REUSE AS REIMAGINATION

Our design incorporates several technologies for energy generation and storage. Solar photovoltaic was chosen as the primary form of electricity generation for its applicability to the geography, affordability, easy shipment and robustness.

The primary form of energy storage is pumped hydroelectric, chosen for simplicity and ability to also store water for the community. This system has the secondary benefit of generating additional electricity during the rainy season when rainfall and stream runoff collects in the upper reservoir.

The secondary form of energy storage is lithium-iron-phosphate (LFP) batteries, chosen for their user-friendly design, affordability at small sizes, and modularity. Together, the energy generation and energy storage power the most important component of the system: the energy usage.

Water is primarily captured and stored by the pumped hydroelectric system, which utilizes a lower and upper water reservoir as well as a mechanism to distribute water between them. The system captures and stores approximately two million liters of water annually to be distributed to the town throughout the dry season.

The primary holding point for the water, the upper reservoir, is rebuilt from the compromised dam. Its three thousand cubic meter volume is sufficiently large to supply water to the town throughout the dry season and to store water from the lower reservoir that is pumped uphill during periods of excess solar generation midday. Water from the upper reservoir flows through a distribution pipeline and a turbine. Once in the lower reservoir, the water is either stored until it is returned uphill or flowed through another distribution pipeline where it is filtered and supplied to the village.

The lower reservoir fills throughout the night as water drains from the upper reservoir to generate electricity for the village. At 1,500 cubic meters, the lower reservoir is half the volume of a competition swimming pool; it drains and fills by one thousand cubic meters daily. As the water flows across the 45 meter difference in elevation between the lower and upper reservoirs, it spins a pump, providing roughly 100 kWh to be used each night by the village. Once the sun rises, the solar system powers the pump and the water is returned to the upper reservoir, completing the cycle.

Lower Reservoir

Solary Arrays

The 75 KW solar array generates 136 MWh of energy annually. The solar system is constructed of four hundred 300 watt solar panels which were first used in the United States and refurbished for reuse in Fiji. These refurbished panels are more affordable and more easily carried to the installation site because they are smaller and lighter than modern designs. Second-life panels are ideal for the Marou Village project because they can generate the required electricity for future decades and showcase the inventiveness of the community in repurposing materials that another culture discarded.

Much of the energy generation is used instantaneously to meet demand. Energy not used in real-time is stored either in the pumped hydroelectric system or in batteries. Excess energy can also be used for more energy-intensive products such as fresh water generation via methods like atmospheric water generation and solar desalination. Water usage by the village and the natural evaporation of water from the reservoirs during the dry season will determine the amount of water that must be generated via these processes.