

Department of Defense
Project Manager Mobile Electric Power (PM MEP)



Tactical Electric Power

Now and for the Future

Mr. Michael Padden
Project Manager

2009 Joint Service Power Expo
May 5-7, 2009
New Orleans, LA

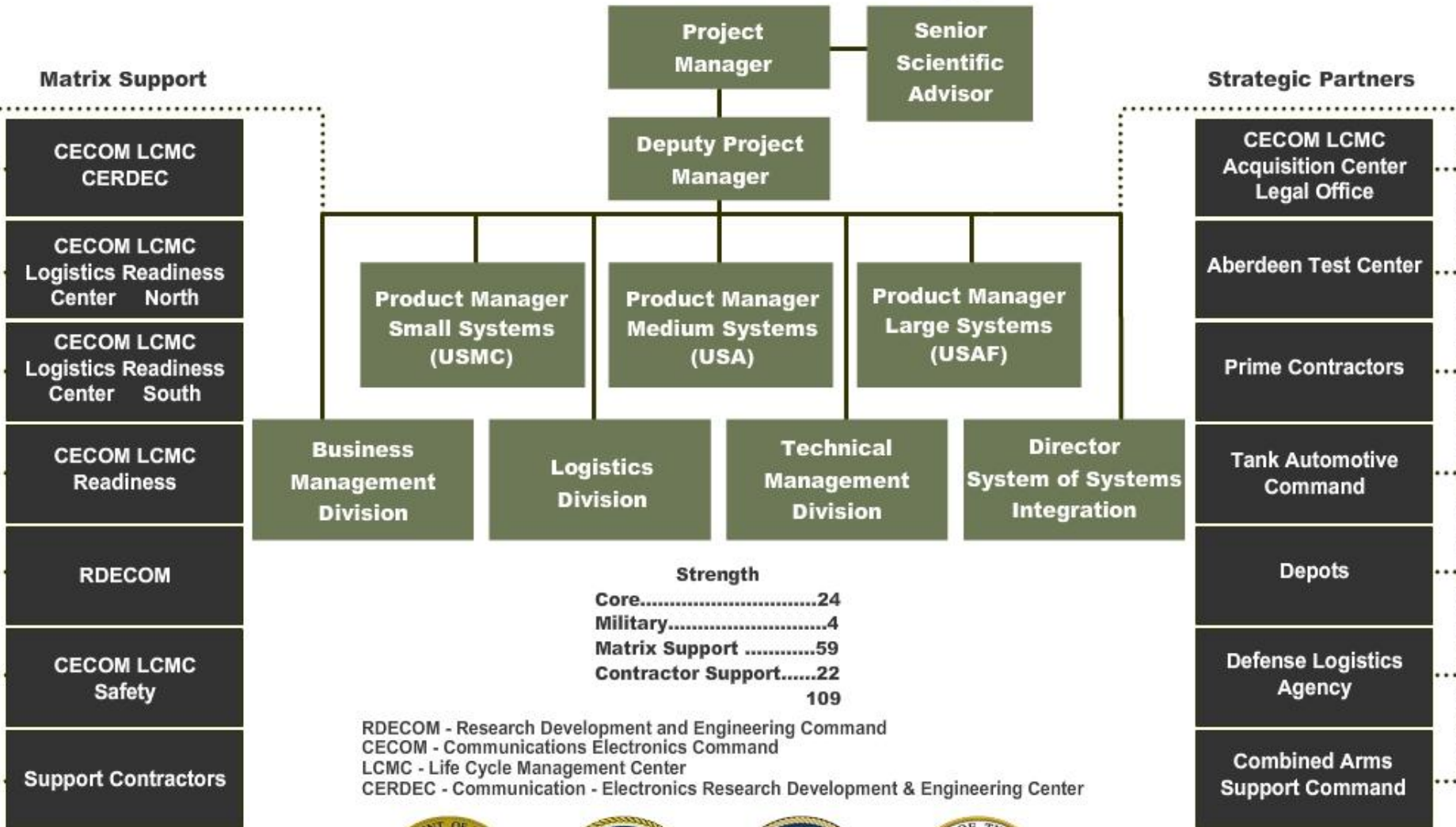
Tactical Electric Power

Now...

Powering the Force



TEAM MEP

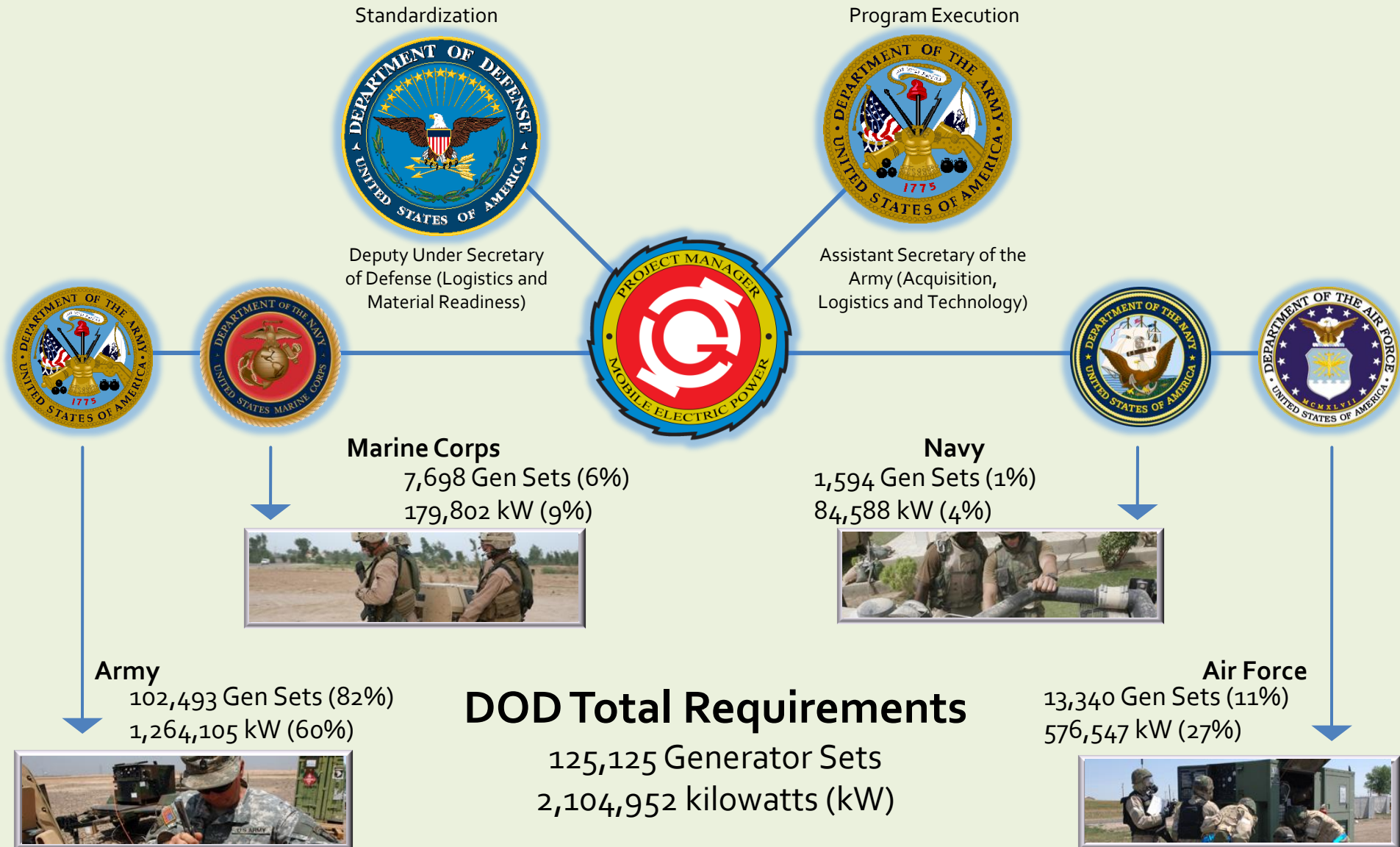


PM MEP Strategic Framework

- Values
 - Integrity – Quality - Innovation
- Mission
 - Provide standardized tactical electric power and environmental control capabilities to the Department of Defense in support of National Security
- Vision
 - Recognized as the Department of Defense leader for innovative power and environmental control solutions; known for the quality of our products and the excellence of our people



PM MEP Executive Agent Mission



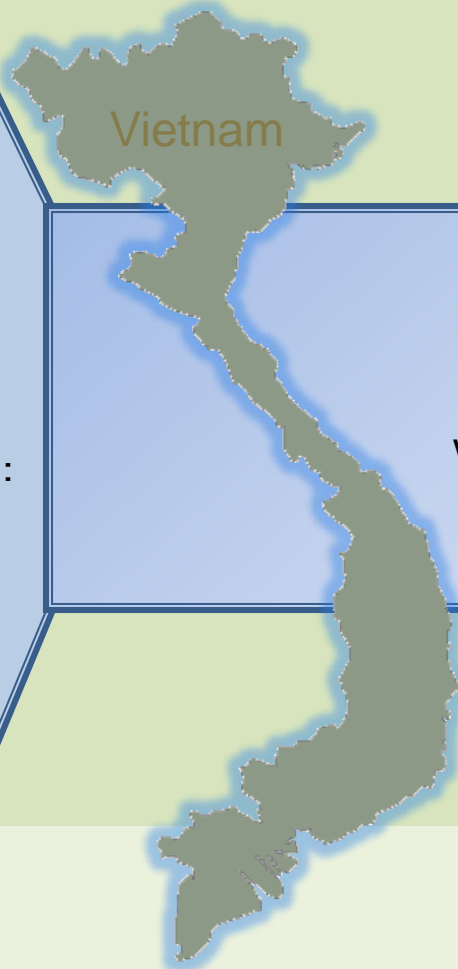
Mobile Electric Power Program History

1965
Southeast Asia

Exorbitant Demand
for Electrical Power

Excessive Proliferation:
2,000 different makes,
models, and sizes

Ineffective Logistical
Support



1967
DOD Ad Hoc
Working Group
Established

- ▶ Identified need for a Department of Defense Standard Family of Mobile Electric Power Generating Sources
- ▶ US Army designated as lead standardization activity
- ▶ Established Project Manager Mobile Electric Power to execute mission
- ▶ Codified in Department of Defense Directive and Joint Operating Procedures

Meeting Operational Needs

- Operation in harsh environments
 - High and low ambient temperatures
 - Dust
 - Reduced acoustic and thermal signatures
 - Low noise
- High performance, rugged systems
 - EMI/EMC/EMP
 - Shock resistance
 - Noise and vibration
 - Resistant to nuclear, biological, and chemical (NBC)
- Deployability and flexibility
 - Interoperability with NATO equipment
 - Fully transportable and mobile
 - Reliability and maintainability
- Advanced control systems and human-machine interfaces
 - Prognostics and diagnostics
 - Automatic sequencing and paralleling



Power Generation and Distribution Programs



2kW



3kW

5kW

10kW

15kW

30kW

60kW

100kW

200kW

Military Tactical Generator

Tactical Quiet Generators

Deployable Power Generation & Distribution System (DPGDS)



840kW



Power Units/Power Plants (PU/PP)



Power Distribution Illumination System Electrical (PDISE)

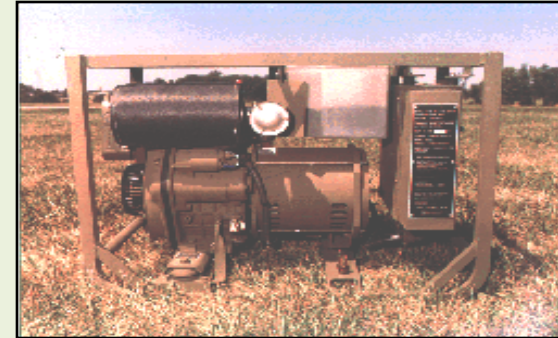
Small 2kW Military Tactical Generator

CHARACTERISTICS/PERFORMANCE:

Fuel	Diesel/JP-8
Noise	79 dBA
Reliability	500 hrs MTBF
Weight (Wet)	138 lbs DC / 158 lbs AC
Size	5.95 cu ft
Operating Temp	-50° to +120°F
Altitude	2kW @ 4000ft/120 F de-rated up to 8000ft
Fuel Capacity	4 hours @ 100% Load
Fuel Consumption	.33gal/hr
ORD –LT2kW	14 Jul 1992

CONTRACTOR:

Dewey Electronics, Oakland, NJ



EQUIPMENT USES:

- Modern Burner Unit, Mobile Kitchen Trailer (MKT)
- RQ-7A Tactical Unmanned Aerial Vehicle (TUAV)
- Enhanced Position Location Reporting System (EPLRS)
- High Mobility Artillery Rocket System (HIMARS)
- Assault Hose System (AHS)
- Woodworking Set
- M77A2 155mm Howitzer

Small 3kW Tactical Quiet Generator

CHARACTERISTICS/PERFORMANCE:

Fuel	Diesel/JP-8
Noise	70 dBA @ 7m
Reliability	>560 hrs MTBOMF
Weight (Wet)	326 lbs
Size	15.05 cu ft
Operating Temp	-25° to +120°F
Altitude	3kW @ 1000ft/107 F de-rated up to 8000ft
Fuel Capacity	8 hours + Auxiliary
Fuel Consumption	.33gal/hr
ORD – CGSA ROC w/Revision	1995

CONTRACTOR:

DRS Fermont, Bridgeport, CT



EQUIPMENT USES:

- Mobile Subscriber Equipment (MSE)
- Joint Biological Point Detection System (JBPDS)
- Patriot/Terminal High-Altitude Area Defense (THAAD)
- Lightweight Water Purification (LWP) System
- Maintenance tent lights and battery charging system

Medium (5-60kW) Tactical Quiet Generators (TQG)

CHARACTERISTICS/PERFORMANCE:

- Decreased weight and cube
- Improved mobility/transportability
- Improved survivability
- Single fuel on the battlefield (diesel/JP-8)
- Reduced fuel consumption
- Increased interoperability
- Increased reliability
- Improved ease of operation/maintenance/repair
- Stringent power quality
- Sustained power output in extreme climatic and environmental conditions

Compared to MIL\STD generator sets which TQGs replace

CONTRACTOR:

DRS Fermont, Bridgeport, CT

L-3, Tulsa, OK



EQUIPMENT USES:

- Command Posts
- Weapon Systems
- Aviation Ground Support
- Water Purification Systems
- Laundry Units
- Bakery Plant
- Printing Plant
- Refrigeration Systems

Large 100/200kW Tactical Quiet Generator

CHARACTERISTICS/PERFORMANCE:

	100 kW	200kW
Fuel	Diesel/JP-8	Diesel/JP-8
Fuel Tank Capacity (gal)	66	128
Fuel Consumption (gal/hr)	7.8	13.9
Oil Capacity (quarts)	30	36
Dimensions (L-W-H)	106" - 40" - 65"	114" - 50" - 75"
Size (Cu ft.)	160	250
Weight (lbs)	6100	9300
Noise	74 dbA@7m	78 dbA@7m
Voltage	120/208V Three Phase	120/208V Three Phase
	240/416V Three Phase	240/416V Three Phase
Frequency	50/60 Hz	50/60 Hz
Reliability	1250 hrs MTBF	600 hrs MTBF
Operating Temp	-25°F to +120°F	-25°F to +120°F
Altitude	Rated power to 4000ft/95°F	Rated power to 4000ft/95°F
Automatic Paralleling Between Sets		



EQUIPMENT USES:

- Medical Facilities
- COSCOMs
- Hospitals
- Homeland Defense
- Military Intelligence
- Special Operations Command
- IBCT

CONTRACTOR:

DRS Fermont, Bridgeport CT

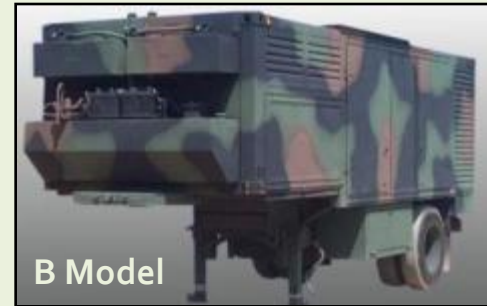
MTBF – Mean Time Between Failure
 COSCOM – Corps Support Command
 IBCT – Infantry Brigade Combat Team



Deployable Power Generation & Distribution System (DPGDS) 840kW (Prime Power)

CHARACTERISTICS/PERFORMANCE:

Fuel	Diesel/JP-8
Fuel Tank Capacity (gal)	120
Fuel Consumption (gal/hr)	60
Oil Capacity (gal)	13
Dimensions (L-W-H)	277" – 98" – 122"
Size (Cu ft.)	1920
Weight (lbs)	30000
Noise	85 dbA@7m
Voltage	2400/4160V Three Phase 2200/3800V Three Phase
Frequency	50/60 Hz
Reliability	950 MTBF
Operating Temp	-25°F to +125°F
Altitude	Rated power to 4000ft/95°F



EQUIPMENT USES:

- Prime Power (249th EN BN)
- Forward Operating Bases
- THAADs
- JLENS
- AVCRAD
- MUSE

CONTRACTOR:

DRS Technical Services, Herndon VA

MTBF – Mean Time Between Failure
249th EN BN – 249th Engineer Battalion (Prime Power)
THAADs – Terminal High Altitude Area Defense System
JLENS – Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System
AVCRAD – Aviation Classification and Repair Depot
MUSE – Mobile Utilities Support Equipment



Power Units/Power Plants (PU/PP)

PU/PP PRODUCT DESIGN

- Power Unit (PU)
 - One generator set mounted on one trailer
 - 5kW, 10kW, 15kW, 30kW, and 60kW TQGs mounted on 1T, 2 ½T, or 5T trailer, towed by HMMWV, 2 ½T, or 5T truck
 - 20 separate models
- Power Plant (PP)
 - Two generator sets with switchbox and ancillary equipment mounted on one or two trailers (depending on generator set size and weight)
 - 3kW, 5kW, 10kW, 15kW, 30kW, 60kW and 100kW TQGs mounted on 1T, 1 ½T, 2 ½T or 5T trailer, towed by HMMWV, 2 ½T, or 5T truck
 - 14 separate models



TQG = Tactical Quiet Generator
HMT = High Mobility Trailer
HMMWV = High Mobility Multi-purpose
Wheeled Vehicle

Power Distribution Illumination System Electrical (PDISE)

CHARACTERISTICS/PERFORMANCE:

Two feeder systems (M200 & M100)
Two distribution systems (M40 & M60)
Utility receptacle and lighting system (M46)
Operating Temp -25 F to +140 F

	<u>M200</u>	<u>M100</u>	<u>M40</u>	<u>M60</u>	<u>M46</u> <u>Utility Kit</u>
Weight (lbs)	140	77	55	45	85
Line distance from generator to load is 300 ft (91.4m) at maximum load.					



EQUIPMENT USES:

- Used extensively throughout the Army

CONTRACTOR:

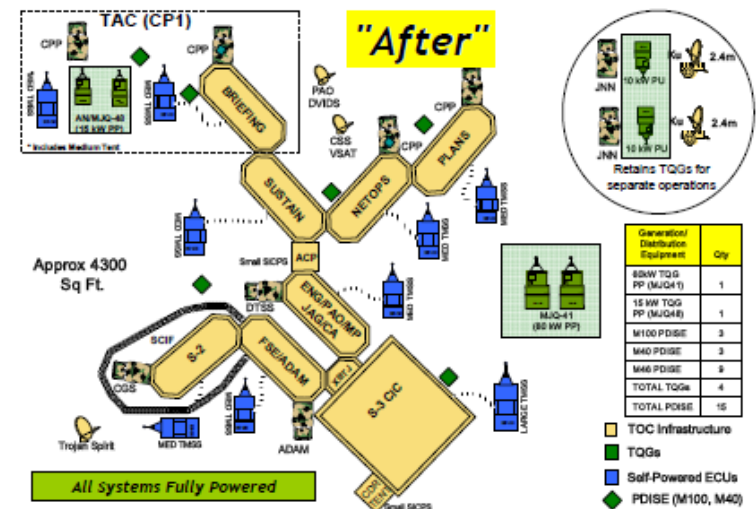
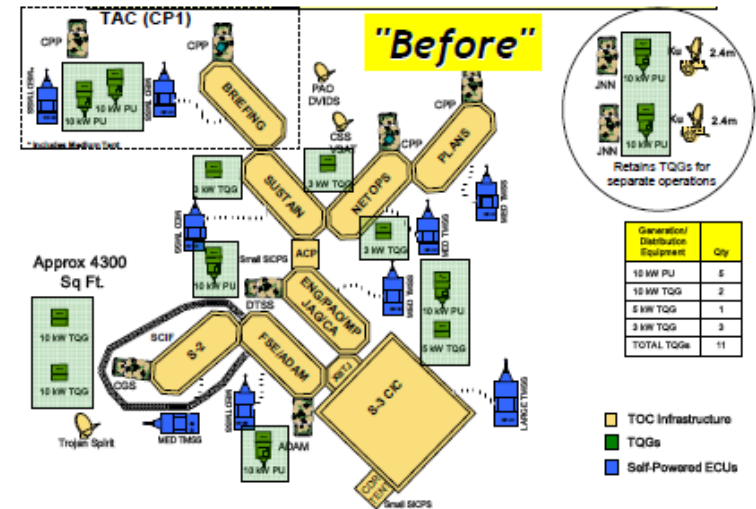
Fidelity Technology Corporation, Reading PA



Command Post Central Power

Benefits and Savings

- ▶ Soldier Safety
- ▶ 24/7 operation of mission-critical equipment
- ▶ Reduction in spare parts, maintenance, fuel consumption
- ▶ Organically supported
- ▶ Reduce Division fuel consumption by 275k gallons per year
- ▶ Reduce Division maintenance by 71k hours per year
- ▶ Reduce carbon dioxide emissions by 2400 tons per year



Total Net Present Value Savings

- ▶ \$5 million: 15 year peacetime scenario
- ▶ \$150 million: 10 year peacetime/5 year low intensity conflict
- ▶ \$200-250 million: 10 year peacetime/5 year high intensity conflict

Department of Defense Project Manager Mobile Electric Power 2008 Accomplishments

- Produced **9,923** generators
- Issued **11,577** generators
 - Fielded **130** Units with **1,798** generators
 - Completed **562** supply transactions with **5,674** generators
- Filled **274** customer orders with **4,105** generators
 - Other Services - **189** orders with **2,818** generators
 - Foreign Military Support – **16** orders with **163** generators
 - Other Army – **69** orders with **1,124** generators
- Trained **298** maintainers and **321** operators



Power and Environmental Control Migration

Past

Environmental Control Units

Military Standard Environmental Control Units



Electric Power Generation

Military Standard Generators



Electric Power Distribution

Distribution Illumination Systems Electrical (DISE)



Present

Improved Environmental Control Units



Tactical Quiet Generators



Power Distribution Illumination Systems Electric (PDISE)

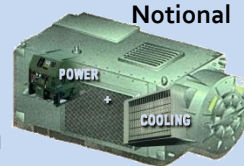


Central Power Solution

Future

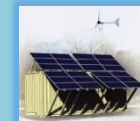
Central Cooling Solution

Co-Generation



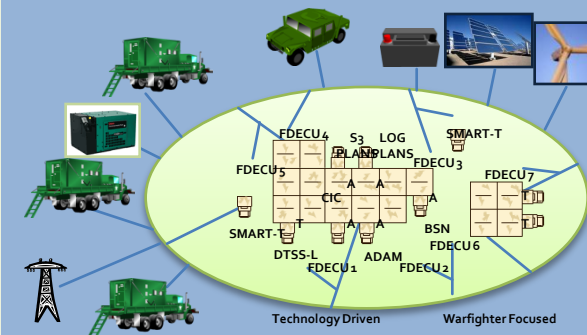
Next Generation Power Sources

- ▶ AMMPS
- ▶ LAMPS
- ▶ STEP



Alternative/Hybrid Energy

Intelligent Power Distribution



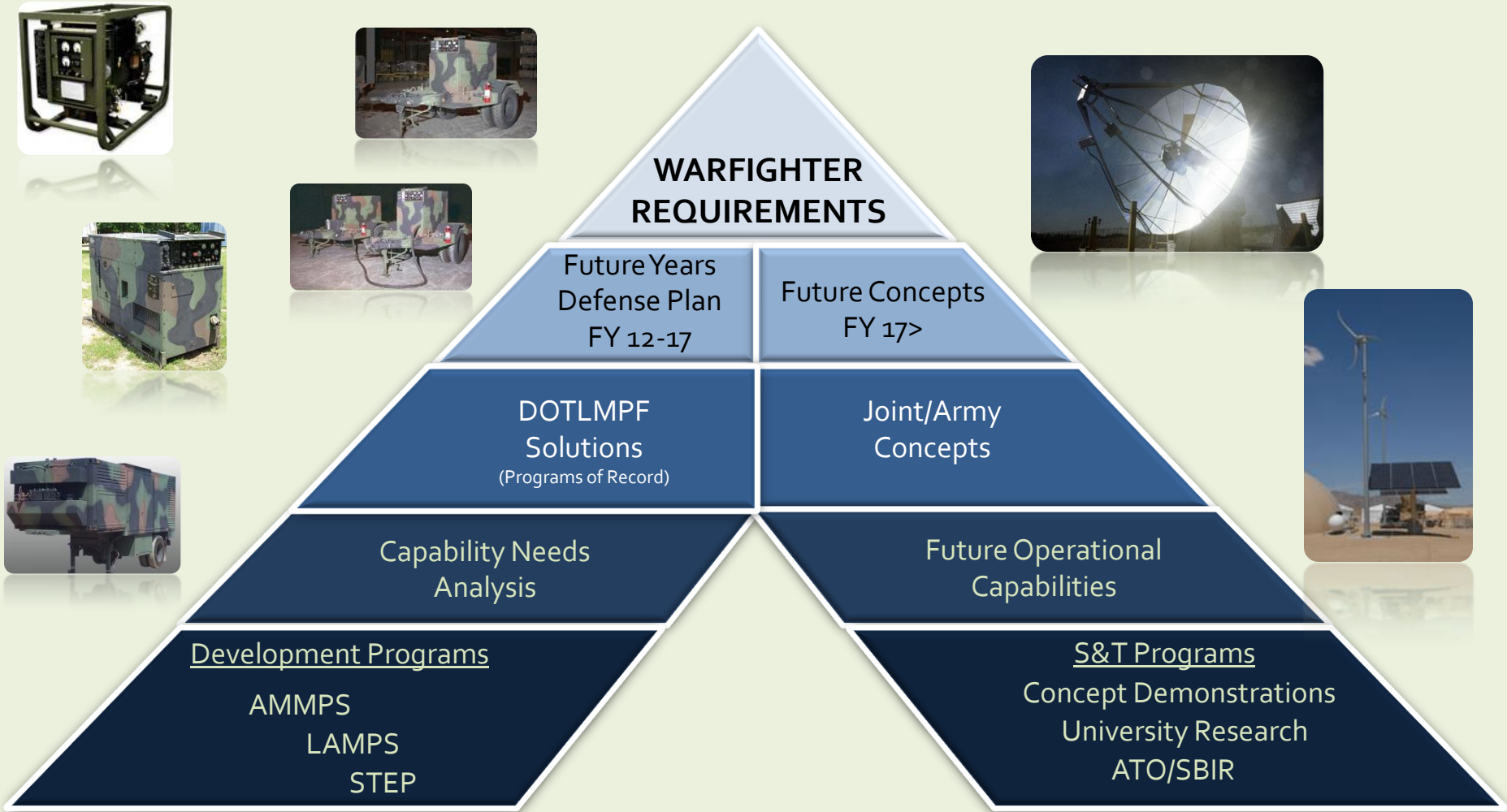
Tactical Electric Power

...the Future

Powering the Force



Hierarchy of Tactical Electric Power Requirements



DOTLMPF: Doctrine, Organizations, Training, Leader Development, Materiel, Personnel and Facilities
 AMMPS: Advanced Medium Mobile Power Sources
 LAMPS: Large Advanced Mobile Power Sources
 STEP: Small Tactical Electric Power

S&T: Science and Technology
 ATO: Army Technology Objective
 SBIR: Small Business Innovation Research

Advanced Medium Mobile Power Sources (AMMPS)



- Third generation of Mobile Electric Power Generating Sources
- Replaces Tactical Quiet Generators (TQG)
- Employs advanced technologies to enhance power generation capability, improve engine control to achieve improved fuel efficiency, increase system reliability, reduce system size and weight, increase survivability for military applications, and reduce total ownership

- 5kW-60kW
- Multi-fuel (JP-8, JP-4, DF-1, DF-2, DF-A)
- Reduced noise and IR signature
- More reliable
- Less weight
- HAEMP protected
- Total package fielding (logistically supportable)
- Power Units/Power Plants
- Less cost (procurement, support cost)
- Transportable (External Airlift Transport [EAT], 5 & 10kW air drop)



Improved Environmental Control Units (IECU)



- Form, fit and function replacement of MIL-STD ECUs
- Use R-410A refrigerant, the commercial industry's standard
- Fully operable up to 125 °F
- Ruggedized for military environments
- Reduced power consumption up to 25%
- Reduced weight up to 30%
- Increased reliability 200% over current MIL-STD ECUs
- Soft start, limited inrush current
- NBC compatible and EMI protected
- Embedded diagnostics



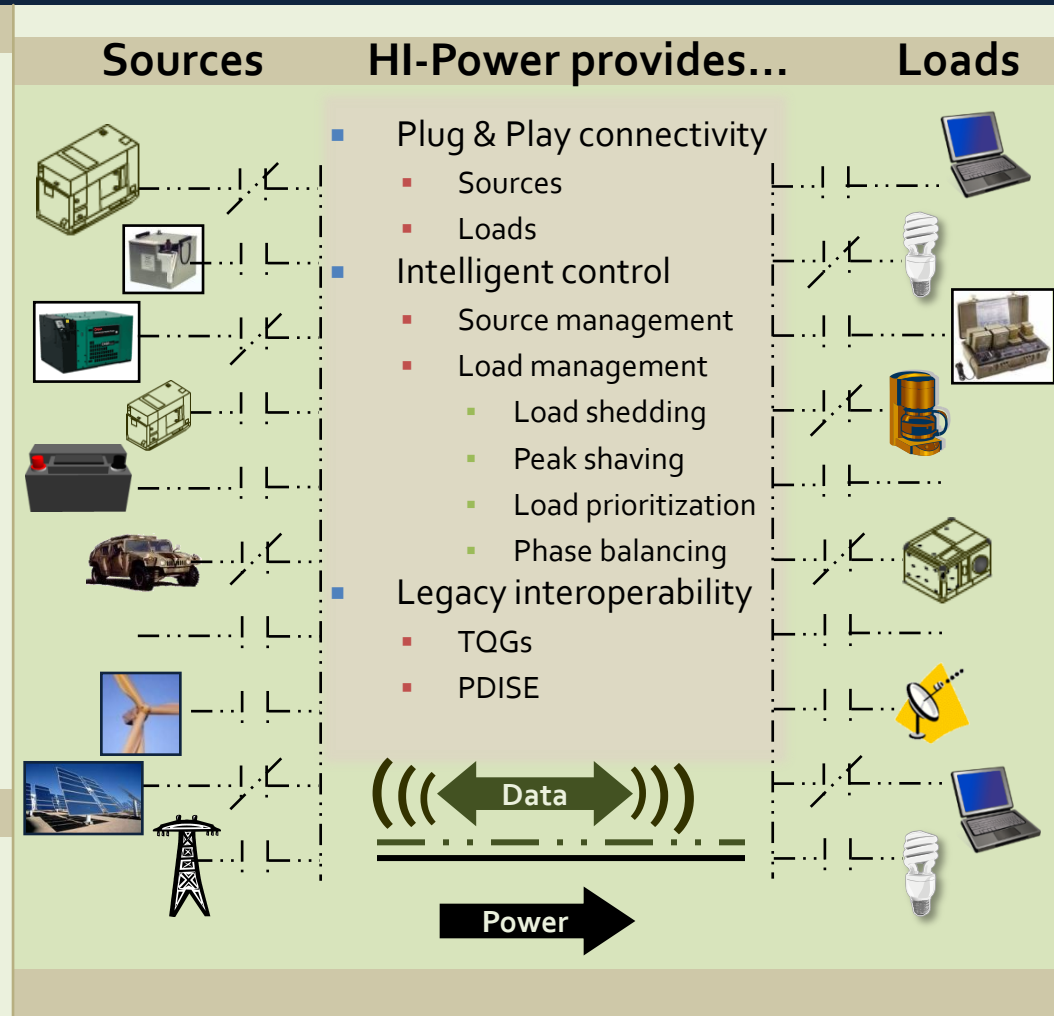
Hybrid Intelligent Power (HI-Power)

Project Objective:

- To develop a general Hybrid Intelligent Power Management architecture that demonstrates
 - Feasibility of Autonomous source and load side management
 - Compatible interface and operation with legacy equipment
 - Reduction in fuel consumption by >25%
 - Fault tolerance and ability to handle transient events
 - Ability to automatically parallel multiple sources
 - Scalability/Flexibility from 2kW – 200kW
 - Plug and Play Capability

Project Execution:

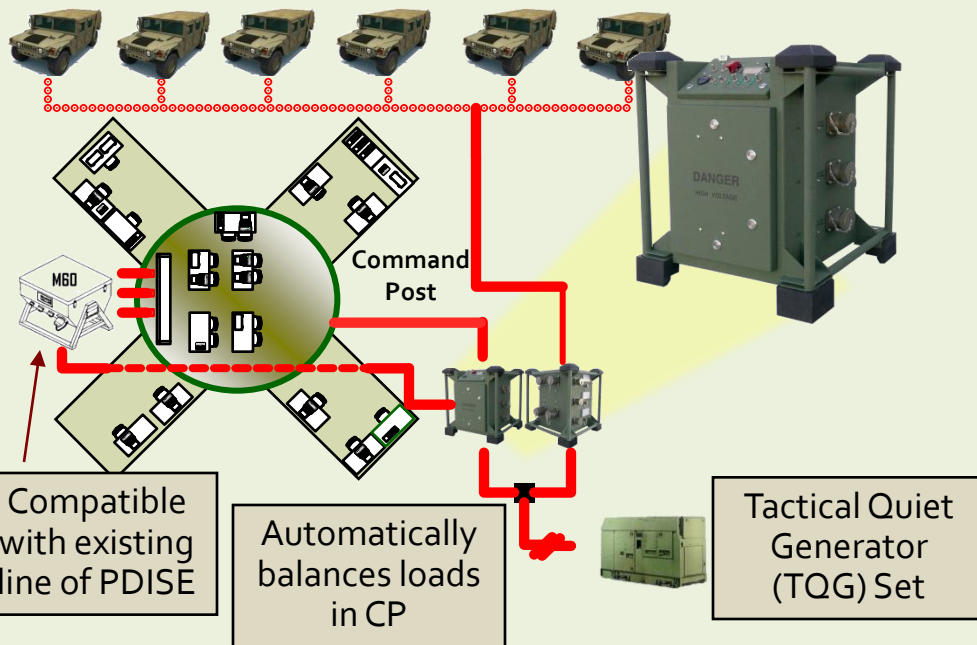
- OSD funded
- PM MEP Program Lead
- CERDEC Technology Lead
- Support contracts
 - Electricore, Inc.
 - I-Power Energy Systems, LCC



OSD – Office of the Secretary of Defense
 CERDEC – Communications and Electronics Research Development and Engineering Center
 TQG – Tactical Quiet Generator
 PDISE – Power Distribution Illumination System Electric

Intelligent Power Management

Vehicles: *Connect as Mission Requires*



Project Objective:

- Power management for Command Posts
- Reduced training needed to establish and maintain an effective power grid
- Improved utilization of power assets
- Reduced fuel consumption
- Compatibility with current line of PDISE power distribution equipment
- Automatic Phase Load Balance
- Input Qualification & Power Management
- Rugged Design for Environmental Survivability

Project Execution:

- Defense Acquisition Challenge Program co-funded by PM-MEP
- PM MEP will transition to production and fielding in 2011.

Net Zero Plus (NZ+)

Joint Capabilities Technology Demonstration

Project Objective: Demonstrate a Forward Operating Base operating on reduced energy consumption.

DEMAND

Enduring energy efficient structures and technologies reduce energy consumption through minimized air infiltration, low power devices, and efficient environmental control.

ENDURING ENERGY EFFICIENT STRUCTURES



External Insulation for Temporary Structures



Monolithic Domes

INFRASTRUCTURE

A system of distribution that precisely measures, analyzes, and connects the flow of power between energy consuming and producing devices

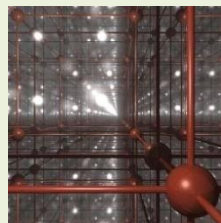
DISTRIBUTE, MANAGE, MONITOR, STORE, METER



Utility Survey



Remote Metering/Assessment

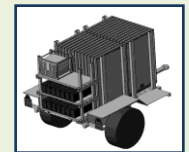


Intelligent Power Management



SUPPLY

Reduces fuel consumption by generating power through a combination of renewable, traditional and alternative power generation



Renewable/Hybrid Power

Project Execution:

- Operational Manager: CENTCOM
- Technical Manager: OSD PSTF
- Transition Manager: PM MEP

Enhanced-Tactical Hybrid Electric Power System (eTHEPS)

Project Execution:

- Project Manager, Mobile Electric Power Initiative with Department of Energy National Renewable Energy Lab
- “Power Block” based on advanced power electronic interfaces
- Follow-on to initial THEPS effort by the Rapid Equipping Force and leveraging microgrid efforts underway at TARDEC, Corps of Engineers, and Defense Logistics Agency



Project Objective:

- Single Point-Source System, but can interface with other sources
- Hybrid Capability
- Plug & Play connectivity
 - Sources
 - Loads
- Intelligent control
 - Source management
 - Load management
 - Load shedding
 - Peak shaving
 - Load prioritization
 - Phase balancing
- Phase balancing
- Legacy interoperability



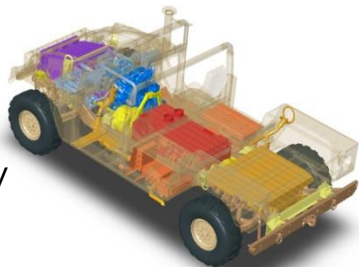
Tactical Intelligent Power System (TIPS)

Project Execution:

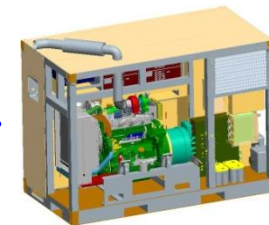
- Cooperative Research and Development Agreement with DRS Inc.
- Based on hybrid electric HMMWV technology
- 75kW rating with additional 18kW peak capability
- Li-ion battery backup

Project Objective:

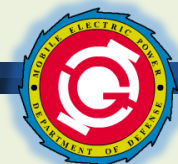
- Enable full-load/high efficiency operation; engine off power at low loads
- Intelligent control system for load prioritization and source control
- System to be tested Spring 2009 to quantify benefits



Similar Systems Approach
And Capabilities across
the Power Spectrum for Mobile
and Fixed Applications



Tactical Intelligent
Power System



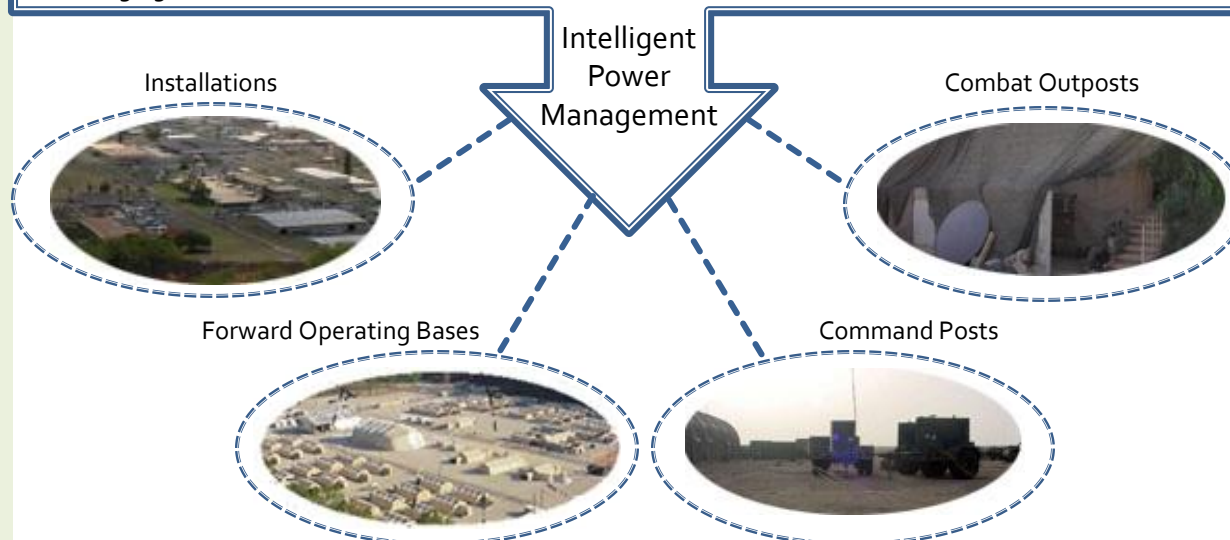
Battlefield Power Architecture Vision

■ Approach

- Holistic Power Architecture
- Scalable, Integrated Micro-grids
- Intelligent Power Management
- Distributed Power Sources
- Plug-and-Play Capability

■ Benefits

- Increased Capability
- Improved Efficiency
- Reduced Fuel Consumption
- Smaller Logistics Footprint
- Power Surety



Battlefield Electric Power Integration

Powering the Force



OSD Energy Strategic Objectives

- Maintain or enhance operational effectiveness while reducing total force energy demands
- Increase energy strategic resilience by developing alternative/assured fuels and energy
- Enhance operational and business effectiveness by institutionalizing energy considerations and solutions in DoD planning and business processes
- Establish and monitor Department-wide energy metrics



2006 – SECDEF creates DDRE Energy Security Task Force & directs Defense Science Board to evaluate/propose Energy Strategy

2007 – ESTF analysis results in \$300M+ plus-up in Power & Energy

2008 – DSB releases Final Report on DOD Energy Strategy

2008 – Congress directs OSD establish an “energy czar” position



2008 – Army establishes Energy Security Task Force to develop way-forward

2008 – Army establishes Senior Energy Council & establishes a Senior Executive position responsible for energy activities

Battlefield Fuel Consumption

Generators are the Army's single largest user of fuel on the battlefield during wartime.*

Category	Peacetime OPTEMPO	Wartime OPTEMPO
Combat Vehicles	30	162
Combat Aircraft	140	307
Tactical Vehicles	44	173
Generators	26	357
Non-Tactical	51	51
Total	291	1040

Army Fuel consumption in peacetime and wartime
(million gallons per year)



*Report of the Defense Science Board Task Force on DoD Energy Strategy

Battlefield Electric Power Challenges

- Integrated and Intelligent Battlefield Power Management
- On-board Vehicle Power (APUs, hybrids, energy storage)
- Large Power Sources
 - Forward Operating Bases/Combat Outposts
 - Prime Power/Directed Energy Weapons Systems
- Low Power Systems
 - Soldier power (battery replacements or hybrids)
 - Battery standardization
 - Unattended ground sensors power
- Fuel reduction and use of alternative renewable energies



PM MEP Initiatives

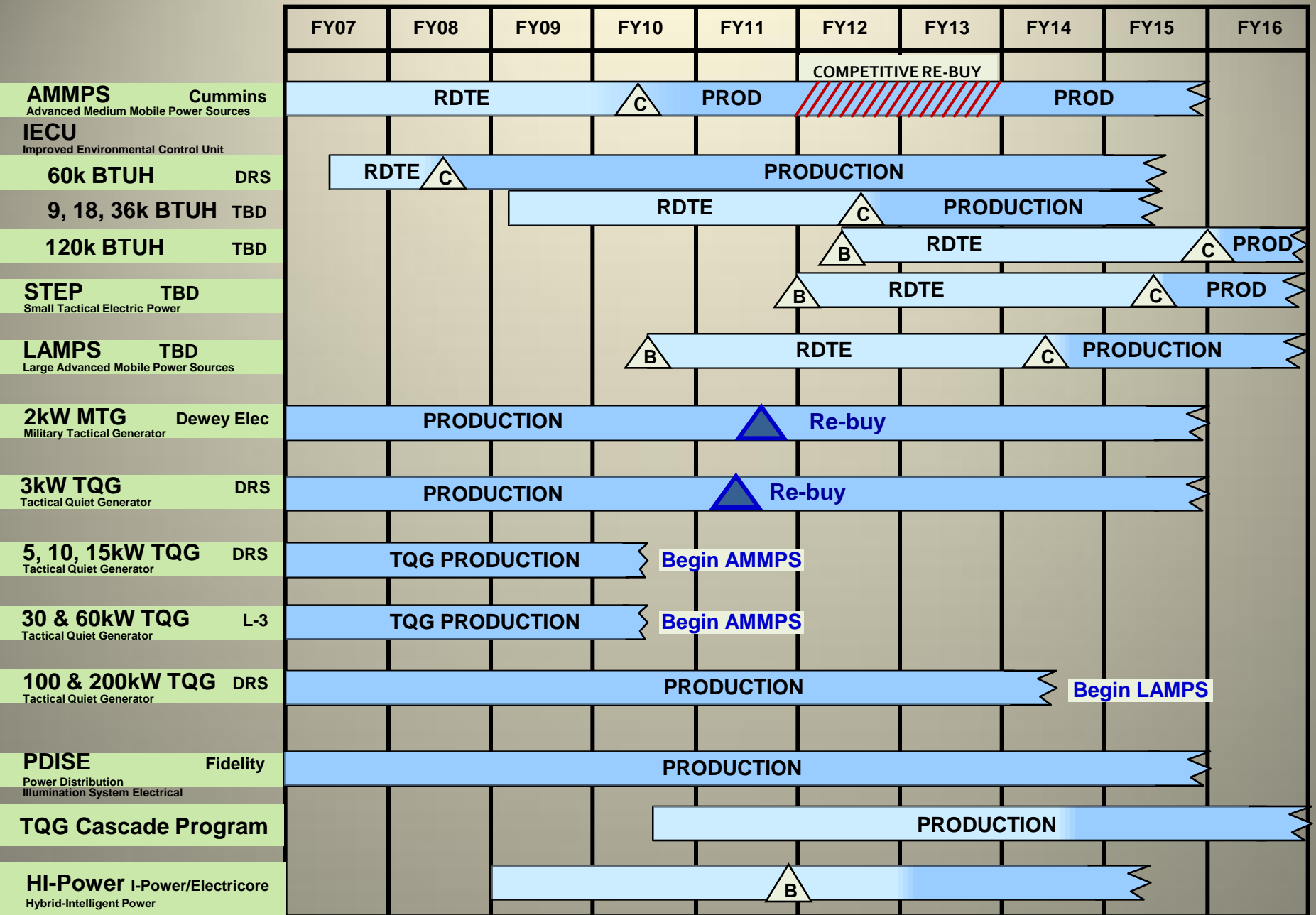
- Designated as the Army's System of Systems Integrator for Battlefield Electric Power
 - Identify current and planned electric power generation/consumption requirements
 - Identify/characterize Forward Operating Base/Combat Outpost power requirements
 - Develop integrated battlefield electric power architecture
- Establishing Product Director for Batteries
 - Central authority for development and acquisition
 - Develop standard family of batteries for military application
- Developing improved Intelligent Power Management and Hybrid-Intelligent Power (HI-Power) systems architectures
- Developing Prototype Hybrid Energy Systems

Business Opportunities

Powering the Force



Tactical Electric Power and IECU Programs



Planned Upcoming Business Opportunities

- 120k BTUH Co-generation: market survey 3QFY 2009/prototype procurement 4QFY2009
- HI-Power Phase II BAA: contract awards 3QFY2009
- Tactical Quiet Generator Cascade Program: RFP 3QFY 2010/contract award 1QFY2011
- Small Power Sources Production Rebuy (2 & 3kW generators) FY2011
- Advanced Medium Mobile Power Sources (AMMPS) competitive re-buy: FY2011 or 2012
- Large Advanced Mobile Power Sources (LAMPS) development: contract award 3QFY2010
- Small Tactical Electric Power (STEP) systems development: contract award 1QFY2012

BTUH – British Thermal Units per Hour
RFI – Request for Information
BAA – Broad Area Announcement
RFP – Request for Proposal

Wrap-up

Powering the Force



Points of Contact

www.pm-mep.army.mil

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- **LTC Gordon (Tim) Wallace (USA)**

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- **Lt Col Bob Thoens (USAF)**

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