VANUA SUN-WELL: *Building Community with Water & Energy*

1. Concept Narrative

Vanua Sun-Well draws inspiration from the enduring human instinct to gather around essential natural resources—places where community, identity, and life intersect. Historically, the "watering hole" or "well" was more than just a source of water. It was a place of gathering, exchange, and connection—whether among animals in the wild or humans drawing life from the earth. Over time, these terms evolved to describe informal hubs of social interaction, where people came together for reasons both practical and communal.

Our proposal reimagines this timeless concept for the village of Marou in Fiji and capitalizes on its potential for more performative life-essential functions. *Vanua Sun-Well* becomes a modern-day "watering hole" layered with today's technologies: a solar energy-harvesting, water-collecting, and water-purifying structure that not only integrates new performative functions but also becomes a symbolic and artistic form for villagers. It is designed as a social and educational catalyst, creating a flexible space where community interaction, learning, productivity, and sustainability symbiotically co-exist and are woven together.

At its heart, the project aspires to become *vanua*—not just a structure, but a "home," and "land," embedded in the iTaukei community. It reinforces belonging, cultural identity, and ecological awareness, all while addressing the practical needs of energy and clean water in a warming world.

The design centers around two strategically positioned circular geometries within the site, which serve as the primary reference point—the *vanua*—of the proposal. These forms are intentionally oriented to frame key views, connecting the space visually to the surrounding hills and the coastal waterfront.

The radial arrangement of the two circles and the crossing paths does more than honor the traditional concept of gathering—it reimagines the site as a dynamic space for connecting people. Much like *lovo*, the communal act of cooking that draws people together through shared ritual, these circular nodes become living spaces of interaction, sites of connection—echoing the organic, communal rhythms of village life.

Primary circulation paths gracefully crisscross and weave around and between the two circles, linking them and reinforcing their shared role as centers for gathering and exchange. The intertwining of the paths around the center of the proposal extend outwards off of the site's boundaries, connecting the existing village center (to the southeast) to existing homes lying on the villages outskirts (to the southwest) while also leading to the existing farm and school currently utilized by the villagers (to the northeast) and extending to the mountain and the existing dam (to the northwest).

Architecturally, the gathering spaces are made with modular elements arranged in circular formation, inspired by the cultural symbolism and architectural form of the traditional Fijian "*bure*". This approach grounds the design in local identity, while adapting it to accommodate both contemporary function and community building.

Made up of individual singular “units” that could be artistically interpreted as a branching tree or butterfly-like in form and profile, this unit becomes the modular repeatable component of the proposal. The unit draws from traditional Fijian construction processes, deeply rooted in cultural practice, from the building elements—*Yavu (foundation), Lalaga (woven walls), Doka (roof),* and *Vakasobuduru (first post)*. Our reinterpretation of these elements overlays them with new performative and social functions. Each unit’s roof (*doka*) element still gives shade but now gathers solar energy through photovoltaic panels. The unit’s wall (*lalaga*) holds the photovoltaic (PV) roof up through a large cistern that captures rainwater runoff funneled from the PV arrays for community use. The foundation (*yavu*) of the unit holds prefabricated bases that can be customized by villagers for various social uses. Together, the construction of the first unit as a prototype becomes the proposal’s “first post” (*vakasobuduru*) as additional units get constructed to complete the circular array. Altogether, the reinterpretation of these vernacular elements for new social, energy-gathering, and water-collecting uses represents not only building components but becomes a layered cultural and performative narrative for the community.

2. Technical Narrative

The design is centered around a kit of parts packaged as a single, reconfigurable “unit” that delivers fresh water and power. This unit can stand alone or be configured into custom arrays. PV panels are attached to butterfly roofs sloped to direct rainwater into an integrated cylindrical catchment cistern. Standard off-the-shelf, turn-key products were chosen for easy sourcing, pricing, and maintenance. The exact components specified are only examples and can be easily swapped out for similar products based on regional availability.

Electricity

Each unit can be equipped with standalone power production, storage, and AC load delivery or unit arrays can be daisy-chained to a more centralized storage and delivery location. For modeling and power production simulation, we chose a kit from SUNGOLD POWER that includes 370W 20% efficient mono panels, a split phase solar inverter, and wall mounted LiFEPO4 Lithium batteries on each unit.

Using Rhinoceros 3D and a Grasshopper script, we ran detailed performance simulations of site geolocated geometry comparing project design iterations with varied panel orientations to an “optimized” PV farm with all panels arrayed north at an angle of 17°. Due to the generally high solar angle at the project site, we found that very low sloped (2-3°) butterfly PV arrays oriented in any direction generated only 4% less power than the optimized farm. Butterfly PV array angles are customizable, meaning that any unit can be configured for max power on any unshaded site on the island.

The design iteration presented for the competition consists of 19 units each with 16 panels for a total of 550 m^2 of collection surface and a nameplate (peak) capacity of 112 kW. Using available local climate files for hourly solar insolation values attenuated by historical cloud cover and derating listed panel performance by 10% to account for dirt and other degradation, the presented design would produce an estimated 183,000 kWH/yr or 355 kWH/sm/yr. Using and estimate for a typical village household on the island requiring ±3,000 kWh/yr, each 10 kWh/yr "unit" could power about 3 households, several cars, or 30,000 liters of community freezer space.

Water

At the center of each unit is a 4,000 liter HDPE food grade rain catchment cistern fed by a gutter set at the bottom of the sloped butterfly PV arrays and connecting canvas strips. Plumbing, piping and connections are standard and already in use on the island. A passive self-flushing solids filter removes dirt and debris before water enters the cistern and a self-contained UV filtration unit powered by PV electricity can be added at the cistern outlet if potable water is desired at a given location. Based on precipitation data from available local climate files, each unit will collect a range of 3,400 to 11,400 liters per month for an approximate total of 80,000 liters per year. The design as presented for the competition has the potential to collect in excess of 1.5 million liters per year. Overflow could be diverted for a variety of uses, such as garden irrigation and/or to feed aquaponic pools aerated with pumps powered by the PV arrays.

Structure

The structure of each unit is made up of a kit-of-parts. The foundation is a 150 mm deep circular slab of mesh reinforced concrete with small, embedded collars (steel, PVC pipe, other) fitted with through bolt connections to resist lateral and uplift loading on the vertical structural members. Collar embeds encircle the central cistern which adds considerable deadload support as it fills with water. Angled PVC sleeves in the slab allow for quick ground pinning to provide additional resistance to shear and uplift when the cistern is empty. These foundations can be site-made or pre-fabricated and stockpiled. They define the placement of the rest of the structure allowing for quick erection without site layout or detailed measurement. The loading concept of the structure that supports the PV butterfly arrays is straightforward, but the particulars of material selection and connection have been left intentionally general. We will need to collaborate with local knowledge and perspectives of both vernacular and modern construction techniques to achieve the most practical/functional/beautiful system to complete the unit's structural concept.

3. Prototyping and Pilot Implementation Statement

Vanua Sun-Well is rooted in the Marou community, building on the local construction concept of the *vakasobuduru* (first post) in the way the project will be piloted and implemented. In our reinterpretation of the *vakasobuduru*, the construction of the first prototype—one of individual "units"—becomes the conceptual "first post" for the larger concentric array. Designed to be scalable, this first unit is self-sufficient, and can be constructed as a working, performative, demonstration pilot. In addition to supplying fresh water, the prototype will produce substantial power for both on-site and community-based needs (see *Technical Narrative*). If successful, additional units can be constructed co-centrically in the geometric array illustrated in the proposal. In addition to facilitating larger community-based activities to occur, this accumulative organization could allow for scalable energy that could begin to power village homes and hold volumes of water for long-term use.

Each individual unit is designed to be constructed through a set of off-the-shelf building materials and technologies, which include pre-existing cisterns, PV modules and racking, batteries, UV filtration units, and dimensional lumber structural members. Each unit can be delivered and constructed as a packaged kit-of-parts, requiring minimal to no larger-scale machinery to construct. Final design of the prototype will rely on the knowledge and experience of local building techniques including structural timber framing and bamboo screen assembly from community experts in construction. Technical expertise from the design team will build on this local knowledge in a collaborative process with the Marou community. Once the first pilot prototype is built, the community can add subsequent units in the concentric array over time, as funding for the project and demand for its performative systems expands.

Lastly, while the foundation, structure, and roof array form a standardized replicable “unit”, the prototype can also become uniquely adapted, configured, and integrated with community needs. A series of diverse fabricated base components can be attached to each standardized unit to allow for different social uses to occur. These range from furniture components like benches, tables, and shelving/storage, to recreational components like a swing, to more performative components like an outdoor shower. Designed with possible community needs in mind, it is up to the local Marouian to decide which social toolkit component they want to mix and match to customize each standardized unit. The hope is that the community will also propose other components to incorporate in the unit configuration “library”. This open system allows each unit to performatively function for standardized energy & water harvesting, while simultaneously fostering different social activities underneath. This flexibility means that the prototype itself becomes a collaborative, community-building, and bottom-up initiative, designed to empower and support the diverse needs and future growth of the Marou village members.

4. Operations and Maintenance Statement

Since this is a modular system, it will be fairly easy to set up and maintain. If you know how to maintain one unit, you can maintain them all. PV systems are generally very durable. Since there are discrete components, problem diagnosis is fairly simple and the solution to the rare failure is usually component replacement. The cistern will be shaded and resting on a solid footing, so should last a very long time. As mentioned, the detailed specification of the structural frame of each unit will be determined with village input and in consultation with the local community’s building experts to configure a system that will be best constructed and maintained by its users. The one component that will most likely need to be replaced more regularly is the canvas roof panels that span between the PV arrays. These will be detailed with grommets and carabiners, so that replacement is relatively quick and simple.

The aspect of maintenance that will require some recurring attention will be regular checking of the PV arrays for obstructions such as leaves and inspection of the cisterns for accumulated debris. Top hatches allow visual inspection/access/cleaning of the cisterns. If deployed, the UV filters need to be checked and the carbon filters changed. In our experience, the users who are collecting their own electricity and water generally become very involved and empowered in the whole process. We imagine that this bottom-up participation by the users of the project will empower the villagers to feel self-sufficient, where things that might seem like a chore in another context become an emblem of pride, co-participation, and agency instead. The main thing we can do to facilitate that organic process is to work with the villagers to write a clear operation and maintenance manual and then pass the torch with some level of import and revelry… in other words: a party!

5. Environmental Impact Assessment

Vanua Sun-Well is conceived as a regenerative community infrastructure—an installation that minimizes environmental impact while actively enhancing local ecosystems and community resilience. Rooted in vernacular tradition and sustainable technologies, the proposal addresses urgent environmental challenges such as water scarcity, energy access, and resilience to climate change through an ecologically sensitive and culturally grounded approach.

Using Off-The-Shelf Materials and Minimizing Soil Disruption

The installation comprises modular, low-impact "units", constructed using durable, low-maintenance materials like food-grade HDPE cisterns, PV panels, bamboo screens, and dimensional timber. Where possible, locally sourced materials are prioritized to reduce embodied energy and transportation emissions. Foundations are shallow and prefabricated, avoiding the need for excavation or heavy equipment, thereby minimizing soil disruption and preserving the integrity of the local ecology.

Engaging Community Farming and Land Use

One of the key long-term co-benefits of the Vanua Sun-Well is its capacity to support and expand Marou's existing off-site community farming onto the project site itself. The integration of rainwater harvesting systems with gravity-fed irrigation lines enables passive water delivery to adjacent planted areas. Modular siting allows for intentional design around growing zones, with overflow water from cisterns directed to raised planters, agroforestry patches, and/or aquaculture ponds. This transforms portions of the site into productive landscapes while also acting as an ecological buffer.

Embracing Water Runoff and Swale Management

The site features an existing swale that channels seasonal runoff. Rather than diverting or modifying this natural feature, the design embraces it by respecting the existing swale in the landscape plan. This existing swale is important as it helps slow, filter, and absorb runoff, preventing erosion and sediment displacement and recharging groundwater. The modular slab foundations also elevate structures slightly above grade, ensuring the installation remains resilient to seasonal flooding without interfering with hydrological flows.

Enhancing Local Biodiversity

Vanua Sun-Well is designed to enhance local biodiversity in a variety of ways. The semi-open structures allow natural air ventilation and light flow, supporting under-canopy growth. The shaded cistern bases create cool, moist microclimates that encourage pollinators and beneficial insects. Planting palettes will prioritize native species and edible landscapes that support both ecological and human nourishment. The proposal's array of units is intentionally sited and designed to sit between and preserve existing tree plantings while also integrating and encouraging new planting zones, acting as a connective habitat corridor within the village.

Mitigation and Stewardship

Every step of the project—from modularity to materials—prioritizes stewardship. Regular maintenance, including leaf clearing from PV panels and cistern inspection, becomes a community ritual that fosters long-term care. The flexibility of the modular system ensures that future growth can continue without disrupting sensitive areas, adapting to both environmental and community needs.

Conclusion

Vanua Sun-Well offers a model for environmentally attuned, culturally rooted community-driven design. Through thoughtful land use, integrated water systems, and biodiversity-supportive strategies, the installation not only avoids ecological harm but creates a layered and living infrastructure that actively contributes to the restoration and resilience of the local ecosystem.