



# Fiji

## NDC Implementation Roadmap

### 2017-2030

Setting a pathway for emissions reduction target under the Paris Agreement



# Living Document

This NDC Implementation Roadmap 2017-2030 shall be considered a “living” document in that information expressed in this publication represents the Government of Fiji’s current understanding of the energy sector, and current understanding of mitigation actions (including technology, finance, capacity building, and technical assistance needs), which will contribute to meeting the targets set out in Fiji’s Nationally Determined Contribution (NDC). The Government of Fiji reserves the right to periodically update the NDC Implementation Roadmap 2017-2030, as may be needed, to ensure validity, transparency, and accuracy over time. Most notably, the Government of Fiji understands that not all of Fiji’s renewable energy resources are mapped in detail, nor are all mitigation actions fully investigated, and that the inclusion of new or improved technology, and its costs over time, will have an impact on future national planning.

The NDC Implementation Roadmap 2017-2030 was developed under the guidance of the Ministry of Economy with support from the Global Green Growth Institute.

## Acknowledgements

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## Foreword



As a Small Island Developing State with a population of less than one million, Fiji's total contribution to global greenhouse gas emissions (GHG) is negligible - especially when compared to countries with far larger and more-developed economies. Regardless, Fiji stands ready to do its part and live out the expectations for sustainable development that we are asking from the rest of the world. We are committed to lead by example, showing how development need not come at the cost of our own natural environment, nor, by extension, the security of our planet's future.

Fiji is proud to be the first country in the world to have ratified the Paris Agreement on Climate Change. We are also proud to lead the United Nations' ongoing climate negotiations as President of COP23, as we rally the global community to seek the full implementation of the Paris Agreement to spare our planet from the worst effects of a changing climate.

Critical to achieving the long-term temperature goals of the Paris Agreement are every nation's Nationally Determined Contributions (NDCs), which articulate efforts by each country to reduce national emissions and adapt to the impacts of climate change. Fiji's NDC, specific to the energy sector, aims for the share of electricity generated by renewable energy sources to approach 100% by 2030 - up from 60% in 2013. In addition, Fiji will pursue an economy-wide indicative reduction of 10% carbon dioxide emissions from energy efficiency improvements. Collectively, these measures will reduce the Fijian energy sector's total carbon dioxide emissions by around 30% by 2030.

This NDC Implementation Roadmap (Roadmap) for Fiji is one of the first few developed to-date globally. Developed with the assistance of the Global Green Growth Institute, the Roadmap sets specific benchmarks for mitigation efforts in line with the goals laid out in the Paris Agreement.

The Roadmap considers current and future energy demand throughout Fiji and sets out clear actions and investments required to meet Fiji's emissions and renewable energy commitments.

This framework covers both supply-side grid improvements and demand-side energy efficiency. It includes actions that make electricity generation greener and transmission and distribution networks ready to take on more renewables; reduce public energy consumption; and decrease emissions in Fiji's transportation sector to achieve our GHG targets. In total, the Roadmap estimates that investment of US\$ 2.97 billion in these areas will reduce Fiji's annual carbon dioxide emissions by 627,000 tonnes by 2030.

Decisive climate action not only involves cuts to global carbon emissions, it requires strategic and ambitious national policies to provide a clear vision for adaptation work and establish vehicles for accessing climate finance. With this NDC Implementation Roadmap, Fiji has taken the lead in setting out our vision for climate action, and we are keen to partner with development organisations and the private sector in helping meet our NDC targets and adapt Fiji and the Fijian economy to the reality of climate change. We hope that this Roadmap serves not only as a guide for Fiji, but as a blueprint for the rest of the world.

A handwritten signature in black ink, appearing to read 'Aiyaz Sayed-Khaiyum'.

**Hon. Aiyaz Sayed-Khaiyum**  
Attorney-General and Minister responsible for climate change

# Executive Summary

Fiji's current Nationally Determined Contribution (NDC) is specific to the energy sector both in terms of a GHG (greenhouse gas) baseline, with 2013 as the reference year, and in terms of potential mitigation actions. The overall mitigation target in the NDC is to reduce CO<sub>2</sub> emissions by 30% from a BAU (Business As Usual) baseline scenario in 2030, by striving to reach 100% renewable energy power generation and through economy-wide energy efficiency. The goal of the NDC Implementation Roadmap 2017-2030 is to provide a temporal pathway with concrete mitigation actions and financing needs to achieve the transformational change called for under the NDC.

In the NDC Implementation Roadmap, mitigation actions under the energy sector are divided between the three sub-sectors of Electricity Generation and Transmission, Demand-Side Energy Efficiency, and Transportation. The implementation of the identified mitigation actions under the Roadmap is divided into short-term (2017-2020), medium-term (2021-2025), and long-term (2026-2030) action periods, whereas all mitigation actions in the Roadmap are closely aligned to existing national policies, strategies, and plans.

The total estimated annual CO<sub>2</sub> mitigation achieved by the identified mitigation actions included in the Roadmap amounts to 627,000 tCO<sub>2</sub>/yr against the BAU baseline in 2030. Where the total investment costs in the energy sector to achieve this level of CO<sub>2</sub> mitigation is estimated to be US\$ 2.97 billion between 2017–2030, plus the estimated US\$ 119 million already invested in mitigation actions between 2014-2017.

- **Electricity Generation and Transmission (427,000 tCO<sub>2</sub>/yr; US\$ 1.671 billion)**

The mitigation actions identified within Electricity Generation and Transmission follow the majority of Fiji Electricity Authority's (FEA) own future development plans, but in striving to meet the potential of 100% renewable energy electricity generation, the Roadmap augments FEA's planning with additional renewable energy electricity generation capacity and transmission system needs including the connection to currently off-grid industry. The largest contribution for CO<sub>2</sub> mitigation up through 2030 in this sub-sector comes from biomass based power generation which includes sustainable biomass plantations and Waste to Energy (212 ktCO<sub>2</sub>/yr), followed by hydro power generation (88 ktCO<sub>2</sub>/yr), solar PV generation (72 ktCO<sub>2</sub>/yr), and grid extension/improvement and grid storage (55 ktCO<sub>2</sub>/yr). Other renewable energy generation technologies such as wind, geothermal, and wastewater treatment and biogas have the potential to further contribute to mitigation and transformational change in the sub-sector.

- **Demand-Side Energy Efficiency (30,000 tCO<sub>2</sub>/yr; US\$ 150 million)**

The mitigation actions under Demand-Side Energy Efficiency are categorised into four types: Energy Labelling and Minimum Energy Performance Standards for electrical appliances (15 ktCO<sub>2</sub>/yr), Energy Efficiency in the Business Community (9 ktCO<sub>2</sub>/yr), Energy Efficiency in the Public Sector (5 ktCO<sub>2</sub>/yr), and Updated Codes and Standards for Buildings (1 ktCO<sub>2</sub>/yr).

- **Transport (137,000 tCO<sub>2</sub>/yr; US\$ 1.149 billion)**

The mitigation actions under Transport include vehicle replacement programmes for buses, taxis, private cars, lorries and minibuses, which are expected to have the largest contribution for CO<sub>2</sub> mitigation (95 ktCO<sub>2</sub>/yr) in the sub-sector. All vehicle replacement programmes would institute an enhanced sub-industry for the scrapping of old vehicles and recycling of materials. Further mitigation actions include the import and use of biodiesel (37 ktCO<sub>2</sub>/yr), improved maintenance for sea vessels (5 ktCO<sub>2</sub>/yr), and increased utilisation of fuel-efficient outboard motors. Additional potential actions to contribute to mitigation and transformational change in the transport sub-sector include: urban and public transport planning, long-term electric transportation strategy, behavioural change, and alternative propulsion systems in maritime transport.



Further work is needed to ensure the sustainable physical implementation of the mitigation actions within the energy sub-sectors. This work includes the need for increased energy sector capacity building and technical assistance, as well as strengthening of the enabling environment in the energy sector.

In addition to the above, the successful implementation of the Roadmap is dependent on certain foundation elements, which are essential to ensure that the mitigation actions under the Roadmap can be appropriately financed, implemented, coordinated, and monitored. The foundation elements include governance and institutional arrangements, Monitoring, Reporting and Verification (MRV), and financing.

- **Governance and Institutional Arrangements**

The implementation of the Roadmap will require constant coordination and active efforts amongst the public-sector, private-sector, development partners, and non-state actors (NSAs). A NDC Implementation Unit will be set up with a goal to coordinate the overall implementation of the Roadmap, and oversee the MRV processes. The various means of implementation and support will be directed by the Budget and Aid Coordinating Committee, which is composed of Government Ministries and Statutory Bodies who interact with development partners. High-level oversight will be provided by a Government Coordination Committee who will report to the Cabinet. Furthermore, it is proposed that a Climate Change Act for Fiji is developed and enacted to provide a legislative foundation that will drive Fiji's transition to a low carbon, climate resilient community, and green economy.

- **Monitoring, Reporting and Verification**

The main purpose of the MRV system for the Roadmap is to transparently demonstrate progress made towards the targets defined in the NDC. Besides measuring an ex-post emissions baseline and mitigation in the energy sector, the MRV system will track the progress of implementation in terms of other impacts (e.g., policies, co-benefits, achieving Sustainable Development Goals (SDGs), plus the inclusion and results of means of implementation (e.g., finance, technology transfer, capacity building). Fiji needs support to significantly strengthen the MRV system, which should be built from the bottom-up as a means to ensure transparency and to contribute to the effectiveness of mitigation actions. In addition, the MRV system for the energy sector will be integrated into the National Reporting and Inventories System, which will be enhanced in the future.

- **Financing**

Fiji has made initial progress in implementing financial instruments, which support mitigation within the energy sector; however, the scale of investments needed for the full implementation of the Roadmap outpaces Fiji's current ability to finance the transformational change envisioned. Therefore, new or significantly expanded financial instruments and support are needed (including credit enhancement instruments, senior debt, bridging/subordinate debt, risk mitigation instruments, equity, and incremental financial support). Thus, Fiji requires further assistance to design, implement, and finance expanded financial instruments and support.

Fiji is committed to ensuring the implementation of the Roadmap, and is working towards reaching the mitigation target of 30% from a BAU baseline scenario in 2030. It is recognised that achieving this target will require unconditional actions by Fiji. However, it is also recognised that the full potential for reaching the target is conditional on Fiji receiving significant means of implementation and support.

# Abbreviations

<b>BAU</b>	Business as Usual	<b>kV</b>	Kilo-volt
<b>CB &amp; TA</b>	Capacity Building & Technical Assistance	<b>kW / kWh</b>	Kilowatt or Kilowatt-hour
<b>CCD</b>	Climate Change Division	<b>LTA</b>	Land Transport Authority
<b>CO<sub>2</sub>e</b>	CO <sub>2</sub> equivalent	<b>MIT</b>	Ministry of Industry and Trade
<b>CO<sub>2</sub></b>	Carbon Dioxide	<b>MOE</b>	Ministry of Economy
<b>COP</b>	Conference of the Parties	<b>MOFF</b>	Ministry of Fisheries and Forests
<b>CSO</b>	Civil Society Organisations	<b>MOIT</b>	Ministry of Infrastructure and Transport
<b>DOE</b>	Department of Energy	<b>MRV</b>	Monitoring, Reporting and Verification
<b>EPC</b>	Engineering, Procurement and Construction	<b>MW / MWh</b>	Megawatt or Megawatt-hour
<b>ESCO</b>	Energy Service Company	<b>MWp</b>	Megawatt Peak
<b>EU</b>	European Union	<b>MSAF</b>	Maritime Safety Authority of Fiji
<b>FBOS</b>	Fiji Bureau of Statistics	<b>NDC</b>	Nationally Determined Contribution
<b>FCCC</b>	Fijian Competition and Consumer Commission	<b>NDP</b>	National Development Plan
<b>FJD</b>	Fiji Development Bank	<b>NGO</b>	Non-Governmental Organisations
<b>FEA</b>	Fiji Electricity Authority	<b>NSA</b>	Non-State Actors
<b>FJ\$</b>	Fiji Dollars	<b>PPA</b>	Power Purchase Agreement
<b>FRCS</b>	Fiji Revenue and Customs Service	<b>PP</b>	Private Partnership
<b>FSC</b>	Fiji Sugar Corporation	<b>PPP</b>	Public Private Partnership
<b>GCF</b>	Green Climate Fund	<b>PV</b>	Photovoltaic
<b>gCO<sub>2</sub>/km</b>	grams of CO <sub>2</sub> per km (i.e., for transport)	<b>RE</b>	Renewable Energy
<b>Gg CO<sub>2</sub></b>	Giga grams of CO <sub>2</sub>	<b>SDGs</b>	Sustainable Development Goals
<b>GGGI</b>	Global Green Growth Institute	<b>SIDS</b>	Small Island Developing State(s)
<b>GHG</b>	Greenhouse gas or greenhouse gases	<b>SPC</b>	Secretariat of the Pacific Community
<b>GIS</b>	Geographic Information System	<b>TC</b>	Tropical Cyclone
<b>GOF</b>	Government of Fiji	<b>tCO<sub>2</sub></b>	Tons of CO <sub>2</sub>
<b>ha</b>	Hectare	<b>tCO<sub>2</sub>/yr</b>	Tons of CO <sub>2</sub> per year
<b>INDC</b>	Intended Nationally Determined Contribution	<b>TOR</b>	Terms of Reference
<b>IPP</b>	Independent Power Producer	<b>UNDP</b>	United Nations Development Programme
<b>IRENA</b>	International Reviewable Energy Agency	<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>ISO</b>	International Organization for Standardization	<b>US\$</b>	United States Dollars
<b>km</b>	Kilometre	<b>WB</b>	World Bank
		<b>WTE</b>	Waste to Energy

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# 1 Background of Fiji in the Context of Climate Change

The Republic of Fiji is a Small Island Developing State (SIDS) located in the South Pacific Ocean consisting of 330 beautiful islands. With a population of approximately 845,309 people (FBOS, 2015)<sup>1</sup>, Fiji also hosts close to 800,000 visitors annually. The majority of the permanent population (over 90%) resides on the five main islands of Viti Levu, Kadavu, Vanua Levu, Ovalau, and Taveuni (FBOS, 2017a).

Given its tropical marine climate, and location in the South Pacific Convergence Zone, Fiji faces the impacts of climate variability. In connection to long-term global climate change, annual average temperatures and sea level have increased each decade in Fiji, and sea level is projected to rise 7–17 cm by 2030 (PACCSAP, 2015).<sup>2</sup> In addition, Fiji is no stranger to severe weather events, as recently witnessed by the Category 5 Tropical Cyclone (TC) Winston, which hit Fiji's islands in February 2016. TC Winston is estimated to have impacted 540,000 people, 62% of Fiji's population, and caused damage and loss of US\$ 995 million (GOF, 2016b).<sup>3</sup>



*Damage from TC Winston on Ovalau Island in 2016*

Fiji's US\$ 3.3 billion<sup>4</sup> economy is composed of various economic sectors, of which the top seven are manufacturing, wholesale and retail (including motor vehicles), transport and storage, government, agriculture, financial services, and accommodation and food services (FBOS, 2016). From 2009-2015, Fiji's economy sustained uninterrupted positive economic growth, with an average annual growth rate from 2011-2015 of nearly 4% (GOF, 2017b). With its growing economy, Fiji has estimated its GHG emissions to be approximately 2,700 Gg CO<sub>2</sub>e in 2011, of which 59% comes from the energy sector, 22% from agriculture, 15% from forestry, and 4% from waste (GOF, 2017c). In relation to the energy sector, Fiji is currently highly dependent on the import of fossil fuels, which remains close to a 30% share of total merchandise imports for Fiji (IRENA, 2015). Only for grid-connected electricity generation, fuel oil consumption in 2015 was 104,000 tons at a cost of US\$ 70 million (FEA, 2016).

In 2016, Fiji's developing economy achieved a per capita GNI of US\$ 4,840 and, in the context of climate change, Fiji's per capita CO<sub>2</sub>-only emissions for energy and cement categories is estimated to be 1.94 tCO<sub>2</sub> per person in 2013. This is significantly lower than Fiji's developed, South Pacific Ocean neighbours Australia and New Zealand, who respectively have a GNI of US\$ 54,420 and US\$ 39,070, and per capita GHG emissions of 16.3 and 7.6 tCO<sub>2</sub> per person. However, as shown in the figure below, some of Fiji's SIDS neighbours have lower per capita CO<sub>2</sub>-only emissions; this is attributed to Fiji's more developed economy (WB, 2017).<sup>5</sup>

1 A National Census will be carried out in 2017.

2 The maximum air temperature has increased by 0.04-0.15°C per decade, and the minimum air temperature has increased by 0.13-0.26°C per decade since 1942 and is dependent on location. Satellite data indicates sea level has risen in Fiji by about 6 mm per year since 1993 (PACCSAP, 2015).

3 Excludes environmental losses.

4 Based on GDP at constant basic prices in 2015.

5 The World Bank reports its per capita CO<sub>2</sub>-only emissions based on energy sector emissions and cement production in a country. Thus, agriculture, forestry, and waste GHG emissions are omitted, as well as industry emissions of GHGs other than CO<sub>2</sub>.

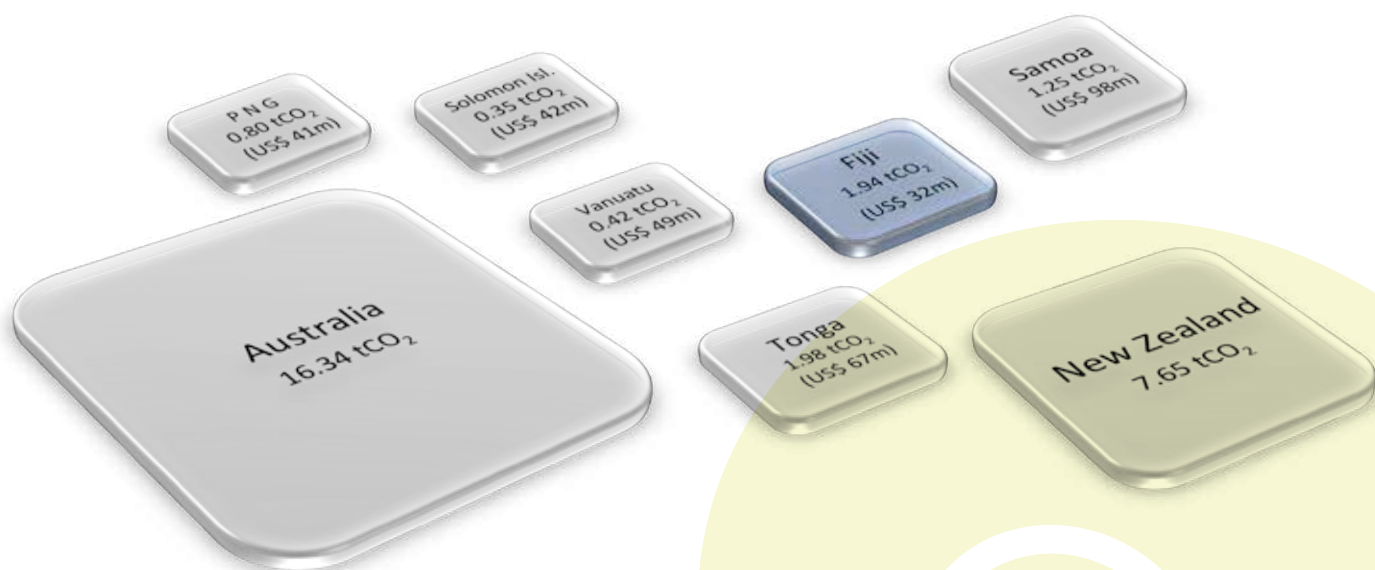


Figure 1: South Pacific Ocean Countries – Per capita CO<sub>2</sub> emissions (WB, 2017) and Climate Finance 2010-2014 (SEI, 2017)

Fiji was one of the recipients of the lowest amount of climate finance for SIDS in the South Pacific Ocean, with US\$ 32 million contributed by partners between 2010-2014 (SEI, 2017). Despite Fiji’s lower economic standing and lower per capita emissions compared to neighbouring developed countries, the fundamental assessment for the NDC Implementation Roadmap (hereinafter referred to as the “Roadmap”), estimated that at least US\$ 119 million in total investment has been made in the energy sector during the period of 2014 through mid-2017, with an estimated direct impact on GHG mitigation of at least 33,000 tCO<sub>2</sub>/yr.<sup>6</sup> Some of this investment capital is supported by disaster assistance after TC Winston, as well as development based financing instruments, such as loan guarantees, which have been successfully implemented in Fiji (GGGI/MOE, 2017).

<sup>6</sup> This includes new renewable energy electricity generation and transmission/sub-transmission investments in the electricity sub-sector, and the inclusion of hybrid passenger cars in the land transport sub-sector. The investment capital originates from the private sector, state-owned enterprises, and the state budget.





Nadarivatu Hydropower plant, Viti Levu



## 2. Fiji's Nationally Determined Contribution and Implementation Roadmap

The Government of Fiji (GOF) has a strong commitment to global efforts in combating climate change and its effects on humans and ecology. This commitment is exhibited in GOF's signature of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, and ratification in 1993, and Fiji's continued commitment to participate in the framework and address issues faced by SIDS. This continued commitment is shown in Fiji's signature and ratification of the Kyoto Protocol in 1998, and further by GOF's signature and ratification of the Paris Agreement on the same day of the 22nd of April 2016. In addition, GOF has both the honour and pleasure to act as the President of the Conference of the Parties (COP) 23, held in Bonn, Germany in 2017.



*Bukuya Rural Electrification Hydropower project (left), Nadarivatu Hydropower reservoir (right)*

### 2.1 Fiji's Nationally Determined Contribution (NDC)

To highlight Fiji's commitment to the Paris Agreement, the GOF issued its Intended Nationally Determined Contribution (INDC) before COP 21 in 2015, and upon ratification of the Paris Agreement, this is now considered to be Fiji's Nationally Determined Contribution (NDC). Fiji's current NDC is specific to the energy sector both in terms of a GHG baseline, where 2013 is considered the reference year, and in terms of potential mitigation actions. In effect, this means that Fiji's current mitigation under the NDC/Paris Agreement relates only to the energy sector, which includes CO<sub>2</sub> emissions from electricity, industry, and transport. In this manner, the energy sector ex-ante Business As Usual (BAU) baseline is estimated to consist of 1,500 Gg CO<sub>2</sub> emissions in the reference year of 2013 originating from fossil fuel consumption. The ex-ante BAU baseline is estimated to reach 1,800 Gg CO<sub>2</sub> emissions up through 2030 (GOF, 2015a).

It is noted that during the fundamental assessment of the Roadmap, it was ascertained that the ex-ante BAU baseline determined in the NDC has a potential error in the projected energy sector CO<sub>2</sub> emissions, and the BAU baseline will be strengthened when an enhanced NDC is developed. Subsequently, the GOF will develop an ex-post BAU baseline to determine energy sector CO<sub>2</sub> emissions, which will be integrated into the Monitoring, Reporting, and Verification (MRV) of the energy sector emissions and mitigation actions. The use of an ex-post BAU baseline and actual annual CO<sub>2</sub> emissions will not only allow for real economic variability, but also allow for a greater level of accuracy in terms of monitored data, reported outcomes, and verification. Please refer to Section 5.2 for more on the MRV Framework for the energy sector.

Fiji's NDC has the following mitigation targets for the period of 2020-2030 (GOF, 2015a):

- Target 1:** To reduce 30% of BAU CO<sub>2</sub> emissions from the energy sector by 2030.
- Target 2:** As a contribution to Target 1, to reach close to 100% renewable energy power generation (grid-connected) by 2030, thus reducing an expected 20% of energy sector CO<sub>2</sub> emissions under a BAU scenario.
- Target 3:** As a contribution to Target 1, to reduce energy sector CO<sub>2</sub> emissions by 10% through energy efficiency improvements economy wide, implicitly in the transport, industry, and electricity demand-side sub-sectors.

Of the 30% reduction of BAU baseline CO<sub>2</sub> emissions, GOF expects that 10% of the BAU baseline emissions mitigation will be achieved “unconditionally” using available resources in the country, and 20% achieved “conditionally” (GOF, 2015a). The figure below depicts the mitigation targets, and the unconditional/conditional contribution of Fiji.

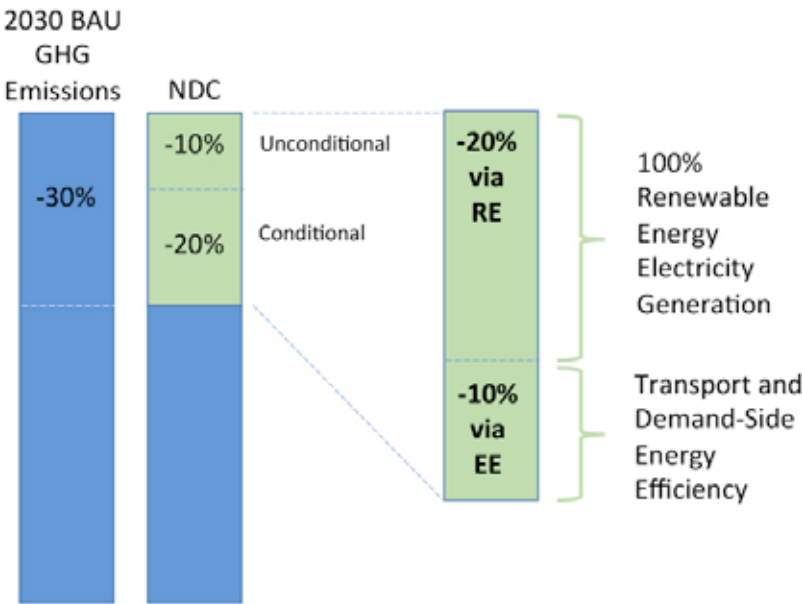


Figure 2: Depiction of the mitigation commitments under the NDC, and unconditional/conditional contributions for renewable energy (RE) and energy efficiency (EE)

## 2.2 Context of the NDC and Roadmap within the Paris Agreement

In meeting its unconditional contribution to mitigating global GHG emissions under the NDC, the GOF is demonstrating its commitment to the Paris Agreement. Fiji’s approach and, indeed, the Roadmap follow the framework of undertaking and communicating ambitious efforts in GHG mitigation as indicated in Article 3 of the Paris Agreement. The Roadmap also takes into account paragraphs 6 and 19 of Article 4 of the Paris Agreement, calling for SIDS to “prepare and communicate strategies, plans and actions for low greenhouse gas emissions development reflecting their special circumstances” and to “formulate and communicate long-term low greenhouse gas emission development strategies”, respectively.

In the following table, the GOF highlights the specific responsibilities it will undertake in the context of the Paris Agreement, and in the implementation of the NDC and the Roadmap. In addition, the GOF calls for the means of implementation and support to assist Fiji in achieving the NDC targets and fully implement the Roadmap.



Table 1: Fiji's responsibilities under the Paris Agreement in implementing the NDC and the Roadmap, and related calls for the means of implementation and support

Article	Specific responsibilities GOF shall undertake in the context of implementing the NDC and Roadmap	Article	GOF Calls for the means of implementation and support to assist Fiji in achieving the NDC targets and fully implemented Roadmap
3	<ul style="list-style-type: none"> <li>✓ To undertake and communicate ambitious efforts for mitigation...et al. as defined in Articles 4, 7, 9, 10, 11 and 13</li> </ul>	6	<ul style="list-style-type: none"> <li>✓ Voluntarily participate internationally transferred mitigation outcomes (ITMOs) with other Parties, insofar that they exceed targets set out in the NDCs, and to avoid double accounting under ITMOs (ref. 2 &amp; 3)</li> <li>✓ Voluntarily participate in a market mechanism contributing to mitigation and support sustainable development, insofar that they exceed targets set out in the NDCs, and to avoid double accounting under the mechanism (ref. 4 &amp; 5)</li> <li>✓ Voluntarily participate in non-market approaches contributing to mitigation, sustainable development, and poverty reduction, through inter alia, mitigation, finance, technology transfer, and capacity-building, in the context of assisting in meeting targets set out in the NDCs (ref. 8 &amp; 9)</li> </ul>
4	<ul style="list-style-type: none"> <li>✓ Prepare, communicate, and maintain successive NDCs, reflecting highest possible ambition, reflecting its common but differentiated responsibilities and respective capabilities, in the light of different national circumstances (ref. 2 &amp; 3)</li> <li>✓ Prepare and communicate low GHG strategies and plans (ref. 6 &amp; 19)</li> <li>✓ Prepare and communicate successive NDCs every five years (ref. 8 &amp; 9)</li> <li>✓ Account for the NDCs, to avoid double counting, and use existing methods and guidance under the Convention (ref. 13 &amp; 14)</li> <li>✓ Strengthen cooperative action on technology development and transfer (ref. 2)</li> </ul>	8	<ul style="list-style-type: none"> <li>✓ Cooperate in enhanced understanding, action and support for loss and damage associated with the adverse effects of climate change, specifically in relation to comprehensive risk assessment and management; risk insurance facilities, climate risk pooling, and other insurance solutions (ref. 3 &amp; 4)</li> </ul>
10	<ul style="list-style-type: none"> <li>✓ Cooperate with other SIDS in capacity-building, and regularly communicate progress made on implementing capacity-building (ref. 3 &amp; 4)</li> </ul>	9	<ul style="list-style-type: none"> <li>✓ Rely on scaled-up financial resources originating from developed country Parties with respect to mitigation through the Financial Mechanisms, and receive transparent and consistent information on support for developing country Parties (ref. 1, 4, &amp; 7)</li> </ul>
11	<ul style="list-style-type: none"> <li>✓ Taking measures, as appropriate, to enhance climate change education, training, public awareness, public participation, and public access to information (ref. 1)</li> </ul>	10	<ul style="list-style-type: none"> <li>✓ Rely on the promotion and facilitation of enhanced actions in technology development and transfer via the Technology Mechanism and financial support for the use of mitigation technology (ref. 4 &amp; 5)</li> </ul>
12	<ul style="list-style-type: none"> <li>✓ Participate in the transparency framework for mitigation actions and support, including to provide clarity and tracking of progress towards achieving NDCs (ref. 5 &amp; 7)</li> </ul>	11	<ul style="list-style-type: none"> <li>✓ Rely on enhanced capacity for the implementation of mitigation actions through country-driven capacity-building (ref. 1, 2, 3, &amp; 4)</li> </ul>
		13	<ul style="list-style-type: none"> <li>✓ Rely on support and capacity building for the implementation of the transparency framework for mitigation actions and support (ref. 5 &amp; 7)</li> </ul>

## 2.3 Goal and Objectives of the Roadmap

**The Goal** of the Roadmap is to provide a temporal pathway for the implementation of mitigation actions needed to achieve the transformation called for under the Fiji's NDC.

To achieve this Goal, the Roadmap answers the question, "How can the energy sector contribute towards achieving the NDC targets", through:

- Increasing awareness among stakeholders about what is required to achieve the NDC targets in the energy sector, and providing of an overarching framework and guidance for the energy sector.
- Defining a pathway with concrete mitigation actions and interventions leading to emission reductions and transformational change in the energy sector over time.
- Providing information about required resources/inputs to achieve and track progress to meeting the NDC targets in the energy sector, including:
  - o Technology and Infrastructure needs
  - o Investment and Finance needs
  - o Strengthened Enabling Environment (e.g., policies, regulations, institutional arrangements)
  - o Capacity Building and Technical Assistance needs (CB&TA), including awareness raising
  - o Strengthened Monitoring, Reporting, and Verification system

**The Objective** of the Roadmap is to reach the target defined in Fiji's NDC to reduce 30% of BAU CO<sub>2</sub> emissions from the energy sector by 2030 (see Section 2.1).

## 2.4 Boundary of the Roadmap

The boundary of the Roadmap is principally based on the use of energy within Fiji, and is further split into three sub-sectors for the energy sector due to the current structure of policy, plans, and regulations. These sub-sectors are <sup>7</sup>:

- Electricity generation, transmission, and distribution
- Electricity demand-side energy efficiency
- Transportation (sub-divided into land and maritime transport)

An important point regarding the first and second sub-sectors of the boundary is that the closer the renewable energy target for grid-connected electricity generation gets to 100%, the less impact electricity demand-side energy efficiency has on the mitigation of GHG emissions. However, electricity demand-side energy efficiency still leads to a large financial and economic impact within the Roadmap in terms of the required investment needed in electricity generation. Thus, increased electricity demand-side energy efficiency will lead to lower investment and unit costs, and, therefore, still plays a valuable part in the Roadmap.

## 2.5 Alignment of the Roadmap to National Policies/Strategies/Plans

In the recent past, the GOF has been active in the development of overarching national strategies, policies, and plans, which are relevant to the energy sector and climate change. The fundamental assessment for the Roadmap identified nine such strategies, policies, and plans which align to the goals and objectives of the Roadmap, and the three sub-sectors for the energy sector it covers. These strategies, policies, and plans are comprehensive and focus predominantly on sustainable development, green growth, poverty reduction, and access to modern services. Most were developed within the recent past (2012-2017), and two are still in draft form (e.g., not enacted). The nine strategies, policies, and plans are highlighted in the below table, along with their alignment to the mitigation actions and needs of the three sub-sectors for the energy sector under the Roadmap. Further information on their alignment can be found in the Fundamental Assessment Report for the Development of Fiji's NDC Implementation Roadmap (GGGI/MOE, 2017).

<sup>7</sup> Note that energy used in cooking (outside of electricity) is not included within the Roadmap.

Table 2: Alignment of National Policies/Strategies/Plans to the NDC Implementation Roadmap

National Policies/Strategies/Plans	Electricity generation, transmission, and distribution	Electricity demand-side energy efficiency	Transportation (land and maritime transport)
Republic of Fiji National Climate Change Policy	✓		✓
Fiji's Intended Nationally Determined Contribution	✓	✓	✓
Green Growth Framework for Fiji	✓	✓	✓
Draft National Energy Policy 2013-2020 and Strategic Action Plan	✓	✓	✓
Draft 20-Year and 5-Year National Development Plan	✓	✓	✓
Electricity Act of 2017	✓		
Fiji Electricity Authority Power Development Plan	✓		
Maritime and Land Transport Policy			✓
Greater Suva Transportation Strategy 2015–2030			✓



Village in Ovalau

## 2.6 Inclusive Stakeholder Engagement Process

The inclusive process undertaken for stakeholder engagement in the development of the Roadmap was predominately top-down, insofar that the stakeholders participating in the engagement process consisted of key national, regional and international institutions, organisations, and companies enclosed within the boundary of the Roadmap/energy sector. It did not involve consultation with grass-roots consumers or users of electricity or transport, but rather selected knowledgeable national institutions, organisations, and companies who represent them as well as regional and international organisations. In this manner, the figure below depicts the stakeholder engagement process.

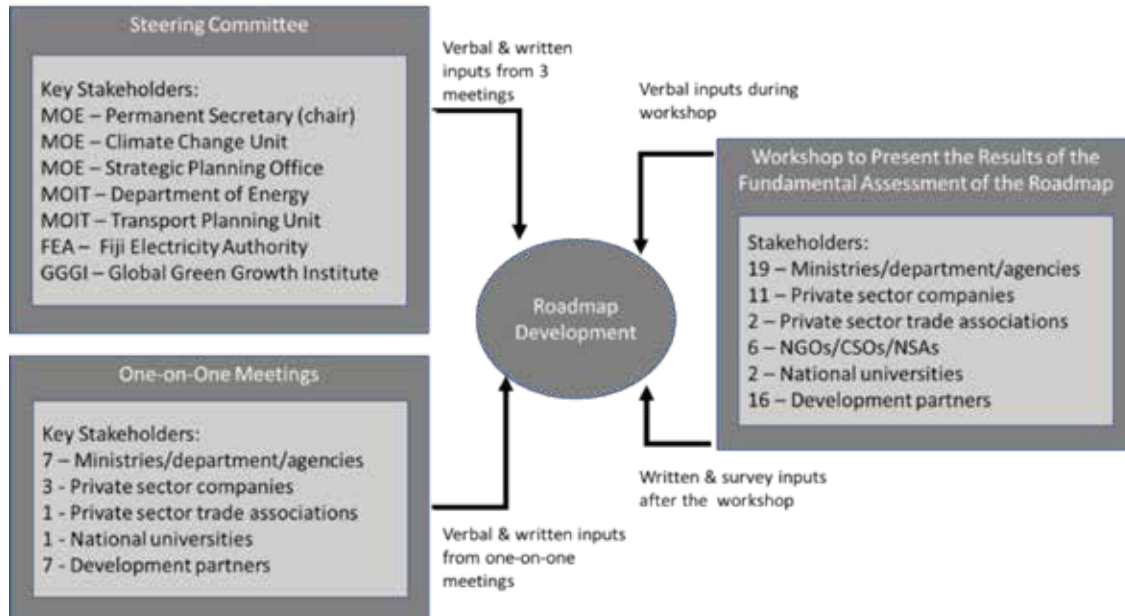


Figure 3: Diagram of stakeholder engagement and communication process

Approximately 60 different key national, regional, and international institutions, organisations, and companies were engaged during the inclusive stakeholder engagement process over the five-month period of developing the Roadmap. The process involved three main engagement mechanisms consisting of a Steering Committee of primary stakeholders, one-on-one meetings with key stakeholders, and a wider engagement of stakeholders during a workshop presenting assessment results. Inputs from the Steering Committee and one-on-one meetings with key stakeholders consisted of both verbal and written feedback. Inputs were gathered verbally from stakeholders during the workshop in the Q&A sessions, and in survey/written form after the workshop.

The post-workshop survey indicated that 95% of respondents felt that they gained insight into the development process of the Roadmap, and 90% of respondents felt that the workshop offered adequate opportunity for stakeholder inputs to the Roadmap. In addition, 90% of respondents indicated that participants in the workshop either fully represented, or maybe represented, the interests of national stakeholders for the energy sector.





Levuka Town, Ovalau



### 3. Mitigation Actions Within the Energy Sub-Sectors

#### 3.1 Total Energy Sector (Overview)

The mitigation actions identified within the energy sector are split between the following sub-sectors, with expected implementation during the short-, medium-, and long-term (2017- 2030):

- Electricity Generation and Transmission
- Demand-Side Energy Efficiency
- Transport (Land and Maritime)

The figure below depicts the annual GHG mitigation achieved via the mitigation actions in the energy sector, which is expected to be 627,000 tCO<sub>2</sub> against the BAU baseline in 2030. The total investment costs in the energy sector to achieve this level of GHG mitigation is estimated to be US\$ 2.97 billion between 2017–2030, plus the estimated US\$ 119 million already invested between 2014-2017.

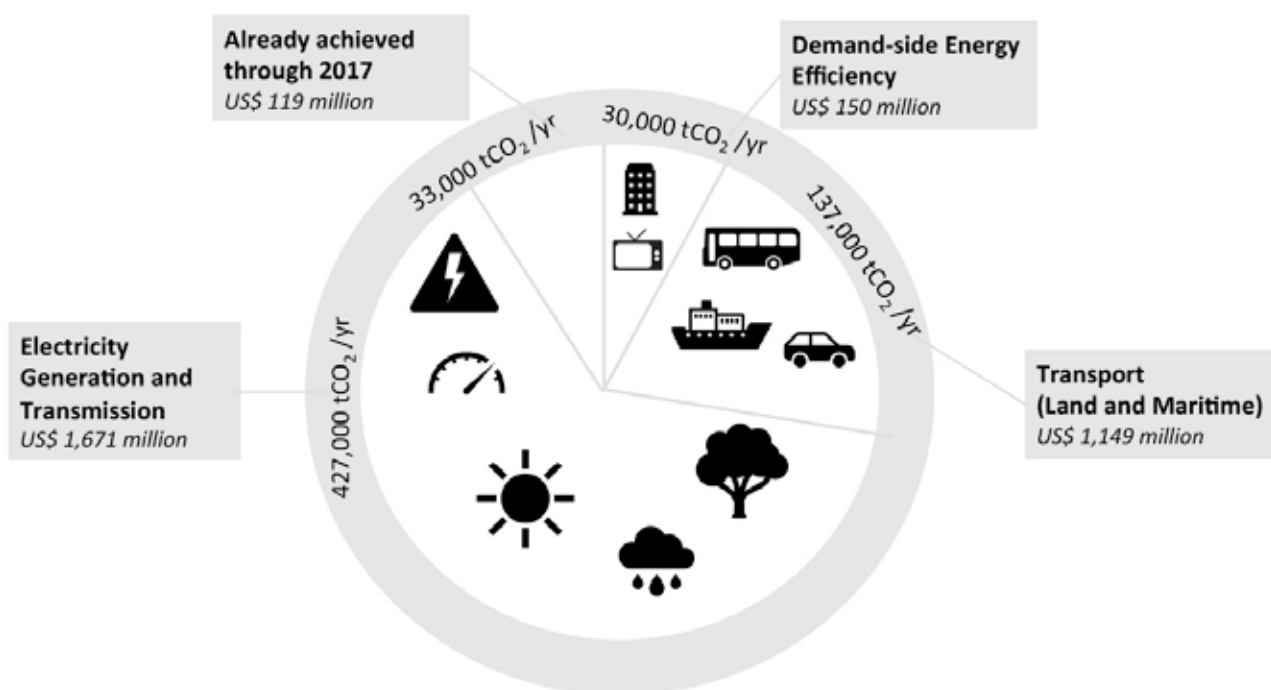


Figure 4: Annual expected energy sector GHG mitigation in 2030 and estimated total investment required

#### 3.2 Sub-Sector Electricity Generation and Transmission

The mitigation actions identified will lead to sub-sector transformation and GHG mitigation in electricity generation and transmission under the Roadmap, and are implementable in the short-, medium-, and long-term (2017-2030). These mitigation actions include the increase in renewable energy electricity generation striving to meet the potential of 100% renewable energy electricity generation across Fiji by the end of 2030 (e.g., direct mitigation). In addition, the extension and improvement of the transmission system across Fiji will strive to contribute to 100% electrification, and, at the same time, strengthen the grid to allow for full stability and synchronisation with the heavy load of renewable energy electricity entering the grid (e.g., indirect mitigation). For the purpose of the Roadmap, the extension and improvement of the transmission system only refers to 132 kV transmission, 33 kV sub-transmission, and connected substations. In principle, the mitigation actions follow the majority of Fiji Electricity Authority’s (FEA) own future development plans,



but in striving to meet the potential of 100% renewable energy electricity generation, the Roadmap augments FEA's planning with additional renewable energy electricity generation capacity and transmission system needs, including the connection to currently off-grid industry.

All mitigation actions in the electricity generation and transmission sub-sector are numbered with the tag E for electricity. In summary, these mitigation actions include the following:

### Short-Term Mitigation Actions (2017-2020)

- E1: Grid Extension and Improvements (1445km grid)
- E2: Increased RE Power Generation (32MWp solar PV, 12 MW biomass)
- E3: Increased Sustainable Biomass for fuel use (14,000 ha)

### Medium-Term Mitigation Actions (2021-2025)

- E4: Grid Extension and Improvements (926km grid + 14 MWh grid storage)
- E5: Increased RE Power Generation (26MWp solar PV, 84 MW hydro, 28 MW biomass/Waste to Energy, WTE).
- E6: Increased Sustainable Biomass for fuel use (5,000 ha)

### Long-Term Mitigation Actions (2026-2030)

- E7: Grid Extension and Improvements (25km grid + 148 MWh grid storage)
- E8: Increased RE Power Generation (69MWp solar PV, 25 MW biomass/biogas)
- E9: Increased Sustainable Biomass for Fuel Use (14,000 ha)

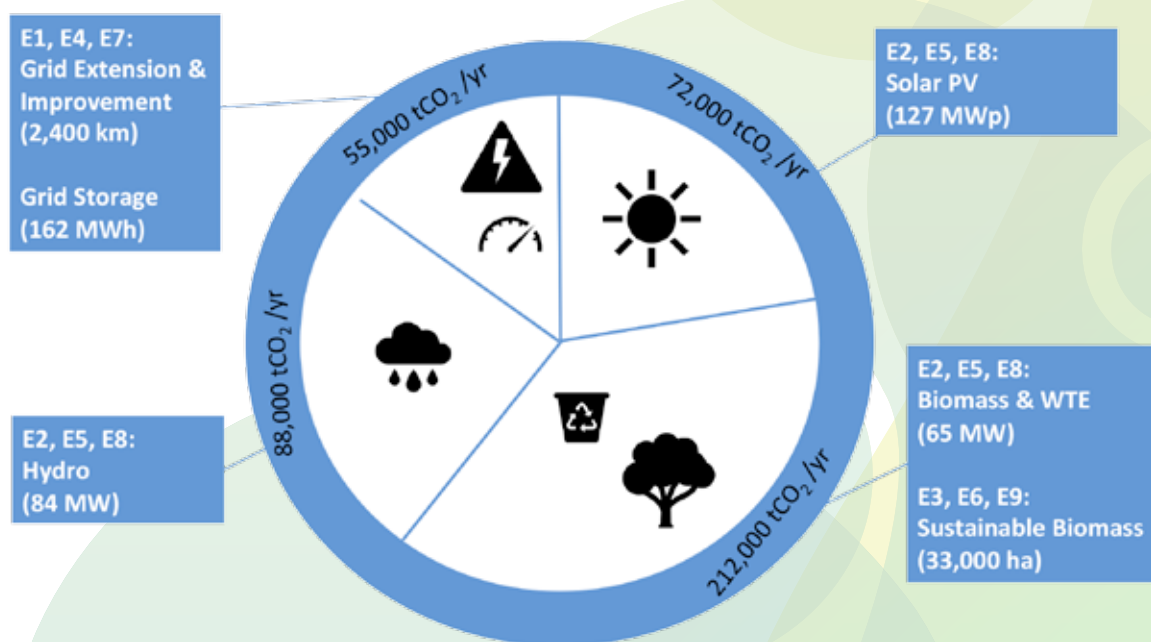


Figure 5: Electricity Generation and Transmission - Overview of Mitigation Actions <sup>8</sup>

<sup>8</sup> The biomass & WTE generation capacity is based on current planning by the private sector in Fiji and existing/potential generation capacity at Fiji Sugar Corporation (FSC). It is noted that there is not enough existing planted biomass fuel resources in Fiji to supply the full extent of fuel needs of existing and new biomass & WTE generation as defined in the Roadmap. However, there is enough arable land available, which was former sugar plantations (DOE/UNDP, 2014a). Therefore, the Roadmap includes the production and supply of sustainable biomass on 33,000 ha for the indicated additional biomass & WTE generation capacity (65 MW).

The mitigation actions for the short-, medium-, and long-term will enable the capacities highlighted in the figure above, and are expected to achieve the indicated GHG mitigation shown. The mitigation actions are briefly described in the following section. For further information regarding mitigation actions, Annex B provides a summary table for each mitigation action.

### Short-Term Mitigation Actions (2017-2020)

The short-term mitigation actions focus on extending and improving the grid, increasing renewable energy power generation capacity, and improving biomass sustainability (for fuel use). Planning for grid extension and improvement is well under way by FEA, as is the process for the procurement of some of the on- and off-grid solar PV generation capacity. Increasing biomass capacity is still in the early stage of development, as are efforts to increase the production volume of sustainable biomass as fuel.

Mitigation Actions E1, E2, and E3: Grid Extension and Improvements, Increased Renewable Energy Power Generation, and Increased Sustainable Biomass for Fuel Use.

- Grid extension and improvements will be made on Viti Levu, Vanua Levu, Taveuni, and Ovalau (including 1445km of 132kV & 33 kV lines). This will help support an increase in RE power generation capacity on Viti Levu, Vanua Levu, Taveuni, Ovalau and rural areas with a total of 32 MWp of solar PV capacity, and 12 MW of biomass generation capacity. In addition, activities will support the setup of up to 14,000 ha of sustainable biomass for fuel use.
- The average annual GHG mitigation is estimated to be a total of 42,000 tCO<sub>2</sub>/yr; 21,000 tCO<sub>2</sub>/yr (solar PV); 21,000 tCO<sub>2</sub>/yr (biomass).
- The estimated total investment required is US\$ 462 million: US\$ 339 million (grid extension and improvement); US\$ 46 million (biomass generation); US\$ 58 million (on- and off-grid solar PV); US\$ 19 million (production and processing of sustainable biomass).

There are some key enabling elements, capacity building, and technical assistance needs that should be addressed to effectively further the implementation of short-term mitigation actions, and to ensure sustainability. These are briefly described in the text box below, and are included in the logic framework found in Annex A.

### Key Enabling Elements, Capacity Building & Technical Assistance Needs

- The Fijian Competition and Consumer Commission (FCCC) needs to be supported and operational in its new role as the electricity sector regulator, especially in terms of tariff setting and licensing.
- Full feasibility studies need to be completed in order for the identified electricity transmission assets to be implemented in this term followed by a procurement process of Engineering, Procurement and Construction (EPC) companies.
- Mapping of locations and full feasibility studies need to be completed for the RE power generation assets identified to be implemented in this term, followed by a process of auctioning or procurement of EPCs and/or Independent Power Producer (IPP) companies.
- Financial instruments for climate finance (loans and guarantees) and incremental cost need to be developed and funded (see Section 5.3).
- Insurance products need to be developed and funded to cover damage and loss from severe weather, especially for solar PV power stations and sustainable biomass plantations.
- The development and implementation of national standards for solar PV equipment and conditions for their supply (e.g., quality, warranties) should be completed.
- A rural electrification master plan should be completed to map out locations for achieving 100% electrification, by both new grid connections and standalone solutions (individual supply or mini-grids).
- Skilled and highly skilled domestic labour to operate and maintain biomass power production in Fiji is developed and sustained.
- Large-scale specific domestic production (production and processing) of sustainable biomass (and knowhow) is gained, including training of skilled labour.
- Optimisation of the use of sustainable biomass residues is achieved, especially a resource survey (Geographic Information System, GIS), processing techniques, logistics planning, and training of skilled labour.

## Medium-Term Mitigation Actions (2021-2025)

The medium-term mitigation actions further extend and improve the grid, establish the first grid storage, increase renewable energy power generation capacity, and improve biomass sustainability (for fuel use). Planning for grid extension and improvement has been mapped out, along with the hydro generation capacity. For this term, on- and off-grid solar PV generation capacity and WTE generation capacity are only partially investigated to date. Biomass/WTE generation capacity will be utilised or expanded at existing FSC sugar mills, and efforts to increase the production volume of sugar cane will be made (bagasse as fuel).

Mitigation Actions E4, E5, and E6: Grid Extension and Improvements, Increased RE Power Generation, and Increased Sustainable Biomass for Fuel Use.

- Grid extension and improvements will be made on Viti Levu and Vanua Levu, along with the installation of a grid synchronisation system, and grid storage added on Taveuni and Ovalau (including 926km of 132kV & 33 kV lines, and 14 MWh of storage). RE power generation capacity will be increased on Viti Levu, Vanua Levu, Taveuni, Ovalau and rural areas to a total of 36 MWp of solar PV capacity, 84 MW of hydro generation capacity, and 28 MW of biomass/WTE generation capacity. In addition, activities will support the setup of up to 5,000 ha of sustainable biomass (sugar cane/bagasse) for fuel use.
- The average annual GHG mitigation is estimated to be a total of 158,000 tCO<sub>2</sub>/yr; 17,000 tCO<sub>2</sub>/yr (solar PV); 86,000 tCO<sub>2</sub>/yr (hydro), and 55,000 tCO<sub>2</sub>/yr (biomass/WTE).
- The estimated total investment required is US\$ 861 million: US\$ 229 million (grid extension, improvement, and storage); US\$ 45 million (biomass generation); US\$ 523 million (hydro generation); US\$ 57 million (on- and off-grid solar PV); US\$ 7 million (production and processing of sustainable biomass).

There are some key enabling elements, capacity building, and technical assistance needs that should be addressed to effectively further the implementation of medium-term mitigation actions, and to ensure sustainability. Note that the items listed for short-term needs still apply in the medium-term. These are briefly described in the text box below, and are included in the logic framework found in Annex A.

### Key Enabling Elements, Capacity Building & Technical Assistance Needs

- Needs listed under the short-term mitigation actions also apply in the medium-term.
- Financial and technical assistance for increasing sugarcane yield per hectare by farmers; harvesting and transport logistics are also needed.
- Financial instruments for the guarantee of gate-payment of sugarcane are needed.
- Assistance in further developing and expanding the PP model between farmers and FSC, including an information dissemination campaign, are needed.
- Develop and implement national standards for grid storage equipment and technical interoperability, and conditions for their supply (e.g., quality, warranties).
- Complete a detailed study on solid waste composition, and the optimisation of solid waste collection and sorting for the greater Suva area (especially a resource survey (GIS), processing techniques, and logistics planning).
- Complete a full technical and economic feasibility study for the IPP(s) and the new grid extension for the hydro power projects, including environmental and social impact analysis, and World Commission on Dams study. The study should be followed by a process of auctioning or procurement of EPCs or IPP/Public Private Partnerships (PPP).
- The PPP Act and PPP Regulatory Guidance needs to be enacted.
- Complete a full technical and economic feasibility study to determine the pathway, technical needs and interoperability, and specifications of the grid synchronisation system. The study should be followed by a process of procurement of EPCs.

## Long-Term Mitigation Actions (2026-2030)

The long-term mitigation actions further extend and improve the grid, increase grid storage, increase renewable energy power generation capacity, and improve biomass sustainability (for fuel use). Planning for grid extension and improvement and grid storage, has not been mapped out. For this timeframe, on-grid solar PV generation capacity, and biomass and biogas generation capacity, is only partially investigated to date. Efforts to increase the production volume of biomass for power generation will be made, where biomass generation capacity would be utilised for a new wood pellet production facility.

Mitigation Actions E7, E8, and E9: Grid Extension and Improvements, Increased RE Power Generation, and Increased Sustainable Biomass for Fuel use.

- Grid extension and improvements will be made on Viti Levu, along with grid storage added on Ovalau and Viti Levu (including 25km of 33 kV lines, and 148 MWh of storage). RE power generation capacity will be increased on Viti Levu and Ovalau for a total of 69 MWp of solar PV capacity and 25 MW of biomass generation capacity. In addition, activities will support the setup of up to 14,000 ha of sustainable biomass for fuel use.
- The average annual GHG mitigation is estimated to be a total of 227,000 tCO<sub>2</sub>/yr; 34,000 tCO<sub>2</sub>/yr (solar PV); 137,000 tCO<sub>2</sub>/yr (biomass/biogas); and 55,000 tCO<sub>2</sub>/yr (grid extension to the Vatukoula gold mine).
- The estimated total investment required is US\$ 348 million: US\$ 142 million (grid extension, improvement, and storage); US\$ 101 million (biomass/biogas generation); US\$ 86 million (on- and off-grid solar PV); US\$ 19 million (production and processing of sustainable biomass).

There are some key enabling elements, capacity building, and technical assistance needs that should be addressed to effectively further the implementation of long-term mitigation actions, and to ensure sustainability. Note that the items listed for short- and medium- term needs still apply in the long-term. These are briefly described in the text box below, and are included in the logic framework found in Annex A.

### Key Enabling Elements, Capacity Building & Technical Assistance Needs

- Needs listed under the short-, and medium-term mitigation actions also apply in the long-term.
- A full technical and economic feasibility study should be completed for the development of biomass pellet production and power generation, including an environmental and social impact analysis, and a biomass resource study.
- A full technical and economic feasibility study should be completed for the development of biogas production and power generation at agriculture facilities in Fiji.
- A full technical and economic feasibility study should be completed to address additional power generation needs for the large-scale introduction of electric vehicles in Fiji.

## Additional Mitigation Actions for Electricity Generation and Transmission Sub-sector

On top of the short-, medium- and long-term mitigation actions outlined above, there is potential for additional mitigation actions that could contribute to the transformational change and sustainable development of the sub-sector. The major additional mitigation actions that have potential are:

### Wind Power Generation

Fiji has been operating the Butoni wind power generation farm located in Viti Levu of 10 MW capacity, but average wind speeds are low (FEA, 2016). The Department of Energy (DOE) started a wind-monitoring programme on Viti Levu, Vanua Levu, Taveuni, and Ovalau. Unfortunately, a large number of the monitoring stations were knocked out during TC Winston, and there are actions being taken to re-establish them. However, DOE still needs technical assistance and capacity building support to create a comprehensive, long-term wind atlas for the areas under the programme, and to address the technical and financial feasibility of further installation of wind power generation (Stakeholder Consultations, 2017).



*Somosomo hydropower reservoir, Taveuni*

### Geothermal Power Generation

Fiji is still in the early stages of mapping out geothermal resources and power generation feasibility. Several locations have been mapped out for geothermal exploration on both Viti Levu and Vanua Levu, with the most promising location being the Savusavu area of Vanua Levu where it is estimated the geothermal generation capacity is greater than 10 MW (IRENA, 2015). Further exploration of the Savusavu area, or others, is needed, including exploratory drilling. In addition, the installation of interconnected undersea power cables should be investigated between Viti Levu, Vanua Levu, and Taveuni.

### Wastewater Treatment & Biogas

Major urban areas of Fiji are in the process of strengthening sewerage and wastewater treatment; a further step in this process could be electricity generation through biogas generation at wastewater treatment facilities (and possible heat use). This potential mitigation action should be addressed further in terms of full feasibility and implementation.

## 3.3 Sub-Sector Electricity Demand-Side Energy Efficiency

The mitigation actions deemed appropriate to achieve measurable GHG mitigation under the Roadmap in the electricity demand-side energy efficiency sub-sector focus on mitigation actions that are implementable in the short- to medium-term (between 2017-2025), and which will have significant impacts on GHG mitigation through 2030. The mitigation actions can be broadly classified into four types: Energy Labelling and Minimum Energy Performance Standards, Energy Efficiency in the Business Community (including Tourism), Energy Efficiency in the Public Sector, and Updated Codes and Standards for Buildings. All mitigation actions in this sub-sector are numbered with the tag “D” for Demand-Side Energy Efficiency.

### Short- and Medium-Term Mitigation Actions (2017-2025)

- D1: Energy Labelling and Minimum Energy Performance Standards
- D2: Energy Efficiency in the Business Community (including Sustainable Tourism)
- D3: Energy Efficiency in the Public Sector
- D4: Updated Codes and Standards for Buildings



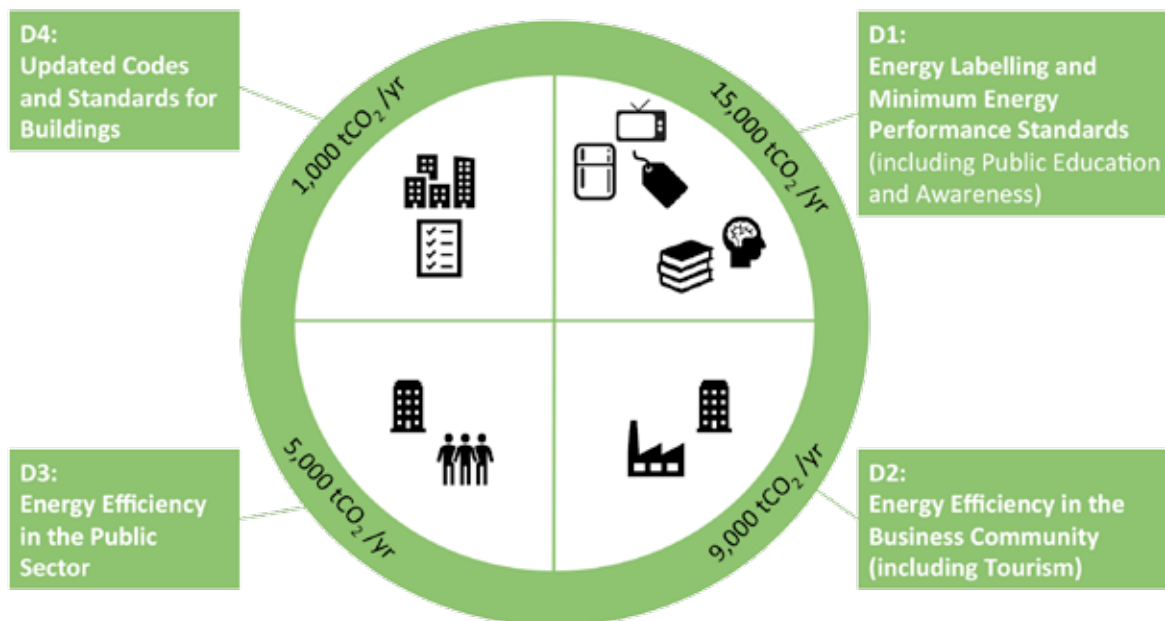


Figure 6: Demand-Side Energy Efficiency - Overview of Mitigation Actions <sup>9</sup>

As indicated previously, the mitigation actions shown in the figure above are to be implemented in the short-, and medium-term, with lasting impacts leading to the estimated GHG mitigation potential shown. The mitigation actions are briefly described in the following section. For further information regarding mitigation actions, Annex B provides a summary table for each mitigation action.

#### Mitigation Action D1: Energy Labelling and Minimum Energy Performance Standards

- This mitigation action starts with gathering comprehensive data on energy consuming products (and continual gathering over time), with a focus on imported energy consuming appliances and equipment, to create a national information system for energy consuming products. This will be followed by the introduction of energy performance standards on energy consuming products, and border control on selected products (e.g., lighting). This mitigation activity includes nationwide educational and public awareness programmes to increase awareness of both the existence and benefits of energy efficient appliances and the savings they generate. Note that this is an expansion of the existing groundwork laid via the existing energy labelling system.
- Annual expected GHG mitigation in 2030: 15,000 tCO<sub>2</sub>/yr
- Investment in energy consuming products D1, D2, and D3 (2017-2030): US\$ 150 million

#### Mitigation Action D2: Energy Efficiency in the Business Community (including Sustainable Tourism)

- This mitigation action includes the mandatory adoption of ISO 50001:2011 – Energy Management in the Business Community. The ISO 50001:2011 provides a framework of requirements for organisations to develop a policy for more efficient energy use. The standard essentially requires entities to: fix targets and objectives to meet the policy, use data to better understand and make decisions about energy use, measure the results, review how well the policy works, and continually improve energy management. As part of this initiative, there is a need to incentivise, through duty concessions and tax rebates, the adoption of energy efficient technologies, plants, and equipment.
- Annual expected GHG mitigation in 2030: 9,000 tCO<sub>2</sub>/yr
- Investment in energy consuming products D1, D2, and D3 (2017-2030): US\$ 150 million

#### Mitigation Action D3: Energy Efficiency in the Public Sector

- This mitigation action includes the following activities: i. undertake a review of public sector budgeting processes and procurement rules, with the objective of providing incentives to undertake energy efficiency projects; ii. implement the recommendations of the review by amending procurement rules and budgeting processes; iii. design and implement

<sup>9</sup> The potential of mitigation from updated codes and standards for buildings is known to be underestimated, see Mitigation Action D4 below.



energy efficiency demonstration projects on public buildings; iv. through stakeholder consultation, establish energy efficiency protocols for public sector facilities and start monitoring and analysing large public sector energy users' performance; and v. develop energy efficiency case studies and communication materials for public servants as well as the general public, based on the new protocols and the demonstration sites, and disseminate widely. As part of this mitigation action, public sector entities are to be mandated or made mandatory to adopt ISO 50001:2011.

- Annual expected GHG mitigation in 2030: 5,000 tCO<sub>2</sub>/yr
- Investment in energy consuming products D1, D2, and D3 (2017-2030): US\$ 150 million

#### Mitigation Action D4: Update Codes and Standards for Buildings

- This mitigation action entails the incorporation of Energy Efficiency into the Fiji Building Code, and includes the following activities: i. undertake a review of codes and standards for buildings, including minimum and best practice standards for energy use for ventilation, cooling, and lighting, and the use of passive technologies; ii. implement the results of the review through a new building code; and iii. increase and strengthen information regarding building stock, energy consumption, and use of energy saving building technologies. In addition, showcase demonstration projects should be developed and information about these projects disseminated to increase awareness about the action.
- Annual expected GHG mitigation: 1000 tCO<sub>2</sub>/yr (for passive technologies only) by 2030. The potential of mitigation under this action is expected to be greater than indicated above, as there is currently a lack of in depth data to allow for a broader determination of the mitigation potential.
- The total investment required over the period of the Roadmap (2017-2030): NA

There are some key enabling elements, capacity building, and technical assistance needs that should to be addressed to effectively further the implementation of mitigation actions D1, D2, D3, and D4, and to ensure sustainability. Note that the items listed for short- and medium- term needs still apply over the long-term. These are briefly described in the text box below, and are included in the logic framework found in Annex A.

### Key Enabling Elements, Capacity Building & Technical Assistance Needs

- Undertake a full assessment and determination of key appliances for which updated and new energy performance standards are required. Followed by formalising and legislating the energy saving standards and import controls at Fiji's borders.
- Provide training to key stakeholders (i.e., institutions in charge of border control of appliances - Fiji Revenue and Customs Service (FRCS), dealers of appliances, staff of coordinating entity).
- Define a strategy and an awareness programme to be developed and implemented across the economy; including training provided to key stakeholders (i.e., institutions in charge of border control of appliances, dealers of appliances, government staff).
- Carry out a baseline study and needs assessment in schools and tertiary institutions to evaluate the extent in which EE is incorporated in the curriculum, identify gaps, and make recommendations for additional elements required; followed by developing content and material to be included in the school curriculum.
- Develop an incentive scheme (i.e., through duty concessions and tax rebates) to support the adoption of energy efficient technologies.
- Design and implement an awareness and information campaign targeting the business community and government stakeholders on energy management requirements for businesses (including hotels and resorts) and public institutions, including enacting the incentive schemes, and providing energy saving case studies.
- Train key stakeholders (owners and service providers) on the implementation and operation of the energy management scheme.
- Strengthen the enabling environment for energy service companies (ESCO) to undertake and finance public and private sector energy efficiency projects and auditing of the energy management programme.
- Train institutions in charge of coordinating and controlling the introduction and enforcement of the energy management standards.
- Review and assess (including gap analysis) existing building codes.
- Train auditors to assess building code standards and performance.
- Institutionalise a command and control mechanism to strengthen data and information gathering, reporting, and verification, and to increase compliance.

### 3.4 Sub-Sector Transport (Land and Maritime)

The mitigation actions under the Roadmap in the transport (land and maritime) sub-sector focus on actions that are implementable in the short- to medium-term, but run continuously through the long-term having a measurable impact on GHG mitigation through 2030. Some of these actions include vehicle replacement programmes for buses, taxis, private cars, lorries and minibuses, which would institute an enhanced sub-industry for the scrappage of older, less efficient vehicles. Other actions include the import and use of biodiesel, improved maintenance for sea vessels, and increased utilisation of fuel-efficient outboard motors. All mitigation actions in the transport sub-sector are numbered with the tag T for transport.

#### Short-Term Actions (2017-2020)

- T1: Vehicle Replacement Programme (including Hybrid vehicles + Scrappage)
  - o Buses, Taxis, Private Cars
- T2: Vehicle Replacement Programme (including Scrappage)
  - o Lorries (<16t), Minibuses

#### Medium-Term Actions (2021-2025)

- T3: B5 Fuel (5% Biofuel in Diesel)
- T4: Improved Maintenance for Sea Vessels
- T5: Fuel Efficient Outboard Motors

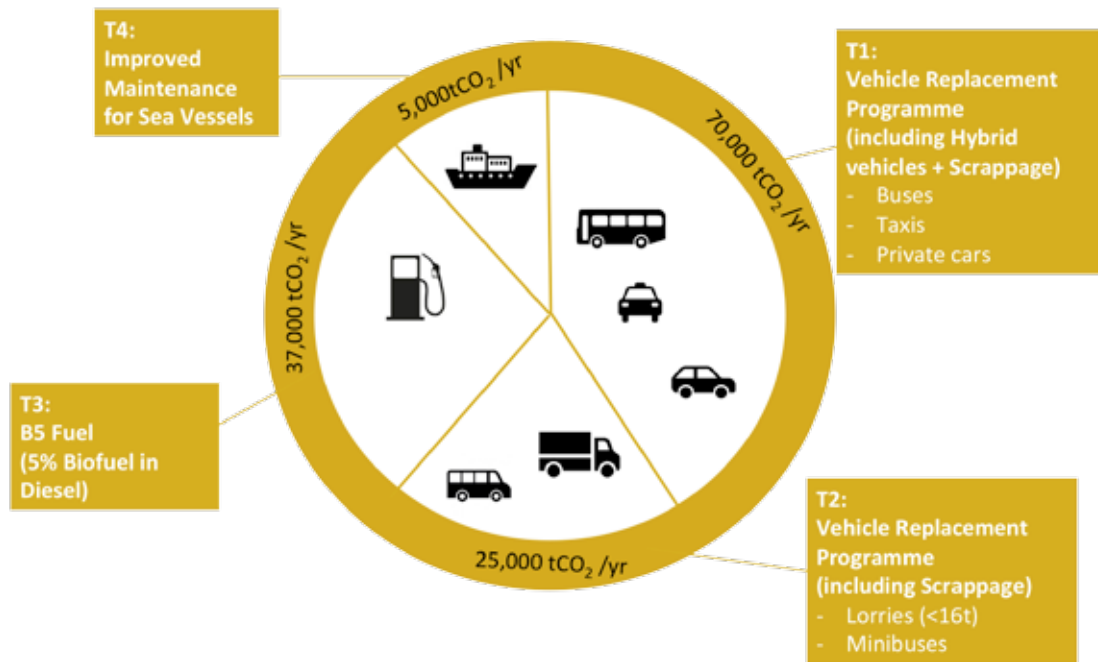


Figure 7: Transport - Overview of Mitigation Actions

The short-term mitigation actions T1 and T2, and the mid-term mitigation actions T3, T4 and T5 are briefly described in this section. The mitigation potential is depicted in the above figure. For further information regarding mitigation actions, Annex B provides a summary table for each mitigation action.

#### Short-Term Mitigation Actions

The short-term mitigation actions for the transport sector focus on replacement programmes for vehicles in land transport, but require additional actions and linkage to Land Transport Authority (LTA), FRCS and FCCC in terms regulation and control. These mitigation actions build upon partly existing initiatives (although on a very limited scope) or planned initiatives for age limits and incentives for fuel-efficient vehicles in Fiji.

The mitigation potential and total investment required for the economy (mainly costs of vehicles) largely depend on the type and size of less efficient vehicles that will be replaced and the more efficient vehicles imported (e.g., Euro IV/VI and Hybrids). An additional factor is the overall level of ambition in terms of vehicles replaced per year from vehicle stock. It is noted that these more efficient vehicles both replace existing less efficient vehicles which are to be scrapped, and are included in the annual growth of vehicles in the fleet (2% annual growth rate assumed between 2017-2030).

**Mitigation Action T1: Vehicle Replacement Programme (including Hybrid Vehicles and Scrappage)**

- This mitigation action improves the vehicle (buses, taxis, and private cars) fleet in terms of fuel use per km per vehicle to achieve a fleetwide reduction in GHG emissions. Age limits for imported used vehicles would be combined with European norm fuel standards for newly imported vehicles. In addition, incentives for hybrid vehicles would be provided to increase the share of hybrid vehicles in the bus, taxi and private vehicle fleet.
- Expected GHG mitigation in 2030: Total 70,000 tCO<sub>2</sub>/yr; 11,000 tCO<sub>2</sub>/yr (buses); 15,000 tCO<sub>2</sub>/yr (taxis); 44,000 tCO<sub>2</sub>/yr (private cars). Average annual expected GHG mitigation between 2017-2030: Total 42,000 tCO<sub>2</sub>/yr; 6,000 tCO<sub>2</sub>/a (buses) <sup>11</sup> ; 9,000 tCO<sub>2</sub>/yr (taxis) <sup>12</sup> ; 27,000 tCO<sub>2</sub>/yr (private cars) <sup>13</sup>.
- Expected total investment required (costs for vehicles only) over the period of the Roadmap (2017-2030): Total US\$ 940 million; US\$ 110 million (buses); US\$ 60 million (taxis); US\$ 770 million (private cars).

**Mitigation Action T2: Vehicle Replacement Programme (including Scrappage)**

- This mitigation action improves the vehicle (lorries and mini-buses) fleet in terms of fuel use per km per vehicle to achieve a fleetwide reduction in GHG emissions. Age limits for imported used vehicles would be combined with European norm fuel standards for newly imported vehicles.
- Expected GHG mitigation in 2030: Total 25,000 tCO<sub>2</sub>/yr ; 24,000 tCO<sub>2</sub>/yr (lorries <16t); 1000 tCO<sub>2</sub>/yr (minibuses). Average annual expected GHG mitigation between 2017-2030: Total 14,500 tCO<sub>2</sub>/yr; 14,000 tCO<sub>2</sub>/a (lorries <16t) ; 500 tCO<sub>2</sub>/yr (minibuses).
- Expected total investment required (costs for vehicles only) over the period of the Roadmap (2017-2030): Total US\$ 205 million; US\$ 200 million (lorries <16t) <sup>14</sup>; US\$ 5 million (minibuses) <sup>15</sup>.



*Buses and cars on the roads in Suva*

11 Assumptions for buses: replaced with 455 Euro IV/VI diesel buses from stock by 2030, and replaced with 504 hybrid buses from stock by 2030.

12 Assumptions for taxis: replaced with 4,700 Euro IV/VI diesel/petrol taxis from stock by 2030, and replaced with 2,100 hybrid taxis from stock by 2030.

13 Assumptions for private cars: replaced with 63,000 Euro IV/VI diesel/petrol private cars from stock by 2030, and replaced with 26,500 hybrid private cars from stock by 2030.

There are some key enabling elements, capacity building, and technical assistance needs that should be addressed to effectively further the implementation of mitigation actions T1 and T2 and to ensure sustainability. Note that the items listed for short-term needs still apply over the long-term. These are briefly described in the text box below, and are included in the logic framework found in Annex A.

### Key Enabling Elements, Capacity Building & Technical Assistance Needs

- Ensure that fuel standards across Fiji to be in line with the vehicle fleet improvements and imported vehicles standards.
- Ensure enforcement of Euro IV standards (2017) and Euro VI standard (2021) for imported vehicles.
- Design and implement a scrappage policy (including standards, recycling) and incentive scheme.
- Design and implement a recycling and disposal policy for batteries of hybrid vehicles in place.
- Complete a data assessment study and gap analysis for the vehicle fleet in land transport.
- Complete a feasibility study and Environmental Impact Assessment (EIA) per the mitigation actions.
- Design and implement eligibility criteria development for vehicles scrapped and replaced.
- Design and implement an incentive scheme per mitigation actions involving FCCC and FRCS (including capacity building).
- Design and execute an awareness campaign among key stakeholders and the public, and addressees of the incentive scheme/ action.
- Provide training to key stakeholders (including scrappage facilities, car dealers, etc.).
- Institutionalise a command and control mechanism to strengthen data and information gathering, reporting, and verification, and to increase compliance.

### Medium-Term Mitigation Actions

Since some mitigation actions require more significant preparatory steps prior to their implementation (i.e., in terms of data assessment and policies), the following mitigation actions are planned for implementation between 2021-2025. For land transport, the focus of the mitigation action is on introducing a portion of biofuel in diesel fuel. For maritime transport, the focus of the mitigation action is on improved maintenance services for sea vessels to increase the fuel efficiency and on a replacement programme for outboard motors. These actions are aligned to the existing key policies on climate change and energy in the transport sector, but require additional actions and linkage to LTA, Maritime Safety Authority of Fiji (MSAF), FRCS and FCCC in terms regulation and control.

The mitigation potential and total investment required for the economy (mainly costs of fuel and services) could not be fully evaluated with sufficient certainty, as underlying data, especially in the maritime transport sub-sector, was not available. The overall investment and impact on GHG mitigation will largely depend on various parameters that could not be fully attained in the preparation of the Roadmap. The provided estimates on GHG mitigation and total investment required are based on the currently available information in Fiji and internationally available comparative figures.

#### Mitigation Action T3: B5 Fuel (5% Biofuel in Diesel)

- All diesel fuel used in land transport would be “B5” fuel with 95% diesel and 5% biodiesel. It is assumed that the B5 fuel is being imported and provided across all land transport sub-sectors (private, public, and commercial). To allow for preparation and to ensure availability of B5 fuel, it is assumed that B5 would be widely available in Fiji from 2021.
- Expected GHG mitigation in 2030: 37,000 tCO<sub>2</sub>/yr; Average annual expected GHG mitigation between 2021-2030: 35,000 tCO<sub>2</sub>/yr 16.
- Expected total investment required: negligible (passes on to fuel cost)

14 Assumptions for lorries: replaced with 13,000 Euro IV/VI lorries from stock by 2030.

15 Assumptions for minibuses: replaced with 420 Euro IV/VI minibuses from stock by 2030.

16 Assumptions: vehicle stock land transport with share of diesel vehicles only; 5% of diesel reduced for diesel vehicles from 2021 to 2030, emission factors (gCO<sub>2</sub>/km) as average for each vehicle type based on values from 2015.

#### Mitigation Action T4: Improved Maintenance for Sea Vessels

- This mitigation action includes regular maintenance services for large sea vessels including measures to improve the fuel efficiency of the engine and the vessel, leading to reduced GHG emissions. The focus of the programme in the medium-term (2021-2025) is on the highest fuel-consuming sea vessel fleet (highest fuel consumption per km, cargo-ton or passenger) from commercial shipping, Government Shipping Franchise Scheme, and Government Shipping Service.
- Average annual expected GHG mitigation between 2021-2030: 5,000 tCO<sub>2</sub>/yr.<sup>17</sup>
- Expected total investment required over the period (2021-2030): US\$ 4-8 million.<sup>18</sup>

#### Mitigation Action T5: Fuel Efficient Outboard Motors

- This mitigation action results in a reduction in fuel use by replacing inefficient 2-stroke outboard motors for smaller private and commercial boats (approx. 10-150hp motors) with higher efficient outboard motors (direct fuel injected 2-stroke or 4-stroke motors). This would result in a reduction in fuel use and GHG emissions.
- Average annual expected GHG mitigation between 2017-2030: Not quantified due to lack of data (up to 20% fuel and GHG reduction possible compared to old 2-stroke).
- Expected total investment required over the period (2021-2030): NA<sup>19</sup>

There are some key enabling elements, capacity building, and technical assistance needs that should be addressed to effectively further the implementation of mitigation actions T3, T4, and T5, and to ensure sustainability. Note that the items listed for short-term needs still apply over the long-term. These are briefly described in the text box below, and are included in the logic framework found in Annex A.

### Key Enabling Elements, Capacity Building & Technical Assistance Needs

- Assess import options for B5 (e.g., Singapore, Korea, Australia) and availability for Fiji.
- As Fiji is a hub for other Pacific Island Countries, and changes in fuel imports to Fiji may have implications for other Pacific Island states, the implications are to be assessed prior to the start of the action and negotiations to be made with other Pacific Island Countries.
- Conduct an assessment of the negative implications for introducing fuel standards to the vehicle fleet in Fiji.
- Apply an Environmental Impact Assessment (international standards), or international label, for the biofuel content of B5 fuel to ensure sustainable sources/production in order to not outsource any negative impacts.
- Complete a data assessment on fuel consumption and GHG emissions in land and maritime transport, separated by sub-categories (to be defined, e.g., type of cars, private, commercial, buses, taxis) and in terms of diesel use.
- Develop an incentive and financing scheme for the mitigation actions involving FCCC and FRCS (including capacity building).
- Design and execute an awareness campaign for the public and key stakeholders involved in the mitigation actions.
- Review and update the Maritime Transport Decree and develop a Maritime Transport Energy & GHG Mitigation Plan.
- Complete a comprehensive transport data assessment on fuel consumption and GHG emissions in maritime transport separated by sub-categories (incl. medium and large sea vessels).
- Design and execute an awareness campaign for owners, operators, associations and other relevant stakeholders (e.g., shipping companies, associations, banks) for mitigation in maritime transport.
- Institutionalise a command and control mechanism to strengthen data and information gathering, reporting, and verification, and to increase compliance.

17 Due to non-availability of reliable data, only rough estimations are possible. Assumptions: considering large sea vessels (30 sea vessels) cause 20% of expected total sea transport emissions in Fiji and only 6% (approx. up to 4-15% for propeller and hull cleaning/coating only) reduction achieved due to maintenance improvements, annual reduction could be approx. 5,000 tCO<sub>2</sub>/yr.

18 Due to non-availability of reliable data, only rough estimations are possible. Investment costs largely depend on type, size and number of vessels undergoing maintenance and the actual maintenance services included/required. Assumptions: 30 large sea vessels with propeller polishing and hull cleaning (annually) and hull coating only every 5 years.

19 Depending largely on the type and size and total number of outboard motors to be replaced annually.



## Additional actions for transforming the transport sub-sector

There is potential for additional mitigation actions that would substantially contribute to transformational change and sustainable development in the transport sector with both direct and indirect impacts on GHG emissions reductions. The major additional actions that are recommended for consideration in future transport policies and plans include (but are not limited to):

### Urban and Public Transport Plan

The increasing number of motorised vehicles in Fiji, and the increase in urban population (urbanisation), requires the improvement of, and providing incentives for, public transport use and non-motorised transport (including cycling and walking). It is recommended to design and implement a transport planning database, and to develop an urban and public transport plan with clear and measurable mid- to long-term targets and milestones, including physical improvements in urban centres including public transport infrastructure (i.e., bus lanes, bus stops, bus depots), parking plans (e.g., park and ride), pedestrian crossings, cycling lanes, and sidewalks. Anti-congestion plans for major urban centres (i.e., for Suva, Nadi and Lautoka) should also be included. Local and national circumstances (e.g., limited space for expanding roads in urban centres) should be considered when developing and implementing the urban and public transport plan.

### Long-term strategy for electric transportation

To facilitate a long-term transition to electric transport in Fiji, preparatory work is required to assess the current gaps and implications of a transition to electric transport in terms of technical, economic, regulatory, and social and environmental aspects.

Aspects that need to be assessed include: i. how to ensure sufficient renewable energy sources are available in the electricity generation system, so that countrywide coverage of electric transportation is technically and economically feasible and ensures no obstacles towards sustainable development; ii. quantifying the incremental costs of additional renewable energy sources for supplying electricity for transportation in Fiji; iii. requirements for recycling and disposal policies/plans for electric vehicle batteries; and iv. assessment of requirements for charging infrastructure and for the regulation of tariffs for electric transport.

A low carbon pathway with clear targets and actions should be developed with clear milestones to achieve a gradual transition to electric transportation in Fiji in the long-term.

### Addressing behavioural change in transportation

Significant fuel savings can be achieved by changing the way people drive and use their vehicles; however, this requires increasing awareness among people about the impacts of transport on their private budget and the national budget, and on the environment (including climate change). Addressing behavioural change through sustainable transport initiatives will not only help to reduce the amount of fuel used and GHG emissions caused, but also lead to a reduction in accidents and casualties caused by transport.

Potential actions include awareness raising about sustainable transport in curricula of schools and universities, and awareness raising programmes (e.g., advertising, campaigns) for drivers and vehicle owners about eco-friendly driving and economic and environmental impacts. In addition, further speed management education, both for land and maritime transport, and the inclusion of eco-friendly driving training in driving license training courses and other educational programmes, could further support behaviour change.

### Alternative propulsion systems in maritime transport

Fiji is an island state and its dependency on inter-island sea transport is well known. Thus, Fiji should make additional preparatory steps to transform the maritime transport sector in the mid- to long-term towards a more sustainable transport system, using alternative propulsion systems to the ones using primarily fossil fuels. This will help to reduce the negative impacts on the environment, reduce the dependency on fossil fuels, and make the maritime transport system more economically feasible in the mid- to long-term.

Actions include (but are not limited to) fully or partly renewable energy driven sea vessels (including wind and solar) and waste-heat recovery systems for larger sea vessels.





## 4. Contributions to the Sustainable Development Goals (SDGs)

The following table shows the results of a general qualitative assessment based on the broadly known impact for the deployment of technology in the different mitigation actions under the Roadmap. A more detailed quantitative and qualitative assessment is needed during Roadmap implementation to determine the exact impacts, and relate these to input needs for the MRV system in order to track the progress of the Roadmap.

Table 3: List of the mitigation actions' expected contributions to the SDGs and key identified targets

No. and SDG <sup>20</sup>	E1-3	E4-6	E7-9	D1	D2	D3	D4	T1	T2	T3	T4	T5
1 No Poverty												
2 Zero Hunger												
3 Good Health and Well-Being (3.6 & 3.9)								✓	✓	✓	✓	✓
4 Quality Education (4.7)				✓			✓					
5 Gender Equality (5.5, 5.A, & 5.C)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6 Clean Water and Sanitation (6.3 & 6.A)			✓								✓	✓
7 Affordable and Clean Energy (7.1, 7.2, 7.3, 7.A & 7.B)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8 Decent Work and Economic Growth (8.4, 8.9 & 8.10)	✓	✓	✓		✓		✓	✓	✓		✓	✓
9 Industry, Innovation and Infrastructure (9.4 & 9.5)			✓	✓	✓		✓	✓	✓		✓	✓
10 Reduced Inequalities												
11 Sustainable Cities and Communities (11.2, 11.5, 11.6)	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
12 Responsible Consumption and Production (12.2, 12.5, 12.7, 12.8, 12.A & 12.B)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
13 Climate Action (13.1, 13.2, 13.3, & 13.B)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
14 Life Below Water (14.1 & 14.A)											✓	✓
15 Life on Land (15.1 & 15.2)	✓	✓	✓									
16 Peace, Justice and Strong Institutions (16.6, 16.7)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17 Partnership for the Goals (17.1, 17.3, 17.7, 17.9, 17.14, 17.15, 17.16, & 17.17)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

20 <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>





Grid-connected solar system in Suva



## 5. Foundation Elements Needed for Roadmap Implementation

### 5.1 Governance and Institutional Arrangements

The Roadmap is important not only to the GOFs climate change commitments, but also to its contribution to the sustainable development and green growth of the electricity (and energy efficiency) and transport sectors in Fiji, as linked to their individual sectoral planning (see Section 2.5 for alignment of the Roadmap to sectoral planning). The actions and elements related to the implementation of the Roadmap will require constant coordination and active efforts amongst stakeholders within the GOF, private sector, Non-State Actors (NSAs), and development partners. Coordination and active efforts are critical not only in ensuring the successful implementation of the Roadmap, but also in ensuring momentum and common purpose amongst stakeholders.

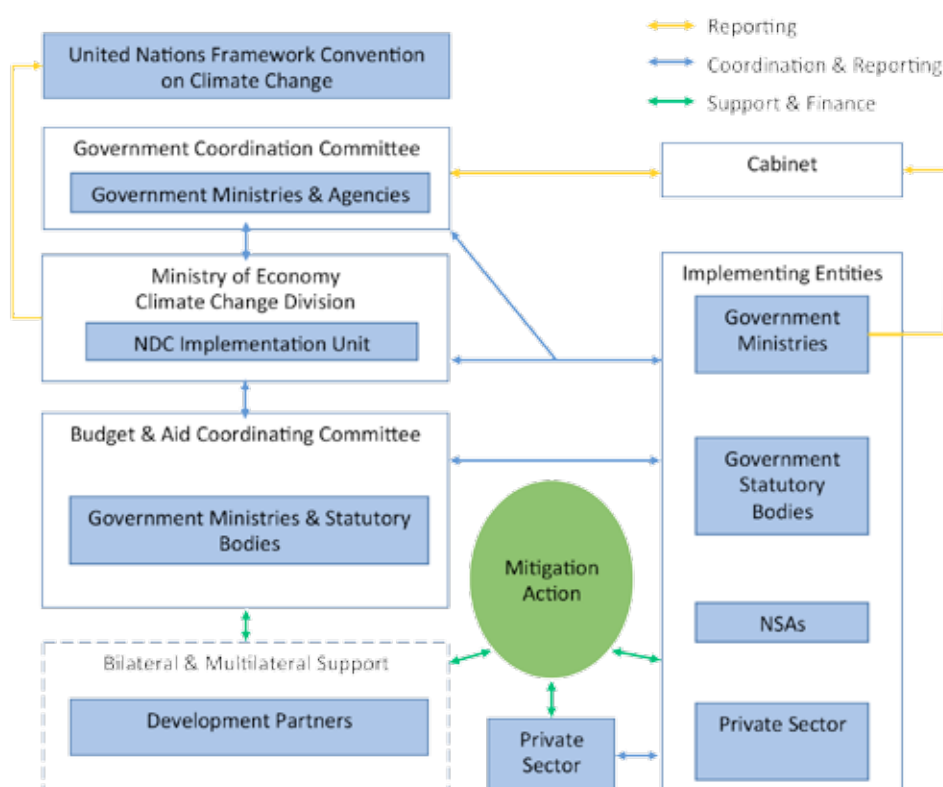


Figure 8: Proposed setup for the governance and institutional arrangement for the NDC Implementation Roadmap

In order to ensure the successful implementation of the Roadmap, the governance and institutional arrangements for implementing the Roadmap (shown in the figure above) will allow for an effective level of coordination and active efforts. This will require capacity within the various stakeholders mentioned in this section. When looking at this from the bottom up, the physical implementation of mitigation actions and interventions are expected to require various means of implementation and support, which would directly come from the private sector, government implementing entities, and development partners. Where the various means of implementation and support will be coordinated by the Budget and Aid Coordinating Committee, which is composed of government implementing entities and development partners.

A NDC Implementation Unit (NIU) will be set up within the Climate Change Division (CCD), with the goal to coordinate the implementation of the Roadmap, and oversee the MRV processes. The NIU will centralise coordination activities for mitigation actions at the national level, and support the government implementing entities responsible for implementing and regulating the Roadmap. It will also allow for a single unit to track and report progress to the GOF in meeting NDC targets, and coordinate further capacity building and training assistance and finance support with the Budget and Aid Coordinating Committee and other development partners bilaterally.

Finally, governance and high-level oversight is needed to ensure that proper coordination is occurring, that the Roadmap is being followed (or revised if needed), and that all actions fit within the GOF's strategic plans for the sustainable development and green growth of Fiji. Governance and high-level oversight will be provided by a Government Coordination Committee who will report to the Cabinet.

To further ensure and enshrine governance, it is proposed to develop and enact a Climate Change Act for Fiji to provide a legislative foundation to manage climate change risks, maximise the opportunities that arise from decisive action, and drive Fiji's transition to a low carbon, climate resilient community and economy. The Climate Change Act should also enshrine elements supporting mitigation actions in inter-ministerial cooperation, private sector engagement, and development partner cooperation.

The following points offer some specific roles of each of the bodies mentioned above:

#### Budget and Aid Coordinating Committee

- Receive strategic, planning, and tactical inputs from the NIU on the implementation of the Roadmap, and needs for means of implementation and support.
- Coordinate the provision and execution of means of implementation and support to mitigation actions under the Roadmap with the NIU and government implementing entities, as a way to ensure resource and cost efficiency are connected to means of implementation and support.

#### NDC Implementation Unit (NIU)

- Communicate and coordinate the actions to achieve the outcomes and activities outlined under the Roadmap with the respective government implementing entities responsible for securing the outcomes and executing the activities.
- Act as a secretariat, communicating progress within the GOF to the Government Coordination Committee; this would include hosting at least every three months inter-ministerial meetings on progress and coordination.
- Ensure that the relevant MRV data needs and stocktaking (Monitoring and Reporting) are conveyed to the appropriate government implementing entities, and collected in a time appropriate and quality manner, based on the periodic reporting needs of MRV.
- Ensure national level reporting (and consolidation) of the MRV, and the verification of results of MRV reporting.
- Coordinate MRV reporting to the GOF (Ministries and Cabinet), UNFCCC, and development partners, and the public (including NSAs) as deemed necessary.
- Act as a secretariat for the coordination of development partner provisions of means of implementation and support of mitigation actions under the Roadmap; this would include communicating progress and providing inputs to the Budget and Aid Coordinating Committee with the purpose to secure capacity building and technical assistance, technology transfer, and finance for mitigation actions.
- Review and amend the Roadmap, as deemed necessary by the GOF (noting periodic review by Ministries and Government Departments).

#### Government Coordination Committee

- Provide the GOF with strategic and tactical advice and decision making on the implementation of the Roadmap. Also, to oversee the progress of the Roadmap, and evaluate the efficient use of capacity and financial resources (e.g., governance).
- Facilitate, as needed, inter-ministerial actions required for implementation of the Roadmap.
- Highlight the need for, and to approve, periodic updates to the Roadmap.
- Communicate progress on the implementation of the Roadmap to the Cabinet; secretarial work will be done by the NIU.

## Broad Enabling Elements, Capacity Building & Technical Assistance Needs

- Carry out an assessment of capacity building and training needs within the key institutions involved in the Roadmap.
- Provide support to initiate the Committees and NIU and, if required, support the coordination and facilitation of the different institutions (especially in the beginning until a process is established).
- Provide technical assistance to the Government Coordination Committee to define the mandate, tasks, and responsibilities (including aspects of technical oversight and coordination of the Roadmap), and to ensure the close alignment of the Roadmap with the GOF's strategic plans for the sustainable development and green growth of Fiji.
- Provide technical assistance to the NIU to define the mandate, roles, and responsibilities of the NIU, and provide training and capacity building to the staff in terms of coordinating the Roadmap and MRV requirements and standards. This may also include training on technical aspects of sub-sector activities, and facilitating and coordinating inter-ministerial meetings under the Roadmap.
- Provide support to the Budget and Aid Coordinating Committee on climate finance initiatives and how this funding is treated under the Roadmap.
- Develop enabling elements including new legislation and policy, such as the enactment of a Climate Change Act for Fiji, and other legislation relevant for the Roadmap implementation.
- Provide technical assistance to review and amend the Roadmap, as deemed necessary by the GOF.
- Support the assessment of staffing requirements (for key positions inside the NIU, Committees, or other Government institutions with relevance to the NDC implementation).

## 5.2 Measurement, Reporting and Verification (MRV) of the Energy Sector

The main purpose of the MRV system of the energy sector is to transparently demonstrate progress made towards the targets defined in the NDC (e.g., GHG mitigation targets against a BAU GHG emissions baseline). However, this is not the only purpose of the MRV system; it must also track progress made in the implementation of mitigation actions and the enabling environment as defined in the Roadmap, assess the achieved impacts and co-benefits in terms of the SDGs (as well as gender inclusion), and track the use and results of means of implementation and support (e.g., capacity building and technical assistance, technology transfer, and finance). The three dimensions of the MRV system are depicted in the figure below.

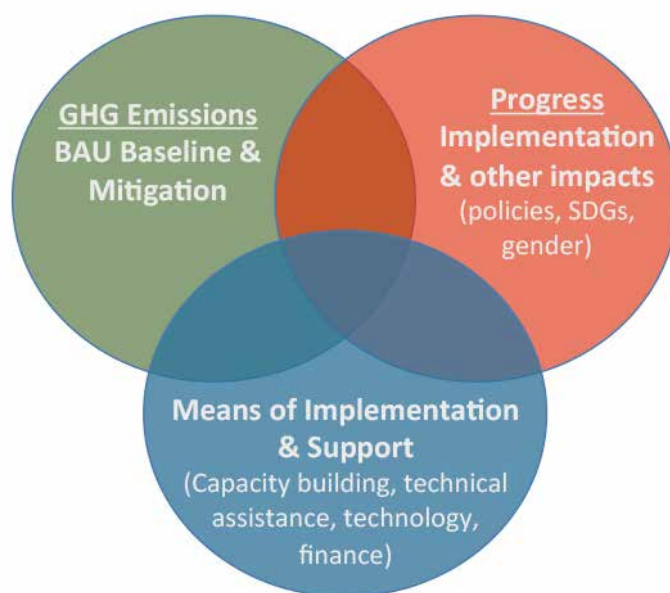


Figure 9: Dimensions of the MRV system for the energy sector

The robust MRV system for the energy sector will ensure transparency, accuracy, and comparability of information regarding GHG emissions, of both the ex-post BAU baseline and the GHG mitigation achieved in the energy sector. The MRV system, and supported activities, will work to strengthen both the national and sectoral data and methodologies required to thoroughly determine GHG emissions across the defined energy sector. In this manner, a bottom-up approach will be used to: i. strengthen data and methodologies; ii. use existing data and reporting pathways; iii. identify additional data and reporting pathway needs; and iv. improve the use of internationally recognised and strengthened methodologies and processes for verification. The strengthening of data and methodologies will be identified early in the short-term phase of the Roadmap to ensure data availability and reporting responsibilities.

It is important to note that the dimensions of the MRV system are directly interlinked. For example, the support provided may have direct influence on GHG emissions reductions achieved, or on other impacts, such as implementation of strengthened policy. This is why the MRV system tracks the three dimensions, as a means to show progress and use of support, but also as a means to identify gaps and bottlenecks to allow for improved implementation.

This MRV system strengthening is very important: it was identified during the fundamental assessment of the Roadmap that available data and data-gathering is not currently of a sufficient standard and quality to determine highly accurate sub-sector GHG emissions under robust methodologies. This strengthening of the MRV system will take place in cooperation with the implementing entities associated with data gathering and reporting in the energy sector. At a minimum, these will include the CCD, FBOS, DOE, LTA, MSAF, FCCC, FRCS (Fiji Revenue and Customs Service), Fiji Roads Authority (FRA), and Ministry of Fisheries and Forests (MOFF).

The MRV system for the energy sector will positively strengthen and underpin the national and sectoral GHG data quality, track the progress and effectiveness of mitigation actions and policies, help identify downstream national and sectoral priorities, and strengthen policy planning and prioritisation in the future.

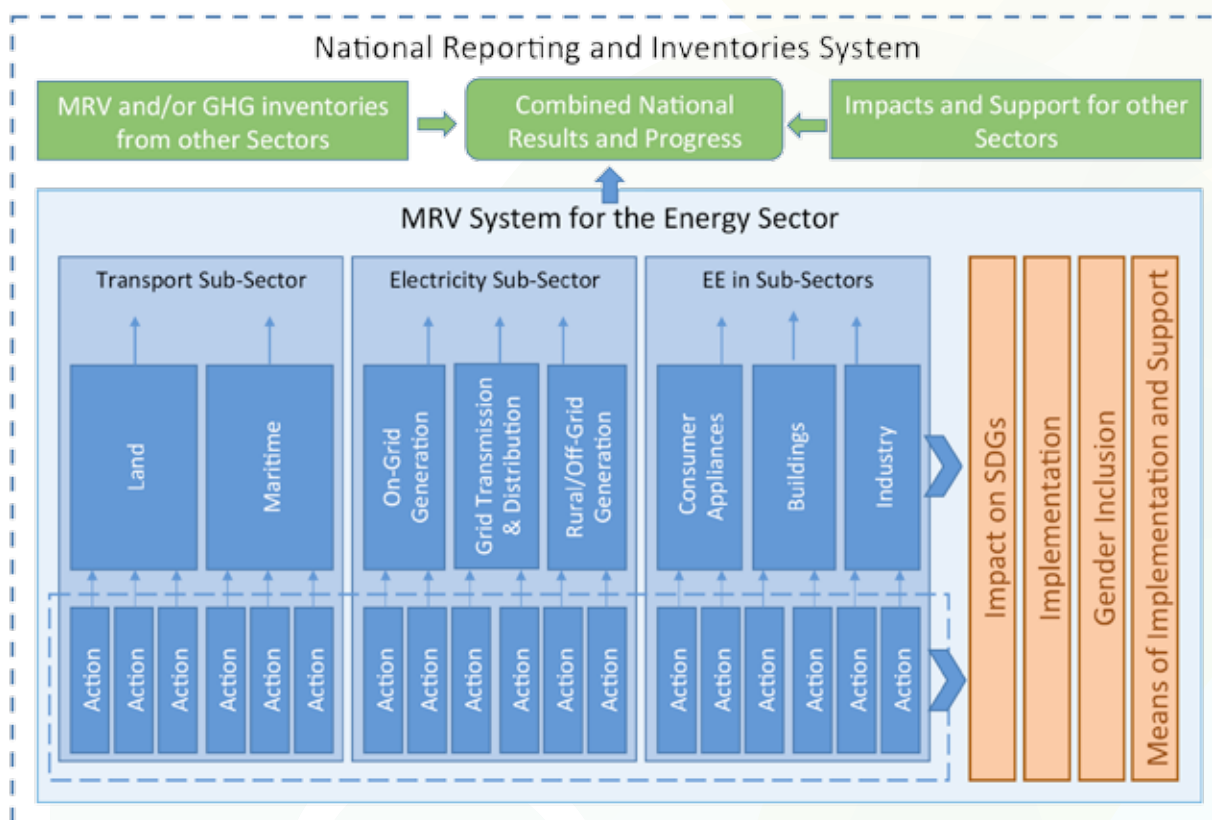


Figure 10: Bottom-up depiction of the MRV system for the energy sector and linkage to the National Reporting and Inventories System



This MRV system for the energy sector will be integrated into the National Reporting and Inventories System, which is currently operating under the CCD. The current national system focuses mainly on GHG inventories and reporting, and, in the energy sector, is monitored using a top-down approach with a focus on broad energy and fuel consumption data. The MRV system for the energy sector takes a bottom-up approach, and, as previously mentioned, includes more than just energy and GHG data. In the future, the GOF may address other sectors for GHG mitigation, thus the integration of these new sectors will be needed. In addition, the strengthening of the National Reporting and Inventories System is needed to allow it to address new indicators (e.g., for impact on SDGs, level of support) and to make it more robust. Figure 12 depicts the bottom-up MRV system for the energy sector and its linkage to the National Reporting and Inventories System.

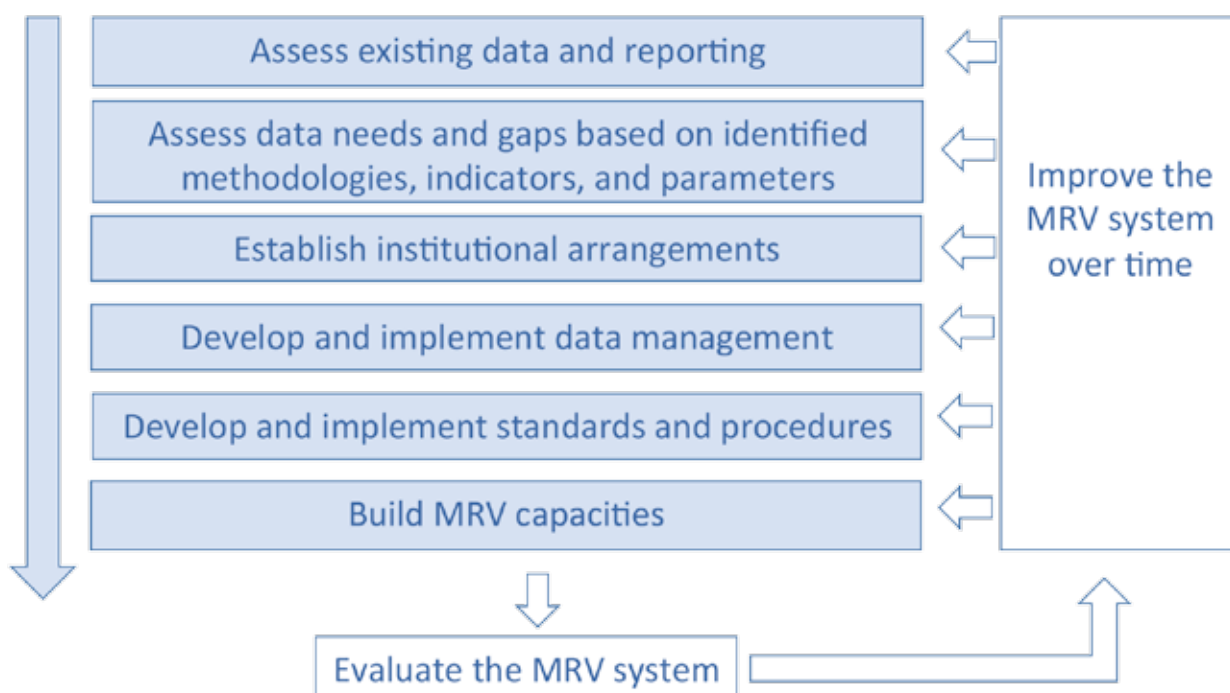


Figure 11: Steps for setting up the MRV system using a bottom-up approach

The key steps for setting up the MRV system for the energy sector are depicted in the figure above. It is important that that the existing national processes for data gathering and monitoring are examined before the MRV system is designed and implemented to allow for efficient integration and strengthening between what exists and what will be developed. Crucially, appropriate monitoring indicators and parameters (e.g., raw data needs) will be identified and monitored at either the mitigation action level, the sub-sector elements level, or at the sub-sector level (see Figure 12). The monitoring indicators and parameters are located in Annex B and in the fundamental assessment report for the Roadmap. In addition, the MRV system will be periodically reviewed and improved during the timeframe of the Roadmap. In this manner, the MRV system will be designed to allow for cost and resource efficiency, as well as accuracy and transparency.

## Broad Enabling Elements, Capacity Building & Technical Assistance Needs

- Design, implement, and build capacity for a robust and transparent bottom-up MRV system, including; the review of existing data and reporting, an assessment of data needs, institutional arrangements, a data management system, standards and procedures for MRV, and an evaluation mechanism.
- Strengthen bottom-up data gathering for the elements of each sub-sector (e.g., electricity, energy efficiency, and transport). This may include multi-agency activities addressing new sources and process for data gathering and reporting, as well as providing and gathering mandatory data through institutionalising of a command and control mechanism.
- Develop enabling elements including new legislation and policy, expanded mandates for FBOS, FRCS, DOE, MSAF, LTA, MOFF, and others, in addition to institutional strengthening.
- Integrate the MRV system into the National Reporting and Inventories System, including national level reporting to the UNFCCC and mitigation action-level reporting to Implementing Agencies and development partners.

## 5.3 Financing the Roadmap

Despite being a developing economy, Fiji has a well-established private financial services sector, private services/ industrial sector, and consumer base. The private financial services sector includes at least six private sector banks operating in Fiji<sup>21</sup> along with the state banks, which are the Reserve Bank of Fiji and Fiji Development Bank (FDB). The private services/industrial sector is a large consumer of energy and includes international and national hotel chains, national commercial companies, and state-owned enterprises such as FSC and FEA.

The GOF has established several incremental financial support incentives to increase the inclusion of renewable energy in power generation, the uptake of energy efficiency vehicles, and improvements for energy efficiency in electricity consumption. An example of an incentive is higher power purchase tariffs for renewable energy IPPs, as well as tax incentives, which in 2017 include, but are not limited to, the following (FRCA, 2016):

- Corporate tax waivers for electric vehicle charging stations, bio-fuel production, Small and Medium-Sized Enterprises (SMEs), and tax-free regions
- Duty concessions on equipment for renewable energy in power generation, electric vehicle charging stations, hybrid vehicles, and spare parts for ships
- Direct subsidy on low emissions diesel bus operators
- Investment deduction in forestry investing
- Investment allowance in capital expenditures for hotels
- Duty concessions for new hybrid vehicles

In addition to the examples of incentives above, the GOF is currently (in mid-2017) working to structure the following two financial instruments to support the implementation of the Roadmap.

### Fiji Green Bonds

A green bond is a debt security that is issued to raise capital specifically to support climate related or environmental projects. In 2017, US\$ 100 million worth of “green bonds” will be issued for the first time, specifically targeted towards projects that qualify under green finance. The Ministry of Economy (MOE) is working with the Reserve Bank of Fiji and the International Finance Corporation to launch these bonds with “green bond certification” before the COP23 meeting.

With a growing community of investors worldwide who demand financial instruments that are socially responsible, Fiji needs to attract these investors through financial instruments like green bonds. A list of climate change mitigation and adaptation projects eligible for green bonds financing has been identified.

21 These are ANZ Bank Fiji, Bank of Baroda Fiji, Bank of South Pacific (BSP) Fiji, BRED Bank Fiji, HFC Bank Fiji, and Westpac Bank Fiji.

## FDB Green Lending

Fiji has established the FDB as an accredited entity to the Green Climate Fund (GCF). The completion of the accreditation process for FDB ensures that Fiji has more direct access to GCF funds for climate change mitigation and adaptation projects. This will create opportunities not only for the Fijian private sector, the GOF, and state-owned enterprises, but also for the FDB who can serve the region through green lending products that constitute the concessional terms of the GCF.

## Estimated Investment Needs for the Roadmap

Under Fiji's NDC, the mitigation target aims to reach 30% GHG reduction below BAU by 2030 in the energy sector. In striving to achieve this target, and mitigate 627,000 tCO<sub>2</sub> against the BAU baseline in 2030, the total investment costs in the energy sector are estimated to be US\$ 2.97 billion between 2017–2030, plus the estimated US\$ 119 million already invested between 2014–2017. The table below offers the short- (2020), medium- (2025), and long-term (2030) outlook for the results and investment needs of potential mitigation actions in the energy sector.

Table 4: Estimated investment needs for the Roadmap implementation

Investment Needs (US\$ million) <sup>22</sup>	Total	2020	2025	2030
Electricity Generation and Transmission	1,671	462	861	348
Electricity Demand-Side Energy Efficiency	150	34	58	58
Transport (Land and Maritime) <sup>23</sup>	1,149	269	440	440
Term Investment Needs (US\$)		765	1,359	846
Total Investment Needs (US\$)				2,970

It can be expected that both the Electricity Generation and Transmission Sub-Sector and the Transport (Land and Maritime) Sub-Sector would, under normal ideal conditions, require finance through equity and debt, typically 20-30% equity and 70-80% debt. The electricity demand-side energy efficiency is mostly household appliances and other lower cost electricity-consuming items, which are often purchased via household income. Thus, under normal ideal conditions for finance, and assuming Fiji had an open line to credit and wealthy consumers, the total amount of equity, which would be required for implementing the Roadmap could be between US\$ 594 and 891 million, and debt between US\$ 2,079 and 2,376 million. Fiji is a SIDS and does not currently have an economy that can bare the above financial burden on its own, thus financial instruments and support are needed for Fiji to reach the transformation outlined in the Roadmap.

## Needs for Financial Instruments and Support

As indicated above, Fiji has already established, or is in the process of establishing, several financial products. In the past, Fiji has implemented incremental financial support incentives for the energy sector. The GOF has contributed funds from the state budget for past investments in the energy sector, along with state and private banks who have issued loans, and state-owned enterprises and private sector companies who have invested in equity. This contributed to a level of investment in the energy sector estimated to be at least US\$ 119 million between 2014-2017 (GGGI/MOE, 2017). This investment was predominately from developed financial instruments and other sources originating from the GOF and the private sector, as well as some support provided by development partners in the form of loans and capacity building and technical assistance (highlighted in blue in the figure below).

Though Fiji has made progress in implementing financial instruments and gaining support for energy sector investments in the past, the scale of investments needed for the implementation of the Roadmap outpaces Fiji's current ability to finance the transformational change envisioned. Therefore, new or significantly expanded financial instruments and support are needed. These are highlighted in Figure 14.

<sup>22</sup> Regarding investment cost estimations, the costs are defined in the period of 2015-2017, where the Roadmap extends into the future until 2030. Therefore, investment costs changes (+/-) should be expected due to inflation, global market conditions, and changes in technology costs. Uncertainty in investment costs gradually increases the further the investments are made extending beyond the 2015-2017 period.

<sup>23</sup> This is an average of US\$ 88 million annual investment in transport systems and efficient vehicles from 2018 to 2030.

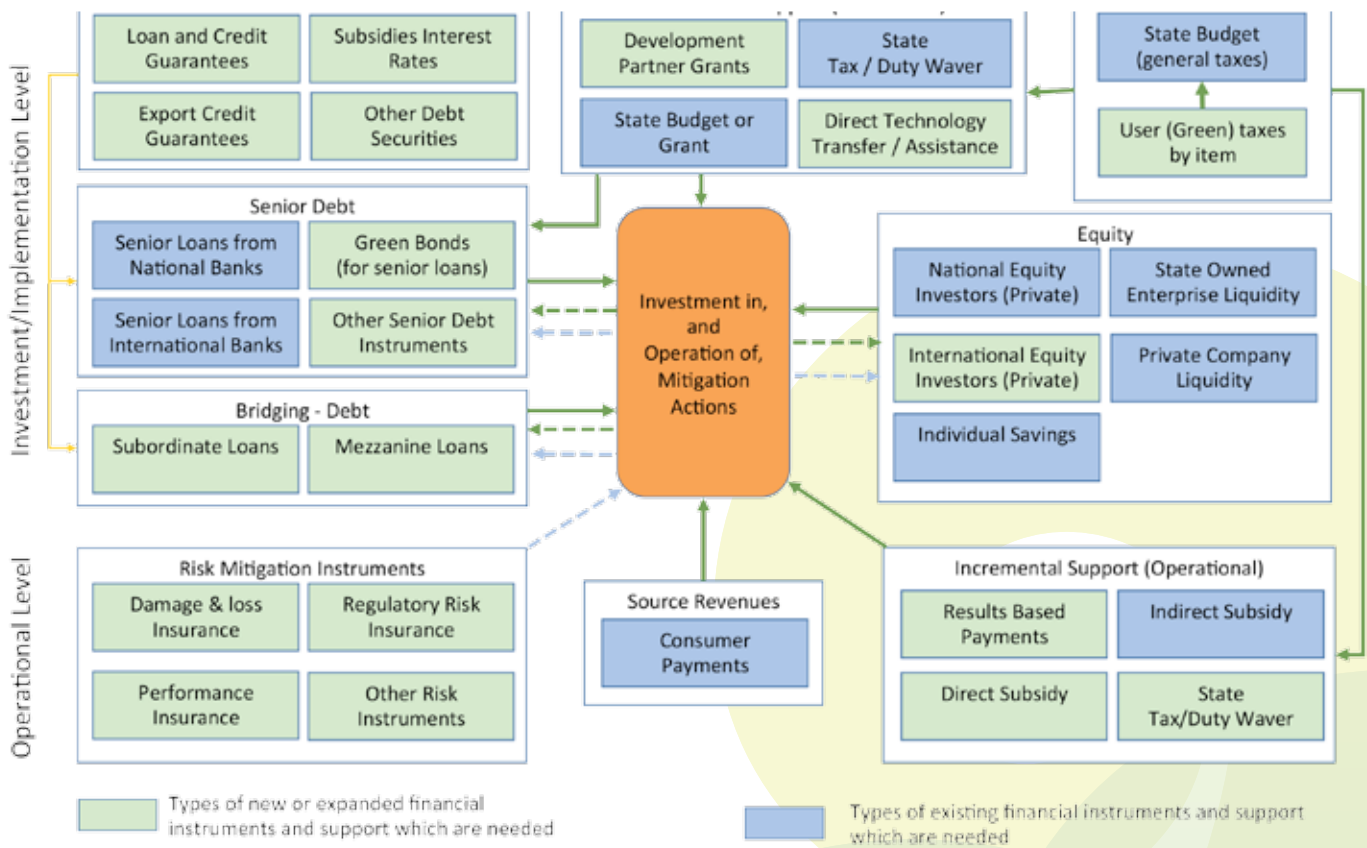


Figure 12: Financial Flows - Needs for financial instruments and support at the investment and operational level

Given the different types of investment (e.g., electricity grid, electricity generation, vehicles, ship improvements, industrial-scrappage, household appliances and lighting, and building improvement and energy management), there are several categories for financial instruments and support, which can significantly improve and enable the financing of the transformational change of the energy sector outlined in the Roadmap. Many of these will need to be individually structured to allow for direct use in the energy sub-sectors; however, overall sub-sector specific and cross-cutting needs for financial products and support also include:

- **Credit Enhancement Instruments:** Credit guarantees and subsidies and below-market interest rates can improve capital availability and lower annual operating costs. These have been successfully implemented in Fiji on a per-project basis, but can be expanded across the energy sector.
- **Senior Debt:** Allocating more senior debt (in connection with credit guarantees) will introduce more capital availability into the energy sector. This could occur by increasing the percentage of commercial bank capital allocated to RE/EE, using green bonds, and broader structured lending.
- **Bridging Debt:** Bridging debt, such as subordinate loans and mezzanine loans, are commonly used in other parts of the world to finance investments in renewable energy power generation. This type of debt is often restructured as senior debt after projects are commissioned, and can also reduce initial equity demand.
- **Risk Mitigation Instruments:** As indicated in Section 1, Fiji is exposed to significant climate impacts. Thus, energy-related assets are at risk to adverse weather conditions. In addition, the regulatory environment is undergoing strengthening for the energy sector as part of the Roadmap. Therefore, a broader range of insurance products (e.g., for loss/damage, regulatory change, performance) will be needed to ensure the transformational change outlined in the Roadmap.

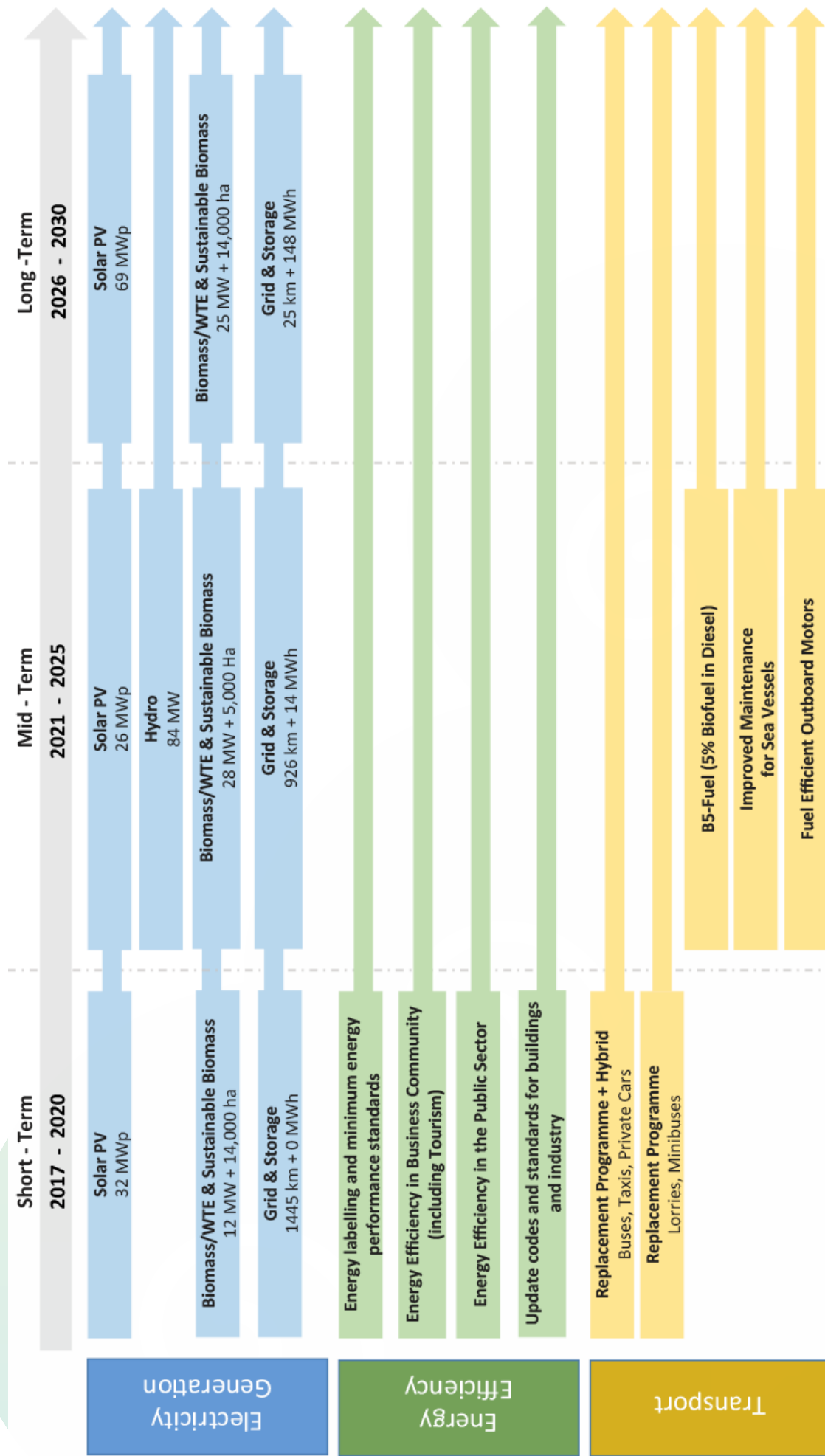


- **Equity:** Fiji has limited financial capacity in terms of the equity needs for the investment to ensure the transformational change outlined in the Roadmap (mainly in the electricity context). Therefore, equity from international sources is needed to implement the Roadmap. It is important to note that recent private sector investments in renewable energy power generation in Fiji had significant foreign equity contributions in the structured finance used.
- **Incremental Support:** Incremental support at the investment and operational level is needed to ensure the transformational change outlined in the Roadmap. This includes grants, results-based-payments, tax and duty waivers, and direct and indirect subsidies. It is well known that many renewable energy and energy efficiency (low carbon) technologies have higher costs than existing fossil-based technologies, which are currently commonplace in Fiji. The reduction of this incremental cost gap is key to ensuring the successful implementation of the Roadmap. The incremental support needs must to be carefully determined through further assessments under the Roadmap, preferably via an economic analysis.



*Monasavu Hydropower reservoir*

## 6. Time Plan for Implementation







Wastewater treatment plant in Suva



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# ANNEX A – Logical Framework for Mitigation Actions

Logical framework for the electricity sub-sector in the NDC Implementation Roadmap	
Outcome A. Strengthened enabling environment for private sector and state-owned enterprise -based implementation of GHG mitigation actions	
Output A.1 - Improved regulatory and planning environment for greater private sector and state-owned enterprise participation in electricity generation and services	
A.1.1	The establishment of renewable energy IPPs, PPPs, and PPs for generation is supported through a transparent process of direct tendering, reverse auctioning, or direct private sector initiatives.
A.1.2	IPPs, PPPs, and PPs for generation are supported through an installation-specific, transparent process of securing PPAs, tariff evaluation and determination, and licensing.
A.1.3	Public electricity suppliers (FEA and successors), and private suppliers of electricity, are supported in the establishment of smart-grid and grid-storage facilities through a transparent process of direct tendering, reverse auctioning, or direct private sector initiatives.
A.1.4	Public electricity suppliers (FEA and successors), and private suppliers of electricity, are supported in the establishment of smart-grid and grid-storage facilities are supported through an installation-specific, transparent process of securing PPAs, tariff evaluation and determination, and licensing.
A.1.5	Public electricity suppliers (FEA and successors), and private suppliers of electricity, are supported through a transparent process of determination of consumer tariffs and fees which take into account actual costs of generation and transmission/distribution/storage/stability, and include the establishment of direct and/or indirect cross-subsidies for rural areas and low energy consumers.
A.1.6	A PPP Act and PPP Regulatory Guidance is established for Fiji, which takes into consideration the technical and economic conditions of IPPs, PPPs, and electricity suppliers.
A.1.7	A rural electrification master plan is completed to map out locations for achieving 100% electrification, by either new grid connections or standalone solutions (single supply or mini-grids), with a preference for renewable energy.
Output A.2 - Increased private sector and state-owned enterprise participation in supplying biomass to the electricity sub-sector	
A.2.1	The private sector is supported in increasing and sustaining the availability of skilled and highly skilled domestic labour to operate and maintain biomass-based electricity production in Fiji.
A.2.2	The private sector is supported in the large-scale domestic production of sustainable biomass through technology and knowledge transfer, and by increasing and sustaining the availability of skilled and highly skilled domestic labour, built on non-discriminatory and gender inclusive practices.
A.2.3	The use of sustainable biomass residues are optimised across Fiji, with a specific focus on creating and sustaining a GIS resource depository, and through technology and knowledge transfer in advanced processing techniques, logistics planning, and training of skilled domestic labour, built on non-discriminatory and gender inclusive practices.
A.2.4	An increase in sugar cane productivity and production is supported across Fiji, with a specific focus on technology and knowledge transfer in advanced farming and harvesting techniques, and transport logistics planning, built on non-discriminatory and gender inclusive practices.
A.2.5	A financial instrument is developed, funded, and operated to support the payment of sugar cane upon delivery by farmers (e.g., a gate-payment of sugarcane).
A.2.6	The piloted PP model between farmers and FSC is developed further and expanded across Fiji, and includes an information dissemination campaign.
A.2.7	Suitable locations (multiple-areas) for new sustainable biomass plantations are identified, along with suitable locations for dedicated biomass processing (pellet) production facilities.
Output A.3 - Improved access to finance and financial risk instruments by the private sector and state-owned enterprises	
A.3.1	New financial instruments are developed and funded, which support sustainable energy (RE and EE) through the climate finance of debt instruments (loans, green bonds, and loan guarantees), and the incremental cost needs (grants and subsidies), which integrate non-discriminatory and gender inclusive practices.
A.3.2	New insurance products for resilience are developed and implemented to cover damage and loss from severe weather events.
A.3.3	An international promotion strategy is designed and executed to encourage a high level of direct foreign investment (both equity and debt) into the energy sector in Fiji.
A.3.4	The process for accessing climate finance and development assistance for the energy sector is both coordinated and supported (e.g., identification, preparation, application, settlement, and M&E of projects and programmes).
Outcome B. GHG emissions are reduced through renewable energy-based mitigation actions in the electricity sub-sector	
Output B.1 - Biomass based electricity generation is increased throughout Fiji	
B.1.1	Pre-feasibility studies are completed for at least 46 MW (combined) of new biomass and WTE power plants (including multiple suitable locations, technical specifications and outputs, and financial analysis).

B.1.2	At least 46 MW (combined) of new biomass and WTE power plants are prepared for finance and initial implementation. This includes site-specific full technical/economic feasibility studies, environmental and social impact assessments, gender inclusion studies, biomass resource availability studies, and financial structuring.
B.1.3	At least 46 MW (combined) of new biomass and WTE power plants are connected to the grid and operational.
B.1.4	The electricity output of existing biomass (18 MW) power capacity is increased through supporting PPs in the sustainable growth and utilisation of biomass resources, and in securing suitable IPP tariffs adjusted for the cost of sustainable biomass.
<b>Output B.2 - Solar PV-based electricity generation is increased throughout Fiji</b>	
B.2.1	The development and implementation of national standards for solar PV equipment and conditions for their supply (e.g., quality, warranties) is completed.
B.2.2	Pre-feasibility studies are completed for at least 123 MWp (combined) of on-grid solar PV generation, and at least 4 MWp (combined) of off-grid solar PV generation (including multiple suitable locations, technical specifications and outputs, and financial analysis).
B.2.3	At least 123 MWp (combined) of on-grid solar PV generation, and at least 4 MWp (combined) of off-grid solar PV generation are prepared for finance and the start of implementation. This includes site-specific full technical/economic feasibility studies, environmental and social impact assessments, gender inclusion studies, biomass resource availability studies, and financial structuring (noting that these may not be required for off-grid solar PV generation).
B.2.4	At least 123 MWp (combined) of on-grid solar PV power stations are connected to the grid and operational, and at least 4 MWp (combined) of off-grid solar PV power stations/hybrids/mini-grids are operational.
<b>Output B.3 - Hydro based electricity generation is increased throughout Fiji</b>	
B.3.1	At least 84 MW (combined) of new hydro power plants are prepared for finance and the start of implementation. This includes site-specific full technical and economic feasibility studies, hydrology resource studies, environmental and social impact assessments, gender inclusion studies, compliance studies with the World Commission on Dams, and financial structuring.
B.3.2	At least 84 MW (combined) of new hydro power plants are connected to the grid and operational.
<b>Output B.4 - Other sources of renewable energy electricity generation are increased and mapped throughout Fiji</b>	
B.4.1	1 MW of biogas power generation is prepared for finance and initial implementation. This includes site-specific full technical/economic feasibility studies, environmental and social impact assessments, gender inclusion studies, and financial structuring.
B.4.2	At least 1 MW of biogas power generation is connected to the grid and operational.
B.4.3	The collection and mapping of wind resource data is continued, and suitable locations for at least three on-grid wind power stations are identified and quantified in technical and financial feasibility studies, as options for future generation.
B.4.4	The mapping of geothermal resource data is continued, and suitable locations for at least one geothermal power station is identified and quantified in technical and financial feasibility studies, as options for future generation.
B.4.5	A full technical and economic investigation on additional renewable energy power generation is completed for the large-scale introduction of electric vehicles in Fiji.
<b>Output B.5 - Fiji has an improved electricity transmission grid (connection, stability, and synchronisation)</b>	
B.5.1	The Vatukoula Gold Mines Grid Extension is completed (including the connection of other industry in the area). Including: i. full technical and financial feasibility study including determination of electricity demand, survey of pathway, determination of technical specifications of the power lines/step down stations/distribution systems; ii. financial structuring and finance; and iii. implementation of the grid extension.
B.5.2	The smart-grid (synchronisation) systems are installed. Including: i. full technical and financial feasibility study including determination of technical needs and interoperability, and specifications of the smart-grid (synchronisation) systems; ii. financial structuring and finance; and iii. implementation of the smart-grid (synchronisation) systems.
B.5.3	At least 2,400 km (132 kV and 33 kV combined) of grid are prepared for finance and initial implementation. This includes determining the most suitable locations, site-specific full technical/economic feasibility studies, environmental and social impact assessments, gender inclusion studies, technical needs and interoperability studies, and financial structuring.
B.5.4	At least 2,400 km (132 kV and 33 kV combined) of grid facilities are installed. This includes assistance for direct tendering, installation and commissioning.
B.5.5	At least 162 MWh (combined) of grid storage facilities are prepared for finance and initial implementation. This includes determining the most suitable locations, site-specific full technical/economic feasibility studies, environmental and social impact assessments, gender inclusion studies, technical needs and interoperability studies, and financial structuring.
B.5.6	At least 162 MWh (combined) of grid storage facilities are connected to the grid and operational. This includes assistance for either the direct tendering or reverse auctioning process, securing PPAs, tariff and fees determination, operator licensing, installation and commissioning.

### Other potential GHG mitigation interventions and actions

Additional on-grid wind power generation

Additional on-grid geothermal power generation

Additional on-grid biogas power generation

### Logical framework for the electricity demand-side energy efficiency in the NDC Implementation Roadmap

Outcome A. Strengthened enabling environment for the private and public sectors implementation of GHG mitigation actions for energy efficiency in the electricity sub-sector

Output A.1 - Improved educational, regulatory, and planning environment for greater private and public sector participation in energy efficiency in the electricity sub-sector

A.1.1	A programme is designed and implemented for information dissemination of EE practices and technologies in the Fiji School Curriculum, which is non-discriminatory and gender inclusive. This includes establishing a baseline for current teaching of EE practices and technologies, and preparing and implementing a new curriculum on EE practices and technologies, including a showcase of technology use in Fiji.
A.1.2	A programme is designed and implemented for information dissemination of EE practices and technologies in the Fiji economy/public as a whole, which is non-discriminatory and gender inclusive. This includes establishing a baseline for current use of EE practices and technologies in Fiji, and showcasing EE standards for goods, and preparing and implementing a marketing and promotion campaign. This also includes showcasing technologies used in Fiji, and third party reviews of their energy savings and economic benefits.
A.1.3	Minimum energy efficiency performance and labelling standards are updated for existing applicable goods, and expanded for new goods. This includes the development and continued update of an energy information database (energy efficiency) for imported or manufactured goods.
A.1.4	Regulations are developed requiring energy audits of EE improvements which seek government support/incentives, including the development of energy audits, standards, and guidelines based on ISO 50001/50002 or another robust standard. This includes non-discriminatory and gender inclusive training for national professionals in energy audit standards and guidelines.
A.1.5	Financial incentives are developed and implemented (long-term) to encourage the use of EE practices and technologies in businesses in Fiji. Incentives may include, for example, waivers on import duties, excise taxes, income and/or dividend taxes, investment allowances, and specific subsidies.
A.1.6	A comprehensive programme is implemented to perform new energy audits and implement recommendations for EE improvements in public buildings (including EE audits of new buildings designs). This includes allocating state funds and other climate finance in the annual state budget to improve public buildings.
A.1.7	Legislation is adopted to strengthen the enabling environment for energy service companies (ESCO) to undertake and finance public and private sector energy efficiency projects. This includes the preparation of a needs assessment analysis including a legislative and gap analysis to find out whether existing legislations are present and sufficient to establish and strengthen the participation of ESCOs in Fiji.

Output A.2 - Improved regulatory and planning environment for greater private and public sectors participation in energy efficiency in buildings

A.2.1	The findings from previous studies on EE in new buildings are implemented in the national building code, including passive technologies (including extensive renovations of existing buildings). As well, one or more showcase buildings are identified and promoted to the building and commercial property industry.
A.2.2	New financial instruments, which integrate non-discriminatory and gender inclusive practices, are developed and funded, which support sustainable energy (RE and EE) through the climate finance of debt instruments (loans, green bonds, and loan guarantees), and the incremental cost needs (grants and subsidies).
A.2.3	New insurance products for resilience are developed and implemented to cover damage and loss from severe weather events (incorporating lower premiums for buildings following the new building code).

### Logical framework for the transport sub-sector in the NDC Implementation Roadmap

Outcome A - GHG emissions are reduced through mitigation actions in the land transport sub-sector

Output A - Improved regulatory and planning environment for greater private sector participation in a more energy efficient land transport sector

A.1.1	The completion of a country-specific, comprehensive transport data assessment for fuel consumption and GHG emissions in land transport separated by sub-categories (to be defined, e.g., type of cars, private, commercial, buses, taxis).
A.1.2	A comprehensive, sub-sectoral technical and economic feasibility study(ies) is completed for introducing Euro IV/VI fuel standard across Fiji on all vehicle types in order to create action for a more energy efficient transport sector, including an impact and gap analysis to be conducted per intervention or group of interventions (e.g., on available information, data, impacts), an environmental and social impact assessment, and a gender inclusion study.



A.1.3	Countrywide use of low sulphur fuel for diesel that complies with Euro IV standards is reached from 2017, and Euro VI standards are reached from 2022.
A.1.4	A needs assessment/pre-feasibility study is completed for large-scale vehicle scrappage facility(ies), including the development of scrappage quality and safety standards (including waste handling and export of scrapped material).
A.1.5	At least one large-scale vehicle scrappage facility is prepared for finance and the start of implementation. This includes full, site-specific technical/economic feasibility studies, environmental and social impact assessments, gender inclusion studies, biomass resource availability studies, and financial structuring (noting that these may not be required for off-grid solar PV generation).
A.1.6	At least one large-scale vehicle scrappage facility is implemented and operational in Fiji with the capacity to scrap thousands of vehicles each year. This includes non-discriminatory and gender inclusive training and information dissemination on scrappage standards provided to scrappage facility operators.
A.1.7	The completion of eligibility criteria for imported vehicles of all types to participate in the programme for a more energy efficient transport sector, and eligibility criteria for vehicles to be scrapped (e.g., age limits, type, size, status of registration, fuel type, etc.).
A.1.8	The completion of a planning and economic impact study, which defines the structure and goals of both positive and negative incentives to encourage a more energy efficient land transport sub-sector. This includes enforcement mechanisms for the incentive scheme (e.g., duty or tax waivers on imported vehicles, subsidy for scrappage fee) and for other interventions in land transport.
A.1.9	A countrywide awareness and dissemination campaign, which is non-discriminatory and gender inclusive, is prepared and implemented to inform vehicle owners, operators, associations, dealers and other relevant stakeholders (e.g., banks) about both the mitigation actions for a more energy efficient transport sector and the incentive scheme.
Output A.2 - GHG emissions are reduced in the private passenger vehicle fleet (via age limits; Euro IV/VI Standard) and partial replacement with hybrid vehicles (including scrappage)	
Output A.3 - GHG emissions are reduced in the lorry vehicle fleet (<16t) (via age limits; Euro IV/VI Standard) (including scrappage)	
Output A.4 - GHG emissions are reduced in the taxi vehicle fleet (via age limits; Euro IV/VI Standard) and partial replacement with hybrid vehicles (including scrappage)	
Output A.5 - GHG emissions are reduced in the bus vehicle fleet (via age limits; Euro IV/VI Standard) and partial replacement with hybrid vehicles (including scrappage)	
Output A.6 - GHG emissions are reduced in the mini-bus vehicle fleet (via age limits; Euro IV/VI Standard) (including scrappage)	
Output A.7 - GHG emissions are reduced via the introduction of 5% biofuel content for diesel fuel (imported) - "B5 fuel"	
A.7.1	Completed assessment of options for the import of B5 diesel fuel (e.g., from Singapore, Korea, or Australia), and for the availability of storage and distribution in Fiji.
A.7.2	The national policy and regulation for the mandate to use and import B5 diesel fuel is completed.
A.7.3	Mechanisms for fuel trading and for establishing contracts to import diesel B5 fuel into Fiji are developed and implemented.
A.7.4	The use of diesel B5 fuel is prevalent in Fiji.
A.7.5	Negotiations completed and agreements about fuel imports/exports reached with other Pacific Island States and with fuel logistic companies (transport and storage facilities and petrol stations) for using B5 fuel.
Outcome B. GHG emissions are reduced through mitigation actions in the maritime transport sub-sector	
Output B.1 - Improved regulatory and planning environment for greater private sector participation in a more energy efficient maritime transport sector	
B.1.1	The completion of a country-specific, comprehensive transport data assessment for fuel consumption and GHG emissions in maritime transport separated by sub-categories (to be defined, e.g., small, medium, and large sea vessels, outboard motors).
B.1.2	A comprehensive, sub-sectoral technical and economic feasibility study(ies) is completed to introduce more energy efficient, maritime transport across Fiji on all vessel and propulsion types to create action for a more energy efficient transport sector. This includes an impact and gap analysis to be conducted per intervention or group of interventions (e.g., on available information, data, impacts), an environmental and social impact assessment, and a gender inclusion study (especially for rural areas).
B.1.3	The completion of a planning and economic impact study, which defines the structure and goals of both positive and negative incentives to encourage a more energy efficient maritime transport sub-sector. This includes enforcement mechanisms of the incentive scheme (e.g., duty or tax waivers for imported outboard motors, subsidy for additional maintenance, use of RE propulsion) for the interventions in maritime transport.
B.1.4	A countrywide awareness and dissemination campaign, which is non-discriminatory and gender inclusive, is prepared and implemented countrywide to inform vehicle owners, operators, associations and other relevant stakeholders (e.g., shipping companies, associations, banks) about both the mitigation actions for a more energy efficient transport sector and the incentive scheme.
Output B.2 - GHG emissions are reduced through improved maintenance services for sea vessels (i.e., hull cleaning and hull coating; propeller maintenance; full engine retrofit)	

Output B.3 - GHG emissions are reduced through fuel efficiency improvements for outboard motors
<b>Other potential GHG mitigation options</b>
Anti-congestion plan for urban areas (Suva, Nadi, Lautoka)
Dedicated bus lanes for Kings Road and Grantham Road
Bus Rapid Transit (BRT) for Suva to Nausori Airport
Eco-driving training (buses, mini-buses, trucks, taxis)
Improvement of sea vessel fleet (age limits, energy efficiency standard)
Renewable energy-driven vessels
Tax scheme (incentives) for fuel efficient vehicles

## Logical framework for the foundation elements needed for the NDC Implementation Roadmap

Outcome A. Strengthened institutional, MRV, and financial enabling environment during implementation of roadmap	
Output A.1 – Strengthened governance and institutional arrangements under NDC implementation	
<i>NOTE</i>	Sub-sector specific activities for strengthened governance and institutional arrangements are highlighted in the logic framework of each sub-sector.
A.1.1	The assessment of gaps, capacity building and training needs within the key institutions involved in the Roadmap is completed. This includes an assessment of staffing requirements (for key positions inside the NIU, Committees or other Government institutions with relevance to the NDC implementation). The mandate, tasks, and responsibilities (including aspects of technical oversight and coordination of the Roadmap) of the Government Coordination Committee will be defined to ensure close alignment of the Roadmap with the GOF's strategic plans for the sustainable development and green growth of Fiji. Support to the Committees and NIU will be provided as well as the coordination and facilitation of different institutions (especially in the beginning until a routine exists). This will be followed by enhanced legislation and policy to allow for comprehensive implementation of the Roadmap, including the development and enactment of a Climate Change Act for Fiji and other legislation relevant to the governance and institutional arrangements under the Roadmap.
A.1.2	The NIU is defined in terms of its mandate, roles, and responsibilities, and staff is trained and their capacity is increased in terms of coordinating the Roadmap and implementing MRV requirements and standards. This may also include training on technical aspects about sub-sector activities, and facilitating and coordinating inter-ministerial meetings under the Roadmap. Capacity is also developed for reviewing and amending the Roadmap as deemed necessary by GOF.
A.1.3	The identification and coordination of the inclusion of climate finance initiatives with development partners, and how this funding is treated under the Roadmap, supports the Budget and Aid Coordinating Committee.
Output A.2 – Strengthened MRV system under NDC implementation	
<i>NOTE</i>	Sub-sector specific activities for a strengthened MRV system are highlighted in the logic framework of each Sub-sector.
A.2.1	A robust, transparent, and bottom-up MRV system for the energy sector is designed and implemented, and relevant statutory bodies are trained. This includes the review of existing data and reporting, an assessment of data needs, institutional arrangements, a data management system, standards and procedures for MRV, and an evaluation mechanism. Legislation and policy are enhanced to allow for comprehensive implementation of the MRV system.
A.2.2	Sub-sector, bottom-up data gathering is strengthened. This may include multi-agency activities addressing new sources and process for data gathering and reporting, and providing and gathering mandatory data through the institutionalisation of a command and control mechanism. In addition, this may include expanded mandates for FBOS, FRCS, and others, as well as institutional strengthening.
A.2.3	The energy sector MRV system is integrated into the National Reporting and Inventories System. This includes national level reporting to the UNFCCC and mitigation action level reporting to Implementing Agencies and development partners.
Output A.3 – New financial instruments and incremental financial support are available in Fiji for roadmap implementation	
<i>NOTE</i>	Sub-sector specific activities for financial instruments and incremental financial support are highlighted in the logic framework of each Sub-sector.
A.3.1	Needs for cross-cutting financial instruments and incremental financial support are defined in detail to allow for their design. Financial institutions and development partners are identified who act as executing entities for such financial instruments and support.
A.3.2	Cross-cutting financial instruments are designed and made available in Fiji to provide capital (debt and equity) to mitigation actions and to reduce financial risks during the operation of mitigation actions.
A.3.3	Cross-cutting support is designed and made available in Fiji to provide incremental financial support to mitigation actions.

## ANNEX B – Information Tables for Mitigation Actions

Electricity: Short-term Mitigation Actions	
<b>Action Name</b>	E1: Grid Extension and Improvements (1445km grid) E2: Increased RE Power Generation (32MWp solar PV, 12 MW biomass) E3: Increased Sustainable Biomass for Fuel use (14,000 ha)
<b>Description</b>	Grid extension and improvements will be made on Viti Levu, Vanua Levu, Taveuni, and Ovalau (including 1445km of 132kV & 33 kV lines).  This will help support an increase in RE power generation capacity on Viti Levu, Vanua Levu, Taveuni, Ovalau and rural areas of a total of 32 MWp of solar PV capacity, and 12 MW of biomass generation capacity.  In addition, activities will support the setup (production and processing) of up to 14,000 ha of sustainable biomass for fuel use.
<b>Key Considerations</b>	<ul style="list-style-type: none"> <li>- Specific locations for new IPPs and sustainable biomass planting are not mapped out.</li> <li>- Access to climate finance (loans and guarantees) are needed to secure debt, and incremental finance is needed to cover the incremental cost differences faced.</li> <li>- Financial risk products are needed to insure against the cost of damage and loss in production from severe weather.</li> <li>- There is not enough skilled and highly skilled domestic labour to operate and maintain biomass power production in Fiji, as FSC and Tropik Woods employ nearly all of the domestic labour in this context.</li> <li>- There are still no fixed national standards for solar PV equipment and conditions to their supply (e.g. quality, warranties).</li> <li>- Small grower and/or cooperative type sustainable biomass production and processing schemes are needed.</li> </ul>
<b>Minimum Data Needs for MRV</b>	<ul style="list-style-type: none"> <li>- Central MRV database needs to be linked to DOE and FEA data.</li> <li>- Annual electricity generation data from power producers are needed along with fuel consumption data. Social economic data such as persons employed or trained (including numbers of women and men) are also needed.</li> <li>- Annual biomass planting and production data from plantations and small growers are needed along with fuel consumption data. Social economic data such as persons employed or trained (include numbers of women and men) are also needed.</li> <li>- Periodic study/evaluation on biomass sustainability.</li> <li>- Total investment and development support needs to be tracked.</li> </ul>
<b>GHG Mitigation Potential</b>	Annual expected GHG mitigation: 42,000 tCO <sub>2</sub> /yr; 21,000 tCO <sub>2</sub> /yr (solar PV); 21,000 tCO <sub>2</sub> /yr (biomass)
<b>Total Investment</b>	The total investment required over the period of the Roadmap (2017-2030):  US\$ 462 million: US\$ 339 million (grid extension and improvement); US\$ 46 million (biomass generation); US\$ 58 million (on- and off-grid solar PV); US\$ 19 million (sustainable biomass).

Electricity: Medium-term Mitigation Actions	
<b>Action Name</b>	E4: Grid Extension and Improvements (926km grid + 14 MWh grid storage) E5: Increased RE Power Generation (26MWp solar PV, 84 MW hydro, 28 MW biomass/WTE) E6: Increased Sustainable Biomass for Fuel use (5,000 ha)
<b>Description</b>	Grid extension and improvements will be made on Viti Levu and Vanua Levu, along with the installation of a grid synchronisation system, and grid storage added on Taveuni and Ovalau (including 926km of 132kV & 33 kV lines, and 14 MWh of storage).  RE power generation capacity will be increased on Viti Levu, Vanua Levu, Taveuni, Ovalau and rural areas to a total of 36 MWp of solar PV capacity, 84 MW of hydro generation capacity, and 28 MW of biomass/WTE generation capacity.  In addition, activities will support the setup (production and processing) of up to 5,000 ha of sustainable biomass (sugar cane/bagasse) for fuel use.



<b>Key Considerations</b>	<ul style="list-style-type: none"> <li>- Specific locations for new IPPs and sustainable biomass planting are not mapped out.</li> <li>- The PP model recently developed by FSC with local farmers needs to be formalised and expanded.</li> <li>- A PPP Act and PPP Regulatory Guidance needs to be enacted.</li> <li>- Access to climate finance (loans and guarantees) is needed to secure debt, and incremental finance is needed to cover the incremental cost differences faced.</li> <li>- Financial risk products are needed to insure against the cost of damage and loss in production from severe-weather.</li> <li>- There is not enough skilled and highly skilled domestic labour to operate and maintain biomass power production in Fiji, as FSC and Tropik Woods employ nearly all of the domestic labour in this context.</li> <li>- There are still no fixed national standards for solar PV equipment and conditions to their supply (e.g. quality, warranties).</li> <li>- Small grower and/or cooperative type sustainable biomass production and processing schemes are needed.</li> </ul>
<b>Minimum Data Needs for MRV</b>	<ul style="list-style-type: none"> <li>- Central MRV database need to be linked to DOE and FEA data.</li> <li>- Annual electricity generation data from power producers are needed along with fuel consumption data. Social economic data such as persons employed or trained (including numbers of women and men) are also needed.</li> <li>- Annual biomass planting and production data from plantations and small growers are needed along with fuel consumption data. Social economic data such as persons employed or trained (including numbers of women and men) are also needed.</li> <li>- Periodic study/evaluation on biomass sustainability.</li> <li>- Total investment and development support needs to be tracked.</li> </ul>
<b>GHG Mitigation Potential</b>	Annual expected GHG mitigation: 158,000 tCO <sub>2</sub> /yr; 17,000 tCO <sub>2</sub> /yr solar PV; 86,000 tCO <sub>2</sub> /yr (hydro), and 55,000 tCO <sub>2</sub> /yr a (biomass/WTE)
<b>Total Investment</b>	The total investment required over the period of the Roadmap (2017-2030):  US\$ 861 million: US\$ 229 million (grid extension, improvement, and storage); US\$ 45 million (biomass generation); US\$ 523 million (hydro generation); US\$ 57 million (on- and off-grid solar PV); US\$ 7 million (sustainable biomass).

### Electricity: Long-term Mitigation Actions

<b>Action Name</b>	<p>E7: Grid Extension and Improvements (25km grid + 148 MWh grid storage)  E8: Increased RE Power Generation (69MWp solar PV, 25 MW biomass/biogas)  E9: Increased Sustainable Biomass for Fuel use (14,000 ha)</p>
<b>Description</b>	<p>Grid extension and improvements will be made on Viti Levu, along with grid storage added on Ovalau and Viti Levu (including 25km of 33 kV lines, and 148 MWh of storage).</p> <p>RE power generation capacity will be increased on Viti Levu and Ovalau for a total of 69 MWp of solar PV capacity and 25 MW of biomass generation capacity.</p> <p>In addition, activities will support the setup (production and processing) of up to 14,000 ha of sustainable biomass for fuel use.</p>
<b>Key Considerations</b>	<ul style="list-style-type: none"> <li>- Specific locations for new IPPs and sustainable biomass planting are not mapped out.</li> <li>- The PP model recently developed by FSC with local farmers needs to be formalised and expanded.</li> <li>- A PPP Act and PPP Regulatory Guidance needs to be enacted.</li> <li>- Access to climate finance (loans and guarantees) are needed to secure debt, and incremental finance is needed to cover the incremental cost differences faced.</li> <li>- Financial risk products are needed to insure against the cost of damage and loss in production from severe weather.</li> <li>- There is not enough skilled and highly skilled domestic labour to operate and maintain biomass power production in Fiji, as FSC and Tropik Woods employ nearly all of the domestic labour in this context.</li> <li>- There are still no fixed national standards for solar PV equipment and conditions to their supply (e.g. quality, warranties).</li> <li>- There are still no fixed national standards for grid storage equipment and conditions to their supply (e.g. quality, warranties).</li> <li>- Small grower and/or cooperative type sustainable biomass production and processing schemes are needed.</li> </ul>

<b>Minimum Data Needs for MRV</b>	<ul style="list-style-type: none"> <li>- Central MRV database needs to be linked to DOE and FEA data.</li> <li>- Annual electricity generation data from power producers are needed along with fuel consumption data. Social economic data such as persons employed or trained (including numbers of women and men) are also needed.</li> <li>- Annual biomass planting and production data from plantations and small growers are needed along with fuel consumption data. Social economic data such as persons employed or trained (including numbers of women and men) are also needed.</li> <li>- Periodic study/evaluation on biomass sustainability.</li> <li>- Total investment and development support needs to be tracked.</li> </ul>
<b>GHG Mitigation Potential</b>	Annual expected GHG mitigation: 227,000 tCO <sub>2</sub> /yr; 34,000 tCO <sub>2</sub> /yr (solar PV); 137,000 tCO <sub>2</sub> /yr (biomass/biogas); and 55,000 tCO <sub>2</sub> /yr (grid extension to the gold mine).
<b>Total Investment</b>	The total investment required over the period of the Roadmap (2017-2030): US\$ 861 million: US\$ 348 million: US\$ 142 million (grid extension, improvement, and storage); US\$ 101 million (biomass/biogas generation); US\$ 86 million (on- and off-grid solar PV); US\$ 19 million (sustainable biomass).

<b>Transport: Short-term Mitigation Actions</b>	
<b>Action Name</b>	T1: Vehicle Replacement Programme (including Hybrid Vehicles and Scrappage) - Buses (T1a), Taxis (T1b), Private Cars (T1c)
<b>Sub-Sector</b>	Land Transport
<b>Description</b>	This action improves the vehicle fleet in terms of fuel use per km and per vehicle to achieve a fleet-wide reduction in CO <sub>2</sub> emissions. Age limits for imported used vehicles would be combined with European norm standards for newly imported vehicles. In addition, incentives for hybrid vehicles would be provided to increase the share of hybrid vehicles in the bus, taxi and private vehicle fleet. A national programme for the scrappage of old vehicles will also be implemented, including support for domestic use or export of recycled materials.
<b>Key Considerations</b>	<ul style="list-style-type: none"> <li>- For private cars and taxis, experience with age limits and hybrid vehicles already exists in Fiji, therefore, the action builds on already exiting experience.</li> <li>- Buses and taxis have both high annual mileage and high utilisation rates among different modes of transport especially in the urban centres.</li> <li>- Among all vehicle types, private cars are the largest in total numbers and have rapidly increased in recent years. Targeting the private car fleet is therefore considered a priority.</li> <li>- Number of vehicle stock based on (Grütter, 2017) for the year 2015 <ul style="list-style-type: none"> <li>- 1,600 large buses; 6,500 taxis; 74,600 private cars</li> </ul> </li> <li>- Estimated annual vehicle growth rate of 2%</li> <li>- FRCS should enhance command and control.</li> <li>- There is no large-scale scrappage and domestic use or export of recycled materials, therefore, this will need to be built up.</li> </ul>
<b>Minimum Data Needs for MRV</b>	<ul style="list-style-type: none"> <li>- Central MRV database is linked to LTA and FRCS data for:</li> <li>- Total number of vehicle stock (including type of vehicle, vehicle ID-number, age, fuel type, status of registration)</li> <li>- For new/imported vehicles: type, age, fuel type, gCO<sub>2</sub>/km, year of first registration</li> <li>- Information about incentives provided from GOF (e.g., tax waver)</li> <li>- Confirmation of scrappage completed per vehicle</li> </ul>
<b>GHG Mitigation Potential</b>	Annual expected GHG mitigation as an average between 2017-2030: Buses: 6,000 tCO <sub>2</sub> /yr <sup>24</sup> Taxis: 9,000 tCO <sub>2</sub> /yr <sup>25</sup> Private cars: 27,000 tCO <sub>2</sub> /yr <sup>26</sup>

24 Assumptions for buses: 1,600 buses in 2015; 2% annual vehicle stock growth rate; vehicles annually replaced (based on stock) 1% between 2017-2020, 3% between 2021-2030; 50% share of hybrid vehicles of annually imported vehicles.

25 Assumptions for taxis: 2% annual vehicle stock growth rate; vehicles annually replaced (based on stock) 5% between 2017-2020, 10% between 2021-2030; 30% share of hybrid vehicles of annually imported vehicles.

26 Assumptions for private cars: 2% annual vehicle stock growth rate; vehicles annually replaced (based on stock) 5% between 2017-2020, 15% between 2021-2030; 30% share of hybrid vehicles of annually imported vehicles.

<b>Total Investment</b>	The total investment required over the period of the Roadmap (2017-2030): Buses: US\$ 110 million (costs for vehicles only) <sup>27</sup> Taxis: US\$ 60 million (costs for vehicles only) <sup>28</sup> Private cars: US\$ 770 million (costs for vehicles only) <sup>29</sup>
<b>Action Name</b>	T2: Vehicle Replacement Programme (including Scrappage) Lorries (<16t) (T2a), Minibuses (T2b)
<b>Sub-Sector</b>	Land Transport
<b>Description</b>	This action improves the vehicle fleet in terms of fuel use per km and per vehicle to achieve a fleet-wide reduction in GHG emissions. Age limits for imported used vehicles would be combined with European norm standards for newly imported vehicles. No hybrid vehicles are currently considered for these vehicle types. A national programme for the scrappage of old vehicles will also be implemented, including support for domestic use or export of recycled materials.
<b>Key Considerations</b>	<ul style="list-style-type: none"> <li>- As the majority of lorries in Fiji are under 16t, they have high annual mileage that leads to high mitigation potential per vehicle and year. Larger lorries may also be included in the programme, but mitigation potential has not been considered.</li> <li>- Minibuses have both high annual mileage and high utilisation rates among different modes of transport especially in the urban centres (and are a growing market).</li> <li>- Number of vehicle stock based on (Grütter, 2017) for the year 2015 <ul style="list-style-type: none"> <li>- 20,500 lorries (&lt;16t); 500 minibuses</li> </ul> </li> <li>- Estimated annual vehicle growth rate of 2%</li> <li>- FRCS should enhance command and control.</li> <li>- There is no large-scale scrappage and domestic use or export of recycled materials, therefore, this will need to be built up.</li> </ul>
<b>Minimum Data Needs for MRV</b>	<ul style="list-style-type: none"> <li>- Central MRV database is linked to LTA and FRCS data for:</li> <li>- Total number of vehicle stock (including type of vehicle, vehicle ID-number, age, fuel type, status of registration)</li> <li>- For new/imported vehicles: type, age, fuel type, gCO<sub>2</sub>/km, year of first registration</li> <li>- Information about incentives provided from GOF (e.g., tax waver)</li> <li>- Confirmation of scrappage completed per vehicle</li> </ul>
<b>GHG Mitigation Potential</b>	Annual expected GHG mitigation as an average between 2017-2030: <ul style="list-style-type: none"> <li>- Lorries &lt;16t: 14,000 tCO<sub>2</sub>/yr <sup>30</sup></li> <li>- Minibuses: 500 tCO<sub>2</sub>/yr <sup>31</sup></li> </ul>
<b>Total Investment</b>	The total investment required over the period of the Roadmap (2017-2030): <ul style="list-style-type: none"> <li>- Lorries (&lt;16t): Approx. US\$ 200 million (costs for vehicles only) <sup>32</sup></li> <li>- Minibuses: US\$ 5 million (costs for vehicles only) <sup>33</sup></li> </ul>

27 Assumptions for buses: average costs per bus: US\$ 100,000 for Euro IV/VI diesel, US\$ 135,000 for hybrid; 455 buses replaced from stock by 2030, 504 hybrid buses in 2030.

28 Assumptions for taxis: average costs per taxi: US\$ 8,000 for Euro IV/VI diesel/petrol, US\$ 10,000 for hybrid; 4,700 taxis replaced from stock by 2030, 2,100 hybrid taxis in 2030.

29 Assumptions for private cars: average costs per car: US\$ 8,000 for Euro IV/VI diesel/petrol, US\$ 10,000 for hybrid; 63,000 cars replaced from stock by 2030, 26,500 hybrid cars in 2030.

30 Assumptions for lorries <16t: 2% annual vehicle stock growth rate; vehicles annually replaced (based on stock) 3% between 2017-2030.

31 Assumptions for minibuses: 2% annual vehicle stock growth rate; vehicles annually replaced (based on stock) 5% between 2017-2030.

32 Assumptions for lorries <16t: average costs per lorry: US\$ 15,000 for Euro IV/VI, in total about 13,000 lorries replaced by 2030.

33 Assumptions for minibuses: average costs per mini bus: US\$ 12,000 for Euro IV/VI; in total about 420 minibuses replaced by 2030.



Transport: Medium-Term Mitigation Actions	
<b>Action Name</b>	T3: B5 Fuel (5% Biofuel in Diesel)
<b>Sub-Sector</b>	Land Transport
<b>Description</b>	All diesel fuel used in land transport would be “B5” fuel with 95% diesel and 5% biodiesel. It is assumed that the B5 fuel is imported and provided across all land transport sub-sectors (private, public and commercial). To allow for preparation and to ensure availability of B5 fuel, it is assumed that B5 would be widely available in Fiji from 2021.
<b>Key Considerations</b>	<ul style="list-style-type: none"> <li>- Diesel is the major fuel source currently used in land transport, especially by vehicles with the highest annual mileage and vehicle size/weight such as buses, lorries, and mini-buses.</li> <li>- The option to import was chosen since the domestic supply of biofuel may not be sufficiently available or may not be economically feasible. Another consideration is that additional biomass is already required for the electricity generation based on renewable energy.</li> <li>- B5 fuel in contrast to E10 (10% bio-ethanol content in petrol) is available in the Singapore fuel and commodity market, which has been the major exporter of fuel to Fiji in recent years.</li> <li>- Insufficient data is available on diesel fuel use in maritime sector. However, once B5 is introduced, it would also be used in the maritime transport sector leading to additional GHG emission reductions.</li> <li>- FRCS should enhance command and control.</li> </ul>
<b>Minimum Data Needs for MRV</b>	<ul style="list-style-type: none"> <li>- Central MRV database is linked to LTA and FRCS.</li> <li>- Based on the sub-categories defined under the transport data assessment (see enabling, CB &amp; TA Needs), B5 diesel consumption would need to be reported.</li> <li>- For GHG emissions reductions achieved, the amount of B5 fuel used for sub-sector and sub-category (mode of transport) would need to be captured and compared with the baseline (ex-post).</li> </ul>
<b>GHG Mitigation Potential</b>	Annual expected GHG mitigation as an average between 2021-2030: <ul style="list-style-type: none"> <li>- 35,000 tCO<sub>2</sub>/yr<sup>34</sup></li> </ul>
<b>Total Investment</b>	The total investment required over the period of the Action (2021-2030): <ul style="list-style-type: none"> <li>- Not determined</li> </ul>

<b>Action Name</b>	T4: Improved Maintenance for Sea Vessels
<b>Sub-Sector</b>	Maritime Transport
<b>Description</b>	This includes regular maintenance services for large sea vessels including measures to improve the fuel efficiency of the engine and the vessel, leading to reduced GHG emissions. The focus of the programme in the medium-term (2021-2025) is on the highest fuel consuming sea vessel fleet (highest fuel consumption per km, cargo-ton or passenger) from commercial shipping, the Government Shipping Franchise Scheme, and the Government Shipping Service.
<b>Key Considerations</b>	<ul style="list-style-type: none"> <li>- Large sea vessels may be identified and tracked based on existing data, and regulation could be enforced and controlled for those categories.</li> <li>- Limited data about fuel use in maritime transport is available. Due to the high, specific fuel consumption of large sea vessels, only a relatively small number of sea vessels need to be targeted to achieve significant GHG mitigation impacts.</li> <li>- MSAF and FRCS should enhance command and control.</li> </ul>
<b>Minimum Data Needs for MRV</b>	<ul style="list-style-type: none"> <li>- Central MRV database is linked to MSAF and FRCS.</li> <li>- Data that is already being measured by shipping companies and operators (e.g. fuel use, mileage, engine type and capacity) should be assessed for its usefulness for the MRV of the intervention as well as other potential uses for intervention planning and design.</li> <li>- Fuel consumption of the existing fleet (sea vessels falling under the category defined for the maintenance programme) needs to be assessed (prior to 2017) based on vessel type, age, engine, fuel type, and mileage. Post-2017, this data should be measured and reported prior to, and after, maintenance.</li> <li>- Data to be monitored would include: vessel type, engine, age, fuel type, purpose of use, and annual mileage.</li> <li>- Additional potential data during the project: port of departure and port of arrival, date/time of departure and arrival; fuel consumption for each fuel type, differentiated by fuel consumed; emission factor of each fuel consumed; distance travelled, time spent at sea; cargo carried.</li> </ul>

34 Assumptions: vehicle stock land transport with share of diesel vehicles only; 5% of diesel reduced for diesel vehicles from 2021 to 2030, emission factors (gCO<sub>2</sub>/km) as average for each vehicle type based on values from 2015.

35 Due to unavailability of reliable data, only rough estimations are possible. Assumptions: considering large sea vessels (30 sea vessels) cause 20% of expected total sea transport emissions in Fiji and only 6% (approx. up to 4-15% for propeller and hull cleaning/coating only) reduction achieved due to maintenance improvements, annual reduction could be approx. 5,000 tCO<sub>2</sub>/yr

36 Due to unavailability of reliable data, only rough estimations are possible. Investment costs largely depending on type, size, and number of vessels undergoing maintenance and the actual maintenance services included/required. Assumptions: 30 large sea vessels with propeller polishing and hull cleaning (annually) and hull coating only every 5 years.

<b>GHG Mitigation Potential</b>	Annual expected GHG mitigation as an average between 2021-2030: 5,000 tCO <sub>2</sub> /yr. <sup>35</sup>
<b>Total Investment</b>	The total investment required over the period of the Action (2021-2030): US\$ 4-8 million. <sup>36</sup>
<b>Action Name</b>	T5: Fuel Efficient Outboard Motors (including Scrappage)
<b>Sub-Sector</b>	Maritime Transport
<b>Description</b>	This action results in an increase in fuel efficiency by replacing inefficient 2-stroke outboard motors for smaller private and commercial boats (approx. 10-150hp motors) by higher efficient outboard motors (direct fuel injected 2-stroke or 4-stroke motors). This would result in a reduction in fuel use and GHG emissions.
<b>Key Considerations</b>	<ul style="list-style-type: none"> <li>- Even though the total number and utilisation of smaller boats with outboard motors is unknown, it is expected that Fiji, as an island state dependent on sea transport for travel between islands, and for tourism, has a very large number of outboard motors in operation.</li> <li>- Due to the high number of outboard motors, overall fuel use and GHG emissions from these activities are considered significant in the maritime transport sector.</li> </ul>
<b>Minimum Data Needs for MRV</b>	<ul style="list-style-type: none"> <li>- Central MRV database is linked to MSAF and FRCS.</li> </ul> <p>Data that is already being measured by MSAF, operators and/or associations, and companies, should be assessed for information on outboard motors, fuel use, and GHG emissions.</p> <p>Engine type, size (in horsepower), fuel type, and annual fuel consumption should be assessed for existing outboard motors and monitored for fuel-efficient outboard motors.</p> <p>MSAF and FRCS should enhance command and control.</p>
<b>GHG Mitigation Potential</b>	Annual expected GHG mitigation as an average between 2021-2030: Not quantified due to lack of data (up to 20% fuel and GHG reduction possible compared to old 2-stroke).
<b>Total Investment</b>	The total investment required over the period of the Action (2021-2030): Not quantified <sup>37</sup>

### Demand-Side Energy Efficiency:

<b>Action Name</b>	D1: Energy labelling and minimum energy performance standards (including public education and awareness raising)
<b>Description</b>	<p>The activities here entail the collection of data on energy consumption, including import of appliances, equipment, vehicles, and data on household and business electricity load profiles, and the integration of this data into a national energy information system. The DOE will be working together with the Bureau of Statistics in terms of collecting this data.</p> <p>The control of freezers and refrigerators at borders around the country is being implemented. Apart from equipment and appliances, plans are underway to also include air conditioning (AC) units, lighting equipment, and multimedia devices (i.e., TV) in the programme.</p> <p>The introduction and control of energy performance standards will be accompanied by educational and public awareness programmes to increase awareness about the existence and benefits of energy efficient appliances. This programme will be integrated in the school curriculum and promote energy saving technologies.</p>
<b>Key Considerations</b>	<ul style="list-style-type: none"> <li>- Energy performance standards for key electrical appliances are a fundamental step to reduce the power demand per appliance and to reduce overall electricity consumption of electricity users</li> <li>- The public and consumers of such appliances need to be informed about energy performance and quality standards, and their benefits.</li> <li>- The public awareness programme builds on the experience of a similar activity undertaken a few years ago related to the Fiji Energy Efficiency Awareness Promotion.</li> <li>- By integrating knowledge about energy efficiency aspects in the school curriculum, public awareness will increase since it is an integral part of the education for everyone that goes through the formal education system.</li> <li>- FRCS should enhance command and control of imports.</li> </ul>
<b>Minimum Data Needs for MRV</b>	<ul style="list-style-type: none"> <li>- Central MRV database</li> <li>- Baseline data on appliances</li> <li>- Number of appliances imported/sold: type, capacity, power factor, wattage</li> </ul>
<b>GHG Mitigation Potential</b>	Annual expected GHG mitigation: 15,000 tCO <sub>2</sub> /yr in 2030

<sup>37</sup> Depending largely on the type, size, and total number of outboard motors to be replaced annually.

<b>Total Investment</b>	The total investment required over the period of the Roadmap (2017-2030): US\$ 1.1 million
<b>Action Name</b>	D2: Energy Efficiency in Business Community (including Tourism)
<b>Description</b>	<p>This activity includes the mandatory adoption of ISO 50001:2011 – Energy Management. The ISO 50001:2011 provides a framework of requirements for organisations to develop a policy for more efficient energy use. The standard requires entities to do the following: fix targets and objectives to meet the policy, use data to better understand and make decisions about energy use, measure the results, review how well the policy works, and continually improve energy management.</p> <p>As part of this initiative there is need to incentivise, through duty concessions and tax rebates, the adoption of energy efficient technologies, plants, and equipment.</p> <p>A sub-activity will be to strengthen the enabling environment for energy service companies (ESCO) to undertake and finance public and private sector energy efficiency projects.</p>
<b>Key Considerations</b>	None
<b>Minimum Data Needs for MRV</b>	<ul style="list-style-type: none"> <li>- Central MRV database</li> <li>- Existing and future electricity demand for appliances and buildings in the business community (per company/building) needs to be determined or tracked annually, at minimum.</li> <li>- Registration system of ESCOs and, at minimum, an annual reporting system of energy performance</li> </ul>
<b>GHG Mitigation Potential</b>	Annual expected GHG mitigation: 9,000 tCO <sub>2</sub> /yr in 2030
<b>Total Investment</b>	The total investment required over the period of the Roadmap (2017-2030): US\$ 175,000 with US\$ 25,000 per annum between 2017-2025 for the mandatory adoption of ISO-norm and US\$ 1 million for strengthening ESCOs.
<b>Action Name</b>	D3: Energy Efficiency in the Public Sector
<b>Description</b>	<p>This mitigation action includes the following activities: i. undertake a review of public sector budgeting processes and procurement rules, with the objective of providing incentives to undertake energy efficiency projects; ii. implement recommendations of the review by amending procurement rules and budgeting processes; iii. design and implement energy efficiency demonstration projects on public buildings; iv. through stakeholder consultation, establish energy efficiency protocols for public sector facilities, and start monitoring and analysing large public sector energy users' performance; and v. develop energy efficiency case studies and communication materials for public servants as well as the general public, based on the new protocols and the demonstration sites, and disseminate widely.</p> <p>As part of this mitigation action, public sector entities are to be mandated or made mandatory to adopt ISO 50001:2011; Energy Management. The ISO 50001:2011 provides a framework of requirements for organisations to develop a policy for more efficient use of energy. The standard requires entities to do the following: fix targets and objectives to meet the policy, use data to better understand and make decisions about energy use, measure the results, review how well the policy works, and continually improve energy management.</p>
<b>Key Considerations</b>	<ul style="list-style-type: none"> <li>- This mitigation action builds on the DOE's on-going programme for energy efficiency within the Public Sector.</li> <li>- Actions on energy efficiency in the public sector have a multiplier effect for the public and for other sub-sectors (private consumers and businesses).</li> </ul>
<b>Minimum Data Needs for MRV</b>	<ul style="list-style-type: none"> <li>- Central MRV database</li> <li>- Existing and future electricity demand for public sector appliances and buildings needs to be determined and tracked annually.</li> </ul>
<b>GHG Mitigation Potential</b>	Annual expected GHG mitigation: <ul style="list-style-type: none"> <li>- 5,000 tCO<sub>2</sub>/yr in 2030</li> </ul>
<b>Total Investment</b>	The total investment required over the period of the Roadmap (2017-2030): <ul style="list-style-type: none"> <li>- US\$ 3 Million</li> </ul>



<b>Action Name</b>	D4: Update codes and standards for buildings and industry
<b>Description</b>	<p>This mitigation action entails the incorporation of Energy Efficiency into the Fiji Building Code. The activities include: i. undertaking a review of codes and standards for buildings and industry, including minimum standards for energy use for ventilation, cooling, and lighting and ii. implementing the results of the review through a new building code.</p> <p>In addition, showcase demonstration projects should be developed, and information about these projects disseminated to increase awareness about the action.</p>
<b>Key Considerations</b>	<ul style="list-style-type: none"> <li>- With a high demand for air conditioning and other appliances (e.g., lighting), buildings are major energy consumers in Fiji.</li> <li>- Incomplete or non-existent building codes for energy efficiency cause unnecessary energy consumption.</li> <li>- This mitigation action is applied in combination with energy performance standards for electrical appliances, since the use of such appliances is most effective if operated in buildings that comply with appropriate building codes.</li> <li>- GOF statutory bodies should enhance command and control.</li> </ul>
<b>Minimum Data Needs for MRV</b>	<ul style="list-style-type: none"> <li>- Central MRV database</li> <li>- Baseline data on building performance</li> <li>- Number of appliances and utilization per annum</li> <li>- Total energy consumed per annum</li> </ul>
<b>GHG Mitigation Potential</b>	<p>Annual expected GHG mitigation:</p> <ul style="list-style-type: none"> <li>- &lt; 1000 tCO<sub>2</sub>/yr (for passive technologies only) by 2030</li> </ul>
<b>Total Investment</b>	<p>The total investment required over the period of the Roadmap (2017-2030):</p> <ul style="list-style-type: none"> <li>- Initially none, however, by 2017 the construction of a building as a demonstration project – US\$ 2.5 million (FJ\$ 5 million) for the building including the land.</li> </ul>



