

# Toward a sustainable energy future for Fiji

Ravita Prasad and Atul Raturi

The University of the South Pacific

Fiji National University

# Overview of Presentation

- Fijian demography
- Current energy usage
- Challenges
- Mitigation or Low carbon Transformation options
- Results from modelling using LEAP
- Way forward

# Fiji Demography

- 2017 Census population was 884,887.
- GDP in 2016 at constant basic price was FJD 6.7 billion with average annual growth rate of 3%.

Census Year	Population	Annual Growth Rate (%)
1976	588,068	2.1
1986	715,375	2.0
1996	775,077	0.8
2007	837,271	0.7
2017	884,887	0.6

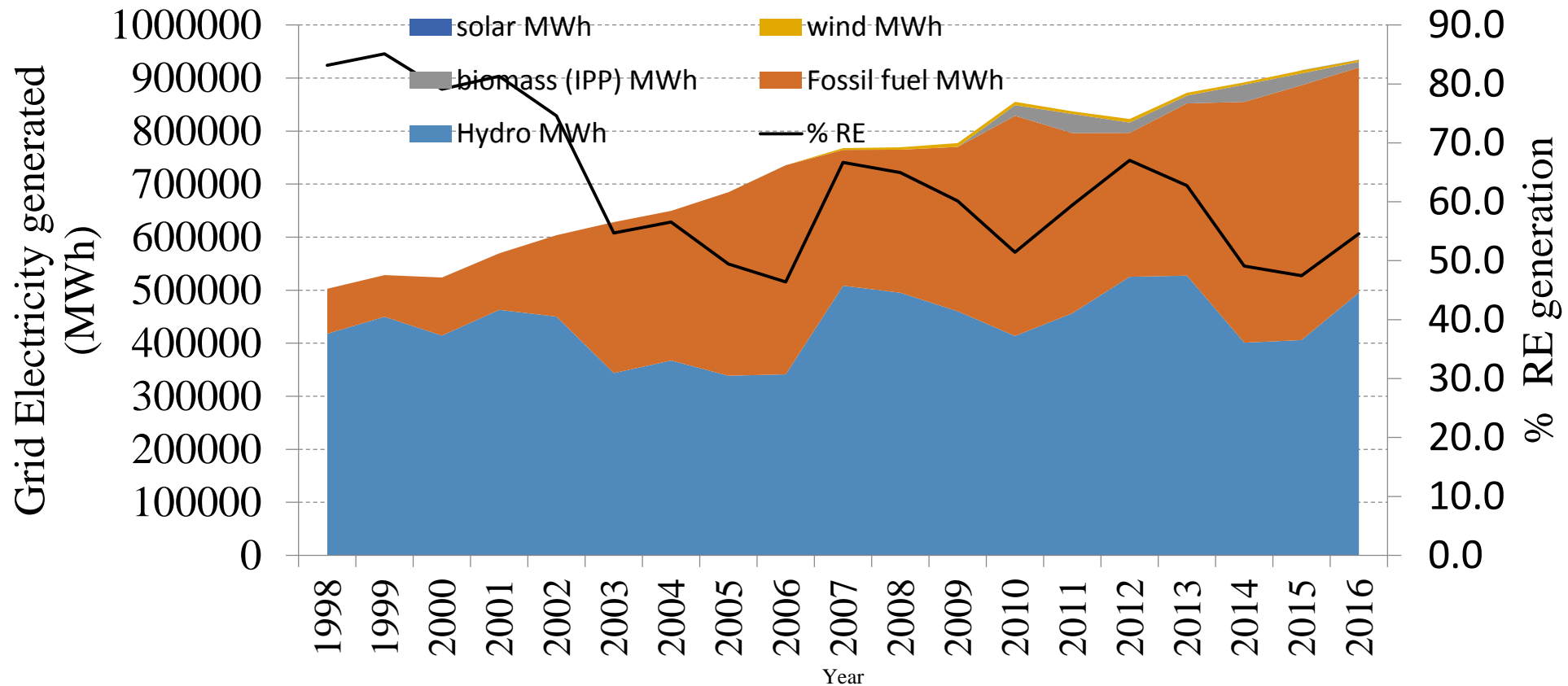
Year	GDP at constant basic price (FJD million)	Annual % change
2011	5738.8	
2012	5819.8	1.4
2013	6095.4	4.7
2014	6436.9	5.6
2015	6684.4	3.8
2016	6709.8	0.4
	Average	3.2

# Energy Situation

- Major users of imported fuels are power utility and the transport sector.
- For electricity generation, there are 4 main types:
  - Grid based (Energy Fiji Limited (EFL) formerly known as Fiji Electricity Authority (FEA))
  - Off-grid electrification managed by Fiji Department of Energy
  - Own power producers such as Vatukoula gold mine, outer island resorts, etc.
  - Independent power producers; Fiji Sugar Cooperation and Tropik Wood Industries limited.
- For transport sector, there are:
  - Land transport
  - Maritime transport
  - Domestic air transport

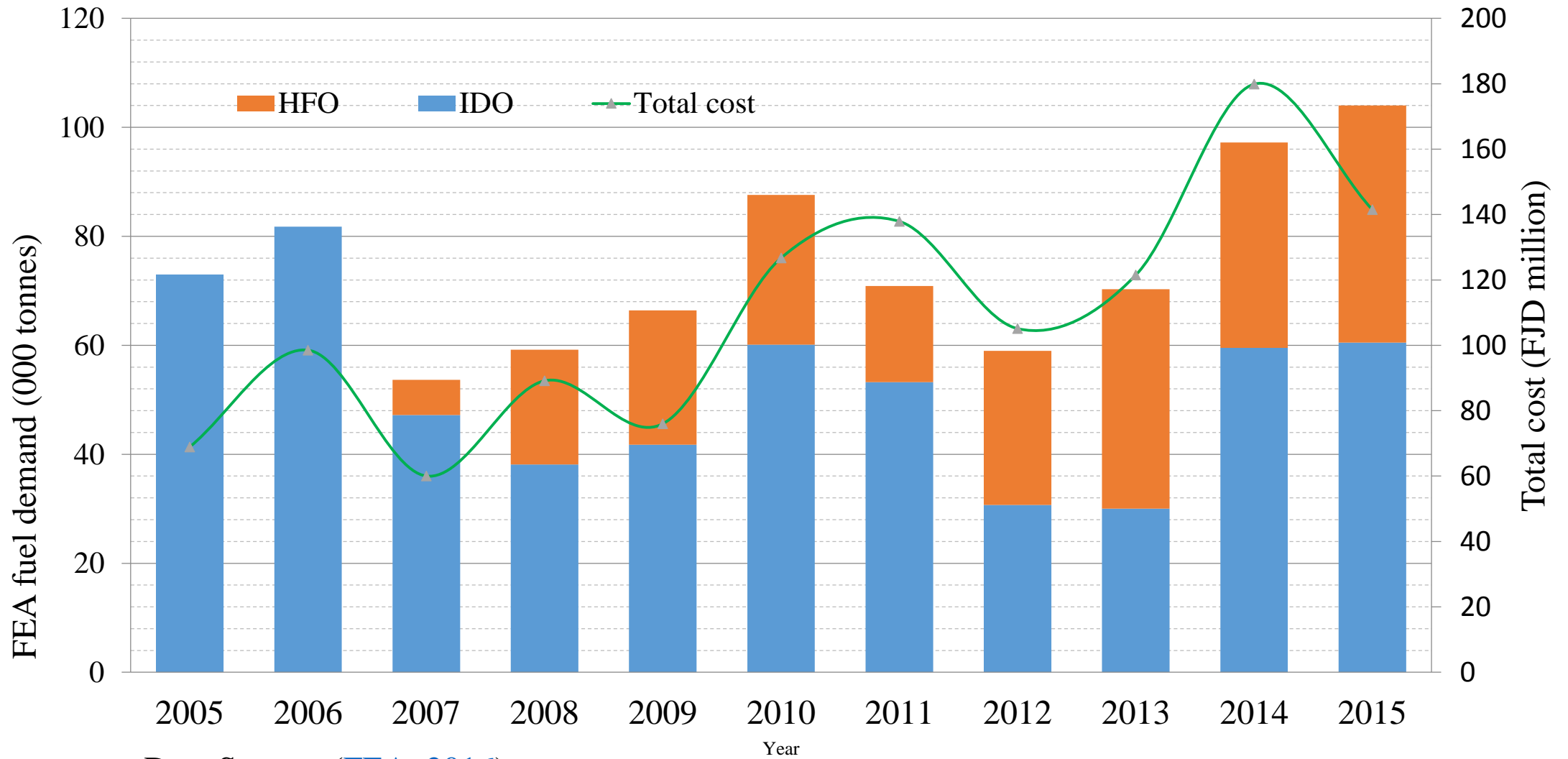
# Electricity Generation Sector (Grid Connected)

- Hydro and diesel are the two major sources for generation.



Data source: ([FEA, 2016](#))

# For thermal generation:



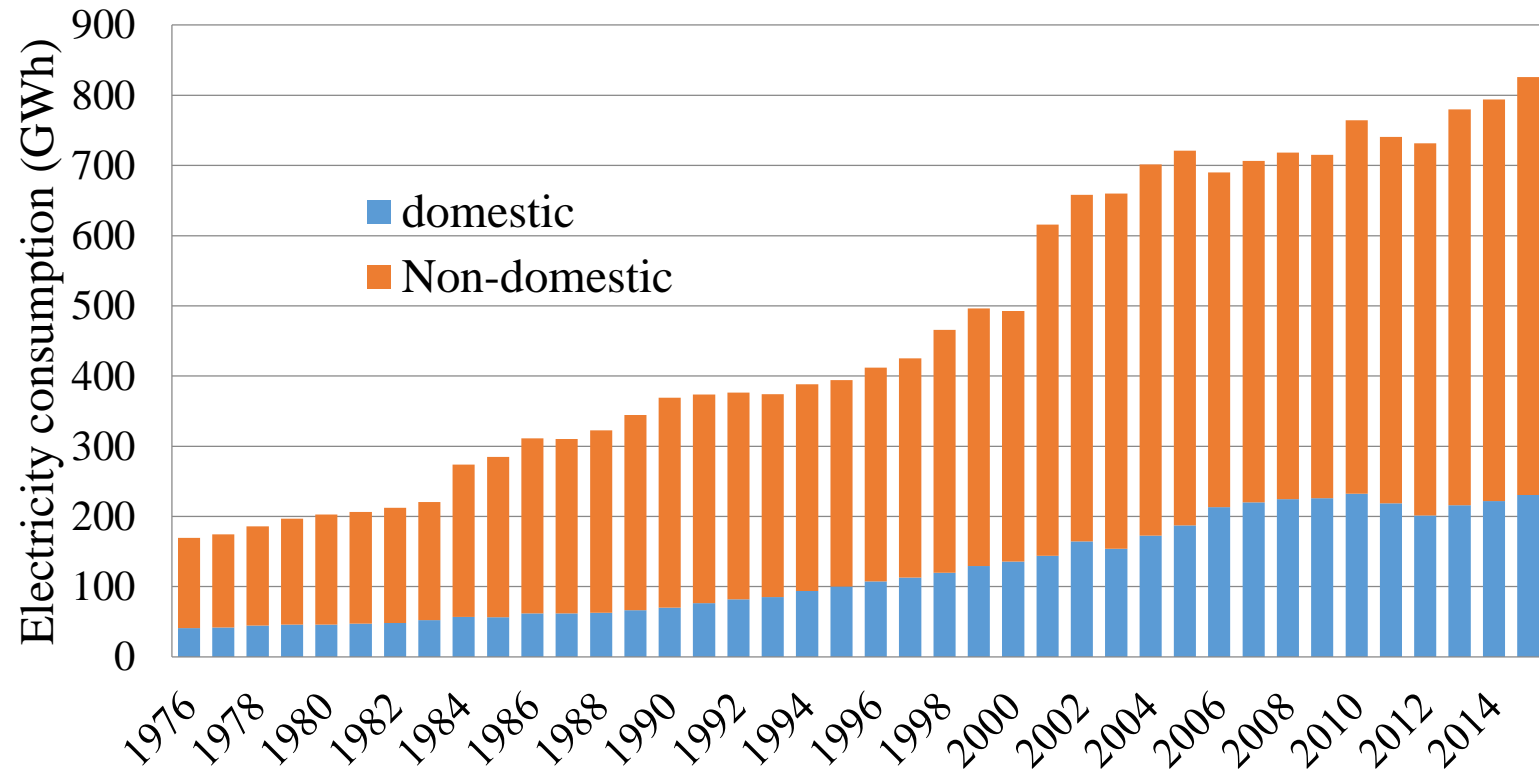
Data Source: ([FEA, 2016](#))

# Grid electricity demand

- Domestic and non-domestic customers.
- 25% of total demand is domestic (residential) customers while the rest are from non-domestic (industrial and commercial customers).

Annual Growth rate:

- Domestic demand = 4.6%
- commercial demand = 4.2%
- Total Demand = 4.3%



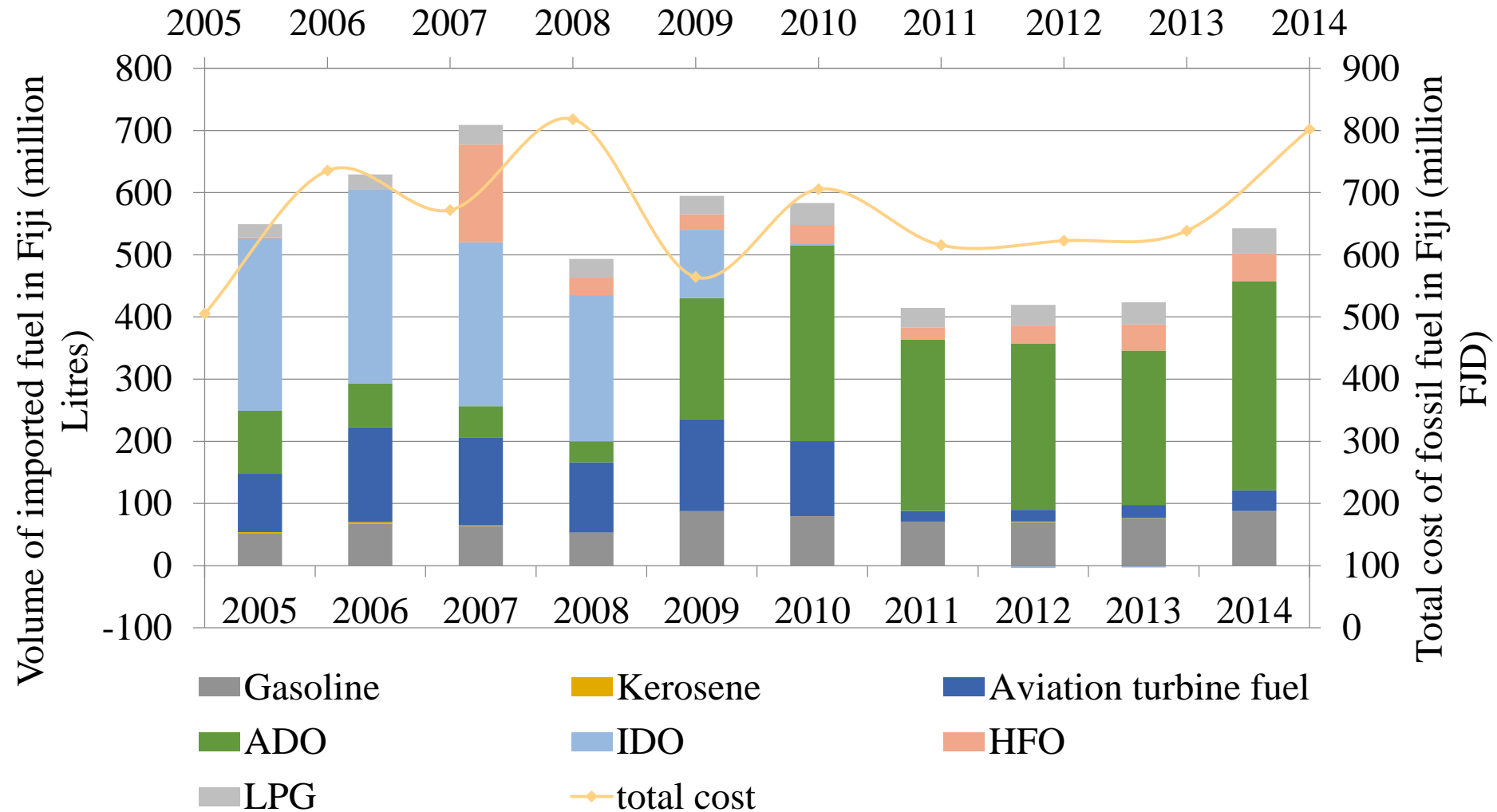
Data Source: ([FBoS, 2018d](#)) Year

# Fossil fuel consumption in Transport

- Currently, there is no fuel consumption data publicly available from Land transport authority, Maritime Safety Authority and domestic aviation.
- Fiji Bureau of statistics is only recording the mineral fuel import in Fiji and re-export to other PICTs.
- This data was used to determine the “retained import” in Fiji and this amount of fuel was assumed to be consumed within Fiji.



# For Transport fuel;



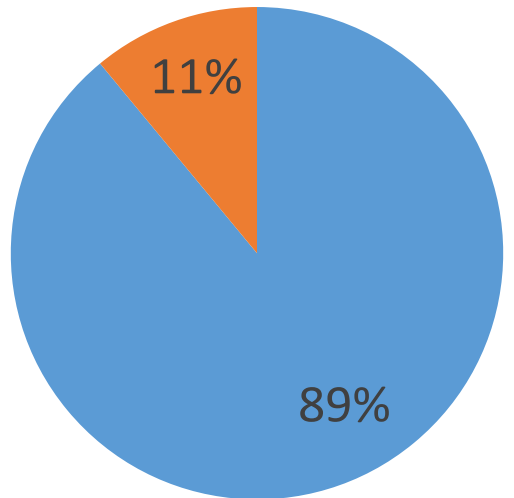
Data Source: FBoS

# UN Sustainable Development Goals (SDGs)

## Goal 7 – Affordable and Clean Energy

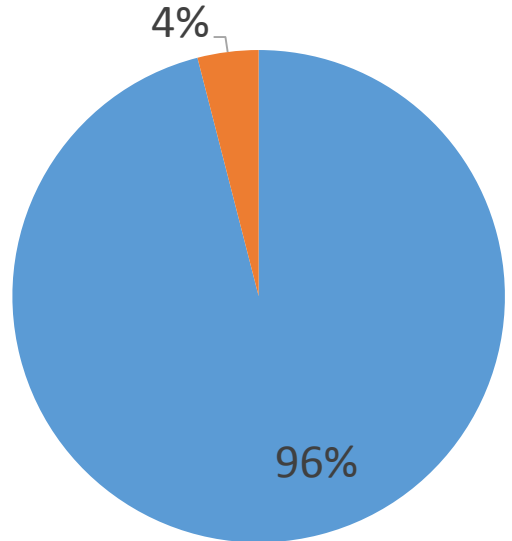
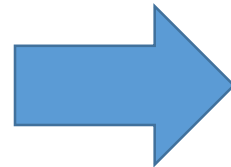
Goal	Indicator
7.1 By 2030, universal access to affordable, reliable and modern energy services	<ul style="list-style-type: none"><li>• Percentage of population with access to electricity</li><li>• Percentage of population with access to clean fuels or technology</li></ul>
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	<ul style="list-style-type: none"><li>• Renewable Energy share in total final energy consumption</li></ul>
7.3 By 2030, double the rate of improvement in energy efficiency	<ul style="list-style-type: none"><li>• Energy intensity measured in terms of primary energy and GDP</li></ul>

# Access to electricity



■ Electrified ■ Non electrified

Census 2007

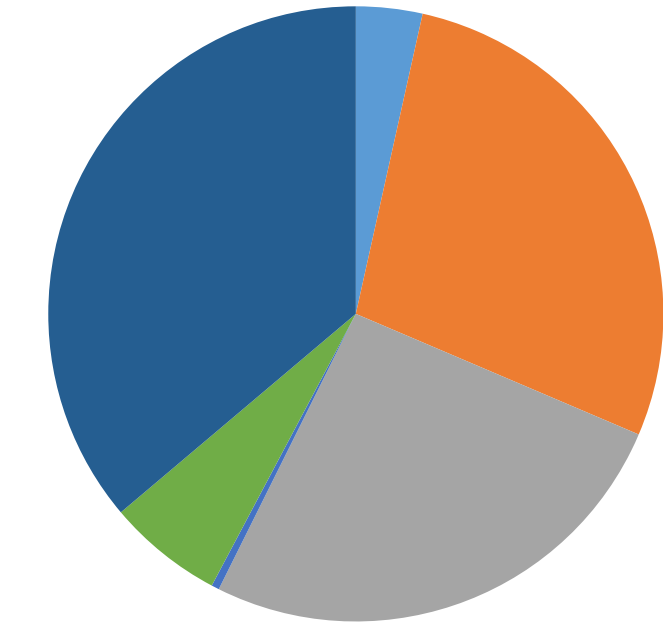


■ Electrified ■ Non electrified

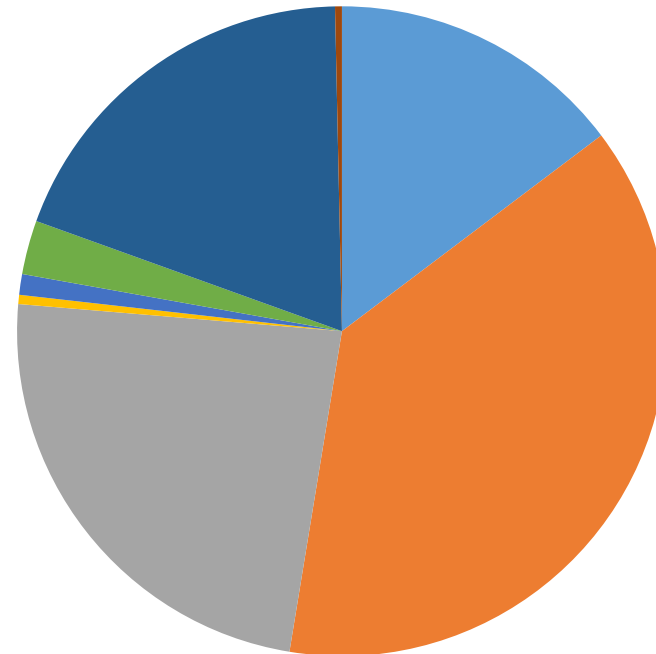
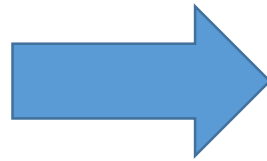
Census 2017

Data Source: Fiji Bureau of Statistics

# Cooking Fuels



2007



2017

- Electricity
- LPG
- Kerosene
- solar power
- biogas
- wood stove
- open fire
- other

% households

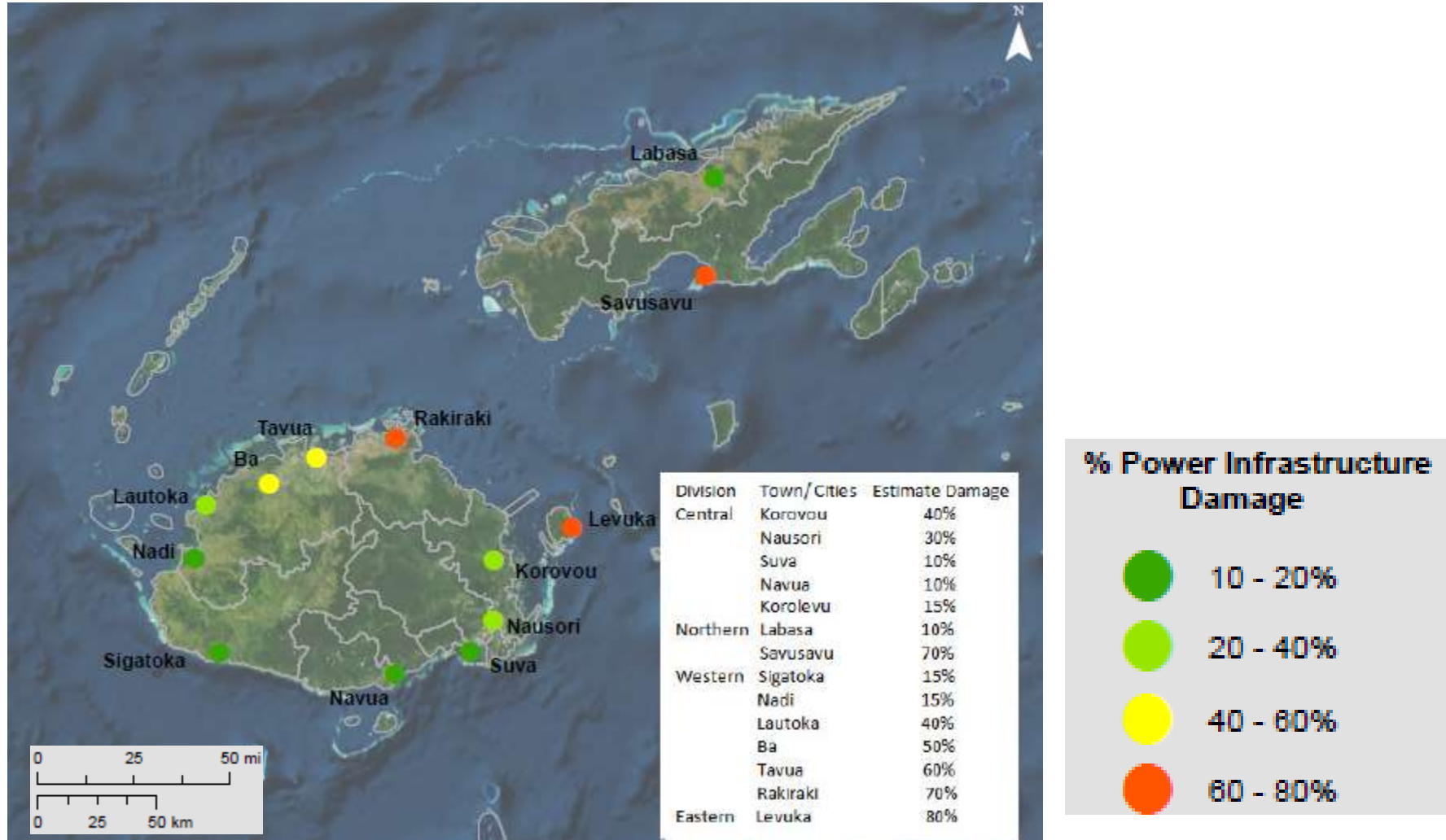
Fuel	2007	2017
Electric	3	15
LPG	28	38
Kerosene	26	24
Open fire	36	19

# Challenges and Threats to Energy

## Natural Disasters

- Fiji is susceptible to natural disasters such as flooding, land slides and tropical cyclones.
- Over the past decade (report from 2013), Fiji has experienced 17 cyclones.
- Recently, there has been TC Winston (category 5) in 2016 which did extensive damage to power infrastructure which led to nation wide power outage in addition to other infrastructure damage and loss of lives.
- TC Josie this year, brought with it a lot of rain which led to flooding and loss of lives.

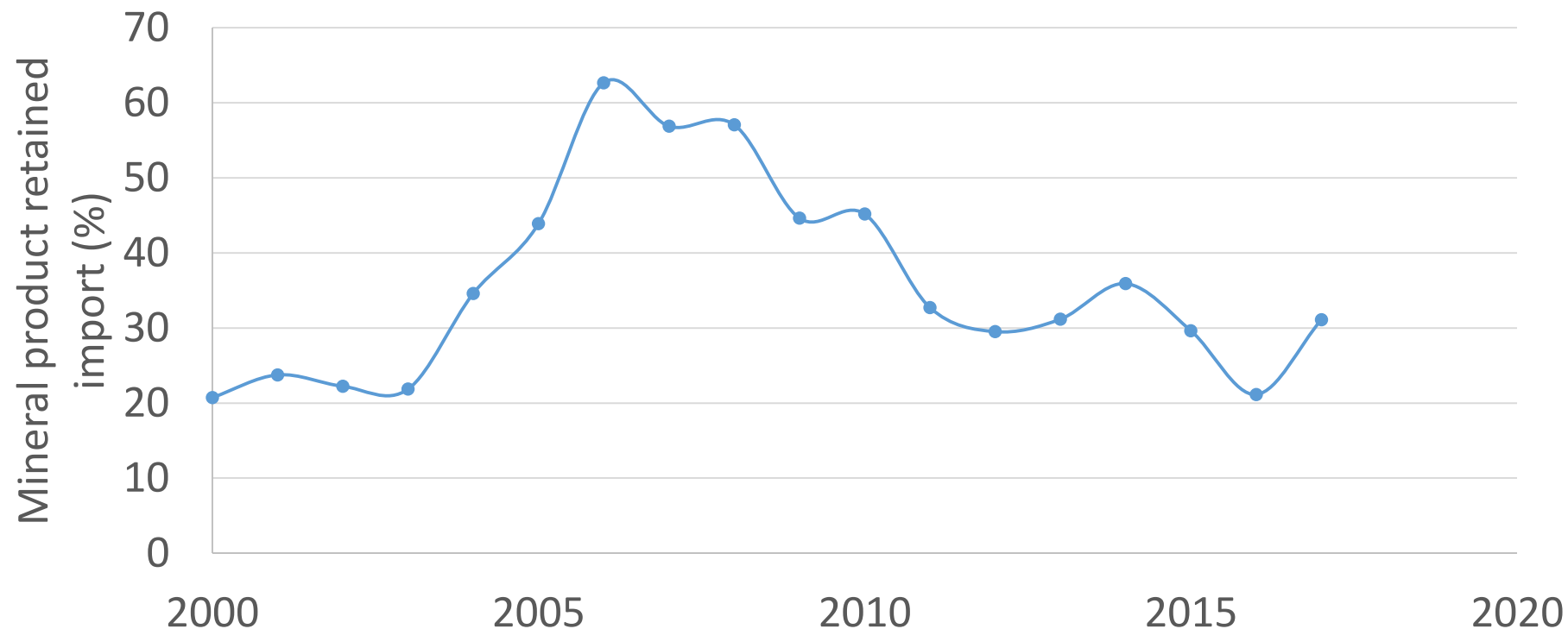
# TC Winston Damage to EFL grid



Source: National Disaster Management office ([NDMO, 2016](#)).

# *High ratio of fossil fuel import to total export*

- Mineral product retained import as a percentage of total export ranges from 20-60%.
- The decreasing trend from 2006 is from the increasing value of total exports.



## *Dispersed islands within an island country*

- Dispersion of islands in Fiji makes it difficult to provide grid electricity on every island.
- Hence, only three major islands have grid electricity while the rest have electricity access through REU of FDoE and resorts on islands have their own diesel generators.
- Fuel wood is the energy source for cooking in majority of the remote islands as well as in interior of the main islands.
- This leads to the challenge of providing modern fuel for cooking in rural areas.
- Transportation costs of fuels (diesel, kerosene and LPG) from mainland to smaller outer islands are significant.
- In addition, there is also the issue of timely availability of boats or ships to transport fuel to remote islands.



# *Transport sector fully dependent on imported fossil fuel*

- Land transport, maritime transport and aviation are currently not using any alternative fuel apart from fossil fuel.
- One of the alternative GoF have introduced is reduced or no duty on hybrid vehicles so there has been rise in these vehicles on Fiji roads in the past two years.
- But there is no use of biofuels even though, B5 and E10 standards have been approved by cabinet.

# To reduce our dependence on fossil fuels:

In this work, two main sectors are considered:

❑ Grid electricity generation and

❑ Transport sector

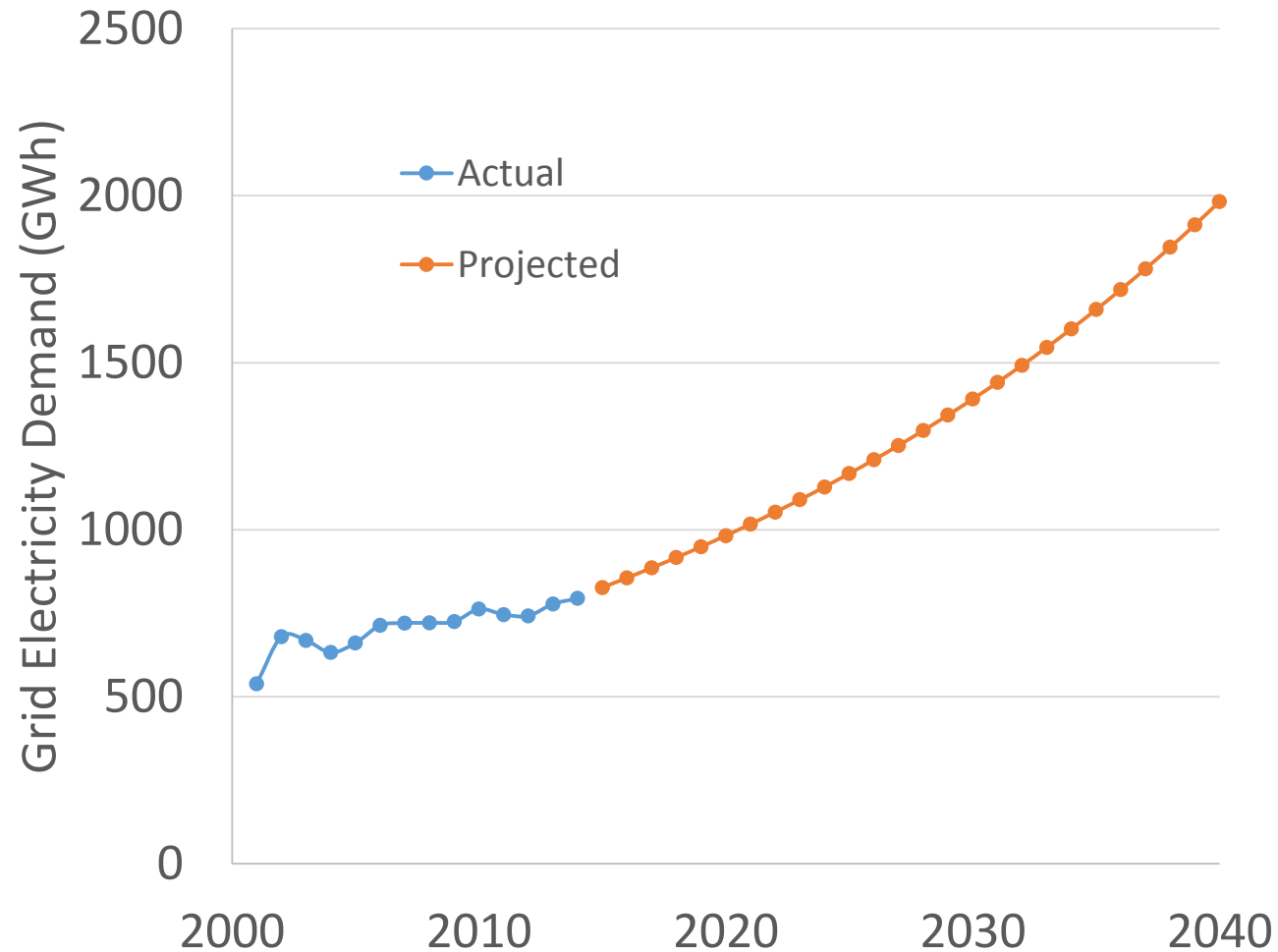
- In electricity generation, new generation technologies such as solar, wind, biomass and hydro are considered to meet the growing grid electricity demand in the 3 main islands in Fiji; Viti Levu, Vanau Levu and Ovalau
- For transport sector , electric and hybrid cars and electric buses are considered and proper hull cleaning and propeller polishing are considered for maritime vessels. No measures are considered for immediate fuel reduction for air transport.

# LEAP Tool used

To carry out the modelling work:

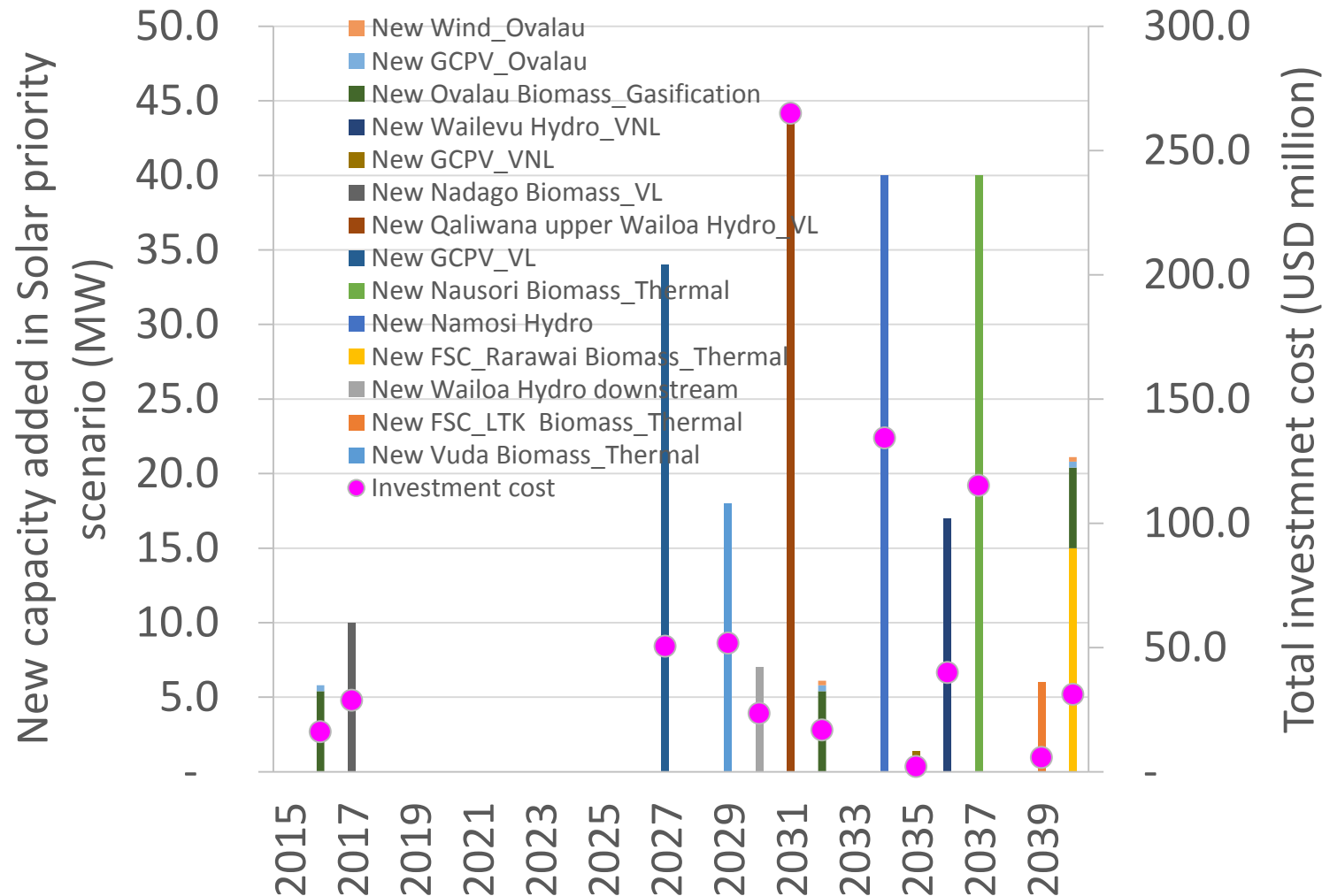
- Long Range Energy Alternative Planning (LEAP) tool was used.
- Base year is taken to be 2015/2016 and end year is taken to be 2040.
- For grid electricity, Energy Fiji Limited's annual report was used for demand while for existing generation technologies information and data was sought from personal communication with EFL.
- For Transport data; Land Transport Authority (LTA) and Maritime Safety Authority of Fiji (MSAF) provided registered vehicles and vessels.
- For transport activity data; questionnaire based surveys were conducted for land and maritime transport.
- Air transport activity data from FBoS was used.

# Grid Electricity demand



- Demand is projected to increase at 3.5% per annum.

# Strategies to meet the demand

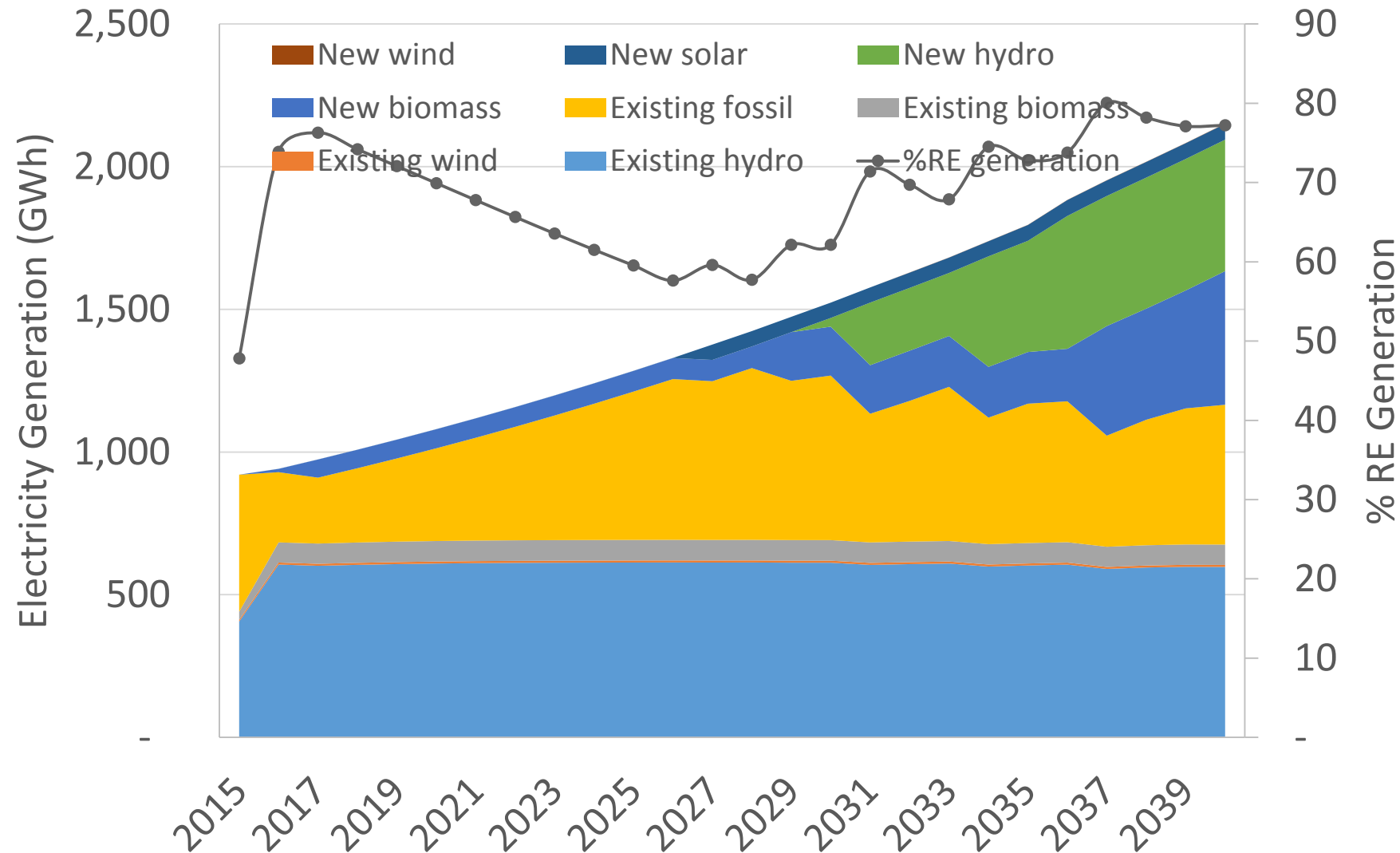


New generation technologies were mostly added after 2025 because the current generation capacity is able to meet future demand at planning reserve margin set at 40%.

## New Investment Cost (USD million)

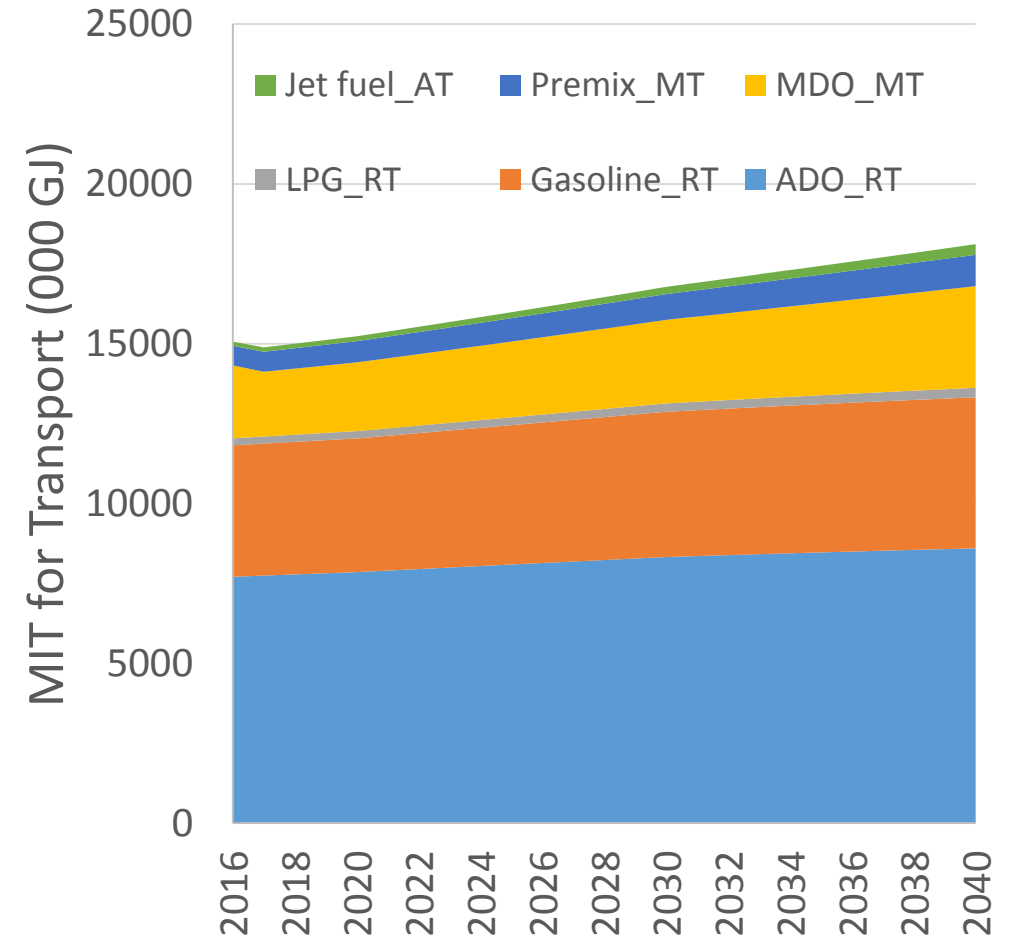
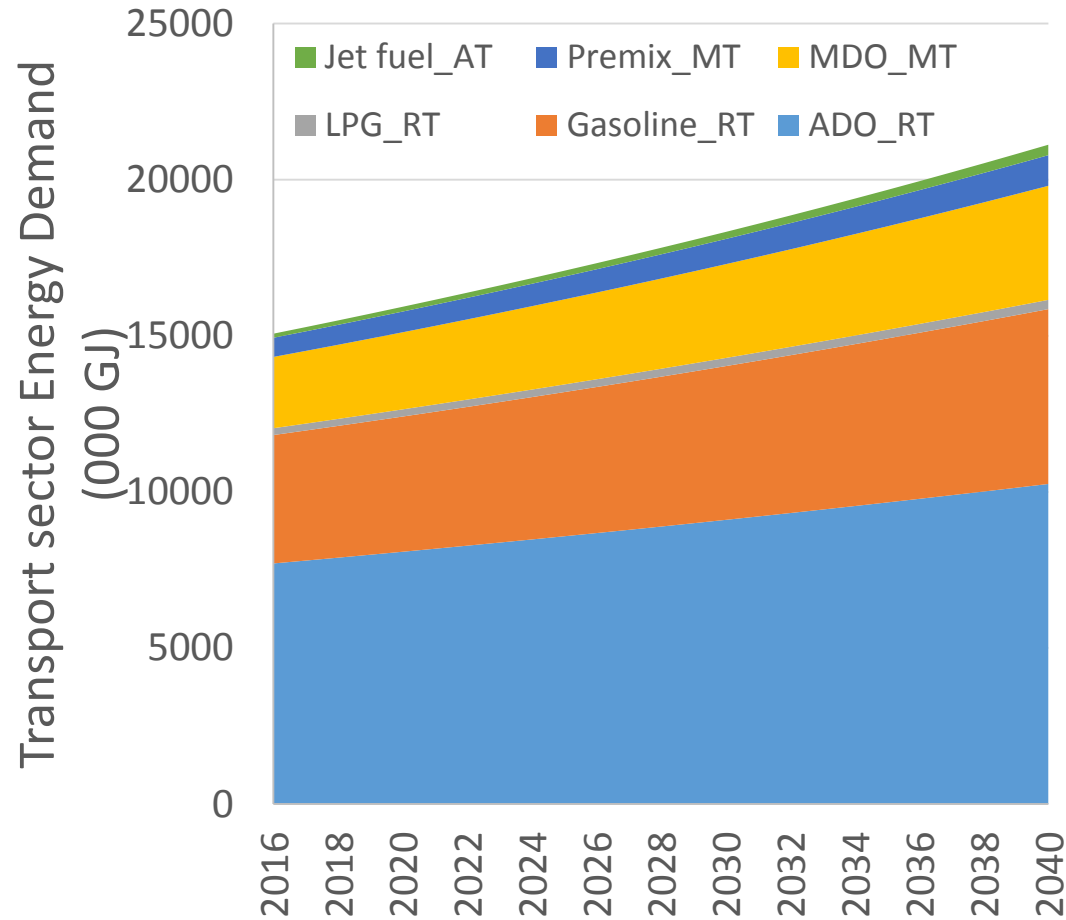
Viti Levu	690
Vanua Levu	42
Ovalau	50
<b>Total</b>	<b>781</b>

# Electricity generation for MIT

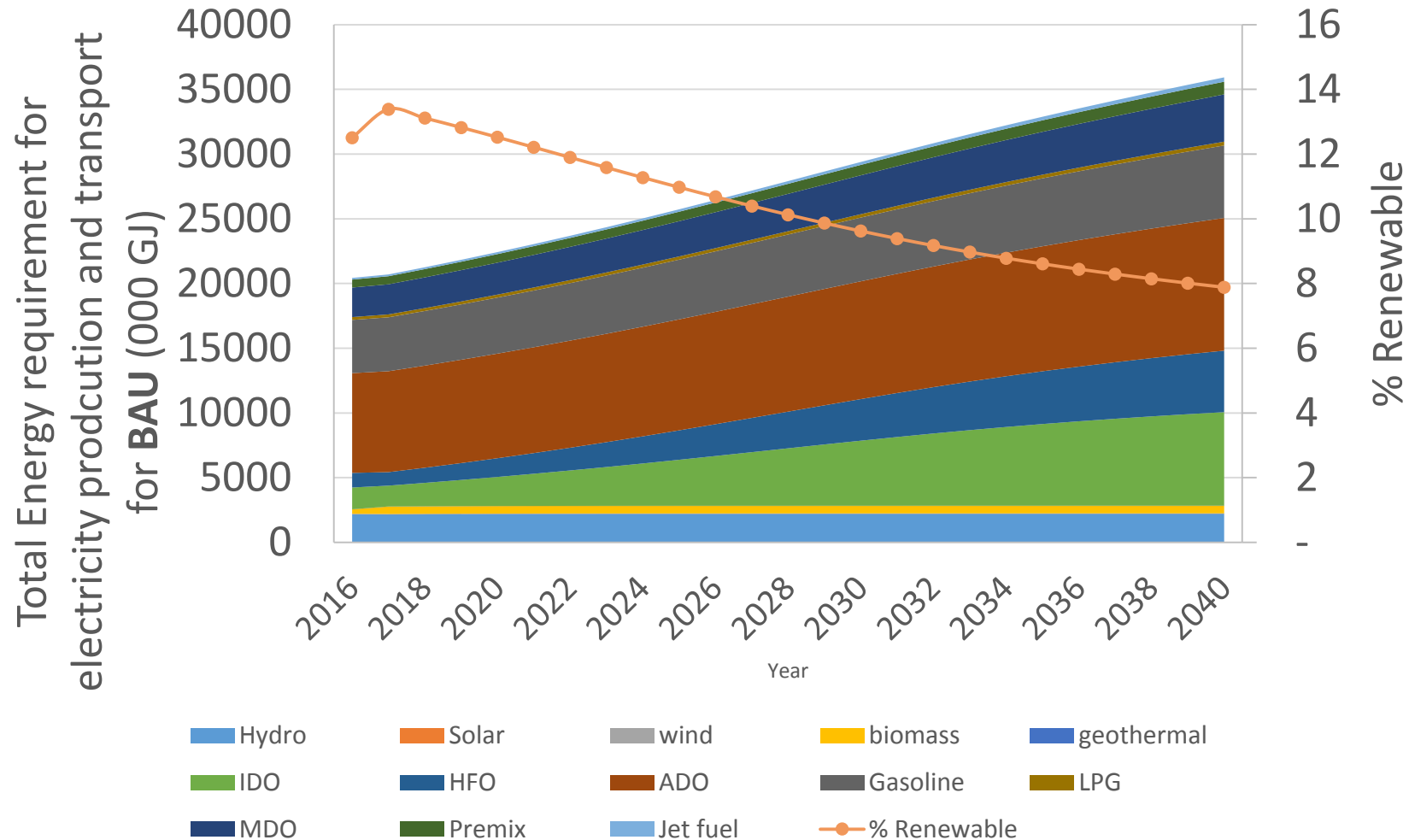


- % RE generation is increasing from 48% in 2015 to 77% in 2040.
- This is using conservative new generation capacities but no storage.

# Energy Demand for transport sector – BAU and MIT Scenarios

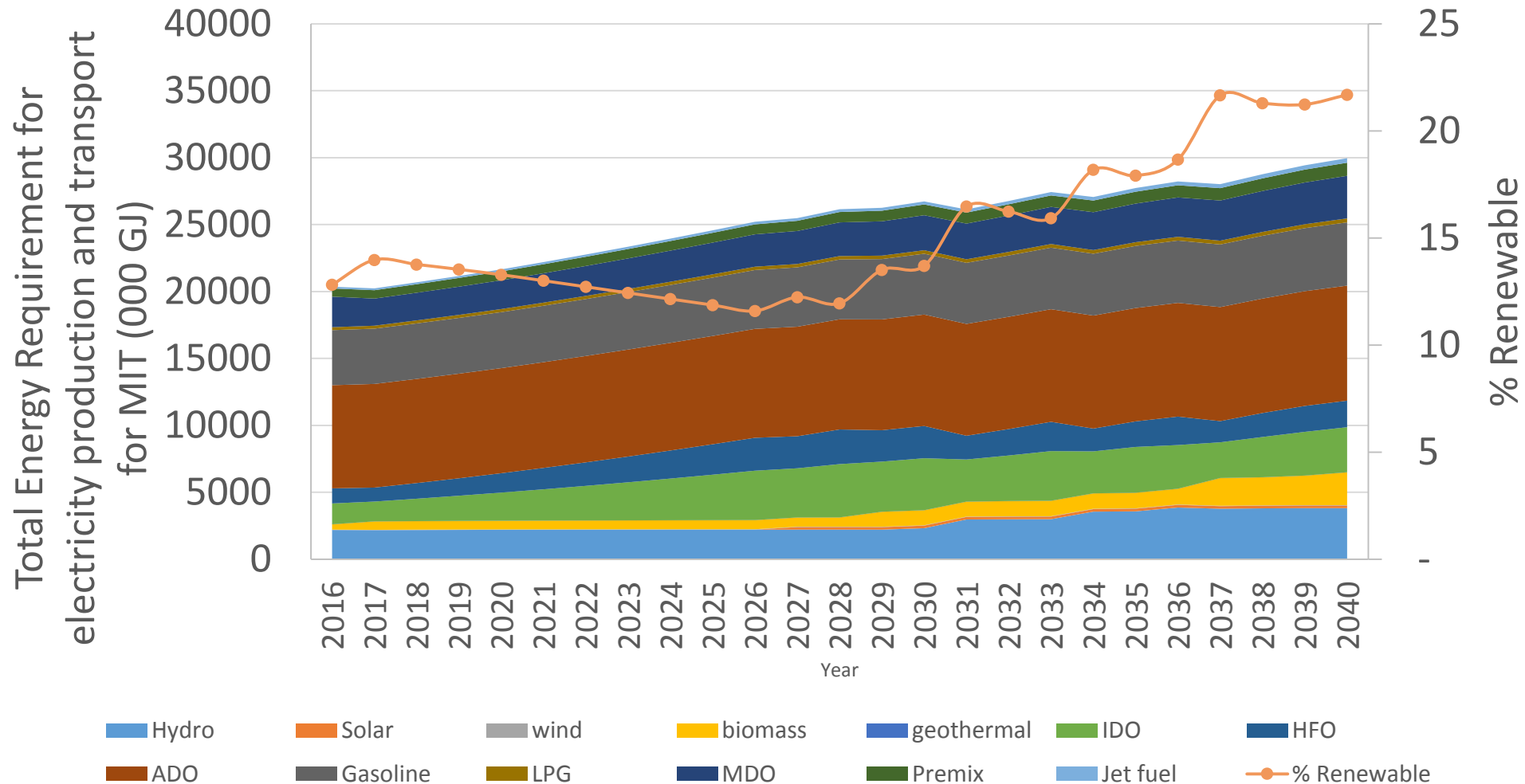


# Total Energy Requirement (Grid electricity +Transport): BAU Scenario

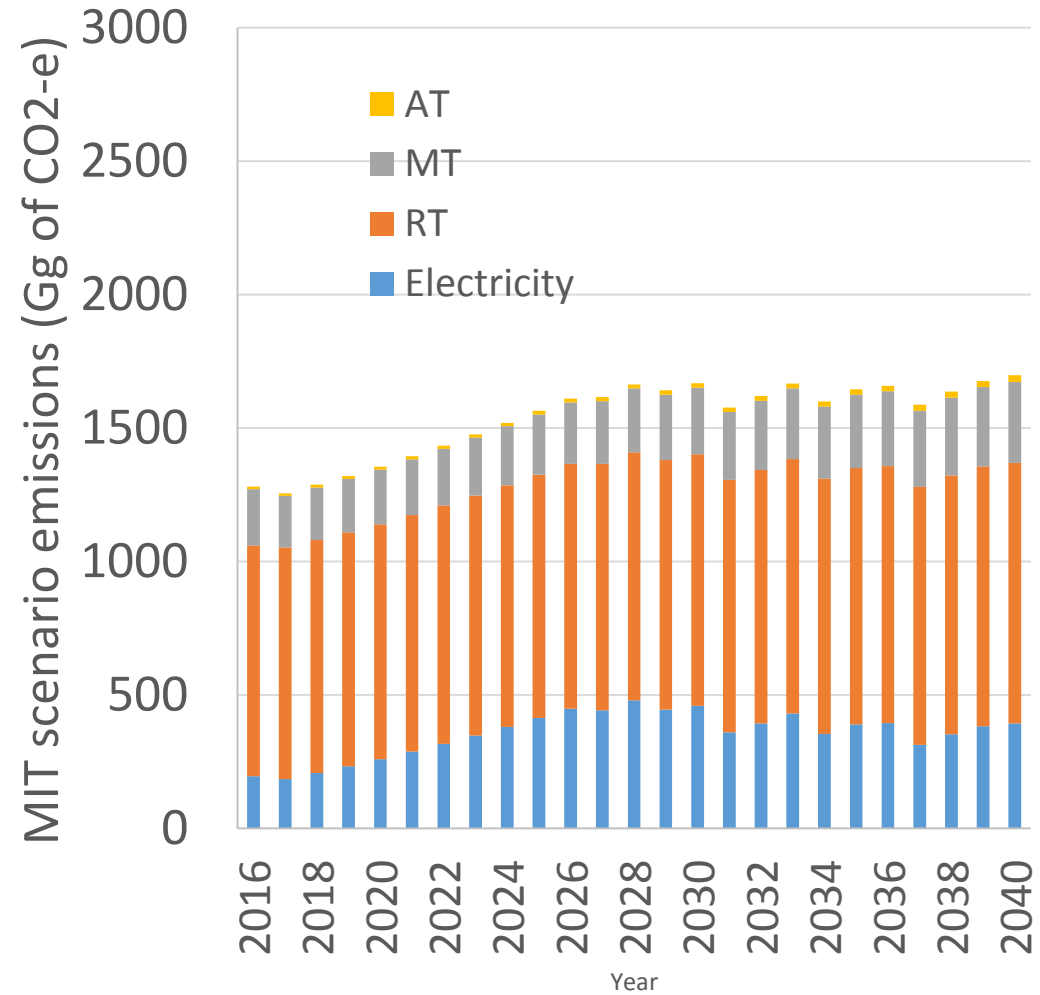
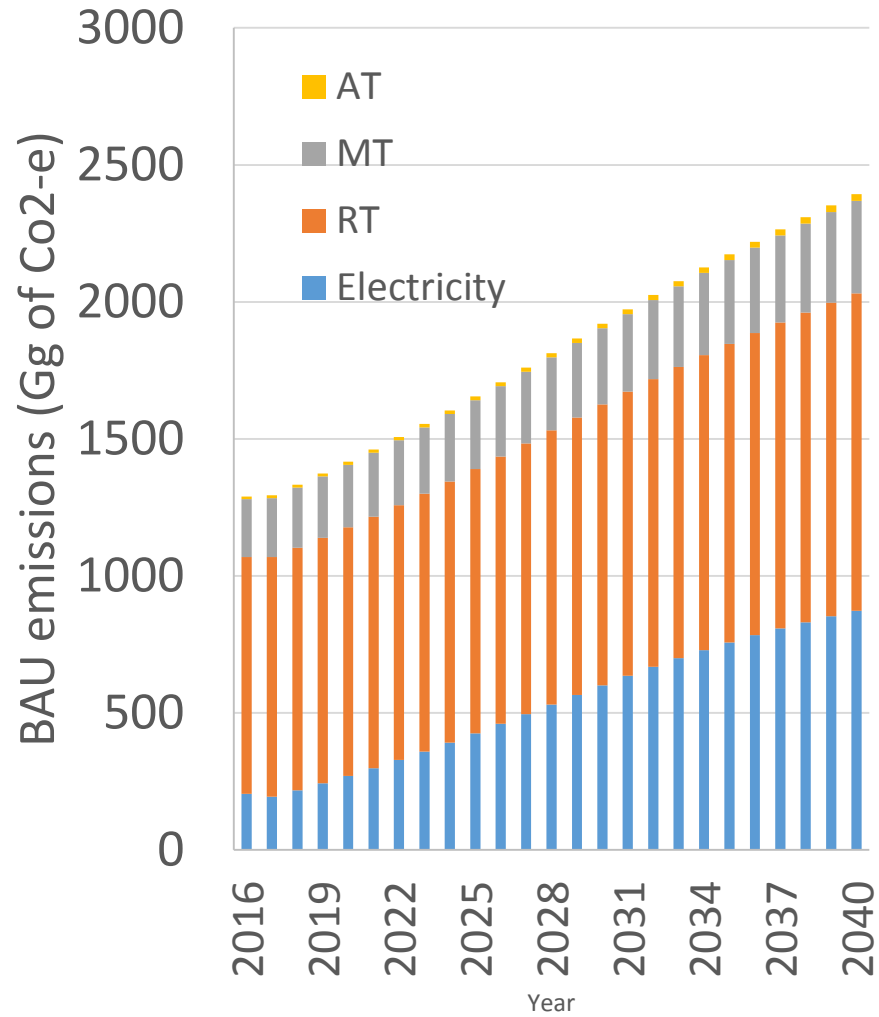




# Mitigation Scenario – Total Energy Requirement



# Total Emissions : BAU and Mitigation



# Strategies for way forward

## Increase Public-Private Partnership (PPP)



The PPP Knowledge Lab of the World Bank Group defines PPP as

“ long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance”.

# Change customer behaviour



- In energy sector to increase renewable energy share in electricity generation and to decrease fossil fuel use in transport sector, the first thing is Changing People's Behaviour on how they use energy services or energy.
- Energy efficiency and conservation is relatively cheap but the investment in change in technologies for businesses or customers need to make financial gain.
- This process will take lot of time and it needs great deal of awareness creation.

Fiji is moving in the right direction by preparing

- ✓ New Building Standards,
- ✓ preparing a Minimum Energy Performance, Standards and Labelling (MEPSL) program,
- ✓ introduction of hybrid vehicles,
- ✓ plan for electric vehicles and other related programmes which in the long-term will promote energy efficiency and conservation.'

# Set Up Risk Mitigation Facilities

- RE and EE projects are perceived as high risk with regards to technology and cash flows by finance institutions.
- ([Parthan et al., 2010](#)) report that absence of risk mitigation facilities in developing countries is constraining the flow of private finance to low-carbon energy investments.
- In Fiji, there can be introduction of new insurance product where insurance is provided for RE projects which covers natural disasters.
- Past resource data (wind or solar) can be studied to ensure reduction in resource supply risk for energy conversion.
- In addition, for biomass resource, long-term contracts with resource suppliers should reduce supply chain risk .
- An established and bankable contractor for construction minimizes the risks of a project not meeting its specifications.
- Conducive policies and an incentive framework reduce the risk in RE and EE market development.

# Stakeholder Capacity Building and Development

- Another factor to minimize the risk of RE or EE failure is to educate consumers or community involved, that is, capacity building of stakeholders involved.
- Capacity building for all stakeholders can be carried out by the donor agency which sets up the RE or EE project or by GoF.
- Capacity building on setting up and managing a finance scheme for maintenance of RE or EE can minimize the risk of failure of RE or EE system.
- Financing institutions and decision makers should also be sensitized about sustainable energy project development .
- Capacity development for land owners to empower them about the sustainable use of their resources, especially in regards to biomass resources

# Credible Feed-in-Tariff (FiT) for Renewable based power producers

- Currently, in Fiji there is no structure for feed-in-tariff (FiT) for electricity generated from different sources of electricity and in the different locations.
- ([FCC, 2014](#)) report the new minimum IPP tariff rate as 33.08 Fijian cents VEP/kWh . This rate is expected to boost IPP investment.
- However, this rate is for “24/7”energy providers; intermittent energy providers such as solar PV get much less.



# Strengthen institutions and government departments supporting sustainable energy development

- The energy institutions in Fiji are responsible for energy planning, energy policy making, energy project financing, determination of energy prices (electricity tariff and fuel prices) and energy research.
- These institutions need to be well financed and adequately staffed to carry out its responsibilities effectively.
- For non-energy institutions who are indirectly involved such as land trust board, finance institutions, licensing of new business approvals from necessary departments, need to be adequately staffed and financed.
- In addition, work done by different departments directly involved in energy sector should plan an integrated approach so their actions would be efficient, effective, more transparent and more coordinated.
- To have a complete picture of energy scene there needs to be a national data repository where all energy related data are collected and available to stakeholders and investors.

Thank You