

RETROFITTING A LARGE HAWAIIAN HOME



BACKGROUND

This project involved the redesign and modification of an existing large home in Hawaii to attain greater cost reduction and energy reliability than those attained by the original design. Prior to installation, the typical monthly consumption varied between about 2,400 kWh/mo while off-site to more than 4,000 kWh/mo while on-site, resulting in electricity bills in excess of \$1,500 per month.



As originally designed, the project consisted of 60 solar panels, 24 KWh of battery capacity and three Outback inverters. It was designed to operate the system using a “critical loads” panel to retain service to a few of the loads, which was selected by the initial installer without proper consultation with the owner.

While the initial installation reduced the costs of operating the house to around \$800 per month, the backup capabilities of the system proved inadequate during a significant outage. The only loads served during the outage were some garden lights, the electrical gates and a few outlets. The most critical load, a refrigeration unit, was not served during the outage.

OBJECTIVES

1. **MAINTAIN POWER** to the entire house as much as possible, not just to pre-selected critical loads
2. Significantly **REDUCE UTILITY COSTS**

RETROFITTING A LARGE HAWAIIAN HOME



ACTIONS AND RECOMMENDATIONS

We undertook a redesign of the home electrical system and recommended adding 30 solar panels to the original design, increasing the battery capacity to 80 KWh and replacing the Outback inverters with SolArk inverters. We also recommended installing a separate transfer switch to handle outages while still being able to serve the entire house. Beyond the hardware design, we considered the operating parameters for the charging and discharging of the batteries to attain the dual objectives of the project.

RESULTS

The following outcomes are primarily attributed to greater and smarter utilization of the solar and battery systems.

- ✓ Operating costs were reduced to **LESS THAN \$200 PER MONTH** on average
- ✓ The entire house is currently **SERVED IN AN EMERGENCY**
- ✓ When the battery is 100% charged, the house can operate at its **FULL LOAD** for about **24 HOURS** during an outage

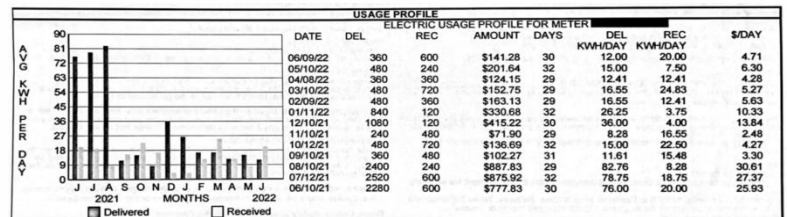


Figure 1: Electricity bill before (June-Aug. 2021) and after (Sept. 2021-June 2022) the retrofit

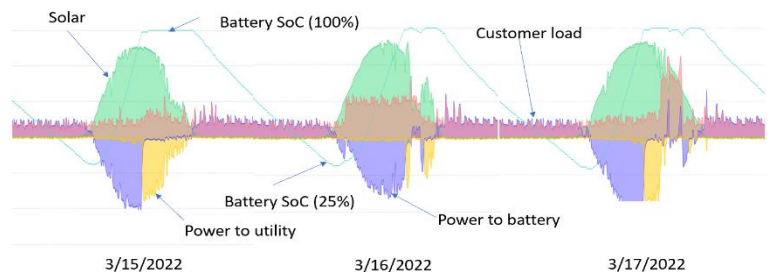


Figure 2: Typical battery status and power flows for a three-day period in ideal conditions (e.g., sunny weather).

To operate off the grid indefinitely, the retrofitted home will require active load management and predictive battery charging/discharging controls, as provided by the ModBESS HomeOptimizer system.