



Republic of Fiji

Talanoa Dialogue Submission

“Where Are We?”

Where are we?

A) Current Emissions Trend

Fiji's total greenhouse gas emissions is approximately 2,500 Gigagrams per year of which 1,500 Gigagrams (59%) is from energy, 557 Gigagrams (22%) from agriculture, 380 Gigagrams (15%) from forestry and 130 Gigagrams (4%) from waste. **Table 1** provides a summary of Fiji's greenhouse gas emissions between 2006 and 2011, which is the reporting period of the draft Third National Communication.

As can be deduced from the table, carbon dioxide emissions, predominantly from the energy sector make up approximately 60% of Fiji's greenhouse emissions. This explains the availability of greater number of data sets and projections for the energy sector relative to others sectors such as agriculture, forestry and other land use (AFOLU) and waste.

Overall, the average trend in total greenhouse emissions have been stagnant since 2006 due to a combination of environmentally conscious policy decisions by the Fijian Government and a uptake of clean technology by consumers and the private sector.

B) Emissions Projection

Table 2 provides the emissions trend for energy sector from 2006 to 2011. Carbon dioxide emissions in the energy sector are expected to gradually increase to 1,800 Gigagrams per annum by 2030 in a Business as Usual (BAU) scenario. This is attributed to factors such as economic growth, increased rural urban drift, increased demand for electricity, access to technology and improved standard of living. Land transport makes up almost 60% of energy sector emissions, followed by electricity production of around 16%.

However, in comparison to global emissions of 49 Gt stated in the 2014 IPCC report, Fiji's total CO₂eq emissions are around 0.006% of world emissions. This equates to 2.8 tonnes of CO₂eq per capita for Fiji in comparison to the global average of 7 tonnes of CO₂eq per capita.

Similar projections for other sectors, including agriculture, forestry and other land use (AFOLU), are envisaged to be developed through preparation of Fiji's enhanced NDCs.

Table 1 Total GHG emission by sector in Gg of CO₂ equivalent

Emissions of gases by sector in Gg of CO ₂ equivalent							Average
	2006	2007	2008	2009	2010	2011	2006-2011
Carbon dioxide							
Energy Gg CO ₂	1,767	1,550	1,333	1,260	1,526	1,410	1,474
Forestry Gg CO ₂	310	330	570	-250	760	560	308
Total Gg CO₂	2,077	1,880	1,903	1,010	2,286	1,970	1,854
Methane							
Energy Gg CH ₄ CO ₂ eq	2	2	1	1	2	1	1
Agriculture Gg CH ₄ CO ₂ eq	414	415	412	409	409	405	411
Waste Gg CH ₄ CO ₂ eq	63	84	80	86	111	130	92
Total Gg CH₄ CO₂ eq	479	500	494	496	521	537	504
Nitrous oxide							
Energy Gg N ₂ O CO ₂ eq	4	4	3	3	3	3	3
Agriculture Gg N ₂ O CO ₂ eq	146	146	154	143	140	146	146
Total Gg N₂O CO₂ eq	149	149	157	146	143	149	149
Total Emissions Gg CO₂ eq	2,700	2,500	2,600	1,700	3,000	2,700	2,500

Table 2 Energy Sector CO₂ equivalent emissions

Energy Sector Emissions (Gg)								
	2006	2007	2008	2009	2010	2011	Average	%
Land Transport	927	912	926	885	886	893	905	59.8
Marine Transport	55	55	55	55	55	55	55	3.6
Air Transport	18	18	18	18	18	18	18	1.2
Electricity Production	286	200	216	233	299	238	245	16.2
Domestic Consumption	76	76	76	76	76	76	76	5.0
Commercial Consumption	67	63	58	56	62	59	61	4.0
Industrial Consumption	125	119	134	164	188	187	153	10.1
Total	1,554	1,443	1,483	1,487	1,584	1,526	1,513	100

C) Plans, Strategies and Guidance Tools

Despite contributing insignificantly to climate change, Fiji remains steadfast in its commitment to the Paris Agreement by continuing to incorporate low emissions and sustainable growth into its development agenda. For example, the 5-Year & 20-Year National Development Plan for Fiji is in line with Fiji’s NDCs, seeking to achieve 99% renewable electricity generation by 2030 from a 2013 baseline of 60% and aiming to achieve 30% reduction in CO₂ emissions from the energy sector over the same period.

Of the 30% reduction of BAU baseline CO₂ emissions, 10% of the BAU baseline emissions mitigation will be achieved “unconditionally” using available resources in the country, and 20% achieved “conditionally” (Figure 1).

To achieve its development targets and stay true to its NDC commitments, Fiji developed its NDC Implementation Roadmap 2017-2030 that seeks to unpack Fiji’s NDC commitments through prioritised public and private sector interventions. These interventions are expected to reduce CO₂ emissions in the energy sector by 627,000 tonnes per annum resulting in a 34.8% decline in the aforementioned BAU scenario. The total investment cost in the energy sector to achieve this level of greenhouse gas mitigation is estimated to be approximately US\$2.97 billion between 2017–2030, plus the estimated US\$119 million already invested between 2014 - 2017 (Figure 2).

The NDC Implementation Roadmap was developed in close coordination with the private sector and guided by a steering committee

consisting of key Government and statutory organisations. To operationalise Fiji’s NDC Implementation Roadmap, the Fijian Government will develop investment plans to attract suitable investment from the private sector.

To mainstream sustainable development into the Government machinery and entice stakeholders to be more environmentally conscious, Fiji has developed the Green Growth Framework. The

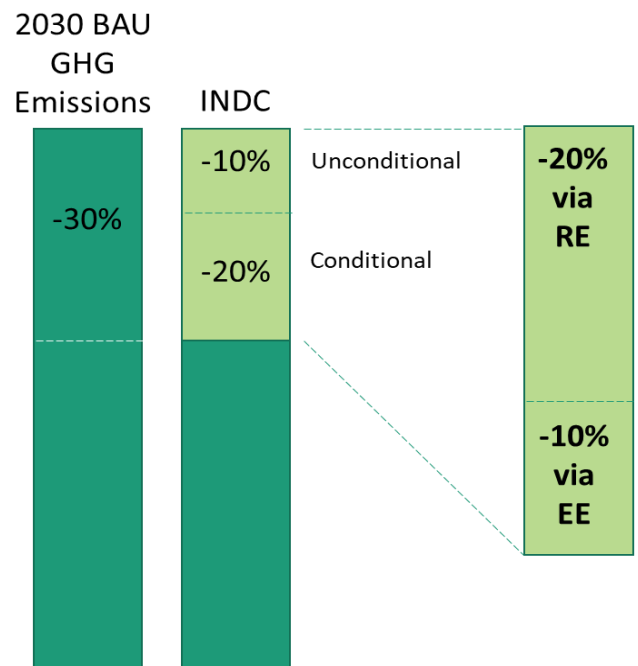


Figure 1: Graphical representation of the BAU baseline emissions mitigation targets (conditional and unconditional)

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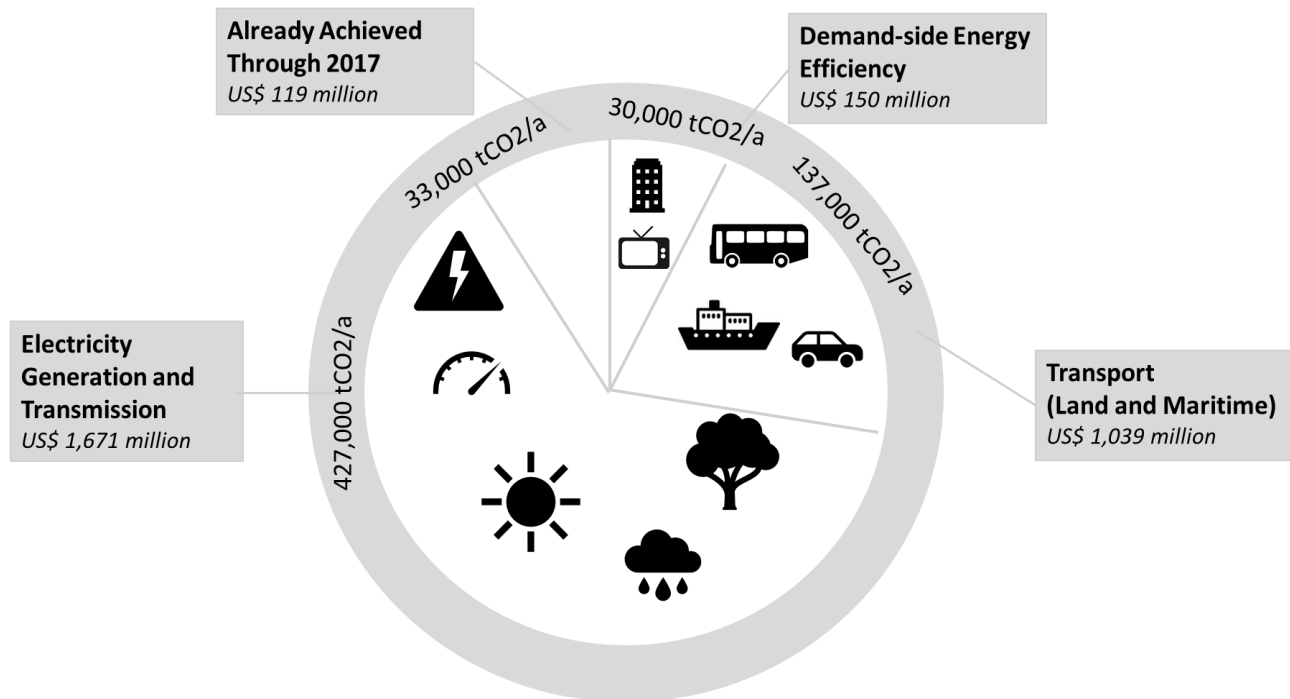


Figure 2 Investment cost and emissions reduction in the energy sector

Framework is used by Government agencies as a guide to develop green policies and projects and has been mainstreamed into Fiji's National Development Plan.

Signifying its support for the Paris Agreement's medium and long term goals and acknowledging the need for enhanced country commitments to urgently peak greenhouse gas emissions, Fiji has embarked on the development of its enhanced NDCs. Sectors such as electricity, transportation, AFOLU and waste are envisaged to be factored into the enhanced NDCs.

In line with Article 4, paragraph 19, of the Paris Agreement, Fiji has also commenced work on developing a long-term low greenhouse gas emissions strategy, which is expected to be closely linked to the current and the soon to be developed enhanced NDCs.

Encompassing these national initiatives and acknowledging that much has changed since Fiji developed its existing Climate Change Policy (2012), Fiji is undertaking a complete review and updating of the policy to reflect its commitment to the Paris Agreement and reflect its national priorities in the context of climate change.

D) International Commitments and Treaties

i) Paris Agreement

To exemplify its commitment to address the global issue of climate change, Fiji became the first country in the world to ratify the Paris Agreement in April, 2016. With this milestone, Fiji marked the beginning of a series of instrumental roles it has taken in the global arena to champion for meaningful actions to address climate change with a particular focus on adaption needs of Small Island developing states.

Fiji reached the pinnacle of its foreign commitment to climate agreements when it took up the colossal task of presiding over the 23rd Session of the Conference of Parties to the United Nations Framework Convention on Climate Change. Through its Presidency, Fiji is placing emphasis on: developing and facilitating the Talanoa Dialogue "stocktake"; supporting the completion of the Paris Agreement Work Programme and its implementation guidelines; rallying momentum for the Pre 2020 Action; developing an Ocean Pathway to strengthen links between the UNFCCC climate space and ocean issues; and enhancing access to

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adequate, sustainable and predictable finance mechanisms.

ii) Kyoto Protocol

Despite not having any mandatory commitments or obligations to sign the Kyoto Protocol, Fiji ratified the same on 17 September 1998 to show its unwavering support to the global climate agenda. The Protocol entered into force on 16 February 2005. Its first commitment period was from 2008 to 2012.

The Doha Amendment establishes a second commitment period to the Kyoto Protocol extending from 2013 to 2020 for Annex I Parties under the Convention. Fiji's ratification of the Doha Amendment on 19 September 2017 as a non-Annex I Party expresses the Fijian Government's continued commitment and support to the implementation of the Kyoto Protocol and pre-2020 climate action. Similar to the Kyoto Protocol, Fiji does not have any commitments under the Doha Amendment as a developing country.

iii) Montreal Protocol

Fiji signed and ratified the Vienna Convention on the protection of the ozone layer and the Montreal Protocol on substances that deplete the ozone layer on October 23, 1989. It has also received an achievement award for complying with the zero consumption of harmful chemicals such as the chlorofluorocarbons. Moreover, the Fijian Government is also reducing its HCFC consumption from its baseline level of 8.44 ODP tons by 2013 to 5.49 ODP tons by 2020 in line with the schedule specified in the HPMP Agreement of Fiji. Notably, Fiji is also working on ratifying the Kigali Amendment soon.

E) Political Will and Effective Policy Making

While there have been various plans, strategies and guidance tools developed to ensure that Fiji progresses towards a more climate resilient, carbon neutral and inclusive development, its ambitions and success have been underpinned

with strong political backing and innovative policy making.

Sustainable development with utmost importance on living in harmony with nature has been enshrined in Fiji's 2013 Constitution. This is further restated in national planning and policy documents mentioned above.

Political will to address climate change and pursue sustainable development is at its highest in Fiji's history. This is exemplified by the significant responsibility taken by the Prime Minister of Fiji, Honourable Frank Bainimarama, to be the first small island developing state and the first Pacific Island country to preside over the 23rd Session of the United Nations Framework Convention on Climate Change.

The Fijian Government has continued to introduce innovative green fiscal measures to entice investments and economic growth. Some key fiscal initiatives are mentioned below, and are demarcated by sectors.

Fuel Sector (Bio – Fuel Production)

To reduce dependence on imported fossil fuels, the Fijian Government has put in place a bio-fuel tax incentive scheme which offers a 10 year tax holiday to a taxpayer undertaking new activity in processing agricultural commodities into bio-fuels. To qualify for the incentive, a taxpayer will have to invest a minimum of F\$1 million and employ 20 local employees or more for every income year.

Once qualified, the taxpayer will have the benefit of duty free importation of plant, machinery and equipment for initial establishment of processing plant, duty free importation of chemical required for bio-fuel production and zero-rated importation of all agricultural items.

Energy Sector (Renewable Energy Projects and Power Co-generation)

To supplement Fiji's renewable energy targets and transition towards a low carbon economy, the Fijian Government is offering a 5-year tax holiday to a taxpayer undertaking a new activity in renewable energy projects and power cogeneration.

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Moreover, to entice greater uptake of renewable technology such as solar PVs, the Fijian Government is offering duty free importation of renewable energy goods. Anecdotal evidence suggest that this fiscal decision has brought about an influx in solar system providers and enticed greater uptake of solar solutions by the private sector. This is further discussed in the next section.

100% write off (accelerated depreciation) is also available in the year an expenditure was incurred on water storage facilities and renewable energy plant and machineries.

Transport Sector (Zero Duty on Green Vehicles and Incentives for Electric Vehicles Charging Stations)

Given that transport makes up almost 59% of Fiji's energy sector emissions, the Fijian Government has focused on measures to introduce clean transportation in an affordable and sustainable manner.

In the 2015 National Budget, the Fijian Government introduced zero duty on Electric Motor Vehicles, Hybrid vehicles, LPG, CNG and Solar Powered Vehicles while keeping a standard VAT of 15%.

To complement this fiscal policy, the Fijian Government also introduced zero duty on hybrid solar electrical powered items, solar and electrical charging station and energy storage system that are imported by companies involved in renewable energy whilst keeping a standard VAT of 15%.

The combination of these fiscal policies has had significant impact on the transport sector. Hybrid vehicle registration/importation from 2008 to 2014 was approximately 1,113, which increased by a staggering 207% to approximately 3,417 between 2015 to March, 2017 following the announcement of tax incentives by Government.

It is clear that every policy decision has both pros and cons. Anecdotal evidence suggests that the overwhelming success of the Fijian Government's duty concession on hybrid and electric vehicles resulted in more public confidence to uptake cleaner technologies that have clear cost benefits. However, the relatively affordable hybrids resulted

in an exponential increase in vehicle registrations which had implications on road traffic management.

In the 2016-2017 National Budget, the Fijian Government imposed selected duty on second hand imported vehicles for private use while keeping zero rated duty on the same for use of taxis. To supplement this fiscal policy decision, the Fijian Government also kept zero import duty on new (firm out) hybrid vehicles and reduced duty on new (firm out) vehicles from 32% to 5%. This fiscal decision is expected to not only control the number of hybrid vehicles registered but also improve the life of Fiji's vehicle stock i.e. entice replacement of old and fuel intensive vehicles.

Financial Sector

Fiji Development Bank - Green Climate Fund Accreditation

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.

Building on this milestone and the recently launched Simplified Approvals Process of the GCF, Fiji aims to maximise access to finance for mitigation and adaptation needs. This will not only be done to finance domestic climate needs but also position the FDB as regional accredited body to enable greater access to GCF funds for the Pacific region.

Domestic Driven Climate Finance Mechanisms

While Fiji is grateful to its development partners and multilateral organisations for their unwavering support to its development aspirations, the financial resources needed to fortify Fiji against the adversities of climate change is far more than what is being received as overseas development assistance.

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Fiji recognises that addressing climate change will require innovative, high impact finance solutions that mobilise public and private sector resources. In this regard, the Fijian Government has introduced the Environment and Climate Adaptation Levy and issued its first ever Green Bonds to raise funds to finance its climate mitigation targets and adaptation needs.

The Environment and Climate Adaptation Levy ('**ECAL**') is a 10 cent levy on plastic bags, 10% duty on vehicles of engine size above 3000cc, 10% charge on yacht docking fee, 10% deductions on income earnings of above \$270,000 and a 10% levy on prescribed services such as hotels, restaurants, cinemas and tour services. Proceeds from the ECAL are being put into a ring fenced account which will be used to finance climate adaptation projects identified in the National Budget. Some of the projects to be financed using the ECAL, such as building seawalls and improving agriculture resilience, will add towards reducing disaster risks.

As mentioned, the funds are being used for projects/programmes that are budgeted for in the National Budget only. As such, eligible projects/programmes are identified by the Ministry of Economy and monitored accordingly. The Ministry of Economy and Fiji Revenue and Customs Services, which collects ECAL and transfers proceeds to the Government ring fenced account, are guided by the Environmental Levy (Budget Amendment) Act 2017. Proceeds from ECAL are expected to be more than F\$100 million in the 2017-2018 financial year.

Fiji is the first country in the Southern Hemisphere, first in an emerging economy, and just third globally after France and Poland to issue Green Bonds whereby the proceeds (expected to be F\$100 million) will go towards climate mitigation, adaptation and environmental protection projects. As a country that is vulnerable to the impacts of climate change, Fiji has set an example to other climate-vulnerable nations in finding new, creative ways to raise climate finance.

As is the case with the ECAL, Green Bond proceeds are placed into a ring fenced account and utilisation is guided by the Fiji Green Bond Framework with oversight from the Green Bond Steering Committee made up of representatives from the Reserve Bank of Fiji, the Ministry of

Economy and the World Bank (International Finance Cooperation). Projects/programmes are selected from the National Budget by the Ministry of Economy and approved by the Steering Committee.

The above mentioned financial mechanisms are innovative examples of mobilising and channelling public and private funds towards addressing climate change. Although majority of the projects identified for funding are adaptation based, these projects have notable mitigation co-benefits that are expected to contribute towards Fiji's sustainable development agenda.

F) Tangible and successful Mitigation Initiatives

Government Initiatives

1) Solar Home Systems

To mitigate emissions and provide access to electricity for vulnerable communities in rural areas, the Government of Fiji, through its Rural Electrification Programme, has installed 2,500 solar home systems around the country, of which 680 are in the process of being repaired or replaced post Tropical Cyclone Winston. During the repair and replacement process, the Department of Energy will replace its old diesel generator schemes with solar systems in over 54 communities in the Northern, Eastern and Western Division of Fiji.

To enhance the Solar Home System programme, Government has allocated F\$10.4 million in the 2017-2018 National budget for the installation of solar home systems in 2,600 rural households in the Western (680), Northern (855) and Eastern (1,065) Divisions. Other source of renewable energy generation such as wind, hydro and biogas are being explored by the Department of Energy through various programmes allocated financing in the National Budget.

2) Renewable Energy Revolving Fund

The Fijian Government, through its Presidency of COP23, is working on the establishment of a revolving fund for renewable electrification in

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partnership with the Leonardo DiCaprio Foundation which will seek to electrify rural communities that currently rely on diesel fuel or are not connected to the national electricity grid. The fund is working with a private company called Sunergise to establish centralised solar energy reticulation system giving communities continuous, reliable and affordable access to energy.

This project is an example of Public Private Partnership that Fijian Government is keen to foster in all aspects of its development. The first phase of the project is expected to electrify 10 villages after which a further 290 villages will be electrified based on lessons learnt from the first 10. The Fijian Government envisages this revolving fund to complement its Rural Electrification Programme.

3) Fiji Urban Water Supply and Wastewater Management Project

Fiji has managed to secure blended funding from a range of multilateral sources to build and renovate critical infrastructure to improve access to safe water and sewerage systems in the greater Suva area of Fiji. Specifically, the funding is for creating a new river water intake station by the Rewa River and improving the Kinoya wastewater treatment plant and associated sewer coverage.

Over half of Fiji's population is urban with further growth expected, particularly around Suva City, the national capital. Urban infrastructures are vulnerable to extreme droughts and flooding as well as sea level rise, causing threats to the environment, health, and social and economic development. Urban water supply and sanitation are particularly under strain, with service interruptions common during both drought periods and heavy rainfall periods. Existing sewerage infrastructure covers only 36% of the Suva City area. Improving water supply and wastewater management is considered essential to Fiji's sustainable development, but its current debt levels constrain its ability to fund such vital adaptation measures.

The project will strengthen water supply through the design and construction of a new water intake

by the Rewa River, with a pumping station, wastewater treatment (WWT) plant, clear water reservoir, and pipeline to increase water production by 30,000 m³ per day. This will improve climate resilience by taking water from further up the river system to avoid salinity. Wastage will be reduced through meter replacement and improved leak detection and repairs. Wastewater management will be strengthened by upgrading and increasing the capacity of the Kinoya WWT plant, improving sewer coverage, and adding new treatment facilities. The project will also strengthen water management and delivery capacity of the responsible institutions.

The project is expected to benefit over 290,000 Fijians in the populated region in Fiji and is expected to take approximately 7 years to complete. The greater Suva area includes the townships of Lami, Suva and Nasinu. The total value of the project is USD\$405.1 million made up of concessional loans from the Asian Development Bank (USD\$153.2 million) and the European Investment Bank (USD\$70.8 million), grant financing from the Green Climate Fund (USD\$31 million) and Fijian Government contribution (USD\$150 million).

4) Solar Island Concept

The Fijian Government is working with the Global Green Growth Institute and the Korea International Cooperation Agency to electrify the islands of Taveuni and Ovalau using 100% renewable energy. These are 3rd and 4th largest islands in Fiji by land mass, respectively. A pre-feasibility study was completed in 2017 which examined options for solar, wind, hydro and battery storage technologies. The technologies will then be further implemented through development partners, private sector and multilateral funding.

Powering the two islands with renewable energy will have significant positive impact on Fiji's renewable energy targets and help reduce dependence on imported fossil fuels. The two islands are envisaged to be running on 100% renewable energy by 2035.

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5) Forestry – Reforestation, Afforestation and REDD+

Despite the absence of the forestry sector from Fiji's NDC, various national efforts have been made to increase forest cover in addition to the existing 1.1 million hectares of forest that cover approximately 56 percent of Fiji's land mass. The forestry sector in Fiji, through the Ministry of Forestry, is committed to contribute towards global efforts to reduce greenhouse gas emissions, strengthen the socio-economic status of its forest resource owners and protect domestic forest ecosystems.

Through its reforestation and afforestation efforts, the Ministry of Forestry has managed to plant 917 hectares of mixed tree species covering key thematic areas such as; establishment of woodlots, food security, education and research, restoration of water catchment and connecting biological corridors. Communities participating in this replanting initiative are being offered around FJD \$1,300 as incentive for the upkeep of planting plots. This initiative is supporting the bio fuel industry by planting fuel rich plant species and has gathered support from the private sector. Moreover, free sandalwood seedlings are being offered by the Fijian Government to encourage non-timber forest products.

Fiji has been actively supporting the REDD+ mechanism by piloting the mechanism in the village of Draubuta, Navosa with the help of Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). A total of 7,400 hectares of land was secured in 2009 and established as a REDD+ zone in 2012 based on socio-economic and cultural surveys, carbon stock analysis, biodiversity surveys and land use mapping. A land use plan was also developed for the pilot programme which informed the stratification of indigenous forest and grasslands for more accurate monitoring of forest carbon changes.

Following the successful uptake of the pilot programme by the Draubuta Village, a community

nursery was established and villagers were trained on nursery management. The pilot programme has been proven to help develop diversify income generating sources such as bee-keeping, sustainable livestock management, and crop diversification. These sustainable practices are helping reduce the agriculture clearance pressure on the nearby Emalu forest in Navosa. The pilot programme has been mindful of developing gender inclusive practices and the women of Draubuta Village have been trained to strengthen their socioeconomic status and improve personal wellbeing through sustainable forest management/harvesting.

Statutory Body Initiatives

6) Fiji Electricity Authority

To maintain Fiji's overall energy target of 100% renewable energy by 2030, the Fiji Electricity Authority (FEA) is continuing to increase its renewable energy portfolio. Fiji's vast rivers and mountainous regions makes Hydro Electricity the ideal renewable energy scheme. For this very reason, FEA is continuing to invest in improving its existing hydro dams and building new ones (Nadarivatu Dam and Somosomo Hydro Mini-Dam).

However, in light of global advances in solar PV technology which has made investments in solar energy more economical, FEA is planning to significantly increase solar energy into its energy generation portfolio. FEA is on the verge of finalising an agreement with a private company to develop a new 5 Mega Watt Solar farm which will be largest solar farm in the South Pacific. If successful, the project is planned to be scaled up to a 20 Mega Watt system which will significantly bolster Fiji's progress towards its renewable energy targets.

Private Sector Initiatives

The private sector in Fiji increasingly understands the benefits of "going green" not only as a branding tactic but also to reduce business costs.

7) Solar Rooftops

Increasing number of manufacturers and tourism operators in particular have installed solar roof top panels to drive down electricity costs and reduce their carbon footprint.

A great example in the manufacturing sector is the Coca Cola Factory in Nasinu which recently completed the installation of a 1.1 Mega Watt solar rooftop system which is the largest privately-funded solar grid connect system in the South Pacific.

In the tourism sector, Turtle Island Resort which has become one of the first total “clean energy” resorts in the world, after the installation of 968 solar panels which are now providing 100% of the power needs of the island. On rainy and cloudy days, the solar plant operates at about 85% of full capacity, maintaining outstanding energy efficiency. The solar installation produces over 1 Mega Watt of power a day helping reduce 220 tonnes of GHG emissions per year and saves 85,000 litres of diesel consumption per year. This has reduced the resorts annual diesel costs by 90%.

Companies such as Mark One Apparel in Suva, Denarau Marina in Nadi and Radisson Blu Resort on Denarau Island are some of many examples of the private sector reducing emissions from energy usage.

8) Alternative Energy Production (biomass)

The recently commissioned Nabou Biomass Power Plant just outside of Nadi is a great example of private sector investment in clean energy generation. The Biomass plant is expected to use waste wood pellets from local saw mills such as Fiji Pine Limited to produce steam power to drive turbines. The plant has potential to generate 12 Mega Watts of electricity enough to supply power to all of Nadi and parts of Sigatoka. The plant management (Korean Company called ‘GIMCO’) is working the Fiji Electricity Authority as an

Independent Power Producer to agree to a power purchase agreement that will enable the Biomass Plant to feed into the national electricity grid.

G) Fiji’s Progress and Current Status in Context of Adaptation

Fiji is especially vulnerable to climate change and natural hazards due to many factors outside of its control, such as its geographical location, land topography, and its tropical marine environment which is strongly influenced by the South Pacific Convergence Zone. It is also especially vulnerable because its economy depends heavily on natural capital which is particularly vulnerable to climate change, such as coral reefs. Climate change will pose many slow-onset problems such as sea level rise, warming, and acidification. It will also likely result in more intense cyclones and greater precipitation extreme events, most notably flooding.

Natural hazards and climate change impose a major obstacle to development objectives such as providing access to housing, electricity, clean and safe water and sanitation, high quality education and health care. The Fijian Government has set out ambitious development objectives in the 5-Year & 20-Year National Development Plan to address significant development challenges.^[1] The National Adaptation Plan (NAP), currently under development, builds from NDP to identify climate change threats and tackle climate change vulnerability. The cross-cutting challenges climate change presents to national development is addressed in the Climate Vulnerability Assessment, Green Growth Framework and the National Climate Change Policy. The National Climate Change Policy, currently undergoing a revision process, provides guidelines for sectors to consider current and expected impacts of climate change in their planning and implementation programmes. Through this process, the following sectors have been identified as strategically important to national development and especially vulnerable to climate change: food security and nutrition, health, human settlements,

¹ MoE, 2017

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infrastructure, and biodiversity and the natural environment.

While comprehensive assessments do not always exist, existing evidence suggests that modern production systems and non-traditional crops are highly vulnerable to climate-induced events such as drought, excessive rainfall, and to extreme weather associated with cyclones and tropical storms [2]. It is likely that coastal fisheries will be unable to support local needs and that over the long term Fiji will become a net importer of fish, undermining long term food security and nutrition. Climate change will have significant impacts on health, not only through major climate related events such as cyclones but also indirect and diffuse effects of climate-sensitive health risks[3]. Fiji will be particularly vulnerable to dengue fever, typhoid fever, leptospirosis, and diarrhoeal disease [4]. Outbreaks of these diseases are especially prevalent when floods or cyclones have occurred [5].

Human settlements and infrastructure are naturally vulnerable to climate change because of littoralisation which has led to many rural and urban centres being located on the coast [5], [6]. Coastal erosion is a particular issue for rural communities, some of which have reported shoreline retreats of 15-20 meters over recent decades [7]. In 2013, the village of Vunidogoloa in Vanua Levu became the first village to be relocated [8]. Assessments have identified over 63 other villages in need of relocation, for which guidelines and policy are currently being developed. Thousands of people are living in low-lying outer islands which are difficult and expensive to protect against sea-level rise and storm surges, calling into question their viability over the long term [5]. Fiji's diverse natural environments and biodiversity is able to adapt to changing climate conditions, but the speed at which changes are occurring make them highly vulnerable⁹. Increases to sea level rise, sea surface temperature, and acidification associated with climate change may have

detrimental impacts potentially altering entire coastal and marine ecosystems [6]. Vulnerability to sudden-onset events such as cyclones is also a major issue for biodiversity and the natural environment. Damage and losses to the natural environment caused by Tropical Cyclone Winston amounted to F\$899.7 million [10].

The Climate Vulnerability Assessment represents a rapid assessment commissioned by the Fijian Government to assess climate change vulnerability and high risk by large exposure in various sectors. These sectors include housing/land-use, transport, water, energy, health/education and agriculture.

1. Housing

About 10 percent of the national population (20 percent of the urban population) lives in more than 200 unplanned (and rapidly growing) urban and peri-urban informal settlements and is particularly vulnerable to natural hazards. The national housing need is increasing by around 600 units per year with very few serviced subdivisions for any income groups. This has led to only few options for the rapidly growing population. These include crowding into existing housing stock (resulting in overcrowding); self-build illegally on vacant state land; or enter into extralegal, informal occupancy arrangements without proper lease agreements, either as paying tenants to freehold landowners or through traditional rights secured through kinship and sealed with key-money (known as tenancy at will arrangements, or vakavanua). Informal settlements consist of housing stock of poor quality than the wider housing stock. This represents higher incidence of poverty and associates with the underlying insecure land tenure of the residents.

2. Transport

The country is subject to poor road networks because of lack of a systematic maintenance and strategic planning. The poor condition of a large

² Taylor, M., et al. 2016

³ Mclver, L., et al., 2016

⁴ Mclver, L., et al., 2012

⁵ GoF, 2017

⁶ IGCI, 2000

⁷ World Bank, 2000

⁸ McNamara, et al, 2015

⁹ SPREP, 2016

¹⁰ GoF, 2016

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portion of the land and marine networks in the urban, rural and coastal areas presents high degree of vulnerability of the networks to disruption from damage to or failure of sections of roads and other assets. Moreover, there is no redundancy in the road network configuration and the poor state of many assets makes land transport highly susceptible to climate hazards at present and in the future. Three major climatic events (Nadi and Lautoka floods in 2012, TC Evan in 2012, and TC Winston in 2016) has had drastic effect on the transport sector.

TC Winston caused an estimated damage of F\$127 million to the transport sector with more than 80% attributed to land transport alone. This sector is more predisposed to hazards such as: increased rainfall intensities; sea-level rise; storm surges and riverine flooding that have the following potential impacts; washouts of low-lying and coastal roads and bridges; landslides on roads located on unstable soils; temporary network disruptions; and the further degradation of already aging marine assets.

3. Water

Less than half of the rural population does not have access to piped water services whereas the urban areas have widespread supply. There is limited coverage of sewerage service in both urban and rural areas with majority of the population depending on site sanitation facilities. Health and environment risks arise due to lack of infrastructure and maintenance for onsite wastewater systems. This is due to limited funding for the sector to address challenges of insufficient cost recovery to finance operation, maintenance, or capital investments. This situation improved markedly since 2010 when Water Authority of Fiji (WAF) took over. The ramification of this was, budgetary resources were increased, there was better cost recovery, and increased investment in maintenance. There is high exposure of water and wastewater infrastructure to natural hazards and climate change. This is because climate—related considerations were not incorporated in the system architecture and in the location and design of

individual facilities. Moreover the most significant water sector vulnerabilities are:

- Inadequate protection against runoff intrusion into pumping stations and water treatment plants.
- Insufficient protection of key assets against soil erosion and landslides.
- The lack of diverse water supply sources for the urban population

4. Energy

Access to electricity is available to 98% of the urban population and 80% of the rural population. The rest of the outer islands utilize off-grid electricity mainly from the Rural Electrification Program of the Department of Energy (DoE), which uses diesel/hybrid generators for mini-grids and solar home systems (SHS) and from private generation using diesel plants.

Despite the fact that all assets are exposed to natural hazards, there is low vulnerability. This is because the assets are generally well maintained. However the main vulnerabilities for the energy sector include:

- Hydro power stations are negatively affected by drought. This is concerning since 55-65% of energy supply generation in Fiji is through hydroelectric schemes.
- Strong winds and cyclones have a negative impact on wind power station
- Flooding and storm surges negatively impact diesel power stations and substations. Frequent flood events impose risk to a high portion of the grid and transformer assets (table 3.9). The analysis done by World Bank projects that in the event of a 100-year return period flood (both pluvial and fluvial flood), 30 percent of the country's transformers and 11 percent of the power plants will be exposed to more than 20 cm of flooding. The losses rendered from this exposure were not reported since data were not available for the flood

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protections and exact location and elevation of the energy assets.

- Transmission and distribution lines located above ground are negatively affected by strong winds and cyclones, in particular falling trees, and by high temperatures (which reduce transfer capability). Transmission and distribution lines located below ground are negatively affected by flooding and coastal erosion.
- Solar home systems and mini-grids are negatively affected by strong winds unless they can be dismantled prior to the event. Diesel generators for mini-grids are impacted by flooding and storm surges.

Recent extreme weather events demonstrate this vulnerability and the entailing substantial costs that result from damage to electricity infrastructure. For instance, the estimated cost from TC Winston amounted to F\$41.1 million which incurred from damage to electricity infrastructure and lost revenues to FEA. In addition to this, the unserved energy to the economy is estimated to be F\$88.5 million.

The risks for the energy sector will undoubtedly increase with the unprecedented weather events and changes in rainfall patterns and temperatures due to climate change. Concerning issues include reductions in generation efficiency, generation, and transfer capability due to increased temperatures; damage to network infrastructure from more intense storms and tropical cyclones; and damage to coastal assets such as transformers and substations due to increases in sea level and storm surge. These risks have economic and service delivery implications.

5. Health and education

The impact of climate change on health is apparent and is likely to increase over time. Fiji is vulnerable to three major epidemics; dengue fever, leptospirosis and typhoid fever along with

diarrhoea. These communicable diseases are climate-sensitive and are highlighted in the government's Climate and Health Action Plan.

The health and education sectors perform critical roles in Fijian society, and disruption to their operation can have both short and long-term impacts on community wellbeing. Health and education services in Fiji are delivered to communities across 110 inhabited islands spread over 18,300 km², with many facilities located in rural and remote maritime areas. Exposure of health and education assets to natural hazards is high. This is due to lack of input design from professionals, poor quality construction materials and insufficient maintenance of facilities. These are further exacerbated in rural and outer islands where it is difficult to access technical support, skill labor and suitable cheap materials. The damage incurred from TC Winston (mainly to schools) was evident of this systematic failure of building and the due diligence to strict compliance to the building code and technical support.

6. Agriculture sector

Fiji's agriculture sector is diverse and comprises of crops, livestock, fisheries and forestry. The agriculture sector is highly vulnerable to the impacts of climate change which is likely to cause changes in rainfall patterns, changes in temperature, sea-level rise and sea flooding. Resilience to climatic conditions is relatively high for traditional crops and production systems. However traditional farming practices have declined in recent decades and conventional farming practices have been adopted to meet commercial production needs. This implies that food production systems may be more susceptible to climatic variability which may threaten food security.

In the last 16 years the agriculture sector has suffered damages and losses from cyclones and floods amounting to about F\$791 million. During this period the country has suffered from 14 major events (six tropical cyclones and eight

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major floods). Cyclones cause; destruction to crops, trees, farming and fishing equipment and related infrastructure; the death of livestock and destruction of the reef ecosystems that support fisheries. Floods also have detrimental effects causing crop damage due to inundation. These damages lead to negative impacts on productivity.

The sector vulnerabilities identified thus far suggest potential areas to build resilience considering climate change is likely to amplify these risks, threatening development and economic growth. The government has embarked on projects to reduce the country's vulnerability which includes establishment of the construction implementation unit - to ensure reconstruction in the education and health sector is done to higher resilience standards. Furthermore a countrywide bridge vulnerability assessment was commissioned to prioritize maintenance.

Additionally there have been reinforced investments in the road sector in order to tackle the existing maintenance backlog. There has also been strengthened support for targeted risk management initiatives such as the Project for Planning of the Nadi River Flood Control Structures. Work has also commenced in exploring options to expand housing insurance and improve the coverage of social safety nets. Another major area of concern is the loss of coastal infrastructure and land resulting from inundation, storm surge, and shoreline erosion. To address this, the Fijian Government has embarked upon major investments in coastal protection – such as seawalls – and relocation of vulnerable infrastructure. Planned relocation in Fiji is a relatively new response to the effects of climate change, and one that is viewed as an option of last resort. Relocation is a complex process and often traumatic for those involved. To date, three communities have been relocated that incurred approximately F\$3 million and was funded by the Fijian Government. Thus, Fiji is in a state where it needs to urgently figure out how it will fund future relocation work since it is obvious that the

Fijian Government alone will not be able to do so.

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