U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY

FEMP's Resilience Planning Tools and Services

2019 Federal Environmental Symposium

October 30, 2019

FEMP
Federal Energy Management Program

Agenda

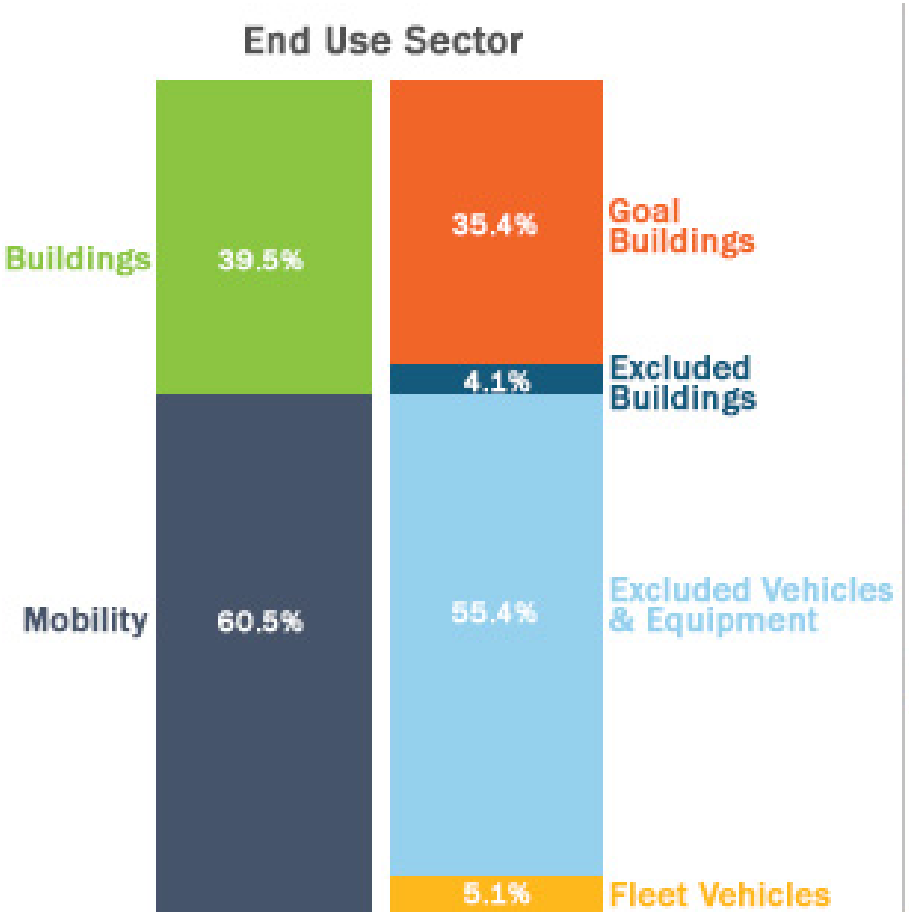
1. **FEMP Overview**
2. **FEMP Resilience Planning Tools and Services**
   - Energy and Water Resilience and Security
   - Facility and Fleet Optimization
   - Distributed Energy Program
   - Performance Contracting
3. **Conclusion**

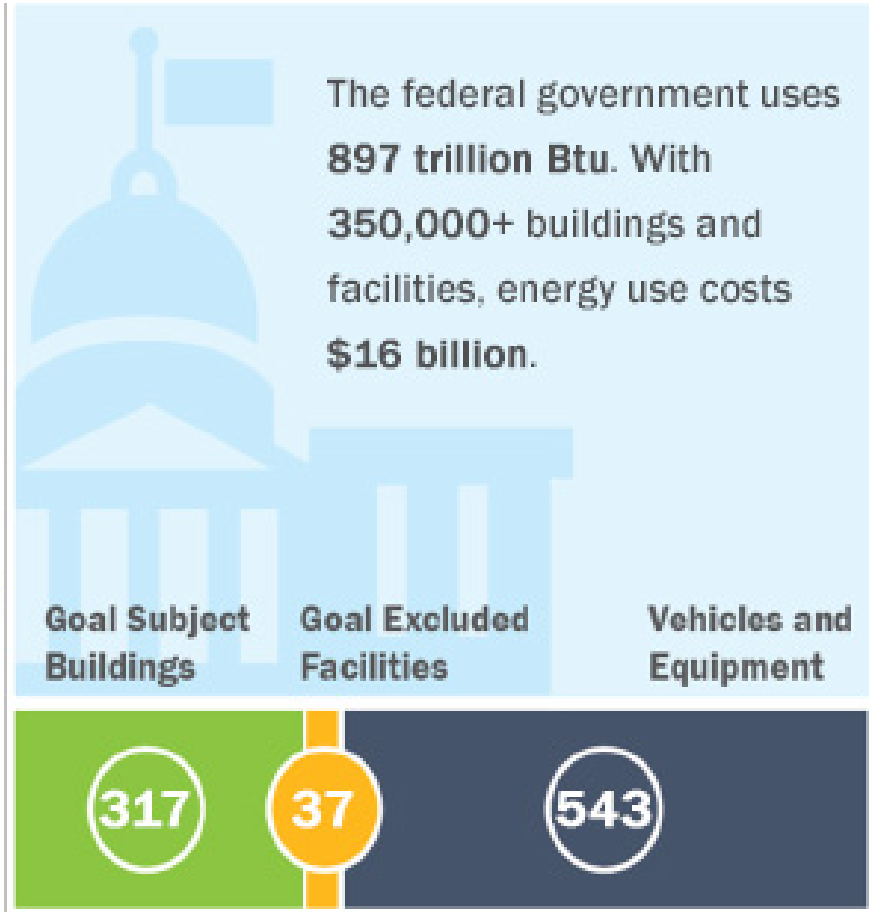
FEMP Overview

Leslie Nicholls
FEMP Strategic Director

Federal Government Energy Use by Sector

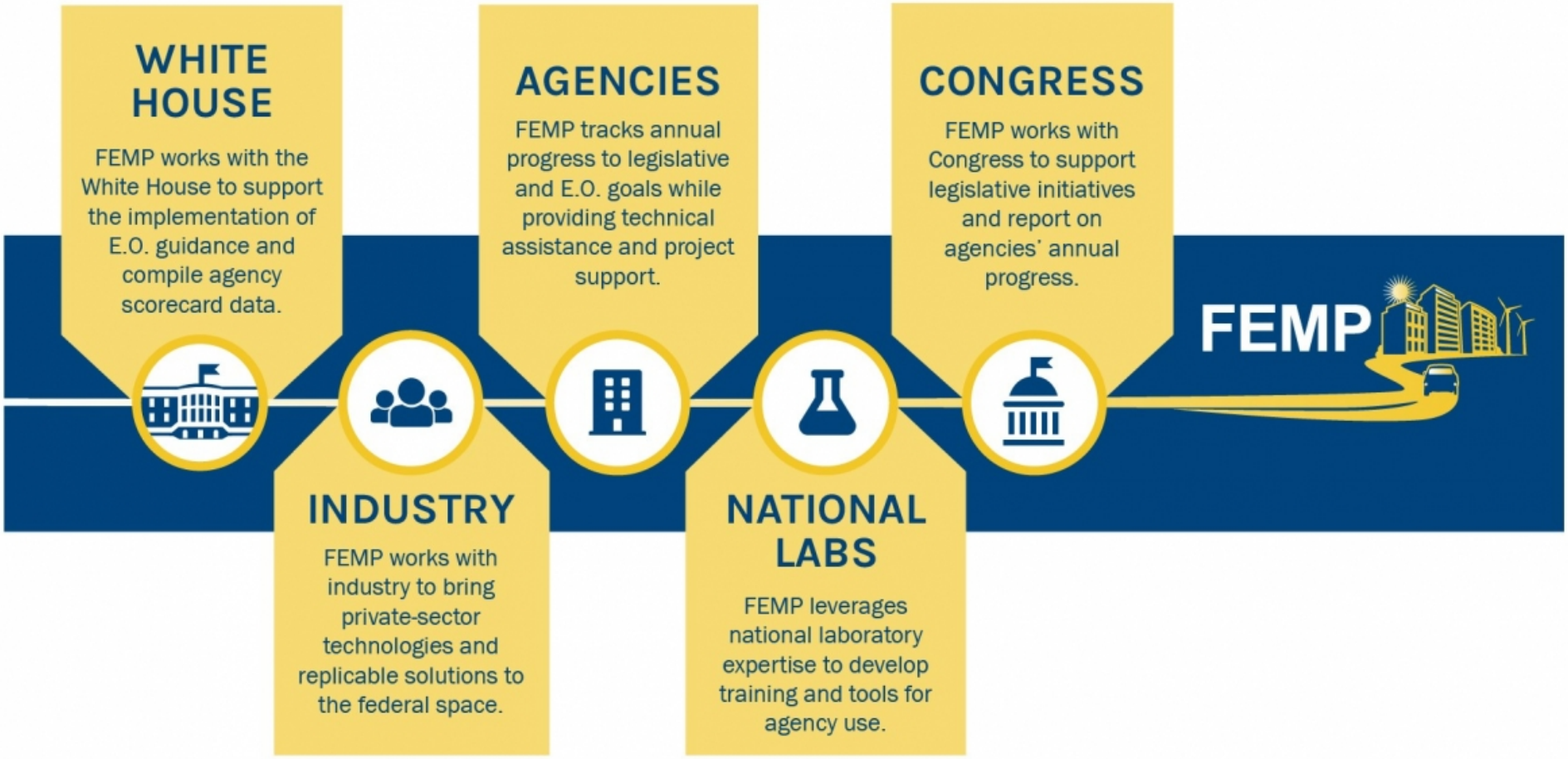
FY 2018 Data





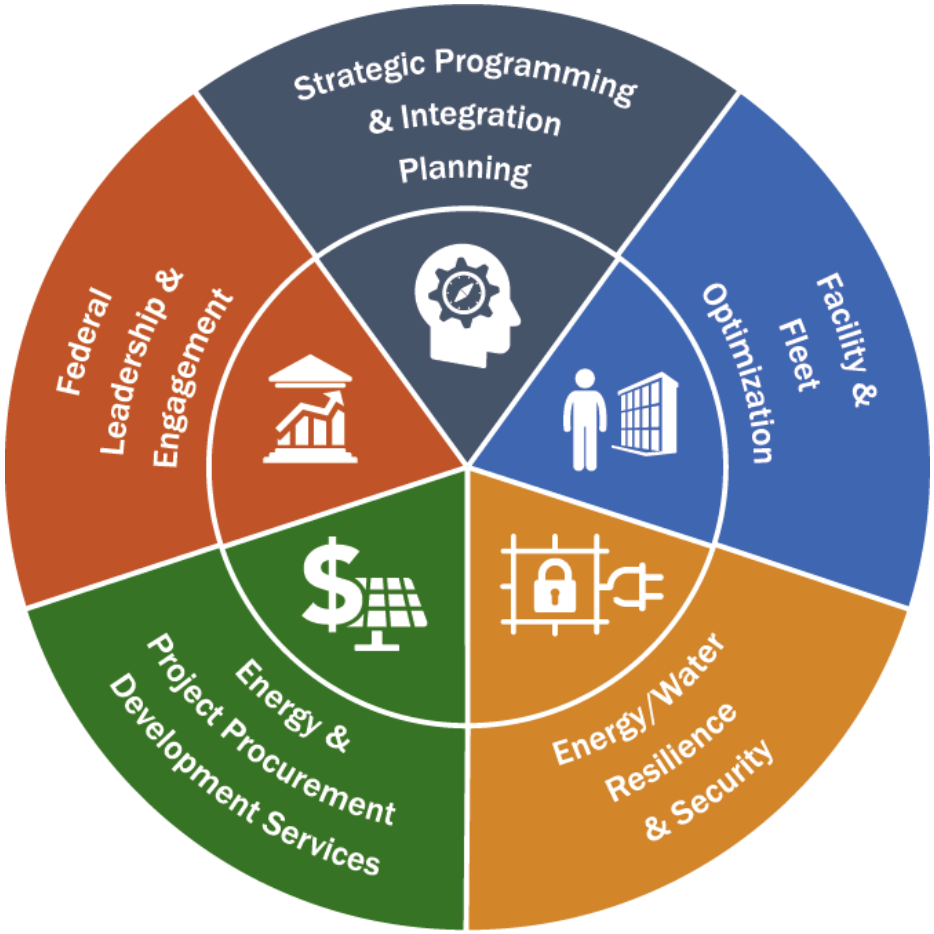
Annual Performance Data: https://ctsedwweb.ee.doe.gov/Annual/Report/Report.aspx

FEMP's Stakeholders



FEMP Wheelhouse

Providing strategic energy management for agencies to become resilient, efficient and secure in support of Administration priorities for American energy dominance, increased government accountability, and development of a future-focused workforce.

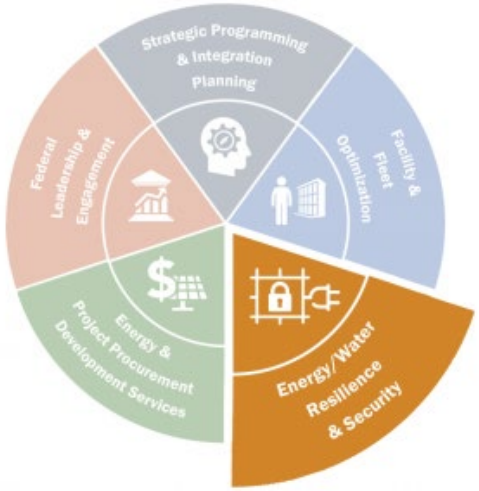


FEMP
Federal Energy Management Program

Energy and Water Resilience and Security

Leslie Nicholls

FEMP Strategic Director



Energy and Water Resilience and Security

Portfolio Resilience Planning and Implementation

Provides a management framework to guide agencies through resilience planning that addresses mission critical energy and water infrastructure and development of resilient, efficient, and secure operations.

Energy and Cyber Security Integration

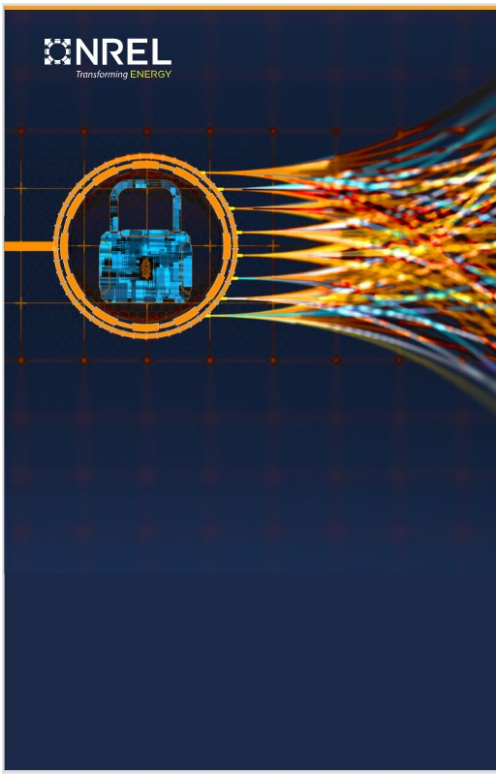
Empowers, educates, and trains federal agencies on how to actively identify, prioritize, and mitigate the risks of cyber or physical attacks on facility-related control systems while maintaining the required level of service for efficient operations.

The DER Cybersecurity Framework

Networked grid devices are now being controlled by consumers or third parties who are not fully aware of the need for cybersecurity. The Distributed Energy Resources Cybersecurity Framework (DERCF) aims to help federal agencies mitigate gaps in their cybersecurity posture for distributed energy systems.

Tool benefits:

- Holistic tool for evaluating cybersecurity posture of federal sites with DER systems.
- Sharper focus on distributed energy technologies – and greater emphasis on physical security and technical management.
- DERCF-guided assessments (web-based application or a downloadable document) present users with questions about security controls and practices that relate to their use of DERs.
- DERCF web application tool will generate a score from the user's responses that indicates their current state of DER cybersecurity – and how they can improve.



FY20 – Validation across federal sites to gather feedback and understand site operations.

Technical Resilience Navigator

The Technical Resilience Navigator (TRN) is a web-based resource that takes a systematic approach to resilience planning based on best practices and proven, practical solutions.

Technical Resilience Navigator

- **TRN Benefits:**
  - ✓ Helps agencies develop and coordinate a strategic decision-making process.
  - ✓ Offers a web application that tracks progress through resilience planning and helps manage and delegate activities.
  - ✓ Provides resources for continual engagement with leadership and stakeholders.
  - ✓ Delivers processes for risk-informed decision making.
- **Offers a flexible approach:**
  - ✓ Can be modified to meet existing resilience goals or requirements.
  - ✓ TRN worksheets can be edited to modify assumed inputs to better fit existing requirements.
  - ✓ Easily docks into existing project execution processes and procedures.

Technical Resilience Navigator

Development Approach

- **Leveraged National Lab expertise (PNNL, NREL, LBNL) and Agency lessons learned**
- **Peer Reviewed with Agencies**
  - Engaged users in final deliverable and refinement via Agency Peer Review Workshops:
    - DOE, Strategic Petroleum Reserve
    - Army, Ft Irwin
    - VA, North Las Vegas
  - Integrating across DOE:
    - Office of Electricity Transmission Permitting and Technical Assistance Division; leveraging lessons learned in developing Distribution System Resilience Decision Framework
    - Integrating lessons learned from PNNL, NREL, and LBNL; briefed INL on progress for potential future integration
- **Incorporated feedback into TRN resources**
- **In-depth Validation & Refinement in FY20**

Facility and Fleet Optimization

Jay Wrobel
FEMP Supervisor - Facility & Fleet Optimization

Facility and Fleet Optimization

Optimized Facility Design & Operations

Provides technical guidance and resources related to increasing energy performance of buildings and campuses.

Building Technology Validation

Assess and coordinate in-field performance of technologies and practices that reduce energy costs and promote energy continuity.

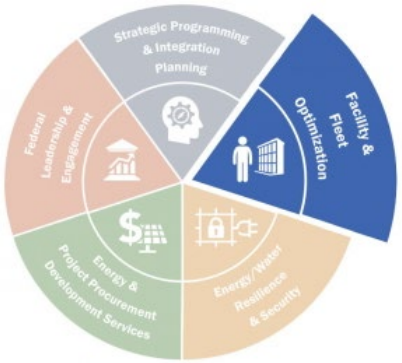
Federal Fleet Management

Provides guidance and assistance on how to reduce petroleum consumption and increase alternative fuel use to meet federal legislation and mandates.

Efficient Product Procurement

Provides information about energy-efficient products and energy-saving technologies that can help agencies meet federal energy-efficient product purchasing requirements.

Building Optimization = Resilience



Audits: Assess all Opportunities

Audits can be done for energy savings but also for resilience, water, and mission-destabilizing impacts in a cross-functional way to measure and identify opportunities

50001 Ready: Manage Your Energy

Management system applicable to energy but also resilience, cyber, water, whatever resource that requires a continuous improvement process

Healthy Buildings: Resilient Staff

Protecting the conditions of the working space leads to enhanced resilience so have a technique to measure and improve productivity from operations is critical

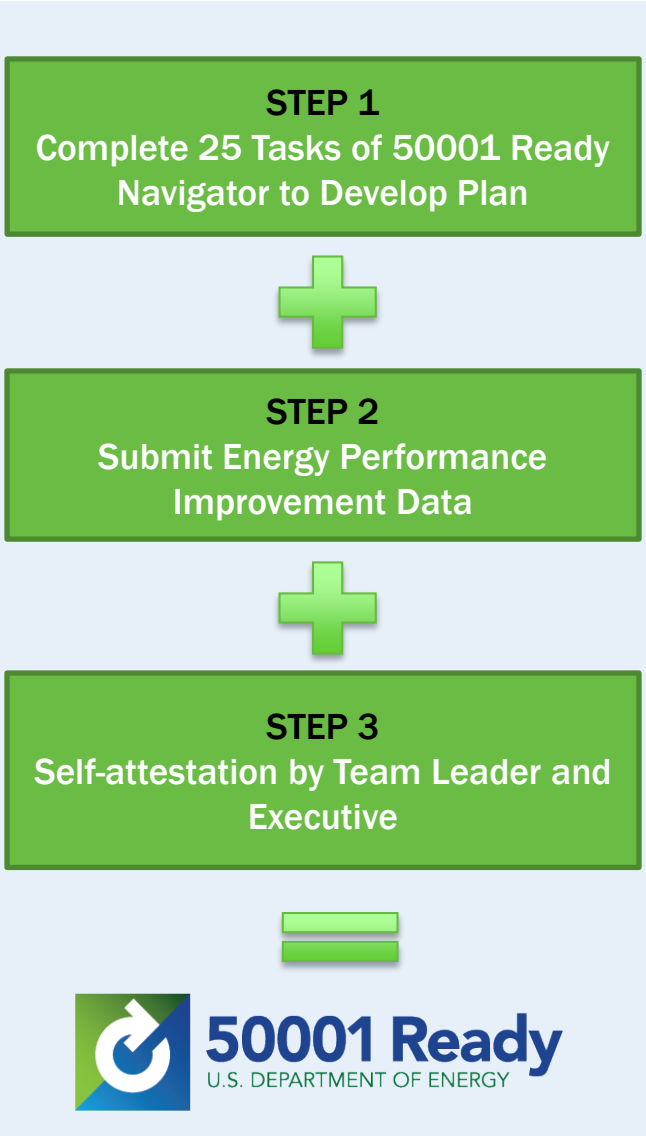
Product Procurement: Every Btu Counts

Verified energy efficient products will place less demand on the load of a site, especially in demand-reducing events

Manage Energy, Manage Resilience

50001 Ready
U.S. DEPARTMENT OF ENERGY

- **An effective energy management system enables:**
  - Creates robust organizational planning
  - Increases operational efficiency
  - Empowers staff to react to change
- **DOE developed 50001 Ready Navigator Tool**
  - Free 'Turbo Tax' for self-guided ISO 50001 conformance
  - Online tool with simple, step-by-step approach to ISO 50001
  - Ability to assign tasks to team members
  - Extensive guidance available in each module
- **50001 Ready Recognition from DOE**
  - Self-attested conformance to ISO 50001
  - No third party audit (internal audit only)
  - Applicable for all sectors and sites of all sizes
  - Free technical assistance available from FEMP, BTO and AMO
  - Standardized to apply across multiple sites
  - Annual recognition allowing for system maintenance and updating



50001 & 14001 Compatibility

50001 Ready
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Unique Elements: data-driven approach

Leverage Common & Similar Elements

ISO 50001

ENERGY POLICY

Energy review
Energy performance indicators
Energy baseline
Energy management

ISO 14001

ENVIRONMENTAL POLICY

Environmental aspects
Emergency preparedness
Environmental management program

Energy baseline
Energy management

MANAGEMENT COMMITMENT

ROLES, RESPONSIBILITY & AUTHORITY
COMPETENCE, TRAINING & AWARENESS
COMMUNICATION
OPERATIONAL CONTROL
MONITORING & MEASUREMENT
DOCUMENTATION
INTERNAL AUDIT
CORRECTIVE & PREVENTATIVE ACTION
MANAGEMENT REVIEW
DESIGN
PROCUREMENT

ISO 9001

QUALITY POLICY

Customer focus
Planning of product realization
Customer-related processes
Control of nonconforming

Healthy Building = Resilient Staff

FEMP Healthy Building Initiative (HBI)

- Integrate energy efficiency and resilience measures with occupant health and wellbeing by quantifying expected financial benefits
- Develop a *toolkit* (data collection guide, cost-benefit calculator, equipment library) to help federal facility managers make a holistic decision on building retrofit and operation

FY20 (in discussion)

- Develop HBI "program-in-a-box" for agency pilot/adoption

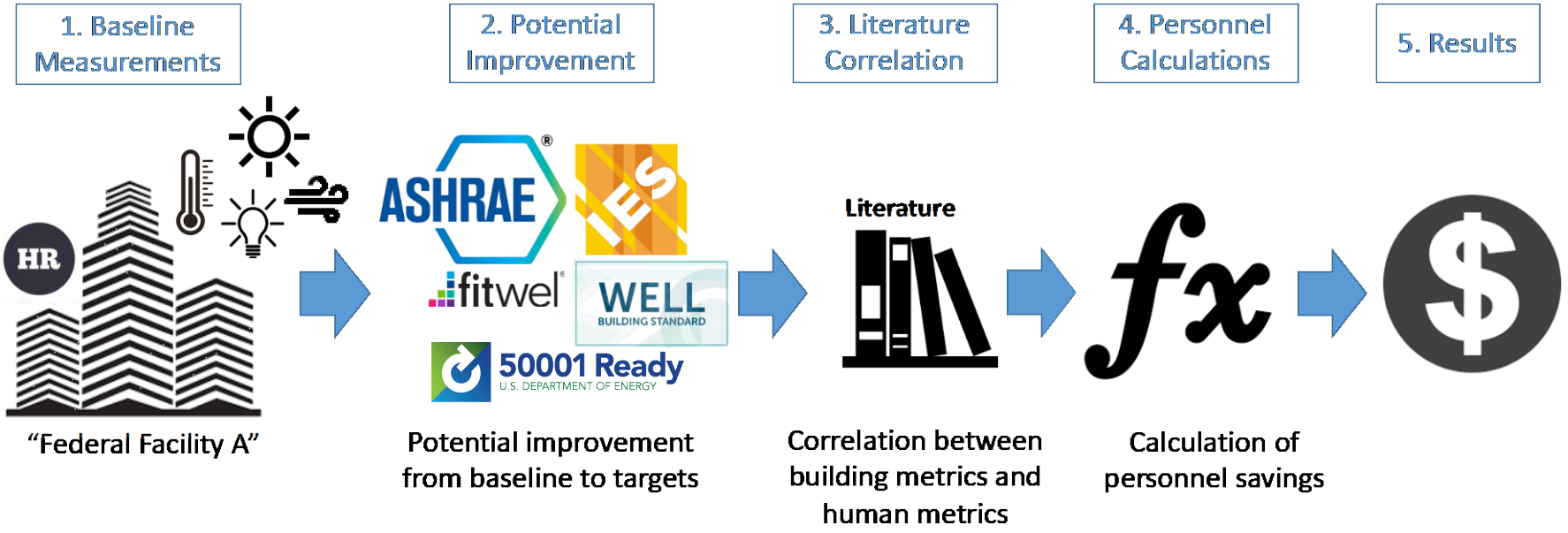
GSA Pilot

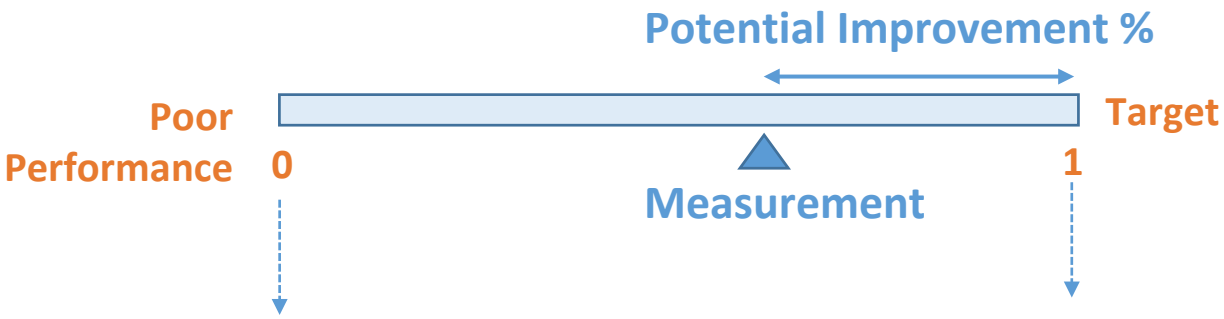
- Validate the project methodology (feasibility, cost, applicability) on GSA buildings (4 pilot buildings and then "unhealthy" GSA facilities)
  - With existing data from Well-built for Well-being study
  - For pilot building(s) using the HBI data collection guide

Federal Healthcare Facilities (under discussion)

- Validate HBI "program-in-a-box" to these private and public facilities

Valuing Healthy Buildings to Include Resilience





Adding Resilience to Critical Buildings

FEMP's Critical Buildings Program assists federal agencies and other organizations with optimizing the design and operation of data centers, laboratories, and hospitals. Energy and water-related improvements to critical buildings can increase the safety, security, reliability, and resilience of mission critical operations.

Assistance

- FEMP provides direct project and technical assistance from subject matter experts on data center-, laboratory-, and hospital-specific measures to reduce energy, water, and cost.

Tools

- Laboratories Benchmarking Tool
- Data Center Profiler (DC Pro) Tools, including PUE Estimator
- Air Management Tools
- Energy Assessment Worksheets

Resources

- Small Data Centers, Big Energy Savings: An Introduction for Owners and Operators
- Data Center Master List of Energy Efficiency Actions
- ASHRAE Classification of Laboratory Ventilation Design Levels

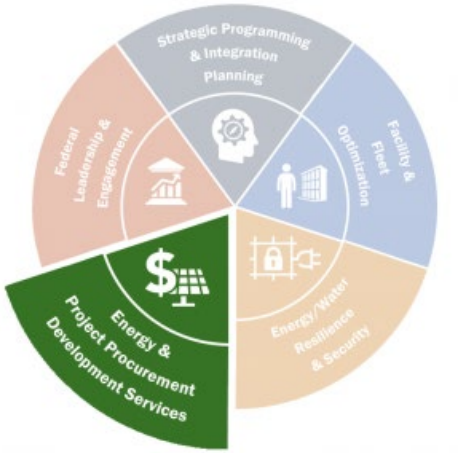
Training

- Two on-demand FEMP laboratory trainings
- Nine on-demand FEMP data center trainings
- Live FEMP webinars
- Data Center Energy Practitioner Trainings

Distributed Energy Program

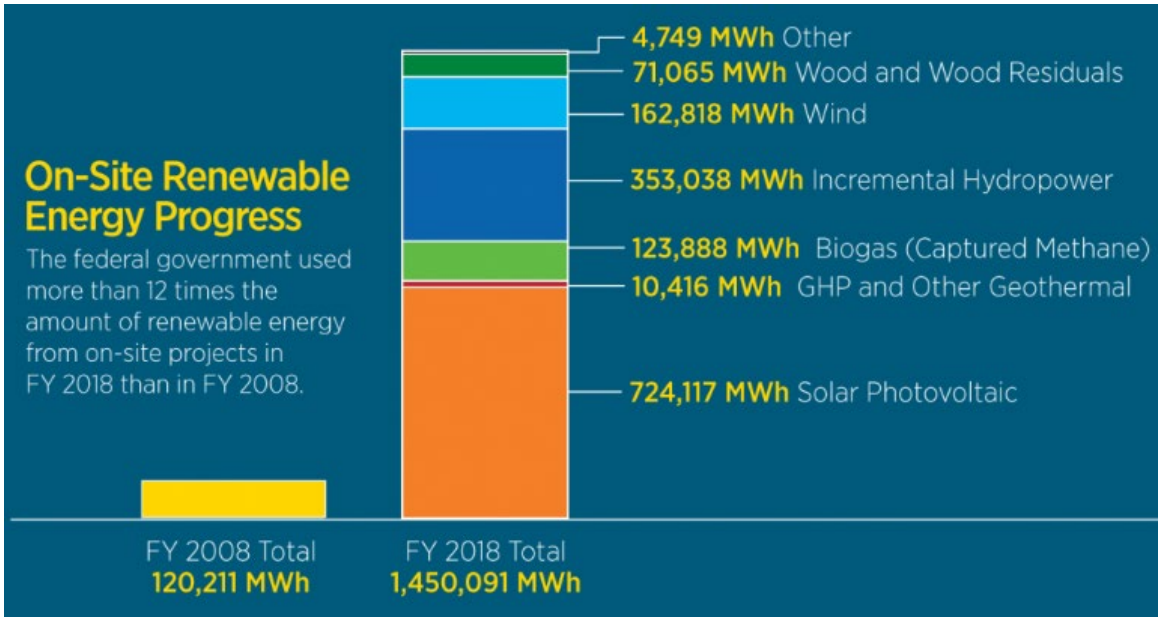
Rachel Shepherd

FEMP Energy Technology Program Specialist



Federal Government's On-Site Renewable Electricity Use FY18

An average of 32% increase for on-site projects each year for the past 10 years

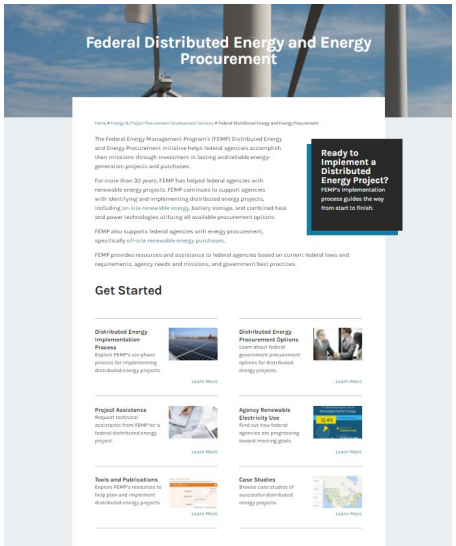


Benefits of On-Site Projects

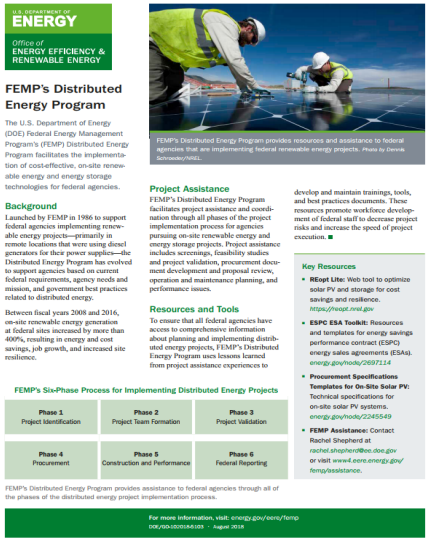
- Agencies receive "bonus" credit, equivalent to doubling the amount of renewable electricity consumed or purchased, if the electricity is produced and used on Federal or Indian land
- On-site renewable electricity projects can reduce federal agencies' utility and operating costs.
- Installing an on-site renewable as the ability to extend a site's survivability during grid outages by sustaining critical load, when paired with appropriate equipment and other technologies such as batteries.

FEMP's Distributed Energy Program Supports Resilience

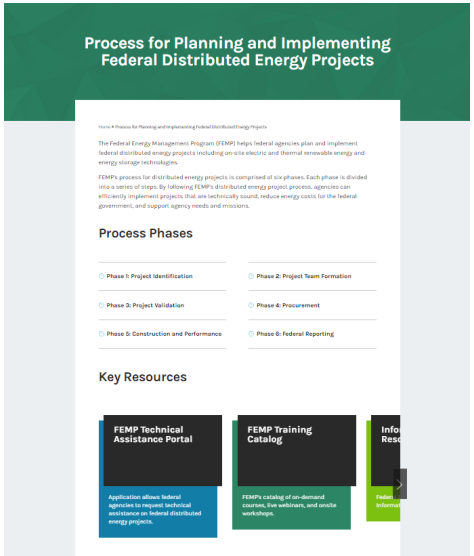
FEMP's Distributed Energy (DE) Program assists federal agencies with the implementation of cost-effective on-site renewable energy, energy storage, and combined heat and power technologies.



[FEMP's Distributed Energy Program Website]



[FEMP's Distributed Energy Program Factsheet]



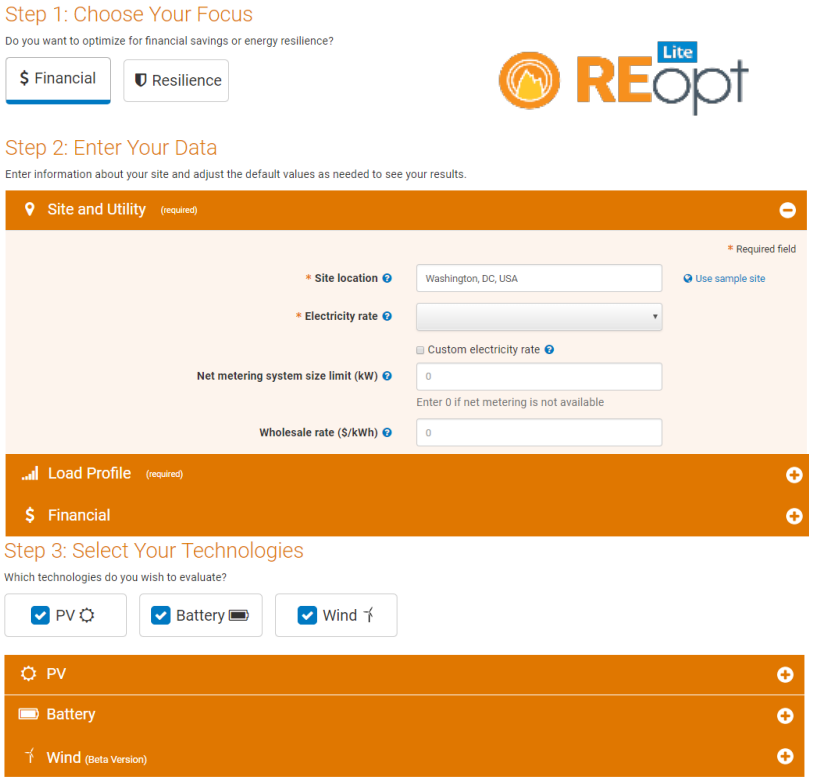
[FEMP's Distributed Energy Implementation Process Website]

Distributed Energy Can Be a Resilience Tool; Can it Work for Your Site?

- Resource
- Technology Costs & Incentives
- Utility Cost & Consumption
- Space Available
- Financial Parameters

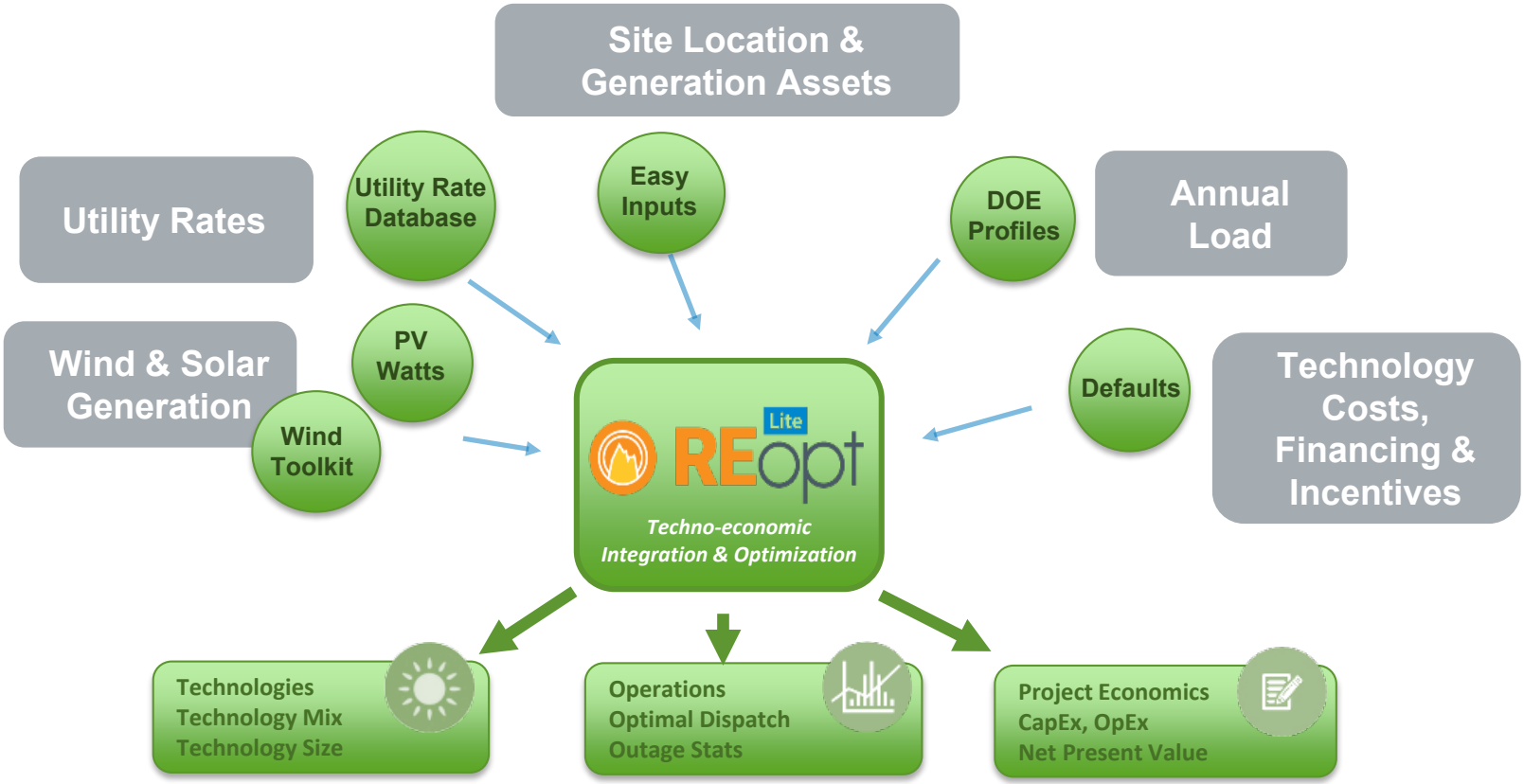
REopt Lite Web Tool

- **REopt Lite** is a web tool that offers a no-cost subset of NREL's more comprehensive REopt model
- **Financial mode** optimizes PV, wind and battery system sizes and battery dispatch strategy to minimize life cycle cost of energy
- **Resilience mode** optimizes PV, wind, and storage systems along with exiting back-up generators to sustain critical load during grid outages
- To access REopt Lite: https://reopt.nrel.gov/tool



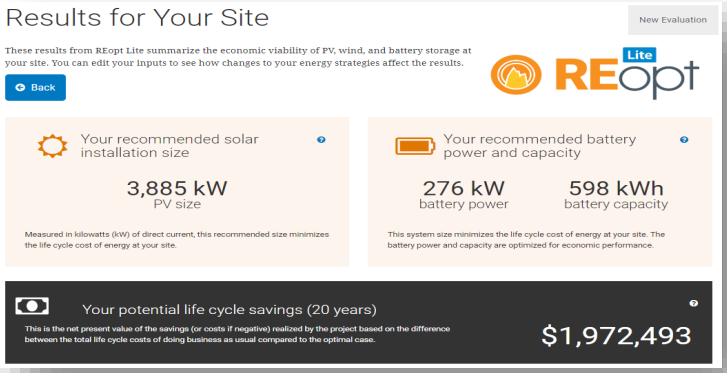
REopt Lite - Techno-Economic Analysis Tool

REopt Lite is Here to Help



REopt Lite Outputs

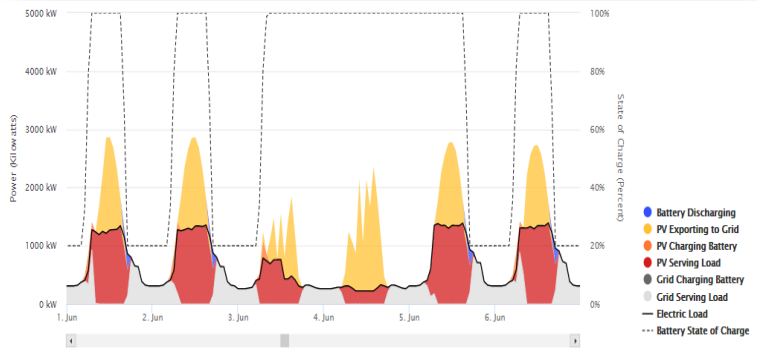
Optimal system sizes & NPV



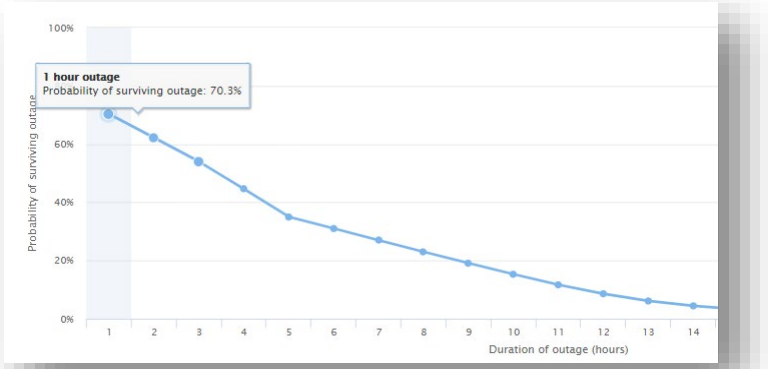
Business-as-usual vs. optimal

	Business As Usual	Optimal Case	Difference
System Size, Energy Production, and System Cost			
PV Size	0 kW	3,885 kW	3,885 kW
Annualized PV Energy Production	0 kWh	6,085,403 kWh	6,085,403 kWh
Battery Power	0 kW	276 kW	276 kW
Battery Capacity	0 kWh	598 kWh	598 kWh
Net CAPEX + Replacement + O&M	$0	$5,176,771	$5,176,771
Energy Supplied From Grid in Year 1	6,085,403 kWh	2,677,867 kWh	3,407,536 kWh
Year 1 Utility Cost — Before Tax			
Utility Energy Cost	$658,462	$502,525	$155,937
Utility Demand Cost	$293,862	$208,232	$85,630
Utility Fixed Cost	$0	$0	$0
Utility Minimum Cost Adder	$0	$0	$0

Optimal dispatch

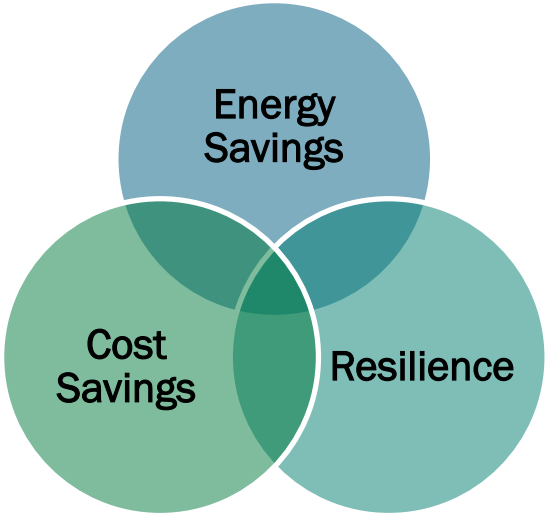


Outage Survivability Curve



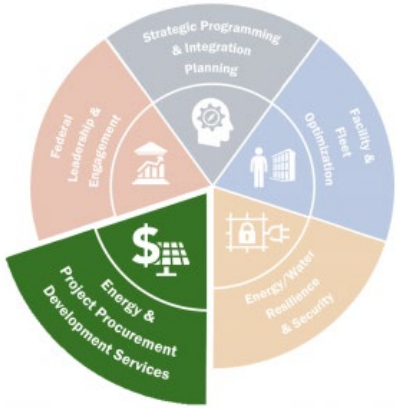
Opportunities for Cost Savings and Increased Resilience Posture

- **RE + storage can provide revenue streams and savings while grid connected**
  - Savings may allow for the incorporation of additional microgrid components
- **When integrated into a microgrid, RE + storage can increase survival time during a grid outage when fuel supplies are limited**
- **Techno-economic modeling can quantify economic and resilience benefits**

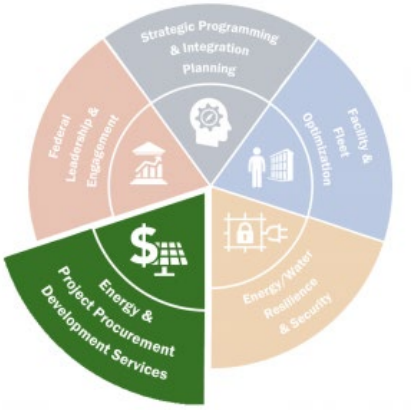


Performance Contracting

Skye Schell
FEMP Supervisor – Energy & Project Procurement Development Services



Energy and Project Procurement Development Services



ESPC, UESC, and Appropriations Funded Project Development

Offers training, project facilitation, best management practices and related services for performance contracts to help agencies implement impactful projects.

Project Quality Assurance Services

Provides quality assurance tools, reports, and services to help ensure federal agency success in their over-sight of performance contracts.

Distributed Energy and Energy Procurement

Provides resources, tools, and assistance that help agencies identify and implement distributed energy projects including on-site renewables, storage, and combined heat and power.

How to Create a Reliable, Resilient System with Performance Contracts

- **Tools to bring $ and expertise to the USG:**

  -ESPCs/Enable -Energy Sales Agreements (ESA's)
  -UESCs -Power Purchase Agreements (PPAs)

- **Consider a variety of resilience related ECMS:**

  -Back-up generation (e.g. back-up generators, CHP, renewables)
  -Storage
  -Controls
  -Micro-grid
  -Update legacy equipment/systems
  -Improve O&M
  -Add redundant systems (e.g., back-up chiller)

Pieces Or Components That Can Be Included

- **Whatever saves energy:**
  - Generators (site vs source allowed*)
  - Wires, Switch Gear, Transformers, Controls
- **Other components that are part of an ECM that saves energy.**
- **CHP can be a big driver of savings**

OMB Memorandum M-12-21:

"In determining whether an ECM qualifies for the energy efficiency definition, calculations may be done on either a 'site energy' basis or a 'source energy' basis. … '[S]ource energy' accounts for the embedded inefficiencies of transmission, distribution, and conversion."

Economics – Finding Savings

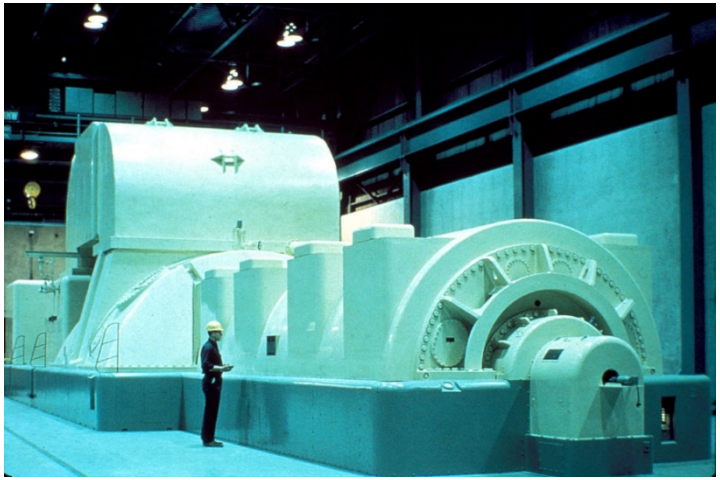
- **Finding sufficient avoided cost can be challenging.** Consider:
  - Bundling energy security ECMs with conventional ones
  - Including O&M costs (especially if replacing back-up generators)
  - Allowing other hard costs sustained during outages
- **Let demand savings be your (and your ESCO's) friend**
  - Conventional utility demand (kW) charges
  - Formal (utility or ISO/RTO) demand response programs
  - ISO/RTO capacity/"resource adequacy" charges
  - Time-varying pricing (TVP) with "rate-responsive" facility operations
    - E.g., time-of-use, day-ahead, "critical peak," or real-time pricing

Notice of Opportunity: Define the Need

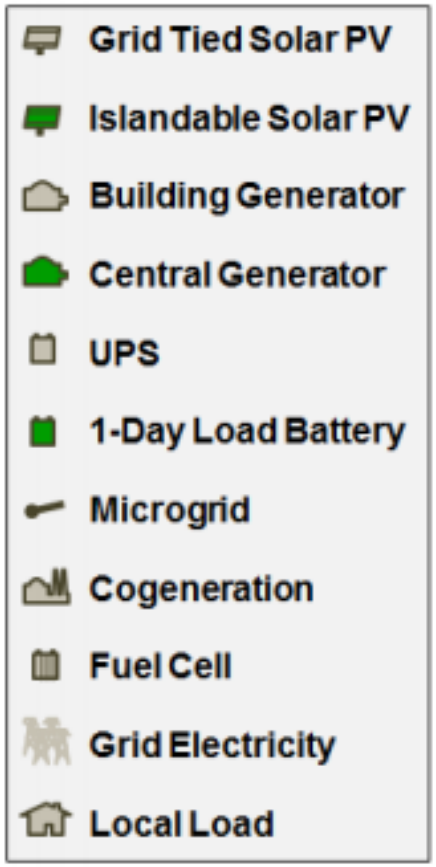
- **ESCO Selector Tool**
  - Helps agencies create an NOO that complies with federal requirements and meets agency needs. The tool produces an editable NOO in Word format as well as an NOO response evaluation form that incorporates the evaluation factors identified in the NOO.
- **Draft a Notice of Opportunity (NOO) with a general description of the need**
  - -- Buildings in scope (Include all possible—easier to cut than add)
    - Comprehensive or energy security only
    - Known critical loads
  - – Define broadly to maintain flexibility and give ESCOs opportunity to show expertise — provide ideas

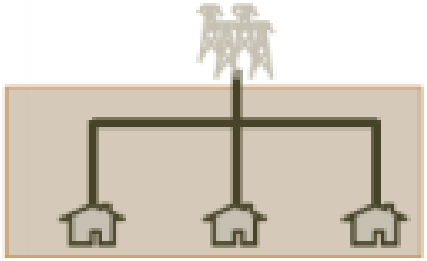
Notice of Opportunity: Clearly Define Responsibilities, Performance, and Outage Penalties

- **Include language that will require the ESCO/Utility to demonstrate:**
  - Qualifications for performing energy security studies
  - Experience in implementing energy security solutions
- **If known, indicate resilience options of interest, such as:**
  - Combined heat and power (CHP)
  - Alternative and renewable energy
  - Energy storage
  - Microgrid
    - Black start
- **Level of reliability required**

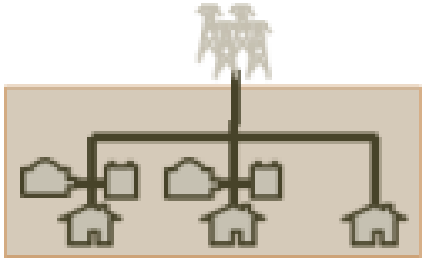


What Scope of Resilience Would You Like Explored in an ESPC or UESC?

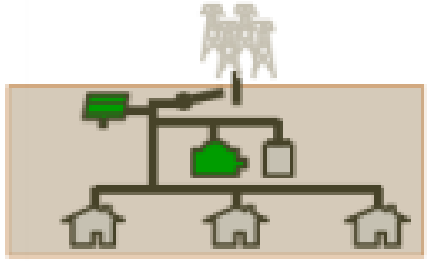




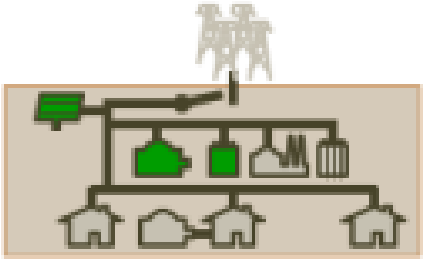
No Backup Systems



Building Generators & UPS



Islandable Solar PV, Microgrid, Central Generators, & UPS



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

What Level of Performance Are You Seeking?

Task Order must include clear definitions of performance

- **Level of reliability (critical to include in contract terms)**
  - How much redundancy
  - Which loads need what
  - 9s of availability, can withstand outage for X hours.
- **Level of resilience**
  - How fast the system can recover from an outage
  - How well the system can withstand assaults — from weather damage to terror and cyber attacks
- **Specified charges for failures to meet performance requirements**
  - Table of damages for outages of varying lengths and frequencies

Enforcement

- **ESPC: 2-in-1 performance contracts**
  1. Guarantees savings
  2. Guarantees any other performance required
- **Damages can be built into TO contract**
  - Time and frequency (see table)
- **Lessons learned**
  - Clear terms in TO on reliability
  - Damages specified for outages (duration and frequency)
    - May be different for critical loads
  - Don't make unilateral changes that relieve ESCO risk

Real Life Cost Savings with Resilience Benefits

- **Campus with over 40 buildings in the metro D.C. area.**
- **60MW capacity, Highly critical loads.**
- **Provides energy security, the ability to continue operations off of grid power, and with redundant systems including a final back-up system, should all else fail, to provide life-safety operations. The campus in fact continued operations in island mode through local outages and weather events, like hurricane Sandy.**
- **Saves approximately $60 million per year.**
- **Additional savings when severe weather utility demand charges would have cost the Federal government almost $1 million. Much of these avoided demand charges are savings in addition to the guaranteed savings used for ESPC payments.**
- **Sell excess to grid.**
- **Other ECM highlights:**
  - 10 chillers for 17,000 tons
  - 2 million-gallon thermal storage (also provides emergency water in case of blackout)
  - Small amount of PV

Conclusion

Leslie Nicholls
FEMP Strategic Director

Resilience/Energy Efficiency Nexus

FEMP resources provide the opportunity to foster synergies between resilience and:

- Energy and Cyber integration;
- Building and Fleet optimization;
- Distributed Energy generation and;
- Performance Contracting

Web Links for Useful Tools and Services

Facility Cybersecurity Tool Suite	https://facilitycyber.labworks.org/
TRN	https://femp.energy.gov/resilience/
REopt Lite	https://reopt.nrel.gov/tool
Consult with a FEMP Project Executives	https://www.energy.gov/eere/femp/energy-savings-performance-contract-federal-project-executives-0
Performance Contracting Training	https://www.energy.gov/eere/femp/federal-energy-savings-performance-contract-training
ESCO Selector Tool	https://hyperion.ornl.gov/noo/
Federal Energy Management Tools	https://www.energy.gov/eere/femp/federal-energy-management-tools
FEMP Training Catalog	https://www7.eere.energy.gov/femp/training/
Energy Exchange	https://www.energy-exchange.com/

For more information, visit: femp.energy.gov

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- 100+ co-located agency meetings
- 100+ sessions; 13 tracks
- 2 inspiring plenary sessions

Google Tip:
"FEMP Energy Exchange"

Questions?