



Department of Defense Installation Energy

Energy Resilience Review
OSD & MIT-LL Study
FUPWG

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OASD (Energy, Installations & Environment)

April 13, 2017








DoD Energy Resilience

Acquisition, Technology and Logistics

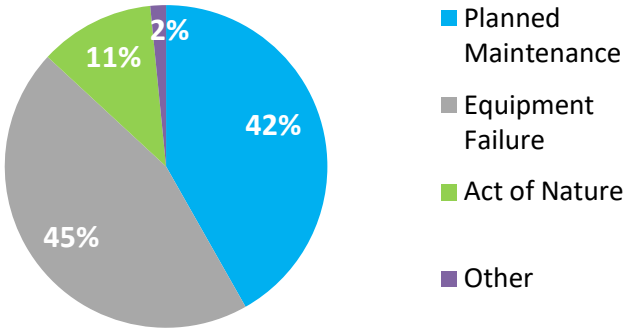
❑ Policy Drivers

- Multiple requirements through FY2017 NDAA;
- DoD Instruction 4170.11(updated 16 Mar 2016), Installation Energy Management, Energy Resilience
- Title 10, Section 2925(a) (modified thru FY2016 NDAA);
- ASD(EI&E) Memorandum on Power Resilience;
- Unified Facilities Criteria (such as Electrical Series)

❑ What are we doing now?

- DoDI 4170.11 change on energy resilience (complete)
  - Ensures performance against existing requirements
  - Encourages cost-effective solutions to improve mission assurance
- Implementing guidance
  - Operations, maintenance, and testing (OM&T) (complete)
  - Energy resilience, mission integration, metrics (in-progress)
- Business case analyses (BCA) approaches to prioritize budget resources or alternative financing projects for energy resilience (complete)
  - MIT-LL study informs energy resilience BCA framework
  - Facilitates framework to quantify costs and availability/reliability

FY 2016 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.

DoD Energy Resilience

DoDI 4170.11, Energy Resilience Change

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- DoD issued DoDI 4170.11 energy resilience update on March 16, 2016
- Overview of DoDI 4170.11 requirements:
  - Identification of critical mission operations and projects should be collaborated with tenants, mission owners, and operators of critical missions impacted
  - Requests clear identification and update of 'critical energy requirements' for alignment of the appropriate energy resilience solutions (requires either metered data or engineering energy load analysis)
  - Continues to require compliance against already existing energy resilience requirements such as operations, maintenance, testing, and fueling consideration
  - Encourages the most cost-effective and reliable energy resilience solutions to ensure mission assurance on military installations (e.g., generators, distributed energy, etc.)
  - Determination of life-cycle cost effectiveness of proposed projects is still required

critical energy requirements. Critical mission operations on military installations or facilities that require a continuous supply of energy in the event of an energy disruption or emergency.

Energy Resilience Guidance Overview
Longer-term focus

- Longer-term: Identification/integration of mission assurance/energy requirements to provide a strategy/plan to help guide energy resilience projects
  - Steps to help achieve long-term objectives (policy, guidance, and technical guides align to these):
    1. Understanding critical mission operations that would need an appropriate level of energy resilience & their associated mission requirements (resilience versus security focused approach)
    2. Identification and right-sizing (load analysis) those associated critical energy loads that would require energy resilience
    3. Alignment of mission performance metrics to improve mission capability and/or reduce risk to mission
       - Important to understand mission requirements (e.g., downtime) and what resilience metrics (availability/reliability/quality) align to those requirements
    4. System designs and technologies should consider impacts and risks to mission loads in question
       - Goal is to improve *mission performance*, not to pursue or make a case for "nice-to-have technologies"
       - Not "chasing" or implementing technology or authority centric goals
       - All technologies and authorities should ensure a sustained and continuous mission capability
    5. Life cycle cost analysis (LCCA) and analysis of alternatives (AoA) is still required for energy resilience that helps achieve mission performance and looks at various technology or mission-related options
    6. Services/Defense Agencies should select the appropriate authority to implement selected technology or technologies, and ensure energy resilience performance metrics are included in those contracts

Examples

MIT-LL Study – Framework to evaluate options

SPIDERS JCTD – R&D demonstration for a microgrid

DoD Energy Resilience
MIT-LL Study Problem Statement

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Study Problem Statement: *How does DoD meet current requirements for cost-effective and available/reliable energy resilience solutions to ensure continuous 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 energy loads
  - Reviewing comprehensive energy resilience 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 available/reliable energy resilience solutions
    - Technology agnostic: focus on quantifying and optimizing cost and availability to critical mission operations
    - Aligned energy resilience solutions to prioritized critical energy loads of the installation
    - Analysis of alternatives (AoA) comparing current baseline (generators) vs. various potential energy resilience options

Some Energy Resilience Options

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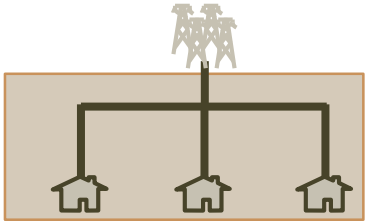
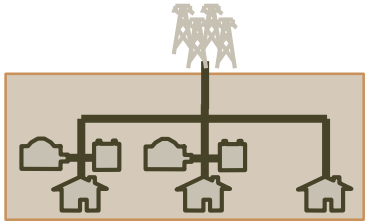
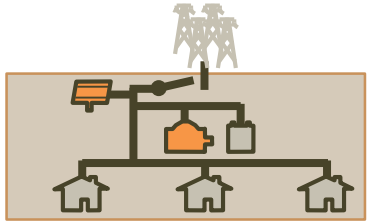
- Grid Tied Solar PV
- Islandable Solar PV
- Building Generator
- Central Generator
- UPS
- 1-Day Load Battery
- Microgrid
- Cogeneration
- Fuel Cell
- Grid Electricity
- Local Load



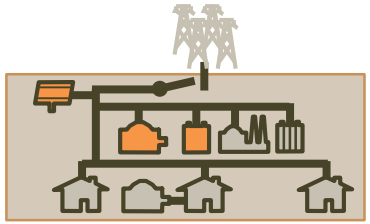
No Backup Systems



Building Generators & UPS



Islandable Solar PV, Microgrid, Central Generators, & UPS



Microgrid, Islandable Solar PV, Building Generators, Central Generators, 1-Day Battery, Fuel Cells, & Cogeneration

This study explored various possible energy architectures. Other considerations are also distribution system upgrades aligned to critical loads, and operations, maintenance, testing, and fueling considerations of existing systems.

Smart Power Infrastructure Demonstration for Energy Reliability and Security (SPIDERS) Joint Capability Technology Demonstration (JCTD)

SPIDERS Operational View (OV-1)

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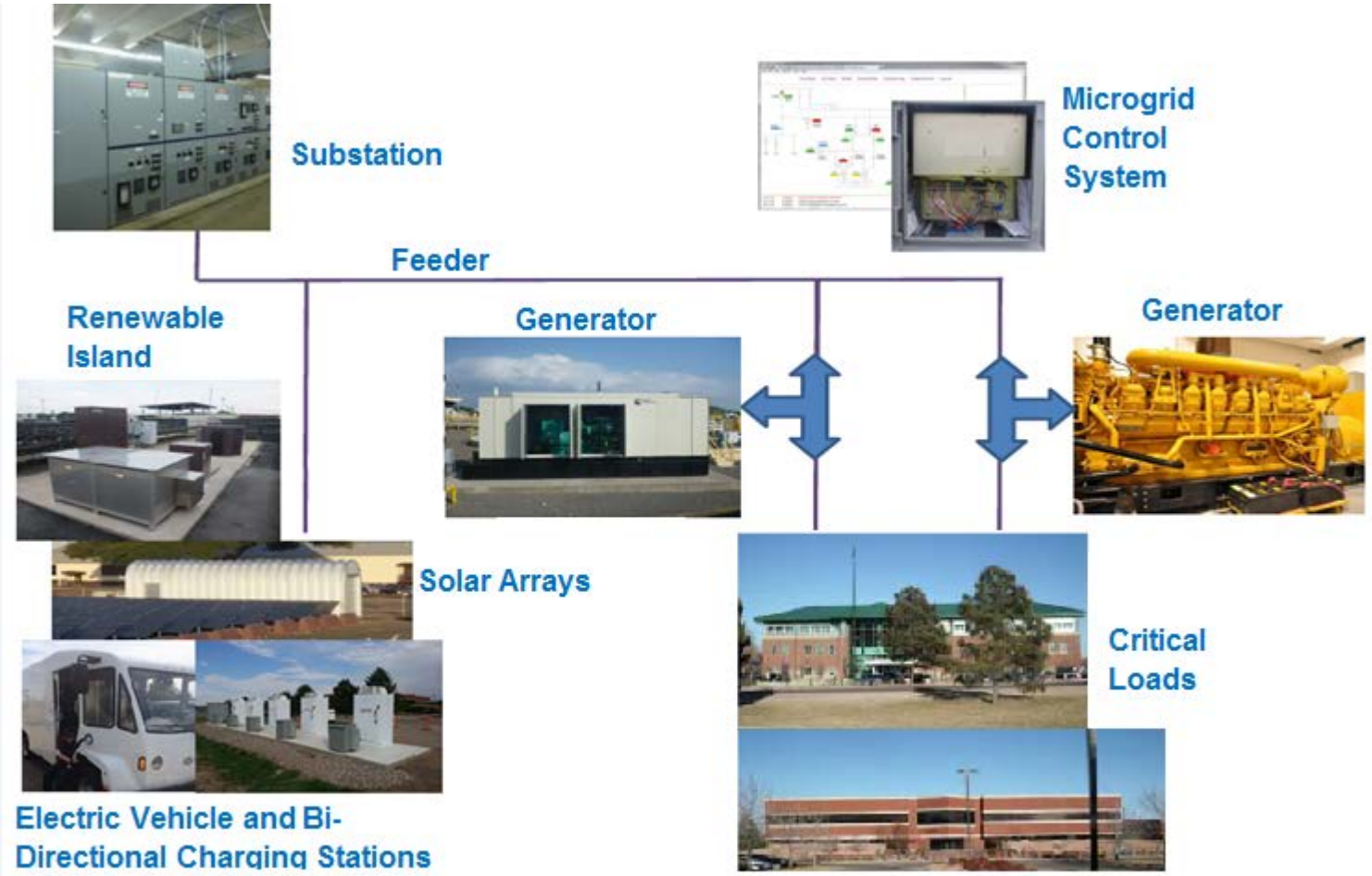

SPIDERS JCTD was not an evaluation of various approaches to achieve energy resilience. SPIDERS JCTD's objective was to demonstrate a microgrid design under a R&D program.

SPIDERS Program Summary

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STAIRWAY TO ENERGY SECURE INSTALLATIONS

Phase 1

PEARL-HICKAM CIRCUIT LEVEL DEMO

- Renewables (8-9%)
- Two Diesel Generators
- Energy Management
- Supervisory Control and Data Acquisition (SCADA) Cyber Test at DOE lab and live on the microgrid

Phase 2

FT CARSON MICROGRID

- Large Scale Renewables (35-50%)
- Vehicle-to-Grid
- Smart Microgrid
- Critical Assets
- Cyber Security Tests, static code analysis, DHS cyber evaluation

Phase 3

CAMP SMITH ENERGY ISLAND

- Entire Installation Smart Microgrid
- Islanded Installation
- Prime Power Generator Sets
- Integrated Storage and Inverter Modules
- Demand-Side Management
- Ancillary Services

TRANSITION

- Template for DoD-wide implementation
- DoD Unified Facilities Criteria
- Concept of Operations (CONOPS)
- Tactics, Techniques, and Procedures(TTPs)
- Transition results/lessons learned to Federal Sector, Utilities, Commercial Sector

CYBER SECURITY BEST PRACTICES

RIGOROUS ASSESSMENT WITH RED TEAMING IN EACH PHASE

DoD Lessons Learned

- Determination of critical loads is important to assign prioritization, reduce vulnerability risks, and to consider cost-effective options (i.e., What exactly are my mission requirements and the level of performance I expect at those critical loads?)
- Reliability of distribution system and current energy systems at critical loads in question requires consideration prior to implementing any new energy system or generation options (e.g., What is current level of availability performance?; Is further resilience required?; What are my options?; etc.)
- Consideration of both fossil and renewable energy options are necessary when considering distributed and continuous power to ensure mission performance

DoD Lessons Learned

- Consolidated/distributed generation at the substation/critical feeder level is an option to improve resilience (determinations can continue for spot generators at critical facilities)
- Solar PV through alternative financing can also be considered to “offset” fuel costs; fuel is still needed as batteries are not cost competitive and are technically challenging
- “New” distributed energy resources and microgrids can provide an installation more flexibility in servicing critical loads, but the base must understand their current level of resilience and if the mission requires additional resilience