



Department of Defense Installation Energy

Energy Resilience Review

OSD & MIT-LL Study

FUPWG

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OASD (Energy, Installations & Environment)

May 18, 2016








DoD Energy Resilience

Acquisition, Technology and Logistics

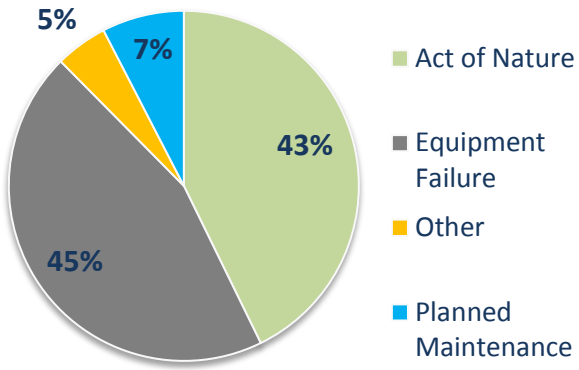
❑ Policy Drivers

- Title 10, Section 2925(a)(9) (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 reliability
- Partnering with OASD(R&E) to pursue energy resilience technologies
  - Broad Agency Announcement for Rapid Innovation Funds
  - Focus to advance commercialization of energy resilience technologies

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.

DoD Energy Resilience Study Problem Statement

Acquisition, Technology and Logistics

Study Problem Statement: How does DoD meet current requirements for cost-effective and reliable energy resilience solutions to 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 reliability to critical mission operations
    - Aligned energy resilience solutions to prioritized critical energy loads of the installation
    - Analysis of alternatives comparing current baseline (generators) vs. 48 potential energy resilience options

Energy Resilience Approaches for DoD Installations

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May 18th, 2016

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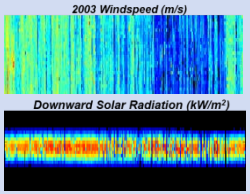
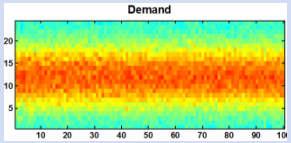
Analysis Methodology

Resource Availability



Base Demand Profile



Financial Model

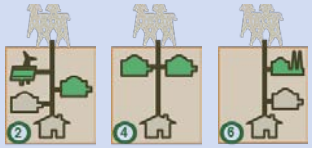
$$\text{SIR} = \frac{D_B - D}{I - I_B}$$

$$\text{Payback} = \frac{I - I_B}{O_B - O}$$

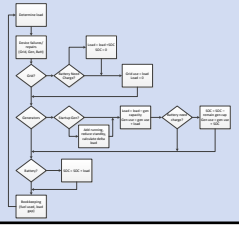
$$\text{LCC} = \frac{I + D}{E_{Tot}}$$

System Devices

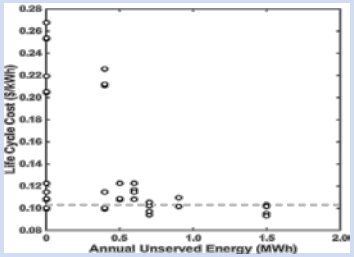
Base Energy Architectures



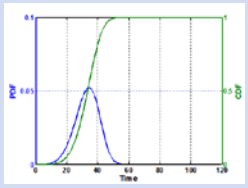
Monte Carlo Time-stepped Simulation



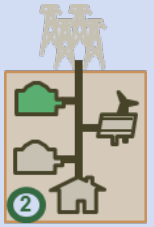
Analyze Architectures



Reliability Models

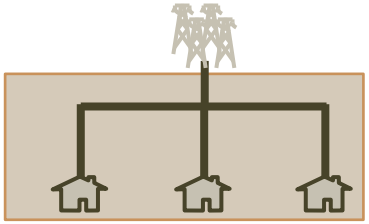


Recommendation

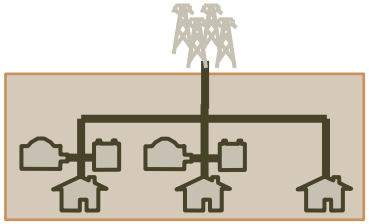


Architecture Options

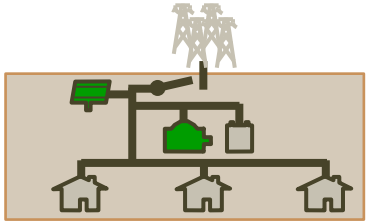
- Grid Tied Solar PV
- Islandable Solar PV
- Building Generator
- Central Generator
- UPS
- 1-Day Load Battery
- Microgrid
- Cogeneration
- Fuel Cell
- Grid Electricity
- Local Load



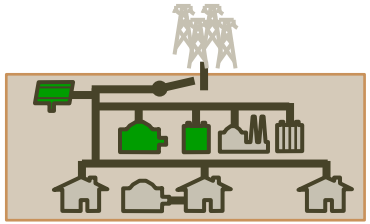
No Backup Systems



Building Generators & UPS



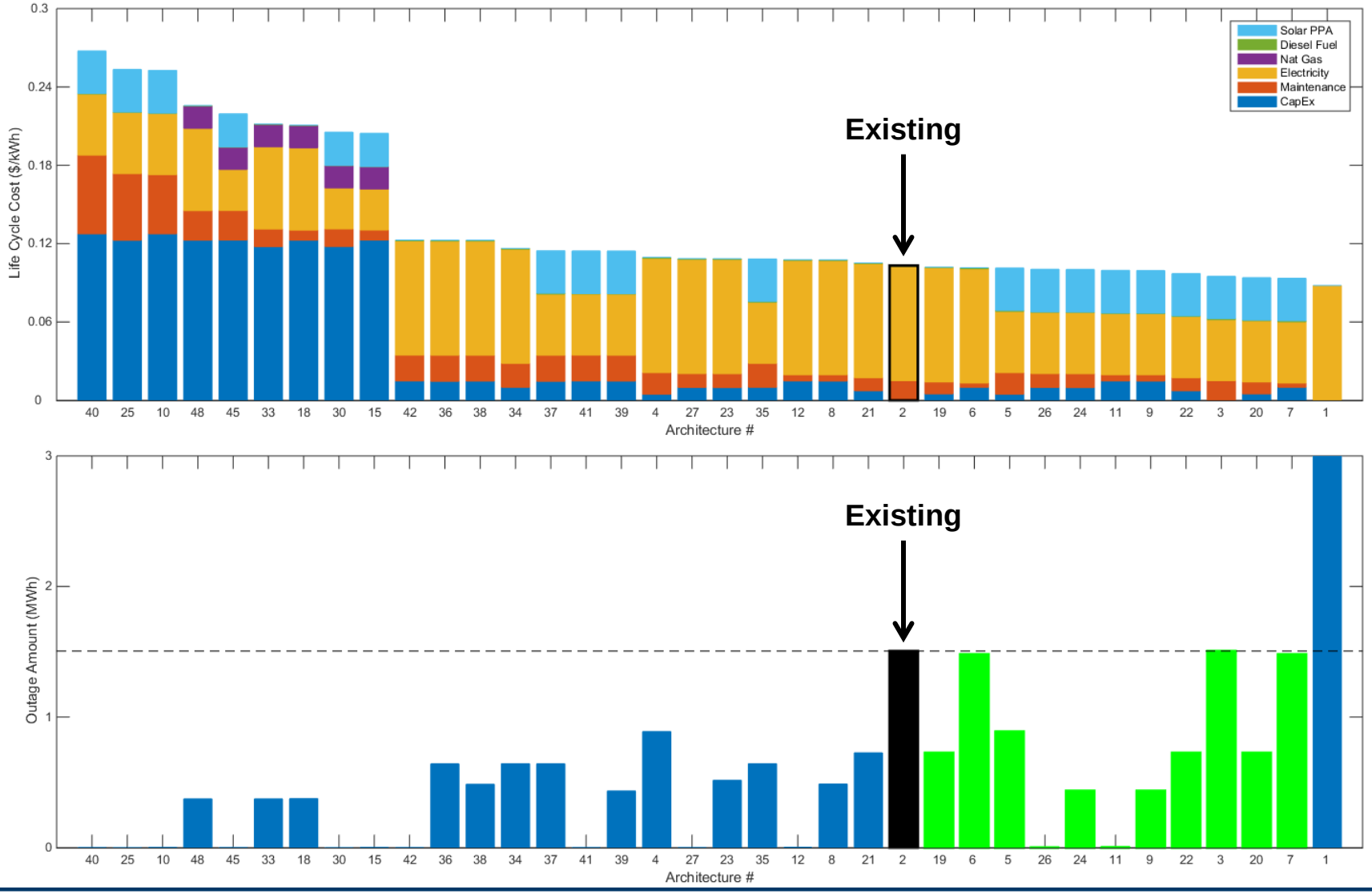
Islandable Solar PV, Microgrid, Central Generators, & UPS



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

These examples explore the possible complexity of architectures available with the tool; a larger number of architecture options are possible.

Architecture Cost Breakdown



Recommendations

- **Consolidated generation at the substation / critical feeder level improves resiliency**
  - **Large emergency diesel generators or natural gas cogeneration with dual fuel capability**
  - **Requires a reliable distribution system on the installation**
  - **Reduces the maintenance burden on base personnel -> more likely to work during an outage**
- **Solar PV through 3rd party financed PPAs can often provide electricity to the installation at below market rates**
  - **For islanded operation the appropriate inverter functionality will need to be included in the PPA agreement**
  - **Potential to offset a modest amount of diesel needed during grid outages**
- **Microgrids that enable a more flexible allocation of power on the installation can also improve resiliency**
  - **Upgraded distribution system including additional switching capability**
  - **Installation wide communication and control of the energy system**