Wireless Base Stations

Model T-1 Battery Range Extension Cases

A wireless base station, or cell tower, has recently experienced too many power outages in which existing back-up batteries are inadequate to prevent a power failure; therefore, an unacceptable power failure occurs well before the end of the power outage. The manager of this base station asked DMFC how the range of existing back-up batteries could be extended with the use of DMFC fuel cells (Figure 1 shows the Model T-1 as a single module and as a double module). Coverage for a 36-hour power outage was considered, as was coverage for a 72-hour outage.

Case 1, for 36 hours: For a wireless base station that consumes an essential 76 kWh over 36 hours, and when existing batteries can provide only 48 kWh over 36 hours, an unacceptable failure occurs well before the 36 hours have elapsed. Adding an DMFC Model T-1 fuel cell makes a total of 88 hours of energy available over 36 hours, so a power failure does not occur before the 36 hours have elapsed, as Figure 2 shows in more detail.

Case 2, for 72 hours: Similarly, for a wireless base station that consumes an essential 151 kWh over 72 hours, and existing batteries can provide only 48 kWh over 72 hours, an unacceptable failure occurs before the 36 hours have elapsed. Adding two DMFC Model T-1 fuel cells makes a total of 206 hours of energy available over 72 hours, so a power failure does not occur before the 72 hours have elapsed, as Figure 3 shows in more detail.

Figure 1. The DMFC Model T-1 system: single module (left) and double module (right) shown in their service position with the cover on and off

Case 1: A 36-Hour Power Outage

When a 36-hour power outage occurs in a setting where a cell tower consumes an essential 76 kWh over 36 hours, and existing batteries can provide only 48 kWh, an unacceptable failure occurs well before the 36 hours of the outage has elapsed.

- Adding DMFC fuel cell (which supplements the existing battery output with 40 kWh over 36 hours) makes a total of 88 hours of energy available over 36 hours, well above minimum power needs.

	 1.1 kW x 36 hrs = 40 kWh	 1000 Ahr x 48V = 48 kWh	 2.1 kW x 36 hrs = 76 kWh load	Energy Requirement
Normal power		—	76 kWh	**76 kWh (requirement)**
Power outage for 36 hours	—	48 kWh from battery		**48 kWh (insufficient for the requirement)**
Power outage for 36 hours with DMFC fuel cells	40 kWh from DMFC fuel cell	48 kWh from battery		**88 kWh (exceeds the requirement)**

Figure 2. Power requirements and delivery for a 36-hour power outage

Case 2: A 72-Hour Power Outage

When a 72-hour power outage occurs in a setting where a cell tower consumes an essential 151 kWh over 72 hours, and existing batteries can provide only 48 kWh, an unacceptable failure occurs well before the 72 hours of the outage has elapsed.

- Adding two DMFC fuel cells (which supplement the existing battery output with 158 kWh over 72 hours) makes a total of 206 hours of energy available over 72 hours, well above minimum power needs.

	 1.1 kW x 72 hrs = 79 kWh	 1000 Ahr x 48V = 48 kWh	 2.1 kW x 72 hrs = 151 kWh load	Energy Requirement
Normal power	—	—	151 kWh	**151 kWh (requirement)**
Power outage for 72 hours	—	48 kWh from battery		**48 kWh (insufficient for the requirement)**
Power outage for 72 hours with two DMFC fuel cells	158 kWh from two DMFC fuel cells	48 kWh from battery		**206 kWh (exceeds the requirement)**

Figure 3. Power requirements and delivery for a 72-hour power outage