

Model T-1 Conquers Simulated Brownout at Customer Site



In February 2015, Oorja tested the capability of a three-module Model T-1 system at a remote wireless base station site in the Philippines aimed to determine the capability, reliability, and efficiency of Oorja products during a simulated brownout.

Customer Goal: With increasingly frequent power outages and brownouts, this customer was looking for the most reliable, cleanest, and least expensive solution for this site, which is a Grade A (high-traffic) site, at an elevation of 4,000 feet, and in a remote area.

System Tested: A three-module Oorja Direct Methanol Fuel Cell (DMFC) system using Oorja Model T-1 units (diagrammed in Figure 1) was put into place at customer request to

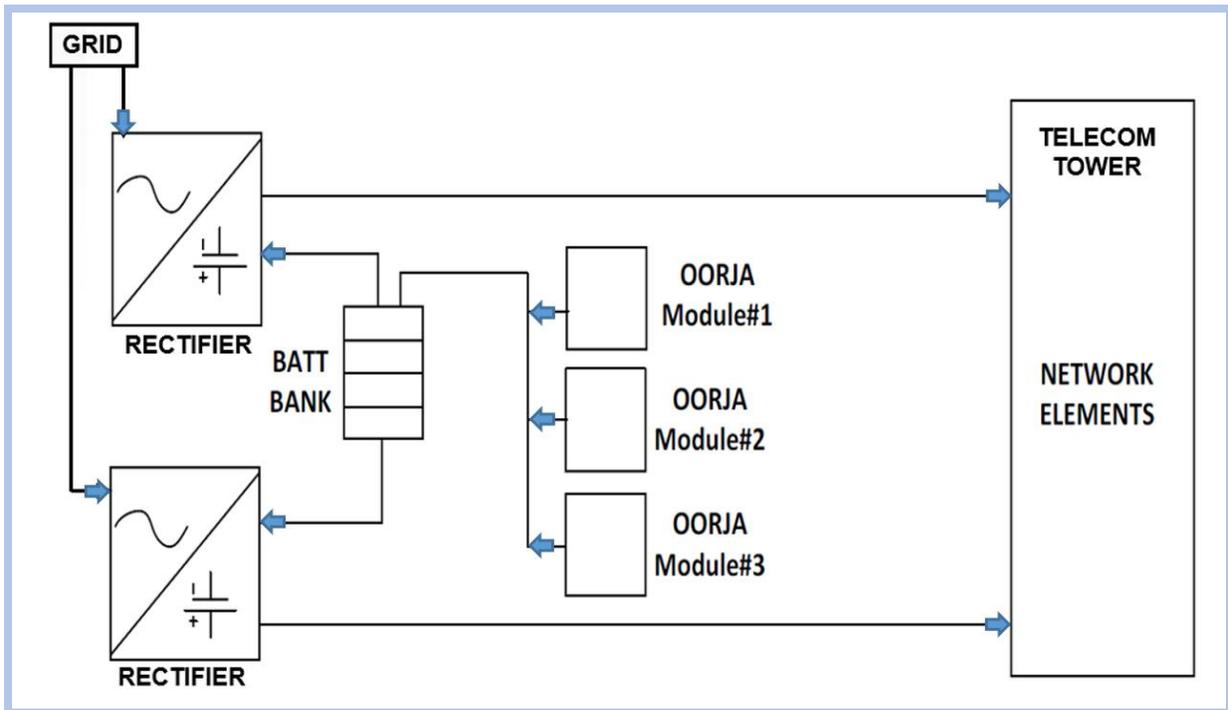


Figure 1. Oorja fuel cell interconnection block diagram

provide back-up power during a simulated brownout. The system had the following characteristics:

- The customer's existing 3- to 4-year old batteries (FUSION), 4 banks (12 V x 4), which normally alternate in supplementing power when there are peak loads and short power outages (peaking and bridging).
- Three Oorja Model T-1 modules, presented as a system, were added:
 - Each module is able to deliver 1.1 kW output.
- Load variation occurs as follows:
 - During a 2.1 kW-range outage, only one Oorja module turns on.
 - Load can vary from 2.1 to 5.0 kW.
 - When the load is increased, the second and third modules are programmed to turn on.
 - This helps save fuel, and power is supplied only as needed.
- Battery voltage parameters:
 - Oorja units start when the grid is out and the battery voltage drops below 47V.
 - The Oorja units recharge the back-up batteries so they can continue to supply power to the load.
 - When the grid comes back on, and after the battery voltage reaches 54V from commercial power, the Oorja units go idle or into standby mode.
- The battery specifications are:
<http://en.naradapower.com/Products/SLA/battdata/pdf/ACME.F/12NDF100.pdf>

Outage Duration: The site outage requirement for the trial was 72 hours. All modules were turned on and off per the customer's requirements and threshold. Following installation of the hybrid back-up power specified above, the AC mains breaker was forcibly turned off for 72 hours straight.

Test Results: No faults occurred during the testing phase.

The total fuel used during the 72-hour outage was about 50 liters of 100% pure methanol. If a reformed methanol system had been used, it would have consumed 225 liters for a 72-hour operation.

The Oorja fuel cells maintained battery state of charge (SOC) between 50% and 80% at all times.

Conclusions: The following features of the Oorja Model T-1 confirmed the capability, reliability, and efficiency of Oorja Model T-1 during this trial:

- Service for this system is exceptionally simple and easy.
- Operation at lower temps (75°C; 165°F).
- Liquid fuel makes fuel logistics simple and easy.

- On-demand fuel supply.
- Fuel cost and off-the-shelf availability, with no special mix required.
- A modular approach, with 1.1 kW net modules, mounted on a 19-inch rack.
- No reformer needed.
- Pressure: 2 psi (versus 250 psi needed for a competitive hydrogen system).
- Installation time of 4 hours.
- Indoor and outdoor installation (a separate weatherproof enclosure is required for outdoor installation).