**RUKU NI VALE - SECURE, PROTECT & SHELTER**

***FIJI LAGI 2025***

**Design Concept Overview**

In response to the increasing frequency and intensity of tropical cyclones, particularly in the South Pacific region, this proposal offers a modular and adaptive installation designed specifically for island nations like Fiji. The design integrates ***self-sufficiency, environmental sensitivity, and community benefit*** into a cohesive system that ***secures, protects, and shelters***. Rooted in both traditional knowledge and modern material technology, the proposal seeks to reinforce climate resilience without compromising ecological or cultural integrity while contributing to the continued growth of the community.

**Location and Context: The Case for Resilience in Fiji**

Fiji, a Melanesian archipelago consisting of over 330 islands, is emblematic of the Pacific’s exposure to the climate crisis. With a population of roughly 900,000 and a geography deeply interwoven with the ocean, the country faces mounting environmental stressors, including tropical cyclones, rising sea levels, and flooding. The wet season, which spans from November to April, brings particularly dangerous storm systems that have historically caused loss of life, displacement, and significant damage to infrastructure.

Economically, Fiji is driven by tourism, agriculture, and remittances from overseas workers. However, rural and remote communities remain structurally vulnerable due to limited resources and logistical challenges. Addressing resilience in such contexts demands a multi-layered solution, one that merges disaster preparedness with ecological care and economic empowerment.

**CONCEPT NARRATIVE**

This proposal responds directly to the increasing threat of tropical cyclones by creating a resilient, adaptable system that prioritises safety, sustainability, and community benefit.

Our proposal integrates **Fibre Reinforced Plastics (FRP)** for structural resilience and lightness, enabling swift construction and reduced vulnerability during cyclone conditions. Solar panel gable roofs serve dual functions: harvesting renewable energy, and cyclone persistence.

The development is multifunctional. It accommodates **eco-tourism, community education, and agrivoltaics (agri-solar)**. It facilitates economic resilience through **farming, rainwater harvesting**, and **animal shelters**, creating co-benefits that support the village of Marou beyond its energy and water needs. This proposal is organised for both **daily utility and emergency response**. In **Cyclone Mode, the modules transform for protection**. The roof decks become safe zones for animals, the **FRP platforms** offer elevated refuge, and each zone contributes to a distributed system of resilience.

The modular layout ensures flexibility, allowing for phased construction and easy adaptation to local needs.

The **Living Modules** offer communal and private space for both locals and visiting researchers or tourists. **Solar Modules**, elevated and pitched, provide optimal energy generation and cyclone resistance. **Agri Modules** combine solar panels with agriculture to generate energy and food simultaneously.

***Visitor and Community Experience***

The site includes outdoor learning spaces, eco-tourism accommodations, and agrivoltaic infrastructure. These create opportunities for education, local employment, and cultural exchange, enriching both community and visitor engagement.

***Co-Benefits***

In addition to energy and water generation, the design supports:

* Local farming practices
* Safe shelter in place during emergencies
* Sustainable tourism
* Animal refuge areas
* Shared Land Uses

The modular layout accommodates multiple uses within each zone, encouraging collaborative land stewardship between the village and visitors. Functions such as energy harvesting, food production, and shelter are integrated rather than separated.

***Primary Modes and Shared Land Uses***

The site is **organised into six primary modules**:

1. Living Pods

Communal and private units for residents, visitors, or researchers. Elevated, well-ventilated, and equipped with renewable power, they function as both everyday housing and tourism facilities.

1. Solar Modules

Pitched gable roofs maximise solar intake while also enhancing aerodynamic resistance during high winds. These modules power all other units and feed surplus energy into village-wide microgrids.

1. Agrivoltaic Zones

Combining crop cultivation with solar panels, these zones allow for food and energy co-production. Shade-tolerant crops benefit from panel cover, and land-use efficiency is maximised.

1. Animal Refuge/ Shelter

Designed decks and safe zones beneath pods provide temporary protection for livestock during cyclones, enhancing food security and welfare.

1. Food Storage Units

Insulated and elevated to avoid flooding, these pods house space for food, ensuring food continuity during supply chain disruptions.

1. Water Storage

Rainwater is collected from rooftops and stored in UV-resistant bladders or tanks, filtered, and distributed for cooking, hygiene, and irrigation.

***Tourism and Community Benefit***

The living pods are designed not only as climate-resilient shelters but also as unique eco-tourism accommodations. Their self-sufficient systems and immersive connection to the landscape offer visitors a low-impact, meaningful stay that aligns with global demand for sustainable travel. Managed in collaboration with the local community, the pods create opportunities for income generation through hosting, guided experiences, and the sale of local crafts and produce. This model supports economic resilience by ensuring that tourism revenue flows directly into the village, strengthening livelihoods while preserving cultural and environmental integrity.

***Material Strategy and Modularity***

At the core of the design is the use of Fibre Reinforced Plastics (FRP), a material chosen for its high strength-to-weight ratio, corrosion resistance, and low maintenance requirements in tropical conditions. This structural approach allows for modular units that are lightweight, easily prefabricated. The structural system supports elevated platforms that reduce ground disturbance, preserve vegetation, and respect natural drainage flows.

The modules promote self-sufficiency, respect traditional knowledge, and allow for long-term adaptability and resilience. Its modular design enables future expansion or relocation without environmental degradation, supporting both short-term needs and long-term community goals. The project fosters cultural continuity alongside innovation. This approach ensures that the solution remains relevant, scalable, and rooted in the unique social and ecological context of the site.

**TECHNICAL NARRATIVE**

***Solar Energy Generation***

Each solar module consists of 20 photovoltaic (PV) panels (1.5m² each), generating approximately 138 MWh annually across the site. That equates to roughly 378 kWh per day based on a 75 kW system. Energy is stored on-site and redistributed through microgrids.

***Cyclone Protection Mechanism***

To ensure durability during extreme weather events, the solar panels are designed with a foldable mounting system. During cyclone warnings, panels can be manually folded and locked into a position that reduces wind resistance and potential damage. This system protects both the solar panels and the structural integrity of the module. The mechanism relies on corrosion-resistant hinges and secure anchoring points, allowing community members to quickly shift into cyclone mode without issue. This adaptability strengthens the overall resilience of the energy infrastructure while extending the lifespan of the panels.

***Water Harvesting and Storage***

Rooftop rainwater collection feeds into UV-resistant tanks and infiltration basins, with each module contributing approximately 312 litres underground. Passive filtration is employed for safe household and irrigation use.

***Material Specification***

FRP is used for all main structures due to its lightweight, high strength, and resistance to salt, heat, and termites. Fixings and connectors are marine-grade for tropical conditions.

***Wind and Water Design***

The gable roof design is both aerodynamic and optimised for solar collection. Elevated modules reduce flood risk while preserving ground permeability. Structural anchors resist high wind uplift.

***Agrivoltaic Integration***

Also known as agrophotovoltaics or agrisolar, refers to the practice of combining solar energy generation with agricultural activities on the same land. This means using agricultural land to simultaneously produce both solar power and crops or livestock. Panel-mounted farming zones enable light-filtered cultivation of shade-tolerant crops, increasing food yield and land efficiency. Waste is composted for reuse, closing the energy-food loop.

**PROTOTYPING AND PILOT IMPLEMENTATION STATEMENT**

***Installation***

The installation minimises disruption to the natural ecosystem while supporting climate resilience and sustainable land use.

***Transportation and Deployment Strategy***

The modular units will be prefabricated and tested to ensure structural performance, environmental efficiency, and ease of assembly. Once validated, the modules will be packed into standard shipping containers for efficient transport to Fiji. Upon arrival, the containers will be shipped to the designated island site. Installation will follow a phased approach, prioritising minimal environmental disruption and allowing for community involvement.

**OPERATIONS AND MANAGEMENT**

A core principle of this project is long-term operability with minimal external dependence. In cyclone-prone and remote areas, resilience is not just about structural integrity but also about a community’s ability to maintain, adapt, and repair its systems independently. The FRP structure resists rust, warping, and termite damage. All mechanical systems are simplified and modular, with parts replaceable using common tools.

Ongoing operations and maintenance are integrated into daily village life rather than being outsourced. During the installation phase, local community members, particularly younger members, can receive hands-on training in maintaining solar systems, overseeing battery storage, and managing water filtration.

The modular design supports long-term adaptability. Components can be replaced individually, and full modules can be upgraded as needs change. As environmental conditions shift, the system is built to evolve with them, fostering a lasting sense of community ownership and climate resilience.

**ENVIRONMENTAL IMPACT ASSESSMENT**

The project prioritises ecological harmony by incorporating native plantings, rainwater harvesting, and agri-voltaic farming that aligns with traditional agricultural methods.

The proposed installation features self-sufficient, modular units designed to operate with minimal intervention in both the natural landscape and the village. Each module is elevated on lightweight, low-impact foundations that preserve existing vegetation, maintain natural drainage, and prevent disturbance to the soil ecosystem. This approach keeps the land permeable and biodiverse while allowing the design to integrate respectfully with traditional land use. The pods are fully sustainable, generating renewable energy for their function and as a shared resource for the village.