Biofuels – Potential for Shipping

Presented by: Mr Pranil Singh
Fiji Department of Energy

Sustainable Sea Transport for the Pacific Workshop
USP, Lower Campus, Fiji

Fiji Department of Energy

- The FDoE vision is for a sustainable energy sector in Fiji while its mission is to provide an enabling environment to achieve the vision.

- The National Energy Policy has 4 strategic areas, namely:
  - National Energy Planning
  - Energy Security
  - Power Sector
  - Renewable Energy

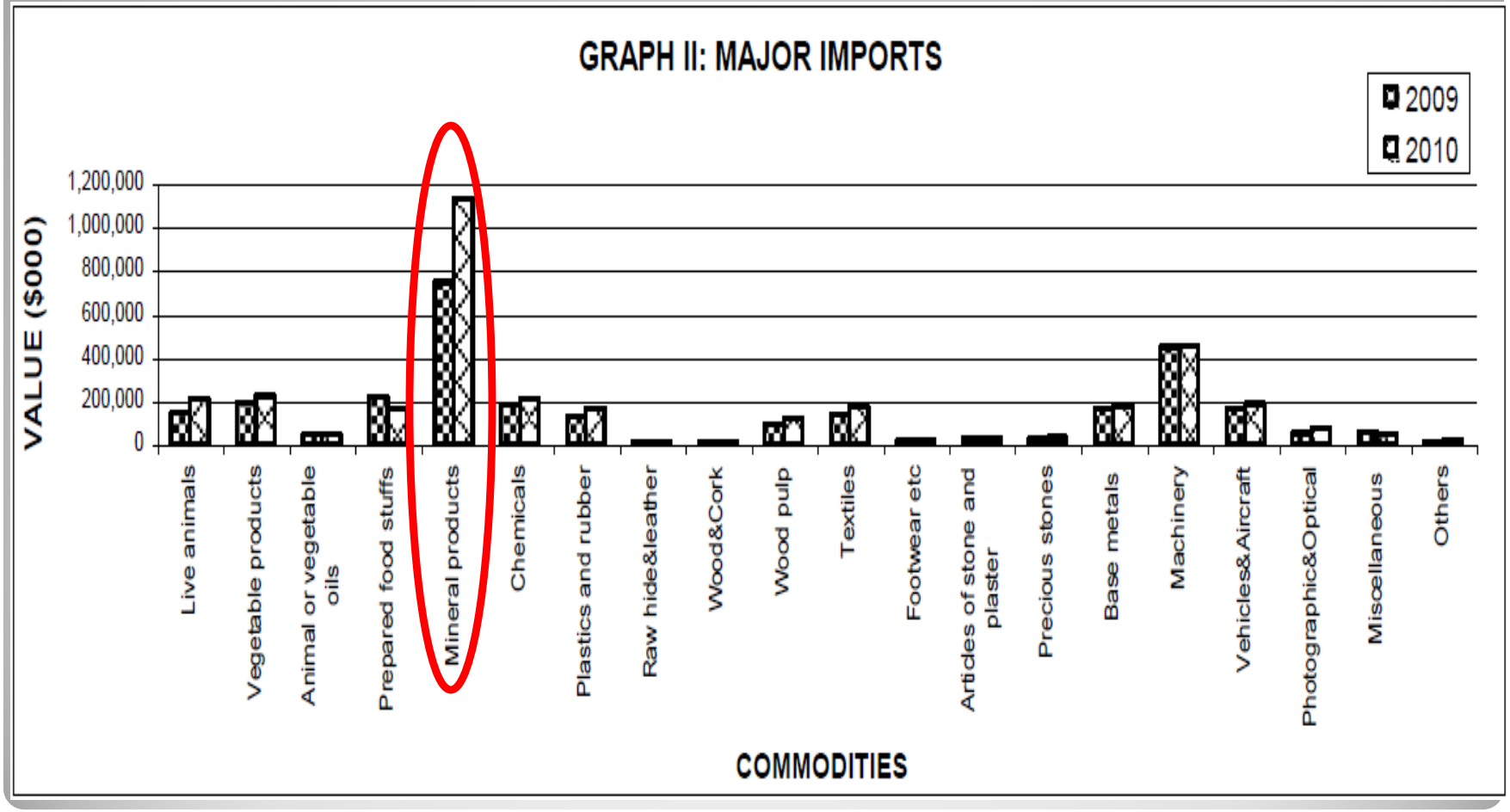
National Energy Policy

- **National Energy Planning** – policy and regulatory framework development
- **Energy Security** – ensure stable and adequate energy supplies by diversifying our energy base
- **Power Sector** – ensuring the demand for reliable and affordable electricity is met
- **Renewable Energy** – research and promote use of renewable energy, provide incentives for renewable technologies.

Projects managed by Biofuel Development Unit

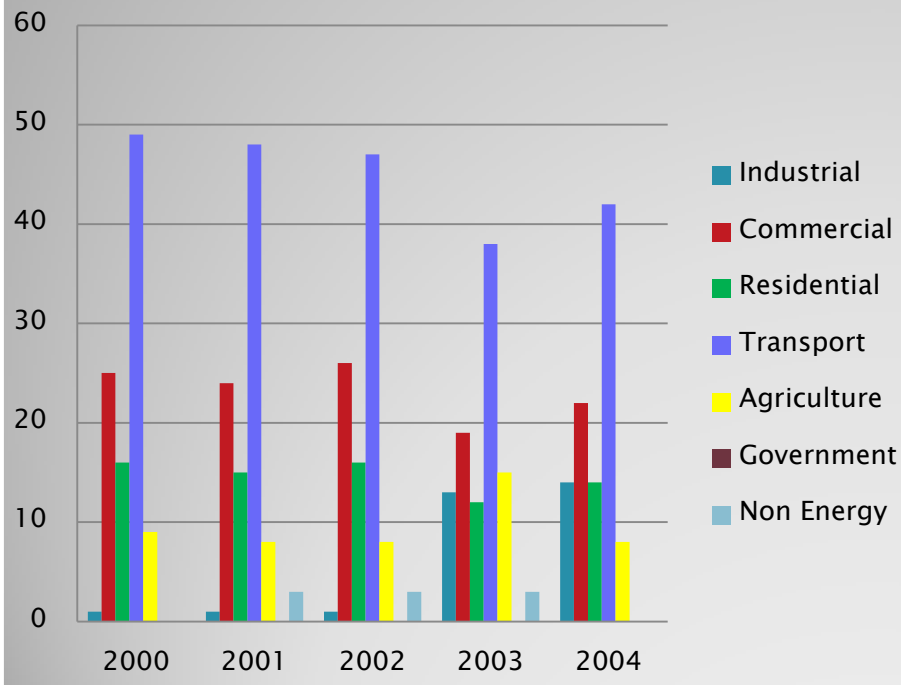
- Establish relevant biofuel standards
- Biofuel testing trials
- Rural and maritime renewable diesel projects
- Coordination of government and private sector efforts in ethanol & biodiesel production
- Coordinate the development of a wider biofuels industry in terms of policy framework and legislation

Extent of Fuel Imports

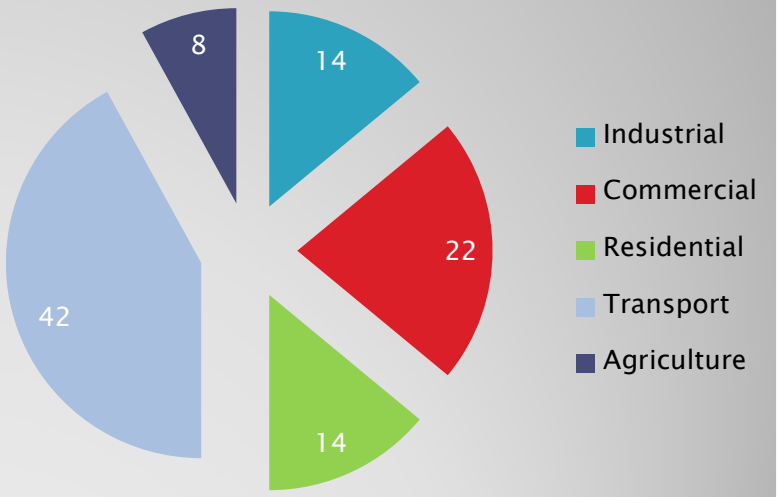


Energy Consumption by Sector

FINAL ENERGY CONSUMPTION BY SECTOR



FUEL CONSUMPTION BY SECTOR



Biofuel

NO.	Fuel Type	Total Imports *	Volume of Blend Required** (litres)	Potential Savings (FJD)
1.	Motor Spirit	49, 404, 283.00	7, 466, 242.00	7, 922, 084.00
2.	Automotive Diesel Fuel	33, 922, 843.00	2, 035, 370.00	3, 043, 146.00
3,	Industrial Diesel Fuel	235, 182 797.00	56, 443, 871.30	72, 432, 476.00
4.	Residual Fuel Oil	20, 318, 647.00	4, 876, 475.00	4, 888, 600.00
TOTAL		338, 828, 570	70, 821, 958.30	88, 286, 306.00

* The Total Imports is the retained imports in Fiji (it is less the re-exported value).

** The Volume of Blend has taken into account the existing standards (5% Biodiesel [ADO], 20% Biodiesel [IDO & RFO] & 10% Ethanol [ULP]). In addition it has also taken into account the energy content of the fuel.

Biofuel Program - Standards

- The Fiji National Fuel Standards currently has:
  1. Diesel Standards
  2. Gasoline standards

- The following amendments have been made:
  1. Diesel standards – now allows 5% (max.) biodiesel to be blended with diesel
  2. Gasoline standards – allows 10% (max.) of ethanol to be blended with gasoline.

Biofuel Program - Standards

- The following standards have been gazetted:
  1. Biodiesel standards (B100)
  2. Ethanol standards (E100)

- The standards (B5 and E10) are currently *voluntary*.

Biofuel Standards

- Standards ensure biofuel producers are selling quality products to the consumers.
- Engine manufacturers can be assured of quality of fuel sold and thus extend the warranty with the use of biofuels.
- These standards are in accordance with the Worldwide Fuel Charter (WWFC) and the International Fuel Quality Centers (IFQC) recommendations

Fiji Diesel Standards

Property	Value	Test Method
Cetane Index	46 (min)	ASTM D976
Sulphur	500 ppm (max)	ASTM D5453
Polyaromatics (Polycyclic aromatic hydrocarbons – PAH)	11 wt%	IP 391
Density @ 15 °C	820 - 860 kg/m³	ASTM D4052
Viscosity @ 40 °C	2.0 - 4.5 cSt	ASTM D445
Distillation temperature, T95	371 °C (max)	ASTM D86
Flash point	61.5 °C (min)	ASTM D93
Carbon residue (10% distillation residue)	0.2 wt % (max)	ASTM D4530
Water and sediment	0.05 vol.% (max)	ASTM D2709
Oxidation stability	25 mg/l (max)	ASTM D2274
Ash and suspended solids	100 mg/kg	ASTM D482
Copper corrosion	Class 1 (max)	ASTM D130
Filter Blocking Tendency	2.0 (max)	IP 387
Lubricity	0.46 mm (max)	IP 450
Colour	2 (max)	ASTM D1500
Conductivity at ambient temperature	50 pS/m	ASTM D2624

Fiji Petrol/Gasoline Standards

Property	Value	Test Method
Benzene	1 % (v/v) [max]	ASTMD5580
Sulphur	500 ppm (max)	ASTMD5453
Oxygen	2.7% (m/m) [max]	ASTMD5622
Phosphorous	0.0013 g/l	ASTMD3231
DIPE (Di-isopropyl ether, CAS: 108-20-3)	1% (v/v) [max]	ASTMD5845
MTBE (Methyl tert-butyl ether, CAS: 1634-04-4)	1% (v/v) [max]	ASTMD5599
TBA (Tertiary butyl alcohol, CAS 75-65-0)	0.5% (v/v) [max]	ASTMD5845
Final boiling point	210 °C	ASTMD5399
Research octane number	91.0	ASTMD2699
Olefin	20% (v/v) [max]	ASTMD6296
Aromatic content	48% (v/v) [max]	ASTMD6293
Motor Octane number	81.0	ASTMD2700
Copper corrosion	Class 1 [max]	ASTMD130
Existent gum	50 mg/L [max]	ASDTMD381
Induction period	6 hrs [min]	ASTMD525
Ethanol	10% v/v [max]	ASTM D5501

Fiji Biodiesel Standards

Property	Value	Test Method
Ester Content	96.5 (min)	EN 14103 modified
Oxidation Stability: Induction Period	6 hrs (min)	EN 14112
Insoluble's (polymers, sludge)	10 mg/L (max)	ASTM D2274
Total Acid Number	0.50 mg KOH/g (max)	ASTM D664
Methanol [1]	0.20 % m/m (max)	EN 14110
Glycerides		
Mono-glycerides	0.80 % m/m (max)	
Di-glycerides	0.20 % m/m (max)	ASTM D6584
Tri-glycerides	0.20 % m/m (max)	
Glycerin (glycerol)		
Free glycerin	0.02 % m/m (max)	ASTM D6584
Total glycerin	0.25 % m/m (max)	
Density@ 15°C	860-890 kg/m^3	ASTM D4052
Kinematic viscosity @ 40 °C	3.5-5.0 mm^2/s	ASTM D445

Property	Value	Test Method
Flash Point	100 °C (min)	ASTM D93
Cetane Number	51 (min)	ASTM D613
Cetane Index	48 (min)	ASTM D976 / D4737
Water	500 mg/kg (max)	EN 12937
Water and Sediment	0.05 % v/v (max)	ASTM D2709
Total Contamination	24 mg/kg (max)	ASTM D2276
Ash Content	0.001% m/m (max)	ASTM D482
Sulphated Ash	0.02 % m/m (max)	ASTM D874
Carbon residue [Ramsbottom, on 100% distillation residue]	0.05 % m/m (max)	ASTM D4530
Sulphur	50 mg/kg (max)	ASTM D2622
Phosphorus	4 mg/kg (max)	ASTM D4951
Alkali metals (Na + K)	5 mg/kg(max)	EN 14108/14109
Alkaline metals (Ca +Mg)	5 mg/kg (max)	EN 14538
Distillation T90	360 °C (max)	ASTM D1160
Copper Strip Corrosion	No. 3 (max)	ASTM D130

Fiji Ethanol Standards

Property	Value	Test Method
Ethanol	99.2% m/m (min) [prior to denaturing] 94.2% m/m (min) [after denaturing]	ASTM D5501
Methanol	0.5% vol. (max)	ASTM D5501
Water	0.7% vol. (max)	ASTM E203
Density	791.5 kg/m^3 (max)	ASTM D4052
Electrical conductivity [1]	500 µS/m (max)	ASTM D1125
Inorganic chloride	10 mg/L (max)	ASTM D7319
Sulphate	4 mg/kg (max)	ASTM D7318
Copper [2]	0.1 mg/kg (max)	ASTM D1688 modified
Phosphorus	0.5 mg/L (max)	ASTM D3231
Sulphur	10 mg/kg (max)	ASTM D5453 [3] (<20ppm) ASTM D2622 (>20ppm)

Property	Value	Test Method
Non-volatile material	5 mg/100mL	ASTM D381
pHe	6.5 - 9	ASTM D6423
Acidity (as acetic acid)	0.007 % m/m (max)	ASTM D1613
Appearance	Clear and bright, no visible impurities	ASTM D4806
Denaturant	1 – 1.5 % vol.	ASTM D5501

Note: To monitor all these properties, an internationally accredited * biofuel testing laboratory is being established.

*** ISO 17025**

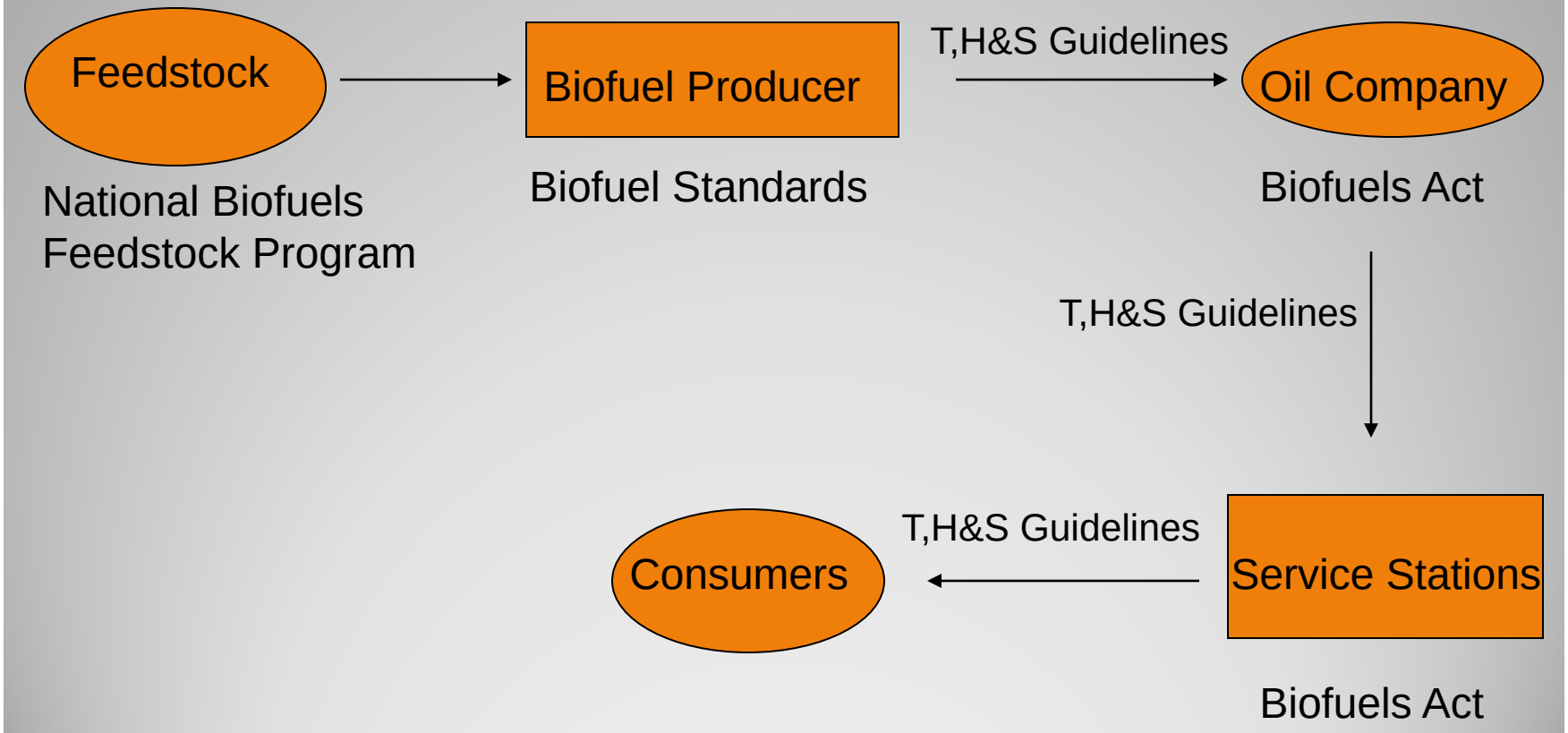
Biofuel Laboratory

Other guidelines for the industry

- **Transportation guidelines** – the vehicles/ships transporting biofuels from the producers to the oil company terminals as well as from the terminals to the service stations need to be accredited vehicles/ships.
- **Handling guidelines** – handling of biofuels requires special attention and training of the fuel handlers will need to be carried out.
- **Storage guidelines** – storage of biofuels will require modifications to the current fuel storage tanks. This is especially important for ethanol storage as moisture can cause phase separation. Nitrogen seals may need to be incorporated in the gasoline storage tanks.

- *Transportation, handling and storage guidelines for ethanol and E10.*
- *Transportation, handling and storage guidelines for biodiesel and B5.*

Biofuel Industry



Biodiesel Program

Company	Production capacity (L)	Comments
Biodiesel Group Co. Ltd	144,000 *(biodiesel)*	This was the only company producing biodiesel from waste veg. oil and from 26th Nov, 2012, this has been merged with NIFL.
Biofuel International	Research Phase *(Pongamia as feedstock)*	The research phase is underway and with the allocation of 5000 hectares of land, 25 Million litres of biodiesel can be produced.
Niu Industries	500,000 *(CNO only)*	Produces renewable diesel (blend of coconut oil with diesel)

Government Funded Program

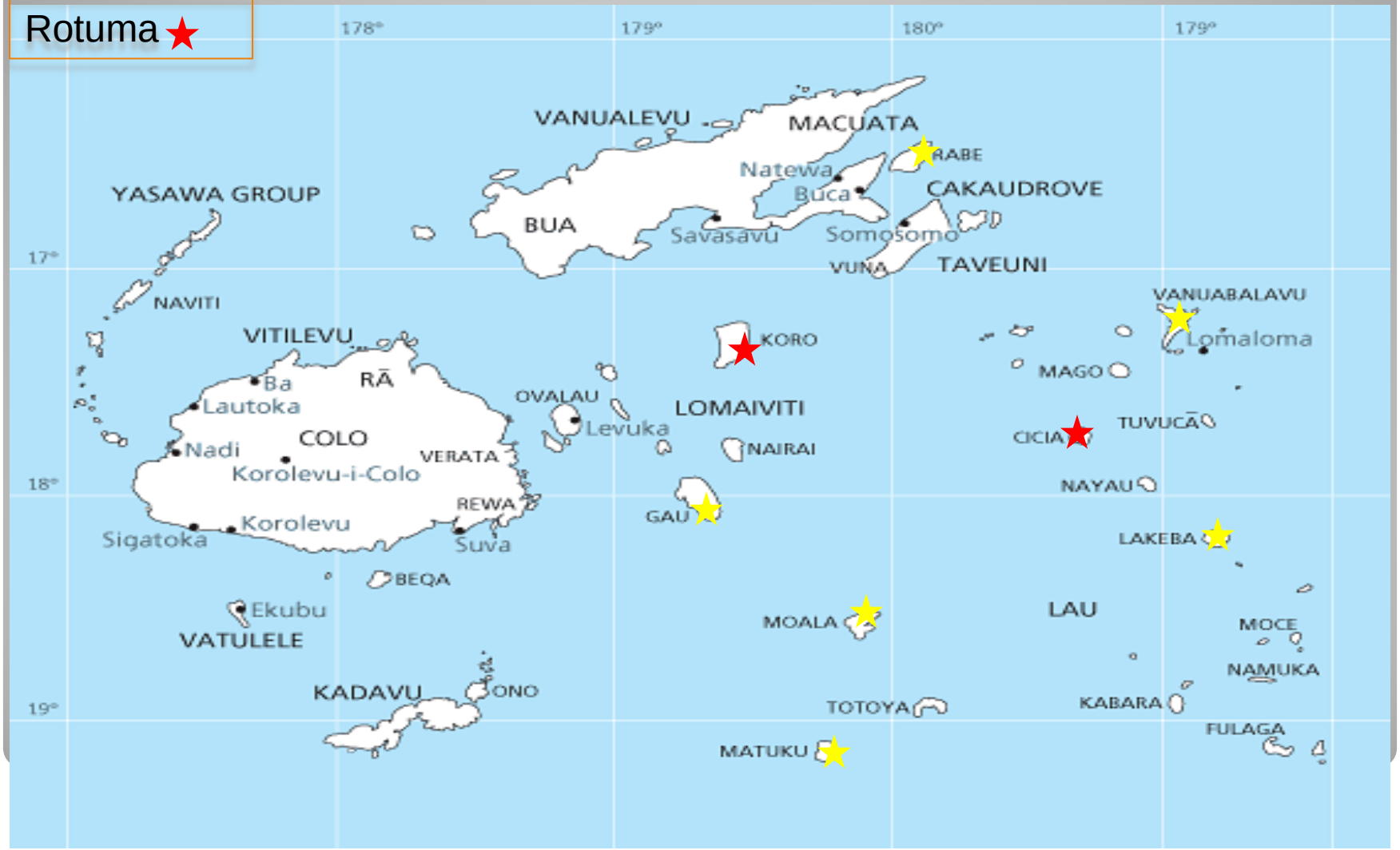
Location	Production capacity (L)	Comments
Koro	170,000	The islands first meet their demands and sent the excess oil to Suva for processing into biodiesel.
Rotuma	170,000	
Cicia	170,000	

*Government aims to have ~20 such mills by 2015.

Company	Production capacity (L)	Comments
Copra Millers (Fiji) Ltd	2.2 Million	Fiji's largest oil mill located in Savusavu.

*Potential for 26 Million Litres of coconut oil.

Government Funded Project Sites



Government funded biofuel projects

Incentives
Bio – Fuel Production

- 10 year tax holiday is available to a taxpayer undertaking a new activity in processing agricultural commodities into bio-fuels as approved by the Commissioner from 1 January 2009 to 31 December 2014. To qualify, the taxpayer must have:-
  - Minimum level of investment of $1,000,000; and
  - Employ 20 local employees or more for every income year.

- Duty free importation of plant, machinery and equipment for initial establishment of the factory.

- Duty free importation of chemical required for bio-fuel production.

Conclusion

Alternative energy supplies with effective conservation measures driven by proper and coordinated policy initiatives is critical in achieving a sustainable transport sector.

Vinaka