**ENERGY FOREST**

**Concept Narrative**

Naviti Island in Fiji faces meteorological issues like floods and typhoons, as well as water resource shortages during the dry season. To address the islanders' shortages of water and electricity and to mitigate the impacts of natural disasters, we have adopted an elevated aerial collection system. In this system, solar photovoltaic modules are placed on top to capture the maximum amount of sunlight for electricity generation. The elevated water tanks prevent the water source from contamination during floods. They supply the villagers with the clean water they need through the force of gravity. In this way, each module (hereinafter referred to as an “Energy Tree”) generates electricity and provides clean water safely and efficiently.

The Energy Trees are connected to form an Energy Forest that generates electricity and water, which is then equitably shared among the residents. The scale of the Energy Forest can be flexibly adjusted, expanding or contracting in accordance with the population size of the community. For example, if the community experiences an influx of new residents, additional Energy Trees can be installed to meet the increased demand for electricity and water.

The Energy Forest also provides shade and protection from the elements, serving as a comfortable and well-ventilated space for community activities, gatherings, and children's play. To facilitate nighttime community activities, lights are strategically installed on the Energy Trees, illuminating the area. During festivals and holidays, the Energy Forest can be transformed into a vibrant performance venue or a bustling marketplace for tourists. Decorations can be added, and the space can be arranged to accommodate various activities, gradually establishing it as a prominent and beautiful landmark in the area.

**Technical Narrative**

The current design of the Energy Tree is modular. It consists of three main functional components: solar photovoltaic (PV) panels at the top, a still in the middle, and a rainwater harvesting tower at the bottom. The solar photovoltaic panels are manufactured using a proven monocrystalline silicon process. They are tilted at an angle of 19 degrees based on the sun's altitude angle in Fiji to achieve maximum efficiency. The still is surrounded by clear tempered glass. This glass allows the still to fully absorb the sun's heat while preventing people from getting injured in the event of damage. The water tower part is made of stainless steel and coated with a fluorocarbon baked enamel finish. This coating ensures a service life of more than 25 years and protection against corrosion from the humid climate and salt. In addition, the design utilizes a horizontally connected Dendriform structure. This structure can withstand the weight of the tanks and ensure safety in the event of an earthquake. To prevent ecological damage caused by the foundation, we intentionally left gaps between the Energy Trees. These gaps effectively reduce wind pressure and allow the structure to withstand typhoons.

Naviti Island, where the site is located, has plenty of sunshine hours, making it ideal for generating electricity from solar panels. Moreover, the island experiences abundant rainfall, which makes it suitable for harvesting rainwater during the rainy season for use during the dry season. The residual heat generated by the solar panels is transferred to the rainwater collection tank below to assist the distillation process. While the water tank raises the temperature for distillation, it can also cool the solar photovoltaic panels. In this way, the various components within the system cooperate with each other to achieve the highest possible efficiency. The generated electricity is stored centrally with Lithium iron phosphate (LFP) batteries as well as Rainwater and Distilled water are stored in the connected water tanks. Eventually they were channeled separately to the village for shared use.

**Technical Data**

Total Area Covered: 400 m²

**Solar Photovoltaic**: Input solar energy, output electricity

**Electricity generated per year: 147 MWh**

0.2 kW/m² x 400m² = 80kW

80 kW x 8760hr x 0.21 = 147,168

80 kW x 8,760 (hours in a year) x 0.21 (capacity factor) = 147,168 kWh (147 MWh)

**Distiller:** Input water from rainwater collection tower and heat from solar panels and heat from sunlight transmitted from surrounding glass, output distilled water

**Annual clean Distilled water: 327,000 L**

(5.5 kW/m²/day (solar radiation) x 365 (days in a year) x 85% (photovoltaic waste heat) x 30% (effective evaporation))/0.627 kWh/L (latent heat of evaporation of water) x 400m² (tank area)

= 327,000 L

**Water Tower: I**nput rainwater, simple filter, output water

**Rainwater harvesting per year: 542,470 L**

400m² (tank area) x 1.5955m (annual rainfall) x 85% (collection efficiency) = 542,470 L

Tank capacity 400m² x 0.5m = 200,000 L

**Prototyping and Pilot Implementation Statement**

The Energy Tree (excluding the foundations) will be pre-fabricated in China, which includes sourcing the materials, processing them, and transporting the goods. All components are designed to easy fit on a ferry boat (4m × 14m or larger). After factory production, the module can be disassembled and shipped to Lautoka port in Fiji, and then transported to Marou Village on Naviti Island for assembly and testing. Concrete foundations are planned to be constructed on site due to the various soil quality.

We need local individuals to assist us in applying for the necessary customs documents and to collaborate with us in shipping the prototype to Naviti Island for assembly.

**Operations and Maintenance Statement**

The Energy Forest will be operated and maintained by the entire community. Currently, the Energy Trees come in two sizes, with areas of 9 square meters (3m X 3m) and 36 square meters (6m x 6m) respectively. Each family or several families, depending on their usage requirements, can be responsible for adopting an Energy Tree (a module) and participating in its planning, construction, use, and maintenance. Maintenance primarily involves cleaning the solar panels and water towers to ensure the efficiency of power generation and the provision of a clean water source.

**Environmental Impact Assessment**

Our design is to minimize impact to the natural environment. We try to select areas free of vegetation to excavate foundations for each Energy Tree. These embedded foundations can also help to reinforce the soil and minimize flood erosion. These Energy Trees can also be easily disassembled and recycled when villagers need to be relocated, ensuring effective reuse of materials and further minimizing environmental impact.