1 - Concept Narrative

The dome structure is aerodynamic in shape, and will therefore help avoid damage caused by cyclones. In fact, the dome's shape will allow the wind to spread evenly over the structure, so as not to weaken it.

The advantage of this structure is that it is designed with local, sustainable materials that blend into the décor and adapt to the local culture, while adding a touch of originality with its round shape.

The dome is simple yet practical and multi-functional, with its rainwater harvesting system, solar energy system and distribution of this water and use of solar energy for the inhabitants of Marou village.

We designed this structure with an eye to aesthetics, ecology, utility and efficiency for the inhabitants of this village in Fiji !

We'd need to set up 4 domes in the village: one near the school so that pupils have easy access to water, and 3 other domes spread around the village near the houses. Each dome would be 10 meters in diameter, with a central free space of 4.5 meters radius, and around it 12 above-ground water tanks with a capacity of 12,500 liters of water, so one dome could protect a total of 150,000 liters of water (not counting the tank buried in the ground). To prevent damage to the dome, it would need to be well anchored to the ground, with concrete foundations of sufficient depth to ensure stability. The dome would have a concrete base at ground level.

2 - Technical Narrative

Rainwater harvesting system :

The dome consists of a concrete structure, a secondary bamboo framework and a covering of tightly-woven natural leaves (pandanus or palm). These leaves are naturally treated with either linseed oil, beeswax or plant resin, to ensure that the dome is waterproof and that rainwater runs off the dome to reach the gutter on the ground, which runs in a circle around the dome. This gutter could be made of recycled sheet metal, and would direct the water towards the leaf filter at the entrance to the pipe leading to the flush filter (which filters dirty water). This filter would be equipped with an overflow system to discharge the dirty water into the ground (this filter would not be positioned under the surface of the dome but next to it, but still under the ground). Once the water has passed through the filters, it would continue on its way up the pipe to the first above-ground water container, thanks to a hybrid pump (both manual and powered by solar energy harvested from the dome). Then, via a series manifold system, once the first tank is full, the water will overflow into the next tank via a pipe linking the tanks. Once all the above-ground containers (tanks) have been filled, the last tank to be filled would have a hose associated with a valve permitting the water to flow out of the tank. The dome would be equipped with an overflow system to drain excess water into the ground. To prevent flooding and erosion, drainage zones would be planted around the dome. There would be a mix of tall plants (vetiver, Indian cane) and low plants (ferns, taro). These plants absorb water. Adding an organic mulch could help retain moisture without sludge.

Water distribution system :

The dome is located slightly higher than nearby homes, so the rainwater stored in the dome would be gravity-fed to homes near the dome. The dome's water reservoirs, via a network of pipes, would also be connected to communal fountains and taps (operated by solar-powered hand pumps) close to the dome; it should not be forgotten that there would be 4 dome dwellings in the village.

Energy system / solar panels :

The dome is based on a solar energy system. The mobile dome features solar panels shaped to match the curvature of the dome. Rechargeable batteries stored in a secure compartment inside the dome are powered by the solar panels on the dome. This energy is used to recharge portable solar lamps and individual batteries for the homes in Marou village. Some of the energy generated by the solar panels can also be used for solar-powered pumps to transfer reclaimed water.

In the center of the dome, there would be a storage area with lockers dedicated to recharging portable lamps and batteries. Each evening, residents would drop off their lamps or batteries, and pick them up the next day recharged. There would be cards with a tracking system for organization, and one or two people in charge of organizing lamp recharging for each dome.

Locking systems :

The structure consists of two half-domes: an immobile half-dome anchored directly in the ground (with concrete foundations), and a mobile half-dome that allows the dome to be opened or closed completely. The mobile half-dome is mounted on rails, and can slide behind the immobile half-dome to open the structure, or slide on the other side to close the structure and form a complete dome. To hook the two half-domes together to create a complete dome, the half-dome on the outside, behind the stationary half-dome, would be a little more than half a dome so that it could overlap the other part of the dome once the structure was closed, so that there would be no empty space between the two parts of the dome and the dome would therefore be watertight. This additional part of the movable half-dome overlapping the immovable half-dome would feature a natural rubber seal (for watertightness) and a cam latch system (which could be operated via a handle on the dome) to hook onto the other part of the structure.

Secondly, the mobile half-dome would slide along the rails thanks to wheels and a hybrid system: manual (with a crank) and/or slow solar motorization. To ensure that the mobile half-dome located on the rails would withstand bad weather (and avoid lifting), the rails would be surrounded by two concrete lips, in the part opposite the immobile half-dome, in which the mobile half-dome would be inserted and hooked to the lips by means of another cam latch system (operated by another handle on the dome).

The two handles for the two closing systems would be located outside the dome, but would be fitted with a secure lock.

3 - Prototyping and Pilot Implementation Statement

The prototype dome will be small but functional, and will be adapted to test the whole structure and its organization: the dome will have a diameter of 4 meters and a height at the center of 2.5 meters; there will be 4 tanks of 1000 liters.

As for the prototyping phase, we will need an NGO or local craftsmen to help us with the dome prototype, and we estimate that it will take 3 to 4 weeks to design a prototype. During the first week, we’ll make contact with the local communities. Then we'll work together to define the exact location of the dome. During this week, we'll prepare the site with the foundations and collect the materials needed to build the dome. The following week, we'll build the structure, including the half-domes, rails and concrete base. The water collection system will also need to be set up, with gutters, filters, containers, pipes, overflow system, pump and tap for the water collection system. Finally, during the second week, we'll install the latches and test the structure's closure. The 3rd week will see the installation of the solar panels and the electrical system. We'll also have to install the water distribution system, with communal taps and fountains. Finally, we'll have to test the prototype and train the local referents who will take care of the dome in the future. We estimate the cost of the prototype at €3,800, but this will also depend on the cost of materials available locally and the cost of local labor.

4 - Operations and Maintenance Statement

For each dome, construction time would be around one and a half months, and the number of people mobilized would be around 15, including at least one site manager, a carpenter (for the bamboo), a mason (for the concrete base), a solar energy technician, a hydraulic energy specialist, a person who trains the local workforce, local craftsmen (for leaf braiding, light ironwork for the closure system...), village residents and volunteers.

For one dome the materials would cost around €15,000, the systems (water and electricity) would cost around €7,000 and finally, the local labor (with technical labor, local craftsmen and local people willing to participate in the project and be trained) would cost around €6,000. The cost of one dome would therefore be €28,000, and the cost of 4 domes would therefore be €112,000 (approx.).

5 - Environmental Impact Assessment

Firstly, the dome's appearance is adapted to its local environment. Secondly, the local materials and plants used for this dome are in keeping with this sustainable project. Finally, the rainwater harvesting and solar energy recovery systems allow us to use nature to supply water and energy in a more sustainable way.