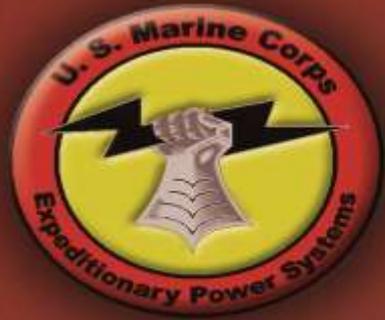




MARINE CORPS SYSTEMS COMMAND

EQUIPPING THE WARFIGHTER TO WIN



Marine Corps Renewable Energy and Microgrid Efforts

Clint Justin Govar
Joint Service Power Expo
Myrtle Beach, SC

May 1-5, 2011





- What Drives Marine Corps Power Acquisition?
- MCSC Micro Grid/hybrid generator efforts
- Expeditionary Solar 101
- MCSC renewable energy efforts



Special Purpose MAGTF

~ As required
(Inf Co ~ 72 hrs Sustainment)

Marine Expeditionary Unit (MEU)

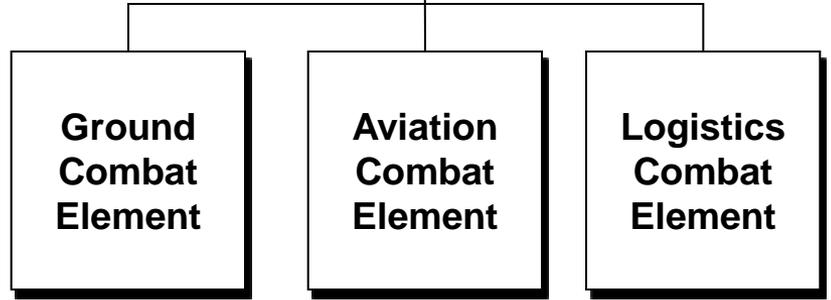
~ 1500 - 3K Marines
(15 days of supply)

Marine Expeditionary Brigade (MEB)

~ 3 - 20K Marines
(30 days of supply)

Marine Expeditionary Force (MEF)

~ 20 - 90K Marines



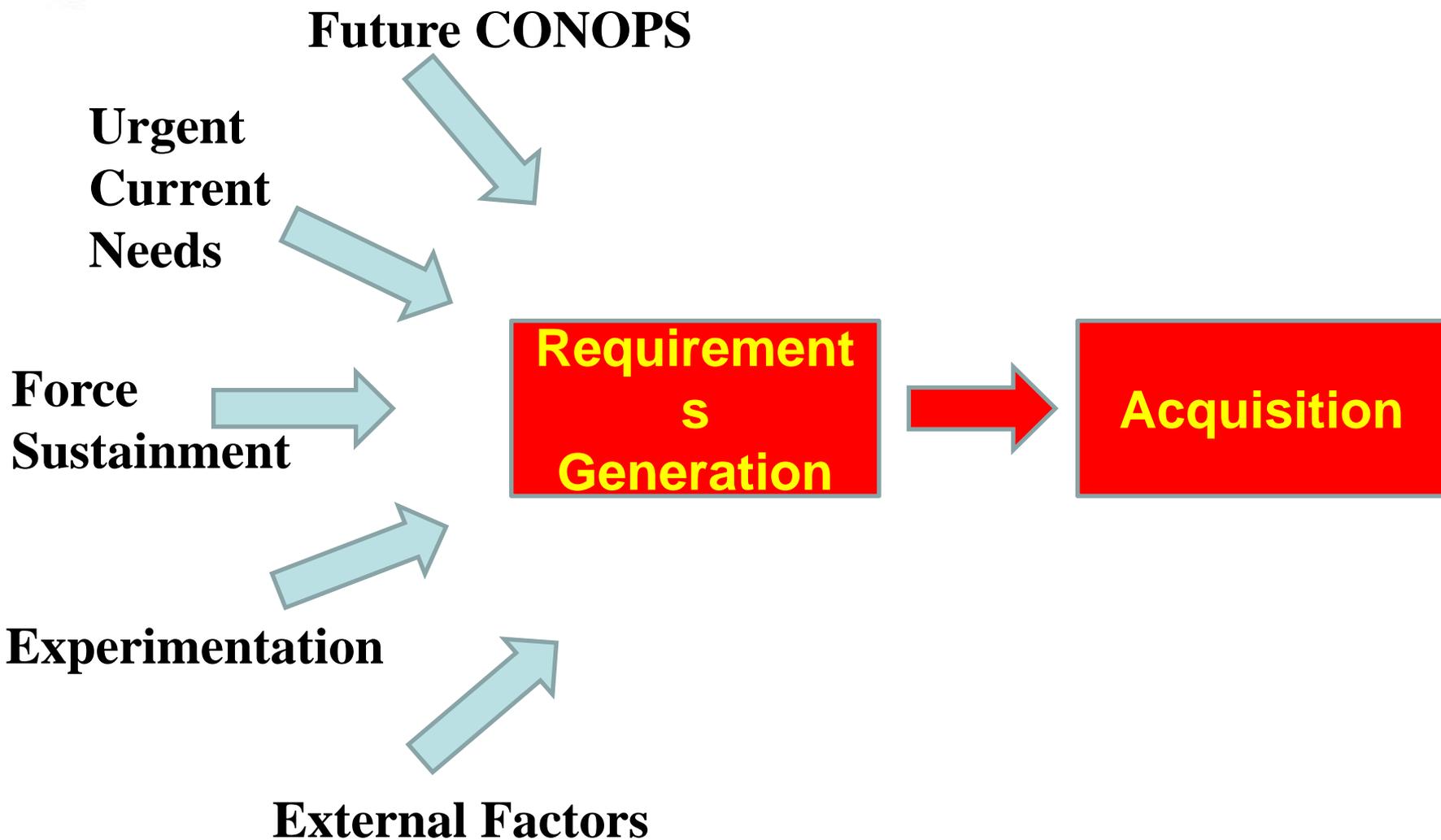
Tasked organized, self sustaining, Naval based force



- **Frequently Moved**
- **Wide Energy Tool Box**
- **Space and Weight are at a Premium**
- **Energy Efficiency (Logistic Burden)**
- **Unique Transportation Requirements**
 - Deploying via ship, air or tactical vehicle
 - Surf landing and cross-deck loading
 - EMI from shipboard systems
 - Shipboard stowage / transport (Lithium Batteries)
 - Supply / resupply is from the Naval / Pre-Positioned Forces



<u>Individual Marine (carried):</u>	Assault Load < 75#, Existence < 150#
<u>Lifted by Marines / Loose Cargo:</u>	One person lift – 44 pounds
<u>Requiring Forklift / Material Handling:</u>	> 400 pounds
<u>HMMWV Trailer Towable:</u>	> 2700 pounds
<u>Medium Tactical Truck Carried:</u>	< 7 tons (off road), 10 tons (on road)
<u>Heavy Tactical Truck Carried:</u>	< 16 tons (on road)
<u>MV-22 Tilt-Rotor Lift:</u>	< 4 tons (internal)*, 7.5 tons (external)
<u>CH-53 Helicopter Lift:</u>	< 5 tons (internal)*, 14 tons (external) * psi limitations apply





- **User Requirement (Formulation, Resolution, Validation)**
- **Acquisition Lead Time (process, policy, people)**
- **Contracting Lead Time (policy, legal, audit)**
- **Technology Development, Demonstration, Maturation**
- **Transition from Development to Production**
- **Suppliers and Parts Long Lead Times**
- **Development of Logistics Supportability**
 - **Development of Training Materials**
 - **Training of Personnel**
 - **Operations**
 - **Maintenance**
 - **Technical Publications**
 - **Provisioning of Spare Parts and Parts Support**

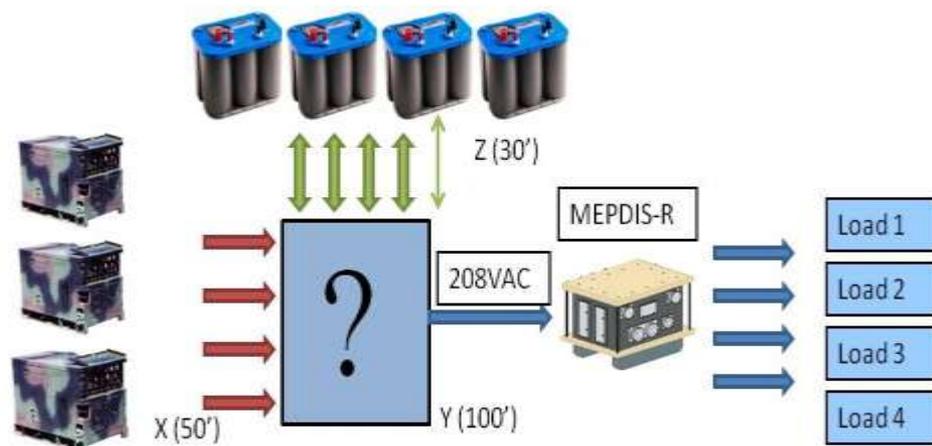


- Tactical Integrated Generator Gridding Energy Resource (TIGGER)
 - Initial MCSC MicroGrid Acquisition Effort
 - 500kW to 800kW
 - Use of TQGs and MEPDIS-R
 - Load shedding/Grid self protect feature
 - Requirements Flux – TIGGER currently Canceled
- Still Following Army Hi-Power Program
- Still involved Navy and OSD R&D efforts
 - ISUP (10-30kW hybrid Generator)
 - RSUP (3-5kW hybrid renewable energy trailer)

From an Acquisition Point of View the Marine Corps currently has no near term plan to procure a micro grid system



- Multi-generator control and hybridization
- Less than 50 kW electric power continuous
- Existing components in military inventory
- Collaborative effort between:
 - OSD (DDR&E)
 - ONR
 - NSWC Carderoc
 - MCSC

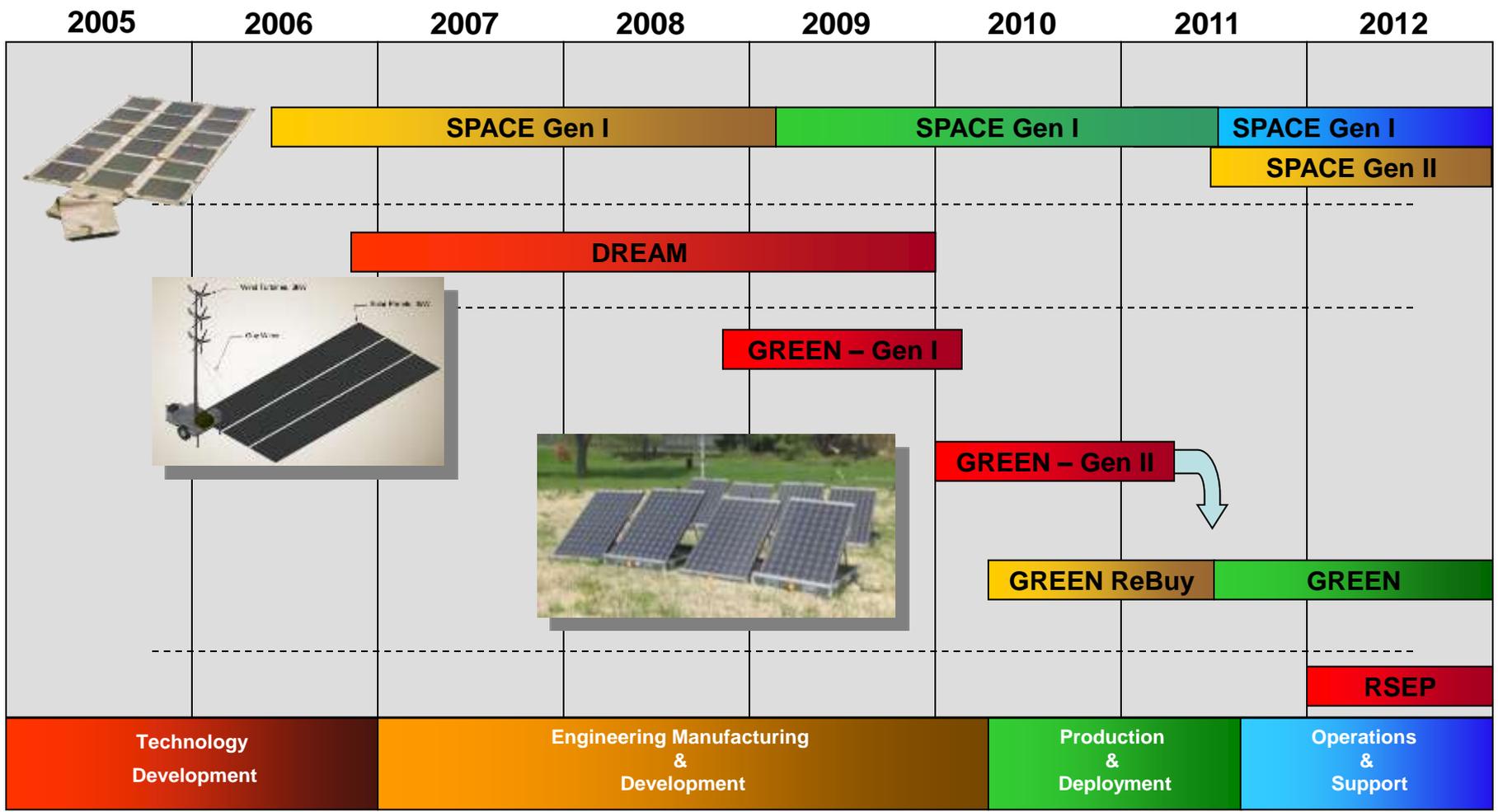




- Solar Systems Have 3 to 4 Basic Parts
 - Solar Array
 - Controller
 - Batteries
 - Power Distribution (Often Cables)
 - Auxiliary Power In (Hybrid Generator not in all systems)
- Larger system do little to decrease total system deployment size and weight
 - Example (two 300W systems vs. one 600W system)
 - Some packaging gains can be achieved
- System weight and size is mostly affected by:
 - Panel Type (brand, flexible vs. rigid) ~ 30% cost
 - Battery type (lead acid vs. lithium) ~ 30% cost
 - Power Management and deployment concept (Packaging strategy and controller i.e. one large box vs. several small boxes) ~ 30% cost



- MCSC rating of solar systems based on solar array size and type
 - “5 rule of thumb” = solar array rating/5 = 24 hour renewable energy rating
 - Still must factor in frequency of bad weather
 - Assumes ideal deployment
- Size of solar array determines % of JP8 reduced
- When rating hybrid systems:
 - Factor in energy storage ability to optimized fuel based generators
- Other important system factors:
 - Peak power capability, output power type, transportability, battery type, survivability, maintainability, etc.

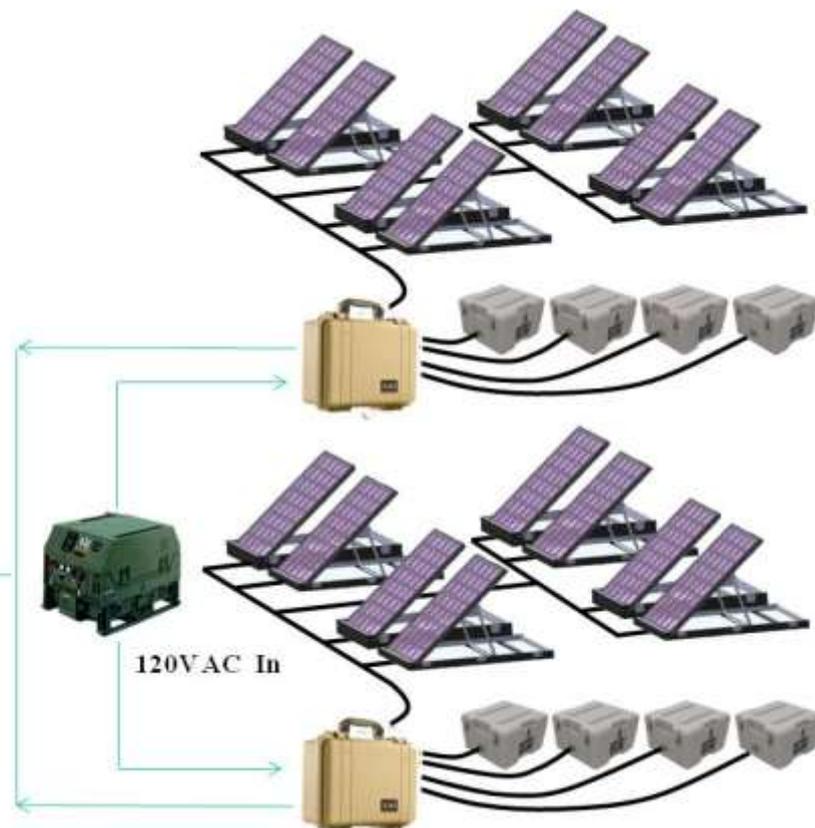


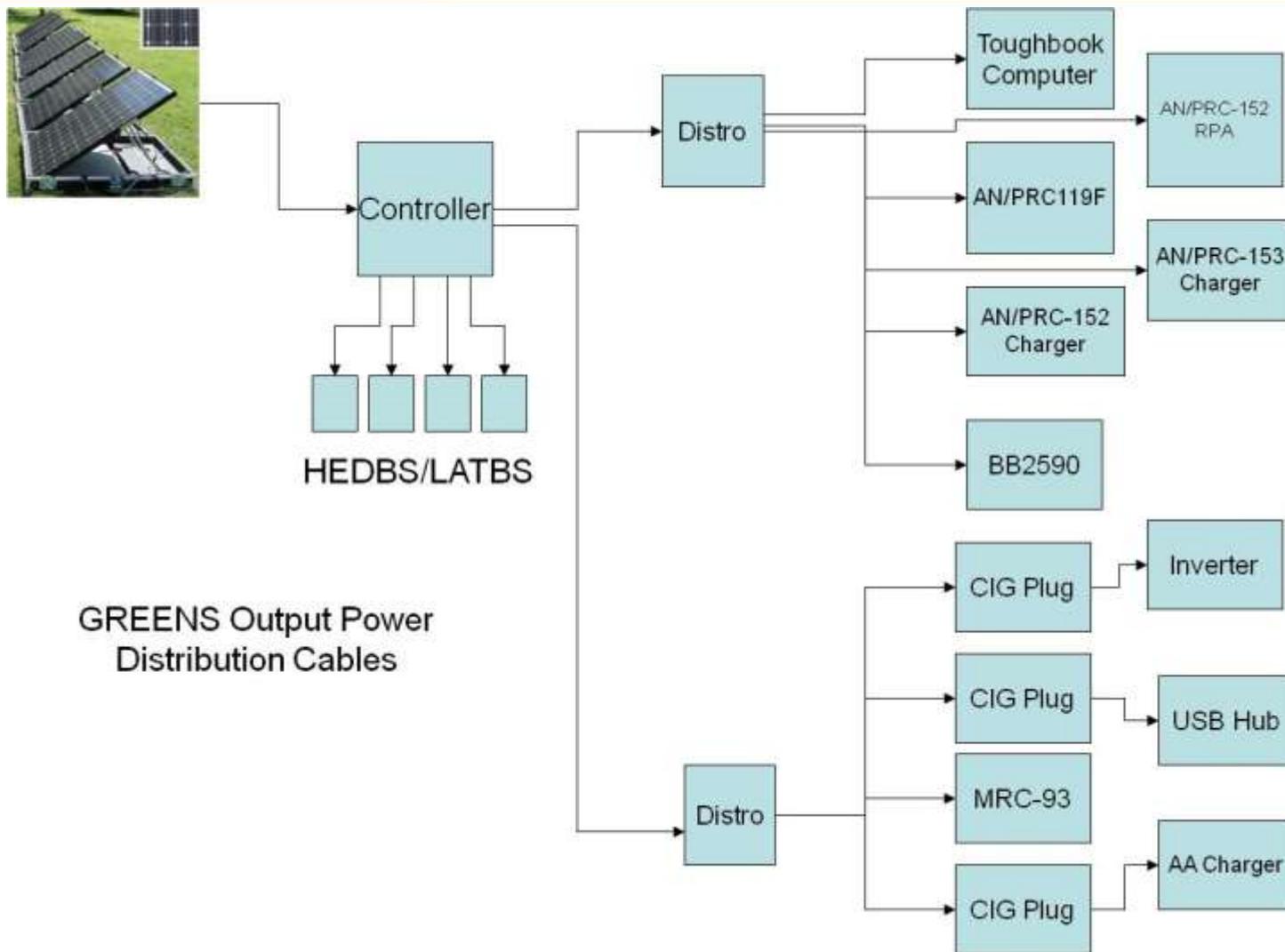
SPACE – Solar Power Adaptor for Communications Equipment (30 Watt continuous)
 GREEN – Ground Renewable Expeditionary Energy Network (300 Watt continuous)

DREAM – Deployable Renewable Alternative Energy Module (1.5 kW continuous)
 SREP – Renewable Sustainable Expeditionary Power (3 -5 kW continuous)

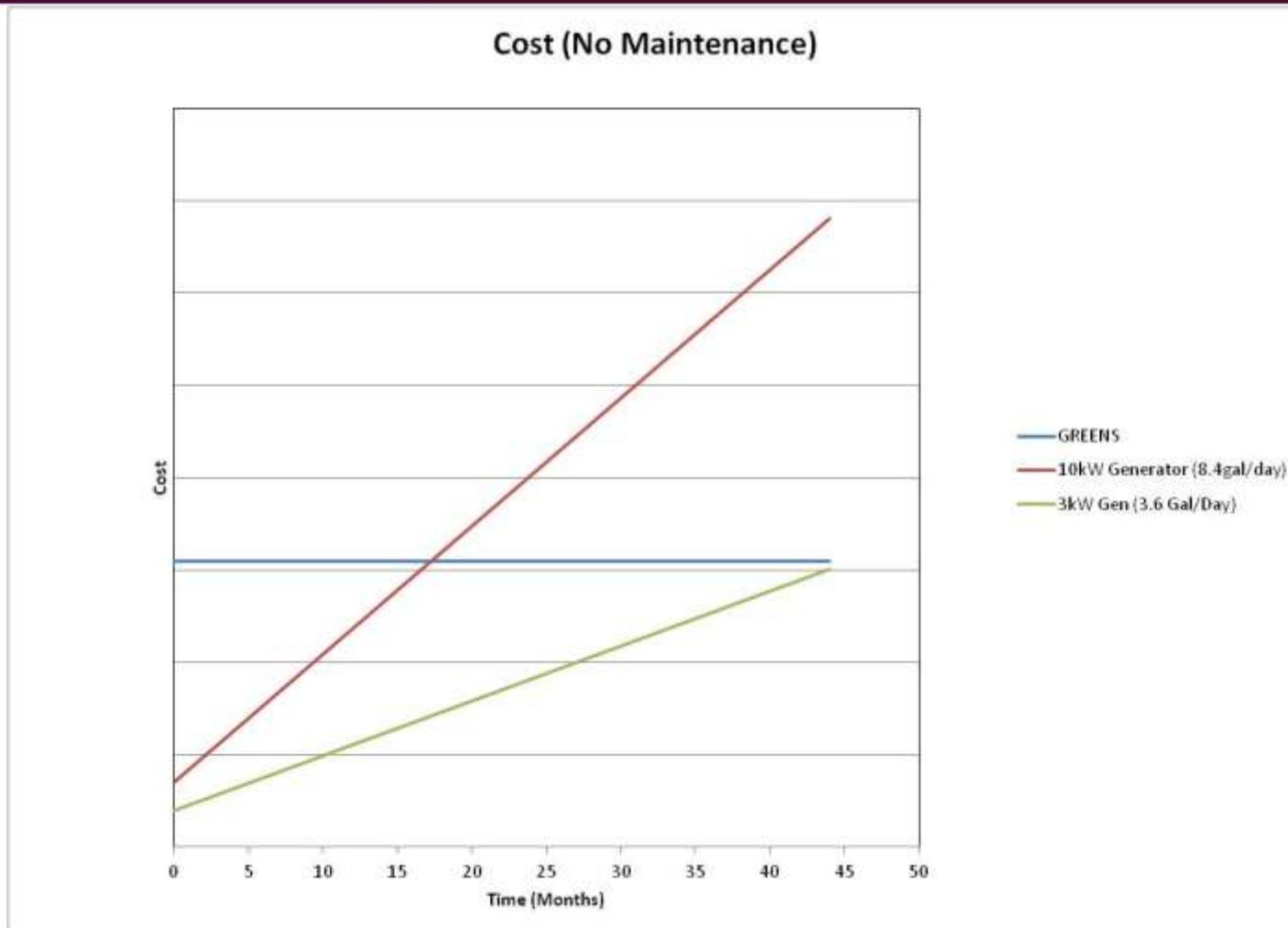


- 300 W continuous power 24/7
- Up to 1000 W of output power
- 24 VDC output power
- Multiple possible inputs
- Generator auto-start capability
- System will include:
 - 1.6 kW Solar Array of 8 panels
 - Controller
 - 4 - 1.2 kWh battery modules
- Man-portable components (< 88 #)

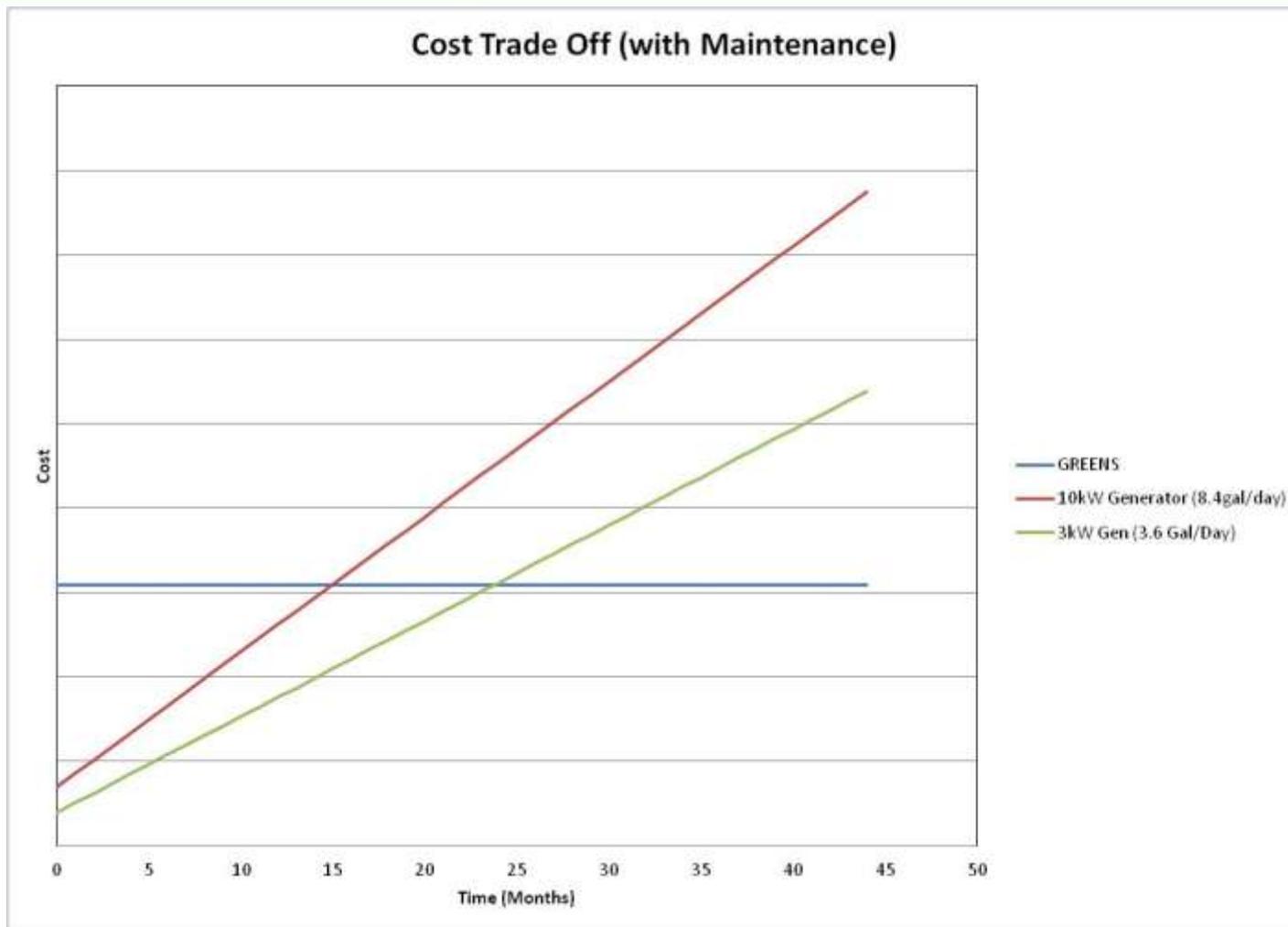




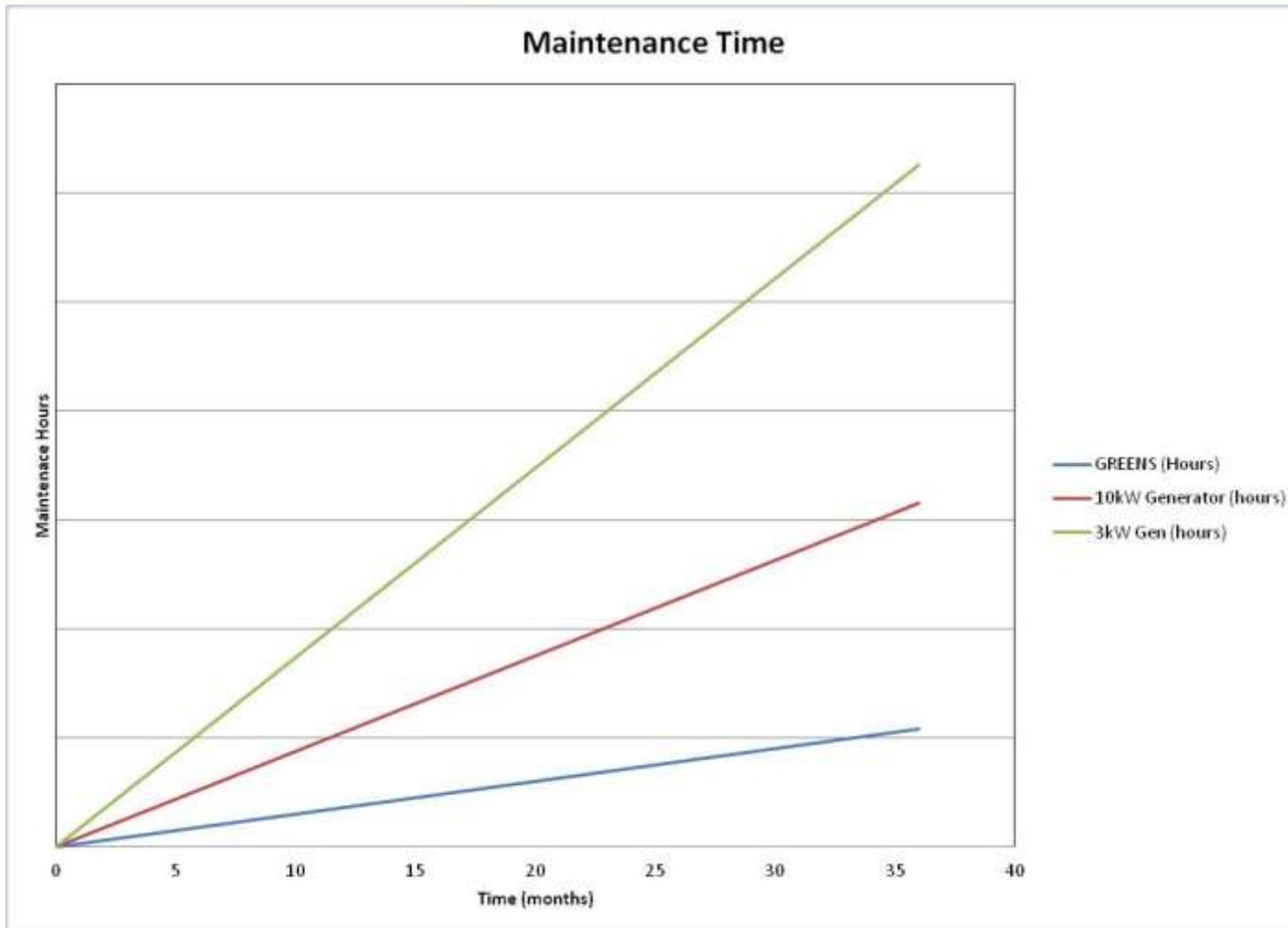
GREENS Output Power Distribution Cables



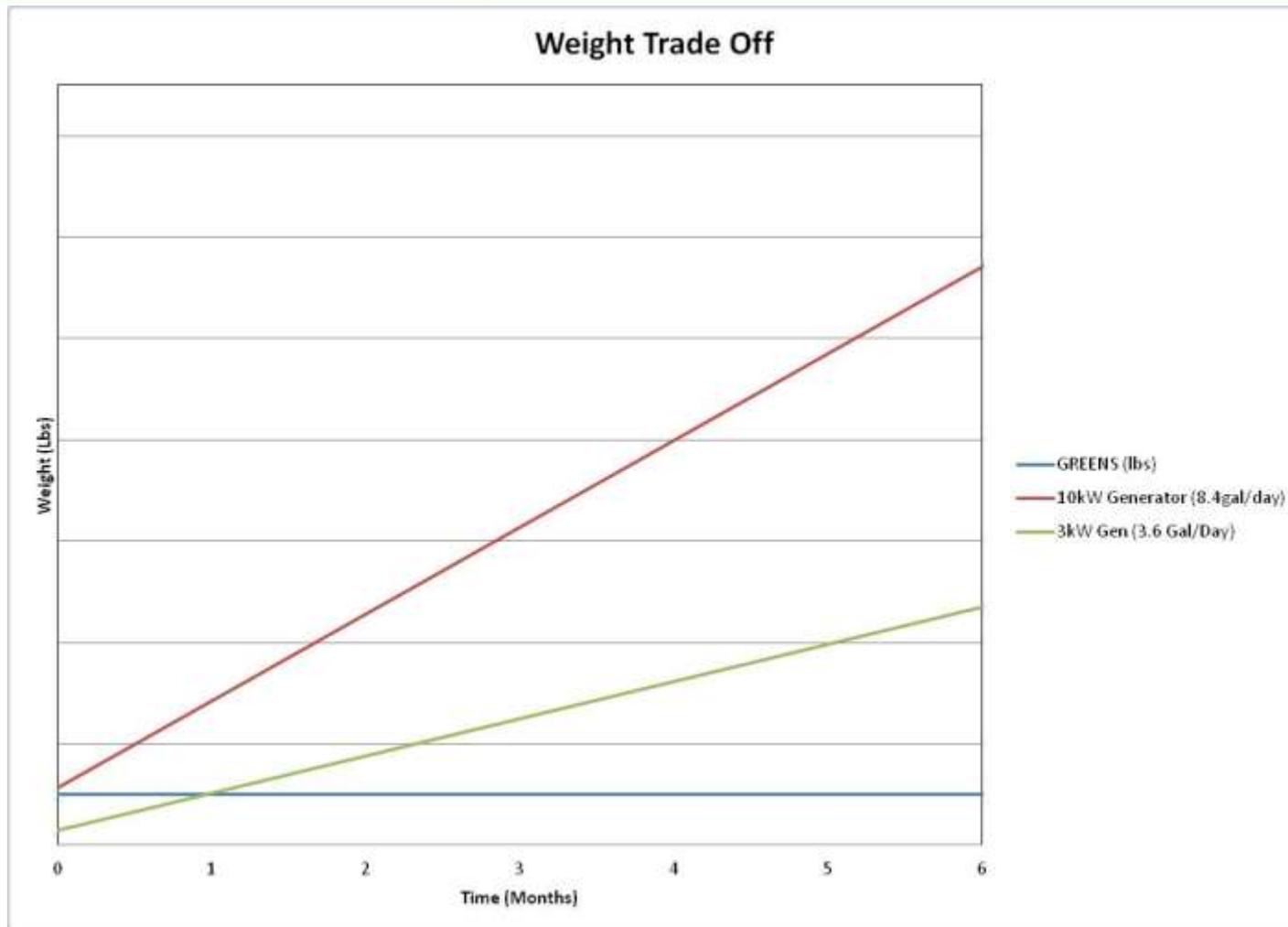
Material cost pay back is ≥ 3.5 years vs. generators



Cost with maintenance payback is ≥ 2 years vs. generators



Require less maintenance man power vs. generators



Weight payback is ≥ 1 month vs. generators



- Current Solar Power Adaptor for Communications Equipment (SPACES) highly successful in deployment to OEF
- Next generation system will be required
- Future capability set (notional) to include:
 - < 10# weight (less battery, case)
 - Multiple folding panels
 - BB-2590/U battery charger
 - AA battery charger
 - USB power port
 - AN/PRC-152, -153, -117F adaptors
 - DC-AC inverter
 - AC charging plug, DC NATO plug
 - Hard case for full suite
 - Soft case for deployed sub-set
 - Backward compatible with SPACES





- ONR Program to build a trailer mounted hybrid renewable energy system
- 3 – 5 kW
- TRL 6 by 2015
- Shall employ sustainable energy strategies
- 40% fuel savings
- Focus Areas:
 - Fuel consumption
 - Noise levels
 - Cost of ownership
 - Maintainability
 - Deployability





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Questions?



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