

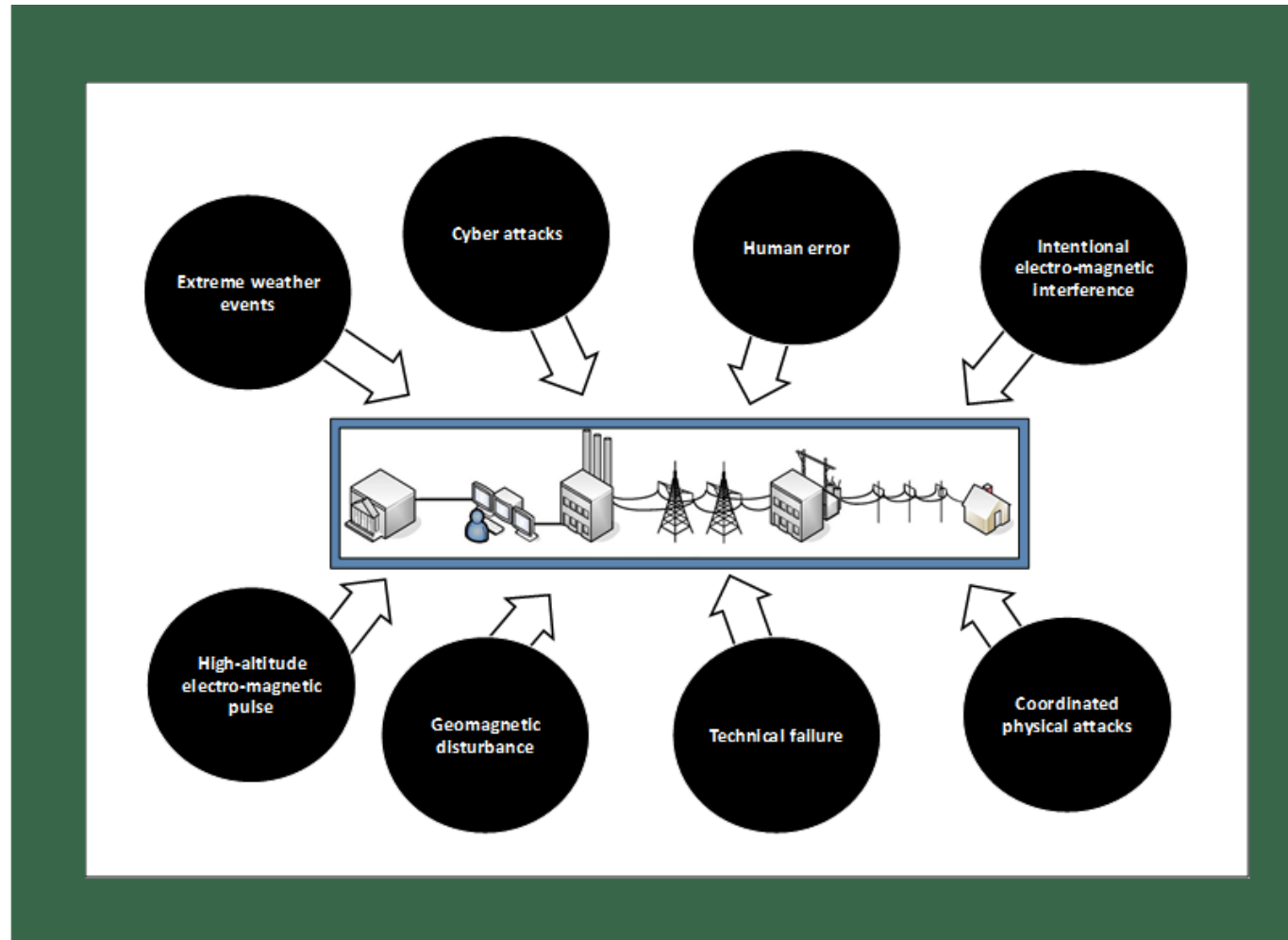


Resilience for Installations and Communities

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Threats to Power Systems



FY 18 NDAA Definition

Resilience: The ability to avoid or prepare for, minimize, adapt to, and recover from anticipated and unanticipated energy disruptions in order to ensure energy availability and resiliency sufficient to provide for mission assurance and readiness, including task critical assets and other mission essential operations related to readiness and to execute and rapidly reestablish mission essential requirements

January 2018 - Department of Defense

Climate-Related Risk to DoD Infrastructure, Initial Vulnerability Assessment Survey (SLVAS)

Report required by Senate Report 114-237, page 11 (TAB C), accompanying S. 2806 of the Military Construction, Veterans Affairs and Related Agencies Appropriations Bill for Fiscal Year 2017

Survey Results

50% of installations surveyed reported impacts from at least one of the listed events.

The top 5 asset categories reporting impacts were:

- Airfield operations
- Transportation infrastructure
- Energy infrastructure
- Training/Range Facilities
- Water/wastewater systems

Mitigation Practices in Other Sectors

- **Large corporations** use back-up generators that stand idle in case of loss of power.
 - Companies such as Amazon, Google, Microsoft and Facebook use back up generators for their data centers.
- **Hospitals and universities** use islanded microgrids in times of crisis.
 - Princeton University's microgrid is an efficient power generation and delivery network that draws electricity from a gas-turbine generator and solar panels. During Hurricane Sandy, Princeton's microgrid was able to disconnect completely and generate all the power needs for the campus, including saving 50 years worth of DNA research.
- **Cities** prepare for large-scale outages due to weather or seismic activity.
 - San Francisco is preparing for earthquakes by investing in microgrids with a goal to invest in resilient buildings to support vulnerable populations in the face of natural disaster.

Threats for the Federal Government

Unexpected outages can be very costly to the Federal Government.

- While the electric grid in the United States is one of the most reliable in the world, it still experiences significant, unexpected power outages.
 - **In 2011 and 2014, electric utilities reported 362 targeted attacks that caused outages** or other power disruptions. Of those, 14 were cyberattacks, and the rest were physical in nature. (CNA, “National Security and Assured U.S. Electrical Power” October 2015)
 - **A military base can expect to experience an outage lasting one to three days every 20 years**, and it has a 50/50 chance of experiencing a week-long outage. (CNA, “National Security and Assured U.S. Electrical Power” October 2015)
 - In 2015 alone, DOD facilities experienced approximately 127 outages that lasted 8 hours or longer, caused by an equal combination of weather and equipment failure (DOD 2015).
 - **An estimated 679 widespread outages occurred from 2003-2012**, with costs averaging \$25-\$70 billion per year (Executive Office of the President 2013).
 - **The cost of US weather-caused outages lasting more than 5 minutes averaged \$18 billion to \$33 billion per year from 2003 to 2012**, and those costs were dominated by 14 long-duration outages.

DOE Policy on Energy Security

- **Executive Orders 13514 (2009) and 13693 (2015) require DOE and other federal agencies to reduce greenhouse emissions.**
 - DOE identified SMRs as “alternative energy” option for meeting clean energy goals
 - The 2010 National Defense Authorization Act directed DOD to study the feasibility of nuclear power on military facilities; in practice, this has focused on SMRs as their size and siting flexibility are better suited for DOD needs than large, conventional reactors.
- **DOE believes that benefits of SMRS other than GHG reduction of SMRs for federal facilities include:**
 - Islanding operations during grid outages
 - Operational flexibility (load following)
 - Requiring less frequent refueling than other backup power
- **DOE is required to improve the security of US energy infrastructure by the by the Fixing America’s Surface Transportation (FAST) Act of 2015**
 - FAST Act provides authority for DOE to mandate specific actions to protect energy infrastructure in response to a grid security emergency, as identified by the President.

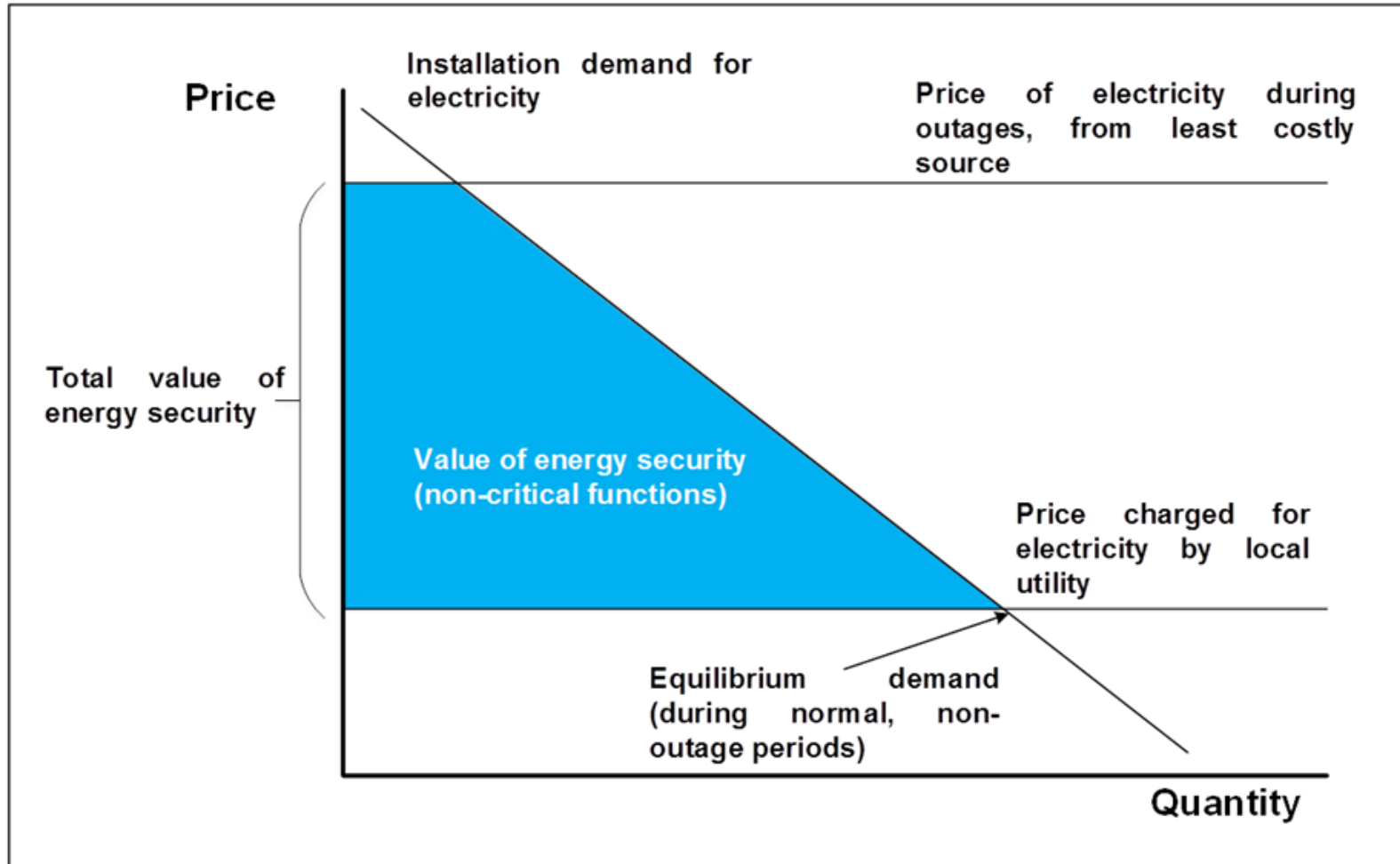
Federal Review of Resilient Infrastructure



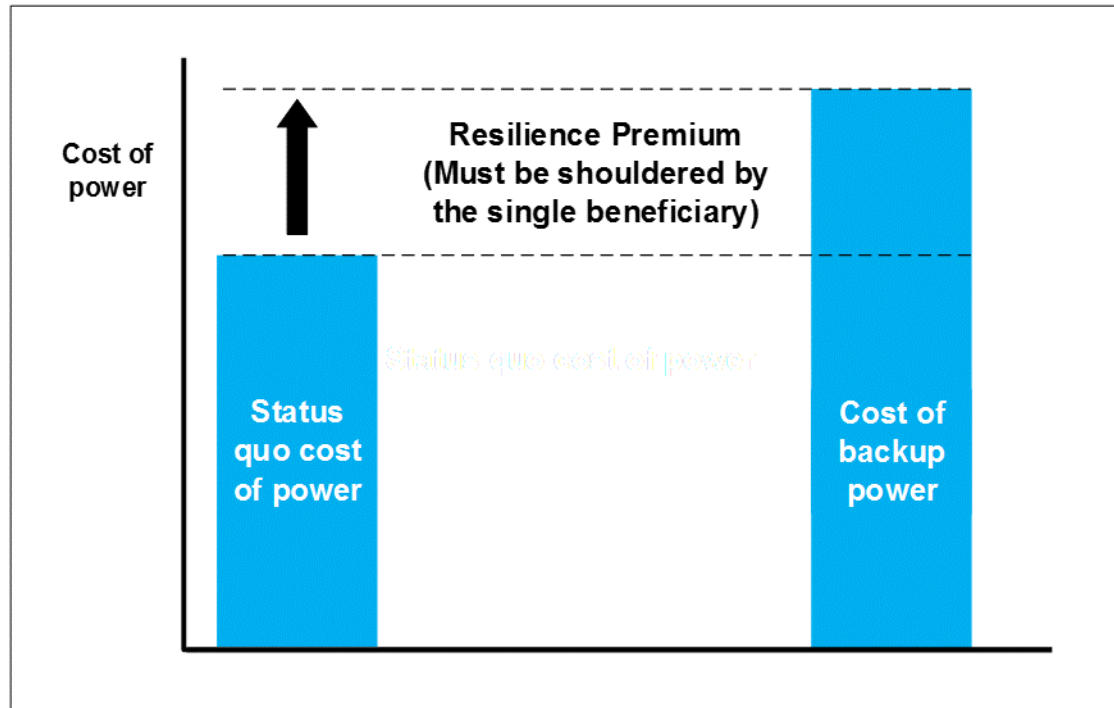
Resiliency Service Agreement – Key Terms

- Resiliency Services Addendum
 - Execute Agreement
 - Capitalize Construction Work in Progress (“CWIP”) as assets on the balance sheet
 - Buy-down
 - Amortization schedule: balloon payment, long term amortization
 - Protections for unscheduled outages
 - Cost increase pass-through
 - Term of 30+ years for PPA
 - Subject to annual appropriation
- Potential Authorities
 - Interagency Agreement, Economy Act, 10 USC 2922a, UESC, others, new authority

Value of Energy Security



Resilience Premium



This premium could be applied to backup power. Typically, the status quo options will be continuing to use the existing electric utility service. The value of resilience should then be captured in the difference between the cost paid for resilience and the lower amount that would be paid by continuing the status quo.

Methods to defray costs

- Inclusion of resilience in larger, financed projects such as UESCs or ESPCs
- Other longer term contract vehicles under authority of 10 U.S.C. § 2922a; WAPA/TVA/BPA agreements; GSA areawide contracts
- Inclusion of resilience through utility privatization
- Sizing “backup” or “emergency” power to do more:
 - Demand reduction
 - Peak Management
 - Interruptible Rates
- Including storage options to create flexibility and reduce fuel requirements

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