Climate Investment Funds (CIF) Renewable Energy Integration (REI) Investment Plan (IP)

September 2023

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Table of Abbreviations

ADB	Asian Development Bank
AIFFP	Australian Infrastructure Financing Facility for the Pacific
AMI	Advanced Metering Infrastructure
BAU	Business as usual
CDM	Clean Development Mechanism
DFAT	Department of Foreign Affairs and Trade
DMS	Distribution Management Systems
DoE	Department of Energy
DRMS	Demand Response Management Systems
DSA	Dynamic security assessment
DSM	Demand-side management
EEZ	Exclusive Economic Zones
EFL	Energy Fiji Limited
EIB	European Investment Bank
EMS	Energy Management Systems
ER	Emission Reduction
EU	European Union
EUS	Employment and Unemployment Survey
FBoS	Fiji Bureau of Statistics
FCCC	Fijian Competition and Consumer Commission
FDB	Fiji Development Bank
FEA	Fiji Electricity Authority
FLMMA	Fiji Locally Managed Marine Area
FRA	Fiji Roads Authority
FREF	Fiji Rural Electrification Fund
FREPP	Fiji Renewable Energy Power Project
FSC	Fiji Sugar Corporation
GCF	Green Climate Fund
GESI	Gender Equality and Social Inclusion

GGGI	Global Green Growth Institute
GHG	Greenhouse gas
GoF	Government of Fiji
GSA	Greater Suva Area
HFO	Heavy fuel oil
HPP	Hydro power plants
HRADC	Human Rights and Anti-Discrimination Commission
IE	Implementing Entities
IOC	International Oil Companies
IP	Implementation Plan
IPP	Independent power producers
IRF	Integrated Results Framework
JICA	Japan International Cooperation Agency
KOICA	Korea International Cooperation Agency
LDA	Land Development Authority
LDF	Leonardo DiCaprio Foundation
LEDS	Low Emission Development Strategy
LTA	Land Transport Authority
MCTTT	Ministry of Commerce, Trade, Tourism and Transport
MDB	Multilateral Development Banks
MFAT	Ministry of Foreign Affairs and Trade
MIMS	Ministry of Infrastructure and Meteorological Services
MoF	Ministry of Finance
MOPS	Means of Platts Singapore
MSAF	Maritime Safety Authority of Fiji
NCCP	National Climate Change Policy
NDC	Nationally Determined Contribution
NDP	National Development Plans
NEP	National Energy Policy
NIIP	National Infrastructure Investment Plan
OPEX	Operating expenditures

PDP	Power Development Plan
PIC	Pacific Island Countries
PPA	Power purchase agreements
PRF	Project Readiness Financing
PSIP	Public Sector Investment Plan
RE	Renewable energy
REI	RENEWABLE ENERGY INTEGRATION
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SEFP	Sustainable Energy Finance Project
SOE	State-owned enterprises
SPCZ	South Pacific Convergence Zone
T&D	Transmission and distribution
TOD	Time of Day
TPP	Thermal power plants
UAE	United Arab Emirates
VRE	Variable renewable energy
WACC	Weighted Average Cost of Capital
WB	World Bank

SECTION 1 PROPOSAL SUMMARY

Fiji's Renewable Energy Integration Investment Plan (REI IP), contained in this document, has been prepared by the Ministry of Finance (MoF) and the Climate Change and International Cooperation Division, under the Prime Minister's Office. Substantial contributions were also made by the Ministry of Public Works, Transport and Meteorological Services (MPWTMS) and its Department of Energy (DoE), the Fiji Development Bank (FDB), and Energy Fiji Limited (EFL). The Asian Development Bank (ADB) and World Bank provided extensive technical support throughout.

Fiji's proposed REI Investment Plan is based on project concepts developed in three recent policy documents: The National Infrastructure Investment Plan (NIIP), the Nationally Determined Contribution (NDC) Implementation Roadmap, and EFL's most recent 10-year Power Development Plan (PDP). These documents contain prioritized lists and detailed descriptions of priority clean energy and climate investments and are the result of extensive analysis and consultation with a wide range of stakeholders.

1.1 OBJECTIVES

The purpose of this REI IP is to seek financing and technical assistance for investments that will enhance the flexibility of Fiji's energy system in ways that allow for the integration of variable renewable energy, and for greater access to renewable energy in areas with limited connectivity. This will be achieved through two interventions or program "components" focused on two of Fiji's top energy sector priorities. The National Energy Policy (NEP) 2023-2030—Fiji's main energy sector policy—has objectives that fall under five policy pillars: (i) Energy Security and Resilience; (ii) Energy Access and Equity; (iii) Energy Sustainability; (iv) Energy Efficiency; and (v) Energy Governance, which aim to provide the guidelines for energy sector policy development between 2023 and 2030. The NEP also endorses and supports the target established in Fiji's National Climate Change Policy (NCCP), of producing 100 percent of national electricity from renewable energy sources by 2030, achieving net zero annual greenhouse gas emissions by 2050, and decarbonizing Fiji's transport sector.

The interventions set forth in this REI IP align completely with the NEP's five pillars and with Climate Investment Funds (CIF) REI's objectives for financing investments in renewable energy integration. Component 1 is focused on creating a "Green Energy Circuit" on Viti Levu, home to Fiji's capital and roughly 70 percent of its population. The transmission investments—mostly in 132 kV transmission lines and substations—foreseen as part of this component are critical to harnessing and managing the huge renewable energy resource potential on the island which includes substantial solar resources, and existing and planned hydropower, wind, and biomass. Component 2 is focused on further electrifying the outer islands, to allow Fiji to reach its goal of 100% electrification. With 96% electrification at present, this goal is within reach, but will require substantial investment in rural, lower income areas that do not yet have grid connections or for whom the grid connection provides only very limited reliability, and often depends heavily on diesel generation.

1.2 EXPECTED OUTCOMES

The financing and technical assistance foreseen under this REI IP is expected to facilitate the uptake of zero carbon electricity into Fiji's grids on Viti Levu and the outer islands and attract private sector investment in renewable energy generation and productive end-uses. The expected outcomes are:

- Increased renewable energy generation capacity and an increasing share of zero carbon electricity generation in Fiji's overall energy mix
- More customers connected (in the outer islands) to grids that deliver affordable, reliable and clean energy
- A consequent reduction in the volume of global (CO_2) and local (NOx, SOx, and particulates) emissions
- Better electricity reliability, resulting from a more diverse portfolio of domestically available renewable fuels and enhanced energy storage and grid management technologies and techniques
- Better resilience—especially of the transmission and distribution network—to climate-induced disasters and damage to infrastructure
- More affordable electricity, resulting from the use of lower cost renewable energy generation, and the use of competitive tenders for the private sector to provide such generation on a least cost basis
- Savings to Fiji's consumers and overall economy, resulting from a reduction in imported diesel used for electricity generation.

The two proposed components are critical to Fiji reaching its' targets under the NEP and NCCP for renewable energy generation and 100% electricity access.

1.3 PROGRAM CRITERIA, PRIORITIES, AND BUDGET

As noted above, Fiji's REI IP is based on project concepts developed in the NIIP, the NDC Implementation Roadmap, and EFL's PDP. Projects in these documents were grouped to match the categories of investments typically funded by CIF's REI Program. These projects were then ranked against 12 REI criteria. This ranking exercise is described in Appendix B. The highest-ranked groups were (i) Transmission & distribution investments for renewable energy projects; (ii) rural electrification, and (iii) Energy Storage & Grid Management Technologies. It was ultimately decided that the focus of Fiji's REI IP should be on (i) and (ii) because of the priority these types of investments for Fiji, and because such investments are necessary precursors to eventual, expanded investment in (iii).

Targeted technical assistance is planned to support the physical investments. These include legal and regulatory reforms, and transaction advisory for the competitive procurement of renewable energy generation, recognition of the importance of storage as a sector activity, and the facilitation of grid access and net metering and/or billing for solar rooftop and other types of distributed electricity generation. Technical assistance will also focus on network planning and operation. This will include assistance with reliability and risk assessment tools for generation adequacy, generation and transmission expansion tools, and generation dispatch and network operation tools.

Fiji is requesting $70 million in financing from CIF, of which only $4 million would be requested as project preparation grants. The two program components are together expected to mobilize nearly US$ 200 million in investment, with complementary investments or blended financing from ADB, World Bank, and the private sector. Private sector contributions will be primarily in the form of investment in renewable energy generation—a portion of that provided by the International Finance Corporation (IFC)—and possible contributions from EFL as counterpart financing.[1] It is expected that—at least for the first projects—roughly 40 Megawatts (MW) of solar capacity could be procured within 2-3 years. Table 1.1 shows the financing requested for each of the components described above.

Table 1.1: Financing Plan for Fiji's REI IP

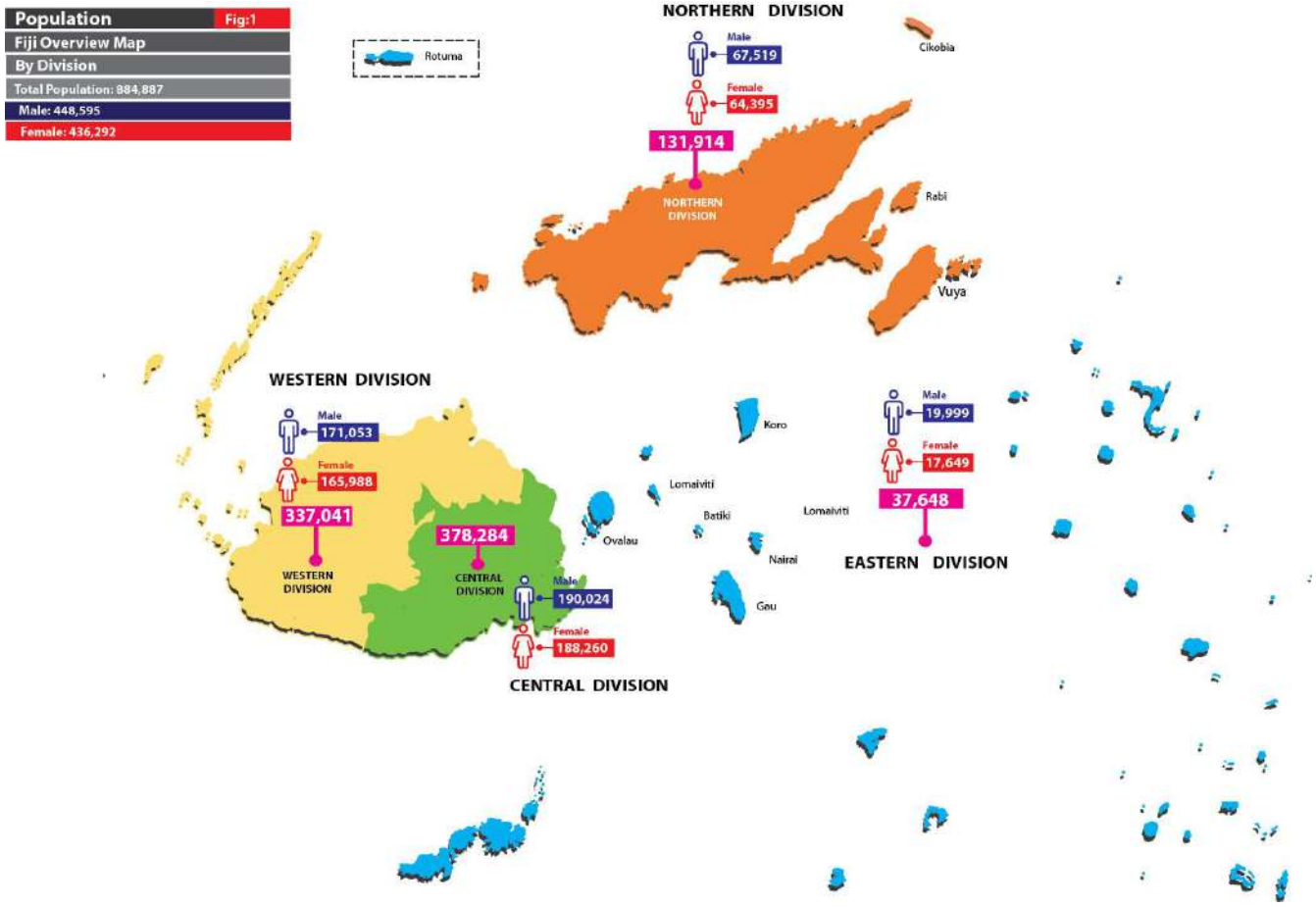
Financing Source	**CIF**				**Others**				
Program	**CIF Fin-ancing**	**CIF Guar-antee**	**Project Preparation (Grant)**	**Total CIF**	**ADB**	**World Bank**	**IFC**	**Private Sector**	**Total**
	(US$Million)								
Viti Levu Green Circuit	25	8	2	35	60		15	35	**145**
Electrification of Outer Islands	33		2	35		15			**50**
Total	**58**	**8**	**4**	**70**	**60**	**15**	**15**	**35**	**195**

[1] The counterpart financing would cover applicable taxes and duties as well as overhead costs associated with the transmission investments.

SECTION 2 COUNTRY CONTEXT

The Republic of Fiji is an island country consisting of over 330 islands in the Southern Pacific Ocean. Fiji's territory is divided into four major administrative divisions further split into 14 provinces. The central division—where Fiji's capital, Suva, is located—is the most densely populated, with more than a third of the total population living across Rewa, Naitasiri and Tailevu provinces.[2] Figure 2.1 provides a map of Fiji's population by gender by administrative division.

Figure 2.1: Population of Fiji by Gender by Administrative Division

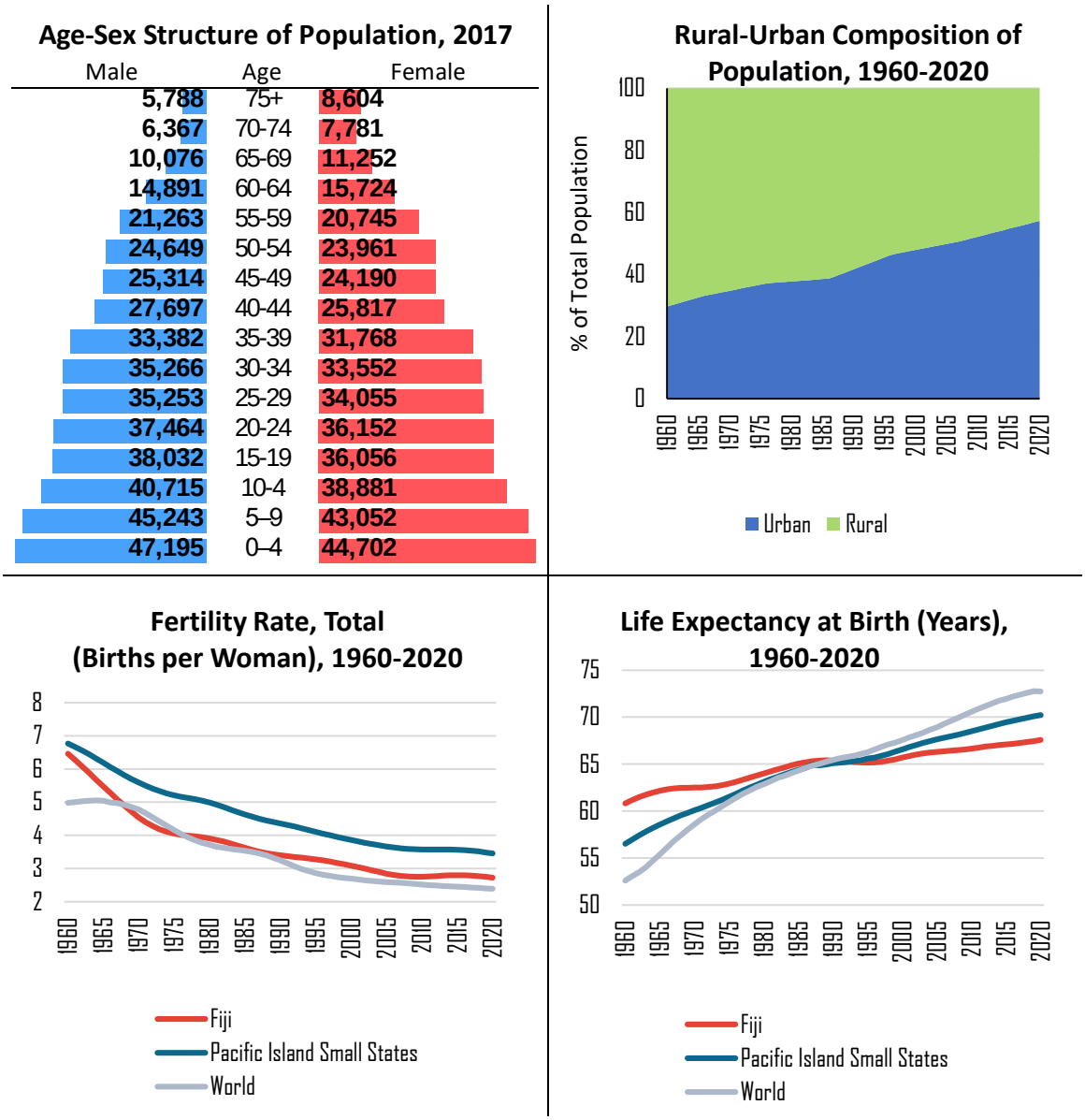


Source: Fiji Bureau of Statistics. (2018). "2017 Population and Housing Census – Release 1." Available at *https://www.statsfiji.gov.fj/index.php/census-2017/census-2017-release-1*

Figure 2.2 provides key demographic statistics for Fiji, including the country's age-sex structure as of 2017 (top lefthand side), the rural-urban composition of its population over time (top righthand side), Fiji's fertility rate (bottom lefthand side), and its life expectancy at birth (bottom righthand side).

[2] Fiji Bureau of Statistics. (2018). "2017 Population and Housing Census – Release 1." Available at *https://www.statsfiji.gov.fj/index.php/census-2017/census-2017-release-1*

Figure 2.2: Fiji's Key Demographic Statistics



Sources: Fiji Bureau of Statistics. (2018). "2017 Population and Housing Census." and World Bank World Development Indicators. (2022). "Fiji." Available at https://data.worldbank.org/country/FJ

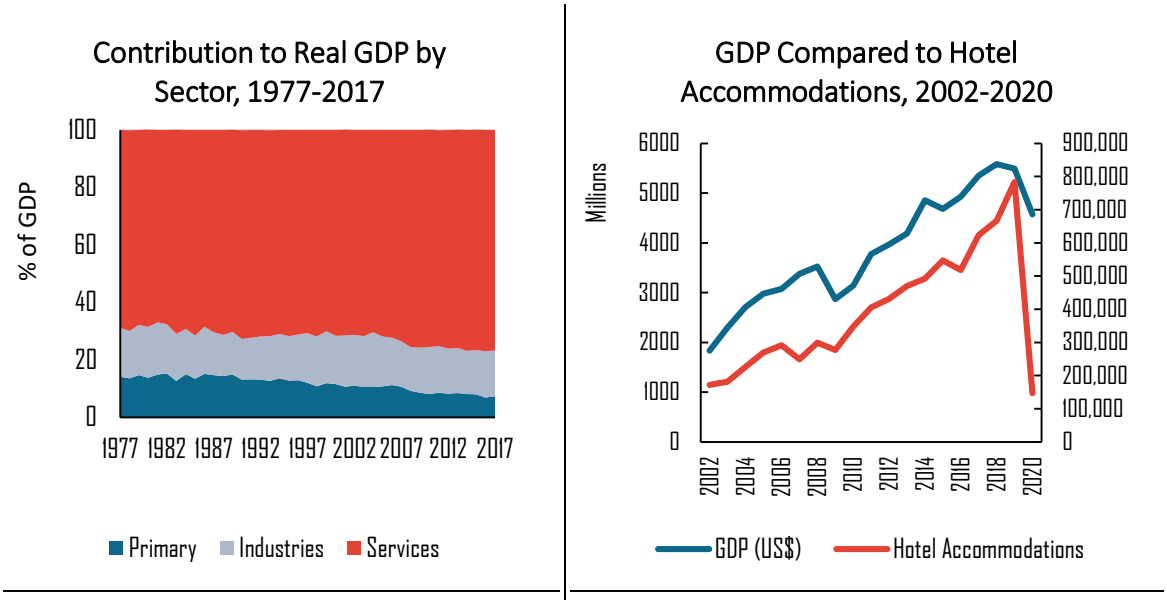
Fiji is one of the five largest Pacific Island economies, backed by a large service sector that is highly dependent on tourism. Since the late 1970s, the contribution of agriculture to Gross Domestic Product (GDP) has decreased substantially as the economy grew more reliant on services. Over the same period, the economic output of the industrial sector has remained stable. As tourism rapidly expanded over the last 40 years, GDP grew at an average pace of 5 percent per year between 1977 and 2017.[3] At the same time, the growth of the tourism industry has also made the Fijian economy more susceptible to external shocks. This was evidenced by

[3] Own calculation of the CAGR of Fiji's GDP between the years of 1977 and 2017 using data from the World Bank.

the economic impact of the recent COVID-19 pandemic, which led to travel restrictions that drastically reduced tourist inflows to the country and contributed to a 17 percent drop in GDP in 2020.[4]

Figure 2.3 shows the composition of Fiji's GDP by sector between 1977 and 2017 (lefthand side) and the relationship between tourism (represented by the level of hotel accommodations in the country) and the country's economic output, as represented by GDP (righthand side).

Figure 2.3: Overview of Fiji's GDP Composition and the Impact of Tourism on Economic Output



Note: "Primary," "Industries," and "Services" are the three major categories of economic activity used by the Fiji Bureau of Statistics to measure economic output. "Primary" sector activities include agriculture, fishing, and forestry; "Industries" refers to secondary sector activities such as processing, manufacturing, construction as well as mining and quarrying; and "Services" refers to all tertiary sector activities, including wholesale and retail trade, accommodation, and financial activities, which together make up the largest share of "Services" sector activities in Fiji.

Sources: Fiji Bureau of Statistics. (2021). "

Sources: Fiji Bureau of Statistics. (2021). "Hotel Statistics - Turnover (All Hotels)," Available at https://www.statsfiji.gov.fj/latest-releases/key-stats.raw?view=download&fileId=1609; and

Fiji Bureau of Statistics. (2021). "Contribution to Real Gross Domestic Product by Sectors." Available at https://www.statsfiji.gov.fj/latest-releases/key-stats.raw?view=download&fileId=6508; and

World Bank World Development Indicators. (2022). "Fiji." Available at https://data.worldbank.org/country/FJ

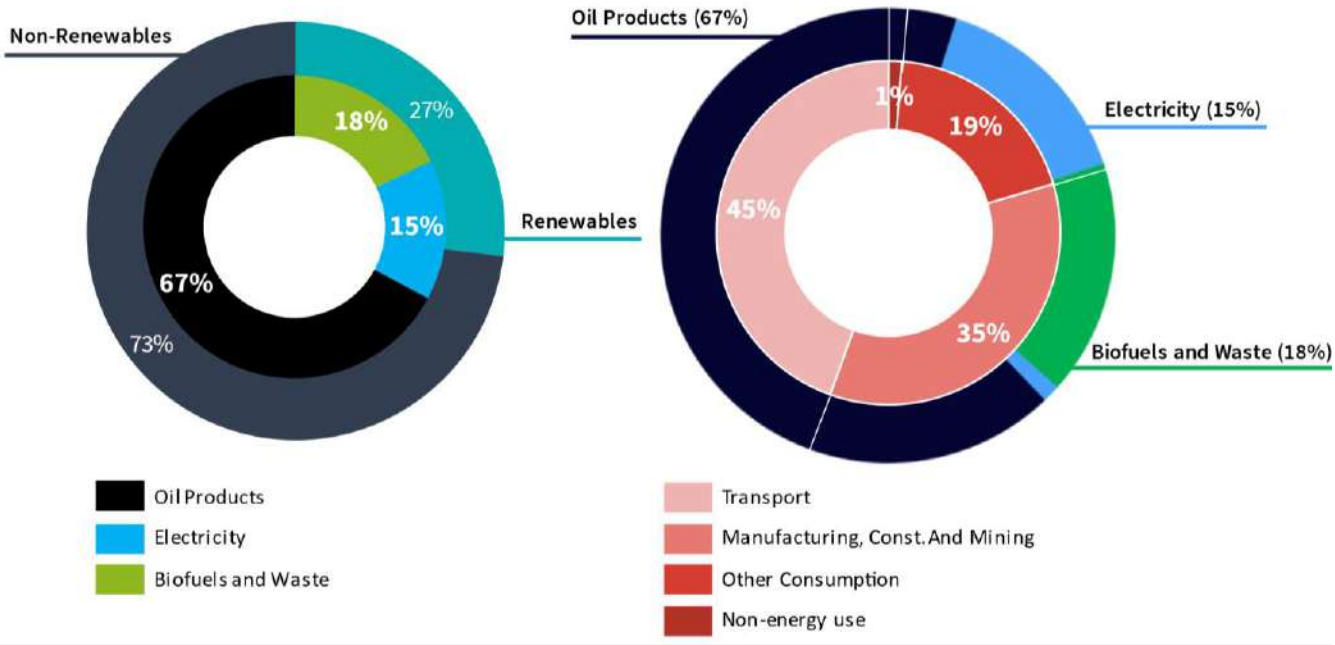
[4] World Bank World Development Indicators. (2022). "Fiji." Available at https://data.worldbank.org/country/FJ

2.1 OVERVIEW OF FIJI'S ENERGY SECTOR

Two-thirds of Fiji's energy is derived from imported oil products, with the remainder being a mix of biofuel (17 percent) and electricity (15 percent).[5] Imported oil is used primarily as fuel in transportation and in manufacturing, but it is also used in thermal power plants (TPPs) and in home diesel generators. Biofuels are primarily used in manufacturing but also in bioenergy power plants and for cooking amongst rural households.[6] Electricity generation meets the demands of urban households, commerce, industry and public services however requires investment to provide access to some parts of rural and maritime areas.[7]

The transport sector is the largest energy consumer in the country, representing 45 percent of total demand, followed by industry/manufacturing at 35 percent. Other consumption, which includes households and commerce, account for 19 percent of consumption.[8] Although renewable energy sources account for over half of electricity generation, they only represent 27 percent of total energy consumed. Figure 2.4 shows the composition of Fiji's energy mix and the key sectors driving energy demand.

Figure 2.4: Composition of Energy Consumption Mix, 2019



Source: United Nations Statistics Division. (2022) "Energy Balance Visualization – Fiji." Available at https://unstats.un.org/unsd/energystats/dataPortal/.

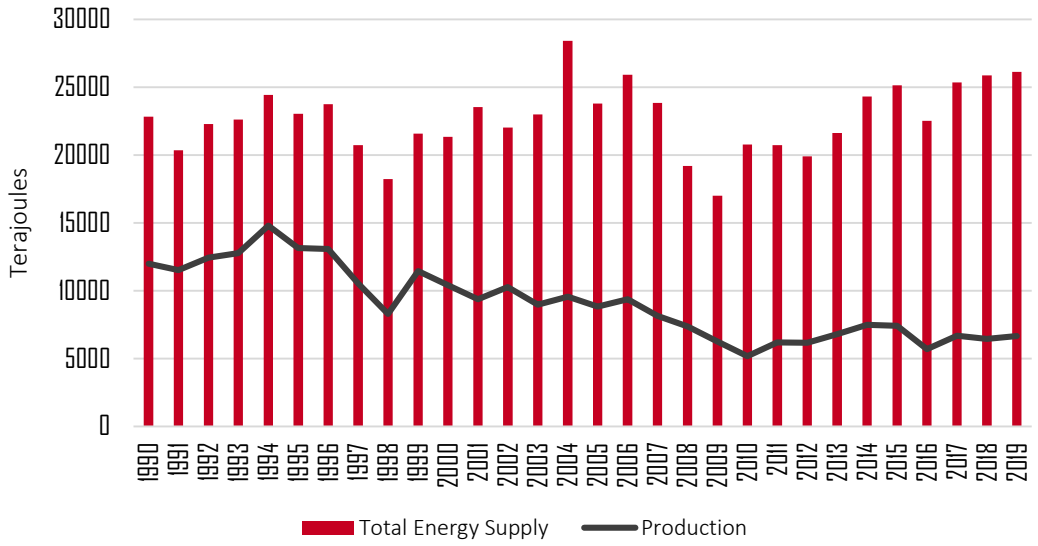
[5] United Nations Statistics Division. (2022) "Energy Balance Visualization – Fiji." Available at *https://unstats.un.org/unsd/energystats/dataPortal/*
[6] Fiji Bureau of Statistics, "2019-20 HIES."
[7] United Nations Statistics Division, "Energy Balance Visualization – Fiji,"
[8] United Nations Statistics Division, "Energy Balance Visualization – Fiji,"

EFL is responsible for most electricity generation, transmission, and distribution in Fiji. EFL generates more than 93 percent of electricity in Fiji, with the remainder being provided by independent power producers (IPPs). After undergoing partial privatization in 2018, EFL remains profitable.

Imported oil is essential to Fiji's economy, with net oil imports accounting for 18.3 percent of all imports in 2020 (US$264 million),[9] a reflection of the country's lack of oil reserves, combined with its transport sector's complete reliance on petrol, and the fact that 40 percent of electricity generation is still provided by TPPs.[10]

Given the absence of local oil production, Fiji's energy sector—including its electricity sector—must rely on petroleum imports for all of its needs not met by domestic renewable sources. In order to generate enough power to meet the existing demand for electricity, EFL has generated 327GWh from oil (via TPPs) in 2021,[11] which accounts for 35 percent of total electricity consumption.[12] The continuous reliance on thermal generation and lack of necessary investments in RE alternatives, coupled with steady economic growth over the last decade, have resulted in a sustained dependence on foreign energy, as reflected in Figure 2.5 below, which shows the total energy supply in Fiji compared to total domestic production over the last 20 years.

Figure 2.5: Dependence on Imported Energy (Domestic Production v. Total Supply), 1990-2019



Source: United Nations Statistics Division. (2022) "Energy Balance Visualization – Fiji." Available at https://unstats.un.org/unsd/energystats/dataPortal/

[9] Observatory of Economic Complexity. (2020). "What does Fiji import?" Available at *https://oec.world/en/visualize/tree_map/hs92/import/fji/all/show/2020/*

[10] International Renewable Energy Agency (IRENA). (2022). "Energy Profile – Fiji." Available at *https://www.irena.org/IRENADocuments/Statistical_Profiles/Oceania/Fiji_Oceania_RE_SP.pdf*.

[11] Energy Fiji Limited. (2022). "2021 Annual Report." Available at *https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf*, p.87

[12] Figure excludes consumption from own (non-grid connected) diesel generators.

2.2 NATIONAL AND INTERNATIONAL CLIMATE STRATEGIES AND PLANS

The NEP 2023-2030 is Fiji's main energy sector policy, and a key component of the country's climate strategy. The NEP lays out the Government of Fiji (GoF)'s vision for the development of a resilient, resource-efficient, cost-effective, accessible, reliable, and environmentally sustainable energy sector. The policy establishes the development of the energy sector as a long-term priority for the GoF and recognizes the dependence on imported oil for the transport and electricity sectors as a major structural challenge, along with other factors such as rising energy demand, ageing infrastructure, and climate risks. The policy acknowledges the necessity for balancing the competing demands of energy security, access, and sustainability, and seeks to scale up renewable energy and the use of alternative fuels in its goal to transition to a sustainable net zero economy by 2050.

The policy also acknowledges that market competition and efficiency are required to promote innovation and affordability and commits to supporting competitive neutrality and regulatory improvements to promote opportunities for private sector participation in electricity and transport. Its objectives fall under five policy pillars: (i) Energy Security and Resilience; (ii) Energy Access and Equity; (iii) Energy Sustainability; (iv) Energy Efficiency; and (v) Energy Governance, which aim to provide the guidelines for energy sector policy development between 2023 and 2030. The NEP also endorses and supports the target established in Fiji's NCCP, of producing 100 percent of national electricity from renewable energy sources by 2030, achieving net zero annual greenhouse gas emissions by 2050, and decarbonizing Fiji's transport sector.

Other climate and sustainability strategies adopted by Fiji, and which have a meaningful impact on the country's energy sector include the Fiji Low Emission Development Strategy (LEDS); the NDC Implementation Roadmap; the SDG7 Roadmap for Fiji; the National Adaptation Plan; and the Maritime and Land Transport Policy. Table 2.1 below provides an overview of each of these key climate policies. Both the NCCP and the LEDS, alongside other low and zero carbon strategies, are also discussed in further detail in Section 0 of this report.

Table 2.1: Key Climate Policies and Strategies

Policy	Overview
National Energy Policy 2023-2030	Fiji's main policy for developing an energy sector that is highly sustainable, inclusive, reliable, and can provide affordable energy services by the end of the decade. The policy has been informed by six principles: affordability; competitive neutrality; energy access for all; gender equity, equality, and empowerment; just transition; and renewable energy and sustainability. The NEP also defines five policy pillars that provide guidelines for energy sector policy development and promotes the scaling up of renewable energy to reduce the country's dependence on imported oil while improving energy security and affordability.
National Climate Change Policy 2018-2030	The NCCP is endorsed by the GoF as a central policy instrument to protect Fiji's development priorities from current, future, and intergenerational climate change risks. It seeks to address the specific climate vulnerabilities faced by

	Fiji and the Fijian people through evidence-based policy on climate change, greenhouse gas emissions mitigation, risk reduction, and environmental protection.
Fiji LEDS 2018-2050	Lays out four pathways for Fiji to achieve net zero carbon emissions by 2050 across all sectors of its economy, mainly through greenhouse gas (GHG) emission reductions. It also includes a commitment to a 40 percent reduction in transport sector emissions by 2030.
NDC Implementation Roadmap 2017-2030	The document aims to provide a roadmap for the implementation of mitigation actions to be taken in the energy sector in order to comply with the country's NDC target (30 percent reduction in emissions from reference year 2013) by 2030.
Updated NDC (2020)	Fiji's updated NDC has the following 12 targets: • Target 1: Reduce 30% of business as usual (BAU) CO_2 emissions from the energy sector by 2030 • Target 2: As a contribution to target 1, reach 100% renewable energy power generation (grid-connected) by 2030, thus reducing an expected 20% of energy sector CO_2 emissions under a BAU scenario • Target 3: As a contribution to Target 1, to reduce energy sector CO_2 emissions by 10% through energy efficiency improvements economy-wide, implicitly in the transport, industry, and electricity demand-side subsectors Target 4: As a contribution to Target 1, to reduce domestic maritime shipping emissions by 40% • Target 5: To adopt Climate Smart Agriculture practices, with emphasis on the promotion of sustainable practices in crop management, livestock and sugarcane farming and fisheries • Target 6: To enhance resilience by upgrading, repairing and relocating existing critical public infrastructure • Target 7: Develop simplified and standardized early warning and monitoring systems, and prioritize nature-based solutions to mitigate the impact of flooding and cyclones • Target 8: Relocate highly vulnerable communities, and implement the concept of 'build back better' • Target 9: Build strong healthcare system by implementing the 'Guidelines for climate-resilient and environmentally sustainable health care facilities in Fiji' • Target 10: To conserve natural environment and biodiversity wealth enabling sustainable long-term provision of ecosystem services, including carbon sequestration potential • Target 11: To plant 30 million trees by 2035 • Target 12: To establish 30% of our Exclusive Economic Zones (EEZ) as Marine Protected Areas and work towards 100% management of our EEZ by 2030 through the implementation of the National Ocean Policy.

SDG7 Roadmap for Fiji	Provides a roadmap with technological options and policy recommendations to assist the GoF in achieving the SDG7 targets.
National Adaptation Plan (2018)	The plan aims to enhance resilience against climate change and climate variability, which are projected to intensify in the future. It offers an all-inclusive evaluation of the impact of climate change on key sectors and establishes a long-term strategy for improving resilience in the energy sector, supported by a climate risk model.
Maritime and Land Transport Policy (2015)	Sets guidelines for pursuing key policies and objectives for improving the efficiency of the maritime and land transport sectors, including: the review of government subsidies for transport; promoting the use of fuel-efficient vehicles; attracting investors; reducing fossil fuel consumption; and encouraging alternative fuels for the transport sector.

Note: Policies listed may be subject to revision.

2.3 GAPS/BARRIERS ANALYSIS

The Government of Fiji is strongly committed to accelerating the use of renewable energy for electricity generation and transport. Fiji has recently experienced its first change in government in 16 years, and with that change comes renewed commitment to renewable energy and climate resilience. Government is committed to achieving 100 percent renewable energy generation by 2036 and net zero annual GHG emissions by 2050. This will require a substantial acceleration in uptake of solar and other variable VREs as we seek to displace the use of fossil fuels in Viti Levu and less populous areas.

Hitting these ambitious targets will also require change, as there is broad recognition that the status quo has Fiji moving too slowly. In April of this year, GoF hosted a National Economic Summit, where discussions of energy sector reforms figured prominently. Representatives from the public and private sectors recognized the importance of the energy sector in driving Fiji's agenda for economic transformation and called on GoF to urgently address issues of supply security and reliability, and to further investigate the potential use of public private partnerships. As part of this effort, GoF intends to review the country's 2017 Electricity Act with potential amendments in mind that would facilitate the entry of IPPs in renewable energy generation and facilitate uptake of distributed renewable energy generation.

A number of regulatory and institutional, technical, financial, environmental, and social challenges remain. These challenges will be addressed to accelerate the uptake of REI technologies and to ensure the success of Fiji's energy sector transformation. Table 2.2 summarizes the key barriers to scaling up REI and some proposed mitigation measures. Section 2.4 focuses more specifically on challenges related to equity and inclusion.

Table 2.2: Summary of Barriers to Scaling Up REI and Potential Mitigation Measures[13]

Category	Specific Barrier	Potential Mitigation Measure(s)
Regulatory and Institutional	**Lack of coordination in the energy sector** The lack of proper coordination between different energy sector stakeholders presents a challenge for the implementation of overarching policies, strategies, and regulations.	Develop an Integrated Energy Plan, as well as set up institutional planning and implementation structures for major stakeholders such as DoE, MPWMST and EFL.
	Lack of coordination in the maritime transportation sector The existing maritime policy is not fully coordinated and there is no sectoral level policy providing an enabling environment for decarbonization of the sector, including for the enhanced enforcement of regulation. Conflicting fiscal policies in Fiji (e.g., duties and excises and import restrictions, fuel price controls, subsidies) currently discourage private sector investment in reducing emissions in this sub-sector. There is also a lack of disaggregated fuel use data and detailed data on boats and motors, and this limits the ability of the Fijian Government to design appropriate fiscal incentives for the private sector and households to invest in low-carbon technologies and vessels.	Increased integration of intergovernmental coordination and cooperation, for planning and incentives to increase the implementation of mitigation actions for the decarbonization of maritime transport. Extend and broaden the use of existing stakeholder workshops and meetings, and private sector associations to encourage effective and efficient implementation of mitigation actions in the maritime transportation sector, such as the Transport Consultative Forum.

[13] Table based on Ministry of Economy of Fiji. (2022). "NDC Investment Plan: 2022 Investment Planning for the Transport and Energy Efficiency Sectors."

Electricity tariff structure that does not reflect the costs associated with variable renewable energy (VRE) integration EFL currently charges a variable rate of 34.01 cents per kWh of electricity to domestic consumers. This variable rate poses a challenge to VRE integration into the grid: as more domestic consumers opt to install their own solar rooftop Photovoltaic (PV) systems, their demand for EFL-supplied electricity is reduced. At the same time, EFL must still pay for all fixed costs associated with the transmission and distribution (T&D) network used to serve these self-generating customers. Additional VRE integration, therefore, negatively impacts the financial performance of EFL by reducing its variable revenues from the sale of electricity without an accompanying reduction in the fixed costs of operating the company's T&D network. As a result, it is not currently in the best interest of EFL to promote the expansion of domestic rooftop solar generation.	EFL should develop a new tariff methodology that incorporates both a fixed and a variable component. The fixed component (fixed charge) should reflect the fixed costs associated with the maintenance and operation of the company's T&D network as well as other fixed costs. The variable component should reflect all variable costs associated with the generation and sale of electricity. By introducing a fixed charge for electricity supply, EFL will be able to cover the costs of T&D operations even for those consumers who opt to install their own solar rooftop PV systems. This new tariff would therefore better align the interests of EFL with those of the GoF and Fijian society, which seek to increase renewable energy generation in the country.
Lack of incentives for renewable energy development and private sector participation in the Electricity Act The Electricity Act sought to make the sector more attractive to private investors through the partial divestment of EFL and the establishment of the Fijian Competition and Consumer Commission (FCCC) as an independent regulatory body. However, transition towards a competitive generation marketplace has been slow, with only 3 IPPs operating and producing a minor fraction of Fiji's total electricity demand. Furthermore, the Electricity Act has failed to boost the adoption of additional RE resources such as solar and wind, resulting in a lack of diversification in Fiji's energy matrix. This lack of diversification leads to an overreliance on hydropower plants, which in turn make the country's	The GoF is determined to conduct a review of the Electricity Act and explore the potential to include provisions that further promote private sector participation in electricity and favour the adoption of alternative RE resources, such as wind and solar. Proposed amendments could be focused on, but not limited to further clarifying a transparent competitive procurement process and licensing parameters for IPPs; the further development of the legal framework for power purchase agreements (PPAs); and the inclusion of an obligation for the utility to accept renewable electricity from IPPs, at a reasonable price regulated by the FCCC (on basis of costs and fair profit under a competitive bidding process).

	electricity infrastructure less resilient and more vulnerable to climate risks, such as drought or floods.	It is also important to create a transparent process of direct tendering, reverse auctioning, or direct private sector initiatives for renewable energy generation.
Technical/Capacity	**Low availability and retention of skilled and technical employees** Fiji is experiencing a deficit of skilled and technical employees, which are essential for the efficient functioning of the electricity sector. Although the country provides training through its education system, that is not currently sufficient to meet the increasing electricity demand and the coming shift towards a fully renewable energy matrix. This challenge is exacerbated by the fact that highly skilled professionals often migrate from Fiji to larger countries that provide more opportunities for career growth, higher salaries, and access to a more dynamic social environment. The lack of incentives to train and retain skilled professionals can lead to a lack of expertise in key areas, such as renewable energy, and result in reduced productivity and increased costs. It can also lead to delays in project completion, and adversely affect the quality of services provided.	The GoF should extend its support for the training of skilled professionals in the energy sector through academic and career incentives. Proposed incentives to foster the creation of a highly skilled workforce could include: reintroducing apprenticeship schemes and increasing opportunities for apprenticeships; providing tax deductions for approved training courses; supporting the establishment of a Training Centre for Renewable Energy at TAFE USP; offering more scholarships for energy-related courses; providing regular trainings for operating and maintaining renewable energy technologies; and creating re-training opportunities for professionals in both the public and private sectors.
	Electric grid infrastructure that is inadequate for the integration of RE technologies The intermittent nature of RE resources, like solar and wind, requires the electric grid to be able to handle fluctuations in supply and demand in real-time. This in turn requires the use of advanced technologies and communication systems, such as smart grid technologies. The addition of electric vehicle (EV) charging stations to the grid also increases demand for electricity and requires additional grid capacity to handle the load. At the present moment, however, Fiji's electricity infrastructure does not fully comply with the necessary	Provide an asset management plan for upgrading electric grid infrastructure for better accommodation of RE resources and EV stations. The plan should provide a framework for the introduction of smart grid technology in order to allow for the expected increase in VRE by new RE projects or individual households in the coming years. This would have the additional benefit of improving grid reliability in the face of increased climate risks, including increased frequency and severity of storms and cyclones, which often lead to supply interruption.

standards to handle the increased demand and fluctuations in supply associated with the integration of RE technologies, while maintaining the reliability and stability of the electric grid.	Possible actions include grants or subsidies for the implementation of smart grid technology, estimating the increased electricity demand from EV charging stations, and working together with FCCC and Fiji Revenue and Customs Service (FRCS) to determine prices that better reflect maintenance costs.
Fragmentation of responsibilities across stakeholders Responsibilities are fragmented among various ministries, departments, agencies and authorities, and sub-sector boundaries are not always 100 percent clear, which makes the process of employing wide-sector actions such as the approval and implementation of REI projects unnecessarily difficult and complicated.	Additional capacity building for improving the Fiji Bureau of Statistics (FBoS) ability to collect energy sector data would also be important for key statistics needed for the renewable energy integration planning process.
Limited storage capacity and reliance on acid lead batteries There remains a significant untapped potential to scale up the use of renewable energy for power generation in Fiji. A key barrier for further expansion of VRE based power is reported to be storage capacity, especially for grid-connected systems managed by EFL and IPPs. The demand for battery storage for individual power projects is expected to increase in the future in Fiji, in line with the increased deployment of on- and off-grid renewable energy power generation, based on the Governments goal to approach 100% on-grid renewable energy power generation by 2030, and increase energy power generation in rural areas. Furthermore, the majority of energy for off-grid VRE based individual power projects is currently stored using lead acid batteries, with only newer systems using Lithium-Ion batteries. In terms of energy consumption and investment requirements, Li-Ion batteries have several advantages	Batteries should be installed on a larger scale by EFL or IPPs to smoothen the variability and vulnerability to the grid created by the increased usage of VRE based power. Furthermore, lead acid batteries currently in use, both for off-grid applications by households and private firms and for on-grid application by EFL, should be replaced by Li-Ion batteries. At present the initial investment needed is higher for Li-Ion batteries compared to lead acid batteries (US$800/kWh vs US$400/kWh), but the cost of Li-Ion batteries is predicted to reduce in the near future. Nonetheless, given the current price differential, natural use of Li-Ion batteries is unlikely to happen unless there is a concerted effort in terms of policy development, awareness raising, advocacy, capacity building for service provider, procurers/operation, as well as maintenance personnel. Further vendor development is also necessary.

	over traditional lead acid batteries. Li-Ion batteries are more efficient which reduces energy lost in storage and conversion. They also have longer life, which reduces the frequency of replacements required and the investment needs over a longer period of time. Li-Ion batteries also have a higher Depth of Discharge through which a larger amount of energy can be withdrawn from it, reducing the capacity needed to be installed and thereby the investment requirements.	Finally, the systems for the recycle and reuse of Li-Ion battery are not as well developed as that for lead acid battery, partly because it is a relatively new and more complex technology and also because it is less standardized. However, there is good recycling infrastructure in Asia, with South Korea and China being the global leaders in recycling of Li-Ion batteries. Battery manufacturers and miners are also setting up recycling facilities, and reuse of Li-Ion is also happening due to its longer life.
	Peak Demand Management Meeting peak demand for power is always a challenge in a growing economy, and all options to manage peak demand need to be fully exploited in order to limit the additional needs of investment in power generation and distribution.	Time of Day tariffs for larger consumers could be introduced in Fiji, as well as other potential measures for energy demand control such as a utility led demand-side management (DSM).
Environmental	**Limited availability of suitable land for RE and REI development** Competing land resources such as agriculture, expanding settlements, and protected areas limit development of new RE and REI projects.	Integrate RE and REI technology with existing structures and promote small scale RE and REI development.
Financial	**Limited financial incentives and financing for maritime transport decarbonization** Fiji has in place various tax incentives, the Shipping Franchise Scheme, and Community Service Obligations to provide domestic shipping services. These incentives and mechanisms do not currently encourage the greater implementation of low-carbon technologies in the maritime transport sub-sector. Maritime transport also suffers from a lack of access to commercial lending at affordable rates for the private sector and individuals to invest in new low-carbon technologies and vessels. Insurance is often not available, or not affordable, in Fiji leaving most vessel owners,	Revise tax structure for the import of efficient outboard motors with a lower duty and excise taxes on cleaner technology and higher values on high emission motors. Create commercial and retail lending mechanisms tailored to support a more rapid transition to lower emissions maritime transport technologies. Provide blended financing which provides for the specific needs of each stakeholder, recognizing that the financing needs for businesses operating inter-island ferries on uneconomic routes are different to those servicing the tourist sector which are different to the individual household using boats for personal use and fishing.

	including the government, to assume the risk of loss and damage of vessels which makes securing loans within the sub-sector even more challenging due to increased risk.	Encourage the development of an insurance market that offers products to underwrite risk for performance of commercial operations and loss and damage of vessels.
	Limited financial incentives and financing for land transport decarbonization In order to decarbonize land transport, the market requires clear, cost-competitive alternatives to current practices. Almost all vehicles registered in Fiji run on unleaded petroleum (ULP) or automotive diesel (ADO), with a very small share of Liquid Petroleum Gas (LPG) vehicles. The existing tax incentives for electric vehicle charging stations and for biofuels use are not compelling enough to motivate change at the individual or commercial level within the market in Fiji.	Create fiscal concessions at both registration and taxation levels for zero-emission transport, such as EVs and mass transit vehicles, for businesses in the form of commercial tax incentives. Amend mass transit pricing methodologies (adjusting levies/fees collected on passenger fares) to support commercial business shifting to lower emission mass transit vehicles and EVs. Develop incentives for the appropriate decommissioning of vehicles assets at the end of their lifecycle.
	Limited awareness of the importance of decarbonizing key sectors, such as land and maritime transportation The human capacity to facilitate change within both the public and private sectors is limited in Fiji, as most people are not fully aware of the importance of reducing GHG emissions, and achieving decarbonization of key sectors, such as land and maritime transportation.	The education institutions in Fiji need to provide the courses and training relevant for a low-carbon shipping future. Raising the level of awareness in the public and private sector on transitioning from fossil fuels, and what options are available and appropriate, as well as available financial incentive are essential to encourage the low-carbon transition of this sub-sector in Fiji.
Social	**Lack of access to electricity in isolated and rural communities** Although 95 percent of Fiji's population has access to electricity, a considerable portion remains disconnected from the grid due to the challenges of distributing power to small and isolated communities and rural villages not located on the main islands. This means that efforts to increase the share of RE resources in the country's energy mix are unlikely to impact this part of the population. Additionally, given that	The GoF should develop a rural electrification master plan that maps out the locations it must reach in order to achieve 100% electrification. It should then identify the best solution to bring electricity for each of these communities – whether by extension of the existing grid, new grid connections, or standalone solutions using renewable energy, such as mini-grid solar, or rooftop solar. Regulations, subsidies, and tariff setting for off-grid areas should be revised through FCCC, and decentralized mini-grid and off-grid renewable energy solutions should be

a significant number of the rural poor rely on standalone diesel generators for their energy needs, instead of solar rooftop solar or other renewable energy sources, they become especially vulnerable to price volatility in the international oil market.

prioritized in cases where the connection to on-grid distribution is not feasible or cost-prohibitive.

The GoF should also provide a roadmap to phase out all villages' diesel generators and replace them with solar home systems and solar mini-grid hybrid projects in the near future.

2.4 SOCIAL EQUITY AND INCLUSION

Fiji has made important progress on education indicators for both women and men. Fiji has attained high levels of gender parity in school education and participation of almost 100 percent in primary and 80 percent secondary.[14] In addition, both genders in Fiji have a very high completion rate of lower secondary school; 106.6% of girls and 100.1% of boys complete lower secondary school in Fiji as of 2021 data.[15]

Despite improvements in educational achievement, Fijian women do not have the same access to economic opportunities that men do. In 2022, only 38.1 percent of women participated in the labour force[16] compared with 75.4 percent of men. This female labour force participation has remained roughly the same since 1990 indicating little improvement over time. In addition, when looking at labour force participation in the upper-middle income group, the gap between men and women is higher in Fiji.[17] A factor that contributes to women's low participation in the labour market is the disproportionate responsibility they have for household tasks and care work. Women spend an average of 2.9 times as much time on domestic work than men. Women spent 15.2 percent of their day and men spent 5.2 percent of their day on unpaid household work in Fiji in 2016. The socio-economic impact of the extensive additional work that women take on is that it limits the amount of time they have available to earn income resulting in less wages earned compared to men. Furthermore, the limited amount of time that women can participate in the workforce is spent working at jobs that tend to be of lower quality and with lower pay. Table 2.3 describes national gender and social inclusion policies.

Table 2.3: Key Policies Relating to Gender and Social Inclusion Policies

Policy	Overview
National Gender Policy (2014)	Fiji's overarching national policy for gender equality and a framework for including gender perspectives in all activities of government and civil society. The policy takes a cross-cutting approach promoting visible active gender mainstreaming in all sectors and advocates the use of gender impact assessments, gender analysis, gender-aware approaches, gender-sensitive institutional arrangements, and continuous training and monitoring. It calls for sector-specific policies to integrate the interests of women into strategies and administrative and financial activities. It further calls for a policy of access to energy supplies to all persons in Fiji (1) to ensure that women in communities are consulted in any energy projects, (2) to recognize that women in rural communities have the most limited access to energy sources (including renewables), and

[14] Asian Development Bank. Women's Resilience in Fiji: How Laws and Policies Promote Gender Equality in Climate Change and Disaster Risk Management. August 2022.

[15] The lower secondary education completion rate measures how many children have completed the last grade of lower secondary education regardless of age completed. World Bank. "Fiji." World Bank Gender Data Portal. Accessed August 2, 2023. *https://genderdata.worldbank.org/countries/fiji*

[16] The labor force participation rate is the proportion of the population ages 15 and older that is economically active.

[17] World Bank. "Fiji." World Bank Gender Data Portal. Accessed August 2, 2023. *https://genderdata.worldbank.org/countries/fiji*.

	(3) to monitor the effect of energy sources which may have a detrimental effect on the health of women.
National Energy Policy 2023-2030	The NEP seeks to improve gender equality and a just transition in the energy sector, including efforts to ensure that women play a role in decision-making, responsibilities, and activities involved with securing safe and affordable energy access. It aims to reduce the burdens, barriers, and inequities that impact the way women interact with energy services, experience energy poverty, access employment opportunities within the energy sector, and take part in energy-related decision-making. It calls for increased access to alternative cooking fuels to reduce reliance on biomass and kerosene.
Ministry of Finance (formerly Ministry of Economy) Gender Equality and Social Inclusion (GESI) Policy (2021)	The Ministry of Finance recognizes that promoting equity and inclusion is both a moral imperative and an economic necessity. The goal of the policy is to ensure that GESI is fully mainstreamed in all Ministry of Finance plans, budgets, processes, and systems. It calls for the implementation of gender-based budgeting as a central part of the public financial management reform process.

In addition to the gender gaps described above, there is a challenge related to occupational segregation, particularly in the energy sector. The DoE has 8.7 percent female staff, while the utility's staff is 12.7 percent female.[18] The 2010–2011 Employment and Unemployment Survey indicates that in both formal and informal self-employed sectors, women make up 27% of the workforce, mainly working in market-oriented agricultural production or fishing, handicrafts, and sales-related jobs. Approximately 800 women, compared to 4,300 men, are self-employed in the formal sector, reflecting the limited participation of women as business owners. In addition, in the tourism industry, women make up a large portion of the sector in positions where wages are usually at minimum wage. Women occupy one-third of this workforce but only hold one-quarter of managerial and professional positions whereas men hold most of the technical and more highly paid jobs.[19] These numbers reflect disproportionate participation in important occupations such as energy, tourism, and technical positions.

There is also an important rural-urban divide in terms of energy access. Access to energy in Fiji is lower in rural areas compared to urban areas. While in main cities access to electricity service covers 96% of the population, it decreases to 86% in dispersed rural areas;[20] thus 4% of urban residents and nearly 20% of people living in rural areas still lack electricity access as of 2021.[21] Although the divide between rural and urban is extensive, access to electricity in recent years has increased exponentially with the percentage of rural

[18] Page 65, FESRIP, Volume 2: Issues and Background Papers

[19] Asian Development Bank. Accessed August 2, 2023. *https://www.adb.org/sites/default/files/institutional-document/210826/fiji-cga-2015.pdf*.

[20] "Access to Electricity, Rural (% of Rural Population) - Fiji." World Bank Open Data. Accessed August 2, 2023. https://data.worldbank.org/indicator/EG.ELC.ACCS.RU.ZSend=2021&locations=FJ&start=1996&view=chart.

[21] Fiji Renewables Readiness Assessment. Accessed August 2, 2023. *https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/IRENA_RRA_Fiji_2015.pdf*.

households in Fiji that have electricity increasing from 30.6 percent in 1986 to 81.4 percent in 2007. This grow was the result of rural electrification efforts, low population growth, and increasing urbanization. [22] Development in rural areas is frozen in Fiji due to this lack of electricity access. People in rural areas are forced to use high-cost, inefficient energy sources such as diesel for lighting and batteries for radios which takes up a large portion of their limited incomes. Women in these rural communities with low incomes are particularly affected since electricity would help them carry out household daily tasks such as food preparation, helping children with homework, agriculture and business activities, and fulfilling obligations in their communities.

Fiji has been taking measures in recent years to expand disability rights. Efforts have included creating a convention with the goal of advocacy, defining disabilities in the Constitution, and describing the rights of disabled peoples in the Constitution. Fiji recently ratified the Convention on the Rights of Persons with Disabilities in 2017. According to the passed resolution, the goal of this convention is to promote, protect and ensure the full enjoyment of all human rights and fundamental freedoms by all persons with disabilities and promote respect for their inherent dignity. In addition, the Fijian Constitution now explicitly defines the term "disability" which legally orders that a person cannot be discriminated against, prevented access, or denied equity because of an individual's disability. The Constitution also states that a person with any disability has the right to the following: reasonable access to all places, public transport, use sign language, Braille or other appropriate means of communication, reasonable access to necessary materials, substances and devices relating to the person's disability.[23] There are also public schools in Fiji offering primary education for persons with physical, intellectual, and sensory disabilities; however, cost and location limited access. Although there are options for people with disabilities to attend primary school, opportunities were extremely limited for secondary school or higher education for persons with disabilities.[24]

[22] "Energy Access Case Study 07 – The Pacific Response: Electrifying Isolated Islands." UNDP, July 27, 2015. *https://www.undp.org/asia-pacific/publications/energy-access-case-study-07-pacific-response-electrifying-isolated-islands.*

[23] "Disability Rights." FHRADC, December 8, 2021. https://www.fhradc.org.fj/disability-right/.

[24] Fiji 2020 Human Rights Report - U.S. Department of State. Accessed August 2, 2023. *https://www.state.gov/wp-content/uploads/2021/03/FIJI-2020-HUMAN-RIGHTS-REPORT.pdf*.

SECTION 3 RENEWABLE ENERGY INTEGRATION (REI) IN FIJI

Renewable energy plays a critically important role in Fiji's electricity sector, and there is huge potential for continued growth. Section 3.1 describes the existing role of renewables in Fiji's electricity sector and opportunities for growth. Section 0 describes the policies and strategies in place to promote that growth. Section 3.3 describes the sector institutions implementing the policies and strategies. Section 3.4 and Section 3.5 describe the role of the private sector and the role of international development partners, in facilitating renewable energy integration.

3.1 RENEWABLE ENERGY IN THE ELECTRICITY SECTOR

Hydropower provided nearly 60% of Fiji's electricity generation in 2021, and there are early solar, wind, and biomass generation projects. There are, nevertheless, major challenges in bringing sufficient resources online, as evidenced by the sector's still high dependence on fossil fuels. Many of these challenges relate specifically to the inability of the grid to absorb additional generation, and additional load. The challenges are compounded by the volatility of hydropower generation over time, as climate change has made it more and more difficult to accurately predict and plan for dry years. The island of Viti Levu—home to ¾ of Fiji's population—has an electricity network which is still largely a radial design. The Monasavu Hydropower Plant—the largest power plant on Viti Levu—is located at the geographical centre of the island, but with too few "spokes" connecting from that central "hub", and few transmission connections to other areas that have good potential sites for renewable energy generation.

Access to electricity also remains a challenge for some. Ninety-five percent of Fiji's population has access to electricity, but a portion of the country's rural population remains without grid connections, relying predominantly on fossil fuels for electricity generation, and traditional fuels for cooking.

This section describes the existing of renewable energy generation in Fiji and identifies some of the principal challenges in bringing additional renewable energy generation online—challenges that CIF support is well placed to address under the REI Program.

3.1.1 Electricity Generation

As described in Section 2.1, more than 90 percent of electricity generation in Fiji is provided by EFL, with most electricity coming from renewable sources, primarily hydro (49 percent) and bioenergy (10 percent). Solar and wind currently account for minimal amounts of power (1 percent and less than 1 percent of all electricity generation, respectively).[25]

Historically, renewable energy sources have been the primary source of electricity, despite growth in hydro generation being stagnant since 2012.[26] In the last 10 years, the combined share of hydro and wind generation in EFL's grid fell from 63 to 58 percent, while IPPs, which primary rely on biomass for electricity generation,

[25] Energy Fiji Limited. (2022). "2021 Annual Report." Available at https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf

[26] Energy Fiji Limited. (2022). "2021 Annual Report." Available at https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf

saw their share increase by two percentage points. The share of thermal power in EFL's electricity matrix peaked at 52 percent in 2015 and has since experienced a gradual decline, reaching 35 percent in 2021.

Figure 3.1 provides an overview of electricity generation by source from 2012 to 2021, and Figure 3.2 shows Fiji's electricity generation mix in 2020.

Figure 3.1: Electricity Generation by Source (Grid-Connected Only), 2012-2021

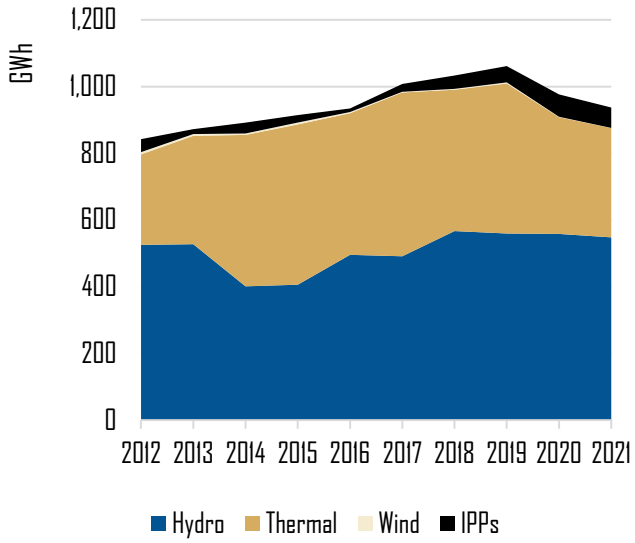
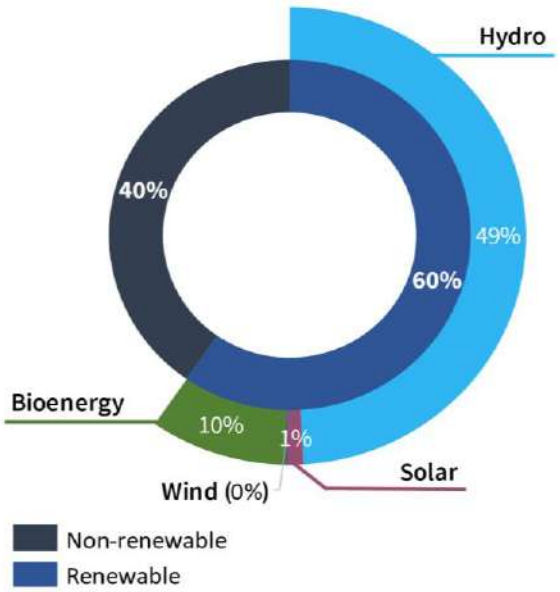


Figure 3.2: Electricity Generation Mix (Total), 2020



Sources: Energy Fiji Limited. (2022). "2021 Annual Report."
International Renewable Energy Agency (IRENA). (2022). "Energy Profile – Fiji."

EFL's installed capacity totals 329 MW and is comprised of 182 MW of thermal and 147 MW of renewable energy (RE). Total available generation capacity stands at 267 MW, including 141 MW of thermal and 126 MW of RE.[27] In 2021, 58 percent of electricity generated came from hydro power plants (HPPs) supplied mainly by the Wailoa and Nadarivatu hydro power stations.[28] Thermal accounted for the second largest share at 35 percent, mostly from Kinoya & Vuda heavy fuel oil power station.[29] IPPs generated 6.5 percent of electricity from biomass and EFL's Butoni Wind Farm accounted for the remaining 0.03 percent.[30] Table 3.1 provides

[27] IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific." Available at https://www.developmentaid.org/api/frontend/cms/file/2022/07/IFCPoweringthePacificGuide-FINAL.pdf.
[28] Energy Fiji Limited. (2022). "2021 Annual Report." Available at https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf, p.87
[29] Energy Fiji Limited. (2022). "2021 Annual Report." Available at https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf, p.87
[30] Energy Fiji Limited. (2022). "2021 Annual Report." Available at https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf, p.87

information on key generation assets in Fiji, including their type, ownership, installed capacity and generation in 2021.

Table 3.1: Main Generation Assets in Fiji

Generator Asset	Type	Ownership	Installed Capacity (MW)	Electricity Generated in 2021 (GWh)
Wailoa/Monasavu Power Station	Hydro	EFL	80	440
Nadarivatu Power Station	Hydro	EFL	44	85
Wainikasou Power Station	Hydro	EFL	6.6	19
Nagado Power Station	Hydro	EFL	2.8	0
Kinoya & Vuda Power Stations	Thermal	EFL	115	274
Labasa & Ovalau Power Stations	Thermal	EFL	16.8	53
Butoni Wind Farm	Wind	EFL	9.8	0.2
Tropik Wood Power Station	Biomass	Tropik Wood	9	61
Lautoka Fiji Sugar Corporation (FSC) Power Station	Biomass	Fiji Sugar Corporation	5	
Labasa FSC Power Station	Biomass	Fiji Sugar Corporation	20	
PV Projects for Self-Consumption				
Coca-Cola Amatil	Solar	Private	1.1	Grid-connected rooftop solar for self-consumption
Mark One textile factory	Solar	Private	0.2	
Radisson Blu resort, Denarau	Solar	Private	0.4	
Smaller Commercial or Household Solar PV	Solar	Private	~1.5	

Sources: IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific." Available at *https://www.developmentaid.org/api/frontend/cms/file/2022/07/IFCPoweringthePacificGuide-FINAL.pdf*; and

Energy Fiji Limited. (2022). "2021 Annual Report." Available at *https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf*

Around 150 rooftop solar PV installations are also operating in Fiji, accounting for about 580 MWh per year, although the majority are very small projects. EFL expects generation to increase to 1,000 MWh in the coming years. Sunergise, an energy service company, operates at least four large installations—ranging from 200 kW to 1.5 MW—on behalf of electricity consumers. The operation is under a net billing arrangement (with a fixed tariff for electricity exported back to the grid) with EFL. EFL has standard technical and commercial terms that it offers to interested parties, but the terms are only available upon request.

3.1.2 Transmission and Distribution

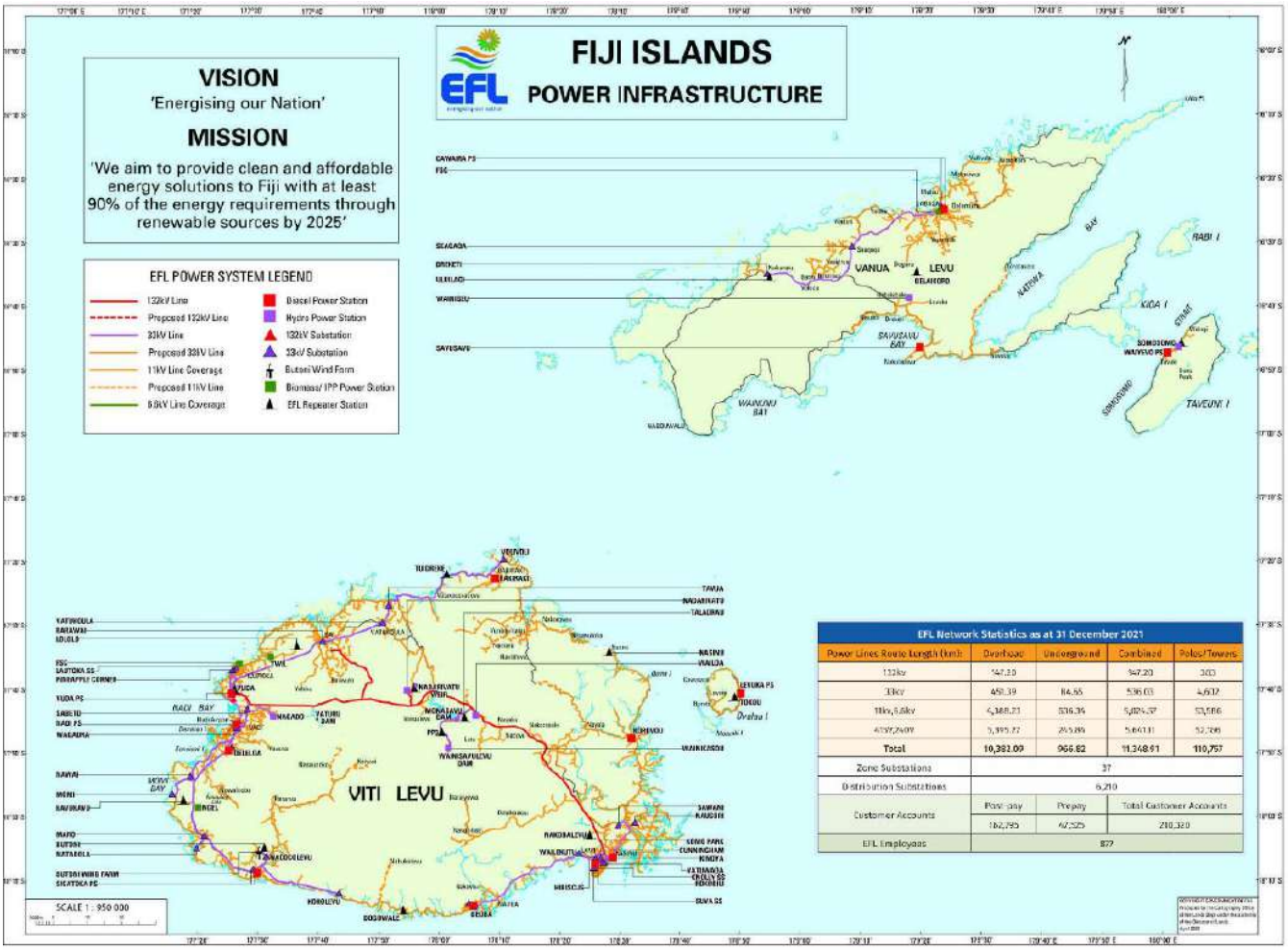
Fiji's transmission and distribution grid is owned and maintained by EFL and consists of more than 11,000 km of total power lines.[31] The transmission network comprises 147 kilometres of 132 kilovolt (kV) transmission lines, 451 km of 33 kV overhead sub-transmission lines, and 84 km of 33 kV underground sub-transmission cables coupled with 37 zone substations that make the conversion to adequate distribution voltage.[32]

The distribution network consists of 4,388 km of overhead high-voltage distribution lines, 636 km of underground high-voltage distribution cables, 5,395 km of overhead low-voltage distribution lines, and 245 km of low-voltage distribution underground cables coupled with 6,210 distribution substations.[33] Figure 3.3 shows the transmission and distribution grid across Fiji's main islands.

Most Fijians have access to electricity, but there is a substantial rural-urban disparity. Roughly 96 percent of the population has access to electricity, either via a connection to the state grid (80 percent), home solar systems (11 percent), or diesel generators (4.5 percent).[34]

[31] Energy Fiji Limited. (2022). "2021 Annual Report." Available at *https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf*
[32] Energy Fiji Limited. (2022). "2021 Annual Report." Available at *https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf*
[33] Energy Fiji Limited. (2022). "2021 Annual Report." Available at *https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf*
[34] Fiji Bureau of Statistics, "2019-20 HIES."

Figure 3.3: Fiji's Transmission and Distribution Grid Infrastructure, 2021



Source: Energy Fiji Limited, "2021 Annual Report."

EFL has targets for System Average Interruption Frequency Index (SAIFI)[35] and System Average Interruption Duration Index (SAIDI)[36] to ensure reliability of electricity distribution to its consumers. In 2021, EFL achieved a SAIFI of 3.23 times (well within its target of six times per year or less), and a SAIDI of 127 minutes (well within its target of less than 255 minutes).[37]

[35] SAIFI refers to the average number of interruptions that a customer experiences over the period of one year.
[36] SAIDI refers to the average outage duration for each customer served, over the period of one year. It is measured in units of time, usually minutes or hours.
[37] Energy Fiji Limited. (2022). "2021 Annual Report." Available at https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf

The company has been able to expand its transmission and distribution grid by 1,700 km (19 percent increase) over the last 10 years,[38] with plans of further investment in the development of a 132kV Transmission Network from Virara Settlement to Rarawai, Ba.[39]

3.1.3 Demand

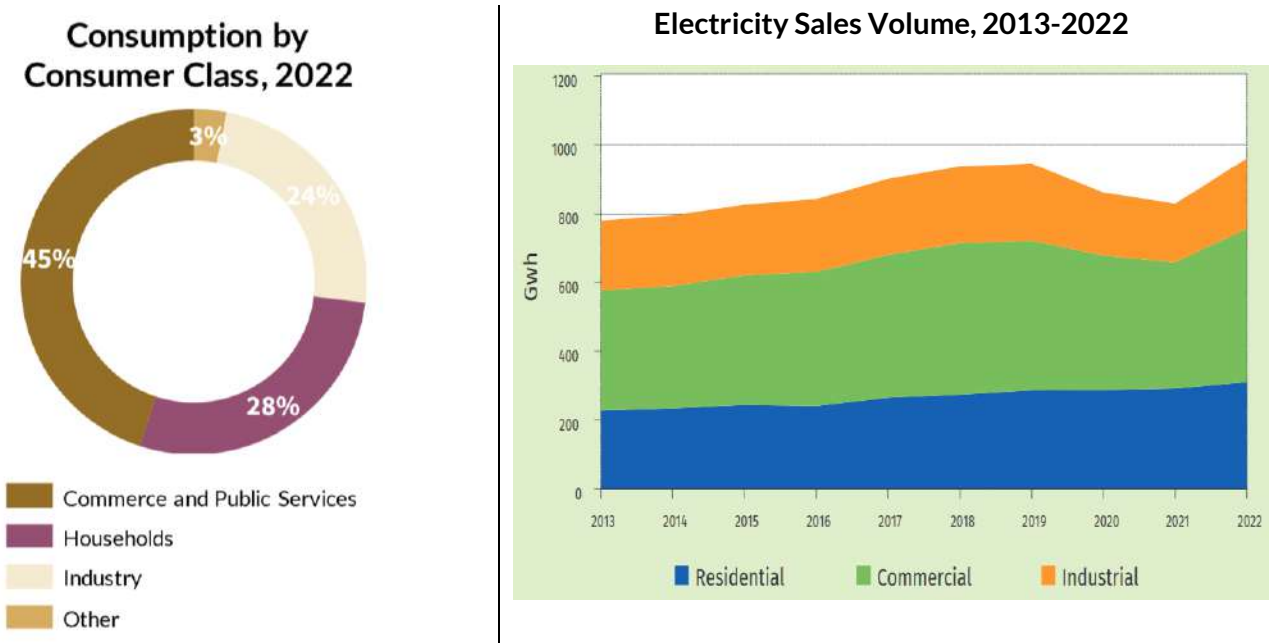
Fiji's electricity demand is driven primarily by the commerce and public services sector, which accounts for 45 percent of consumption from grid-connected electricity. Households account for another 28 percent of consumption, followed closely by the industrial sector, which makes up 24 percent of demand.[40]

Electricity sales grew steadily between 2013 and 2019, but experienced a sizeable decline between 2020 and 2021, as a result of the COVID-19 pandemic.[41] The effects of the pandemic, however, have been uneven across consumer classes: while the residential sector was spared from the decline in demand, industry and commerce electricity sales have been heavily impacted, as these sectors were most vulnerable to the economic slowdown caused by COVID. As of 2022, however, demand from the commercial and industrial sector has rebounded, bringing electricity sales back to pre-pandemic levels. Demand is forecast to continue to grow at a rapid pace with the growth of Fiji's economy.

Figure 3.4 below shows an overview of electricity demand by consumer class.

[38] Own calculation considering a total network grid of 9,234 km in 2012, according to EFL's 2012 Annual Report available at *https://efl.com.fj/wp-content/uploads/2014/02/FEA-ANNUAL-REPORT-2012-1.pdf*.
[39] Energy Fiji Limited. (2022). "2021 Annual Report." Available at *https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf*
[40] United Nations Statistics Division. (2022) "Energy Balance Visualization – Fiji." Available at *https://unstats.un.org/unsd/energystats/dataPortal/*.
[41] Energy Fiji Limited. (2022). "2021 Annual Report." Available at *https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf*, p.27

Figure 3.4: Electricity Demand by Consumer Class



Source: United Nations Statistics Division. (2022) "Energy Balance Visualization – Fiji." Available at https://unstats.un.org/unsd/energystats/dataPortal/.

Energy Fiji Limited. (2023). "2022 Annual Report." Available at *https://efl.com.fj/wp-content/uploads/2022/08/EFL-2022-Annual-Report.pdf*, p.27

3.2 NATIONAL LOW OR ZERO CARBON ENERGY STRATEGIES

In addition to the national and international climate strategies described in Section 2.2, Fiji has a number of policies aimed specifically at reducing carbon emissions. These are described below.

Fiji's NCCP 2018–2030 established Fiji's national climate change response and NDC under the Paris Agreement. The policy outlined the overarching objectives to address the specific climate vulnerabilities faced by Fiji through evidence-based policy and legislation. The NCCP established a mandate for the creation of the LEDS and underpinned the basis for the development of the Climate Change Act.

The Climate Change Act, Fiji's main piece of legislation governing low emission strategies, was enacted in 2021. The Act recognizes that Fiji and the entire world are facing a climate emergency, and that Fiji is especially vulnerable to the effects of climate change due to its position as an island state and its consequent exposure to the damages of rising sea levels, climate disasters such as cyclones and flooding, as well as the destruction of marine ecosystems from which the country heavily relies for food security and economic stability.

The Climate Change Act legally-binds Fiji to achieve net zero carbon emissions by 2050. It establishes a robust legal framework for transforming Fiji into a carbon-neutral nation and enhancing the climate resilience of its economy. It does so by incorporating various provisions, such as carbon budgets, the establishment of a carbon market, addressing climate-induced human mobility, implementing nature-based solutions, legally

recognizing maritime boundaries considering sea level rise, securing climate finance, and fostering intergovernmental resilience building.

The Act empowers the Minister responsible for Climate Change to implement measures to limit Fiji's GHG emissions. This includes issuing guidelines for state entities to align their decisions and policies with the Act's objectives, imposing fees on emissions exceeding a certain level, and introducing fiscal incentives. It also mandates the creation of the Fijian GHG Inventory and its public availability online, for improved measurement, reporting and verification of emissions and emissions reductions.

Fiji's Low Emission Development Strategy (LEDS) 2018-2050 outlines the pathways for Fiji to reach its goal of net zero carbon emissions by 2050. The strategy lays down four different low emission scenarios that Fiji may achieve depending on the extent and ambition of the policies adopted. The strategy evaluates the potential impact of current policies at the sector level and proposes additional key policies and actions necessary to further reduce emissions.

At the most ambitious scenario under LEDS, Fiji reaches net zero emissions by 2041. This would be achieved through a complete transformation of Fiji's energy sector to one based on a wide variety of on-grid and off-grid renewable energy generation. Specific policy actions include capacity building for renewable energy and smart grid technology; complete transition of Fiji's land transport system to hybrid-electric and electric vehicles; full methane capture and utilization for organic waste reduction and recycling programs; and extensive afforestation measures to offset the increase in emissions caused by population and economic growth.

3.3 INSTITUTIONAL FRAMEWORK AND CAPACITY

Fiji's government and energy sector institutions are extremely well placed to implement REI IP projects financed by CIF. It has 5- and 20-year **National Development Plans (NDP)** that it updates regularly and more recently, a **National Infrastructure Investment Plan (NIIP)** approved by Cabinet in early 2023. EFL has similarly developed a 10-year **Power Development Plan (PDP)**, with nearly US $1 billion in investment foreseen in the next decade.

Fiji's 20-Year NDP (2017-2036) provides a vision for "Transforming Fiji" towards an even more progressive, vibrant, and inclusive society. It outlines a framework that encompasses strategic policy manoeuvres, new approaches to development and the aspirations of all Fijians. The Plan consists of two prongs or approaches, which are designated as: "Inclusive Socio-economic Development" and "Transformational Strategic Thrusts".[42] The plan aims to achieve 100 percent renewable electricity generation by 2036.[43] In order to achieve this goal, the GoF plans on developing a variety of renewable energy sources, including hydropower, wind, solar, biomass, geothermal and wave and tidal energy, where they are viable and affordable.[44]

[42] Government of Fiji. (2017). "5-Year & 20-Year Development Plan." Available at *https://www.adb.org/sites/default/files/linked-documents/LD4%205yr%20and%2020yr%20DP%20Transforming%20Fiji.pdf*, p.2
[43] Government of Fiji. (2017). "5-Year & 20-Year Development Plan." Available at *https://www.adb.org/sites/default/files/linked-documents/LD4%205yr%20and%2020yr%20DP%20Transforming%20Fiji.pdf*, p.3
[44] Government of Fiji. (2017). "5-Year & 20-Year Development Plan." Available at *https://www.adb.org/sites/default/files/linked-documents/LD4%205yr%20and%2020yr%20DP%20Transforming%20Fiji.pdf*, p.3

Additional goals outlined in the plan include further grid extensions in Viti Levu, Vanua Levu, Ovalau and Taveuni, continued GoF funding for rural electrification projects, and decentralized renewable energy sources (solar, mini hydro, hybrid biofuel/diesel operated generators and wind systems) for the rural and outer islands where grid connections are not feasible. In addition, the plan also highlights the importance of ensuring that future electricity projects are climate-resilient (including possibly adopting underground cables for electricity distribution) and emphasizes the use of carbon credits under the Clean Development Mechanism as of future infrastructure financing arrangements. Finally, the plan also states that IPPs of both small- and large-scale electricity production will be supported with fair pricing for the sale of electricity, and that the ongoing regulatory reforms in the electricity sector – which include the partial divestment of EFL – will promote private sector participation and raise efficiency and service delivery.

More recently, GoF approved the **NIIP (2023-2034).**[45] The NIIP serves as a strategic guide for screening and prioritizing infrastructure investments in Fiji over the next 5-10 years. It is the result of a comprehensive assessment of infrastructure needs across all sectors, drawing from the NDP objectives and sectoral plans. By consolidating a list of more than 570 potential projects, the NIIP employs a systematic and transparent process to prioritize investments across sectors, considering economic viability and the government's funding capacity. Box 3.1 provides additional description of the NIIP.

Box 3.1: Fiji's National Infrastructure Investment Plan (NIIP)

Fiji's NIIP plan encompasses a wide array of infrastructure investments, focusing on capital construction projects and programs with a value exceeding $100,000. Spanning nine key sectors (roads and jetties; aviation; maritime; water and sanitation; energy; public buildings; telecommunications; waterways; and urban development), these projects are aligned with Fiji's long-term vision for development as outlined in the NDP.

Beyond prioritization, the NIIP aims to strengthen government planning processes at its various stages, including during the development of project concepts, inclusion in the Public Sector Investment Plan, preparation of priority projects, project appraisal, selection criteria, implementation, and monitoring. By enhancing these processes, the NIIP seeks to ensure that the projects selected align with Fiji's strategic development objectives. The NIIP also aims to consolidate infrastructure capital investment projects into a single register across all sectors. To achieve this, the plan collaborates with both "on-budget" government-funded agencies and statutory authorities, as well as "off-budget" state-owned enterprises.

The NIIP provides a roadmap for the next decade, enabling the GoF to flexibly respond to challenges like climate change and health issues. It also provides guidance for the assessment of costs and benefits of the projects in the pipeline and allow for the prioritization of projects to be developed and incorporation of such priority investments in the GoF's medium-term expenditure framework.

The NIIP database contains several energy projects that could benefit from CIF financing, including projects to expand energy accessibility through new renewable energy generation and the installation of solar hybrid systems; feasibility studies for new hydro- and wind-powered generation; expansion of access through extension

[45] Available online at *https://theprif.org/document/fiji/national-infrastructure-investment-plans/fiji-national-infrastructure-investment-plan*

of the grid; and expansion of electric vehicle infrastructure, including charging stations and rooftop solar for EV chargers. The table below summarizes the main energy sector projects included in the NIIP.

Table 3.2 summarizes projects under the NIIP that Government have determined could be eligible for CIF Financing under the REI Program.

Table 3.2: Projects under the NIIP that Could be Eligible for CIF Financing

Project Reference	Program Name	Project Description
E11	Renewable Energy - Hydro	Feasibility study, detail designing, and implementation of potential micro and small hydro plants. Around 20 potential sites. The project will be able to assist the DoE in meeting its renewable energy target of 100% by 2036, which will contribute to reducing Fiji carbon emissions. This will assist Fiji in reducing the use of fossil fuels.
E12	Accessibility to All - Renewable source	Upgrading of 50 Diesel Generators to 50 Solar Hybrid Systems. The project will be able to assist the DoE in meeting its renewable energy target of 100% by 2036, which will contribute to reducing Fiji carbon emissions. This will assist Fiji in reducing the use of fossil fuels.
E15	Accessibility to All - Renewable source	Installation of 15,000 Solar Home Systems within 10 years - 1500 systems per year. The project will be able to assist the DoE in meeting its renewable energy target of 100% by 2036, which will contribute to reducing Fiji carbon emissions.
E18	Renewable Energy - Wind	The project is for DoE to develop P90 bankable report of the 15 identified wind sites to inform investors and development partners to make available funding for electricity power generation from wind sources.
E19	Accessibility to All - LAKARO	Expansion of grid of the Kadavu, Lakeba and Rotuma government stations. The project will include the grid extension from: Kadavu - Namalta to Nasalia, Vunisea to Kavala Lakeba - Tubou - Nasaqalau, Tubou - Waitabu Rotuma - Round the Island.
E20	Accessibility to All - Hybrid	Nabouwalu government Stations - Upgrade and expand. Upgrade of generation plant and extension of grid.
E21	Renewable Energy - Solar	Nabouwalu Government Stations - Installation of a Solar Hybrid System. The project will be able to assist the DoE in meeting its renewable energy target of 100% by 2036, which will contribute to reducing Fiji carbon emissions. This will assist Fiji in reducing the use of fossil fuels.
E22	Accessibility to All - Nationwide Grid Expansion	The project will be able to assist the DoE in meeting its energy access goal by 2026.
E23	Accessibility to All - Upgrade House Wiring	The project will be able to assist the DoE in meeting its energy access goal by 2026.
E24	Energy Efficiency - EV Charging Stations	This project will support EV integration for the land transport sector and enable the DoE to achieve its targets of reductions in Energy intensity (consumption of imported fuel per unit of GDP in MJ/FJD) and GHG emissions from 2013 baseline NDC target.
E105	National Charging Station Network	To construct and install charging centers for EV around the country

Project Reference	Program Name	Project Description
E106		To install roof top solar for all Land Transport Authority (LTA) owned properties Fiji wide and accommodated EV vehicle chargers.

EFL's Board of Directors recently approved a 10-year **PDP (2019-2028)**, which includes projects in the NIIP as well as additional capital expenditure foreseen by EFL. EFL assesses its PDP every 2-3 years. The PDP was revised in late 2019 and subsequently in 2022. It encompasses projections for electricity demand and strategies for generating and delivering electricity until 2028 across its service areas in Viti Levu, Vanua Levu, Ovalau, and Taveuni Power Systems. The PDP estimates a total investment of FJD1.97 billion (US$900 million) needed for the development and commission of renewable energy projects over the next three years. These projects include strengthening the distribution network, expanding electricity access in urban and rural areas, acquiring new electricity meters and vehicles, improving the Monasavu Hydro-Electric Scheme, upgrading the 33 kV sub-transmission network from Vuda to Naikabula, replacing three 132 kV towers, enhancing equipment and systems for more reliable power supply through automation, and building a new 132 kV transmission network from Virara, Ba to Koronubu, Ba. These projects will increase capacity to meet future electricity demand from renewable sources and improve the security and reliability of power supply.[46]

The following subsections summarize the institutional, legal, and regulatory framework in the energy sector. Section 3.3.13.3.1 provides information on important institutions in the energy sector, including those responsible for policy, regulation, generation, transmission, distribution, and electrification. Section 3.3.23.3.2 summarizes key energy sector policies, legislation, and regulations in the energy sector of Fiji.

3.3.1 Institutional Framework

The **Ministry of Finance, Strategic Planning, National Development & Statistics (MoF)** has oversight over national budgeting, and thresholds for lending between government-owned entities. The Ministry plays a key role in creating an enabling environment and determining Fijian Government fiscal policy and incentives. It also has a central role in the prioritization and allocation of the government budget and leveraging global public finance for climate action. The MoF has led the development of the LEDS and NDC Roadmap, which are now being implemented through its investment plan and program pipeline. It also has purview over FDB and is responsible for data collection and statistics via the FBoS, which is housed within the Ministry.

The **Department of Energy** (DoE), which resides within the Ministry for Public Works, Transport, and Meteorological Services, is responsible for developing energy policies and sector strategy, including government policies on renewable energy.[47] The DoE is also responsible for rural electrification in Fiji, which it implements by subsidizing EFL to build grid-compatible mini-grids. The rural electrification strategy is currently demand-driven. While there is some self-generation as well as supply provided by nongovernmental organizations, rural electrification efforts principally consist of EFL grid extension and electrification provided by the DoE. Since its inception, the DoE has installed more than 400 generators and some 100 kilometres of

[46] Republic of Fiji. (2023). "National Infrastructure Investment Plan," p. 51.
[47] IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific," p. 83

low-voltage distribution in order to expand electricity access to rural areas.[48] In most cases, the DoE transfers the operation of the systems to rural communities. The government and other development partners support rural electrification programs implemented by the DoE.

Energy Fiji Limited (formerly Fiji Electricity Authority or FEA) is responsible for the generation, transmission, distribution, and retail of electricity throughout Fiji. As part of the new Electricity Act of 2017, FEA was corporatized as EFL, and divesture has been undertaken.[49] In April 2018, the GoF transferred 5 percent of EFL shares to eligible EFL customers.[50] In 2019, the Fiji National Provident Fund acquired a 20 percent stake in EFL. In 2021, Seven Pacific Pte Ltd acquired the fund's share along with an additional 24 percent share from the Fiji government. As of 2021, the Fiji government holds a 51 percent share against Seven Pacific's 44 percent share, with the remaining 5 percent distributed among EFL customers.[51]

In addition to corporatizing EFL, the Electricity Act has removed many of EFL's regulatory functions, which have been gradually transferred to the FCCC, as the latter builds internal capacity. EFL, under agreement with FCCC, has retained a few regulatory functions, including licensing qualified electricians.[52] Finally, EFL is also responsible for undertaking grid extensions for the purpose of rural electrification on behalf of the GoF and the DoE.

The **Ministry of Trade, Co-operatives, Small and Medium Enterprises,** formerly known as the Ministry of Commerce, Trade, Tourism and Transport is responsible for formulating and implementing policies and strategies that create and facilitate growth in industry, investment, trade, tourism, transport, co-operative businesses, micro and small enterprises and enhance metrology, standards, and consumer protection, including potentially facilitating investment in renewable energy and renewable energy integration projects.

The **Ministry for Public Works, Transport, and Meteorological Services** houses a **Transport Division**, which is responsible for coordination, planning, and enactment of policies and monitoring of the land and maritime transport sector in Fiji. The Transport Division runs multiple programs to improve sustainable transportation in Fiji, including *MTCC Pacific- Retrofitting of Government Vessel with Energy Efficient Technology*, which seeks to identify energy efficiency technologies that can be retrofitted in select government vessels to reduce GHG emissions, and the *Pacific Blue Shipping Partnership (PBSP)*, a partnership of Pacific Island Countries for the decarbonization of the shipping transport sector at a domestic level, including through the progressive renewal of Fiji's domestic shipping fleet to green ships, alongside the promotion of a sustainable maritime logistic supply chain.[53]

The **Land Transport Authority (LTA)** is responsible, among other duties, for establishing standards for registration and licensing of vehicles, as well as developing and implementing enforcement strategies consistent with road safety and protection of the environment.[54] As such, the LTA is the party responsible for

[48] IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific," p. 83
[49] IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific," p. 77
[50] IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific," p. 77
[51] IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific," p. 77
[52] IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific," p. 77
[53] Ministry of Commerce, Trade, Tourism & Transport of Fiji. (2022). "Sustainable Transportation." Available at https://www.mcttt.gov.fj/division/transport/sustainable-transportation/
[54] Land Transport Authority of Fiji. (2022). "About Us." Available at https://www.lta.com.fj/about-us

the registration and licensing of electric and hybrid vehicles, and for developing the standards which they must meet in order to circulate in the country.

The **Maritime Safety Authority of Fiji (MSAF)** is the maritime transport regulator for Fiji. As part of its responsibility, MSAF is responsible for vessel registration, inspections, and surveys;[55] it is also in charge of issuing safety certificates for all vessels, including any vessel powered by renewable energy, including those equipped with electric motors running on solar power and wind.

The **Fiji Roads Authority (FRA)** is responsible for managing nearly all of Fiji's roads (with a few exceptions, including farm roads and cane access roads), bridges, and jetties, in addition to their associated infrastructure, such as drainage. streetlights, and traffic signals.[56] Furthermore, FRA is in charge of planning and developing the road network to meet the country's immediate and long-term needs. As a result, FRA has put together the *Greater Suva Transportation Strategy 2015-2030*, which serves as the transport blueprint for the Greater Suva Area (GSA) through 2030, and includes measures to promote environmental sustainability, including increasing the use of environmentally friendly transport, such as electric vehicles and green buses.[57]

International Oil Companies, namely Mobil, Pacific and Total, import petroleum products into Fiji, distribute their products at wholesale and retail levels, and re-export to other Pacific countries. Supply is provided by medium-range tankers from refineries in Australia, Singapore, and New Zealand.[58]

Investment Fiji is the national economic development agency in charge of ensuring increased sustainable levels of investment and exports in Fiji. The GoF actively encourages foreign investment in a range of sectors, including RE and REI, and offers services and assistance to foreign and local investors through Investment Fiji. Furthermore, Investment Fiji acts as a regulatory authority for foreign investments and advises the government on matters of investment and exports.

The **Fijian Competition and Consumer Commission** (FCCC) is the competition authority and essential industrials regulator for Fiji. It was established as an independent regulator in 2010, with the objective of encouraging fair competition in the sectors falling under its jurisdiction, while protecting the interests of consumers. The commission determines the regulated prices of Unleaded Petrol, Premix, Kerosene, Diesel, and LPG fuels. The fuel price in Fiji is impacted by the movement in Means of Platts Singapore, the international freight rate and the exchange rate. Fuel and LPG price reviews are carried out quarterly.[59]

FCCC has also been responsible for controlling retail electricity prices since 2010. In September 2019, it issued its first tariff methodology. As a result of the Electricity Act 2017, FCCC has also become the electricity regulator. A summary of the main changes implemented by the Electricity Act in the allocation of regulatory functions is provided in Table 3.3 below.

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[55] Maritime Safety Authority of Fiji. (2022). "Services." Available at *https://www.msaf.com.fj/services/*
[56] Fiji Roads Authority. "Assets." Available at *https://www.fijiroads.org/what-we-do/assets/*
[57] Fiji Roads Authority. (2015). "Greater Suva Transportation Strategy 2015-2030." Available at *https://www.fijiroads.org/wp-content/uploads/2018/11/GSTS-REPORT-2015-2030.pdf*
[58] World Food Programme. (2022). "Logistics Capacity Assessment: Fiji." Available at *https://dlca.logcluster.org/display/public/DLCA/3.1+Fiji+Fuel*
[59] World Food Programme. (2022). "Logistics Capacity Assessment: Fiji." Available at *https://dlca.logcluster.org/display/public/DLCA/3.1+Fiji+Fuel*

Table 3.3. Changes to Regulatory Functions Resulting from the Electricity Act of 2017

Regulatory Function	Current	Electricity Act (2017)	Additional Information
Tariff setting	FCCC/EFL	FCCC	FCCC previously regulated retail tariffs and offered guidance on wholesale prices. The wholesale prices of EFL's current PPAs are below FCCC's guidance price. Under the new Act, FCCC will review all PPAs and will have the power to intervene and mediate in PPA negotiations.
Promoting competition	FCCC	FCCC	FCCC is responsible for encouraging competition in all sectors in which it operates. Under the 2017 Electricity Act, one of the main responsibilities of the regulator will be to ensure active competition for the benefit of residents.
Preparation of technical codes and standards	EFL	FCCC	Under the 2017 Act, responsibilities for technical codes and standards will fall under FCCC. However, as FCCC has insufficient capacity, EFL's codes and standards will largely be carried over.
Licensing	EFL	FCCC/EFL	Licensing of IPPs has been transferred to FCCC under the 2017 Act. This will avoid the current situation of EFL granting licenses to competitors. EFL will continue to issue licenses to qualified electricians.
Dispute resolution	FCCC	FCCC	FCCC acts as arbiter whenever disagreements arise between IPPs and EFL or during PPA negotiations.

Source: IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific," p. 83; and Electricity Act (2017)

3.3.2 Key Energy Sector Laws and Regulations

The overarching law that governs Fiji's energy sector is the Electricity Act of 2017. The Act lays out the institutional arrangement in which EFL has exclusivity in the provision of transmission and supply of electricity, acting as a single buyer for generators. The Electricity Act also sets important incentives to private investment in electricity through the assignment of an independent regulatory body for the sector, and partial divestment of EFL to private investors. The issuance of licenses for generators wanting to operate in Fiji's electricity market is also governed by the Electricity Act.

There are also various other laws that affect the energy sector, despite not being sector-specific, including: (i) the Public Enterprises Act, which regulates management and accountability of public enterprises such as EFL to ensure adequate efficiency in its administration; (ii) the Environment Management Act, which enacts policy on preservation of natural resources and sets the requirements for conducting environmental impact

assessments for certain projects; (iii) the Climate Change Act (2021), which creates a legal basis to support Fiji's sustainable development objectives, long-term climate ambition, net zero emissions target, and commitment to protecting Fiji's environment; and (iv) the Companies Act (2015) and the Foreign Investment Act (1999) which together provide the legislative framework for the establishment and operation of businesses and regulations for foreign investors in Fiji.

Land acquisition, alienation and use procedures vary by the type of land. The most abundant iTaukei land (native land) is governed by the iTaukei Land Trust Act (1940), which restricts transfers only to the state, with private investors only having the option to lease for up to 99 years with approval from the iTaukei Land Trust Board. State land can also be leased under the provisions of the Land Use Act (2010). Lastly, freehold land is subject to the Land Sales Act (1974) and thus can be bought and sold freely by non-residents for industrial and commercial purposes. Table 3.4 provides an overview of important energy sector laws in Fiji.

Table 3.4: Key Sector Legislation

Legislation	Overview
Energy Sector-Specific Laws	
Electricity Act (1966)	Establishes EFL as the entity responsible for supplying, transmitting, and distributing electricity with exclusivity in Fiji. The Act also vested EFL with regulatory power within the domestic electricity market. *This Act was later superseded by the new Electricity Act of 2017.*
Electricity Act (2017)	Allows the government to make the partial divestment of EFL to private investors and transferred most of EFL's regulatory functions to the FCCC.
General Laws	
Public Enterprises Act (2019)	Sets the legal basis for the regulation of public enterprises. Governs the reporting, accountability, employment, and finance of government entities.
Climate Change Act (2021)	Provides the basis for the regulation and governance of the national response to climate change and the introduction of a system for the measurement, reporting and verification of GHG emissions.
Environment Management Act (2005)	Governs the implementation of environment sustainability practices in the use and development of natural resources.
Foreign Investment Act (1999)	Establishes the legal procedures and requirements for foreign investors and companies to invest in Fiji.
Companies Act (2015)	Provides the legal basis for the regulation of all companies in Fiji, including registration and operation of companies and responsibility of shareholders.
Land Use and Acquirement Laws	
Land Development Act (1961)	Establishes the Land Development Authority vested with power to approve land development, improvement and

	settlement schemes and schemes for the processing and marketing of produce proposed by any public or private body or person.
iTaukei Land Trust Act (1940)	Establishes the iTaukei Land Trust Board, vested with control over all iTaukei (native) land. Sets the provisions over sale and transfer of iTaukei land to the state, and alienation by lease or license to interested parties.
Land Sales Act (1974)	Sets provisions regarding the purchase and disposition of (non-native) land by non-residents.
Land Use Act (2010)	Provides for a longer tenure of leases (up to 99 years) for native land and designates a Land Use Unit responsible for the issuance and renewal of land leases.

Note: Acts listed are subject to amendment.

Regulatory Framework

Before the approval of the Electricity Act (2017), it was EFL's[60] responsibility to provide technical regulation for the electricity sector, which created potential conflicts of interest, as the service provider was put in charge of devising regulations for competitors in the sector. In order to eliminate potential conflicts, the Electricity Act transferred regulation responsibility to the FCCC, which was already responsible for tariff regulation in the sector.

The Land Transport Act (1998) is another important piece of regulation affecting the energy sector, as it establishes the LTA, responsible for determining the requirements and standards for vehicles, including those pertaining to safety, the environment and fuel standards. Table 3.5 provides an overview of key regulations in the energy sector.

Table 3.5: Key Regulations

Regulation	Overview
EFL Grid Code (2011)	Sets out the operation and connection requirements for all generators connected to EFL's grid and is in line with standard international practices. *This regulation was later superseded by the FCCC Electricity Regulations of 2019*.
FCCC Electricity Tariff Methodology (2019)	Sets out the approach to be applied by the FCCC in regulating electricity tariffs.
FCCC Electricity Regulations (2019)	Sets out the technical regulation in the electricity sector in terms of connection and operation requirements for generators supplying electricity to the national grid.
Land Transport Act (1998)	Establishes the LTA, to regulate the registration and use of vehicles, the licensing of drivers and the enforcement of traffic laws.

[60] Formerly known as the "Fiji Electricity Authority" (FEA).

3.4 ROLE OF PRIVATE SECTOR, INNOVATION, AND LEVERAGE OF RESOURCES

EFL has outlined major investments over the next three years, including refurbishing existing plants, such as the Monasavu Hydro-Electric Scheme, and investing in rural electrification projects, but substantial private investment will be essential for the country to achieve future energy demand targets, including its goal of 100 percent RE generation by 2030. With the divestment of EFL and sector regulation improvements, private operators have begun developing RE IPP projects in Fiji, which are at different stages of implementation, as shown in Table 3.6.

Table 3.6: Planned Renewable Energy IPPs

Power Station	Operator	Type	Capacity (MW)	Status
Wainikovu	Hydro VL Pty Ltd	Hydropower	13	Unsolicited bid by private developer. PPA negotiations under way.
Wainakoroiluva	Hydro VL Pty Ltd	Hydropower	15	Unsolicited bid by private developer. PPA negotiations under way.
Waivaka	Hydro VL Pty Ltd	Hydropower	4	Unsolicited bid by private developer. PPA negotiations under way.
Naboro	TBC	Waste to Energy	5-10	Solicited IPP, with procurement first started in 2017 and later halted. New tenders began in Feb 2021.
Rarawai	Fiji Sugar Corporation	Biomass	40	Unsolicited bid by FSC. FSC currently conducting feasibility studies.
Lautoka (Expansion)	Fiji Sugar Corporation	Biomass	N/A	N/A
Qeleloa Solar	Sunergise	Solar PV	5	Solicited IPP tendered out by EFL.
Mua, Taveuni	TBC	Solar PV with storage	1.55	MOU signed between Korea International Cooperation Agency (KOICA) and EFL. Commissioning expected in 2023.
Viti Levu solar farms	TBC	Solar PV with storage	3 X 5	Three projects will be tendered out by EFL. IFC providing financing.

Source: IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific," p. 76

The subsections that follow describe Fiji's experience with commercial and public financing of energy sector projects.

3.4.1 Role of Commercial Lenders[61]

Availability of financing is an essential component of private sector investment. In addition to funding from development partners and the public sector, commercial lenders can also play an important role in supporting the private sector and fostering innovation. Fiji's financial sector has the highest level of experience in the Pacific Island Countries (PICs) with both structuring and operating financial instruments and in supporting economic sectors in Fiji, including RE and REI.[62] This experience exists in both the public and private entities operating in the financial sector, and the private financial sector is strengthened in Fiji due to the depth of public experience with commercial (e.g., business) and retail (e.g. household) financing. A list of the major commercial banks currently operating in Fiji is provided below.

ANZ. Fiji's largest bank has been active in providing loans to RE projects. It is managing the World Bank's Sustainable Energy Finance Project pool. In addition, given its extensive experience in the energy sector, it may be best positioned to finance REI projects.

BRED Bank. The bank has been active in RE lending since opening its first branch in 2013 and could be a potential financing partner in REI projects.

Westpac. Westpac has been active in providing loans for RE projects. Westpac's Pacific business (including its Fiji operations) has been up for sale since 2020, although an acquisition offer by Kina Bank has been rejected by competition regulators in Papua New-Guinea.

Bank of Baroda. The bank has shown willingness to fund RE projects and offers microfinance to small and medium enterprises.

BSP. The bank is interested in providing loans for RE projects. It also offers business loans, overdraft, and other services.

HFC Bank. HFC has also shown interest in providing loans for RE and possibly REI projects.

3.4.2 Role of the Public Sector

The public sector could also play a role in the financing of eligible projects via the FDB. FDB provides lending under a variety of financial products which have been used for financing the implementation of renewable energy and low-carbon technology in Fiji in the past. Furthermore, the bank may be able to operate facilities focused on-lending to commercial entities to finance the implementation of low-carbon technologies. FDB also serves as an accredited entity of the Green Climate Fund (GCF) for direct access to project funds and may contribute to blended financing arrangements in project implementation.[63]

[61] Section based on IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific," p. 84

[62] Ministry of Economy of Fiji. (2022). "NDC Investment Plan: 2022 Investment Planning for the Transport and Energy Efficiency Sectors," p.72

[63] Ministry of Economy of Fiji. (2022). "NDC Investment Plan: 2022 Investment Planning for the Transport and Energy Efficiency Sectors," p.36

3.5 DEVELOPMENT PARTNER ACTIVITIES

There are currently many bilateral and multilateral development partners providing financing to development projects, including RE and REI, in Fiji. Table 3.7 summarizes ongoing development partner projects, as well as pipeline projects expected to be launched in the near future, including their level of funding.

Table 3.7: Summary of Ongoing and Planned Development Partner Projects in Fiji

Development Partner	Project	Objectives/Description	Funding
Ongoing Projects			
ADB/World Bank (WB)	Transport Infrastructure Investment Sector Project	The objective of the project is to improve the resilience and safety of land and maritime transport infrastructure for users of project roads, bridges and rural jetties and wharves. The project seeks to prioritize investments in high poverty areas, including the poorer northern islands of Vanua Levu and Taveuni. As of 4 May 2023, all outstanding contracts have been awarded and the project has achieved 66.03% of disbursements.	$100 million Ordinary Capital Resources (OCR) $50 million co-financing from World Bank
ADB (Co-financing from GCF and European Investment Bank (EIB)	Urban Water Supply and Wastewater Management Investment Program	The project, approved in 2016, will improve access to sustainable water supply in the GSA. As of December 2022, the overall progress (including design, procurement, and construction progress) was approximately 76.3% for the Design Build Operate (DBO) contract, while the overall progress was approximately 85.1% for the GM contract. Works under both the contracts are now projected to be completed by October 2023 and likely commissioning of the new water intake and distribution mains by end of 2023.	Multi-tranche financing facility Tranche 1: $42.1 million OCR Co-financing of $31.0 million from GCF and $26.6 million from the EIB
ADB (Funding from Japan Fund for Prosperous and Resilient Asia and the Pacific)	Enhancing COVID-19 Preparedness for Tourism Recovery Project	The project will strengthen the capacity of Fiji to safely reopen to tourists and rebuild the country's economy, through investments in (i) the reopening of Nadi International Airport with COVID-19 measures, and (ii) enhanced testing capacity for the tourism industry.	$3 million grant funded by the Japan Fund for Prosperous and Resilient Asia and the Pacific

Development Partner	Project	Objectives/Description	Funding
Ongoing Projects			
AIFFP	Airports Fiji (AFL)[64]	The loan, signed in June 2021, will fund essential maintenance and capital works at Nadi International Airport and several outer islands' airports, refinances existing debt and supports the infrastructure priorities of AFL.	FJD10.0 million ($4.6 million) in addition to a guarantee of FJD96.0 million ($43.8 million)
AIFFP	Fiji Transport Infrastructure Restoration Project[65]	This financing package, approved in 2022, will support the renewal or resealing of more than 1.5 million square meters of road surface throughout Fiji, as well as replacement of nine bridges that are crucial to the Fijian economy. Importantly, the financing package includes a three-year grace period during which repayments will not be required.	$40.0 million in addition to a grant of $10.3 million
IFC	15 MW Solar Power Public Private Partnership (PPP) project[66]	The project, approved in 2020, involves the selection of a private sector partner to deliver at least 15 megawatts (MW) of solar power to the national grid. IFC will also assist EFL in exploring potential renewable energy sources in Vanua Levu.	$15 million
WB	Fiji Recovery and Resilience Second Development Policy Operation	The project has multiple objectives, including: i) promote private sector-led economic recovery; ii) enhance climate, disaster, and social resilience; and iii) strengthen debt, public financial and fiscal management.	$100 million

[64] Source: AIFFP. (2021). "Airports Fiji (AFL)" Available at https://www.aiffp.gov.au/investments/investment-list/airports-fiji-afl
[65] Source: AIFFP. (2022). "Fiji Transport Infrastructure Restoration Project" Available at https://www.aiffp.gov.au/investments/investment-list/fiji-transport-infrastructure-restoration-project
[66] Source: IFC. (2020). "EFL and IFC sign agreement for Pacific's largest solar project" Available at https://pressroom.ifc.org/all/pages/PressDetail.aspx?ID=17784

Development Partner	Project	Objectives/Description	Funding
Ongoing Projects			
WB	Fiji Recovery and Resilience First Development Policy Operation with a Catastrophe - Deferred Drawdown Option	The project's objectives include: i) promote private sector-led economic recovery; ii) enhance climate, disaster, and social resilience; and iii) strengthen debt and public financial management.	$145 million
WB	Fiji Social Protection COVID-19 Response and System Development Project	The project seeks to mitigate the impact of the COVID-19 crisis on the income of the unemployed and underemployed, and to increase efficiency and adaptability of Fiji's social protection system.	$50 million
WB	Fiji Social Protection COVID-19 Response and System Development Project - Additional Financing	The project seeks to mitigate the impact of the COVID-19 crisis on the income of the unemployed and underemployed, and to increase efficiency and adaptability of Fiji's social protection system.	$48.9 million
WB	Fiji Carbon Fund Emission Reduction (ER) Program	The objective of the project is to make payments to the program entity for measured, reported, and verified ERs from reduced deforestation and forest degradation, and enhancement of forest carbon stocks (REDD+) at the national level in the Republic of Fiji and to ensure that paid amounts are distributed according to an agreed benefit sharing plan.	$12.5 million
WB	Fiji COVID-19 Emergency Response Project	The project seeks to prevent, detect, and respond to the threat posed by COVID-19 and strengthen national systems for public health preparedness in the Republic of Fiji.	$7.35 million

Development Partner	Project	Objectives/Description	Funding
Ongoing Projects			
Pipeline Projects			
ADB	Nadi Flood Alleviation Project **(Suspended)**	A technical assistance grant of US$2 million to prepare the project is ongoing. Subject to agreement on the design for ADB financing, the government would finance the detailed engineering design through its own resources in parallel with ADB's loan processing. Government feedback on design has been pending since August 2021. In addition, it has been decided that pipeline support to the project is no longer to proceed due in part to assessed adverse environmental effects.	$100 million OCR (2022 Standby) **(Suspended)** ADB was coordinating closely with potential co-financing partners, including JICA, and potentially AIFFP, European Union (EU), and Agence Française de Développement (AFD), before support was suspended due in part to adverse environmental effects.
ADB (Funding from Japan Fund for Prosperous and Resilient Asia and the Pacific)	Rural Electrification Project	A proposed grant is primarily intended to support physical investment in the government's rural electrification program. The project is also expected to come up with innovative funding and operating models which may have potential to be replicated under a larger investment project in the future.	$3 million grant funded by the Japan Fund for Prosperous and Resilient Asia and the Pacific (2022 Standby)
ADB	Suva Port Project – Project Readiness Financing	ADB has engaged a firm through regional technical assistance (TA) to undertake a strategic review of development options for the Suva Port, including multi-criteria analysis of project site options, which is expected to be completed in Q4 2022. Project Readiness Financing (PRF) of up to $10 million is proposed for detailed design of the proposed Suva Port Project. The government and ADB agreed to review the timing of the proposed PRF when the site selection study is completed.	$10 million OCR (2023 Standby)

Development Partner	Project	Objectives/Description	Funding
Ongoing Projects			
ADB	Urban Water Supply and Wastewater Management Investment Program	Project scope, cost and safeguard compliance are under review. An ongoing EIB TA is supporting the preparation of several environmental studies required as part of due diligence for tranche 2. Potential ADB TA support towards the rescoping of tranche 2 is under discussion. The financing availability period ends on 31 July 2026, indicating timely completion is challenging without an extension.	Multi-tranche financing facility Tranche 2: $111.1 million OCR and $44.2 million of co-financing from EIB. (2023 Standby)
ADB	Suva Port Project	Proposed investment in the relocation of the Suva container terminal and redevelopment of the vicinity. The proposed project may need to be deferred due to limited available fiscal space.	$200 million OCR (2024 Standby)
JICA	The Project for the Reconstruction of Tamavua-i-wai Bridge[67]	The objective of the project is to improve the resilience of Queens Road, which is the most important road connecting to the capital city of Suva located on the island of Viti Levu.	¥2.931 billion ($21.8 million)
JICA	Standby Loan for Disaster Recovery and Rehabilitation[68]	This loan aims to ensure reserve funds to respond to the immediate financial demands of a post-disaster recovery and the rehabilitation phase, together with mainstreaming policies related to disaster risk reduction in Fiji.	¥5 billion ($37 million)
KOICA	Taveuni Solar Power Plant	The project will develop a 1.55MW solar PV project on the island of Taveuni. The project aims to increase renewable energy generation on the island with benefits for green	$3.5 million

[67] Source: JICA. (2022). "Signing of Grant Agreement with Fiji: Supporting the reconstruction of a bridge to overcome vulnerability to natural disasters" Available at https://www.jica.go.jp/english/news/press/2021/20220329_10e.html

[68] Source: JICA. (2020). "Signing of Japanese ODA Loan with Fiji: Contributing to immediate recovery from natural disasters, together with mainstreaming disaster risk reduction" Available at https://www.jica.go.jp/english/news/press/2019/20200221_11_en.html

Development Partner	Project	Objectives/Description	Funding
Ongoing Projects			
		tourism development and increased energy security, as well as contributing to GHG emissions reduction. This will complement and enhance the current hydropower plant and ensure that electricity generation on Taveuni island remains 100 per cent renewable for many years to come. The project on Taveuni is part of Fiji's NDC Implementation Roadmap and its recently launched Low Emission Development Strategy. KOICA signed a deal on the PV project construction with EFL and builder Clay Energy in 2021.	
WB	Fiji Tourism Development Program in Vanua Levu	The project aims to address urgent infrastructure and essential service gaps in Vanua Levu, increase private sector participation in tourism, and reduce negative environmental externalities of tourism.	$40 million

SECTION 4 PROGRAM DESCRIPTION

Fiji's REI Investment Plan is based on project concepts developed in three recent policy documents: The NIIP, the NDC Implementation Roadmap, and EFL's 10-year PDP. These documents have lists and—in many cases—detailed descriptions of priority clean energy and climate investments and are the result of extensive analysis and consultation with a wide range of stakeholders.

Projects in these documents were grouped to match the categories of investments typically funded by CIF's REI Program. These projects were then ranked against 12 REI criteria. This ranking exercise is described in Appendix B. The highest-ranked groups were (i) Transmission & distribution investments for renewable energy projects; (ii) rural electrification, and (iii) Energy Storage & Grid Management Technologies. It was ultimately decided that the focus of Fiji's REI IP should be on (i) and (ii) because of the priority these types of investments for Fiji, and because such investments are necessary precursors to eventual, expanded investment in (iii).

Both types of investments align well with CIF's REI IP criteria and are urgent priorities for Fiji to decarbonize its electricity sector. Each of the proposed interventions or program "components" are described in the sections below. More detailed descriptions of the proposed interventions are contained in Appendix A.

4.1 A GREEN ENERGY CIRCUIT FOR VITI LEVU

Key to the development of potential RE for the Viti Levu Interconnected System is a secure, reliable transmission system at 132 kV that links the potential RE sites to critical areas of demand. A well-designed transmission grid will also take into consideration the risk of VRE on the operational stability of the system (See Figure 4.1).

4.1.1 Overview of Proposed Intervention

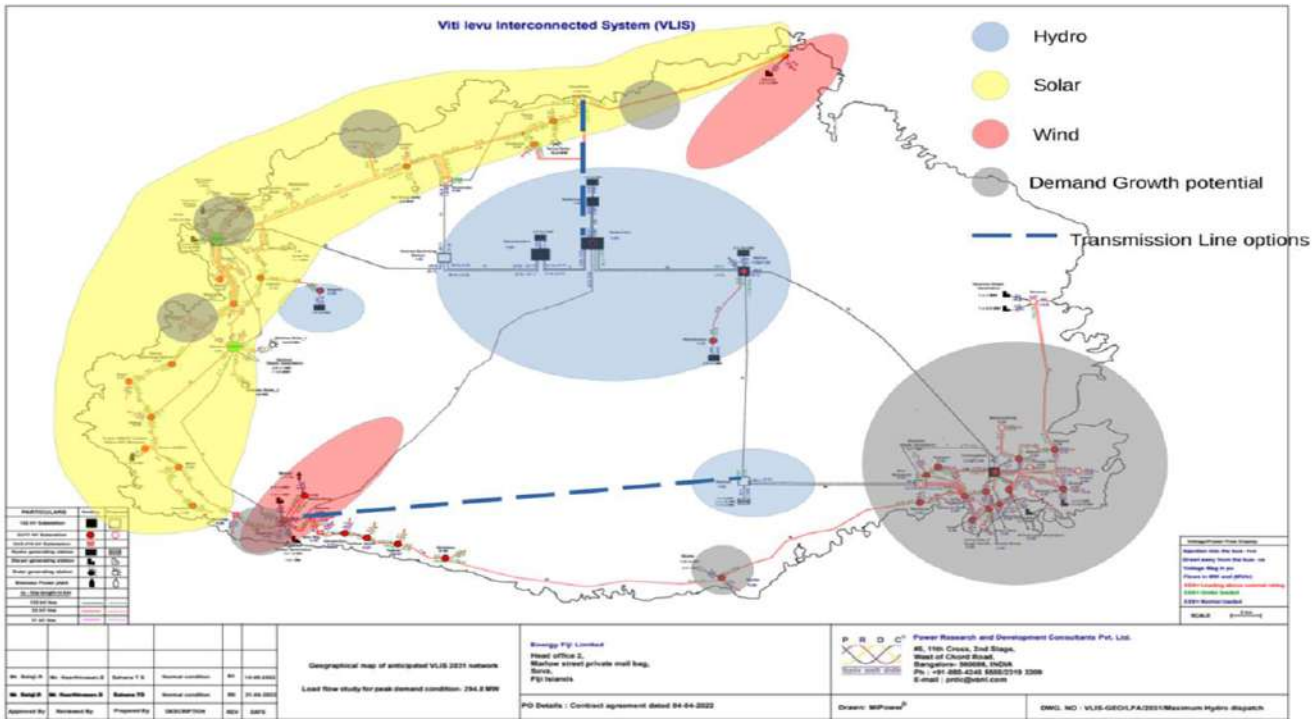
The proposed Green Energy Circuit for Fiji will upgrade and improve climate resilience of the existing transmission network to enable evacuation of existing and planned solar, hydropower, and wind. This component combines:

- Investment in upgrades of existing and construction of new 132 kV transmission lines and substations in Central and Western Viti Levu, areas with existing and substantial potential renewable energy resources.
- Transaction advisory support for 40 MW of new solar IPPs at preferred renewable energy locations on Viti Levu (including the Western side of the island).
- Technical assistance studies for putting in place systems to (a) ensure a periodic assessment and agreement on an appropriate capacity reserve margin given Viti Levu's demand growth, resource mix, future development plans for generation and transmission as well as learnings from the first renewable projects, (b) update generation dispatch operational plans to incorporate variable renewable energy, (c) evaluate storage and demand response to increase firm capacity and improve flexibility over the medium-term as the share of renewables increase, (d) review and update the grid code and (e) support utility and regulator dialogue on supporting system security while improving the share of clean energy.
- Guarantees to mitigate risk perceptions (addressing expected risks around solar generation preceding transmission availability, concerns around curtailment of dispatch for operational reasons over the term of the power purchase agreement, timely payment security) that could result in wider bid participation from reputed developers and better pricing commensurate to Fiji's scale and potential in the Pacific.

Under a BAU scenario where system security is prioritized in a small island context (without access to inter-island interconnections)- diesel generation is expected to provide dispatchable power to customers while EFL expects hydropower to be developed over the next 5-10 years. VRE penetration is limited to a small fraction of the daily requirement. There is an opportunity to support significant scale up of renewables in Viti Levu to provide adequate energy to reduce and reduce diesel generation during the daytime of a typical day. The interplay of variable renewable energy (solar PV), other generation sources and transmission plans as well as the need for limited storage would need to be assessed and suitably scaled over the medium-term.

The envisaged renewable energy generation plants are expected to be delivered by private sector IPPs. Given the lack of large-scale renewable deployment in the Pacific in general and Fiji specifically, ADB will support project development with transaction advisory services. ADB will draw on its experience assisting the government of Cambodia with a 100 MW solar park project which utilized a public private partnership approach that successfully crowded in IPPs, resulting in the lowest offtake prices in the Association of Southeast Asian Nations (ASEAN) region. ADB will also consider providing stapled guarantees, as necessary, to mitigate offtake risks for IPPs.[69]

Figure 4.1: Renewable Energy Resource Potential and Transmission Infrastructure on Viti Levu



[69] ADB will draw on its prior experience using blended finance for grid expansions to accommodate gigawatt scale VRE growth in India using CTF cofinancing, as well as experience with viability gap financing for grid connected IPP solar projects in Nepal using SREP cofinancing. ADB will also draw on more recent experience with transaction support for large scale IPP solar and wind projects in Central Asia as well as transactions in the Pacific where the Pacific Renewable Energy Program provides guarantee support to private sector projects to mitigate specific risks. ADB has funded multiple projects which incorporate grid enhancing technologies including high-performance conductors in Nepal and Bangladesh for upgrading existing lines as well as maximizing capacity and efficiency for new high-voltage line, and utility-scale energy storage systems in Mongolia and the Maldives.

4.1.2 Investment Preparation Activities

Preparation of this investment component will require technical studies as well as legal and regulatory reforms in the sector.

Technical Studies

Several technical studies will be important to identify and evaluate specific options for augmenting the current 132 kV transmission grid to secure and strengthen the connections from potential RE sources to the load centers on Viti Levu. These include the development of:

- **Reliability and risk assessment tools for generation resource adequacy.** Traditional resource adequacy methods are inadequate to guarantee reliability in a swiftly evolving electrical power system. Power grids are undergoing rapid transformations, shifting from a structure supported by resources that can be dispatched as needed to a structure that depends on intermittent energy sources and storage with limited duration. Typical resource planning models frequently overlook aspects such as weather data, the influence of climate, resources located behind the meter, transmission considerations, or comprehensive data regarding the availability of energy storage. In order to guarantee that resource adequacy models are capable of offering accurate risk assessments, Fiji should undertake probabilistic modelling that simulates random variables in a weather-dependent manner, compares simulations with historical data for benchmarking, models generator outages as being influenced by weather conditions, adjusts simulations to align with future expectations, and incorporate the impacts of climate change into the simulations.
- **Generation and transmission expansion tools.** Generation and transmission expansion tools are critical for long-term planning and optimization of the electricity grid. These tools help utilities, grid operators, and policymakers make informed decisions about the development of new generation capacity and the expansion of the transmission infrastructure. Specialized transmission expansion tools and considerations for systems with high renewable energy penetration include:
    - Grid interconnection and integration tools: Tools to facilitate the connection of renewable projects to the grid and ensure seamless integration
    - Energy storage sizing and optimization software: Tools to assess and optimize the size and operation of energy storage systems, including batteries
    - Generation and Transmission Planning Integration: Generation expansion tools should consider the impact of new generation projects on the transmission infrastructure, including the need for transmission upgrades
    - Power Flow Analysis: Power flow analysis tools evaluate the steady-state performance of the transmission grid under different operating conditions and generation scenarios.
- **Generation dispatch and network operation tools.** Generation dispatch and network operation tools for systems with high renewable energy penetration are essential for utility engineers to effectively manage and operate the grid. These tools help ensure grid reliability, stability, and efficiency in the presence of variable and intermittent renewable generation. Important tools and considerations for utility engineers in such systems are:
    - Energy Management Systems (EMS): EMS software is the core tool for generation dispatch. It provides real-time monitoring, control, and optimization of power generation and transmission. EMS includes components such as:

    - State Estimation: Calculates the real-time state of the power system
    - Load Forecasting: Provides short-term load forecasts to guide generation dispatch decisions
    - Renewable Energy Forecasting Tools: Software and models for predicting renewable energy generation, such as wind and solar forecasts
    - Optimization Algorithms: Determine the optimal generation schedule considering generation costs, constraints, and reliability requirements
    - Economic Dispatch Models: Economic dispatch models optimize the operation of existing and planned generation assets to minimize production costs while meeting demand and environmental constraints
    - Unit Commitment: Decides which generation units to start or stop based on predicted load and available generation resources
- Renewable Integration Models: These models assess the integration of variable renewable energy sources into the grid. They consider factors like variability, intermittency, and grid reliability
- Demand Response Management Systems: Software to manage demand response programs and optimize load flexibility
- Dynamic security assessment is one of the critical aspects of power system studies that are used to identify critical contingencies in the grid by analysing their corresponding dynamic security constraint violations on the grid
- Grid Frequency Control Tools: Tools for monitoring and controlling grid frequency are critical for maintaining system stability. These tools include frequency measurement, load shedding, and Automated Generation Control (AGC) functions
- Voltage and Reactive Power Control Tools: Tools for managing voltage and reactive power in the grid, critical for renewable energy integration
- SCADA (Supervisory Control and Data Acquisition) Systems: Systems for monitoring and controlling grid assets, including renewable generation
- Advanced Metering Infrastructure Systems: Systems for collecting and managing data from smart meters and sensors for better grid management
- Distribution Management Systems: Software for managing the distribution grid, including integrating renewable distributed energy resources
- Stability Analysis: Stability analysis tools assess the dynamic behaviour of the grid under transient conditions, ensuring that the transmission system remains stable during disturbances.

Legal and Regulatory Reforms

The Government of Fiji is committed to the substantial legal and regulatory reforms required to bring more renewable energy into electricity generation. These reforms could include:

- The introduction of competitive auctions for renewable energy generation, especially from solar facilities, possibly including mandates for the purchase of renewable energy by utilities or large consumers
- Expansion of the use of net metering and/or net billing to spur investment in rooftop solar
- Legal recognition of storage as a distinct activity and regulatory reforms to promote investment in storage.

Box 3.1 includes a preliminary analysis of some of the shortcomings of the Electricity Act, specifically, and identifies areas of needed reform that could be supported as part of project preparation and implementation.

Box 4.1: Analysis of Fiji's Electricity Act

Fiji's Electricity Act of 2017 did much to modernize the legislative and regulatory framework of Fiji's electricity sector, which was then operating under legislating dating from 1966. The Act made fundamental changes aimed at improving competition and efficiency, and EFL's financial capability, including the corporatization and partial privatization of EFL, and transferring regulatory functions from EFL to the FCCC. The Electricity Act cemented EFL's position as the exclusive provider of transmission and electricity services in Fiji and the exclusive licensed retail seller.

The Electricity Act also opened the possibility of IPPs entering the market. However, it did not establish a structure or mechanisms to actually encourage or facilitate private sector investment in generation or competition in generation. Any new generation must sell its output to EFL as the single buyer, and so long as EFL is also the main generator and only retail supplier, the incentive for EFL to enter into long-term PPAs with competitors is not strong.

Further, the Act is silent on renewable energy and investment in RE generation, such as solar IPPs, rooftop solar, as well as other means of enabling utilization of RE, such as off-grid and microgrid technologies, and the use of energy storage systems. If the policy imperatives described in section 3.3.2 are to be met, updating and further modernizing Fiji's legislative framework is probably required: by introducing mandates for the purchase of RE or perhaps restructuring Fiji's electricity sector by creating a single buyer separate from EFL coupled with mandates to procure RE. Competitive auctions for RE from, especially solar farms, could be conducted.

The significant decreases in the cost of solar photovoltaics in recent years, the popularity and rapid adoption of net metering (or billing) models around the world, and advances in technologies that have popularized off-grid solutions and microgrids should all work to Fiji's advantage as the country seeks to increase the share of renewables in generation, reduce reliance on imported fuel and reduce emissions. Legislative authorization and the establishment of an enabling framework, coupled with the imposition of duties on incumbent service providers, often provide impetus for change in thinking and new investment. In the case of net metering, experience shows that for consumers to become prosumers, legislative duties need to be imposed on incumbent utilities. Legislation does not need to be comprehensive, but can provide an overarching framework, with a requirement for implementing regulations to be designed and promulgated.

Additionally, the rapid advances in, and decreasing costs of, battery energy storage solutions offer potential benefits for Fiji's electricity sector – principally, the ability of the delivery infrastructure to handle greater variable renewable energy generation. Storage offers many uses that are rapidly being implemented around the world under newly designed regulatory systems. Again, legislative impetus coupled with regulatory design that enables investment in storage is necessary.

All of these matters should be brought under the Electricity Act with defined duties on the relevant sector participants to take the actions necessary to ensure policy is achieved.

That the reforms in the 2017 Electricity Act went only partially towards some of the Act's objectives, can be seen by the fact that the term "independent power producers" is defined but only used once (in section 4(d)),

as a statement of an objective to create opportunities for IPPs to provide electricity (and then limited to "if economical and, from a system integrity perspective, more beneficial to Fiji and consumers").

The term "renewables" only appears once throughout the Act – the Minister and regulator being required under section 6(2)(c) to exercise their functions to keep tariffs low by (among other imperatives) requiring "possible generation from renewable sources". A stronger, clearer mandate is required.

"Storage" does not appear in the Act. If investigation and possible facilitation of investment in storage is desired, specific legislative provision is necessary. Licensing of storage as a distinct activity appears the best way of enabling its introduction; it can be both part of a RE generating facility, but also an activity operating as part of the transmission or distribution infrastructure. Section 6(3) does require the Minister and regulator to promote research into, and the development and use of, new technology, but only by or on behalf of, persons who already hold a license to generate, transmit or supply electricity.

The Electricity Act contains provisions authorizing the public electricity supplier, EFL, to compulsorily acquire "public installations," not just on license expiry but at any time during the term of a license. "Installation" has a standard meaning (plant, apparatus, buildings, etc.) but "public" is not defined. Compensation must be paid, and the State Acquisition of Lands Act 1940 applies, but this must present an issue for sector investors.

4.2 ELECTRIFICATION OF OUTER ISLANDS

Most Fijians have access to electricity, but a portion of the country's population remains without, relying predominantly off-grid and traditional fuels. The majority of the unelectrified households are in the rural and maritime areas as well as in informal settlements. There is, therefore, a substantial rural-urban disparity: 96 percent of the country's population has access to electricity, but access is skewed towards urban and some rural areas because of the challenges of distributing power to small and isolated communities and rural villages in the outer islands.[70] Four percent of urban residents and nearly 20 percent of people living in rural areas still lacked electricity access as of 2021.[71] Roughly five percent of the population rely on standalone diesel generators for electricity, making them vulnerable to price volatility in the international oil market. Women in rural communities with low incomes are particularly affected since without electricity they face challenges carrying out household daily tasks such as food preparation, helping children with homework, agriculture and business activities.

Achieving universal access to electricity is a priority for the GoF. Through the implementation of the *National Electrification Policy* and the development of an updated electrification master plan, the DoE has been working with national energy utilities, renewable energy suppliers, financing schemes, and relevant stakeholders to add both off-grid and on-grid energy capacity to fill all electrification access gaps and support as close to universal access to electricity as much as possible. The NEP 2023-2030 has "Energy Access and Equity" as one of its five

[70] "Access to Electricity, Rural (% of Rural Population) - Fiji." World Bank Open Data. Accessed August 2, 2023. https://data.worldbank.org/indicator/EG.ELC.ACCS.RU.ZSend=2021&locations=FJ&start=1996&view=chart.
[71] Fiji Renewables Readiness Assessment. Accessed August 2, 2023. *https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/IRENA_RRA_Fiji_2015.pdf*.

policy pillars, alongside Energy Security and Resilience, Energy Sustainability, Energy Efficiency, and Energy Governance. In its 2017 National Development Plan[72] the GoF stated its intent to deliver 100 percent access to 100 percent access to electricity by 2021, but this objective was indefinitely postponed given delays associated with the global COVID-19 pandemic. With CIF's assistance proposed, the goal could conceivably be achieved by 2026.

4.2.1 Overview of Proposed Intervention

CIF financing would be blended with World Bank financing to support the DoE and EFL in efforts to electrify and improve the quality and reliability of supply in rural areas and increase the percentage of renewable energy generation available to customers in outer islands. These investments would expand the reach of the electricity grid of the Lakeba, Kadavu, Rotuma, Taveuni, Vanua Levu, and other priority outer islands to be identified to reach those with no or limited electricity access in rural communities; and would upgrade existing grid technologies and infrastructure to allow the shift from diesel-only generators to hybrid renewable energy systems.

Fiji's NIIP includes electrification investments planned by DoE for Lakeba, Kadavu, and Rotuma. DoE also has plans to invest in Taveuni. These islands collectively include roughly 30,000 people, nearly 100 villages, airstrips, government buildings, post offices, health centers and schools. The investments include:

- In Kadavu, grid extensions from the Vunisea mini-grid via Nasali to Nabukavesi ira
- In Lakeba, grid extensions from Tubou to Nasaqalau, and from Tubou to Waitabu
- In Rotuma, construction of a distribution line around the entire island
- In Taveuni, grid extension, from Naselesele to Lavena, Wairiki to Navakawau, Salialevu Tee to Off, Soqulu Est. Tee to Off and Nacogai Tee to Off
- In Vanua Levu, support to DoE and/or EFL in further line extensions, to complement plans in the NIIP to upgrade and expand connections to government stations and install solar hybrid systems.

These investments will help expand energy access and allow the country to reach its universal electricity access goal. It will help improve the quality of energy services, increase access for households from tier one to higher tiers of access[73], and improve reliability for business and commercial enterprises who rely on diesel generators. They will also provide the basis for the transition from polluting and inefficient diesel generators to decentralized, hybrid renewable energy systems for rural households.

Other possible investments could include contribution and collaboration with the Fiji Rural Electrification Fund (FREF) for co-financing/financial risk mitigations, technical assistance, and knowledge exchange with other PICs.[74]

4.2.2 Investment Preparation Activities

Project preparation would include consultations with communities on the selected islands to assess households' affordability, productive users of energy, land ownership, environmental and social risks and mitigation measures, and technical/engineering aspects of the investments. The team will also assess the

[72] Republic of Fiji: Ministry of Economy. (2017). "5-Year & 20-Year National Development Plan," Available at https://www.fiji.gov.fj/getattachment/15b0ba03-825e-47f7-bf69-094ad33004dd/5-Year-20-Year-NATIONAL-DEVELOPMENT-PLAN.aspx.
[73] See the Multi-Tier Framework for energy access: https://mtfenergyaccess.esmap.org/.
[74] As of 2023, FREF is administered by the Department of Energy.

institutional, policy and regulatory framework that would allow sustainable operation of outer island electrification schemes. Based on these findings, preliminary feasibility studies will be carried out that will inform the project design, economic and financial feasibility, and implementation arrangements.

SECTION 5 FINANCING PLAN AND INSTRUMENTS

Table 5.1 shows the financing requested for each of the components describe in Section 4. The financing

Table 5.1: Financing Plan for Fiji's REI IP

Financing Source	CIF				Others				
Program	CIF Fin-ancing	CIF Guar-antee	Project Preparation (Grant)	Total CIF	ADB	World Bank	IFC	Private Sector	Total
	(US$Million)								
Viti Levu Green Circuit	25	8	2	35	60		15	35	**145**
Electrification of Outer Islands	33		2	35		15			**50**
Total	**58**	**8**	**4**	**70**	**60**	**15**	**15**	**35**	**195**

Viti Levu Green Circuit

The Viti Levu Green Circuit component includes:

- CIF concessional financing for transmission investments under EFL's PDP of $25 million (public sector)
- Technical assistance grants from CIF and ADB on the identified studies and preparatory work described in Section 4
- ADB financing of about $60 million for 132 kW transmission investment related to EFL's PDP; ADB will help facilitate public sector terms (loans, guarantees, and TA funds) to facilitate private sector investment in VRE.
- 40 MW of solar developed by the private sector, procured through reverse auctions to ensure lowest cost and highest compliance with bid terms (at roughly $1000/kW); roughly $15 million of this is anticipated to be financed by IFC
- ADB Private Sector debt financing of about US$20 million for new renewable energy generation developed by the private sector and co-financed with other partners inside and outside Fiji
- CIF-financed public sector offtake guarantees (for renewable energy project developers) that could be stapled to the tenders to address some of the distinct risk perceptions with scaling up intermittent renewables and improve risk perception of projects
- Possible counterpart financing from EFL, typically to cover applicable taxes and duties as well as overhead costs.

The combined investments result in a leverage ratio of approximately 5X of CIF funds (in other words, the total investment package is just over 5 times the financing provided by CIF).

Fiji's MoF, will act as the borrower. MoF will serve as intermediary to allocate CIF REI resources effectively by on-lending to EFL, who in turn, will act as the Implementing Entity.

Electrification of Outer Islands

The electrification component includes CIF financing of $35 million, blended with World Bank financing of $15 million. US$2 million is proposed for project preparation, to support the investment preparation activities described in Section 4.1.2.

SECTION 6 ADDITIONAL DEVELOPMENT ACTIVITIES

Bilateral and multilateral development partners are extremely active in Fiji's energy sector, on Viti Levu as well as in the outer islands. Section 3.5 described some of these.

Asian Development Bank (ADB). In addition to its current support in the preparation of the CIF REI Investment Plan, ADB has shown interest in supporting transmission investment and RE generation in Fiji and has supported various investment studies and investment workshops in the country. This grant is intended to support physical investments in the government's rural electrification program for all islands, and to devise innovative funding and operating models for electrification.

Australia's Department of Foreign Affairs and Trade (DFAT). DFAT has been supporting various advisory and capacity building projects of the World Bank Group and other development partners in the RE sector. DFAT has also been focusing on education and health issues in Fiji but is increasing its involvement with private sector development and good governance. Australia is one of Fiji's most important bilateral development partners, with a budgeted bilateral assistance program equivalent to $28.7 million (A$40.0 million), and total ODA equivalent to $58.3 million (A$81.2 million) in FY2021. The country focuses on health, security, governance, and economic recovery. Significant supplementary support has been provided in FY2021 and FY2022, including in direct budget support. In December 2021, Australia announced an additional $61 million (A$85 million) budget support grant, as co-financing for a proposed ADB policy-based loan.

Australian Infrastructure Financing Facility for the Pacific (AIFFP). Starting in 2021, the AIFFP began providing infrastructure financing in Fiji, with a focus on several sectors such as energy, education, health, communications, and roads. The program has already authorized three transactions, including a FJD106 million facility for Fiji Airports to fund maintenance and capital projects at Nadi International Airport and outer island airports, an AU$5m grant to support the Nadi Flood Alleviation Program, and a loan of US$50.3 million to support the Fiji Transport Infrastructure Restoration Project. AIFFP has the ability to offer aid in the form of grants, loans, or blended finance to both the GoF and its institutions, as well as the private sector.

European Investment Bank (EIB). EIB, together with ADB, is one of most significant lenders for hard infrastructure financing in Fiji. EIB has been supporting EFL by offering technical assistance, capacity building, and financial and project management assistance with the development of the Ba River hydropower project. Relevant pipeline projects under development, but not yet confirmed, include a US$300 million hydropower plant at Natiwana/Nadarivatu, and an additional hydropower plant on Taveuni Island to be developed by EFL and possibly co-financed by ADB. In March 2023, EIB Global also signed a letter of intent with EFL to support two major renewable energy projects, namely the Qaliwana and Vatutokotoko hydropower plants. The projects will help increase the share of renewable energy in Fiji's generation capacity bringing it to 75% once completed.[75]

European Union (EU). The EU is exploring the possibility of supporting EFL in the development of two hydropower projects (29MW and 28 MW), including, possibly, the hydro plant planned for Taveuni.

[75] European Investment Bank. (2023). "EIB Global opens office in Fiji." Available at https://www.eib.org/en/press/all/2023-094-eib-global-opens-office-in-fiji

Fiji Rural Electrification Fund (FREF). FREF Launched during Fiji's COP23 Presidency with support from the Leonardo DiCaprio Foundation (LDF), the fund provides renewable energy to Fiji's outlying islands and villages. Together with Sunergise (Fiji) Limited, the Fiji Locally Managed Marine Area Network and EFL, FREF seeks to bring solar power to communities with no electricity or that rely on pollution-emitting diesel generators. LDF has provided a grant as seed funding to electrify the first village, while also helping mobilize funding for additional communities. The financing program provides clean energy to communities at the same or a lower price than diesel generators, which rely on a supply chain that is easily disrupted by extreme weather events. The goal of the program is for the communities served to receive round-the-clock electricity services from solar and battery hybrid systems for the same or less money than they would spend on fossil fuels to run diesel generators for only three to four hours a day. It is expected that once a sufficient number of communities are operational, the revenues from the electricity sales will be used to finance further communities, creating a self-funding system that will expand the program throughout rural Fiji. FREF has successfully electrified the community of Vio Island, on the coast of Lautoka. Currently, five rural communities have been identified for electrification, three of which have undergone a site survey. FREF is actively seeking donor support for Phases 3 and 4, which will electrify all five communities. FREF was overseen by FDB until 2023; responsibility for it has since moved to DoE.

Japan International Cooperation Agency (JICA). JICA has been active in Fiji's infrastructure sector, providing training and capacity building with the Pacific Power Association. In addition, Japan is collaborating with ADB on the proposed Nadi Flood Alleviation Project and has provided standby loans for disaster recovery and rehabilitation, and COVID-19 emergency loans as budget support in 2021 ($94.8 million) and 2022 ($87.2 million) as co-financing for ADB policy-based loan programs.

New Zealand's Ministry of Foreign Affairs and Trade (MFAT). MFAT has been supporting various advisory and capacity building projects of the World Bank Group and other development partners in the RE sector. It has also prioritized governance issues, improving economic governance, and education. ODA has been provided for the development of RE as technical assistance to ADB in the development of Taveuni Hydropower Project. New Zealand is expected to provide Fiji with assistance equivalent to $99.5 million (NZ$148.4 million) over three years (FY2021–FY2024), a significant increase on prior years, focused on strengthening governance and institutions, and supporting Fiji's economic resilience, community well-being, and security.

The Korea International Cooperation Agency (KOICA). KOICA is providing a US$ 3.5 million grant for the development of a 1.55MW solar PV project on the island of Taveuni. The project aims to increase renewable energy generation on the island, which will have several benefits, including supporting green tourism development, enhancing energy security, and contributing to the reduction of GHG emissions. The Global Green Growth Institute (GGGI) is providing support for the project by conducting a full feasibility study for the implementation of the power plant, with the ultimate objective of helping the GoF achieve 100 percent renewable generation in Taveuni by 2030.[76] KOICA also funded, in 2021, the batteries for a 4MW solar IPP in Ovalau. The developer has a PPA with EFL and intends to do more develop additional solar. KOICA is also considering developing new rooftop solar projects in Suva.

[76] Source: GGGI. (2017). "Fiji Solar Project on Taveuni island." Available at *https://gggi.org/project/fiji-solar-project-on-taveuni-island/*

United Arab Emirates (UAE). The UAE has committed to support the development of solar hybrid mini-grids and utility-scale RE projects in Fiji. A US$ 5 million grant from the UAE Pacific Partnership Fund was approved in 2013 for the development of a Joint Renewable Energy Project.[77] The project's main objective was to facilitate the development of solar-powered electrification in the islands of Kadavu, Rotuma, and Lakeba. It was initiated through a bilateral agreement between Fiji and the United Arab Emirates, enabling the UAE Government's renewable energy arm, Masdar, to commence the tendering process in early 2014. By 2015, the project had been successfully concluded, resulting in the implementation of three solar PV microgrids: a 150 kW plant on Lakeba Island, a 225 kW plant on Kadavu Island, and another 150 kW plant on Rotuma Island.[78]

United States Trade and Development Agency. USTDA is providing support to Fiji's Ministry of Finance, Strategic Planning, National Development and Statistics (MoF) for a feasibility study that will advance the country's dual goals of 100% rural electrification and renewable power generation by 2036.[79] The study will be conducted by Arizona State University's Laboratory for Energy and Power Solutions (ASU) in collaboration with the international intergovernmental GGGI and California-based XENDEE Corporation. The study aims to support the development of up to 75 solar-powered mini-grids with energy storage.

World Bank and IFC. The WB and IFC are supporting RE generation through projects with the DoE, advisory and transaction support to develop RE IPPs, direct equity investment, supporting local finance institutions with partial guarantees and other instruments. ADB is overseeing the implementation of a US$3 million grant from the Japan Fund for Prosperous and Resilient Asia and the Pacific. IFC is currently working with EFL to identify sites for 15 MW of solar on Vanua Levu, to be tendered as an IPP.

[77] Source: PACNEWS. (2013). "Solar Powered Electrification for Kadavu, Rotuma and Lakeba." Available at *https://prdrse4all.spc.int/system/files/pacnews_-_fiji_uae_pacific_partnership_fund.pdf*

[78] Source: Mubadala. (2015). "The UAE Inaugurates Three Micro Grid Solar Plants in Fiji." Press Release. Available at *https://www.mubadala.com/en/news/uae-inaugurates-three-micro-grid-solar-plants-fiji*

[79] U.S. Trade and Development Agency. (2023). "USTDA Advances Rural Electrification in Fiji." Press Release. Available at *https://ustda.gov/ustda-advances-rural-electrification-in-fiji/*

SECTION 7 IMPLEMENTATION POTENTIAL WITH RISK ASSESSMENT

There are tremendous opportunities to scale up renewable energy integration in Fiji. At the same time, it is also important to identify potential risks associated with increased investments in REI in Fiji and outline effective risk mitigation strategies in order to ensure the success of REI projects implemented in the country. Section 7.1 describes risks specific to Fiji; Section 7.2 describes Fiji's absorptive capacity to take on financing and implement the proposed investments.

7.1 COUNTRY/REGIONAL RISKS

Table 7.1 describes the main risks, and risk mitigation strategies associated with the investment in REI in Fiji across several dimensions, namely: social, gender, environmental, technical, economic, and financial, and disaster and climate change.

Table 7.1: Risks to Fiji's REI IP

Dimension	Risk Rating before mitigation	Risk Rating after mitigation	Risks	Risk mitigation strategies
Social	Moderate	Low	▪ The rapid integration of new technologies could lead to the destruction of jobs related to redundant maintenance and operation tasks and old technology no longer being used. At the same time, a decline in jobs within the fuel supply chain as oil becomes less prominent in the energy mix is to be expected. ▪ Customers in rural areas who are slated to receive electricity access may not be able to afford the connections and/or cost of electricity consumption. Collections have historically also been a challenge in some rural systems operated by local communities.	▪ Training and relocation assistance could be provided whenever possible to better prepare workers in the electricity sector for performing tasks related to the adoption of the new processes, systems and technologies brought by the scaling up of REI. ▪ Access in rural areas (financing of an electricity connection) will likely require government to absorb some or all of the cost of the initial capital expenditure, as has been the case with previous DoE projects.
Gender	High	Moderate	▪ The existence of barriers for female participation in the energy and electricity industry can prevent them from taking advantage of opportunities created by new investments. These could include bias and behavioural barriers that negatively affect women in job interviews or promotions, and the lack of incentives for training and education of women in Science, Technology, Engineering, and Mathematics (STEM) fields. ▪ Insufficient gender inclusivity in education can have detrimental effects on the training of women, resulting in sub-optimal outcomes. As a consequence, women may not be adequately prepared to seize employment opportunities arising from investments in REI projects.	▪ REI projects can be implemented with a gender perspective, prioritizing and incorporating requirements for gender equality. This can contribute to greater inclusion and participation of women in the sector. ▪ Investments in REI projects can involve training programs and capacity building initiatives. These programs can be designed to include women, providing them with the necessary skills and knowledge to actively participate in the sector and take on leadership roles.

				▪ Government can evaluate if the approach to women's education prioritizes gender inclusiveness and provides a welcoming environment that creates a level playing field for women pursuing careers in traditionally male-dominated sectors.
Environmental	Moderate	Low	▪ Without proper planning, dams and reservoirs built for HPPs can have adverse environmental and social impacts as a result of flooding, displacement of plants and animal species, loss of biodiversity and displacement of communities living in the project areas. Solar and wind projects also have possible consequences in terms of land use, deforestation, and disruption of natural habitats.	▪ All project preparation under the REI IP will include comprehensive Environmental Impact Assessments (EIAs) before the construction of hydro projects to assess potential environmental impacts and identify mitigation strategies. This includes biodiversity conservation, water quality management and involvement of local communities in the planning and decision-making processes.
Technical	Low	Low	▪ Implementation of REI projects naturally create job opportunities in areas related to the project's development. However, brain drain and high levels of emigration in Fiji can lead to a situation where there is a lack of skilled workers to occupy newly created job opportunities in the energy sector. ▪ VRE poses challenges to grid infrastructure and energy supply management because of to the intermittent nature of these sources. In particular, the grid may not be fully suitable for large-scale integration of VRE resources due to a lack of sophisticated forecasting, power flow management and energy storage solutions.	▪ Project designs can include the training of skilled professionals in the energy sector. This could include apprenticeship schemes, increasing scholarships for energy-related courses, and offering regular trainings for operating and maintaining renewable energy technologies. ▪ Project designs will come with appropriate asset management plans for upgrading electric grid infrastructure to better accommodate intermittent energy supply.
Economic & Financial	Moderate	Low	▪ The 2017 Electricity Act says little about utility-scale renewable energy generation or distributed generation (e.g., rooftop solar). EFL is chiefly responsible for planning, procuring, and interconnecting such resources.	▪ The GoF is committed to overhauling the Energy Act to facilitate procurement of utility-scale renewable energy generation and distributed generation.

			▪ Solar IPPs interested in Fiji have previously proposed tariffs close to the cost of diesel generation, offering little savings for EFL and its customers.	▪ Reverse auctions, facilitated by the development partners show evidence of achieving much lower levelized costs than non-competitive tenders and unsolicited proposals for solar energy generation.
Disaster & Climate Change	High	Moderate	▪ Fiji's energy infrastructure is susceptible to climate and disaster-related risks, resulting in reduced energy reliability. Many of the substations and transformers are situated in coastal areas, and a significant portion of distribution lines are above-ground and reliant on a single transmission line. Additionally, thermal generation stations are frequently located along the coast. These factors expose Fiji's electricity grid to the damaging effects of cyclones and floods.	▪ Climate resilience will be incorporated into each project design. Asset management plans will also incorporate resilience ▪ The use of risk-sharing instruments such as blue bonds and catastrophe bonds could be considered as a way of helping increase resilience to disaster and climate-related risks.

7.2 ABSORPTIVE CAPACITY

This section analyses the financial absorptive capacity of the GoF and EFL to implement the proposed program.

Government of Fiji

Following the 2008 financial crisis, Fiji embarked on a period of sustained growth supported by its flourishing tourism sector. The growth was further fuelled by the adoption of expansionary fiscal policies beginning in 2014, which helped enable investments in infrastructure and human capital.[80] This resulted in the country's economy expanding at an average annual pace of 6.7 percent, and its GDP per capita nearly doubling between 2009 and 2019. The economic expansion, however, was accompanied by a significant increase in public debt. As a response to rising debt levels, the GoF announced the implementation of stricter spending controls in 2019 as part of a medium-term fiscal consolidation program.

After a 17 percent GDP contraction in 2020 and a further 5.1% decline in 2021, Fiji's economy experienced a strong recovery in 2022 with an estimated 16 percent growth in 2022 attributed to a robust resurgence in tourist arrivals.[81] The International Monetary Fund (IMF) projects a 7 percent real GDP growth for Fiji in 2023, accompanied by a decrease to 3.5 percent in inflation.[82] The fiscal deficit is also expected to improve, declining from 12.2 percent of GDP in FY2022 to a projected 7.7 percent for FY2023. Furthermore, Fiji's foreign exchange reserves remain comfortable at 6.2 months of prospective imports, supported by concessional financing and remittances.[83] Moreover, GoF has acknowledged the need for a fiscal consolidation plan as a way of dealing with the longer-term structural risks associated with an economy with still high levels of public debt, heavily dependent on tourism, and susceptible to natural disasters.[84]

ADB and the World Bank both have a longstanding with Fiji's MoF, which will act as the borrower. MoF will serve as intermediary to allocate CIF REI resources effectively by on-lending to both the DoE and EFL, who in turn will act as the implementing entities. MoF has excellent implementation readiness, as it works extensively with bilateral and multilateral donors.

Financial Standing of EFL

EFL has stated in its 2021 annual report that the new FCCC regulatory framework – which includes tariffs – allows the company to recover all cost related to the production, distribution, and retail of electricity,[85] while also providing the company and other key stakeholders a greater degree of certainty and transparency with the application of the tariff methodology.[86]

Even before the current tariff methodology came into effect, EFL was able to achieve sustained profitability: with the exception of 2014, when below-average rainfall negatively affected the company's two largest HPPs,

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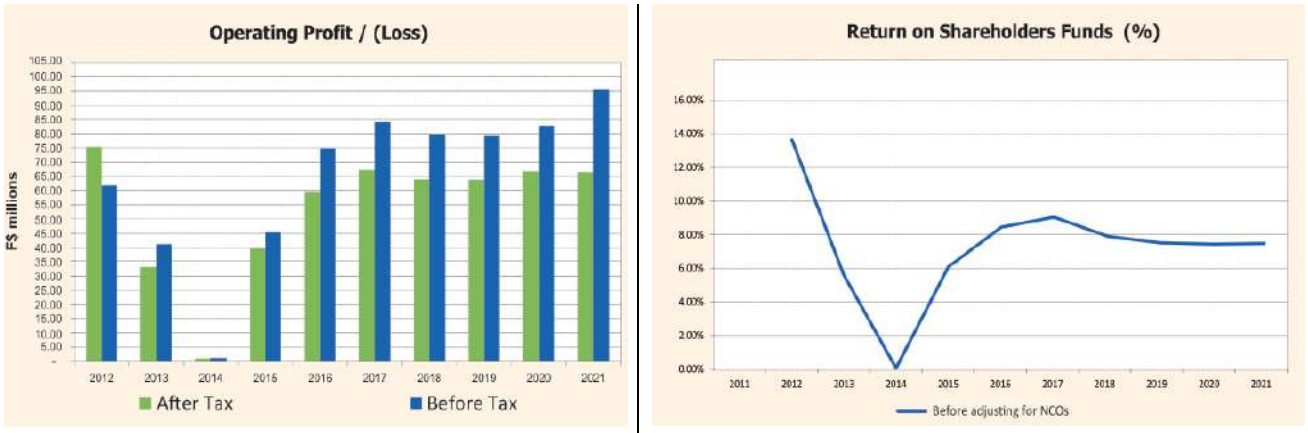
[80] World Bank. (2023). "Fiji Public Expenditure Review" p.2
[81] International Monetary Fund. (2023). "IMF Staff Completes 2023 Article IV Mission to Fiji." Available at https://www.imf.org/en/News/Articles/2023/03/21/pr2386-fiji-imf-staff-completes-2023-article-iv-mission-to-fiji
[82] International Monetary Fund. (2023). "Republic of Fiji." Available at https://www.imf.org/en/Countries/FJI#whatsnew
[83] International Monetary Fund. (2023). "IMF Staff Completes 2023 Article IV Mission to Fiji." Available at https://www.imf.org/en/News/Articles/2023/03/21/pr2386-fiji-imf-staff-completes-2023-article-iv-mission-to-fiji
[84] World Bank. (2023). "Fiji Public Expenditure Review" p.3
[85] Energy Fiji Limited. (2022). "2021 Annual Report." Available at *https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf*, p.23
[86] Energy Fiji Limited. (2022). "2021 Annual Report." Available at *https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf*, p.28

ELF has enjoyed healthy and sustained profit margins over the past ten years.[87] EFL's reliance on low-cost RE sources for electricity generation has been both a competitive advantage and a challenge: while low-cost RE generation allows the company to enjoy high profit margins in most years, it also leaves EFL exposed to risks associated with weather events, primarily droughts, which can negatively impact the operations of its hydropower plants, and consequently its financial performance in any given year.

Figure 7.1: EFL Profitability, 2012-2021



Source: Energy Fiji Limited. (2022). "2021 Annual Report." Available at https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf

The strength of EFL's financial standing is bolstered by the strong regulatory regime for tariffs. Tariffs in the electricity sector are set by the FCCC, which published its latest methodology on 16 September 2019. There are five objectives that must be met during the tariff elaboration process, namely the final tariff must: (i) cover the costs of supply of electricity; (ii) encourage efficiency in providing electricity; (iii) promote efficient consumption; (iv) address affordability for poor households; and (v) ensure environmental sustainability. The FCCC recognizes that some of these objectives are often conflicting as each can represent the interest of a different stakeholder.

One of the key principles that the FCCC considers in electricity tariff regulation is the revenue that utilities are allowed to recover to cover incurred costs plus a fair return to investors. The formula for determining allowable revenue requirements takes into account fuel costs, operating expenditures, depreciation, assets employed in electricity supply and the rate of return of the utility, based in its calculated Weighted Average Cost of Capital.[88] The tariff is to be reviewed every 4 years under the new regulatory cycle, with the next review scheduled for October 2023.

[87] Fiji Electricity Authority. (2015). "2014 Annual Report." Available at https://efl.com.fj/wp-content/uploads/2015/09/FEA-Annual-Report-2014-1.pdf, p.2

[88] The WACC is an estimate of the investors' required rate of return for a given risk level associated with an investment made in an entity.

SECTION 8 INTEGRATIVE APPROACH TO MONITORING, EVALUATION AND LEARNING

The Monitoring, Evaluation, and Learning strategy for Fiji's IP is based on CIF REI's Integrated Results Framework (IRF). It is collaboratively established by the GoF, national implementing entities, and Multilateral Development Banks (MDBs). Its primary purpose is to facilitate the continuous tracking and reporting of progress towards achieving the outcomes and objectives outlined in this investment plan.

In this comprehensive approach, various dimensions of monitoring, evaluation, and learning are utilized to capture the impacts of programs and projects. Additionally, important elements, such as gender inclusion, are integrated to provide a nuanced and holistic understanding of the program's advancement and thematic specifics and ensure the long-term achievement of the goals outlined in this plan.

Theory of change and IRF

Each support activity included in this REI IP is designed to tackle specific obstacles that hinder the broader integration of renewable energy in Fiji. By implementing these activities, using concessional resources, the IP anticipates achieving specific outcomes, as shown in Table 8.1, which outlines the program's general Theory of Change approach for Fiji.

Moreover, specific indicators have already been defined in connection with the IP's IRF, as presented in the Appendices. These indicators will enable the monitoring and assessment of progress based on the program's envisioned outcomes. However, it is important to note that the targets set for these indicators are somewhat tentative and indicative, as they depend on assumptions about the type of investments sub-borrowers will ultimately undertake and the projects that will meet eligibility criteria. The final results will heavily rely on the preferences of sub-borrowers and the financing assessment decisions of implementing entities.

Table 8.1. Theory of Change Concept Map

Barriers	• **Affordability constraints for low-income Fijians.** Despite the increasing accessibility of decentralized RE systems like solar PV, low-income households in isolated rural communities may still lack sufficient disposable income or savings to afford home energy systems and switch from existing diesel generators.	• **Low availability and retention of skilled and technical employees.** Brain drain and high levels of emigration in Fiji can lead to a situation where there is a lack of skilled workers to occupy newly created job opportunities in the energy sector. • **Susceptibility of the energy infrastructure to climate and disaster-related risks.** The positioning of many substations and transformers in coastal areas, along with above-ground distribution lines heavily reliant on a single transmission line, exposes Fiji's electricity grid to the impacts of cyclones and floods.

	• **Geographical and economical challenges of distributing power to small and isolated communities.** The rugged terrain and lack of infrastructure make establishment costly, while low population density raises and absence of economies of scale makes the investment unattractive for the private sector. • **Electric grid infrastructure that is inadequate for the integration of RE technologies.** Substituting currently used diesel generators for intermittent renewable energy resources, such as solar and wind, would require a grid capable of managing real-time fluctuations in supply and demand caused by these technologies. This necessitates advanced technologies and communication systems like smart grids, which are currently not fully implemented.	• **Lack of coordination and fragmentation of responsibilities across stakeholders.** The lack of proper coordination among different energy sector stakeholders poses a challenge for implementing cohesive policies, strategies, and regulations. Responsibilities are fragmented across multiple ministries, departments, agencies, and authorities, leading to complications and difficulties in executing broad sector actions, including the approval and implementation of renewable energy projects.
	Rural Electrification	**Transmission and Distribution Network Expansion (EFL)**
Supported Activities	• Expand the reach of the electricity grid of the Lakeba, Kadavu, Rotuma and Taveuni islands to reach those with limited or no electricity access in rural communities. • Upgrade existing grid technologies and infrastructure to allow the shift from diesel-only generators to hybrid systems. • Offer financial backing to the FREF for the establishment of re-charging stations and the introduction of solar power in communities without electricity or relying on polluting diesel generators.	• Support EFL in expanding transmission and distribution infrastructure and create the basis to support the integration of additional VRE in the future. • Provide EFL with the necessary financing for the initial investments in the T&D infrastructure required to manage the load changes resulting from the increased adoption of EVs and REI technologies. • Assist EFL and/or GoF in preparing competitive tenders for solar (or other renewable energy) IPPs. • Assist GoF in planning and implementing power sector reforms needed to increase uptake of renewable energy.

Main Expected Outcomes	• Provide the basis for the transition from polluting and inefficient diesel generators to decentralized, hybrid RE systems for rural households. • Help expand off-grid energy access and allow the country to reach its universal electricity access goal. **Transformational change:** rural residents become more integrated in Fijian society and enjoy a better quality of life. The electric grid infrastructure is enhanced to better accommodate REI technology, making it more reliable and attractive to private investors with increased access to finance.	• Contribute to the achievement of the Fiji's universal electricity access goal. **Transformational change:** improved efficiency and capacity of the interconnected transmission and distribution system, leading to reduced risk of outages and failures. Increased integration of renewable energy sources, facilitation of electric vehicle adoption and universalization of electricity access.

Relevance: Both activities supported by this IP are highly relevant to Fiji's development goals and long-term sustainability. Expanding and enhancing Fiji's transmission and distribution network is a top priority as it reduces the country's dependence on imported diesel and hydro resources, which make it vulnerable to external price shocks and droughts. By upgrading this infrastructure, Fiji can seamlessly integrate large-scale renewable energy generation without facing technical or reliability issues. Furthermore, CIF financing for rural electrification programs plays a crucial role in achieving Fiji's goal of 100 percent electricity access by 2026, given that, without donor funding, the rate of return on these projects would most likely not be sufficient to attract private sector investment.

Systemic change: The expansion of the transmission and distribution network in Fiji would enable the adoption of significant new VRE sources, addressing the country's current limited utilization of VRE and reliance on imported petrol. This transformative step holds the potential to propel Fiji towards its goal of achieving 100% electrification. Beyond that, it would also have a life-changing impact on unserved or underserved rural areas, providing them with more affordable and reliable energy delivery solutions.

Scale: The REI activities supported by this IP hold the potential for substantial decrease in GHG emissions in Fiji as currently roughly 40 percent of electricity currently comes from non-renewable sources. Specifically, electricity and other energy generation were responsible for emitting an estimated 237,124 metric tonnes of CO_2e in 2020. Additionally, household emissions in the same year reached 28,751 metric tonnes of CO_2e for both urban and rural households in Fiji, with a significant portion attributed to the use of wood for cooking and diesel generators for electricity, which are more prevalent in rural households.

Speed: Both of the supported activities can be implemented swiftly and efficiently upon approval, as the construction of transmission and distribution lines follows a quick and straightforward process, particularly when there is sufficient generation capacity. The process of building these lines is well-established, involving standardized engineering practices and established protocols. Moreover, transmission and distribution lines

are typically constructed using readily available materials and technologies, which further streamlines the development process. Moreover, EFL has already planned the initiation of numerous new lines within the next 1-2 years, aligning with the government's objective of achieving universal energy access by 2026.

Resilience: A nationwide grid expansion is paramount to increasing the overall redundancy of the interconnected T&D system. By having redundant pathways for electricity transmission, the grid becomes more robust and resilient, reducing the impact of cyclones and other extreme weather events on the continuity of energy supply. Similarly, improved energy access in remote areas, which are often the most vulnerable to the effects of climate change, enhances overall resilience in these communities. Access to reliable and sustainable energy sources enables them to maintain essential services, communication networks, and access to critical resources, therefore minimizing the adverse impacts of climate-related events, such as storms, floods, or heatwaves.

Throughout the program's execution, other signals indicating transformational changes can be effectively addressed and analysed through impact assessments, just transition studies, co-benefit evaluations, and social and gender inclusion studies. Additionally, specific learning-oriented activities will contribute to this process. These evaluations and studies, driven by the CIF, the country, and the MDBs, will be carried out as necessary based on the activities that receive financial support from the program. By combining systematic monitoring with research and evaluation, employing mixed methods and diverse forms of evidence, a comprehensive understanding of the program's achievements and lessons learned will be gained, enabling an informed perspective on its implementation.

APPENDIX A INVESTMENT CONCEPT BRIEFS

A.1 VITI LEVU'S GREEN ENERGY CIRCUIT

PROBLEM STATEMENT

Fiji relies on expensive oil imports for more than two-thirds of existing energy needs, with transport applications alone accounting for more than forty percent of total energy consumption. Despite the country's vast renewable energy potential and historical investment in hydropower, forty percent of electricity generation still comes from fossil fuels. High and volatile imported diesel prices have contributed to large trade deficits, which have taken a toll on Fiji's economy and consumed funds that could otherwise be available for other socially beneficial development of the country. The expansion of renewable energy generation has historically been limited by network infrastructure constraints which restrict the ability of Fiji's electrical network to accommodate an increasing share of variable renewable energy (VRE) on the grid.

Renewable energy generation plays a critically important role in the energy mix, but there is substantial room for additional capacity. Hydropower provided nearly 60% of Fiji's electricity generation in 2021, and there are early solar, wind, and biomass generation projects. There are, nevertheless, major challenges in bringing sufficient resources online, as evidenced by the persistently high dependence on diesel generation. Many of these challenges relate specifically to the inability of the grid to absorb additional energy flow and power loading. The challenges are compounded by the volatility of hydropower generation over time, as climate change has made it more and more difficult to accurately predict and plan for dry years. The island of Viti Levu—home to ¾ of Fiji's population—has an electricity network which is still largely a radial design. The Monasavu Hydropower Plant—the largest power plant on Viti Levu—is located at the geographical center of the island, but with too few "spokes" connecting from that central "hub", and few transmission connections to other areas that have good potential sites for renewable energy generation. Figure 2 shows the existing transmission network on Viti Levu, with an overlay of the areas with existing or unexploited potential for renewable energy generation.

PROPOSED CONTRIBUTION TO INITIATING TRANSFORMATION

The proposed Green Energy Circuit for Fiji will upgrade and improve climate resilience of the existing transmission network to enable evacuation of existing and planned solar, hydropower, and wind. This component combines:

- Investment in upgrades of existing and construction of new 132 kV transmission lines and sub-stations in Central and Western Viti Levu, areas with existing and substantial potential renewable energy resources.
- Transaction advisory support for 40 MW of new solar IPPs at preferred renewable energy locations on Viti Levu (including the Western side of the island).
- Private sector investment in approximately 40 MW of solar (or other RE) IPPs, including investment from IFC.

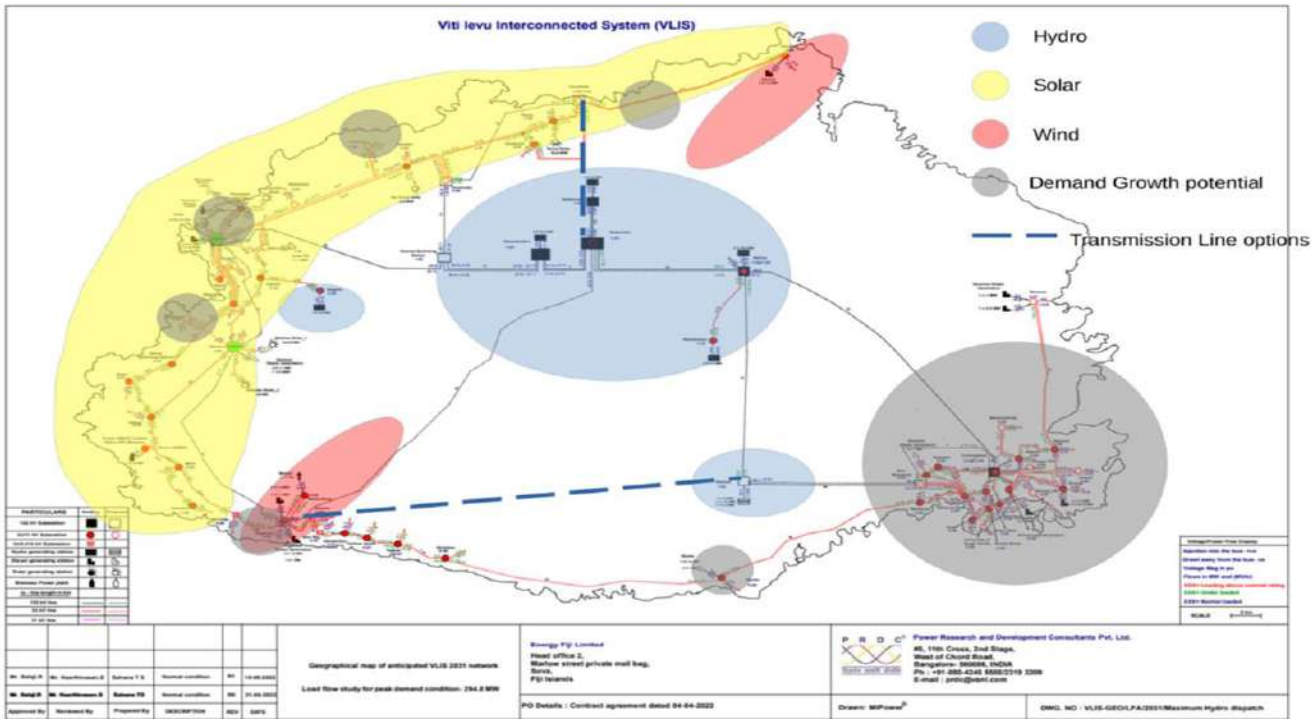
- Technical assistance studies for putting in place systems to (a) ensure a periodic assessment and agreement on an appropriate capacity reserve margin given Viti Levu's demand growth, resource mix, future development plans for generation and transmission as well as learnings from the first renewable projects, (b) update generation dispatch operational plans to incorporate variable renewable energy, (c) evaluate storage and demand response to increase firm capacity and improve flexibility over the medium term as the share of renewables increase, (d) review and update the grid code and (e) support utility and regulator dialogue on supporting system security while improving the share of clean energy.
- Guarantees to mitigate risk perceptions (addressing expected risks around solar generation preceding transmission availability, concerns around curtailment of dispatch for operational reasons over the term of the power purchase agreement, timely payment security) that could result in wider bid participation from reputed developers and better pricing commensurate to Fiji's scale and potential in the Pacific.

Under a business as usual (BAU) scenario where system security is prioritized in a small island context (without access to inter-island interconnections)- diesel generation is expected to provide dispatchable power to customers while EFL expects hydropower to be developed over the next 5-10 years. VRE penetration is limited to a small fraction of the daily requirement. There is an opportunity to support significant scale up of renewables in Viti Levu to provide adequate energy to reduce and reduce diesel generation during the daytime of a typical day. The interplay of variable renewable energy (solar PV), other generation sources and transmission plans as well as the need for limited storage would need to be assessed and suitably scaled over the medium term.

The envisaged renewable energy generation plants are expected to be delivered by private sector independent power producers (IPPs). Given the lack of large-scale renewable deployment in the Pacific in general and Fiji specifically, ADB will support project development with transaction advisory services. ADB will draw on its experience assisting the government of Cambodia with a 100 MW solar park project which utilized a public-private partnership approach that successfully crowded in IPPs, resulting in the lowest offtake prices in the ASEAN region. ADB will also consider providing stapled guarantees, as necessary, to mitigate offtake risks for IPPs.[89]

[89] ADB will draw on its prior experience using blended finance for grid expansions to accommodate gigawatt scale VRE growth in India using CTF cofinancing, as well as experience with viability gap financing for grid-connected IPP solar projects in Nepal using SREP cofinancing. ADB will also draw on more recent experience with transaction support for large scale IPP solar and wind projects in Central Asia as well as transactions in the Pacific where the Pacific Renewable Energy Program provides guarantee support to private sector projects to mitigate specific risks. ADB has funded multiple projects which incorporate grid enhancing technologies including high-performance conductors in Nepal and Bangladesh for upgrading existing lines as well as maximizing capacity and efficiency for new high-voltage line, and utility-scale energy storage systems in Mongolia and the Maldives.

Figure 2: Renewable Energy Resource Potential in Viti Levu



IMPLEMENTATION READINESS

The Fiji economy has after contractions in 2020 and 2021 rebounded with real growth in 2022-2023 and an increase in electricity demand. Energy Fiji Limited (EFL) is responsible for generation, power purchase, transmission and distribution in Viti Levu. It generates more than 93% of electricity in Fiji, with the remainder being provided by IPPs. After undergoing partial privatization in 2018, EFL remains profitable and is committed to its 10-year Power Development Plan. This plan estimates a total investment of FJD1.97 billion (US$900 million) needed for the development and commissioning of renewable energy projects over the next 10 years.[90] This investment will increase capacity to meet future electricity demand from renewable sources and improve the security and reliability of power supply. The investments foreseen in this Green Energy Circuit are planned to break ground in the next 5 years.

EFL stated in its 2021 annual report that the new FCCC regulatory framework—which includes tariffs—allows the company to recover all costs related to the production, distribution, and retail supply of electricity,[91] while also providing the company and other key stakeholders a greater degree of certainty and transparency with the application of the tariff methodology.[92] The Government endorsed National Infrastructure Investment Plan (NIIP) identifies the need for electricity transmission on Viti Levu to support renewable energy to assist Fiji in meetings clean energy goals.

[90] Republic of Fiji. (2023). "National Infrastructure Investment Plan," p. 51
[91] Energy Fiji Limited. (2022). "2021 Annual Report." Available at https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf, p.23
[92] Energy Fiji Limited. (2022). "2021 Annual Report." Available at https://www.parliament.gov.fj/wp-content/uploads/2022/08/Energy-Fiji-Limited-Annual-Report-2021.pdf, p.28

RATIONALE FOR REI FINANCING

Financing under the REI Program will ensure that the Green Energy Circuit on Viti Levu is cost-neutral or delivers cost savings to electricity end-users. A primary constraint on renewable energy deployment in Fiji is the additional costs of grid expansion and upgade to facilitate significant scaling up of grid-connected generation capacity which will be mostly VRE (solar, wind, and hydro) as well as the ability to forecast and integrate renewables in a smooth manner. EFL's weighted average cost of capital (WACC) is capped by the regulator, FCCC. Blended finance is needed to ensure that WACC remains under the cap as well as provide long term capital for transmission grid expansion that can dovetail with renewable energy development timelines.

RESULTS INDICATORS

The results indicators to be monitored throughout implementation of this component will include the following:

- MW of installed renewable energy capacity on new or upgraded transmission lines
- MWh of clean energy consumed by customers benefitting from the connections
- The volume of global (CO_2) and local (NOx, SOx, and particulates) emissions offset by providing access to a cleaner mix of energy.

FINANCING PLAN AND FINANCIAL INSTRUMENTS

The table below describes the financing foreseen by various parties.

This includes:

- CIF concessional financing for transmission investments under EFL's PDP of $25 million (public sector) .
- Technical assistance grants from CIF and ADB on the identified studies and preparatory work.
- ADB financing of about $40 million for 132 kW transmission investment related to EFL's PDP; ; ADB will help facilitate public sector terms (loans, guarantees, and TA funds) to facilitate private sector investment in VRE.
- 40 MW of solar developed by the private sector, procured through reverse auctions to ensure lowest cost and highest compliance with bid terms (at roughly $1000/kW);); roughly $15 million of this is anticipated to be financed by IFC.
- ADB Private Sector debt financing of about US$20 million for new renewable energy generation developed by the private sector and co-financed with other partners inside and outside Fiji.
- CIF-financed public sector offtake guarantees (for renewable energy project developers) that could be stapled to the tenders to address some of the distinct risk perceptions with scaling up intermittent renewables and improve risk perception of projects.
- Counterpart financing – typically to cover applicable taxes and duties as well as overhead costs.

Financing Source	CIF				Others			
Program	CIF Fin-ancing	CIF Guar-antee	Project TA Grant	Total CIF	ADB[93]	IFC	Private Sector	Total
	(US$ Million)							
Viti Levu Green Circuit	25	8	2	35	60	15	35	**145**

The combined investments result in a leverage ratio of approximately 5X of CIF funds (in other words, the total investment package is just over 5 times the financing provided by CIF).

PROJECT PREPARATION TIMETABLE

Project Preparation Step	Timeline and milestones
Preliminary pre-feasibility studies for generation options and transmission system and ADB transaction advisory services mandate initiation.	Q1 2024
Detailed concept for Viti Levu Green Energy Circuit + commencement of TA consultants for feasibility studies.	Q2 2024
Feasibility studies and due diligence completed. Solar IPPs Risk mitigation matrix and market sounding completed.	Q4 2024
CIF Project Funding proposal submitted by ADB, EFL and Government of Fiji.	Q1 2025
ADB Board/Management approval and signing of loan agreements.	Q2 2025

PROJECT PREPARATION NEEDS

Technical Studies

Several technical studies will be important to identify and evaluate specific options for augmenting the current 132 kV transmission grid to secure and strengthen the connections from potential RE sources to the load centers on Viti Levu. These include the development of:

[93] ADB funding comprises sovereign funding and non-sovereign funding for generation and transmission related investments in Viti Levu.

- **Reliability and risk assessment tools for generation resource adequacy.** Traditional resource adequacy methods are inadequate to guarantee reliability in a swiftly evolving electrical power system. Power grids are undergoing rapid transformations, shifting from a structure supported by resources that can be dispatched as needed to a structure that depends on intermittent energy sources and storage with limited duration. Typical resource planning models frequently overlook aspects such as weather data, the influence of climate, resources located behind the meter, transmission considerations, or comprehensive data regarding the availability of energy storage. In order to guarantee that resource adequacy models are capable of offering accurate risk assessments, Fiji should undertake probabilistic modelling that simulates random variables in a weather-dependent manner, compares simulations with historical data for benchmarking, models generator outages as being influenced by weather conditions, adjusts simulations to align with future expectations, and incorporate the impacts of climate change into the simulations.
- **Generation and transmission expansion tools.** Generation and transmission expansion tools are critical for long-term planning and optimization of the electricity grid. These tools help utilities, grid operators, and policymakers make informed decisions about the development of new generation capacity and the expansion of the transmission infrastructure. Specialized transmission expansion tools and considerations for systems with high renewable energy penetration include:
    - Grid interconnection and integration tools: Tools to facilitate the connection of renewable projects to the grid and ensure seamless integration
    - Energy storage sizing and optimization software: Tools to assess and optimize the size and operation of energy storage systems, including batteries
    - Generation and Transmission Planning Integration: Generation expansion tools should consider the impact of new generation projects on the transmission infrastructure, including the need for transmission upgrades
    - Power Flow Analysis: Power flow analysis tools evaluate the steady-state performance of the transmission grid under different operating conditions and generation scenarios.
- **Generation dispatch and network operation tools.** Generation dispatch and network operation tools for systems with high renewable energy penetration are essential for utility engineers to effectively manage and operate the grid. These tools help ensure grid reliability, stability, and efficiency in the presence of variable and intermittent renewable generation. Important tools and considerations for utility engineers in such systems are:
    - Energy Management Systems (EMS): EMS software is the core tool for generation dispatch. It provides real-time monitoring, control, and optimization of power generation and transmission. EMS includes components such as:
        - State Estimation: Calculates the real-time state of the power system
        - Load Forecasting: Provides short-term load forecasts to guide generation dispatch decisions
        - Renewable Energy Forecasting Tools: Software and models for predicting renewable energy generation, such as wind and solar forecasts
        - Optimization Algorithms: Determine the optimal generation schedule considering generation costs, constraints, and reliability requirements
        - Economic Dispatch Models: Economic dispatch models optimize the operation of existing and planned generation assets to minimize production costs while meeting demand and environmental constraints

    - Unit Commitment: Decides which generation units to start or stop based on predicted load and available generation resources
- Renewable Integration Models: These models assess the integration of variable renewable energy sources into the grid. They consider factors like variability, intermittency, and grid reliability
- Demand Response Management Systems: Software to manage demand response programs and optimize load flexibility
- Dynamic security assessment is one of the critical aspects of power system studies that are used to identify critical contingencies in the grid by analysing their corresponding dynamic security constraint violations on the grid
- Grid Frequency Control Tools: Tools for monitoring and controlling grid frequency are critical for maintaining system stability. These tools include frequency measurement, load shedding, and Automated Generation Control (AGC) functions
- Voltage and Reactive Power Control Tools: Tools for managing voltage and reactive power in the grid, critical for renewable energy integration
- SCADA (Supervisory Control and Data Acquisition) Systems: Systems for monitoring and controlling grid assets, including renewable generation
- Advanced Metering Infrastructure Systems: Systems for collecting and managing data from smart meters and sensors for better grid management
- Distribution Management Systems: Software for managing the distribution grid, including integrating renewable distributed energy resources
- Stability Analysis: Stability analysis tools assess the dynamic behaviour of the grid under transient conditions, ensuring that the transmission system remains stable during disturbances.

Legal and Regulatory Reforms

The Government of Fiji is committed to the substantial legal and regulatory reforms required to bring more renewable energy into electricity generation. These reforms could include:

- The introduction of competitive auctions for renewable energy generation, especially from solar facilities, possibly including mandates for the purchase of renewable energy by utilities or large consumers
- Expansion of the use of net metering and/or net billing to spur investment in rooftop solar
- Legal recognition of storage as a distinct activity and regulatory reforms to promote investment in storage.

Environmental and Social Issues

The investment financed under this project present limited social and environmental risks. Upgrading existing transmission lines and substations is conducted within existing rights of way (ROW); no resettlement is required, there are no impacts on indigenous peoples, and minimal impacts—if any—on environment. New transmission lines and sub-stations, as well as investments in generation and storage would follow ADB Safeguard Policy and Government of Fiji's requirements. The benefits of diversification of generation locations and grid investments would support improved climate resilience, especially higher wind loading, to minimize the risk of grid-supplied electricity being disrupted by major meteorological events. The potential for climate insurance tools to facilitate investments (and at lower costs) would also be considered. The additional

renewable energy supplies will reduce local air pollution and will reduce foreign exchange outflow for petroleum fuel purchases, freeing up funds for other socially beneficial investments.

A.2 OUTER ISLANDS ELECTRIFICATION

PROBLEM STATEMENT

Most Fijians have access to electricity, but a portion of the country's population remains without, relying predominantly off-grid and traditional fuels. The majority of the unelectrified households are in the rural and maritime areas as well as in informal settlements. There is, therefore, a substantial rural-urban disparity: 96 percent of the country's population has access to electricity, but access is skewed towards urban and some rural areas because of the challenges of distributing power to small and isolated communities and rural villages in the outer islands.[94] Four percent of urban residents and nearly 20 percent of people living in rural areas still lacked electricity access as of 2021.[95] Roughly five percent of the population rely on standalone diesel generators for electricity, making them vulnerable to price volatility in the international oil market. Women in rural communities with low incomes are particularly affected since without electricity they face challenges carrying out household daily tasks such as food preparation, helping children with homework, agriculture and business activities.

Achieving universal access to electricity is a priority for the Government of Fiji (GoF). Through the implementation of the *National Electrification Policy* and the development of an updated Electrification Master Plan, the Department of Energy (DoE) has been working with national energy utilities, renewable energy suppliers, financing schemes, and relevant stakeholders to add both off-grid and on-grid energy capacity to fill all electrification access gaps and support as close to universal access to electricity as much as possible. The National Energy Policy (NEP) 2023-2030 has "Energy Access and Equity" as one of its five policy pillars, alongside Energy Security and Resilience, Energy Sustainability, Energy Efficiency, and Energy Governance. In its 2017 National Development Plan[96] the GoF stated its intent to deliver 100 percent access to 100 percent access to electricity by 2021, but this objective was indefinitely postponed given delays associated with the global COVID-19 pandemic. With CIF's assistance proposed, the goal could conceivably be achieved by 2026.

PROPOSED CONTRIBUTION TO INITIATING TRANSFORMATION

CIF financing would be blended with World Bank financing to support the DoE and Energy Fiji Limited (EFL) in efforts to electrify and improve the quality and reliability of supply in rural areas, and increase the percentage of renewable energy generation available to customers in outer islands. These investments would expand the reach of the electricity grid of the Lakeba, Kadavu, Rotuma, Taveuni, Vanua Levu, and other priority outer islands to be identified to reach those with no or limited electricity access in rural communities; and would upgrade existing grid technologies and infrastructure to allow the shift from diesel-only generators to hybrid renewable energy systems.

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[94] "Access to Electricity, Rural (% of Rural Population) - Fiji." World Bank Open Data. Accessed August 2, 2023. https://data.worldbank.org/indicator/EG.ELC.ACCS.RU.ZSend=2021&locations=FJ&start=1996&view=chart.
[95] Fiji Renewables Readiness Assessment. Accessed August 2, 2023. *https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/IRENA_RRA_Fiji_2015.pdf*.
[96] Republic of Fiji: Ministry of Economy. (2017). "5-Year & 20-Year National Development Plan," Available at *https://www.fiji.gov.fj/getattachment/15b0ba03-825e-47f7-bf69-094ad33004dd/5-Year-20-Year-NATIONAL-DEVELOPMENT-PLAN.aspx*.

Fiji's National Infrastructure Investment Plan (NIIP) includes electrification investments planned by DoE for Lakeba, Kadavu, and Rotuma. DoE also has plans to invest in Taveuni. These islands collectively include roughly 30,000 people, nearly 100 villages, airstrips, government buildings, post offices, health centers and schools. The investments include:

- In Kadavu, grid extensions from the Vunisea mini grid via Nasali to Nabukavesi ira.
- In Lakeba, grid extensions from Tubou to Nasaqalau, and from Tubou to Waitabu
- In Rotuma, construction of a distribution line around the entire island.
- In Taveuni, grid extension, from Naselesele to Lavena, Wairiki to Navakawau, Salialevu Tee to Off, Soqulu Est. Tee to Off and Nacogai Tee to Off.
- In Vanua Levu, support to DoE and/or EFL in further line extensions, to complement plans in the NIIP to upgrade and expand connections to government stations and install solar hybrid systems.

These investments will help expand energy access and allow the country to reach its universal electricity access goal. It will help improve the quality of energy services, increase access for households from tier 1 to higher tiers of access[97], and improve reliability for business and commercial enterprises who rely on diesel generators. They will also provide the basis for the transition from polluting and inefficient diesel generators to decentralized, hybrid renewable energy systems for rural households.

Other possible investments could include contribution and collaboration with the Fiji Rural Electrification Fund (FREF) for co-financing/financial risk mitigations, technical assistance, and knowledge exchange with other Pacific Island Countries (PICs).[98]

Implementation Readiness

The World Bank has a long-standing with Fiji's Ministry of Finance (MoF, formerly Ministry of Economy), which will act as the borrower. MoF will serve as intermediary to allocate CIF-REI resources effectively by on-lending or on-granting to both the DoE and EFL, who in turn will act as the Implementing Entities (IEs). MoF has excellent implementation readiness, as it works extensively with the World Bank and other donors. After a 17 percent GDP contraction in 2020 and a further 5.1 percent decline in 2021, Fiji's economy experienced a strong recovery in 2022 with an estimated 16 percent growth in 2022 attributed to a robust resurgence in tourist arrivals.[99] The IMF projects a seven percent real GDP growth for Fiji in 2023, accompanied by a decrease to 3.5 percent in inflation.[100] The fiscal deficit is also expected to improve, declining from 12.2 percent of GDP in FY2022 to a projected 7.7 percent for FY2023. Furthermore, Fiji's foreign exchange reserves remain comfortable at 6.2 months of prospective imports, supported by concessional financing and remittances.[101] Moreover, Government has acknowledged the need for a fiscal consolidation plan as a way of dealing with the longer-term structural risks associated with an economy with still high levels of public debt, heavily dependent on tourism, and susceptible to natural disasters.[102]

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[97] See the Multi-Tier Framework for energy access: *https://mtfenergyaccess.esmap.org/*.
[98] As of 2023, FREF is administered by the Department of Energy.
[99] International Monetary Fund. (2023). "IMF Staff Completes 2023 Article IV Mission to Fiji." Available at https://www.imf.org/en/News/Articles/2023/03/21/pr2386-fiji-imf-staff-completes-2023-article-iv-mission-to-fiji
[100] International Monetary Fund. (2023). "Republic of Fij." Available at https://www.imf.org/en/Countries/FJI#whatsnew
[101] International Monetary Fund. (2023). "IMF Staff Completes 2023 Article IV Mission to Fiji." Available at https://www.imf.org/en/News/Articles/2023/03/21/pr2386-fiji-imf-staff-completes-2023-article-iv-mission-to-fiji
[102] World Bank. (2023). "Fiji Public Expenditure Review" p.3

The World Bank has extensive experience working with DoE which reports to the Minister for Public Works, Transport, and Meteorological Services, and is responsible for developing energy policies and sector strategy, including government policies on renewable energy.[103] The DoE is also responsible for rural electrification. Since its inception, DoE has installed more than 400 generators and some 100 kilometers of low-voltage distribution to expand electricity access to rural areas.[104] DoE typically transfers the operation of the systems to rural communities or—if the area is part of EFL's service area—has EFL undertake construction and operation. As of 2023, responsibility for the FREF was also transferred from Fiji Development Bank to DoE.[105] DoE has roughly US$100 million in projects planned under the NIIP, with a focus on rural hydropower generation, zero energy building deployment, and re-charging stations.

As noted above, DoE is responsible for rural electrification in areas outside of EFL's mandated service areas. The department has been tendering hybrid mini-grids as Engineering Procurement and Construction (EPC) contracts through its online portal, with local authorities operating the schemes. These tenders have only included the building component of the electrification schemes and not their operation. All procurements by the DoE are conducted through the government's Procurement Office as per the Financial Management Act's Procurement Regulations of 2010. All tenders for rural electrification are published on the Procurement Office's website. The DoE is also open to receiving unsolicited bids for rural electrification from RE sources. Currently, there is no public procedure to manage unsolicited bids and all bids are managed on a case-by-case basis.

Rationale for REI Financing

Financing under the REI Program has the potential to reduce the cost of power supply to end-users in outlying islands, many of whom are in rural and lower-income areas. This will allow government to continue to provide affordable service to the most vulnerable.

The GoF subsidizes electricity for low-income residential customers and small and medium-sized businesses, in order to ensure affordable access regardless of income and to stimulate local economic activities and job creation. The generous terms of CIF financing blended with World Bank concessional financing will help to keep the line extensions affordable for end-users while limiting Government's debt service outlays, especially in the earlier years.

In addition, the investments would allow the islands to decarbonize their power supply especially for users who rely on diesel-based self-generation, and contribute to the economic development through the provision of more reliable power.

Results Indicators

The results indicators to be monitored throughout implementation of this component will include the following:

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[103] IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific," p. 83
[104] IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific," p. 83
[105] Launched during Fiji's COP23 Presidency with support from the Leonardo DiCaprio Foundation (LDF), the fund provides renewable energy to Fiji's outlying islands and villages. Together with Sunergise (Fiji) Limited, the Fiji Locally Managed Marine Area Network (FLMMA) and the Fiji Electricity Authority (FEA), FREF seeks to bring solar power to communities with no electricity or that rely on pollution-emitting diesel generators. The goal of the program is for the communities served to receive round-the-clock electricity services from solar and battery hybrid systems for the same or less money than they would spend on fossil fuels to run diesel generators for only three to four hours a day.

- Number of customers connected to the grid (by type of customer)
- MWh of clean energy consumed by customers benefitting from the connections
- The volume of global (CO_2) and local (NOx, SOx, and particulates) emissions offset by providing access to a cleaner mix of energy
- MW of new renewable energy capacity installed as an indirect result of the grid investments.

Financing Plan and Financial Instruments

The table below describes the financing foreseen by various parties.

Financing source	CIF			Others		
Component	CIF Financing	Project Preparation (Grant)	Total CIF	World Bank	Private Sector	Total
Electrification of Outer Islands	33	2	35	15		**50**

Project Preparation Timetable

Project Preparation Step	Timeline and milestones
Community consultations and TA	Q1/2 2024
Preliminary feasibility studies for identified lines	Q2 2024
Environmental and Social Safeguards studies	Q3 2024
Feasibility studies	Q3 2024
World Bank Board approval	Q4 2024

Project Preparation Needs

Project preparation would include consultations with communities on the selected islands to assess households' affordability, productive users of energy, land ownership, environmental and social risks and mitigation measures, and technical/engineering aspects of the investments. The team will also assess the institutional, policy and regulatory framework that would allow sustainable operation of outer island electrification schemes. Based on these findings, preliminary feasibility studies will be carried out that will inform the project design, economic and financial feasibility, and implementation arrangements.

Environmental and Social Issues

The investments financed under this project present very limited social and environmental risks. New transmission lines and sub-stations, as well as any investments in generation and storage would follow World Bank Safeguard Policy and GoF's requirements.

APPENDIX B RANKING OF POSSIBLE PROJECTS

Projects from the NIIP, NDC Implementation Roadmap and EFL's PDP were grouped into categories of investments that CIF had indicated were eligible for REI funding. The table below shows these categories.

Opportunity	Possible CIF Engagement through REIIP	REIP activity category
T&D for RE Projects	Potential T&D projects could include grid interconnection to integrate regional markets and increase their flexibility. It could also include new and smart grids, both large and small scale, that complement each other and enable new ways to manage variable renewable energy generation.	Enhancing infrastructure to be renewable energy-ready
Energy Storage & Grid Management Technologies	Energy storage solutions could include all types of storage technologies, such as batteries, pumped hydro, and green hydrogen, which can back up the variability of renewables and provide various services. Grid management technologies could include new technologies for real-time grid management that enhance electricity system flexibility and facilitate distributed generation, such as advanced metering systems, wireless network control, and DSM, including outreach to specific users.	Scaling up renewable energy-enabling technologies
Electrification of Land Transport Sector	This would include the introduction of EVs, and electric vehicle charging infrastructure.	Scaling up renewable energy-enabling technologies
Electrification of Maritime Transport Sector	This would include any technology that would help make Fiji's maritime transport sector low-carbon.	Scaling up renewable energy-enabling technologies
Rural Electrification	There may be an opportunity to support re-charging stations or grid upgrades needed to shift from diesel-only to hybrid systems in rural communities. In addition, CIF could finance the connection and other grid infrastructure costs of rooftop solar connections in rural communities.	Enhancing infrastructure to be renewable energy-ready

These categories of projects were then ranked against 12 CIF REI criteria. The criteria were, in some cases, recharacterized slightly or simplified to capture what stakeholders understood to be the intent. The original REI IP criteria, and the criteria used by GoF are compared in the table below.

REI IP Criteria	Simplified Criteria
Relevance	Relevance
Scale	Scale
Speed	Speed
Systemic change	Systemic change
Adaptive sustainability	***Resilience***
Potential for GHG emissions reduction/avoidance	***Emissions reduction***
Potential to contribute to just transition	***Protection of vulnerable***
Value for money	***Financial and economic benefits (CBA)***
Mobilization potential	***Potential for leverage***
Implementation potential	Implementation potential ***(readiness)***
Gender equality	***Gender equality and social inclusion impact***
Development impact potential (SDGs)	***Development impact***
Development impact potential (co-benefits)	

The ranking of each category, against each criterion, are shown in tables on the following pages. The highest-ranked groups were (i) Transmission & distribution investments for renewable energy projects; (ii) rural electrification, and (iii) Energy Storage & Grid Management Technologies. It was ultimately decided that the focus of Fiji's REI IP should be on (i) and (ii) because of the priority these types of investments for Fiji, and because such investments are necessary precursors to eventual, expanded investment in (iii).

Criteria	T&D for RE Projects	Energy Storage & Grid Management Technologies	Electrification of Land Transport Sector	Electrification of Marine Transport Sector	Rural Electrification
Relevance	5 Fiji needs more RE generation to achieve its climate goals, which require significant investments in T&D	4 Highly relevant to managing VRE; but transmission is more important at this stage, as Fiji is still figuring out how to expand RE generation	3 Land transport sector is primarily dependent on hydrocarbons and plays a significant role in total transport emissions	2 Maritime transport sector is primarily dependent on hydrocarbons but is responsible for only a fraction of total transport emissions	5 Fiji is committed to provide electricity for all. Many remain disconnected from the grid due to challenges of distributing power to isolated rural communities
Scale	4 Electricity and other energy generation were responsible for emitting an estimated 237,124 metric tonnes CO2e in 2020	4 Electricity and other energy generation were responsible for emitting an estimated 237,124 metric tonnes CO2e in 2020	5 The land transport sector emitted an estimated 817,396 metric tonnes CO2e in 2020	3 The maritime transport sector emitted an estimated 198,500 metric tonnes CO2e in 2020	2 Difficult to quantify. Total estimated household emissions for 2020 were 28,751 metric tonnes CO2e for both urban and rural households
Speed	5 Many new lines slated by EFL to begin construction in coming 1-2 years; lines can be built relatively quickly	4 Could be built and installed relatively quickly, depending on the specific technology	2 T&D network probably still too underdeveloped for much uptake of charging stations; no clear business model yet	2 Lots of small investments with diverse ownership, so could take time to implement; would need to go through a financial intermediary	3 Lines could be built relatively quickly, assuming there is enough generation
Systemic change	5 Would allow for uptake of substantial new VRE, where Fiji currently has very little	4 Depends on the specific technology being considered, but could be transformational if it encourages uptake of more VRE	2 Change likely to be more gradual/incremental initially	2 Change likely to be more gradual/incremental initially	4 Would move Fiji close to 100% electrification and be transformational for unserved or underserved rural areas
Resilience	5 Grid redundancy improves grid resilience during a cyclone event	5 Support of VRE reduces reliance on hydro, lowering vulnerability to droughts	2 Diversification of fleet fuel use helps build resilience to fuel supply disruptions	2 Diversification of fleet fuel use helps build resilience to fuel supply disruptions	4 Improved energy access builds resilience in remote areas most vulnerable to effects of climate change

Criteria	T&D for RE Projects	Energy Storage & Grid Management Technologies	Electrification of Land Transport Sector	Electrification of Marine Transport Sector	Rural Electrification
Emissions reduction	5 Major gains in emission reductions if Fiji manages to achieve its 100 percent renewable electricity generation by 2036	4 Significant gains achievable if it leads to uptake of RE generation; there may be some marginal efficiency gains in having better grid management	3 Increasing the share of HEVs and EVs may have a significant impact on emissions. However, GHG reduction/avoidance will only happen if electricity generation has more RE in the mix, so that should be a priority.	2 Electrifying passenger and cargo ships could result in sizeable emission reductions, but it would not be quick due to challenges mentioned above	1 Providing rural households with renewable electricity will limit the increase of GHG emissions coming from households, but will have limited impact on current emission levels
Protection of vulnerable	3 Opportunities for new types of jobs for women engineers and energy professionals	3 Opportunities for new types of jobs for women engineers and energy professionals	3 Transition to EVs would include training for professionals working on combustion vehicles	3 Potential for new types of skilled and low-skilled greens jobs built around a sustainable marine economy	5 Improved energy access reduces household burdens on women in remote areas and outer islands, allowing for greater economic opportunities
Financial and economic benefits (CBA)	5 Financial return is assured because of regulatory framework; economic return is large because of potential for avoided diesel once VREs are connected	4 Financial return assured because of regulatory framework; economic return depends on specific equipment used but should be relatively high if it offsets diesel generation	2 Economic benefits limited by fact that a lot of electricity comes from diesel	3 Relatively high CAPEX costs would potentially outweigh benefits	2 Financial return likely to be low (as is the case for a lot of rural electrification investment); economic return depends on extent to which diesel costs would be avoided and electricity would be put to productive use
Potential for leverage	5 MDBs are keen to finance T&D and have offered to do so in the past	4 MDBs keen to finance, but these are newer technologies and not as visible, so may be somewhat more difficult to make the case	3 Various bilaterals and MDBs have shown interest and supported studies; FDB also looking to support	3 Various bilaterals and MDBs have shown interest and supported studies; FDB also looking to support	5 Likely to be substantial donor interest in rural electrification projects

Criteria	T&D for RE Projects	Energy Storage & Grid Management Technologies	Electrification of Land Transport Sector	Electrification of Marine Transport Sector	Rural Electrification
Implementation potential (readiness)	5 Plans for most near-term T&D investments already in PDP and at pre-feasibility or feasibility study phase	1 Few existing plans for these types of investments	1 A number of donor studies have been funded, but little beyond the study stage	1 A number of donor studies have been funded, but little beyond the study stage	5 Department of Energy already has quite detailed plans
Gender equality and social inclusion impact	3 Opportunities for new types of jobs for women engineers and energy professionals	3 Opportunities for new types of jobs for women engineers and energy professionals	4 New electric buses would improve accessibility over legacy buses	3 Supports Fiji's continued progress in promoting inclusion in maritime industry	5 Women in outer islands are more vulnerable to effects of climate change
Development impact potential	4 Enable development of private utility-scale generation market	5 Enables development of private sector market for distributed energy resource tech	3 Reduced pollutants from combustion vehicles improves air quality	3 Health benefits for fishers and other maritime crew due to both zero emissions and reduced noise of electric onboard motors	5 Potential to create new economic opportunities in remote and off-grid areas
Total Score and Ranks of RE Technologies					
Score	54	45	33	29	46
Rank	**1**	**3**	**4**	**5**	**2**

These projects best meet the CIF criteria

APPENDIX C INDEPENDENT TECHNICAL REVIEW

[To be completed during consultation period]

APPENDIX D STAKEHOLDER CONSULTATIONS

[Section to be updated after completion of consultation period in September.]

A mix of virtual and in-country stakeholder consultations were undertaken between November 2022 and October 2023. Stakeholders consulted are indicated below, grouped by organization.

GENERAL CONSULTATIONS

World Bank

1. Mr. Mitsunori Motohashi, Pacific Hub Energy Program Coordinator
2. Mr. Kamleshwar Khelawan, Senior Energy Specialist and World Bank Lead
3. Ms. Slavena Georgieva, Energy Specialist

Asian Development Bank (ADB)

1. Mr. Len George, Principal Energy Specialist and ADB Lead
3. Mr. Ranishka Wimalasena, Energy Specialist
4. Ms. Katherine Guy, Infrastructure Specialist
5. Mr. Karan Chouksey, Climate Finance (Energy) Specialist

International Finance Corporation (IFC)

1. Mr. Bilal Aslam, Investment Officer, International Finance Corporation (IFC)

Office of the Prime Minister

1. Ms. Deepitika Chand, Senior Climate Change Officer (Mitigation)

Ministry of Finance, Strategic Planning, National Development and Statistics

1. Mr. Kamal Gounder, Manager/Coordinator, Infrastructure Sector, Budget & Planning Division
2. Ms. Ranjila Singh, Mitigation Specialist, Climate Change and International Cooperation Division
3. Ms. Malvina Singh, Senior Budget Analyst, Infrastructure Sector, Budget & Planning Division

Ministry of Infrastructure and Meteorological Services

1. The Honorable Mr. Ro Filipe Tuisawau, Minister
2. Mr. Taitusi Vakadravuyaca, Permanent Secretary
3. Mr. Mikaele Baleti, Director, Department of Energy
4. Mr. Deepak Chand, Deputy Director, Department of Energy
5. Mr. Taniela Tabuya, Principal Scientific Officer, Department of Energy
6. Mr. Jonati Delaimoala, Senior Scientific Officer, Department of Energy

Ministry of Commerce, Trade, Tourism & Transport

1. Mr. Shaheen Ali, Permananet Secretary
2. Ms. Faranisese Kinivuwai, Director Transport
3. Ms. Jacinta Lal, Principal Tourism Officer
4. Ms. Sherine Lata, Principal Transport Planner
5. Ms. Aseri Driu, Senior Transport Planner

Fiji Development Bank

1. Saul Minam, CEO
2. Setaita Tamanikaiyaraoi, Climate and Eco Finance Manager

Other Development Partners

1. Mr. Kapchae Ra, Country Director, Korea International Cooperation Agency
2. Mr. Uliasi Butukoro, Korea International Cooperation Agency
3. Mr. Patrick Ramananarivo, Head of Section, Climate Change, Environment, and Energy, Delegation of the European Union
4. Ms. Roxane Castelein, Programme Manager, Delegation of the European Union
5. Mr. Benoit Cambier, European Investment Bank Representative for the Pacicifc

Energy Fiji Limited (EFL)

1. Mr. Hasmukh Patel, Chief Executive Officer
2. Mr. Chitoshi Fukuka, Deputy Chief Executive Officer
3. Mr. Bobby Naimawi, Chief Operating Officer
4. Mr. Khrisneel Prasad, General Manager Special Projects

Fiji Competition and Consumer Commission

1. Mr. Avneet Singh, Senior Market Analyst (Energy)
2. Ms. Lice Dakunimata, Market Analyst (Energy)
3. Ms. Tulia Dicoka, Market Analyst (Energy)

Private Sector

1. Mr. Ajay Raniga, CEO, Sunergise
2. Mr. Peter Nuttal, Member, Micronesian Center for Sustainable Transport

GENDER-RELATED CONSULTATIONS

Separate consultations were also undertaken to specifically focus on gender-related issues. This included interviews, a focus group discussion, and a workshop hosted at the Ministry of Women, Children and Social Protection on August 23, 2023.

Interviewees are listed below:

Secretariat for the Pacific Community

1. Ms. Florence Ventura, Deputy Manager of GEM Division
2. Ms. Joanne Kunatuba, former Gender Adviser
3. Mr. Shane Harrison, Gender Officer

Ministry of Women, Children, Social Protection

1. Ms. Eseta Nadakuitavuki, Permanent Secretary

Department of Energy (under Ministry of Infrastructure and Meteorological Services

1. Mr. Taniela Tabuya, Senior Scientific Officer
2. Mr. Vishal Prasad, Senior Scientific Officer
3. Jonati Delaimoala, Senior Scientific Officer

Energy Fiji Limited

1. Ms. Annabel Ducia, General Manager for Customer Services

2. Ms. Alisi Vunibola, Manager for Customer Services & Contract Centre

Department of Environment

1. Ms. Kelera Ravono, Manager, Budget and Planning Division
2. Mereani Nata, Climate Finance Officer

Summary of Workshop Discussions

Participants in the workshop at the Ministry of Women, Children, and Social Protection are listed below:

1. Reijieli Mawa, Department of Women - Ministry of Women, Children and Social Protection
2. Laisani Petersen, UNWomen/ MWCSP
3. Mereseini Baleilevuka - Community Leader, Educator - Nadi
4. Faith Grace - Indigenous Community Leader - Suva
5. Deepak Chand - Department of Energy -Assistant Director
6. Vishal Prasad - Department of Energy - Senior Scientific Officer
7. Jonati Delaimoala - Department of Energy - Senior Scientific Officer
8. Alanieta Volevole - Community leader, Yasawa (Western Division)
9. Emele Duituturaga - Consultant

A summary of the workshop consultations is included below.

Women in Fiji's energy sector confront a myriad of challenges that restrict their active participation and representation. One notable issue is the limited female involvement in training programs. Access to quality education and vocational training remains unequal, preventing women from acquiring the technical skills necessary for careers in the energy sector. This gender disparity is further exacerbated by the sector's male dominance, with women predominantly relegated to administrative roles while men dominate the technical areas.

These disparities begin at the educational level, with a low representation of females in STEM curricula from school to tertiary levels. Societal stereotypes and cultural norms steer women away from pursuing energy-related careers, perpetuating the underrepresentation of women in this crucial industry.

Poverty also plays a significant role in limiting women's participation. Many women are burdened with manual household chores, leaving them with little time for productive work in the energy sector. Additionally, women face hurdles in decision-making processes, and their contributions often go underappreciated and undervalued.

Furthermore, the migration of trained men overseas for employment leaves a gap in the industry's workforce. Climate change impacts, such as dry spells and reduced dam capacity, further strain Fiji's energy infrastructure. Land acquisition issues affect those without access to power, particularly in informal housing areas.

The disposal of solar panels and batteries raises environmental concerns, while growing urban migration compounds the energy sector's challenges. Technology transfer becomes crucial with outward migration, and solutions are needed to empower women and create employment opportunities.

To address these issues, several solutions have been proposed. Empowering women through training and promoting their involvement in trouble-shooting and maintenance of solar systems can provide livelihoods and employment opportunities. Encouraging women to manage projects, raise awareness, and carry out training can also help bridge the gender gap.

The Barefoot College, a residential training center, holds potential for training community women. Community education and awareness programs linking solar systems to climate change understanding are vital. The new Energy Policy with a gender focus and increased mentions of gender can be a policy lever to drive change. Data collection, gender integration in Key Performance Indicators (KPIs), and collaboration among stakeholders are essential steps forward.

Incorporating the Ministry of Itaukei Affairs into community engagement can strengthen outreach efforts. Building the capacity of government agencies for gender analysis and inclusion of women in planning and decision-making processes are critical strategies. The Pacific Gender and Energy Network's Strategic Action Plan, addressing institutional, sectoral, decision-making, and individual agency levels, presents a framework for progress in Fiji's energy sector.

Summary of Focus Group Discussions

The focus group discussions included three women from Lakeba (one of the areas to be electrified under DoE plans). One of these now lives in Nadi, one in Nausori, and one in Lakeba. A summary of this discussion is included below.

In recent times, Viti Levu experienced unexpected power cuts that caught many residents off guard. One particularly challenging situation unfolded at a hairdressing salon, where customers found themselves in the midst of a hair wash when the power abruptly went out. This left both the salon owner and her clients in a precarious situation. After hastily finishing the hair wash, the salon owner rushed home, where her sick husband awaited her care. However, her phone's battery was running low due to the power outage, and the solar lights at home hadn't charged. Despite owning a business, she still bore the primary responsibility for meal preparations and her husband's well-being, highlighting the dual roles that many women in Fiji juggle.

Another issue stemming from these power cuts is the damage caused to electrical appliances. Determining responsibility and compensation for these damaged goods, especially if they were purchased on hire purchase and are still being paid off, has become a pressing concern for affected individuals and families.

In situations where the supply of electricity is limited, men are often given priority. This prioritization leaves children unable to study, and women find themselves cooking in the dark or relying on candlelight, further compounding the challenges they face during power cuts.

Lakeba, characterized by its traditional patriarchal setting and chiefly hierarchy, requires a sensitive approach to addressing energy issues. Enlisting the support of chiefly women or those married into the chiefly line is essential, as they hold a respected standing in the community and can effectively advocate for change.

The breakdown of the diesel generator in Lakeba from November to December of the previous year was a particularly trying period for women and families in the region. It led to damage to appliances, forcing residents to resort to alternative energy sources such as kerosene, gas, and solar panels to meet their basic energy needs.

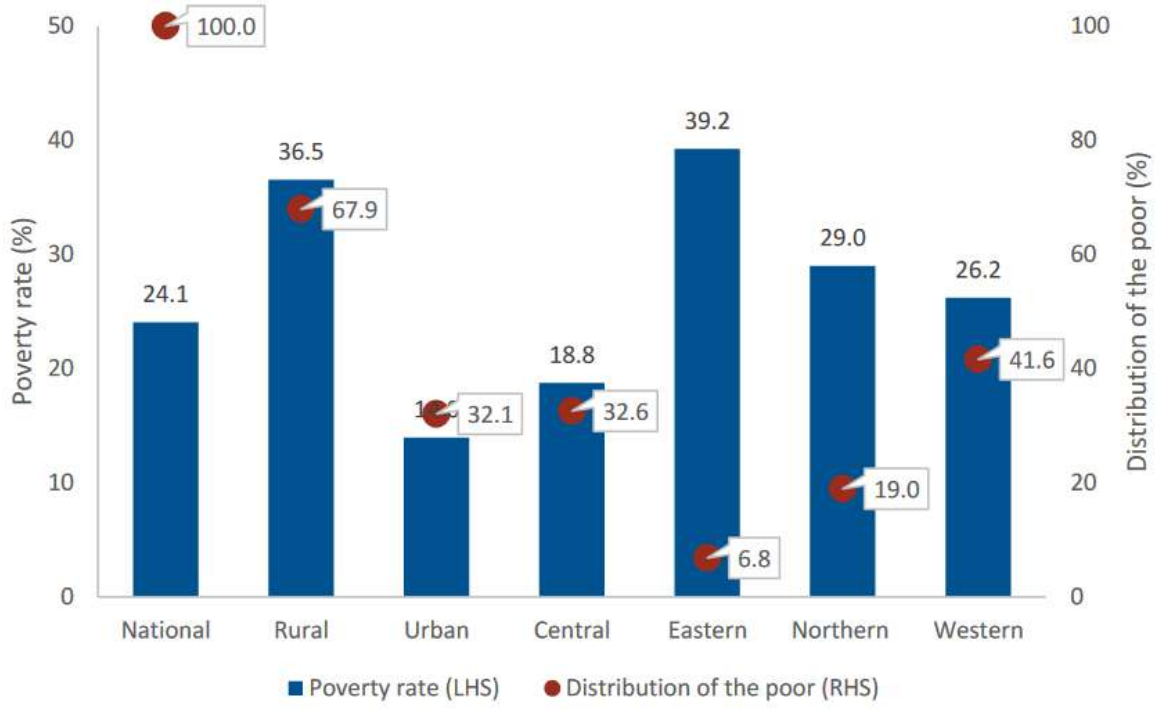
Typically, the generator operates from 6 am to 1 pm and again from 2 pm to 11 pm, incurring an average monthly cost of $15, which is a significant expense for many families in Fiji. These challenges underscore the urgent need for reliable and equitable access to electricity in the region, with a specific focus on addressing the unique concerns faced by women and their families during power interruptions.

APPENDIX E ADDITIONAL BACKGROUND INFORMATION

ADDITIONAL COUNTRY CONTEXT

Fiji's poverty rate is estimated at 24.1 percent of the total population in 2020. The poor are mostly rural residents (67.9 percent), and poverty rates are especially high on the Eastern Division, which comprises small rural islands mostly detached from the main isles' economic development. The figure below details poverty rates and distribution of the poor by division and population composition.

Poverty Rates and Distribution of the Poor by Division, 2019-2020



Source: Fiji Bureau of Statistics. (2021). "2019-20 Household Income and Expenditure Survey Main Report (HIES)." Available at https://www.statsfiji.gov.fj/images/documents/HIES_2019-20/2019-20_HIES_Main_Report.pdf

Despite relatively high levels of poverty, most Fijians have access to electricity, water supply, and sanitation. Roughly 96 percent of the population has access to electricity, either via a connection to the state grid (80 percent), home solar systems (11 percent), or diesel generators (4.5 percent).[106] Water supply is also available to the same proportion of Fijians, either through metered connection (66 percent), communal standpipes (25 percent) or boreholes (5 percent).[107] In addition, 87 percent of the population has access to non-shared improved sanitation facilities.

[106] Fiji Bureau of Statistics, "2019-20 HIES."
[107] Fiji Bureau of Statistics, "2019-20 HIES."

In its 2017 National Development Plan[108] the GoF stated its compromise in delivering 100 percent access to clean and safe water to urban areas by 2021 and for the rural and maritime areas by 2030, as well as 100 percent access to electricity by 2021. While World Bank data shows the electricity goal was achieved in 2020[109], GoF 2021 MICS report estimated that access to clean water is still absent for about 2.4 percent of the population.[110]

CLIMATE CHANGE ADAPTATION AND MITIGATION CHALLENGES

Given its location in the Pacific and its land topography, Fiji is broadly exposed to the impacts of climate change, including rises in sea level, warming, acidification and the aggravation of extreme weather events – particularly flooding and tropical cyclones, which have impacted Fiji a lot in recent years. The conditions of Fiji's climate, particularly its tropical marine environment, are also heavily influenced by the South Pacific Convergence Zone (SPCZ).[111]

The GoF recognizes the risks posed by climate change to the current and future development of Fiji and has committed to achieving net zero annual GHG emissions by 2050.[112] However, given the country's negligible contribution to total global emissions, the extent of climate change impact on Fiji will be determined by factors outside of its control. Future climate projections point to a worst-case scenario if the world follows a high emissions pathway up to 2040 and the SPCZ moves south, while best-case scenarios are dependent on the world maintaining a low emissions pathway until 2040. Figure 8.3 shows future climate scenarios by emission pathways and movement of the SPCZ.

[108] Republic of Fiji: Ministry of Economy. (2017). "5-Year & 20-Year National Development Plan," Available at *https://www.fiji.gov.fj/getattachment/15b0ba03-825e-47f7-bf69-094ad33004dd/5-Year-20-Year-NATIONAL-DEVELOPMENT-PLAN.aspx*.

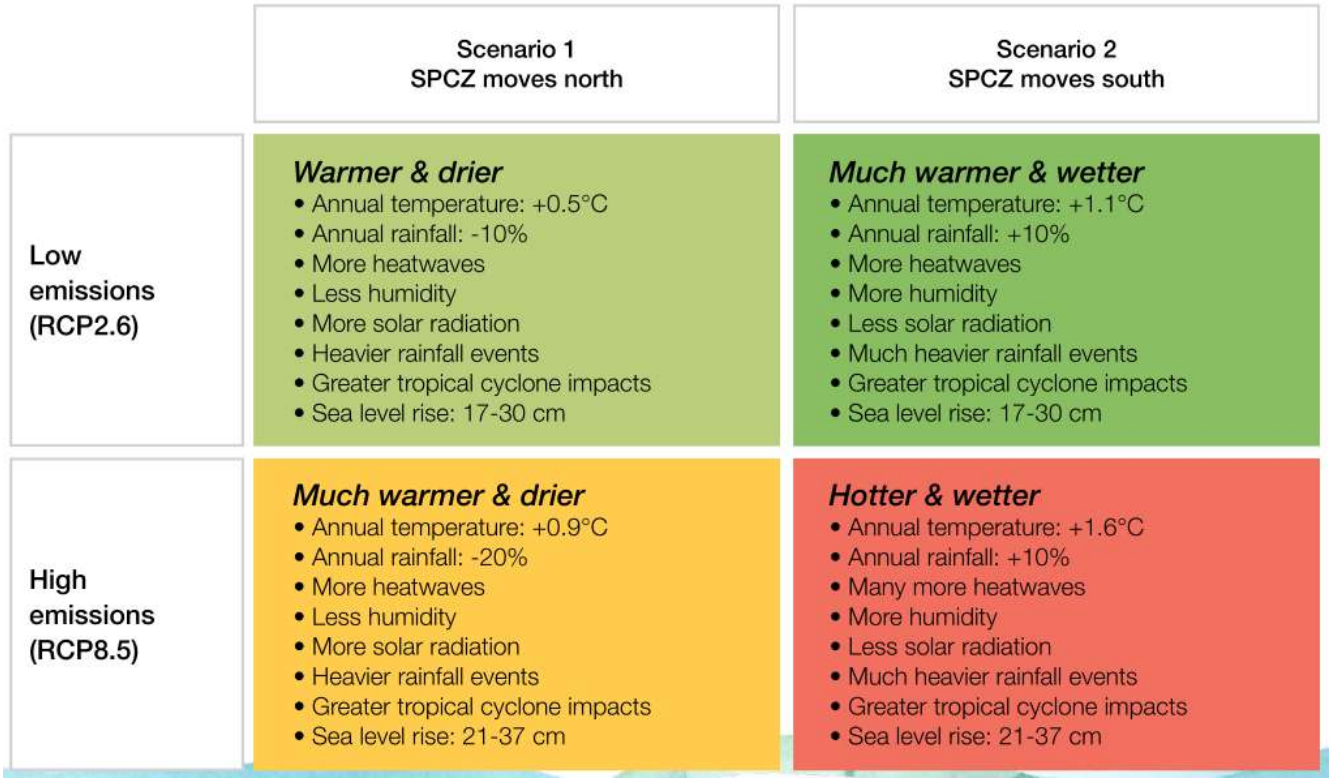
[109] World Bank World Development Indicators.

[110] Fiji Bureau of Statistics, "Fiji MICS 2021."

[111] The South Pacific Convergence Zone is a band of low-level convergence, cloudiness and precipitation which stretches from the Solomon Islands through Vanuatu, Fiji, Samoa, and Tonga.

[112] Government of Fiji. (2019) "National Climate Change Policy 2018-2030." Available at *https://fijiclimatechangeportal.gov.fj/wp-content/uploads/2022/01/FIJI-NCCP-2018-2030_0.pdf*

Figure 8.3: Standardized scenarios for Fiji for the period 2040-2059 relative to 1986-2005 for low and high emission pathways



Source: Fiji Meteorological Service. (2021) "Current and Future Climate for Fiji." Available at https://www.met.gov.fj/aifs_prods/Climate_Products/Country%20Report%20Fiji.pdf

Fiji's economic reliance on natural capital, which is particularly vulnerable to climate change, imposes long-term threats to food security and nutrition, which was evident after tropical cyclone Winston. It is likely that coastal fisheries will become unable to support local needs and Fiji will become a net importer of fish over the coming decades.[113] Highly vulnerable sectors such as water, fisheries, transport and the environment are expected to face combined annual losses of up to 20 percent of Fiji's GDP from climate change impacts, if no preventive measures are taken.[114] According to Fiji's Climate Vulnerability Assessment (CVA), a significant investment of F$9.3 billion (nearly 100% of GDP) is required over a decade, along with additional costs for maintenance, operation, and social expenses, to significantly diminish the country's vulnerability.[115]

In order to address the challenges posed by climate change in Fiji, the GoF has commissioned a climate change vulnerability assessment, identifying the sectors most vulnerable to climate risk, which include housing & land

[113] Source: Government of Fiji. (2018) "Talanoa Dialogue Submission – 'Where Are We?'" Available at https://unfccc.int/sites/default/files/resource/105_Talanoa%20dialogue_Where%20Are%20We.pdf

[114] Source: World Bank. (2023) "Fiji Public Expenditure Review" Available at https://documents1.worldbank.org/curated/en/099040323214538735/pdf/P1776900f90a0f0e00825406ce7962da34c.pdf, p. 3.

[115] Source: World Bank. (2023) "Fiji Public Expenditure Review" Available at https://documents1.worldbank.org/curated/en/099040323214538735/pdf/P1776900f90a0f0e00825406ce7962da34c.pdf, p. 3.

use, transport, water, energy, health & education, and agriculture. Sector-specific challenges and risks are shown below in the table below.

Sector-Specific Challenges and Risks Posed by Climate Change

Sector	Sea level rise	Increased temperatures	Extreme weather events[116]	Challenges and risks
Housing & Land use	✓		✓	Coastal erosion and shoreline retreats represent an issue faced by rural communities located in isolated isles or in near coast settlements. Higher incidence of storms and cyclones constitutes a risk for at least 20 percent[117] of the national population that still lives in informal housing.
Transport	✓		✓	Poor condition of a large 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.
Water	✓	✓	✓	Inadequate protection against runoff intrusion into pumping stations and water treatment plants. Insufficient protection of key assets against soil erosion and landslides.
Energy			✓	Negative impact of drought in hydro power stations that constitute over 60 percent of Fiji's electricity generation. Frequent flood events impose risk to diesel power stations and transformer assets. Lastly, cyclones and storms pose threats to transmission and distribution lines. Lack of investment in renewable energy by residential users and private sector where there is sizeable potential.
Health & Education		✓	✓	Fiji will be particularly vulnerable to dengue fever, typhoid fever, leptospirosis, and

[116] Extreme weather events include tropical cyclones, floods, droughts, excessive rainfalls and tropical storms.
[117] United Nations. (2023). "UN-Habitat - Fiji" Available at https://unhabitat.org/fiji

				diarrhea, as outbreaks of these diseases are more prevalent when floods or cyclones have occurred. Lack of adequate protection in health and education facilities make them highly vulnerable to damage caused by cyclones.
Agriculture & Aquaculture	✓	✓	✓	Cyclones generally result in destruction to crops, trees, farming and fishing equipment and related infrastructure. Increases to sea level rise and sea surface temperature may result in the 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.

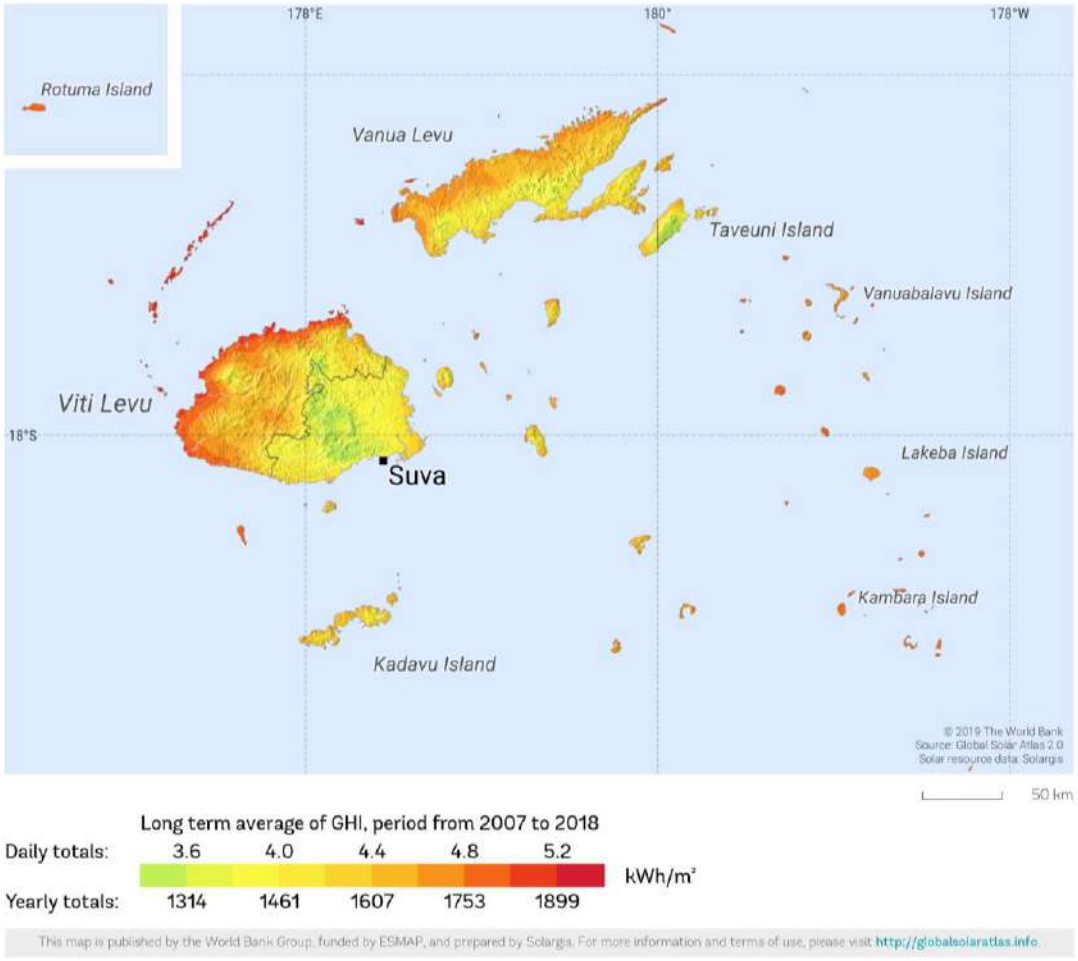
Source: Government of Fiji. (2018) "Talanoa Dialogue Submission – 'Where Are We?'" Available at https://unfccc.int/sites/default/files/resource/105_Talanoa%20dialogue_Where%20Are%20We.pdf

Utility-scale Solar Photovoltaics (PV)

Solar potential in Fiji varies considerably: outer islands and the northwest coastal areas of the larger islands have good solar potential (annual average of 5–6 kWh/m2/day), while areas such as Viti Levu's interior are subject to considerably more cloud coverage and are therefore not as viable for solar PV projects (annual average of about 3.7 kWh/m2/day).[118] The figure below provides an overview of the long-term average solar irradiance in Fiji.

[118] IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific." Available at *https://www.developmentaid.org/api/frontend/cms/file/2022/07/IFCPoweringthePacificGuide-FINAL.pdf* p.73

Solar Irradiance Map of Fiji (average), 2007-2018



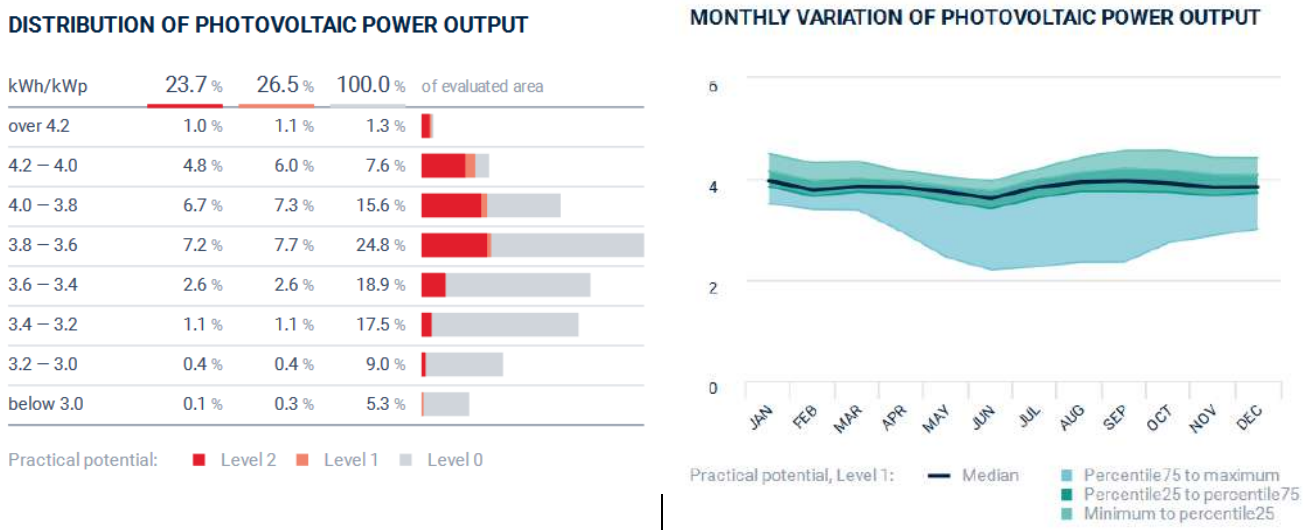
Source: Global Solar Atlas. (2022). "Global Horizontal Irradiation – Fiji." Available at *https://globalsolaratlas.info/download?c=-5.790897,162.597656,5*

The Global Solar Atlas estimates that 26.5 percent of Fiji's territory has practical potential for the installation of PV generation[119] – excluding land with identifiable physical obstacles to utility-scale PV plants. Furthermore, 7.1 percent of this area has potential for over 4 kWh/kWp of photovoltaic power output, with low monthly variation.[120] **Error! Reference source not found.** shows PV potential statistics for Fiji.

[119] Global Solar Atlas. (2022). "Global Photovoltaic Power Potential – Fiji." Available at *https://globalsolaratlas.info/global-pv-potential-study*

[120] Global Solar Atlas. (2022). "Global Photovoltaic Power Potential – Fiji." Available at *https://globalsolaratlas.info/global-pv-potential-study*

Fiji PV Power Output Potential Statistics



Source: Global Solar Atlas. (2022). "Global Photovoltaic Power Potential – Fiji." Available at *https://globalsolaratlas.info/global-pv-potential-study*

POTENTIAL FOR RENEWABLE ENERGY GENERATION

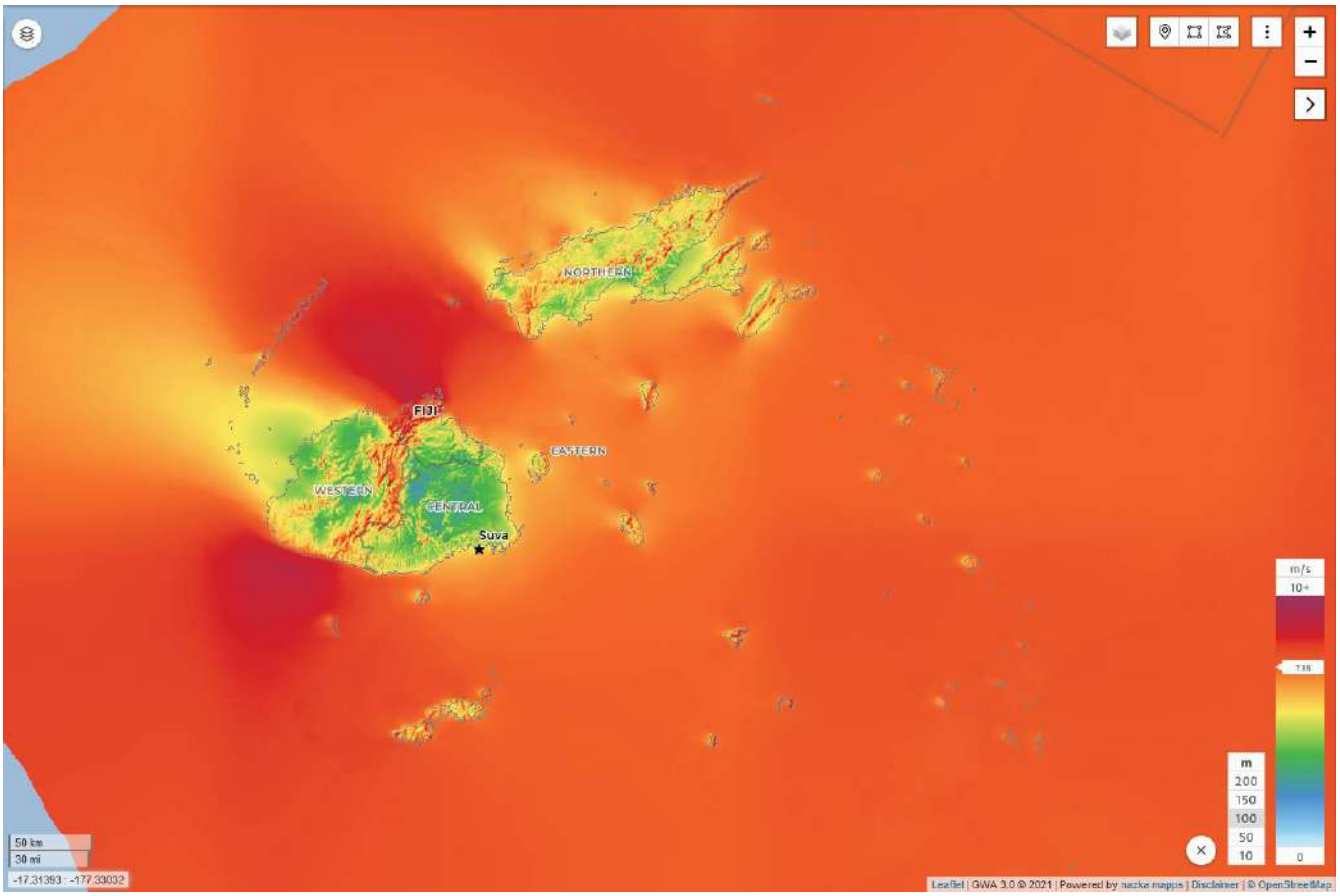
Utility-scale Wind Power[121]

The scarcity of detailed feasibility studies on wind power for Fiji makes estimating generation potential a difficult task. In general, onshore wind potential is very limited, with only a few stretches of land exhibiting adequate conditions – for example Kadavu island and Suva Peninsula. EFL's Butoni Wind Farm, located south of the western division, has not met generation expectations, with only about 2.7 GWh generated in 2019 from its capacity of 10MW – which is equivalent to a capacity factor of about 3 percent. There is, however, high technical potential for wind power offshore, estimated by The World Bank at 27 GW for fixed turbines and 159 GW for floating turbines in regions of great water depth.[122] Nonetheless, the real practical potential needs to be assessed though a more comprehensive analysis. The figure below shows the wind speed map for Fiji provided by the Global Wind Atlas.

[121] IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific." Available at *https://www.developmentaid.org/api/frontend/cms/file/2022/07/IFCPoweringthePacificGuide-FINAL.pdf* p.74

[122] World Bank. (2020). "Offshore Wind Technical Potential in Fiji." Available at *https://energydata.info/dataset/offshore-wind-technical-potential/resource/a66d9300-c3ef-4119-9ab0-97ad35276e39*

Wind Speed Map for Fiji (m/s), 2022



Source: Global Wind Atlas. (2022). "Fiji." Available at *https://globalwindatlas.info/en/area/Fiji/Central*

Hydropower[123]

Fiji has substantial potential for hydropower generation due to its high elevation and considerable rainfall. In 2015, the Japan International Cooperation Agency (JICA) assessed hydropower potential in Fiji. Thirty-seven potential hydro sites in Viti Levu and Vanua Levu were reviewed and ranked. The potential sites ranged from 700 kW to 7,300 kW in size. The study identified six schemes, shown in the table below, as feasible under the current tariffs and load forecast.

Indicatively feasible hydro schemes in Fiji—JICA assessment

Site	Basin	Estimated Peak Capacity (KW)	Estimated Annual Generation (MWh)
Nabiaurua	Ba	1,400	8,197
Naboubuco	Rewa	2,700	15,308
Nakavika	Navua	2,600	14,205
Wainavadu	Rewa	2,500	13,749

[123] IFC. (2021). "Powering the Pacific: A Guide to Investing in Renewable Electricity Generation in the Pacific." Available at *https://www.developmentaid.org/api/frontend/cms/file/2022/07/IFCPoweringthePacificGuide-FINAL.pdf* p.72

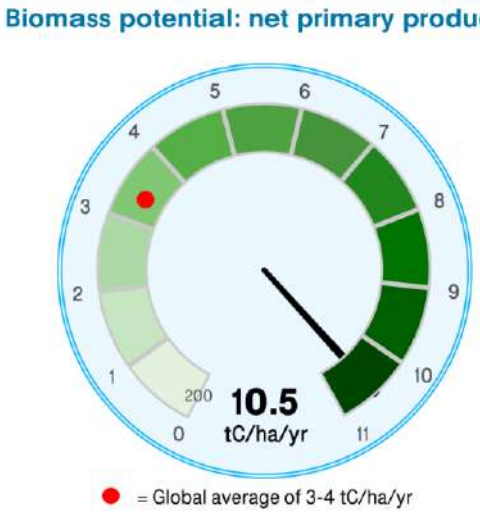
Waisoi	Rewa	2,100	11,322
Saquru	Labasa	2,000	10,660

Source: JICA. (2015). "The Project for the Effective and Efficient Use of Renewable Energy Resources in Power Supply in Republic of Fiji — Final Report" Available at *https://openjicareport.jica.go.jp/pdf/12230173_01.pdf*

Bioenergy

Fiji has substantial biomass potential as measured by its net primary production[124] of 10.5 tons of carbon per hectare per year (as shown in the figure below) – about three times the global average. Bagasse and wood residue constitute most of the biomass available to be used as fuel. Current bioenergy generation assets are comprised of the Lautoka and Labasa FSC power stations, which generate energy from bagasse, and the Nabou (Tropik Wood) Power Plant, which uses wood residue as fuel.

Biomass Potential of Fiji



Source: International Renewable Energy Agency (IRENA). (2022). "Energy Profile – Fiji."

The viability of bagasse as a fuel source for IPPs is rather limited, as state-owned FSC has exclusive rights to produce sugar in Fiji, hence why both bagasse power plants are owned by FSC. Potential for biomass generation from wood residue was assessed by JICA at 10MW for Viti Levu and 3.7 MW for Vanua Levu, Furthermore, a Fiji Renewable Energy Power Project (FREPP) report on the feasibility of biomass in Fiji found that, although there is still considerable potential for biomass generation from wood residue, the feasibility of potential projects is uncertain due to inadequate grid connections and high transport costs. Operation of the Nabou Power Plant has demonstrated in practice these existing feasibility constraints as it experienced regular operating difficulties and had to close for long periods at a time due to lack of feedstock.

[124] Net primary production is the amount of carbon fixed by plants and accumulated as biomass each year, measured in tons of carbon per hectare per year (tC/ha/yr).

APPENDIX F DEVELOPMENT CO-BENEFITS

The projects described in this investment plan have the potential for extensive economic, social, and environmental co-benefits:

Job Creation Benefits

- REI projects have the potential to generate jobs in the energy and infrastructure sectors, both in the short and long-run. This includes direct employment opportunities in project development and implementation, as well as indirect job creation through increased demand for local industries supplying components, materials, and services for REI infrastructure construction. More specifically, the projects will make possible new jobs constructing, operating, and maintaining new solar and hydropower generation projects that will use the new transmission and distribution lines (indirect job creation)
- The new transmission and distribution infrastructure will need to be built and maintained (direct job creation)
- Moreover, the projects will improve access and reliability of electricity supply, allowing for increased productivity of existing businesses and higher levels of economic activity in areas served by the new lines, potentially leading to new jobs and new businesses, with particular benefits expected for Fiji's tourism industry (second-order job creation)

Energy Security Benefits

- Better availability and affordability of RE systems facilitated by REI financing can help ensure a more stable and reliable energy supply and reduce the frequency of outages. Additionally, given that connection to Fiji's interconnected transmission network is only possible on the major islands, Fiji's less populated islands would greatly benefit from having access to decentralized and affordable electricity generation systems.
- New transmission lines will allow for the greater deployment of solar and hydropower generation, displacing generation fuelled by imported diesel, improving energy security and reducing high—and volatile—import costs, which exceeded five percent of Fiji's GDP in 2019.
- Less reliance on imported fuel can lead to lower inflation and costs of production, as well as the level of foreign currency reserves used to pay for the imports.

Climate Change Effects and Local Air Pollution Benefits

- Fiji is vulnerable to climate change, which could increase the risk of flooding, worsen coastal erosion, harm biodiversity, and increase the frequency and severity of tropical cyclones. REI projects can help build a more disaster- and climate-resilient energy sector. Furthermore, reducing the share of hydro in the energy mix by increasing the availability of wind and solar energy can make the electricity supply less prone to disruptions or price surges during extended drought periods. Additionally, decentralized REI systems, such as solar panels on rooftops and mini-grids, combined with energy storage solutions, such as batteries, provide both localized energy generation and backup power during outages. This reduces vulnerability to centralized power infrastructure damage and ensures a more reliable energy supply during disasters.

- The new transmission lines will displace diesel-fuelled generation by allowing more renewable energy to be built. About 18 MW of solar generation is already planned for Viti Levu, and there is potential for about 100 MW of solar there by 2031. The displacement of diesel by renewables will reduce GHG and local pollutant emissions compared to diesel-fired generation. There is also substantial hydropower generation potential.
- Rural electrification may also displace the use of biomass in homes, leading to lower levels of indoor air pollution.

Social Services and Infrastructure Benefits

- The increased access to and better reliability and quality of electricity that these transmission and distribution projects will make possible can also improve service delivery at schools, hospitals, and clinics, leading to better health and educational outcomes
- Roads will need to be built to allow access to construction sites; these improvements to transportation infrastructure can lead to secondary benefits to the population, businesses, and tourists.

Gender Benefits

- Better access to electricity will have several benefits for women, including better security through public streetlights, better access to information and communication, and more opportunities for economic activity inside and outside the home.
- Women will also benefit from jobs in the construction in the transmission and distribution lines or in the renewable generation that the new lines will enable. By actively recruiting and training women, investments made through REI projects can help bridge the gender gap in traditionally male-dominated industries and promote more equal access to employment opportunities.