1. Concept Narrative

This project is inspired by the dynamic changes in Marou's natural environment, such as changes in the speed or direction of the wind, conditions of natural light, and movement of water. It engages these dynamic systems through a series of interventions that generate energy as well as unique visual and tactile human experiences. For example the vertical axis wind turbine tower consists of 15 turbines, the ones closest to the ground will rotate slower and the ones at the top faster, visualizing the change in wind speed relative to distance from the earth. By diversifying our interventions to address a variety of changes in our natural systems we create a more robust energy supply and offer a wider range of experiences. Our interventions aim to be adaptable and easily maintained such that they could be deployable in different combinations to suit different sites.

Technical Narrative

These interventions, consisting of energy producers and consumers, work together. The energy producers; wind turbines, solar canopy, and hydro turbines, generate energy during specific environmental conditions and when combined produce energy through a wider range of conditions. The Tanoa is our main energy consumer. When the producers are generating energy in excess of the village's needs it can be sent to our excavator machines which dig giant Tanoa shaped water retention ponds into the drainages, slowing down water and reducing erosion. This practice of finding alternative uses for surplus energy reduces energy loss and the impacts of material extraction associated with batteries. An adaptable and reconfigurable system designed to harness energy directly from Marou's dynamic natural environment. It draws from the constant shifts in wind direction and speed, fluctuations in natural light, and the movement of water. Most of the energy generated by the system is intended to meet the village's immediate demands, but any surplus will be redirected to the Tanoa, a water retention feature powered by an autonomous fleet of excavation robots. These systems not only generate energy but also visualize natural phenomena; for example, the ducted wind turbines rotate to indicate changes in wind direction, creating a visual link between the environment and energy production.

Prototyping and Pilot Implementation Statement

The technical concept is centered around ensuring constant and reliable power generation. By integrating multiple renewable sources—solar, wind, and hydro—we are able to maintain energy production during sunny, rainy, and windy conditions. Wind energy will be captured through a combination of Vertical Axis Wind Turbines (VAWTs) and Horizontal Axis Wind Turbines (HAWTs), with the VAWTs producing approximately 50 kW and the HAWTs producing 20 kW. Solar energy will be generated through a modular solar canopy system that allows for future expansion and is projected to produce approximately 30 kW during its initial phase. Hydropower is incorporated more as a method to visualize water dynamics onsite rather than as a primary energy source. All three energy generation systems are interconnected, ensuring a robust and resilient power supply. Excess energy generated by the system will be directed toward the construction of the Tanoa, a water retention pond shaped like a traditional kava bowl. The Tanoa will serve critical ecological functions, including retaining water for agriculture and slowing erosion throughout the village

Operations and Maintenance Statement

The construction of the Tanoa is managed by six AI-powered excavation machines, organized into three types, with two machines per type, each specialized for different aspects of the digging process. These machines utilize AI reinforcement learning and proximity tracking to excavate the bowl-shaped retention pond. They operate autonomously, learning and improving over time, and are wirelessly recharged by perimeter posts distributed around the site. When a machine veers off course, reinforcement learning protocols will correct the behavior, allowing the system to evolve and become more efficient without human intervention. The construction timeline is anticipated to span several months, gradually sculpting the Tanoa as energy surpluses permit. We than anticipate the combination of the local school in order to learn about these machines and how their can be a career surrounding the robots. This career or schooling can show how to maintain, and use the robots. The installation sequence for the site is intentionally phased to align with environmental impact priorities: hydro systems will be installed first to observe and manage water flow, followed by wind turbines, then the solar canopy, and finally the deployment of the excavation machines for the Tanoa. The installation and maintenance strategy reflects our commitment to community empowerment. This is not a system we will build for the community, but one we will teach them to build themselves, as they need, when they need. Every system—energy generation, the solar canopy, excavation machines, and water filtration—has been designed to be as simple and scalable as possible, minimizing the need for specialized external support.

To support the long-term operation and growth of the system, we will provide comprehensive maintenance tutorials. These tutorials, available either through a localized video platform or via distributed physical media such as CDs and players, will offer in-depth, step-by-step instructions on troubleshooting common issues and expanding the system. By equipping the village with accessible and self-paced learning tools, we eliminate the dependency on external technical experts, saving both time and resources. Early tests demonstrate that this method—similar to learning through online video tutorials—is effective, familiar, and scalable for rural communities.

Environmental Impact Assessment

Finally, the project has been designed with environmental sensitivity in mind. Embodied carbon impacts are minimized through the use of lightweight, locally sourced materials, including wood for the pavilions. The Tanoa, beyond its water retention role, will interact positively with local farming and drainage patterns, mitigating soil erosion and improving crop resilience. Our turbines are designed to have minimal impacts on bird populations by rotating at slower, wildlife-conscious speeds. Similarly, the overall intervention strategy emphasizes low soil disturbance and preservation of the site's natural characteristics. Through all of these layers—energy generation, environmental visualization, and ecological restoration—the project seeks to reframe human relationships with the environment, fostering resilience and self-sufficiency through design that responds dynamically to nature.