



# Gen Set Eliminator System

NDIA Power Expo Conf

03 May 2011



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# Gen Set Eliminator Definition

- Eliminates the need for a second (back-up) Generator Set
  - Optimizes the function of a single Gen Set
  - Takes advantage of energy storage
  - Allows for power to be available when the Gen Set is off
  - Optimizes energy extracted from fuel

# Present System Configurations

- Diesel gen-sets of various power levels
  - Present systems grown organically
  - Sized for peak power requirements but predominately run at low output
  - Low output means lowest efficiency
  - Always must be on
  - Works satisfactorily, but at high cost
  - Subject to high maintenance

# Current System Problems

- Cost of energy is too high
- Supplying energy risks personnel lives
- Delivered Diesel fuel costs
- Local Electricity unreliable / non-existent
- Power Outages
- Lack of power source integration
- Power quality variability

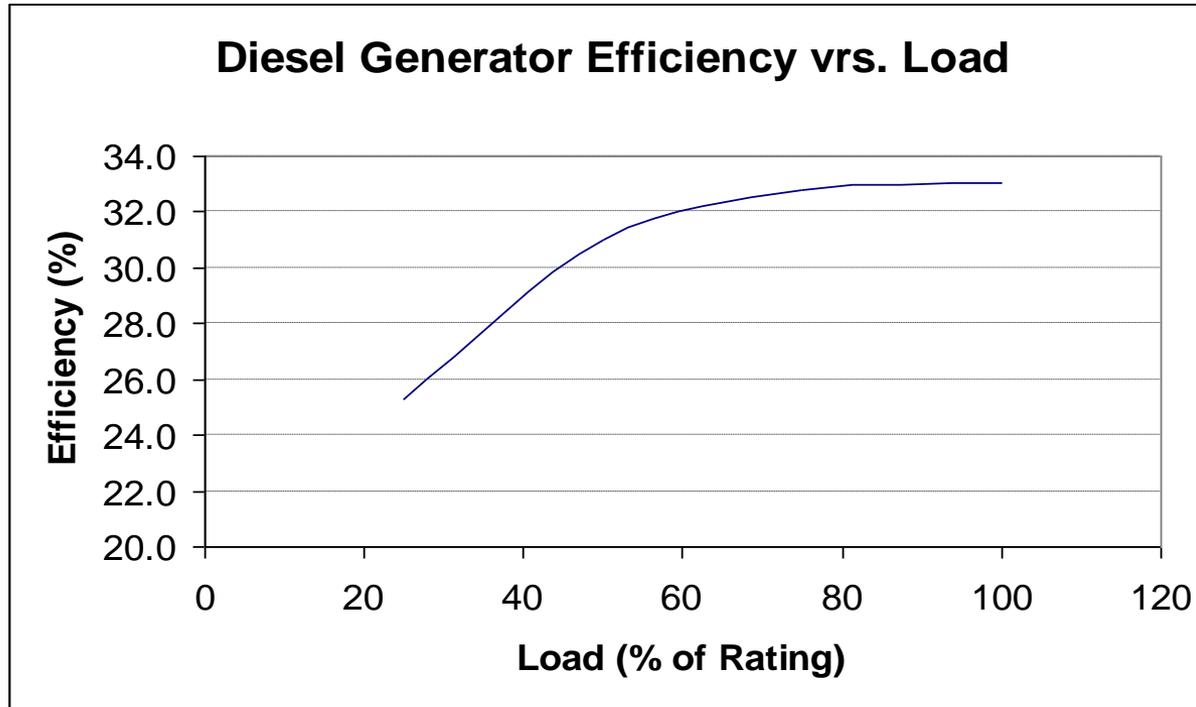
# Desired Solutions

- Decouple Energy Generation from Use
- Reduce fuel consumption
- Utilize local and renewable sources
- Increase flexibility
- Reduce audible and thermal footprints
- Increase reliability
- Lighten load

# Path Forward

- Increase efficiency
- Optimize
- Incorporate best methods
- Energy optimization with Storage

# Typical Diesel Gen-Set



Diesel Gen-sets conversion rates of 25-33% are typical and are typically run at a low output and therefore their lowest efficiency, equates to highest fuel consumption per unit energy extracted

# Energy Storage Operating Scenario

- Existing 1st Gen Set runs at higher efficiency
- Existing Gen Set runs when needed to meet load and to charge battery
- Existing Gen Set is shut off – and the energy is drawn from the battery
- Existing Gen Set is re-started and run as needed again to meet load / charge battery

# Energy Storage Benefits

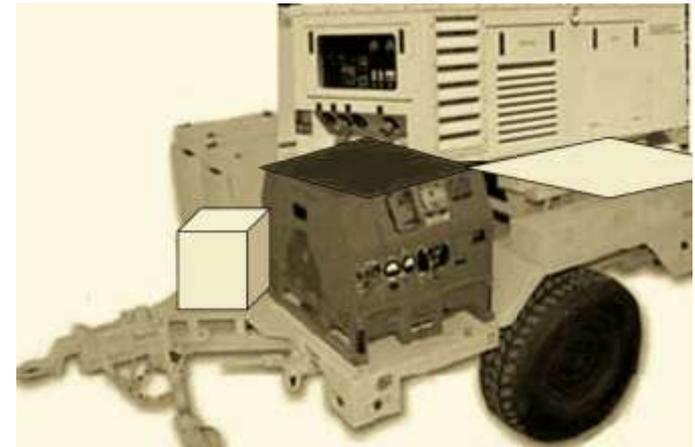
- Reduces Cost
  - 20 - 33% less Fuel consumption
- Integrates multiple power sources
  - Local power
  - Solar / Wind / FC
  - Intelligently controls power
- Quality
  - Eliminates switching power loss
  - Improves power quality

# Energy Optimization with Storage

Towable “Gen Set Eliminator” Eliminates need for 2<sup>nd</sup> Gen Set



Existing Trailer and Gen Set



Gen Set Eliminator System

# Preliminary Specifications

- Output Voltage (Typical) 208/120 VAC
- Master/Slave Capable Yes
- Time on Battery (At Average Power) 3+ Hours
- Maximum Input Power 150KW
- Maximum Gen-Set Bypass 500KW
- Input Voltage (Nominal) 208 VAC
- Input Frequency 47-63Hz
- Temperature of Operations -20 to +60C
- Environmental Mil-Std 810F
- Onsite Communications Integrated
- Monitor/Control channels 80
- Expandable Yes
- Input/Output Efficiency (Double Conversion) >80% Typical

Subject to Change



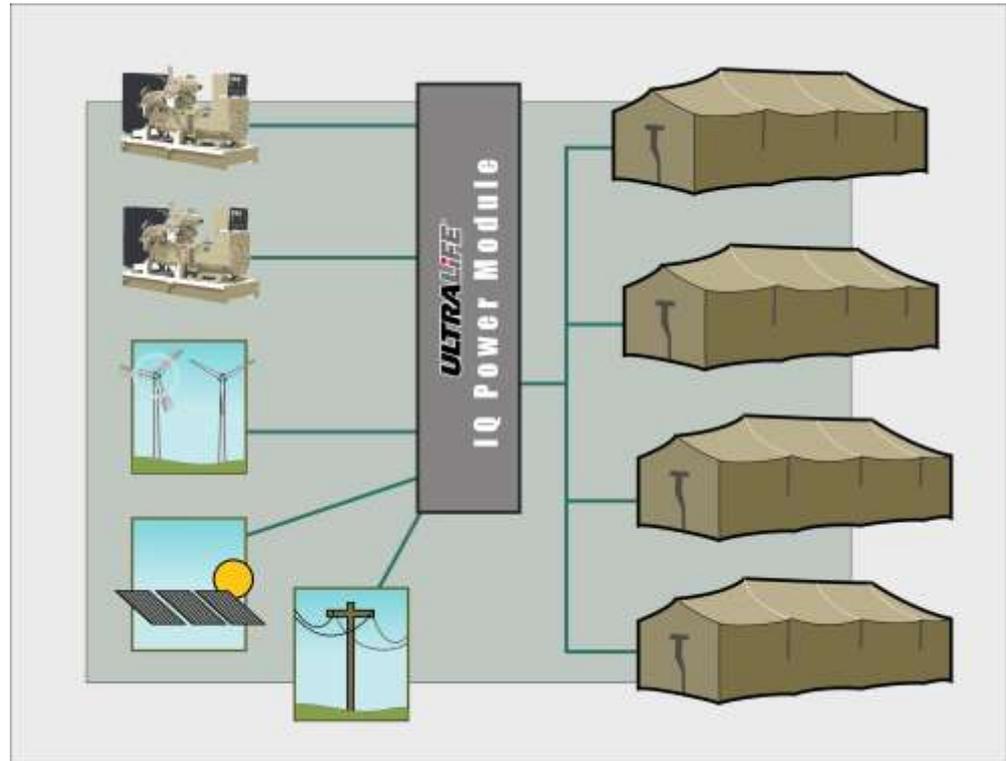
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# Configuration Options

- Trailer mounted systems, with or without renewables
- Skid mounted systems, for Independent Energy
  - Solar Panels
  - Invertor/Rectifier
  - GenSet
  - Batteries
  - Battery development specific to application

# Scalability of Energy Storage Systems

Ruggedized Power Module shown with integrated Solar Panels and Wind Turbines



# System Detail - Programmable



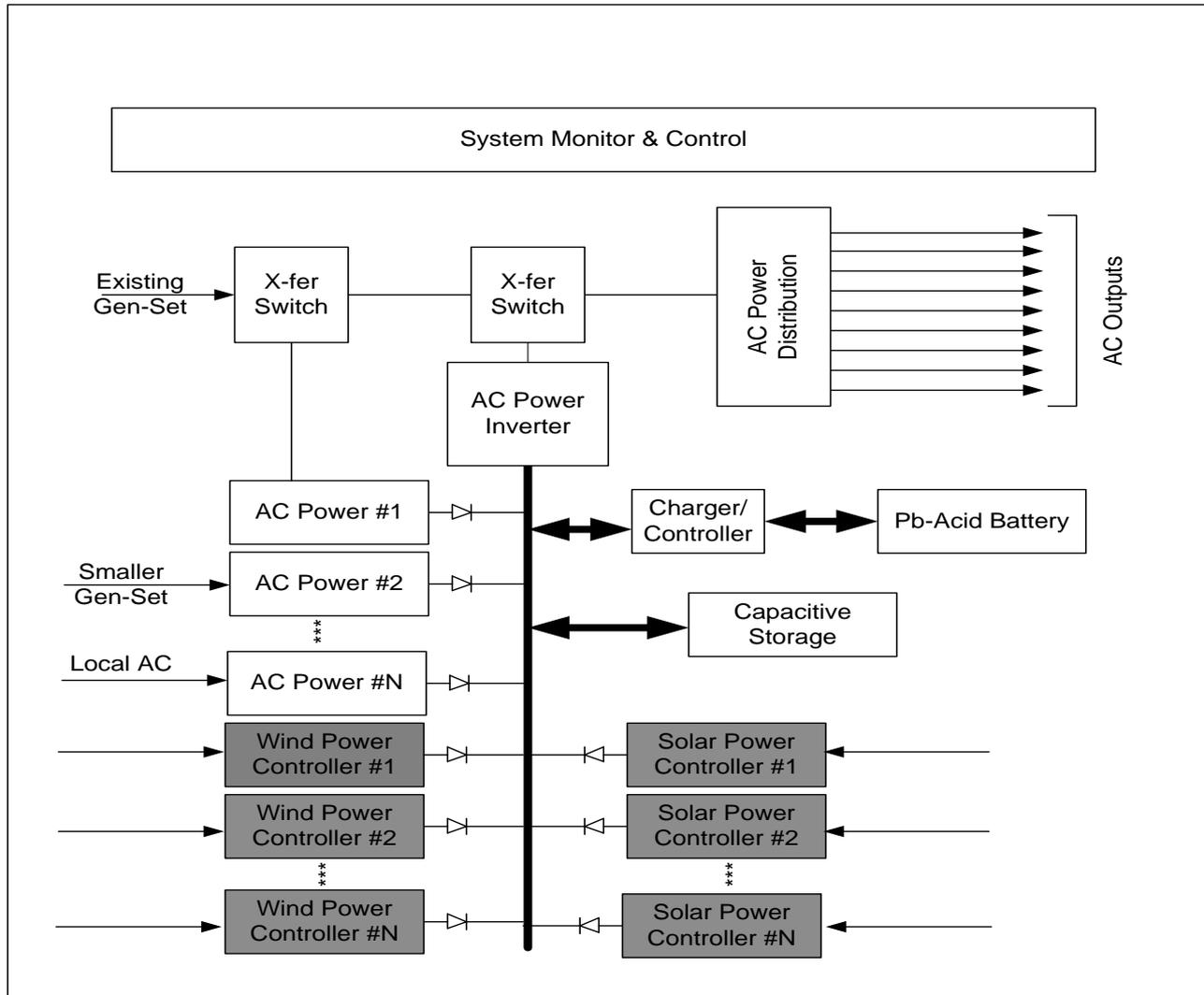
## Software Monitoring

Touch Screen Interface

Sources		Loads						
Gen-Set A	WindC	Critical 1	Critical 2	Critical 3	Critical 4	Critical 5	Critical 6	Critical 7
Gen-Set B	Solar B							
Local AC	Fuel Cell A							
Wind A	Fuel Cell B	Primary 1	Primary 2	Primary 3	Primary 4	Primary 5	Primary 6	Primary 7
Wind B	TBD							
Solar A	TBD							
Storage		Secondary 1	Secondary 2	Secondary 3	Secondary 4	Secondary 5	Secondary 6	Secondary 7
SOC	TAPL							
Temps	Charge							

- Medical Tent
- Guard Lighting
- Comms Tent
- Mess Tent
- A/C Tents 1-5

# Schematic Details



# Batteries Type used for Storage

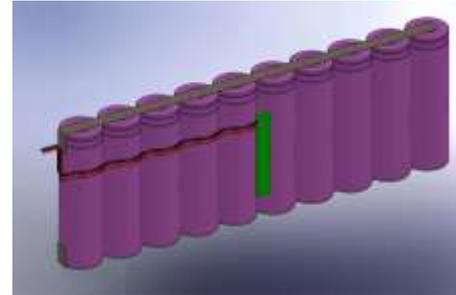


Standard Li-Ion Cobalt Oxide  
Cylindrical 18650 cell before closing

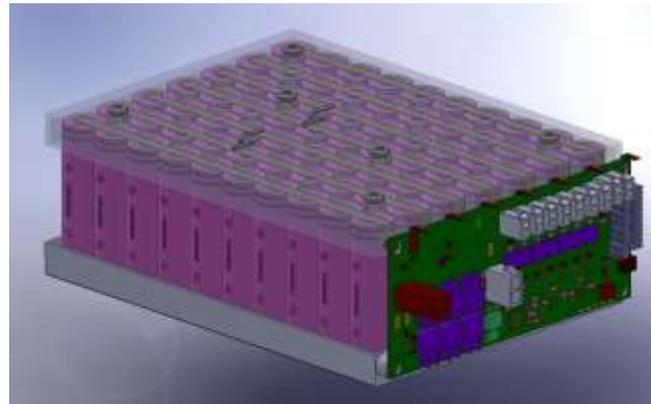
# Li-Ion Battery – Building Blocks

## Design Basic Cell String (10P)

Based on readily available  
mass produced Li-ion  
Cobalt Technology



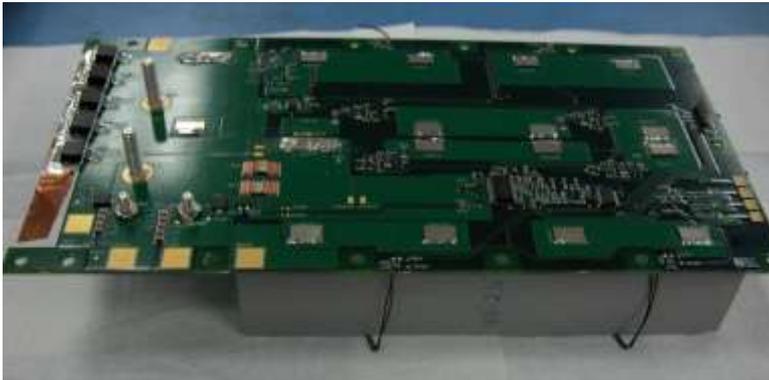
## Basic Brick 7S 10P



**BRICK=**  
**(70 Cells)**

Shown With Integrated Monitoring and  
Control Circuitry Designed and Assembled  
by Ultralife

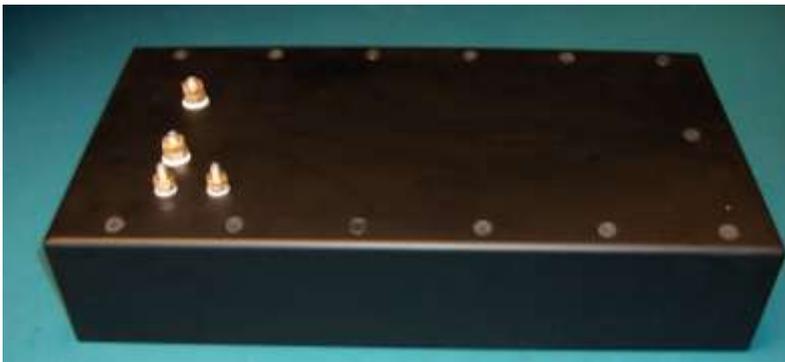
# Testing and Qualification



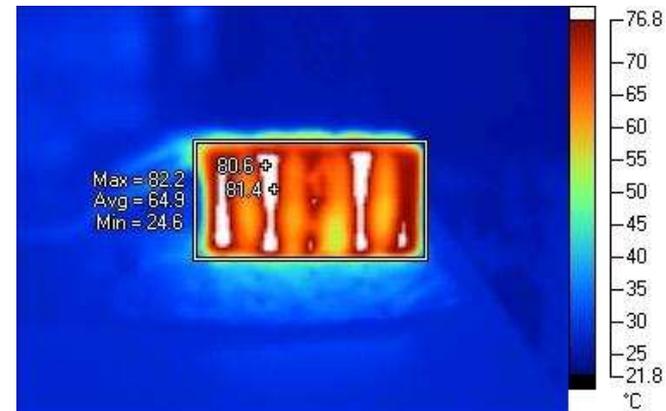
■ Circuit Board Design



■ Cell Arrays (9S4P 26650 )



■ Custom Enclosures



■ Full Diagnostic and  
■ Qualification Capability

# Battery Configuration Options

## Ultralife

36 volt, 30Amp, 24Ahr, 860 Whr

Cells: Panasonic, 18650, 2.4Ah

Pack: 10S10P packs



## Ultralife

BB-2590 Li-Ion Battery

200 W-hrs

# Energy Storage Advantages

- Power monitoring & control
  - Power generation management
    - Reduce diesel on time through energy storage
    - (Run diesel at higher efficiency for short time then shut off)
    - Select / Use / Store Renewable Energy Sources
  - Consumption management
    - Selectively shut down various users
- Power system monitored and managed
- Existing system remains available
- High power quality
- Reduced power outages
- Alternative energy source integrated
- Consolidated alternative energy sources
  - Standardized system configuration
  - Supply Power with no Noise
- Double conversion for power quality
- Battery backup eliminates power loss

# Reduces Operating Expense with Better Power

- Reduction in Diesel Fuel consumption of 25-33% over a standard Diesel Gen-Set operated independently
- Fewer power interruptions - Built in UPS.
- Reduced Thermal and Acoustic Footprint.
- Silent operations with Electrical power intact.
- Reduced Operating Hours on Diesel Gen-Sets in use.
- Reduced Diesel Engine Piling due to more optimal loading.
- Improved system response to short term surge requirements.
- Scalable as required.

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