



FIJI RENEWABLE ENERGY INVESTMENT PLAN (REI IP)

For submission to Climate Investment Funds (CIF)

Presentation Outline

I. Overview of Fiji's Energy Sector

II. Key Policies and Strategies

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V. Program Description

VI. Activities Empowering Women and Vulnerable Groups

VII. Financing Plan and Instruments

VIII. Policy Reform and Technical Assistance Needs

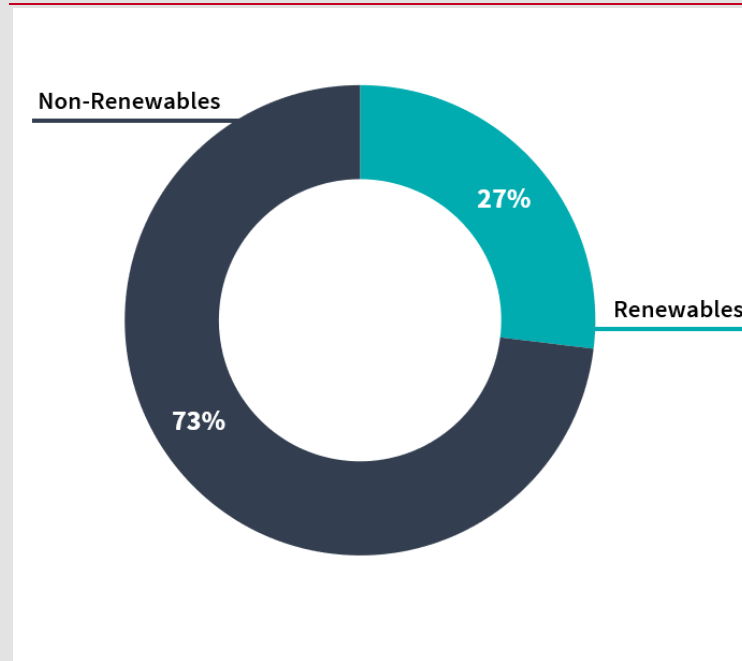
OVERVIEW OF ENERGY SECTOR



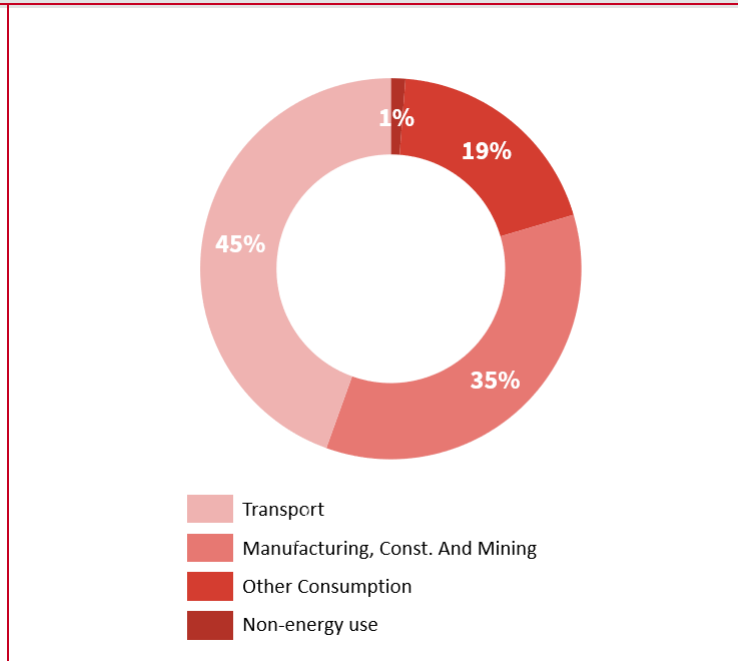
Energy Consumption Mix

- Over **two-thirds** of Fiji's energy comes from **imported oil products**, primarily used for transportation and manufacturing
- Oil is also used in **thermal power plants (TPPs)** and **home diesel generators**
- Biofuels are primarily used in **manufacturing** but also in **bioenergy power plants** and for **cooking among rural households**
- Renewable energy sources contribute to more than **50%** of electricity generation, they only make up **27%** of total energy consumption
- **EFL** is responsible for generating more than **93%** of Fiji's electricity, while IPPs supply the rest

Energy Consumption Mix
2019



Energy Consumption by Sector
2019

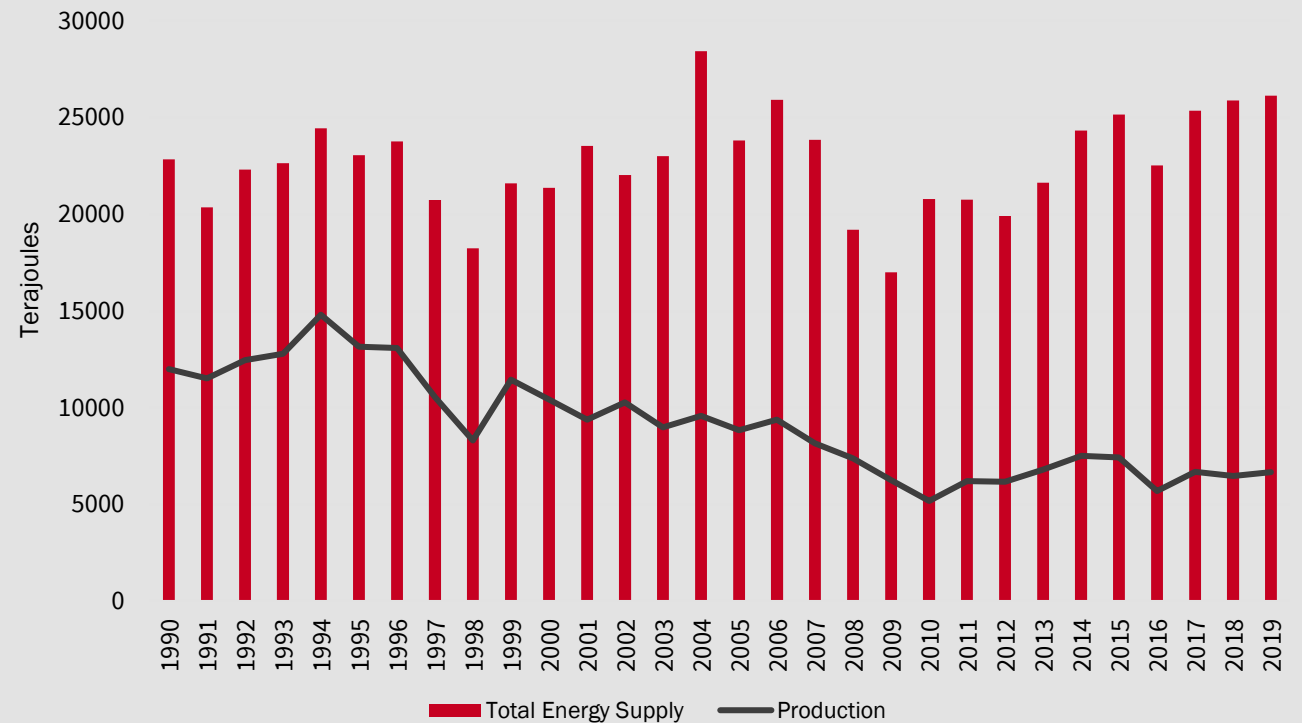


The Role of Imported Energy

- **Imported oil is crucial** for Fiji's economy, representing **18.3% of all imports** in 2020
- This dependence is a result of **Fiji's absence of oil reserves**, its **transportation sector's exclusive use of petrol**, and the fact that **35% of electricity generation is still reliant on TPPs**
- The continuous reliance on thermal generation coupled with steady economic growth over the last decade, has resulted in a **sustained dependence on foreign energy**

Dependence on Imported Energy

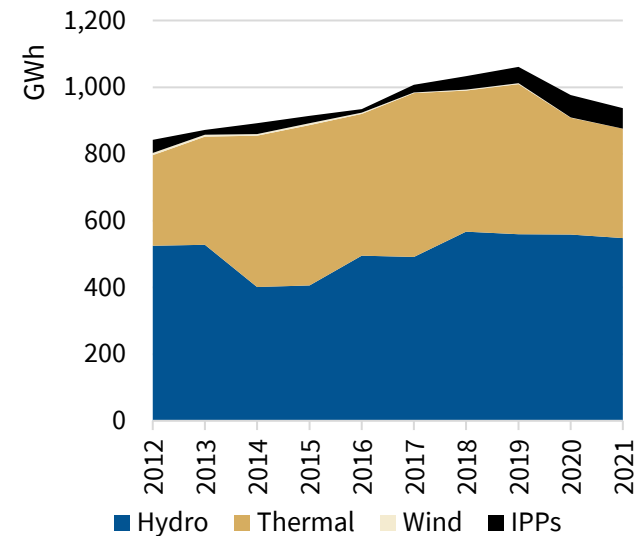
Domestic Production v. Total Supply
1990 - 2019



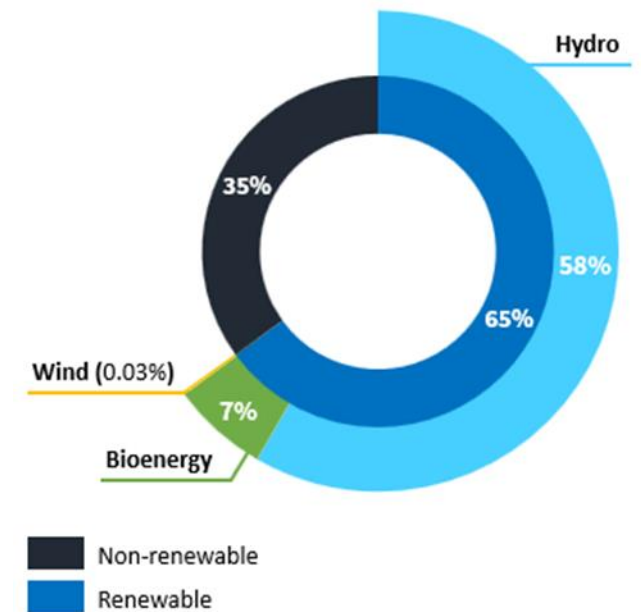
Electricity Generation

- Over **90%** of electricity generation in Fiji is provided by EFL
- Historically, renewable energy sources have been the primary source of electricity, despite minimal growth in hydro generation since 2012
- As of 2020, hydro accounted for **58%** of total electricity generation, and bioenergy accounted for another **6.5%**
- Solar (**1%**) and wind (**0.03%**) account for minimal amounts of electricity generation
- The share of thermal power in EFL's electricity matrix **peaked** at **52%** in **2015** and has since experienced a gradual decline, reaching **35%** in 2020/2021

Electricity Generation by Source
(Grid-Connected Only)
2012-2021



Electricity Generation Mix
2020



KEY POLICIES AND STRATEGIES



Key Energy and Climate Policies

Policy	Description
National Energy Policy (2023-2030)	<ul style="list-style-type: none"> • Fiji’s main policy for the development of the energy sector • Informed by six principles: affordability; competitive neutrality; energy access for all; gender equity, equality, and empowerment; just transition; and renewable energy and sustainability • 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)	<ul style="list-style-type: none"> • Central policy instrument to protect Fiji’s development priorities from current, future, and intergenerational climate change risks • 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 Low Emission Development Strategy (LEDS) (2018-2050)	<ul style="list-style-type: none"> • 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 • Includes a commitment to a 40 percent reduction in transport sector emissions by 2030.
SDG7 Roadmap for Fiji	<ul style="list-style-type: none"> • Provides a roadmap with technological options and policy recommendations to assist the GoF in achieving the SDG7 targets
National Adaptation Plan (2018)	<ul style="list-style-type: none"> • Aims to enhance resilience against climate change and climate variability • Offers an all-inclusive evaluation of the impact of climate change on key sectors • Establishes a long-term strategy for improving resilience in the energy sector, supported by a climate risk model
Maritime and Land Transport Policy (2015)	<ul style="list-style-type: none"> • Guidelines set in policy include review of government subsidies for transport; promoting the use of fuel-efficient vehicles; attracting investors; reducing fossil fuel consumption; and encouraging alternative fuels

Other Relevant Strategies

Strategy	Description
Fiji's National Development Plan (2017-2036)	<ul style="list-style-type: none"> • Aims to achieve 100% renewable electricity generation by 2036 • Emphasizes development of a variety of RE sources • Outlines plan for further grid extensions in Viti Levu, Vanua Levu, Ovalau, and Taveuni • Includes plans for rural electrification and decentralized RE sources (solar, mini hydro, hybrid biofuel/diesel operated generators and wind systems) for the rural and outer islands where grid connections are not feasible
Fiji's National Infrastructure Investment Plan (NIIP)	<ul style="list-style-type: none"> • Serves as a strategic guide for screening and prioritizing infrastructure investments over the next 5-10 years • Foresees investments of FJD 13.5 billion (US\$ 5.9 billion) over the next 10 years • Encompasses a wide array of infrastructure investments (over 570 potential projects), focusing on capital construction projects and programs with a value exceeding \$100,000 • Result of a comprehensive assessment of infrastructure needs across all sectors, drawing from the NDP objectives and sectoral plans • Employs a systematic and transparent process to prioritize investments across sectors, considering economic viability and the government's funding capacity
EFL's Power Development Plan (2018-2028)	<ul style="list-style-type: none"> • Includes projects in the NIIP as well as additional capital expenditure foreseen by EFL • PDP estimates a total investment of FJD 1.97 billion (US \$900 million) needed for the development and commission of renewable energy projects over the next 10 years • Projects include strengthening the distribution network, expanding electricity access in urban and rural areas, acquiring new electricity meters and vehicles, and various other power infrastructure improvements/upgrades

NDC Commitments

Target 1	Reduce 30% of business as usual (BAU) CO2 emissions (ref. year 2013) from the energy sector by 2030	Target 5	Adopt Climate Smart Agriculture practices in crop management, livestock, sugarcane farming, and fisheries	Target 9	Implement the 'Guidelines for climate-resilient and environmentally sustainable health care facilities in Fiji'
Target 2	Reach as close to 100% renewable energy power generation (grid-connected only) by 2030	Target 6	Enhance resilience by upgrading, repairing, and relocating existing critical public infrastructure	Target 10	Conserve natural environment and biodiversity wealth enabling sustainable long-term provision of ecosystem services
Target 3	Energy efficiency improvements economy-wide, implicitly in the transport, industry, and electricity demand-side subsectors	Target 7	Develop early warning and monitoring systems, and nature-based solutions to mitigate the impact of flooding and cyclones	Target 11	Plant 30 million trees by 2035
Target 4	Reduce domestic maritime shipping emissions by 40%	Target 8	Relocate highly vulnerable communities, and implement the concept of 'build back better'	Target 12	Establish 30% of Fiji's Exclusive Economic Zones (EEZ) as Marine Protected Areas and work toward 100% management of EEZ by 2030

 = Energy-related commitments

ENERGY SECTOR CHALLENGES



Energy Sector Key Challenges

STRUCTURAL

High dependence on fossil fuels

Fiji's dependence on oil imports entails risks due to the volatility of oil prices and trade deficits

Volatility of hydropower generation

Increased risks of droughts or floods due to climate change further compound the already innate volatility of hydro generation, which accounts for most of the country's electricity generation

TECHNICAL

Electric grid infrastructure that is inadequate for the integration of additional VRE generation

Fiji already has *substantial* renewable energy generation. Additional integration of variable 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

GEOGRAPHIC & ECONOMIC

Geographic and economic challenges of distributing power to small and isolated communities and rural villages in the outer islands

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

Geographical remoteness, a lack of scale (small markets), and the frequency and intensity of natural disasters (often uninsurable) adds substantially to investments costs relative to other regions.

ENVIRONMENTAL

Susceptibility of the energy infrastructure to climate and disaster-related risks

Potential damage from more frequent weather events like cyclones, tropical storms and floods

Coastal power infrastructure faces risks from rising sea levels

Threat of storm surges and coastal erosion

Increased risk of infrastructure aging through water corrosion

PRIORITIZATION OF PROJECTS



Approach to Ranking 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, as shown below

Opportunity	Possible CIF Engagement through REIP	REIP Activity Category
T&D for RE Projects	<ul style="list-style-type: none"> • Grid interconnection to integrate regional markets and increase their flexibility. • New and smart grids to enable new ways to manage VRE generation. 	Enhancing infrastructure to be renewable energy-ready
Energy Storage & Grid Management Technologies	<ul style="list-style-type: none"> • All types of storage technologies, such as batteries, pumped hydro, and green hydrogen, which can back up the variability of renewables. • New technologies for real-time grid management, such as advanced metering systems, wireless network control, and demand side management. 	Scaling up renewable energy-enabling technologies
Electrification of Land Transport Sector	<ul style="list-style-type: none"> • Introduction of EVs, and electric vehicle charging infrastructure. 	Scaling up renewable energy-enabling technologies
Electrification of Maritime Transport Sector	<ul style="list-style-type: none"> • Any technology that would help make Fiji’s maritime transport sector low carbon. 	Scaling up renewable energy-enabling technologies
Rural Electrification	<ul style="list-style-type: none"> • Support for re-charging stations or grid upgrades needed to shift from diesel-only to hybrid systems in rural communities. • Financing of connection and other grid infrastructure costs of rooftop solar connections in rural communities. 	Enhancing infrastructure to be renewable energy-ready

Ranking Criteria

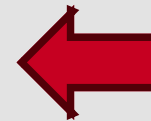
Categories of projects were ranked against 12 simplified criteria, based on CIF REI's original criteria

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

Ranking Outcome

- Based on a scoring exercise, it was decided that the focus of Fiji's REI IP should be on:
 - (i) Transmission & Distribution Investments for RE Projects, accompanied by any necessary investments in energy storage & grid management technologies; and
 - (ii) Rural Electrification
- Energy Storage & Grid Management Technologies* also ranked well and will inevitably be an important part of the investments financed under the REI IP, but additional studies (as part of project preparation) are necessary to determine specifically which types of investments are needed accompany the T&D investments.

REI Technology	Score	Ranking
T&D for RE Projects	54	1
Energy Storage & Grid Management Technologies	45	3
Electrification of Land Transport Sector	33	4
Electrification of Maritime Transport Sector	29	5
Rural Electrification	46	2



These projects best meet the CIF criteria. There is substantial potential for overlap between the first and second categories.

Energy storage & grid management technologies will also inevitably be part of the T&D investments required to bring VRE generation online.

PROGRAM DESCRIPTION

Projects in Fiji that best meet CIF Criteria



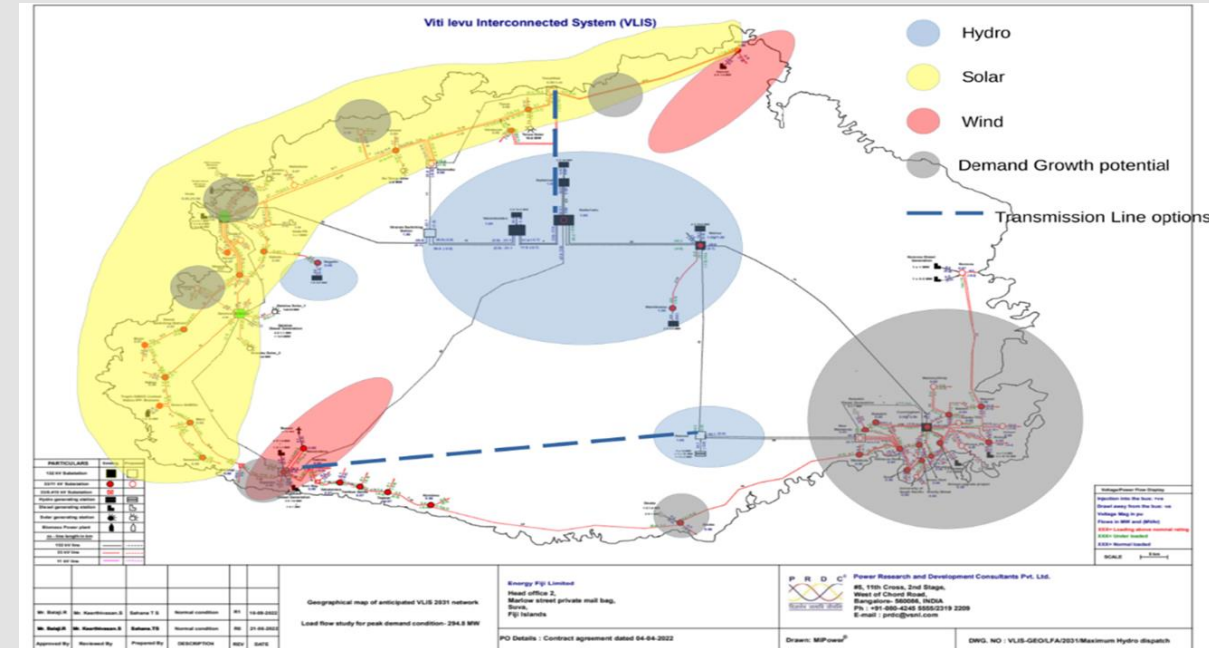
Project Concept 1: A “Green Energy Circuit” for Viti Levu

Overview

- Investment in 132 kV transmission lines and grid management and storage to facilitate uptake of VRE generation
- Assistance on sector reforms and procurement RE IPPs
- Investment in climate resilience of the transmission network through managerial, operational, and structural measures

Financing

- US\$25 million in concessional CIF loans for transmission, grid storage and grid management
- US\$8 million in CIF guarantees for RE IPPs to de-risk the “Pacific Premium”
- US\$2 million in project preparation grants from CIF
- US\$60 million in sovereign and non-sovereign financing from ADB; some of this could be used to debt finance IPPs
- US\$35 million from private sector for RE IPPs (approximately 40 MW); \$15 million from IFC
- US\$10 million (estimated) as counterpart contributions from EFL or GoF to cover taxes, duties, and overhead costs



- Associated activities (also refer to Appendix of this presentation)**
 - Support on technical studies required for VRE uptake
 - Support on sector reforms
 - Support preparing tenders for RE IPPs
 - Support for the promotion of activities empowering women and vulnerable groups

Project Concept 2: Outer Islands Electrification

Overview

- Investment in extension of transmission lines on outer islands
- Several projects included in NIIP
- Facilitates delivery of solar (instead of diesel)
- Improve supply reliability for those with intermittent supply

Financing

- US\$35 million in CIF loans blended with US\$15 million in World Bank financing

Associated activities

- Consultations with local communities to assess project impact and mitigation measures
- Assessment of institutional, policy and regulatory framework to support electrification schemes
- Preliminary feasibility studies to inform project design, economic and financial feasibility, and implementation arrangements
- Support for the promotion of activities empowering women and vulnerable groups

Possible Sites



ACTIVITIES EMPOWERING
WOMEN AND VULNERABLE
GROUPS



Activities Empowering Women and Vulnerable Groups

In order to ensure that women and other vulnerable groups equally benefit from economic opportunities generated by the project, several activities will be considered prior and during the implementation of the proposed program

These activities contemplate both project concepts 1 and 2 and include the following potential interventions

- 1 Establishing gender working group with key stakeholders to oversee development of a Gender Action Plan
- 2 Support for increased female representation in renewable energy decision making through quotas
- 3 Supporting female and vulnerable group participation during the consultation and decision-making process
- 4 Introduction of gender and social inclusion criteria into bidding documents for sub-contractor companies
- 5 Targeted trainings on STEM and measures to attract and retain female talent (scholarships, bursaries, etc.)
- 6 Vocational training for women and vulnerable groups to empower them to become solar engineers
- 7 Training for women and vulnerable groups interested in operation and maintenance of solar equipment
- 8 Training for women and vulnerable groups interested in other income generating opportunities associated with the project

FINANCING PLAN



Financing Plan

Financing Source	CIF				Others				
Program	CIF Financing	CIF Guarantee	Project Preparation (Grant)	<u>Total</u> <u>CIF</u>	ADB ^[1]	World Bank	IFC	Private Sector ^[2]	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] ADB funding comprises sovereign funding and non-sovereign funding for generation and transmission related investments in Viti Levu.

[2] Note that the estimates of private sector investment are extremely conservative and excludes the FJD1.12 billion investment (US\$ 500 million) EFL intends to invest in transmission & distribution. With these investments, the leverage ratio would be 8.9. Also excluded are the FJD 2.97 billion (US\$1.31 billion) foreseen in hydropower generation. With these investments, the leverage ratio would be 27.6. Finally, the estimates also exclude indirect downstream investments (e.g., in electric transport) likely to be made once the grid is upgraded.

POLICY REFORM AND
TECHNICAL ASSISTANCE
NEEDS



Technical Studies and Legal & Regulatory Reforms

Technical Studies

Technical studies will be carried out to identify options for augmenting the current 132 kV transmission grid to secure connections from RE sources to load centers on Viti Levu. Examples of potential studies are provided below.

1

Reliability and risk assessment tools for generation resource adequacy

2

Generation and transmission expansion tools

3

Generation dispatch and network operation tools

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. Examples of proposed reforms are provided below.

1

Introduction of competitive auctions and possibly mandates for the purchase of RE

2

Expansion of the use of net metering and/or net billing to spur investment in rooftop solar

3

Legal recognition of storage as a distinct activity and regulatory reforms to promote investment in storage

APPENDIX: TECHNICAL
STUDIES NEEDED AS PART
OF PROJECT PREPARATION



Key Technical Studies for Component 1 (1/2)

1 Reliability and risk assessment tools for generation resource adequacy

In order to guarantee that resource adequacy models are capable of offering accurate risk assessments, Fiji should undertake **probabilistic modeling** 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

2 Generation and transmission expansion tools

Grid interconnection and integration tools to facilitate connection of RE projects to grid

Energy storage sizing and optimization software to assess and optimize the size and operation of energy storage systems, including batteries

Energy storage sizing and optimization software to assess and optimize the size and operation of energy storage systems, including batteries

Generation expansion tools to consider the impact of new generation projects on the transmission infrastructure, including the need for transmission upgrades

Power flow analysis tools to evaluate the steady-state performance of the transmission grid under different operating conditions and generation scenarios

Key Technical Studies for Component 1 (2/2)

3

Generation dispatch and network operation tools

Energy Management Systems (EMS)

software is the core tool for generation dispatch, providing real-time monitoring, control, and optimization of power generation and transmission

Renewable Integration Models to assess integration of VRE sources into the grid

Demand Response Management Systems to manage demand response programs and optimize load flexibility

Dynamic security assessment to identify critical contingencies in the grid by analyzing their corresponding dynamic security constraint violations on the grid

EMS Components

State Estimation

Load Forecasting

Renewable Energy Generation Forecasting

Optimal Generation Scheduling Algorithm

Economic Dispatch Models

Unit Commitment

Grid Frequency Control Tools for monitoring and controlling grid frequency, including frequency measurement, load shedding, and Automated Generation Control (AGC) functions

Voltage and Reactive Power Control Tools for managing voltage and reactive power in the grid, critical for renewable energy integration

SCADA Systems for monitoring and controlling grid assets, including renewable generation

Distribution Management Systems for managing the distribution grid, including integrating renewable distributed energy

Systems for **collecting and managing data from smart meters and sensors** for better grid management

Stability analysis tools to assess the of the grid under transient conditions