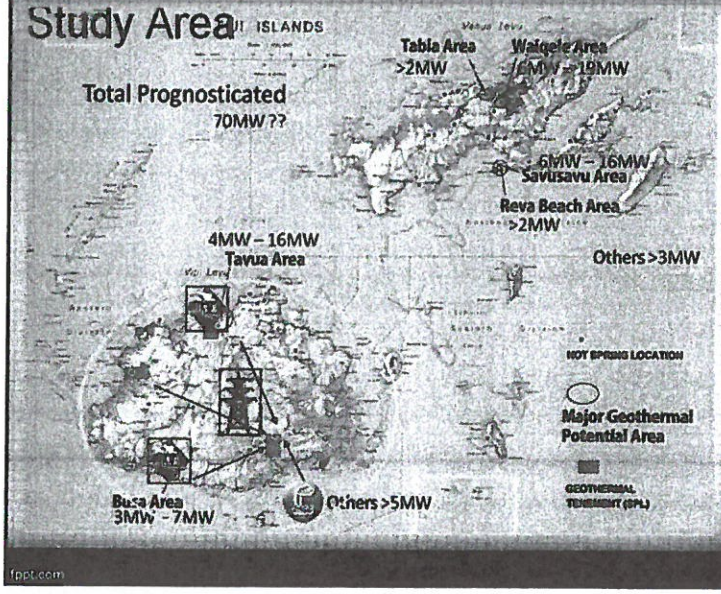
The World Bank



European Investment Bank

IRENA
International Renewable Energy Agency

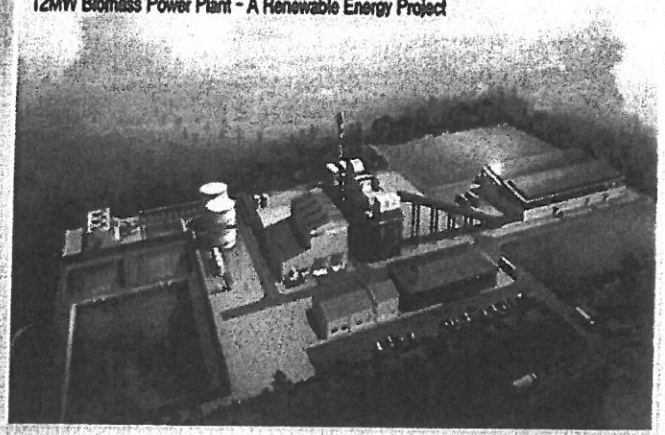
RENEWABLE ENERGY IN GRID CONNECTED POWER - Geothermal



The World Bank

RENEWABLE ENERGY IN GRID CONNECTED POWER - Biomass

12MW Biomass Power Plant - A Renewable Energy Project



Korea Eximbank
THE EXPORT-IMPORT BANK OF KOREA

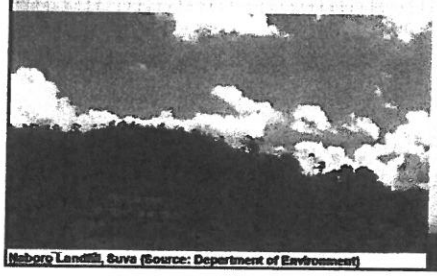
fppt.com

RENEWABLE ENERGY IN GRID CONNECTED POWER - Waste to Energy

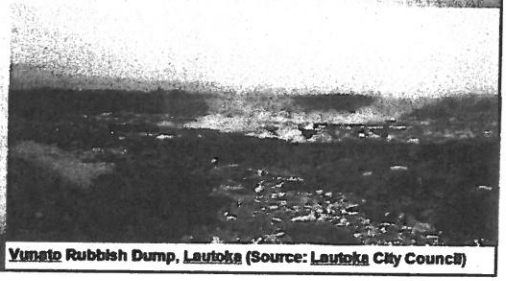
Estimated Quantity of MSW Generated in Fiji

Division	Population (2007 Census)	Annual MSW Generation (Tons/year)
Central	342,386	49,988[13]
Western	319,611	46,663
Northern	135,961	19,850
Eastern	39,313	5,739
Total	837,271	122,240

Source: FREPP Waste to Energy Report 2015



Naboro Landfill, Suva (Source: Department of Environment)



Vunato Rubbish Dump, Lautoka (Source: Lautoka City Council)

RENEWABLE ENERGY IN GRID CONNECTED POWER – Renewable Energy Islands

Link to Key National Objectives:

- Most Economical Option
- Lead to Sustainability and Resilience

Pre-feasibility Study for 100% Renewable Electricity Generation on Ovalau and Taveuni Islands

- 30% Mitigation of GHG Emissions in the Energy Sector
- Contribute to National Target of 100% Renewable Elec. By 2035

Global Green Growth Institute

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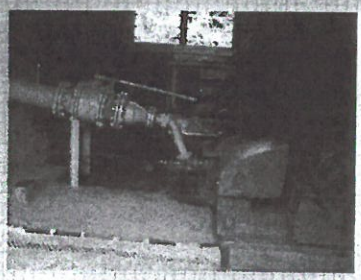
RENEWABLE ENERGY IN OFF GRID POWER

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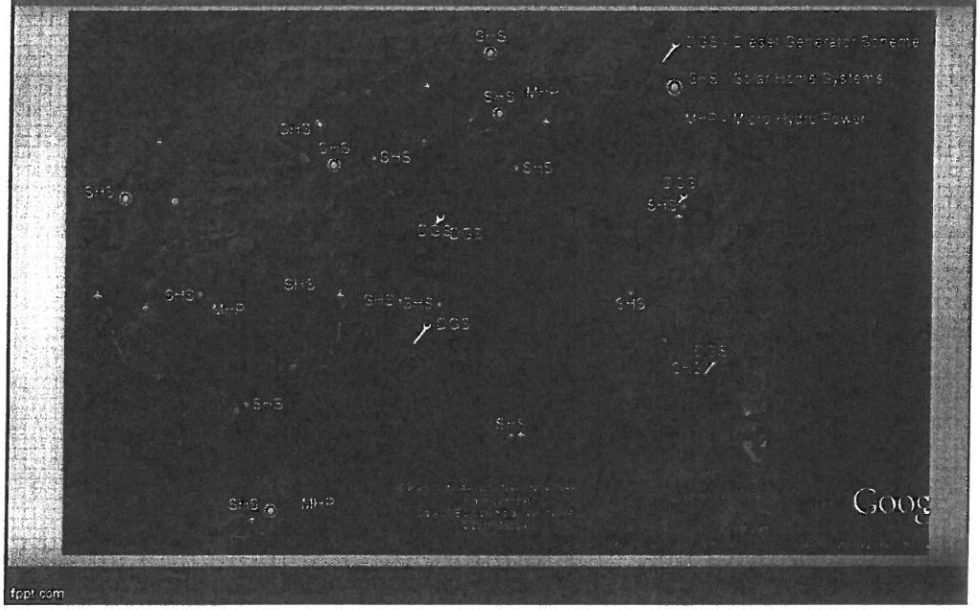
RENEWABLE ENERGY IN OFF GRID POWER – Hybrid Systems



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FINANCING AND MARKET CHALLENGES

Average annual investments needed to achieve SE4ALL targets in the electricity sector by 2020				
Investment Cost	**FJ$/Annum**	**Investor**	**2016/2017 DOE Budget FJ$**	**Donor Grant Funding FJ$**
Efficiency	**2,000,000**	**Private**	**265,000**	**-**
Hydro	**14,100,000**	**FEA**	**-**	**-**
Grid Connected Solar	**1,500,000**	**Private**	**-**	**World Bank SEFP**
Solar Stand Alone (Rural)	**11,500,000**	**Government**	**7,000,000**	
Hybrid Systems	**2,000,000**	**Government / Private**	**3,500,000**	**2,400,000 EU /GIZ**
Geothermal	**14,611,765**	**Private**	**-**	**World Bank TA**
Biomass/Waste to Energy	**6,180,000**	**Private**	**-**	**-**
Medium Wind	**1,250,000**	**Private**	**-**	**-**
Grid Extensions	**3,220,000**	**Government**	**8,601,916**	**3,864,319 (Power Restoration)**
Total Annual	**54,161,765**			

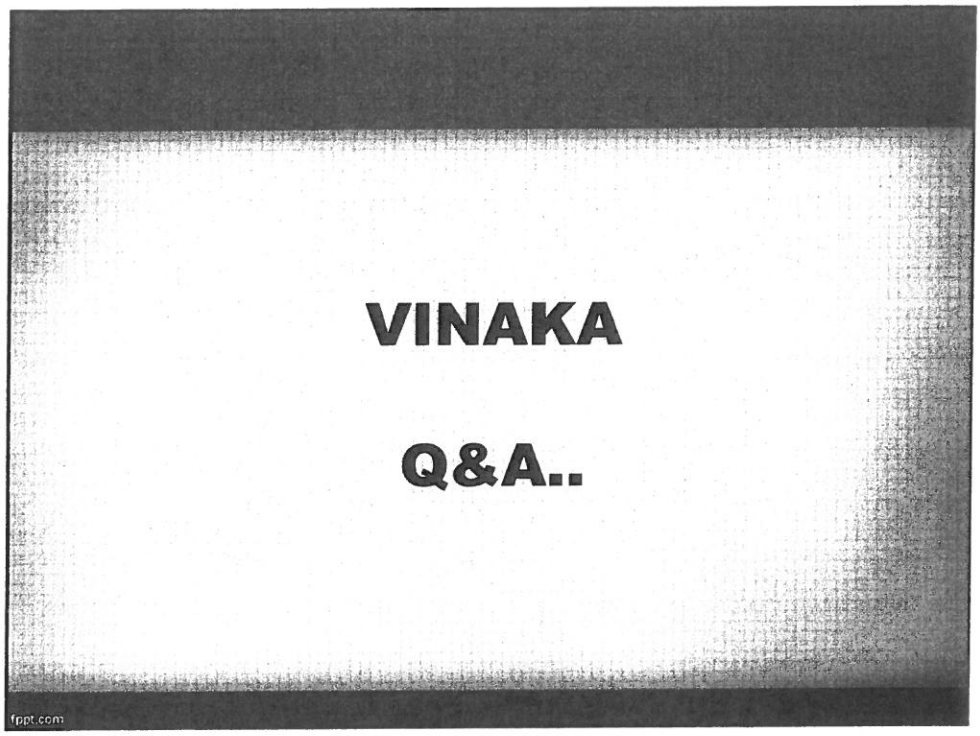
Source: SE4ALL report

fppt.com

RENEWABLE ENERGY IN TRANSPORT – SUSTAINABLE TRANSPORT

KEY POINTS

- Targets – 100% Renewable by 2035
- 94 million FJD per annum from now until 2030
- Potential game changers are Biomass and Geothermal Power
- Small scale distributed generation systems
- Private sector participation in Off Grid RE systems
- Focus on Transport Sector


VINAKA
Q&A..
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Fiji Sugar Corporation Ltd, Fiji Islands.
Cogeneration

Fiji Sugar Corporation's Cogeneration presentation to The Standing Committee on Economic Affairs

Save ENERGY for better tomorrow

Fiji Sugar Corporation Ltd, Fiji Islands.
Cogeneration

Cogeneration in Sugar Cane Processing

- ✓ Sugar cane has 25% Bagasse which can be used as fuel for boilers
- ✓ Bagasse is used for producing electricity and heat required for sugar cane process
- ✓ By optimizing conversion of Bagasse into heat energy, we can maximize power generation and at the same time meet process heat requirements
- ✓ Excess power generated can be exported to the national grid

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Fiji Sugar Corporation Ltd, Fiji Islands.
Cogeneration

Cogeneration
Technology Progress World wide

Period	Electricity generation in kWh *
Till 1970	20 to 30
Till 1985	20 to 40
Till 1995	Up to 90
Now	Up to 230

***Power generation per tone of cane crushed**

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Fiji Sugar Corporation Ltd, Fiji Islands.
Cogeneration

Power Export from FSC

	LAUTOKA MILL		LABASA MILL	
year	Cane crushed in MT	Power exported in GWh	Cane crushed in MT	Power exported in GWh
2011	643521	9.25	570471	4.32
2012	490462	9.82	413283	4.62
2013	368755	5.43	546150	6.63
2014	554214	9.93	544348	6.17
2015	502325	2.98	662534	9.22
2016	402168	--	653353	9.79

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Fiji Sugar Corporation Ltd, Fiji Islands.
Cogeneration

- FSC has been exporting power to the grid since 1994 after meeting its demand.
- FSC energy centers had low pressure boilers and back pressure turbines, the quantity of power that can be exported was very small and directly proportionate to the process steam demand.
- FSC has installed a Condensing Extraction Turbine in Labasa mill which increased the power export to FEA by 30% and FEA's diesel generation is reduced by 60%
- From end of June 2017, Labasa mill will be exporting power to the grid round the year and will cover 90% of the power requirement for Labasa power distribution system.
- Labasa mill Cogeneration plant will be using 24,000 MT fire wood / year after using bagasse from 800,000 MT cane crushed. (If the factory crush 1 Million MT cane, no fire wood will be required for operating the cogeneration plant round the year)
- FSC is looking at Labasa mill crossing 800,000 MT crop by year 2018.

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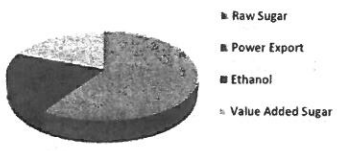
Fiji Sugar Corporation Ltd, Fiji Islands.
Cogeneration
FSC's Future Plan for Cogeneration

Modern sugar cane processing industry revenue distribution

Sugar cane Industry Revenue Distribution

Product	Revenue in FJD / MT Cane
Raw Sugar	32
Power Export	29
Ethanol	22.4
Value Added Sugar	20
Total	103.4

Revenue in FJD



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Fiji Sugar Corporation Ltd, Fiji Islands.
Cogeneration

- Revenue opportunity in power export is almost equal to revenue from raw-sugar. For FSC to be a self sustainable organization, maximizing power sales revenue is the way forward.
- In the national perspective FSC's cogeneration is very significant.
- Viti Levu Power consumption is around 900 GWh / Year, and FEA generates 40% of this power through its diesel or HFO based power plants.
- Power generated by FSC is 100% renewable and sustainable. By 2019 – 20 FSC will be contributing 16 % of the total power generated by FEA and reduce power generation using diesel by 40%.
- Fuel required for these cogeneration plants will be from 2 million MT of Sugar Cane processed in Viti Levu. FSC is looking at crossing 2 Million MT cane crop size in Viti Levu by the year 2018

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Fiji Sugar Corporation Ltd, Fiji Islands.
Cogeneration

FSC's Future Plan for Cogeneration

Mill	2018 - 19	2019 - 20	2020 - 21	2021 - 22	2022 - 23
Lautoka	27.64	27.64	27.64	27.64	27.64
Rarawai	31.10	107.89	107.89	138.99	225.00
Penang	--	16.20	16.20	16.20	16.20
Total export in GWh	58.74	151.73	151.73	182.83	268.84
Power export revenue in M FJD	16.63	35.76	35.76	56.04	84.50

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Fiji Sugar Corporation Ltd, Fiji Islands.
Cogeneration

- Commission an extraction condensing turbine in Lautoka mill in the place of 12 MW back pressure turbine by end of June 2018. For this FSC requires 13 M FJD capital investment support from government in the financial year 2017.
- Commission Rarawai cogeneration plant Phase I , 1 X 20 MW unit by January 2019
- Commission Penang state of art Syrup Mill with a modern 10 MW cogeneration facility by June 2019
- For commissioning Rarawai cogeneration and Penang Syrup mill as above we are looking forward for Government's decision to tie up the financial closure of the projects by March 2017.
- Commission Rarawai cogeneration plant Phase II , second 1 X 20 MW unit by January 2022

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Fiji Sugar Corporation Ltd, Fiji Islands.

Rarawai 2 X 20 MW Cogeneration plant Phase I

- Capital investment for 1 X 20 MW power plant including, modifications required in Rarawai mill for integration with cogeneration plant and payment to FEA for power evacuation system development, is estimated at 112 Million FJD.
- Until Phase II is implemented, the Yoshimini boiler will be refurbished and used with the 5 MW TG set.
- The Steam turbines driving the 3 mill crushers will be replaced with electric motors.
- Cane feeding and preparation station will be upgraded.
- Boiling house will be upgraded to reduce specific steam consumption from 46 % to 40% on cane.

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Fiji Sugar Corporation Ltd, Fiji Islands.

Need for cogeneration at Rarawai Sugar Mill

- To replace aged and inefficient energy center (boilers and turbo-generators) of the mill.
- Ensure supply of adequate electricity and process steam to the sugar mill.
- Increase revenue up to 28 FJD for every MT of sugar cane processed.
- Return the factory to optimum crushing capacity and improve overall performance.
- Export electric power up to 85 kWh per MT of sugar cane processed. This means each MT of sugar cane processed will reduce 28 litres of diesel import into the country.

Save ENERGY for better tomorrow

Fiji Sugar Corporation Ltd, Fiji Islands.

High lights for Rarawai cogeneration plant

- Power generation/year 250 Gwh
- Power export/year 225 Gwh
- Gross revenue 74.43 M FJD
- Plant estimated capital cost 190 M FJD
- Fossil fuel (Diesel) offset by 66.66* Million litres / year
- After utilizing bagasse from 2.5 Million MT cane, the cost of bio mass fuel purchased will be 12 M FJD / year

*Equals 133.32M FJD fuel import

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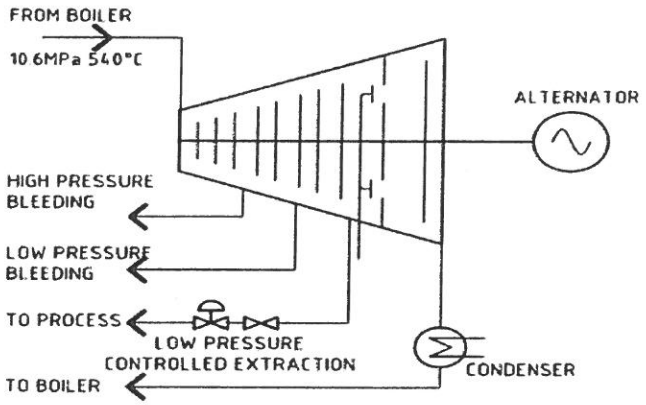
Fiji Sugar Corporation Ltd, Fiji Islands.

Extraction cum Condensing turbine



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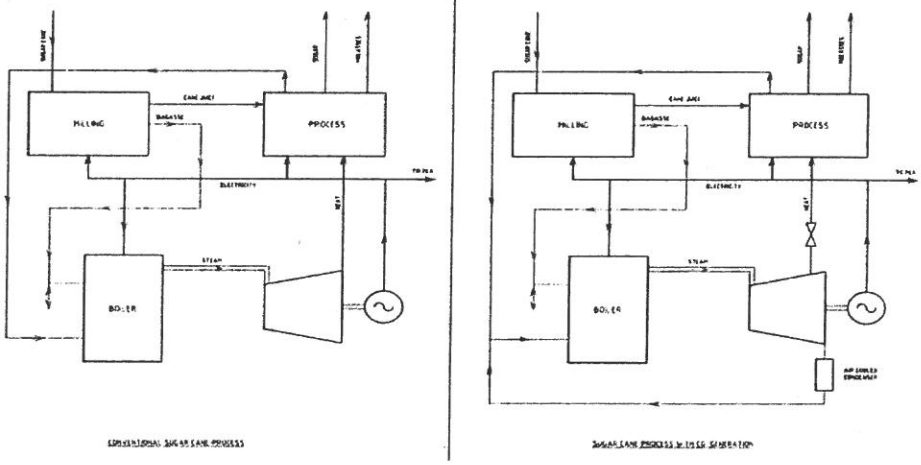
Fiji Sugar Corporation Ltd, Fiji Islands.

Cogeneration



Save ENERGY for better tomorrow

Fiji Sugar Corporation Ltd, Fiji Islands.

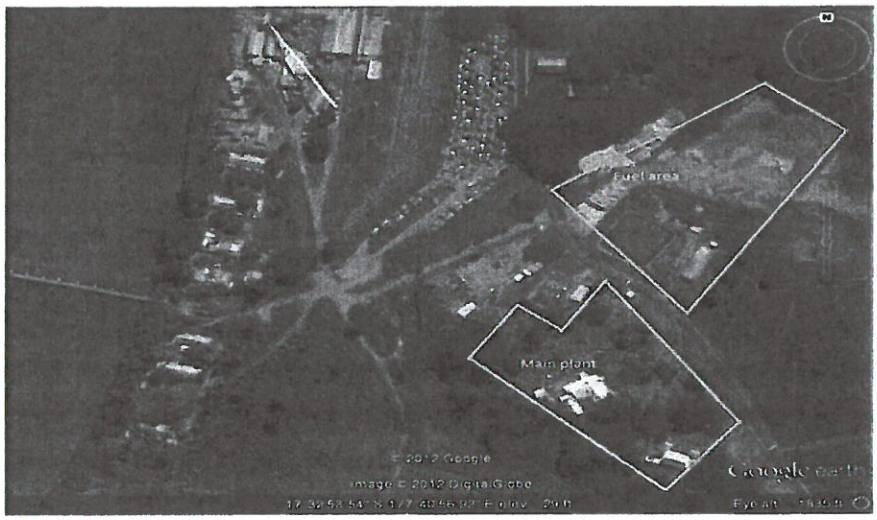
Milestones achieved in Rarawai Cogeneration Project

- A Feasibility study was completed.
- Detailed project report prepared and detail engineering completed.
- Government of India has granted 70 Million USD line of credit for the implementation of the project.
- Power purchase agreement finalized with FEA.
- FEA has finalized Power evacuation facility to be developed for the project and indicated FSC's share of investment for developing the facility.
- The Department of Environment clearance obtained for the project.
- Project site selected in Rarawai and detailed survey of site completed.
- Limited geo tech study completed.
- Layout of the plant finalized.

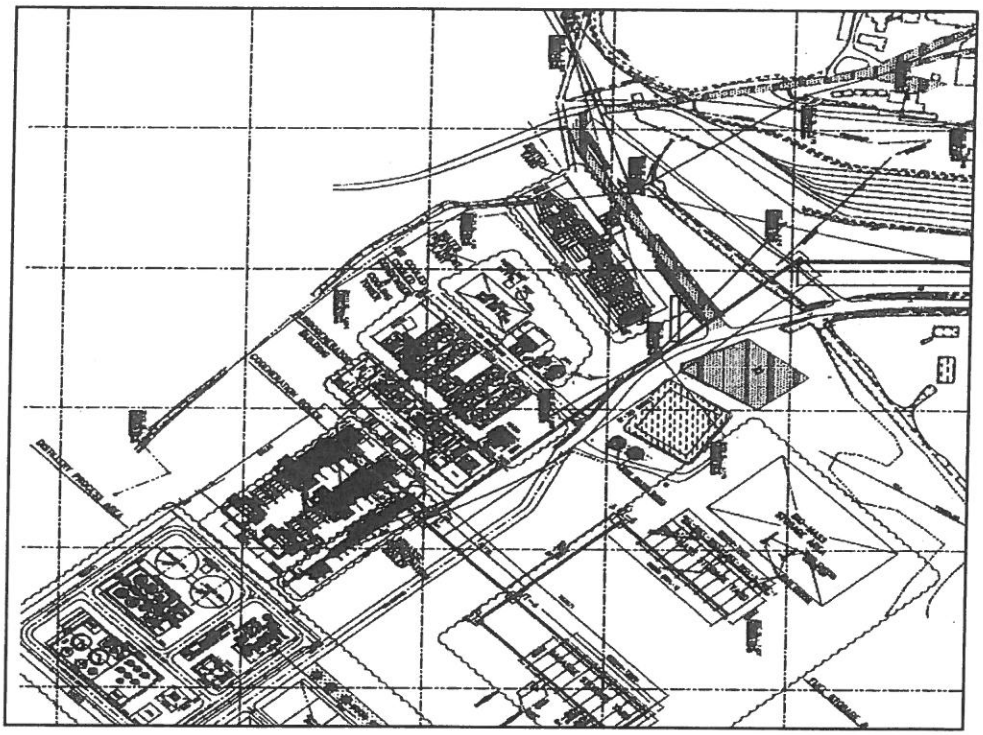
Save ENERGY for better tomorrow

Fiji Sugar Corporation Ltd, Fiji Islands.

Site chosen for project



Save ENERGY for better tomorrow



Fiji Sugar Corporation Ltd, Fiji Islands.

Thanks

TROPIK WOOD INDUSTRIES LTD (TWIL)

PRESENTATION TO PARLIAMENT STANDING COMMITTEE ON ECONOMIC AFFAIRS

Drasa and Navutu Power Plant Update

TWIL Representatives:
Executive Chairman – Mr. Faiz Khan
GM Finance & Admin – Mr. Vimlesh Kumar

DRASA PLANT – Project Initiation

- Project initiated in 2005
- Main focus - generating power to export to national grid.
- Project Management Company - to carry out feasibility study, design specification, procurement processes, project management and implementation.
- Plant commissioned in September 2008.

DRASA PLANT – Project Initiation (cont'd)

- Plant components and investment value:

Component	Supplier	Value
Steam Boiler	RCR Energy	$10.44m
9.3 MW Turbine	Siemens	$10.17m
Cooling Towers	Cooling Towers (NZ) Ltd	$1.83m
Cogen – Plant and Equipment	Various	$10.26
Total		**$32.70**

DRASA PLANT – Plant Rated Capacity

Component	Design Capacity (MRC)
Steam Boiler	Steam output of 35 tons per hour
Siemens Turbine	9.3 MW @ 40 ton steam per hour

DRASA PLANT – Challenges from Initial Commissioning

- The plant has never operated as per initial projections.
- The boiler was substantially damaged by fire on 2 separate occasions - 1st fire in April 2009 and 2nd fire in April 2012.
- Substantial losses since initial commissioning.
- Impairment loss of $7m taken up in the books.

DRASA PLANT – Challenges – Contributing Factors

- Poor project planning and implementation.
- Plant design issues.
- Availability of fuel.
- Water quality issues.
- Technical skills.

DRASA PLANT – Contributing Factors – Actions Taken

- Plant studies carried out by 3 different cogeneration plant experts to establish the causes of 2 fires and make recommendations.
- Plant improvements - $1.5m
- New water treatment facility - $4.8m.
- Replaced super heater tubes - $0.8m
- Turbine Overhaul - $2.5m

DRASA PLANT – Contributing Factors – Actions Taken (cont'd)

- Combustion still an issue – attributable to Boiler Furnace.
- Legal claim against Boiler manufacturer, RCR Energy.

DRASA PLANT – Contributing Factors – Actions Taken (cont'd)

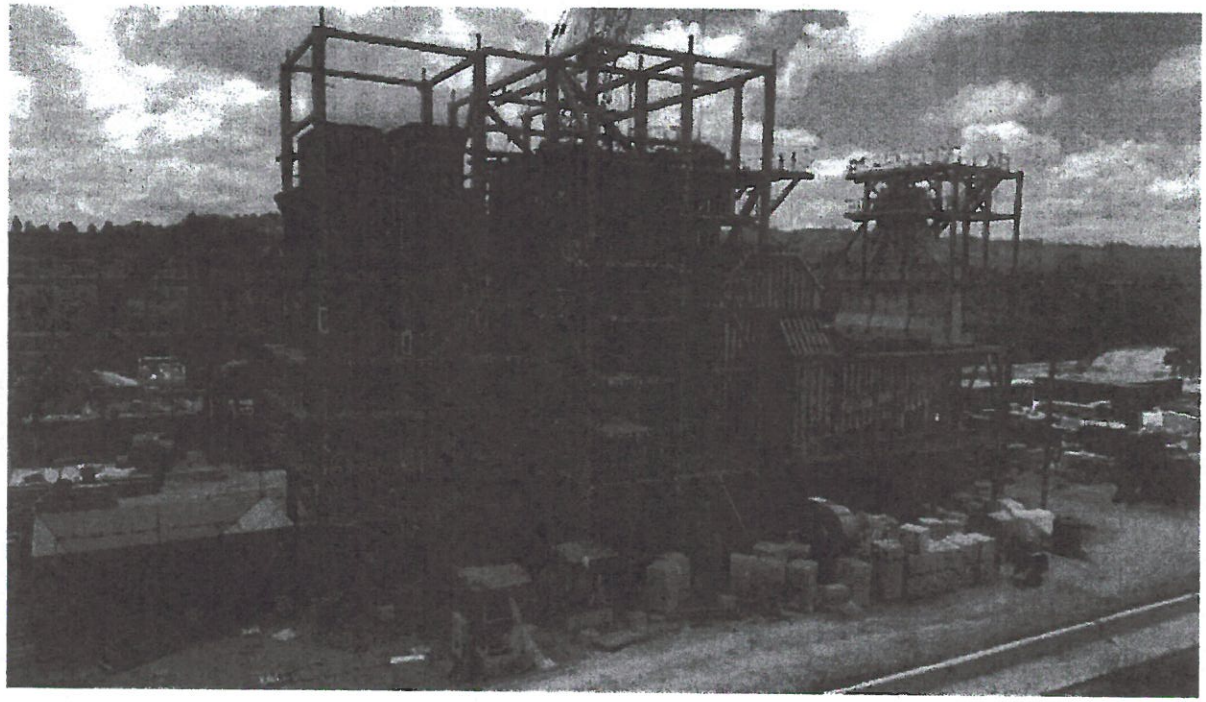
- In conclusion, TWIL already has a plant at an investment value of $33m that has been poorly designed. Over period of time it has incurred substantial losses.

- TWIL is taking all corrective measures that can be carried out on the plant with the view to operate and recover some if not all of these losses.

- While turbine rated capacity is 9.3MW, the reports from experts reveal that it can only generate upto 4 to 5 MW due to these design deficiencies.

- TWIL is currently exploring plant operations under an O&M arrangement.

NABOU BIOMASS PLANT



This project is a joint venture between TWIL, GIMCO, GS Power & DAEWOO

NABOU BIOMASS PLANT

- TWIL has 25% equity in Nabou Green Energy Ltd.

- Project Cost – USD$44m

- Plant Components
  - Boiler – LAWI
  - Turbine - Siemens
  - Water Treatment - Korea (GIMCO)
  - Design and Engineer - Korea (Eltech)

- Plant Capacity

  The plant design capacity is 12 MW and net export to the grid is planned at 10MW.

NABOU BIOMASS PLANT - Progress

- Project on schedule - 82.93% complete.
- Planned commercial Operation Date – 30th April 2017.
- Strength of this project – Experience and technical expertise of Korean partners.

VINAKA VAKALEVU