"The integrated sail-inspired vertical axis wind turbines contribute approximately 17,500 kWh annually, providing critical nighttime and cloudy-day energy supply, reducing storage dependence and enhancing microgrid resilience."
Key Specifications:
•Primary Water Source:Rainfall collected from the surfaces of the solar wave structures.Collection Mechanism:Solar panel surfaces are slightly tilted (10°–20° angles) to efficiently guide rainwater towards hidden gutter systems integrated into the wave frames.
•Storage System:Rainwater is funneled into modular storage tanks positioned strategically throughout the site. Proposed initial storage capacity:o Each tank: 10,000–20,000 liters
o Total distributed storage: scalable depending on rainfall and community needs.
•Material Choices:
Non-toxic, food-grade materials for gutters and tanks (e.g., HDPE, stainless steel). UV-resistant and corrosion-resistant coatings to ensure long-term durability.
Water Demand & Supply Calculations:
•Average Annual Rainfall in Yasawa Islands: ~1,800 mm
•Collection Efficiency (including evaporation and losses): ~80%
Example Calculation:
Water collected=Catchment area×Rainfall×Efficiency\text{Water collected} \text{Catchment area} × \text{Rainfall} × \text{Efficiency}Water collected=Catchment area×Rainfall×Efficiency
Given: Catchment area ≈ 3,000 m² (solar surface)
•Rainfall = 1.8 meters
•Efficiency = 0.8 Calculation:
3,000×1.8×0.8=4,320 cubic meters/year3,000 × 1.8 × 0.8 = 4,320 \text{ cubic meters/year}3,000×1.8×0.8=4,320 cubic meters/year =4,320,000 liters/year= 4,320,000 \text{ liters/year}=4,320,000 liters/year
Approximately 4.3 million liters of freshwater per year!

Site Location Plan Within the Island of Naviti
1:2000

0 100 200 400 600 800 1000 meters

0 300 600 1000 feet

Site Boundary

The Connection Between Fiji, Indigenous Culture, Climate, and the Ocean

The Republic of Fiji, a nation composed of more than 300 islands scattered across the South Pacific Ocean,has a culture deeply and inseparably intertwined with the sea and the wind. The ocean has long served as a foundation for life, mythology, trade, and survival for the people of this land.

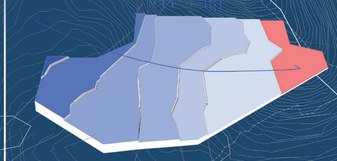
The traditional Fijian sailing canoes, known as Camakau, were ingeniously crafted centuries ago to harness the tropical winds. Fijians mastered the art of navigating between islands, turning seamanship into not only a vital technology but also a profound element of their cultural identity and national pride.

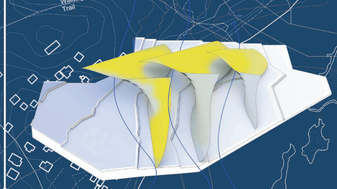
In Fijian life, waves are more than natural phenomena; they are the rhythm of existence. Waves guide fishermen, signal climatic changes, and offer a continuous, calming presence in daily life. Respect for the ocean and a deep understanding of its patterns are embedded in the cultural upbringing of every generation.

From a climatic perspective, Fiji lies within a tropical region, blessed with abundant rainfall, steady winds, and intense sunlight. These climatic conditions have profoundly influenced traditional architecture, settlement patterns, agriculture, and modes of travel. The intelligent use of natural resources such as wind, rainwater, and solar energy has always been essential to daily life in Fiji.

Thus:
A design rooted in the imagery of sails, waves, and wind is deeply aligned with the culture and environment of Fiji. These elements are not merely aesthetic choices but reflections of millennia of human coexistence with nature — where sails do not merely propel, but breathe life into the world around them.

Rainwater lake and rainwater collection for purification





The flow of coastal winds between the architectural elements initiates the rotation of small-scale wind turbines attached to the curved surfaces, enabling the seamless conversion of natural wind energy into sustainable power.

Assumptions:
•Type of Turbine: Vertical Axis Wind Turbine (VAWT)
•Rated Power per Turbine: 1 kilowatt
•Number of Turbines: 10 units integrated into the sail-like structures
•Average Wind Speed at Site: Approximately 5 to 6 meters per second
•Capacity Factor: Estimated at 20% based on local wind conditions
•Hours in a Year: 8,760 hours
Energy Production Calculation:For a single turbine:1 kW×0.20×8,760=1,752 kWh/year1 \, \text{kW} × 0.20 × 8,760 = 1,752 \, \text{kWh/year}1kW×0.20×8,760=1,752kWh/year
For ten turbines:1,752×10=17,520 kWh/year1,752 × 10 = 17,520 \, \text{kWh/year}1,752×10=17,520kWh/year
Final Output:
Specification Value Number of Turbines 10Total Installed Wind Capacity 10 kilowatts Estimated Annual Wind Energy Production 17,500 kilowatt-hours (kWh)
Interpretation:
•The wind turbine array is expected to generate approximately 17,500 kWh of clean energy annually.This contribution significantly enhances the microgrid's resilience, providing critical energy during nighttime and cloudy or stormy periods.It helps reduce dependency on battery storage and ensures continuous energy supply for the Marou community.The visual integration of the turbines into the sail-inspired architecture maintains the project's artistic vision while delivering robust functional benefits.Calculation:
3,000×1.8×0.8=4,320 cubic meters/year3,000 × 1.8 × 0.8 = 4,320 \text{ cubic meters/year}3,000×1.8×0.8=4,320 cubic meters/year =4,320,000 liters/year= 4,320,000 \text{ liters/year}=4,320,000 liters/year
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