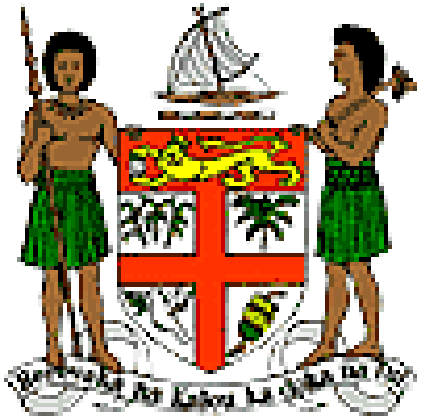
Biofuel Developments in Fiji



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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 (BDU)

- 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

GLOBAL ISSUES TO ADDRESS

- DEPLETION OF FOSSIL FUEL RESOURCES
  - global daily consumption of 84 M Barrels per day (2006)
  - Reserves will last in 43 years

- ENVIRONMENTAL CONCERNS
  - Pollution- use of fossil fuels
  - Global warming
  - Climate change

GLOBAL SOLUTIONS- DEPLETION OF FOSSIL RESOURCES

- Introduction of alternative fuels (Biofuels) is one of the main solutions

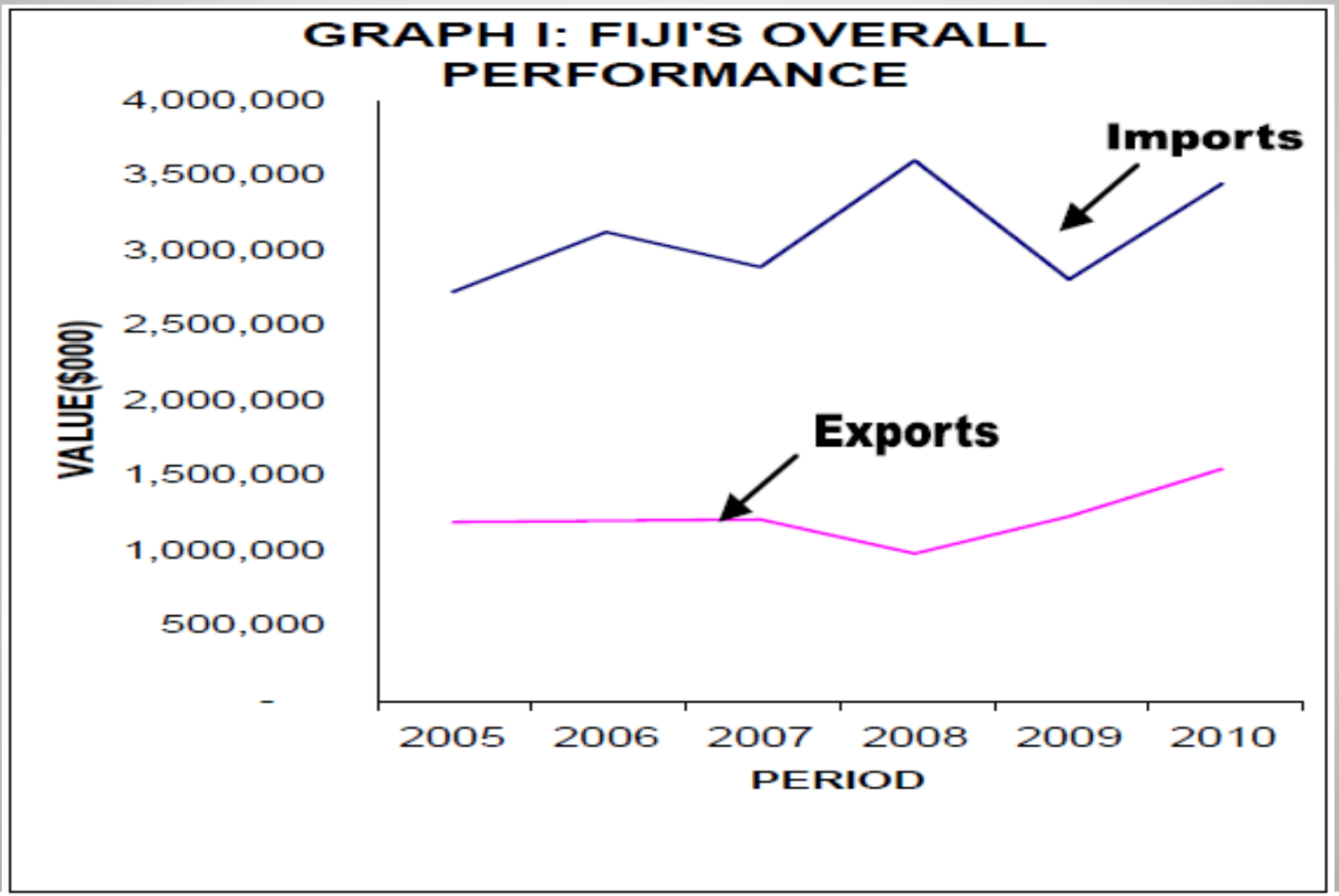
  Challenges
  - Financial viability?Market?Legislations?
  - Infrastructure compatibility
  - Technology compatibility- Vehicles etc
  - Supply chain?
  - Feedstock availability/sustainability
  - etc etc

GLOBAL SOLUTIONS- ENVIRONMENTAL ISSUES

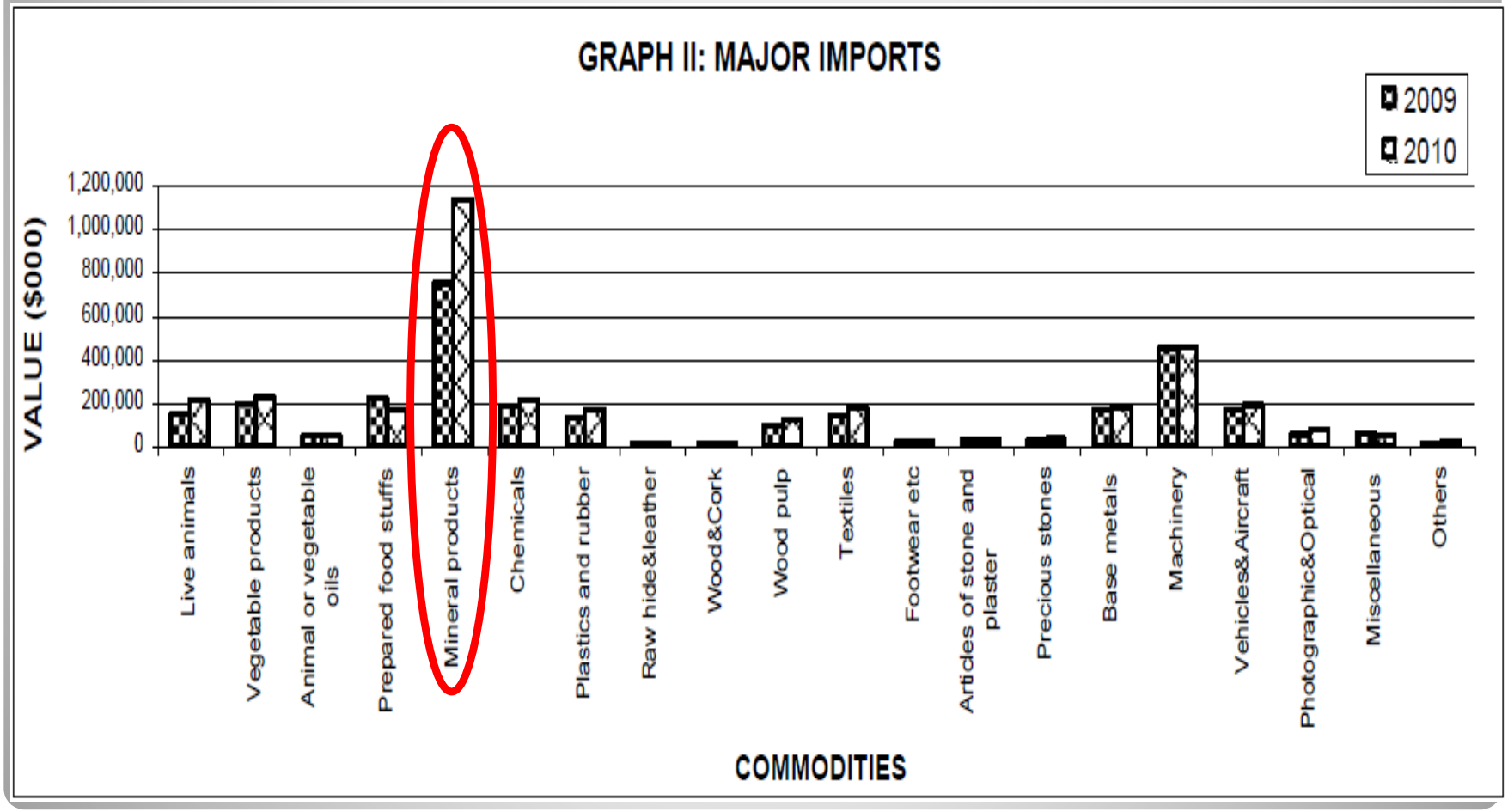
- Introduction of cleaner fuels- E.g. Euro standards; Kyoto Protocol

  Challenges
  - Technology compatibility?
  - Infrastructure compatibility?
  - costing structure?
  - Supply chain ?

Fiji Scenario



Extent of Fuel Imports



Fiji Scenario- Diesel Import

Year	Automotive Diesel Volume (ML)	Industrial Fuel Diesel Volume (ML)	Total Diesel Volume (ML)	Automotive Diesel cost ($m)	Industrial Fuel Diesel cost ($m)	Total Diesel Cost ($m)
2010	391.67	91.01	482.68	455.90	104.38	560.28
2011	394.61	52.24	446.85	588.45	76.97	665.42
2012	393.00	43.20	436.20	607.73	65.80	673.53
2013 as @ Nov	381.07	2.755	383.83	583.50	4.062	587.56
Average/annum	390.09	47.30	**437.39**	558.90	62.80	621.70
B2-requirement	7.802	0.946	8.748			
B3-requirement	11.703	1.419	13.122			
B5-requirement	19.505	2.365	21.870			

Note: Fiji has potential to supply over 100ML of vegetable oil per annum

Fiji Scenario- Gasoline Import

GASOLINE

Year	Gasoline Volume (ML)	Gasoline Cost ($)				
2010	101.863	128.634				
2011	96.524	138.428				
2012	94.342	139.557				
2013 as @ Nov	92.005	137.123				
Average/annum	**96.18**	**135.94**				
E3-requirement	2.89					
E5-requirement	4.81					
E7-requirement	6.73					
E10-requirement	9.62					

Note: Fiji has potential to supply around 30ML of Ethanol per annum but actual planned capacity is approximately 10ML.

Feedstock availability?

- Coconut Oil
- Fiji has potential for 27ML of coconut oil
- Present utilization is 4ML
- Pongamia
- Biofuels International- 1.12 ML (1st Yr of Harvest; 88.8ML(7th YR of Harvest-Maturity)
- Molasses
- Est- 110,000 tons of molasses- 30ML Ethanol.

What is Fiji doing to solve the issue of fossil fuel depletion?

- **Fiji National Fuel standards** has
  - Diesel standards (allows 5% max B100)
  - Gasoline standards (allows 10% max E100)
  - Biodiesel standards (B100)
  - Ethanol standards (E100)
- The standards (B5 and E10) are currently *voluntary*.

- **INCENTIVES**

  - Duty concession of $0.13 for diesel purchased for blending with biodiesel

  - Duty free importation of equipments and chemicals.

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

  - 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.

- **ESTABLISHMENT OF ACCREDITED BIOFUEL LABORATORY**

-DOE working in partnership with USP (IAS)

- Project cost **$1,926,954.87**

- Phase 1 – procurement and accreditation of basic physical properties of biofuel (Accreditation complete)

- Phase 2- procurement and accreditation of complex chemical properties (Procurement in progress- accreditation to be fully completed by 2015.

- Laboratory employs 3 fulltime staffs with industry experience.

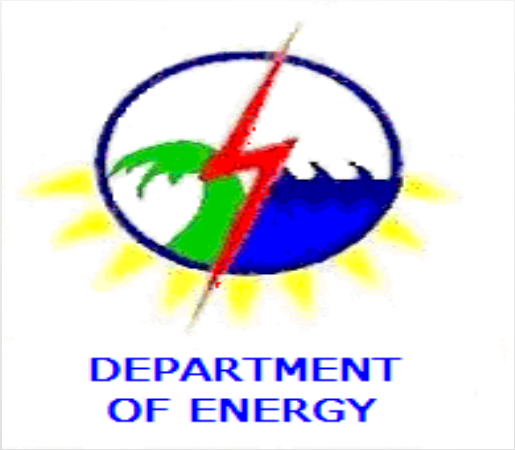
ESTABLISHMENT OF 9 MARITIME BIOFUEL MILLS

Year	Project	Production Capacity (ML per year)	Total Project Cost
2010	Koro	0.24	**343,103.26**
2011	Rotuma	0.24	**468,192.00**
2011	Cicia	0.24	**468,192.00**
2013	Gau	0.24	**411,842.73**
2013	Moala	0.24	**450,565.08**
2013	Matuku	0.24	**452,030.08**
2013	Rabi	0.24	**596,363.88**
2013	Lakeba	0.24	**598,252.88**
2013	Vanuabalavu	0.24	**616,001.58**
	Total sum	2.16	**4,404,543.49**

RECENT PROGRESS

- Development of a National Biofuel Policy Framework followed by enforcement of mandate (2014-2015)
- Finalization of the shift from Euro2 to Euro4 standards (2014)
- Ethanol production expected to commence by June 2016.

Vinaka



Fiji Diesel Standards

Property	Value	Test Method
Cetane Index	46 (min)	ASTMD976
Sulphur	500 ppm (max)	ASTMD5453
Polyaromatics (Polycyclic aromatic hydrocarbons – PAH)	11 wt%	IP 391
Density @ 15 °C	820 - 860 kg/m^3	ASTMD4052
Viscosity @ 40 °C	2.0 - 4.5 cSt	ASTMD445
Distillation temperature, T95	371 °C (max)	ASTMD86
Flash point	61.5 °C (min)	ASTMD93
Carbon residue (10% distillation residue)	0.2 wt % (max)	ASTMD4530
Water and sediment	0.05 vol.% (max)	ASTMD2709
Oxidation stability	25 mg/l (max)	ASTMD2274
Ash and suspended solids	100 mg/kg	ASTMD482
Copper corrosion	Class 1 (max)	ASTMD130
Filter Blocking Tendency	2.0 (max)	IP 387
Lubricity	0.46 mm (max)	IP 450
Colour	2 (max)	ASTMD1500
Conductivity at ambient temperature	50 pS/m	ASTMD2624

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)

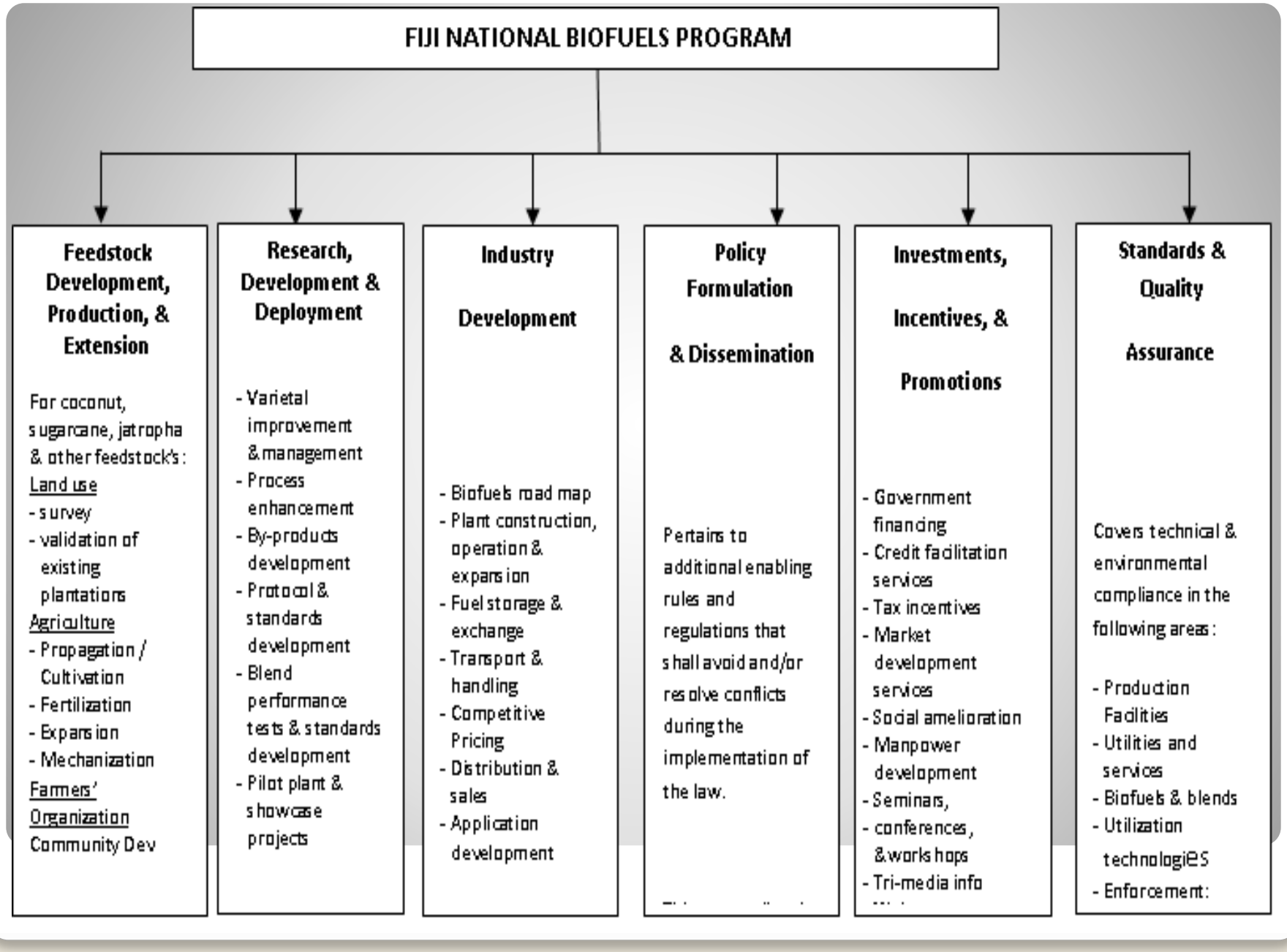
Property	Value	Test Method
Non-volatile material	5 mg/100mL	ASTM D381
pHe	6.5 - 9	ASTM D6423
Acidity (as acetic acid)	0.007 % m/m (max)	ASTM D1613
Appearance	Clear and bright, no visible impurities	ASTM D4806
Denaturant	1 – 1.5 % vol.	ASTM D5501

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

*** ISO 17025**

Pacific Island Countries Diesel Quality

Country	Land Transport	Electricity
American Samoa	N/A	2500 ppm
Cook Islands	10 ppm	5000 ppm
Fiji	500 ppm	5000 ppm & Heavy Fuel Oil
New Caledonia	50 ppm	N/A
Tonga	5000 ppm	5000 ppm
Tuvalu	5000 ppm	5000 ppm


FIJI NATIONAL BIOFUELS PROGRAM
Feedstock Development, Production, & Extension
For coconut, sugarcane, jatropha & other feedstock's:
Land use
- survey
- validation of existing plantations
Agriculture
- Propagation / Cultivation
- Fertilization
- Expansion
- Mechanization
Farmers' Organization
Community Dev
Research, Development & Deployment
- Varietal improvement & management
- Process enhancement
- By-products development
- Protocol & standards development
- Blend performance tests & standards development
- Pilot plant & showcase projects
Industry Development
- Biofuels road map
- Plant construction, operation & expansion
- Fuel storage & exchange
- Transport & handling
- Competitive Pricing
- Distribution & sales
- Application development
Policy Formulation & Dissemination
Pertains to additional enabling rules and regulations that shall avoid and/or resolve conflicts during the implementation of the law.
Investments, Incentives, & Promotions
- Government financing
- Credit facilitation services
- Tax incentives
- Market development services
- Social amelioration
- Manpower development
- Seminars,
- conferences, & workshops
- Tri-media info
Standards & Quality Assurance
Covers technical & environmental compliance in the following areas:
- Production Facilities
- Utilities and services
- Biofuels & blends
- Utilization technologies
- Enforcement:

Government funded biofuel projects