



DoD Energy Resilience

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August 9, 2016

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DoD Energy Resilience

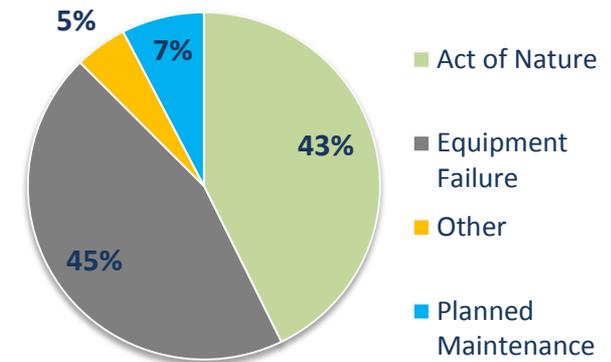
□ Policy Drivers

- Multiple requirements through FY2017 NDAA;
- Title 10, Section 2925(a) (modified thru FY2016 NDAA);
- ASD(EI&E) Memorandum on Power Resilience;
- Department of Defense Instruction 4170.11, Installation Energy Management; and,
- Unified Facilities Criteria (such as Electrical Series).

□ What are we doing now?

- DoDI 4170.11 change focused on energy resilience complete
 - Ensures performance against existing requirements
 - Encourages cost-effective solutions improving mission assurance
- Developing business case analyses (BCA) approaches to support/prioritize budgetary resources or alternative financing projects for energy resilience
 - MIT-LL study informs energy resilience BCA framework
 - Facilitates framework to quantify costs and availability/reliability

FY 2015 Utility Outages



Details on OASD(EI&E) Energy Resilience Initiatives:
http://www.acq.osd.mil/eie/IE/FEP_Energy_Resilience.html

DoD energy resilience is the ability to prepare for and recover from energy disruptions that impact mission assurance on military installations.

Results from Power Resilience Review in 2014

DoD Emergency Power, Fuel, and Testing

	Trained Operator	Preventive Maintenance	Fueling plans in place	Testing/Exercising	Fueling Contracts with DLA
Total DoD	90%	94%	84%	60%	74%

% of respondents in compliance with policy.

- Most solutions for critical energy requirements are backup generators tied to an individual 'critical' facility – there is a gap in policy for other solutions that could be more cost-effective and reliable
 - Initial and continuous sizing of energy generation was identified as an area for improvement in policy compliance
 - O&M in terms of trained operators, preventive maintenance, and fueling plans generally in good shape across installations, some issues identified by-installation
 - Most apparent opportunity was in testing/exercising backup and fueling plans

Results of Power Resilience review in 2014 helped shape policy.

Energy Resilience Policy Overview

- DoDI 4170.11 policy includes the following energy resilience requirements:
 - Better define and describe 'critical' energy requirements for installations (coordinate collaboratively with tenants, missions owners and operators of critical facilities)
 - ✓ Track 4 Energy Resilience to Achieve Mission Assurance, Session 1: Energy Resilience Policy
 - ✓ Track 4 Energy Resilience to Achieve Mission Assurance, Session 3: Working Together to Achieve Energy Resilience: Energy and Mission Assurance
 - Continue to perform against already existing requirements: sizing of energy loads, maintenance, fuel, plans, and testing/exercising (principally generators)
 - ✓ Track 4 Energy Resilience to Achieve Mission Assurance, Session 1: Energy Resilience Policy
 - Encourage the most cost-effective solutions that improve mission readiness (allows for solutions beyond generators)
 - ✓ Track 4 Energy Resilience to Achieve Mission Assurance, Session 1: Energy Resilience Policy
 - ✓ Track 11: Integrated Energy, Session 5: Planning Large and Small Scale Microgrids and Smart Grids

Our Priorities: (1) Make sure the stuff you got will work (generators); and (2) think about smarter ways to support the mission (more resilient and will save money).

Application of DoDI 4170.11 Policy MIT-LL Study Example

DoD Energy Resilience

Study Problem Statement

Study Problem Statement: How does DoD meet current requirements for cost-effective and reliable energy resilience solutions for critical mission operations?

- To implement energy resilience solutions, DoD requirements include:
 - Prioritization of energy requirements to critical mission operations (in partnership with DoD mission assurance communities)
 - Pursuit of life-cycle cost-effective energy resilience solutions that provide the most reliable energy to critical mission operations
 - Reviewing energy solutions beyond typical backup or standby generators
- How does MIT-LL study help DoD address this problem?
 - Primary focus is to review cost-effective and reliable energy resilience solutions
 - Technology agnostic – focus on quantifying and optimizing cost and availability/reliability to critical mission operations
 - Aligned energy resilience solutions to prioritized critical energy loads for the military installations
 - Analysis of alternatives comparing current baseline (generators) vs. over 40 potential energy resilience options

Results

Establishing Critical Energy Requirements

Organization	Total Energy (MW)	Critical Energy (MW)	% Critical by Org
Total	10,000	2,500	-
Org 1	3,000	750	30%
Org 2	2,000	500	20%
Org 3	3,000	600	24%
Org 4	1,000	350	14%
Other	1,000	300	12%

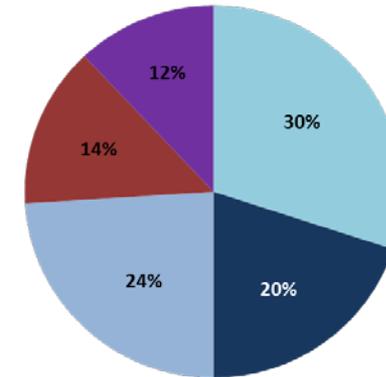
*Conceptual data for training purposes only.

- PR review was first attempt at identifying and quantifying critical energy requirements across military installations
 - Alignment to enterprise-level critical mission operations
 - Established prioritization for energy resilience requirements and policy/compliance
- Good first attempt to quantify critical energy requirements to support mission assurance
 - Improvements needed to develop a broader and more integrated approach for better initial and continuous sizing as mission adapts
- MIT-LL study quantified specific critical energy loads at the military installation to critical mission operations

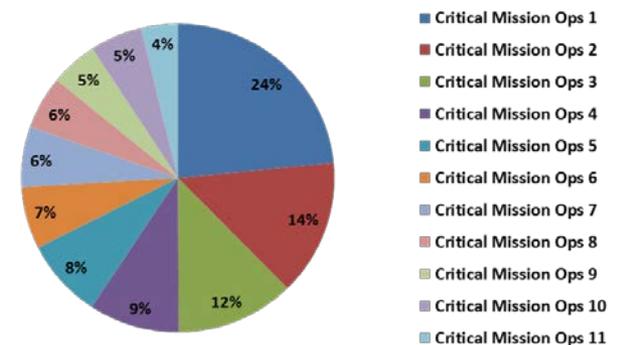
DoD is continuing to improve guidance to quantify energy loads that align to critical mission operations, and also encouraging continuous process to ensure appropriate sizing of energy generation with evolving missions.

Critical Energy Requirements by Organization

Org 1 Org 2 Org 3 Org 4 Other



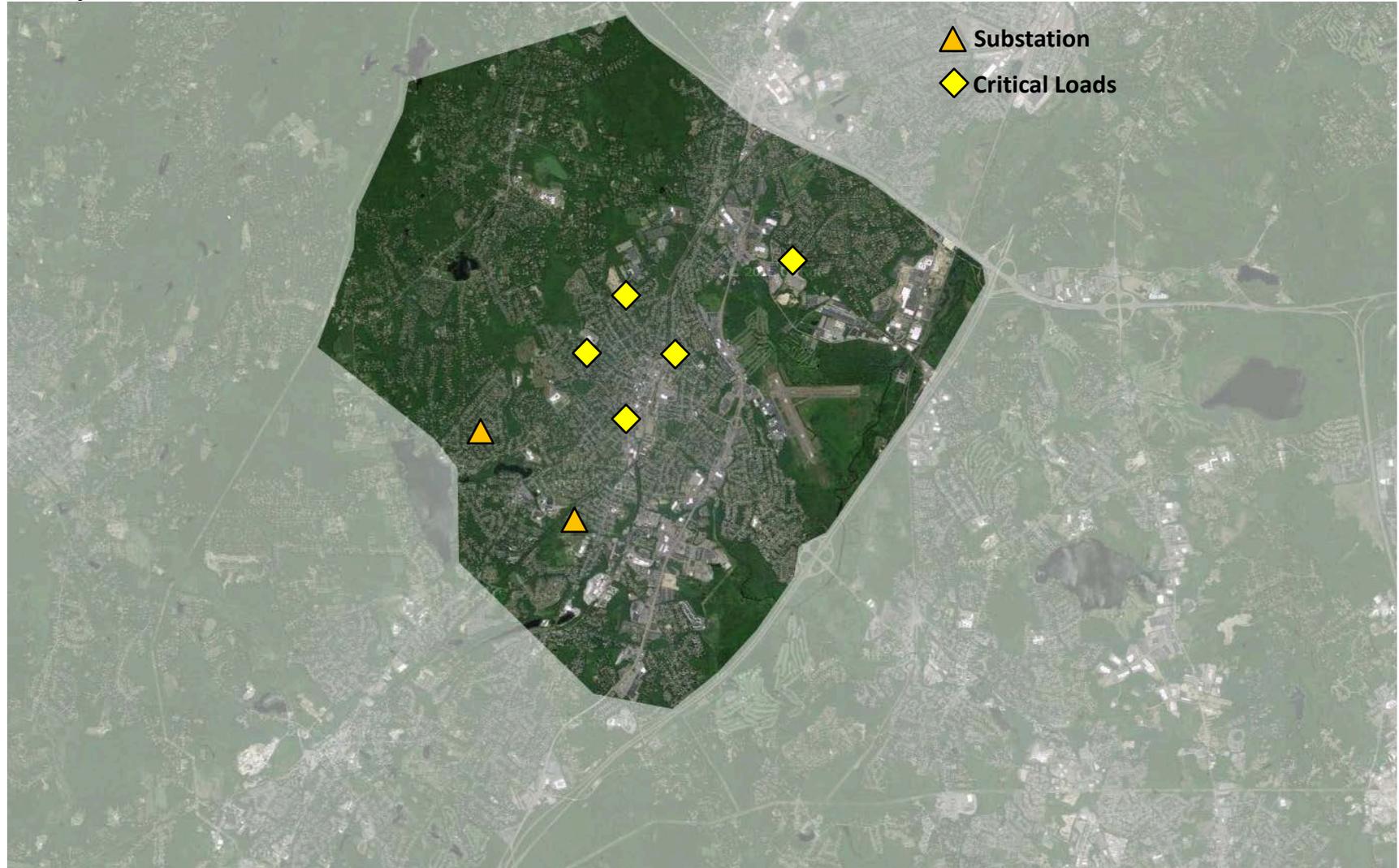
Org 1
Critical Energy Requirements by Mission



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Base-Level Critical Loads Example

Example Case – Not an actual installation

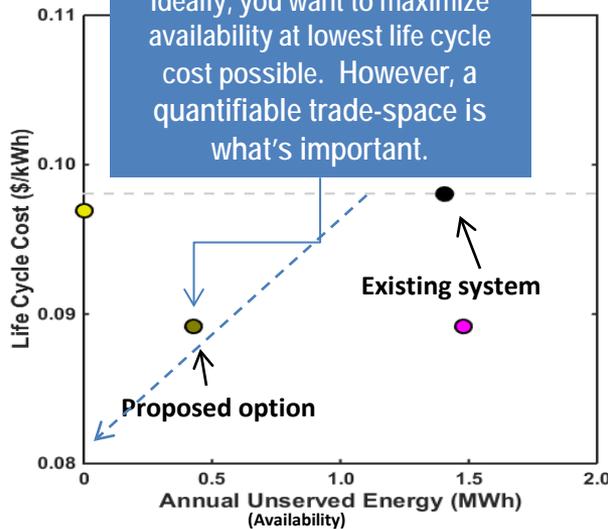


Bottom-Line Up Front (BLUF)

Study Results Overview

Cost attribute: life-cycle costs (\$/kWh)
 Mission attribute (availability): annual unserved energy (MWh)

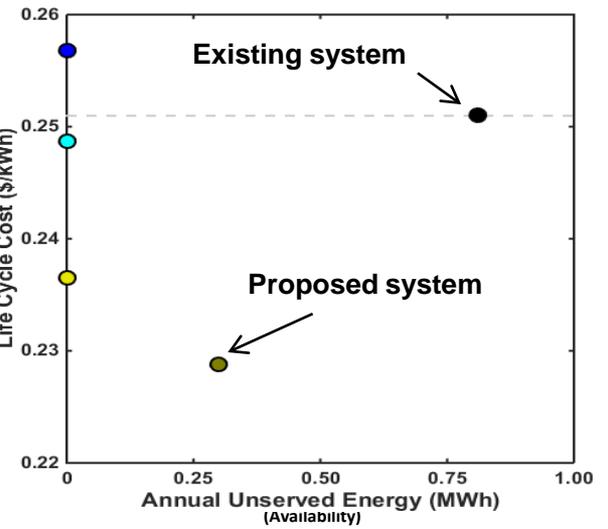
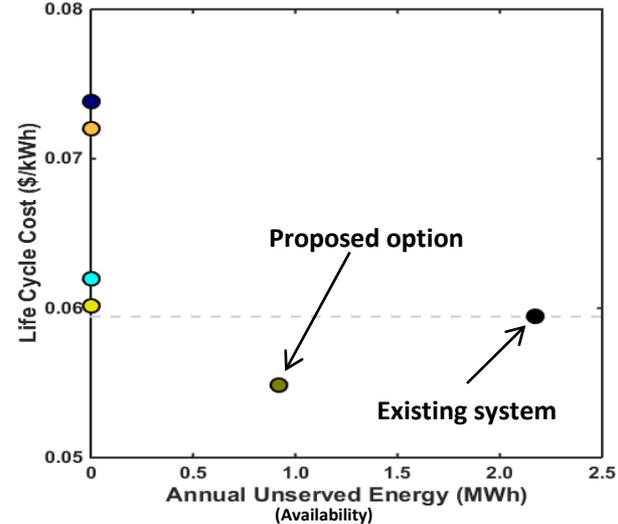
Ideally, you want to maximize availability at lowest life cycle cost possible. However, a quantifiable trade-space is what's important.



Findings/Results (generalized)

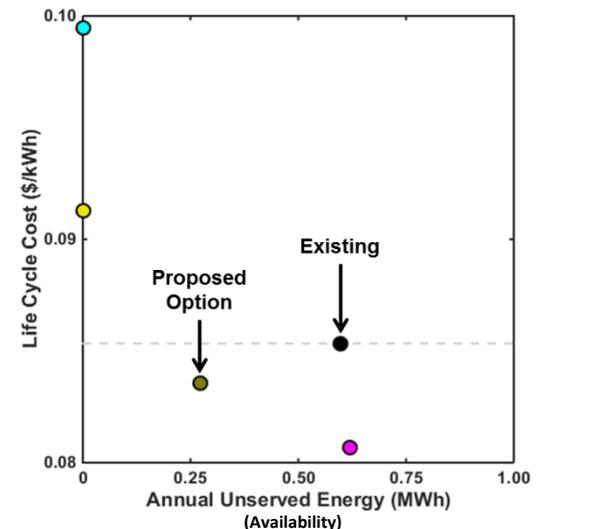
- Critical Energy Loads: 6 MW to 21 MW
- Generators: 50 to 350 generators
- Reductions in costs: 0.2¢/kWh to 2.2¢/kWh,
- Availability improvements: 0.3 MWh to 1.2 MWh
- Base characteristics: Isolated location with frequent outages, integrated/urban base with reliable power, etc.

	Generator	Microgrid	UPS	PV	CHP	FC
●	X					
●	X	X	X			
●	X	X	X	X		
●	X		X	X		
●	X			X		
●	X	X		X		
●	X	X	X	X	X	
●	X	X	X	X		X
●	X	X	X	X	X	X



Framework allows for quantifiable tradeoffs between cost and mission assurance attributes.

Results across diverse bases indicate that more cost-effective and reliable energy resilience solutions exist to support critical mission operations on our military installations.



DoD-Wide Recommendations

Sampling of Findings

These are not necessarily new requirements – further prioritization and awareness is required in the installation energy portfolio.

- **Communication**
 - Encourage routine meetings between installation energy leads and mission operators to determine and prioritize 'critical' mission operations and energy requirements across the entire base
 - Improve guidance to determine prioritized energy load calculation for critical mission operations
 - Coordinate with the community (inside and outside of the base) to ensure critical interdependent mission requirements are met during energy outages
- **Technical**
 - Understand your current energy systems and infrastructure; do not site energy systems on unreliable grid
 - Prioritize/ensure energy resilience systems are only placed on critical energy loads and not oversized
 - Standardize a process to ensure O&M of energy systems (e.g., generators, UPS, etc.) for full reliability picture
- **Cost and Performance Data**
 - Encourage tracking of the appropriate cost data (capital, operation, maintenance, and testing) of energy generation and infrastructure to replicate and justify the business case for future energy resilience solutions
 - Encourage tracking of performance data that aligns to mission and availability/reliability of energy systems and infrastructure (outage data, failure rates, etc.) to assist in tradeoff decisions between cost/mission
 - Helps to identify cost-effective and prioritized remediation for reliability risks on the base's electrical distribution system

Collaborating with Services and Defense Agencies to raise awareness through future guidance across the DoD.