Cinergy

DC Generator/Battery Hybrid Deployment in Fiji

The Challenge

To supply DC power directly to telecoms equipment from a fuel-efficient DC Generator/Battery hybrid solution.

Telecoms radio equipment typically requires either 24V or 48V DC power. This power requirement is normally delivered from an AC power source, either a local grid connection or an AC generator, via a bank of rectifiers.

The problem with this delivery method is that the rectifiers generate heat resulting in power loss and a higher cooling load. Further, rectifiers are typically far more sensitive to high ambient temperatures than the radio electronics whose power they supply and are often a key driver for site air-conditioning.

The Solution

Cinergy has a range of fuel-efficient hybrid generator/battery solutions based on DC architecture and DC generator technology which can supply DC power directly to telecoms equipment. These solutions can be used as primary power sources on off-grid sites and also as stand-by power sources on grid-tied sites where the grid is unreliable.

On off-grid sites, the Cinergy solution allows rectifiers to be discarded, reducing power loss and removing a significant heat source and point of failure. Since Cinergy solutions include a deep-cycle battery bank, with a low-power thermo-electric cooling option available, a separate UPS is also unnecessary.

So, apart from higher efficiency, the Cinergy solution can offer an opportunity to remove or significantly reduce levels of air-conditioning.

Case Study Site

In January 2011, Cinergy installed its Rapid Deployment Hybrid system on a typical Digicel PDH site in Fiji to prove the savings yielded through direct DC power supply. The system, contained in a single, secure skid unit, included:

- A 5.5kW DC generator powered by a diesel Perkins engine
- A single battery string of 24 2V 400Ah VRLA AGM cells
- Remote management, monitoring and battery charge control

The site UPS and usual AC power source were disconnected and the Cinergy system delivered 48V DC power directly to the radio equipment.

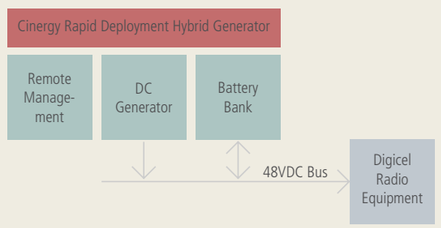
The radio equipment on site is housed in outdoor units with no air conditioning. The site power demand ranged from 0.95kW to 1.72kW with an average of 1.35kW.

DC Voltage Range & Quality

The DC voltage range supplied by the Cinergy solution on the Fiji site was 47.8V to 57.8V. The voltage ripple of the DC generator itself does not exceed 200mV on full load – in conjunction with the battery bank, power ripple is negligible. The radio equipment on site operated with no issues when supplied with the DC power directly from the Cinergy solution.

The DC voltage range supplied is governed by the selected battery charging strategy.

Figure 2. Cinergy Hybrid Generator



The high end of the voltage range occurs when the DC generator is running to charge the batteries and the charging process has neared completion and the supplied voltage is the rapid charge voltage for the batteries used – in this case 2.4V per cell or 57.6V for the 48V battery string. Where the battery technology used requires charge voltage temperature compensation, this voltage will reduce in warm climates. For instance, with a temperature compensation of -5mV/degree C and a battery reference temperature of 25 degrees C, for every 10 degrees above this temperature, the charge voltage would reduce by 50mV per cell, or 1.2V for a 48V battery string.

The depth to which the battery bank is discharged before charging begins determines the low end of the voltage range. The relatively small battery bank deployed at the site in Fiji required a battery discharge to 50%. A more typical installation would include twice the battery capacity and discharge the batteries to 75%, thus raising the low end of the voltage range by at least 1 volt.

Fuel & System Performance

The key benefit of a generator/battery hybrid solution is that the generator runs cyclically to charge the system batteries, dramatically reducing engine run hours and fuel consumption and delivering a corresponding reduction in fuel and maintenance costs. The performance of the Cinergy solution can be compared against an 11kVA AC generator/battery hybrid solution run by Digicel Fiji on similar sites and with an 11kVA AC generator running 24 hours per day.

Table 2: Fuel and System Performance

	Cinergy Solution	11kVA AC hybrid solution	Cinergy Saving %	11kVA Generator running 24 hours per day	Cinergy Saving %
Fuel Consumption (litres per day)	18.8	21	10.5%	50	60%
Engine Run Hours per day	10	14	29%	24	28%

The Cinergy system used on site is designed, sized and configured for rapid deployment. The new Cinergy Cubes solution on the same site, using a 10kW DC generator and 998Ah battery bank, would consume less than 17 litres of fuel per day and run for 7 hours per day, yielding even greater savings.

Conclusion

The fuel consumption and engine run hours of the Cinergy DC hybrid solution are impressive. The Fiji trial showed that it is practical to supply DC power directly to radio equipment from a DC-based generator/battery hybrid system and that the Cinergy solution:

- Allows rectifiers to be discarded
- Reduces or removes requirement for air conditioning
- Delivers significant additional CapEx and OpEx reductions over AC generator battery hybrid solutions