1. **Concept Narrative**

The design concept of this project draws inspiration from natural forms in the local biome, primarily the palm tree. The structure flares outward dramatically, maximizing its surface area to collect solar energy and rainwater. It then tapers into a thick, sturdy trunk that not only supports the canopy but also functions as a channel for directing rainfall. This solar farm will provide an abundance of resources to the Marou community. Not only will the solar farm function to supply year-round renewable energy and water to the community, it will also serve as an expansive community gathering space. The flared structure of our design is not only advantageous to solar gain but also to provide shade and protection to spaces below it. Below our structures, community gathering spaces and walking trails extend the functionality of our solar farm. Community spaces will omit non-organic materials such as concrete or steel and instead, be consistent with natural materials found in Fiji. This will include bamboo and timber. The walking trails within the design boundaries will feature shredded woods in certain areas and natural dirt with minimal landscaping that forms a rain garden. Our project aims to minimize land intervention and overall impact on the community. While the structures may be large, they are designed to integrate seamlessly into daily life, providing support rather than disruption. By using indigenous materials and design elements, the project ensures a sense of continuity, making the new development feel both welcoming and recognizable. The solar farm is projected to produce 136,779kWh of electricity and 1453M3 of rainwater per year. Additionally, it serves as the community spaces and children’s playground.

1. **Technical Narrative**

The tree-like structures will be capped with monocrystalline solar PV panels to maximize electricity generation. The structure’s surfaces are designed to be flat, except where necessary for rainwater drainage with. While a 16 degree tilt would produce the most energy, we calculated that a flat surface will produce only 4.8% less than the optimal tilt angle. Considering the structural stability and easier maintenance access to PV panels, the structure’s roof surfaces are designed to be nearly flat with an average inclination of 2%for rainwater drainage and harvesting. The flat roof installation ensures the PV panels generate electricity without being shaded by adjacent panels. By making the roof surfaces flat, the effective catchment surfaces of the structures are maximized; the maximum volume of rainwater is harvested from the given roof size.

The direct current (DC) electricity generated from solar panels is transmitted first to a substation located at the solar farm and then to the main power center housed within the village center or in a barn adjacent to the center via underground conduits. Locating the power center and battery banks at the village center ensures their security and ease of maintenance access. The DC electricity is converted to alternating current (AC) prior to transmission to households to meet domestic demands or is stored to the batteries.

Beneath the solar panels, a waterproofing surface will garner rainwater to the roof drain placed at the top of the trunks of each solar tree, channeling water down through PVC piping. The rainwater harvesting system extends beyond the immediate site, introducing a broader water infrastructure system throughout the village. Collected rainwater first passes through a sediment filtration system integrated into the solar trees before being transported via a conduit to the village’s central service tank, which has a capacity of 20,000 gallons. Supplied by the central tank and to ensure accessibility, smaller localized service cisterns are distributed throughout the village, ensuring that every household is within 50 meters—approximately a one-minute walk—from a water source, reducing the burden of carrying heavy loads over long distances. Water in each cistern will be filtered once more though ceramic filters for domestic consumption. This decentralized rainwater distribution system will also ensure uninterrupted water service in case of system malfunction or during alternating maintenance periods. The primary structure system of the solar and rainwater structure will be bamboo, OSB, and lumber. In consideration of hurricanes and extreme weather conditions, the structure is engineered with a reinforced base and a resilient structural system to withstand high winds and intense storms. The design of the tree-like structures remains consistent, allowing for modularity in construction. Like a living organism, the solar farm can expand beyond the project’s initial scope and scheme, adapting to meet the future water and energy needs of the community.

1. **Prototyping and Pilot Implementation Statement**

During the prototyping phase, the team will begin a revision of the concept design based on feedback from the judging committee, community members, and design experts. Receiving this feedback will be crucial for any revision before the physical prototyping. Once a final scheme is agreed upon, the team will begin the production of detailed technical drawings. Once completed, the team will begin building small scale prototypes to test rainwater harvesting capabilities and solar energy production. After testing, the team will address any identified issues found during this phase. During prototyping, the team will also be able to access material quantity needs. This will help the production process during implementation.

If chosen for pilot implementation, the design team will perform as an advisory role to the field construction team. The design team will provide **construction drawings** of a full-scale solar tree as well as begin to incorporate any changes during implementation from local and external experts on the solar farm construction.

1. **Operations and Maintenance Statement**

The operation and maintenance of the project should be primarily manageable by local community members. Before completing the project, residents can receive training on cleaning the solar panels integrated into the structure and cleaning the cisterns on a regular basis. The layout of the solar panels on the solar trees incorporates maintenance pathways between the panels so that they can be easily accessed. A manual for the solar tree and cistern maintenance will be made available at the village center. While the community space will remain open for public use without strict maintenance requirements, it would be ideal for community members to take turns managing cleaning, landscaping, and upkeep to ensure its continued functionality. The durable structural design should minimize the need for any repairs to the structure itself. The battery barn and the main power center will be placed at the village center or near its vicinity to ensure their security and ease of access.

1. **Environmental Impact Assessment**

To respond to the need for resilient development and the erosion-prone topographic context of the site, our solar farm is designed to capture significant rainwater while reducing further soil degradation. However, recognizing that these structures cannot collect all rainfall within the site boundaries, we will make slight topographic adjustments to direct excess water into a centrally located rain garden. This garden will manage stormwater by returning it to the water table, reducing runoff and erosion into the village while preserving the site's original vegetation. Unlike traditional solar farms that create extensive shade, the dispersed arrangement of our solar trees allows for dappled sunlight, fostering vegetation growth beneath. Additionally, using bamboo as our primary construction material ensures locally sourced, renewable resources, significantly lowering the project's carbon footprint by minimizing reliance on imported materials.