**The Breathing Earth**

**1. Concept Narrative**

In this project, the primary objective is to **utilize innovative and sustainable materials** to address the pressing needs of Marou Village while creating a design that resonates with the cultural and environmental identity of the community. The design incorporates features for water collection, a sufficient array of photovoltaic (PV) panels, a biodiverse structure, and an architecture to serve as both a functional space and a symbol of progress.

The design concept draws inspiration from the natural form of the **Vatu Rua Mountains**, reflecting the village's commitment to sustainability and environmental stewardship. This parametric design is open and inviting, offering shaded seating areas beneath a sculptural roof. It is surrounded by water collection features, integrated solar panels, and biodiverse materials that foster a connection between the natural and built environments. The space is envisioned as a hub for community gatherings, meetings, and small events, fostering social interaction and shared experiences while embodying the values of renewable energy and resource efficiency.

By incorporating these elements, the design becomes more than just an energy system—it is a natural landmark that inspires and educates visitors and residents alike about the beauty and importance of sustainable development.

**2. Technical Narrative**

**Technologies Incorporated**

The design integrates innovative technologies to create a sustainable, multifunctional system for Marou Village. Key elements include:

**Sustainable and Biodiverse Materials**: The structure uses bio-based and biodiverse materials that not only provide durability but also contribute to ecological benefits.

These materials include:

***Particulate Absorbing Components****: The body of the structure can absorb particulate matter and bind CO2, acting as a natural filter for the surrounding environment.*

***Habitats for Moss, Algae, and Mycelium****: The design fosters the growth of moss and supports habitats for algae and mycelium, enhancing biodiversity.*

***3D-Printed Wood Fibers and Biopolymers****: The main structural components are created using 3D-printed wood fibers and biopolymers grown under lab conditions. These materials align with regenerative principles and contribute to a negative carbon footprint.*

***Rainwater Retention Panels****: These panels are mounted on the structure and act as an outer layer. The primary function is to capture and temporarily store rainwater within vertical ceramic facade panels. The stored water evaporates over three days, providing a cooling effect for the structure and its surroundings. The panels are compatible with existing facade systems, ensuring seamless integration.*

***Solar Photovoltaic (PV) Panels****: The project incorporates* ***250 solar*** *PV panels that generate approximately* ***375 kWh per day*** *under average sunlight conditions (5 peak sunlight hours), resulting in a total of* ***136,875 kWh annually****. The panels are strategically placed to maximize efficiency and aesthetic harmony with the structure.*

**Annual Energy and Water Generation**

***Energy Output****: The solar PV array produces 136,875 kWh annually, meeting the energy demands of the installation and contributing surplus energy to the community.*

***Water Harvesting****: The Rainwater Retention Panels optimize water collection, storing and evaporating water to cool the environment while reducing the need for groundwater extraction.*

**System Inputs and Outputs**

***Inputs****: Sunlight, rainwater, and minor maintenance resources.*

***Outputs****: Clean electricity, potable water, a cooled environment, reduction of CO2 and O2 production and enhanced biodiversity.*

**3. Prototyping and Pilot Implementation Statement**

The team’s approach to prototyping and pilot implementation prioritizes collaboration with the Marou Village community to ensure the design aligns with their needs and values. Key steps include:

**Community Engagement**: Early-stage workshops and interviews will be held to gather feedback on the design, identify specific needs, and ensure the community’s voice shapes the final installation. This process will be conducted over a period of 10 days to foster a comprehensive understanding of the community's priorities.

**Prototyping**: The team will import 3D printing abilities and water storage technology to create a 1/5 scale model of the structure at the site. This prototype will help evaluate how the design functions in the local environment, testing aspects such as rainwater flow, solar panel placement, and material performance.

**Refinement and Feedback**: The prototype will serve as a tangible representation of the design, enabling the community to provide hands-on feedback. Adjustments will be made to address any concerns or additional requirements identified during this phase.

**Full-Scale Implementation**: Once the prototype is refined and approved, the second phase of the project will commence. This includes constructing the full-scale installation and conducting training programs for local community members to operate and maintain the system. The wooden structure is constructed on site, with each component labeled and coded for accurate assembly. Meanwhile, the different 3D-printed parts are produced off-site in a controlled environment. These components are then transported to the site and installed in their designated positions on the structure. By involving the community in this process, the project ensures long-term sustainability and fosters a strong sense of ownership among residents. By integrating prototyping, community collaboration, and capacity building, the project lays a strong foundation for successful implementation and long-term impact.

### 4. Operations and Maintenance Statement

The design is intended to evolve into a self-sustaining green landscape over time due to the nature of the materials used. Key operations and maintenance considerations include:

**Moss and Greenery Management**: The structure and skin is designed to stimulate moss growth, eventually transforming it into a natural green landmark. Regular trimming of moss and vegetation can be necessary, depending on local weather patterns and annual rainfall.

**Solar Panel Maintenance**: As with any solar installation, periodic cleaning and inspection of the panels will be required to maintain optimal efficiency. These tasks can be completed using basic tools and minimal technical expertise.

**Community Involvement**: Local residents will be trained in system operation and maintenance through workshops conducted during the implementation phase. This includes moss management, solar panel upkeep, and general inspections.

By empowering the Marou community with the knowledge and tools to manage the system, the project ensures long-term resilience and sustainability.

### 5. Operations and Maintenance Statement

The project’s environmental impact is minimized through its design, which incorporates renewable energy systems, water management, and biodiversity-enhancing materials. The following assessments and strategies highlight its ecological benefits:

**Land Preservation**: The adaptive nature of the structure reduces the need for extensive land alteration. By preserving the natural topography and vegetation, the project minimizes habitat disruption.

**Biodiversity Promotion**: The use of biodiverse materials supports the growth of native moss, algae, and mycelium, which provide habitats for small organisms and enhance ecological balance in the area.

**Stormwater Management**: The Rainwater Retention Panels mitigate flooding and soil erosion by capturing and slowly evaporating excess rainwater. This reduces pressure on local drainage systems during heavy rainfall.

**Carbon Sequestration**: The materials used in the structure actively bind CO2 and filter particulate matter, reducing air pollution and contributing to a cleaner environment.

**Energy Efficiency**: The solar PV panels produce clean electricity, reducing reliance on fossil fuels and decreasing the community’s carbon footprint.

**Water Resource Protection**: By prioritizing rainwater harvesting, the project limits groundwater extraction, mitigating the risk of saltwater intrusion into local wells and preserving freshwater resources.