



Welcome to the 2015 DoD Virtual Energy Summit



*Department of Defense
Energy Resilience*

Ariel Castillo, Ph.D.
*Office of the Assistant Secretary of Defense
(Energy, Installations & Environment)*
October 27, 2015



CLEARED
For Open Publication

Sep 10, 2015 5

Department of Defense
OFFICE OF PREPUBLICATION AND SECURITY REVIEW



Agenda

Acquisition, Technology and Logistics

- Energy Resilience Overview
- DoD Power Resilience Review
 - Findings & framework review
 - Conclusions
- Business Case Analysis Study
 - Overview & concept review



Energy Resilience Overview, Findings and Next Steps

Acquisition, Technology and Logistics

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

❑ What we found?

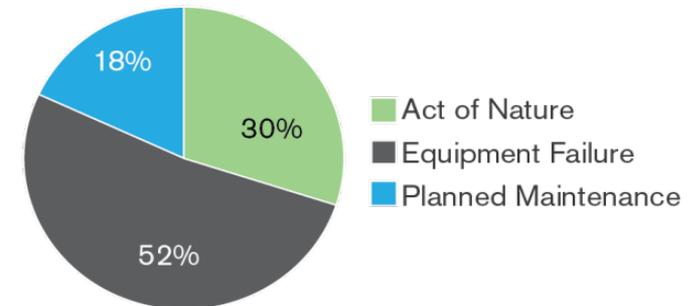
- Many energy resilience policies did already exist
- Disruptions primarily from natural and reliability issues
- ‘Critical’ energy requirements were identified by DoD Components that align to mission assurance
- Most solutions for critical energy requirements are fixed backup generators tied to a critical facility
 - Opportunities beyond generators could be more *cost-effective* while also improving *mission readiness*

❑ What are we doing now?

- Developing universal energy resilience guidance
 - Ensure performance against existing requirements
 - Encourage the most *cost-effective* solutions that improve *mission readiness*
- Developing business case analyses (BCA) approaches to support budgetary resources or alternative financing opportunities
 - Study to review BCA approaches (MIT-LL Study)

FY 2014 Utility Outages²

Utility Outages by Cause



Results – Dec 2013 thru June 2014

Existing Requirements Reviewed	DoD % Compliant
Trained Operator	90%
Received Preventive Maintenance	94%
Fueling Contracts in Place w/ DLA*	74%
Fueling Plans in Place	84%
Testing/Exercising	60%

***Installations also have contracts in place with other providers.**

²Further details of utility outages are found in DoD’s Annual Energy Management Report, located at the following: http://www.acq.osd.mil/ie/energy/energymgmt_report/main.shtml.



Power Resilience Review Overview

Acquisition, Technology and Logistics

- ❑ OASD(EI&E) conducted a DoD Power Resilience Review from Dec 2013 – Jun 2014¹
- ❑ DoD-wide power resilience review helped understand vulnerabilities and risks that impact mission assurance
 - Results included 500+ CONUS/Hawaii/Alaska installations, sites and facilities
 - Examined adherence to key resilience policies and policy gaps
 - Identified more integrated/holistic critical energy requirements
- ❑ Focus was on remediating issues associated with existing critical energy requirements and policies

¹Further details on the power resilience review, along with resilience guidance are located at: <http://www.acq.osd.mil/ie/energy/power.shtml>.



Establishing Critical Energy Requirements

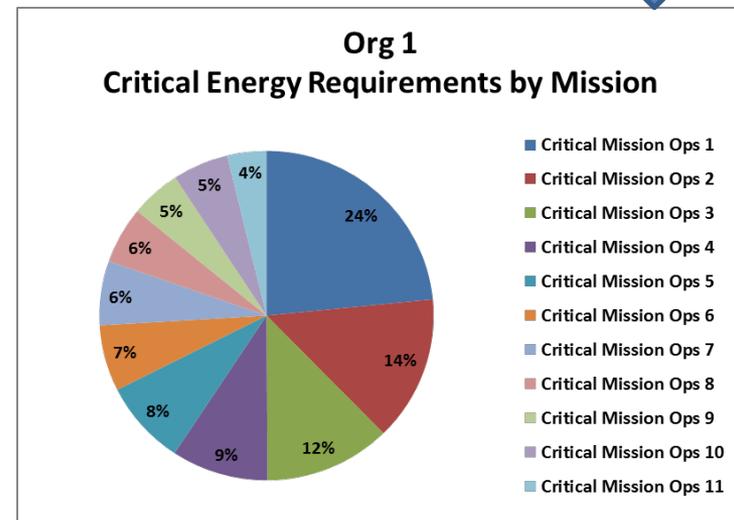
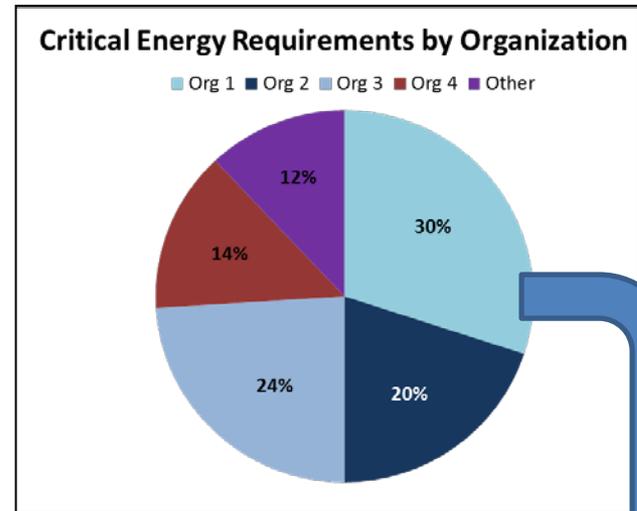
Acquisition, Technology and Logistics

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.

- First time we had identified and specifically quantified critical energy requirements
 - Alignment to critical mission operations by-installation
 - Established prioritization for energy resilience requirements and policy/compliance
- Good first attempt to quantify critical energy requirements to support mission assurance
 - However, gap was identified for initial sizing and specifically continuous sizing as mission adapts

Improving guidance to quantify energy loads that align to critical mission operations – encouraging continuous process to ensure appropriate sizing of energy generation with evolving missions.





DoD Emergency Power, Fuel, and Testing

Acquisition, Technology and Logistics

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

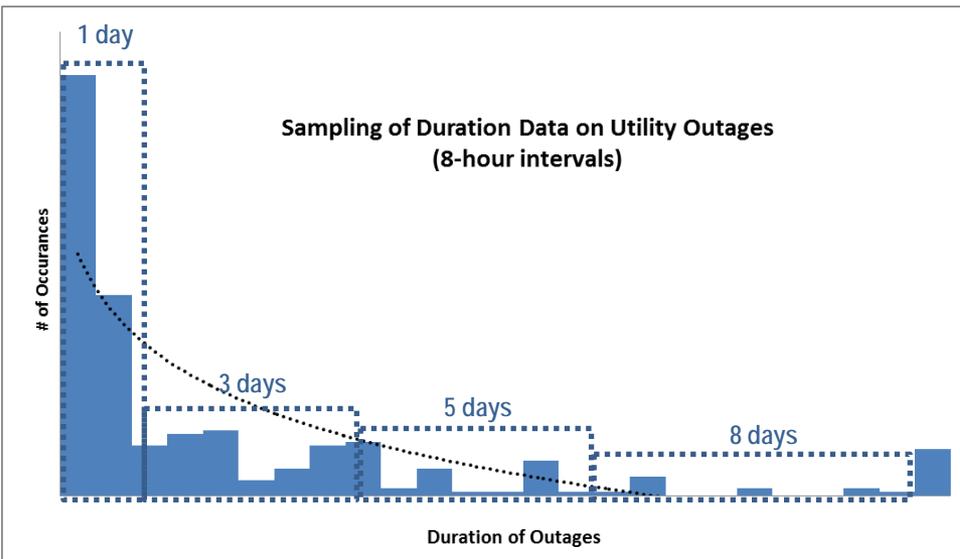
% of respondents in compliance with policy.

- 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



Establishing a Baseline and Thinking about Risk Trade-Offs

Acquisition, Technology and Logistics



- Outage Duration Data Results
 - > 50% only lasted 1 day
 - ~ 25% lasted 1 to 3 days
 - < 10% lasted beyond 5 days
 - ~5% lasted beyond 8 days

Most outages are of shorter duration and very few typically extend beyond 1 week.

* For training purposes, analysis performed on sampling of outage, generator, and fuel data.

Analysis of Current State of Generators and On-site Fuel Supplies:

- On-site fuel supply fell between 1-2 day range at 100% load requirements
 - Current on-site fuel supply has potential to meet ~70% of historical outages
 - On-site fuel supply does not include additional fuel deliveries
 - If fuel deliveries extend to 1 week or greater, could potentially meet ~95% of historical outages
- However, we should still ask: Are generators the most resilient and cost-effective way to support mission assurance on military installations?

Ensure compliance with existing policies to remediate risks today, and think about more cost-effective and reliable solutions to improve our energy resilience.



Energy Resilience Policy Conclusions & Recommendations

Acquisition, Technology and Logistics

- Develop universal power resilience guidance, prioritizing important energy resilience requirements
 - Encourage the most cost-effective solutions that improve mission readiness (allow for solutions beyond generators)
 - Better define and describe 'critical' energy requirements for installations (coordinate collaboratively with tenants, missions owners and operators of critical facilities)
 - Continue to perform against already existing requirements: sizing of energy loads, maintenance, fuel, plans, and testing/exercising

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).



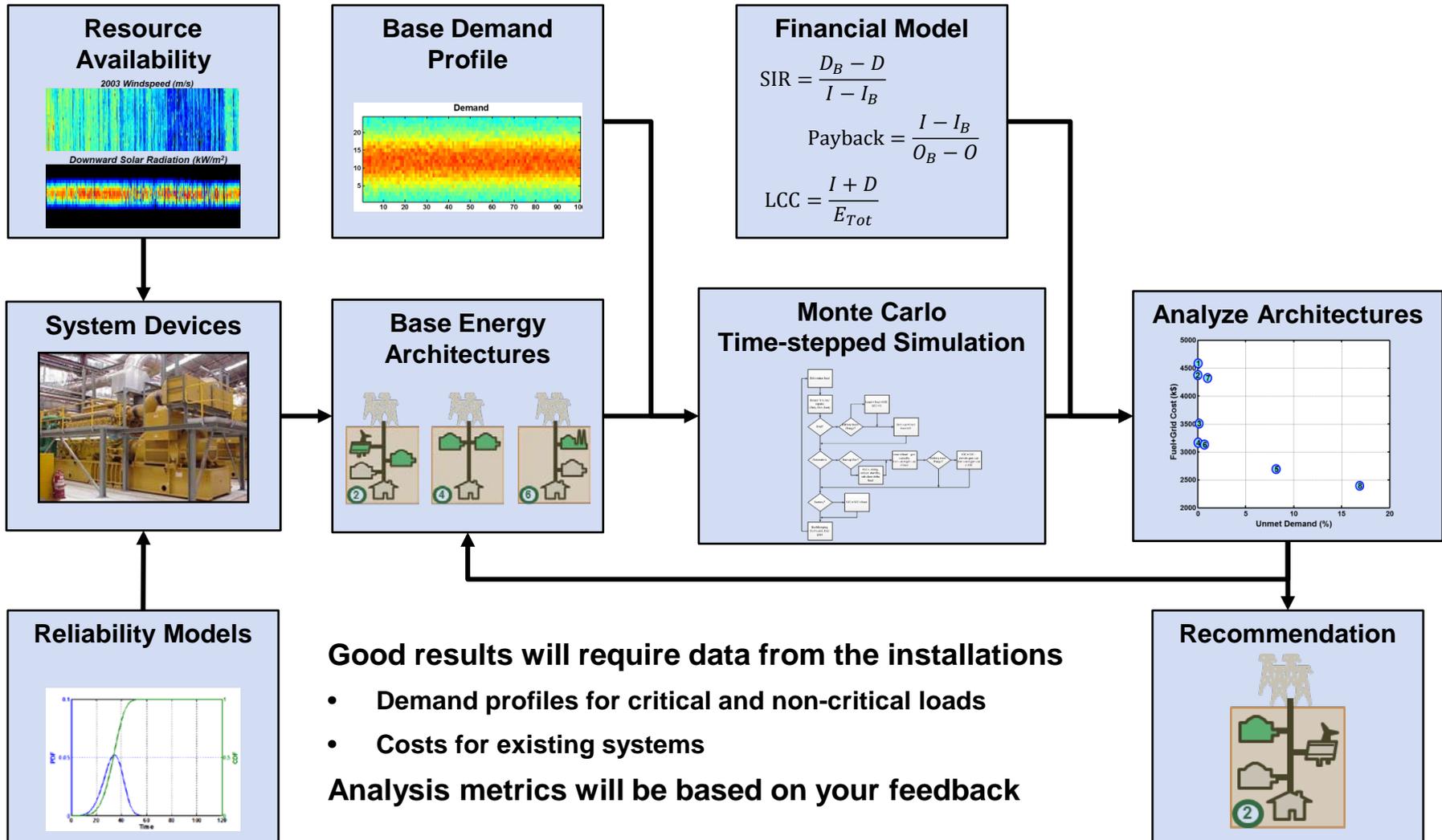
❑ Developing business case analyses (BCA) approaches to support budgetary resources or alternative financing opportunities

- Evaluate current DoD life cycle cost analysis approaches and levelized cost of electricity practices and methodologies
- Items of interest include:
 - ✓ *Operations, maintenance, and repair related costs*
 - ✓ *Disruption/outage costs*
 - ✓ *Financial incentives*
 - ✓ *Availability, reliability, and quality metrics*



Energy Resilience BCA Study Analysis Approach

Acquisition, Technology and Logistics

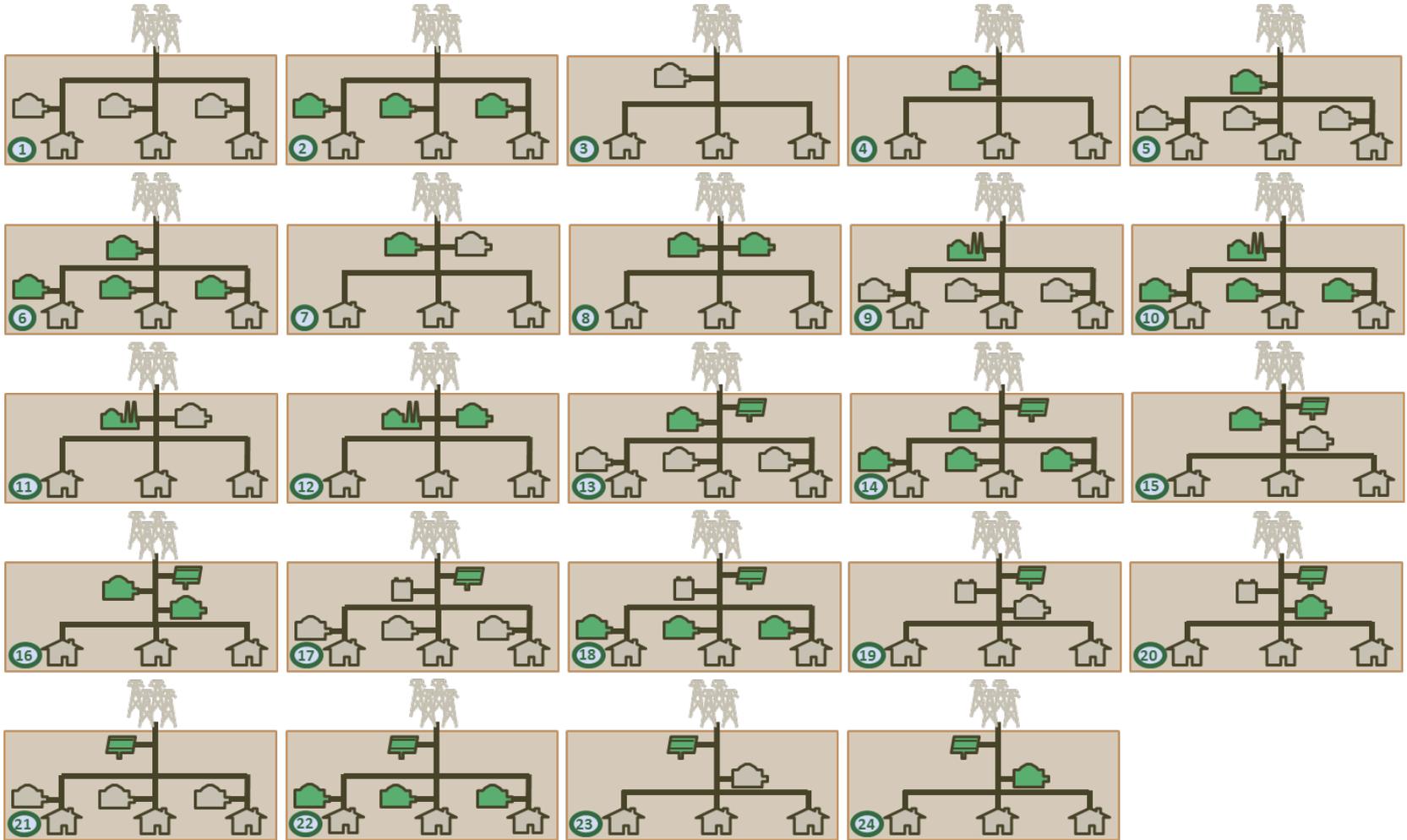




Energy Resilience BCA Study

Energy Architecture Review Concept

Acquisition, Technology and Logistics



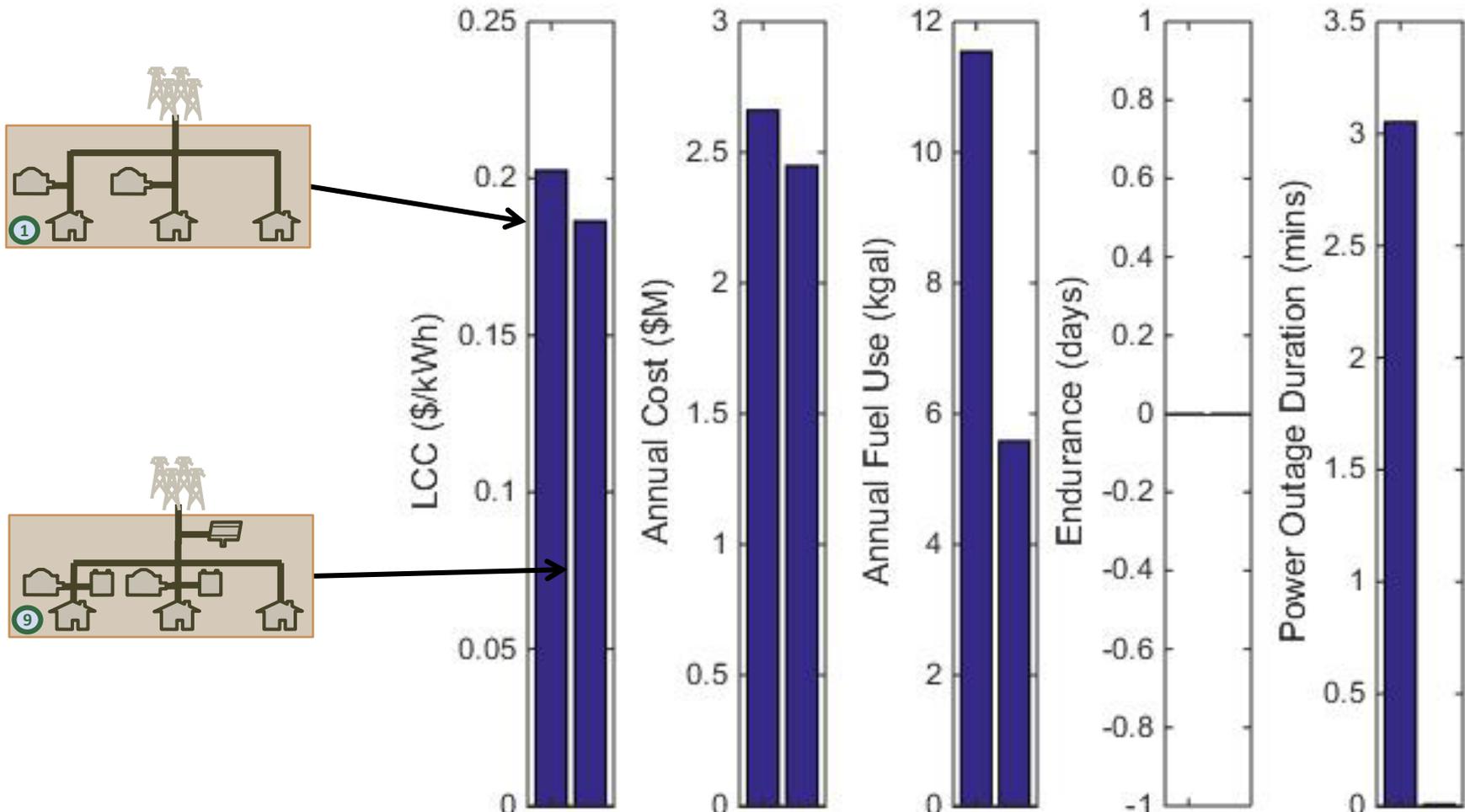


Energy Resilience BCA Study

Energy Architecture Comparison Concept

Acquisition, Technology and Logistics

Energy Architecture Comparison Concept – Solar PPA and Generator Battery and Building Backup Generators



-Preliminary Conceptual-



Backup



Resilience Philosophy and Principles

Acquisition, Technology and Logistics

Resilience is, “the capacity of a system, enterprise, or a person to maintain its **core purpose** and integrity in the face of dramatically changed circumstances” (Zolli, Healy, 2013).¹

“Resilience thinking requires that you recognize and appreciate that the systems we depend upon are complex adaptive systems. A traditional command-and-control approach to managing resources usually fails to acknowledge the limits to predictability inherent in a complex adaptive system. Resilience thinking is systems thinking” (Walker, Salt, 2006).²

Review of resilience principles:

- ✓ Intimately ties organization’s core purpose (mission) to changing conditions (disruptions)
- ✓ Encourages recovery (adaptation) of mission during disruptions in a cost-effective manner
- ✓ Remains agnostic to specific programs, technologies or threats, with a focus on mission or capability of the organization (NO arbitrary biases which limit mission success and cost \$\$\$)
- ✓ Performed correctly, it is an application of systems thinking: it allows for efficient and cost-effective operations to maximize the capabilities of your organization

Resilience (PPD-21): the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions.

Security (PPD-21): reducing the risk to critical infrastructure by physical means or defense cyber measures to intrusions, attacks, or the effects of natural or manmade disasters.

Resilience Is NOT Security³:

- ✓ Resilience encourages continuation of your mission through the most affordable solution
- ✓ Security encourages “protection” of something to a threat (asset or even the resilient solution)
- ✓ Security is typically layered on top of resilient solutions, and are often expensive (no savings)
- ✓ Resilience minimizes security protection schemes and eliminates risks early-on through systems thinking – builds in risk decisions early to maximize capability, and to minimize security protection and costs

¹Zolli, Healy, *Resilience, Why Things Bounce Back* (New York, 2013), 7.

²Walker, Salt, *Resilience thinking, Sustaining Ecosystems and People in a Changing World* (Washington, D.C., 2006), 11.

³See the following: <http://www.dhs.gov/what-security-and-resilience>.



**THIS CONCLUDES OUR PRESENTATION FOR
TODAY.**

**Please join us tomorrow from 1200-1330 when
we will be talking about the next generation of
facility energy remote auditing tools**