

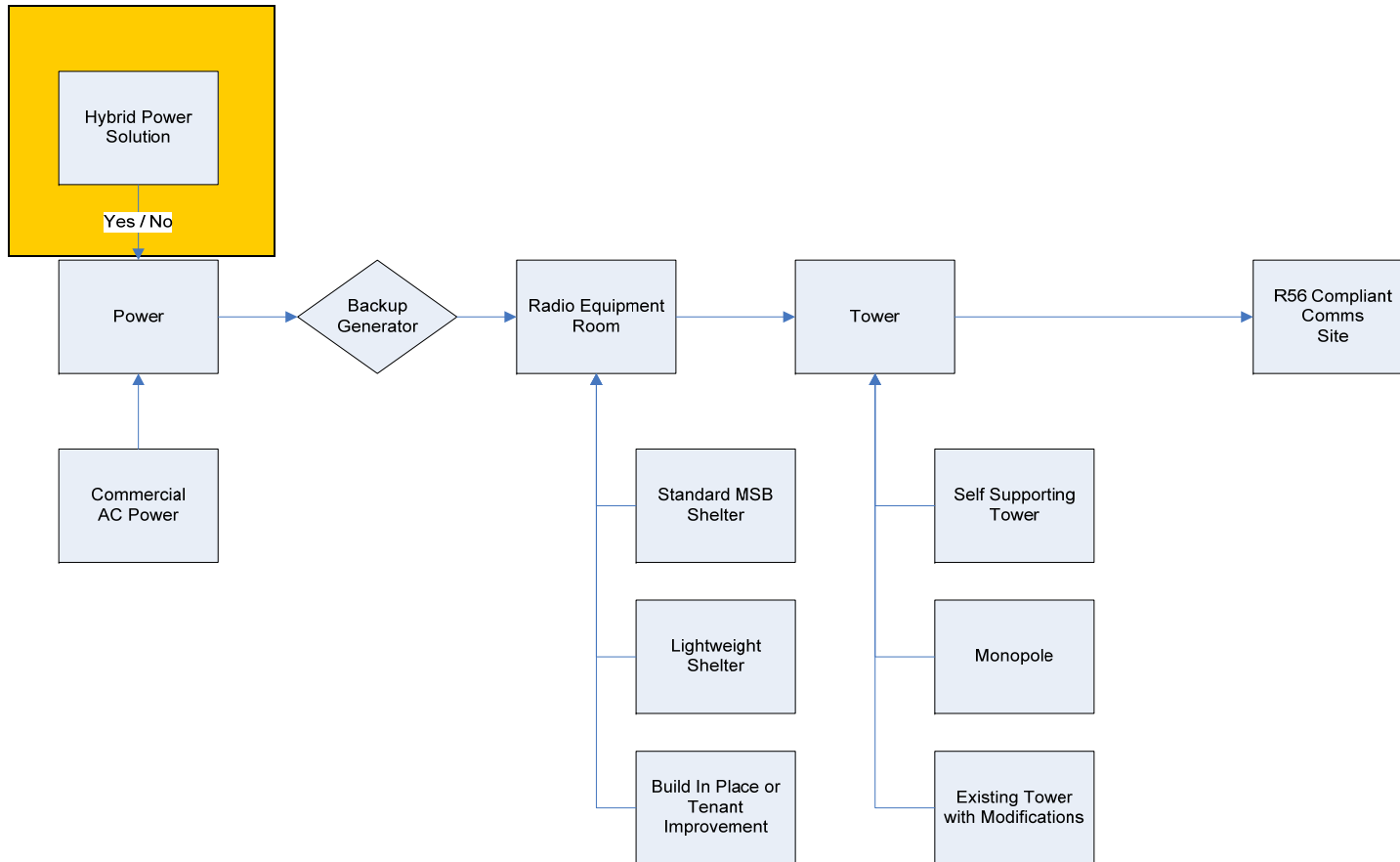


HYBRID POWER SYSTEMS FOR MISSION CRITICAL ENTERPRISE LAND MOBILE RADIO SITES

By:

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National Site Design and
Integration Team**

Radio System Overview



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Remote Site Hybrid Power Supply Needs Assessment



- **Cost effective as an alternative to high cost for commercial power**
- **Highly reliable and redundant power supply system**
- **System designed for worst case scenario – typically low solar months of Dec – Jan with expected radio traffic**
- **Battery backup is sufficient to allow normal preventative maintenance schedules**
- **System monitoring provides status of system at component level.**



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Hybrid Energy Power Solutions

Search of Marketplace for Manufacturers / Providers



- **Solar**
- **Wind Turbines**
- **Fuel Cells**
- **Generators**
- **Non-Traditional**
 - **Geothermal**
 - **Hydro**
 - **Micro-CoGen**
 - **BioFuels**
- **Motorola Ventures efforts in this space (partnerships, investments, etc.)**



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Design and Cost Drivers for Remote Sites

•Radio System Design

- Number of Radio channels
- Duty Cycle (standby versus active)
- Backhaul solution

•Site Access

- Paved or Dirt road
- Helicopter

•Days of Autonomy

- Battery bank

•Climate

- Temperature range
- Humidity
- Wind

•Shelter Design and Size

•DC Load

- DC by Design
- Load shedding
- Lights
- Wiring



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Actual System Design



2000 Ah/Day Load– 7800 Ah Battery Bank – 35.8 KW solar plant (270 panels) – 4 wind turbines – 1.2 Design to Load Factor

•Radio System Design

- 3 Radio channels
- 8 hr Active Duty Cycle (standby versus active)
- Backhaul solution – MW to HQ

•Site Access

- Dirt road – 2 hr from paved

•Days of Autonomy

- 3 Days – 7800 Ah Battery bank
- Backup 35 KW propane generator

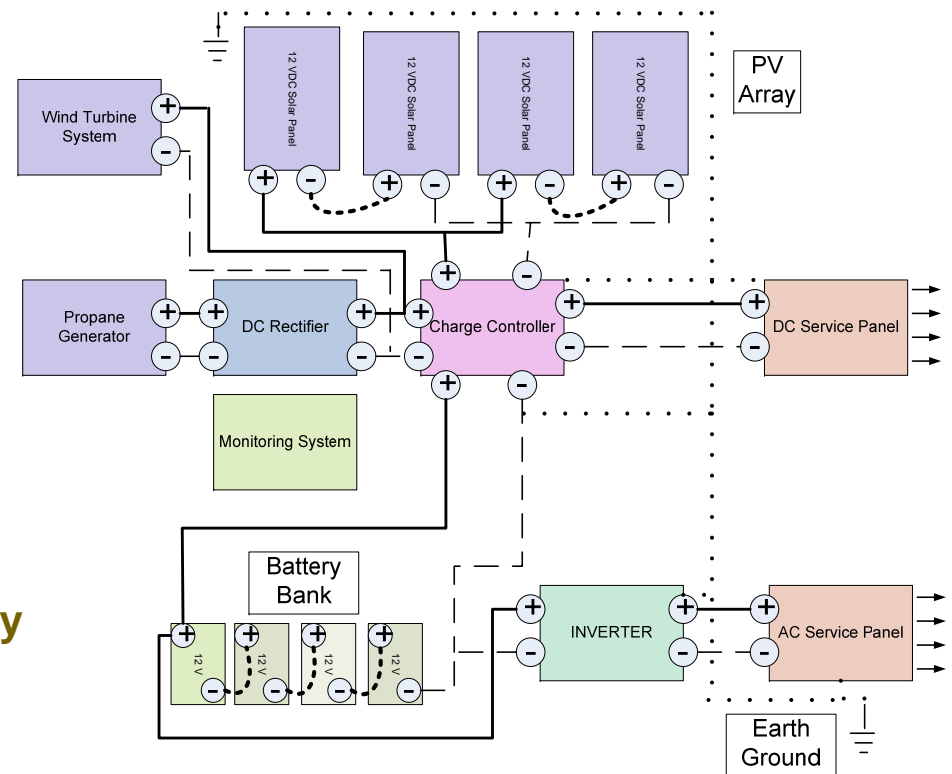
•Climate

- Hot Summers – Cold Winters
- Design includes HVAC system
- 4 Wind Turbines – cliff edge – good wind

•2 Shelter Design – one radio / one battery and solar system controller

•DC Load

- Load shedding
- All LED Lights



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Actual System Design



600 Ah/Day Load – 650 Ah Battery Bank – 2.6 KW solar plant (40 panels) – 2 wind turbines – 1.0 Design to Load Factor

•Radio System Design

- 2 Radio channels
- 8 hr Active Duty Cycle (standby versus active)
- Backhaul solution – MW Loop

•Site Access

- Helicopter

•Days of Autonomy

- 3 Days – 650 Ah Battery bank
- Backup 35 KW propane generator

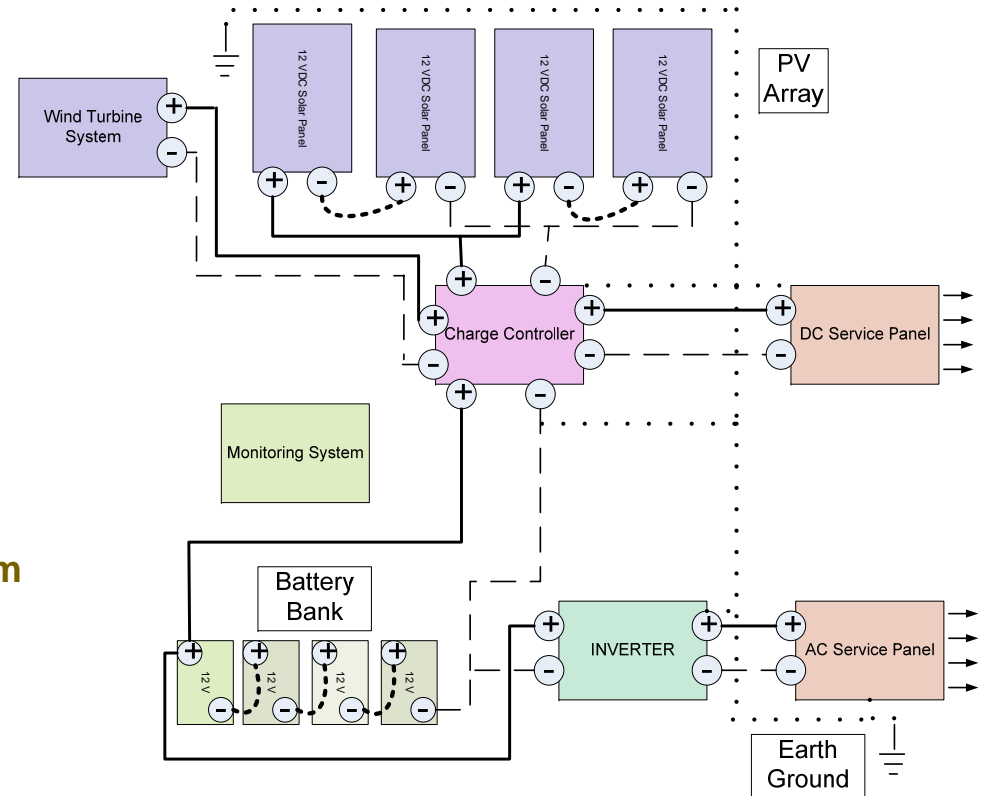
•Climate

- Hot Summers – Cold Winters
- Heavy insulation – DC fan/louver system
- 2 Wind Turbines – 400W

•smartShelter Design – Full DC shelter design with integrated controls

•DC Load

- Load shedding
- All LED Lights



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Continuing need seen in our customer base



- **Integrated systems with high reliability**
- **Remote site deployment solutions in a variety of climates and field conditions**
- **Low operations and maintenance costs**
- **Standard system designs with COTS components**
- **smartShelter design with full DC integrated, R56 compliant, components and standards**

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