Financing Federal Microgrids

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Agenda and Team

Agenda

I.	FEMP Support
II.	What is a Microgrid?
III.	Implementation Considerations
IV.	Procurement Options
V.	Case Studies and Resources

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FEMP's Purpose

The U.S. Department of Energy's Federal Energy Management Program works with key individuals to accomplish energy change within organizations by bringing expertise from all levels of project and policy implementation to enable federal agencies to meet energy-related goals and provide energy leadership to the country.

FEMP's Distributed Energy Program

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

[FEMP's Distributed Energy Program Website](#)

[FEMP's Distributed Energy Program Factsheet](#)

[FEMP's Distributed Energy Implementation Process Website](#)

Resilience is a Top Priority for FEMP

An aerial photograph showing a large industrial facility, possibly a power plant or refinery, completely surrounded by floodwater. The facility includes several large, white, rectangular buildings with flat roofs, a larger central building with a grey roof, and various pipes and structures. The surrounding area is a mix of green fields and more industrial structures, all submerged in murky brown floodwater. The sky is overcast.

Energy and water resilience is a key component of federal facility infrastructure operations

Resilience is accomplished when operational and procedural elements are able to withstand, adapt to, respond to, and recover from disruption

AP/David Philip

FEMP's Technical Resilience Navigator

The Technical Resilience Navigator (TRN) helps users assess risk to a site's critical functions from energy and water utility disruptions and prioritize solutions that reduce risk.

Key Outcomes

- Identify site hazards and vulnerabilities in energy & water systems, operations, and plans
- Establish risk from different sources, and how solutions reduce risk
- Better integrate planning for energy and water management, continuity of operations, other site priorities

Distributed Energy as Part of a Potential Resilience Solution

Distributed energy (renewable energy, storage, and combined heat and power, backup generators) can contribute to sites' ability to anticipate, prepare for, and adapt to changing conditions and to withstand, respond to, and recover rapidly from disruptions by:

Helping fund other
resilience solutions
(cost savings/revenue)

Increasing survival time
during a grid outage
(backup power/redundancy)

Potential DE Solutions to Enhance Resilience

Financing Federal Microgrids

FEMP technical report:

Financing Microgrids in the Federal Sector

- What is a Microgrid?
- Should my Agency Pursue a Microgrid?
- Economic and Technical Considerations
- Procurement Options

What is a Microgrid and How Can it Help?

What is a Microgrid?

A group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid, and can operate in both grid-connected or island-mode (DOE 2011).

Microgrids are Complex Systems

Gaps Microgrids May Address

- **Energy use optimization and utility reliability**

- Demand response savings
- SAIDI
- SAIFI

- **Resilience vulnerabilities**

- Critical energy & water systems
- Continuous mission operations
- Life safety

Technical Considerations

Synchronous Generators

- Combined Heat & Power
- Backup Generators

Microgrid-Ready PV

- Smart inverter
- Additional space

RE + Battery

- Necessary to fully utilize RE while islanded

Phased Implementation

- **Single project is ideal approach**
- **Multiple implementation phases may be required due to cost**
 - Well-defined concept needed
 - Plan for future modifications, expansion, functionality, use cases
 - Lessons learned incorporated into future phases
- **Risk mitigation**
 - Each phase or project should stand on alone, but be “microgrid ready” for integration into system
 - Commission final result as a system

Potential DE Solutions to Enhance Resilience

	Grid Connected DE	Microgrid-Ready DE	DE and Energy Storage	Microgrid
Backup Power	No backup power, but could support a future microgrid	Can be configured to provide backup power	Backup power for multiple loads or an entire site	
Upfront Cost	Slightly higher cost than grid-connected (for equipment, space, communications)	Higher cost (for storage and controls)	Much higher cost (for additional required equipment, controls, and communication)	
Cost Savings	Lowers utility bills	Could lower utility bills with potential for additional savings and/or revenue streams	Lowers utility bills with potential for additional savings and/or revenue streams	
Complexity*	Fairly straight forward, requires minor revisions to equipment functionality	More complex due to required charge/discharge protocols and other factors	Much more complex, requires isolation, communications, and detailed analysis of existing distribution system, knowledgeable and skilled operators	

* Dependent on agency's and contractor's experience implementing DE and resilience projects

Procurement Options

Federal DE Project Procurement Options

Legend & Abbreviations

ECM	Energy Conservation Measure	ESPC ESA	ESPC Energy Sales Agreement
UESC	Utility Energy Service Contract	PPA	Power Purchase Agreement
ESPC	Energy Savings Performance Contract	EUL	Enhanced Use Lease

*System is privately owned initially, government must retain title by end of the contract (OMB Memo requirement)

Performance Contracts are a Budget-Neutral Solution

Reallocate the Government's Utility Bill

Limited-source contract between a federal agency and its serving utility for energy- and water-efficiency improvements and demand-reduction services.

- Legal authority: [42 USC 8256](#), up to 25 years
- During contract term, payments come from resulting savings (or agency funds)*
- Performance Assurance required; guarantees are negotiable
- DE projects can be bundled with other measures
- UESCs can be executed under one of the following:
 - Areawide contracts (AWCs)
 - Basic ordering agreement (BOAs)
 - Separate contracts
 - Interagency Agreements (when working with a Federal utility)

** Unlike ESPCs, UESCs do not have a statutory annual savings requirement but must still be lifecycle cost effective. Performance assurance required for annual scoring.*

Energy Savings Performance Contract

Privately Financed

Government Owned

Contract between a federal agency and an energy service company (ESCO) to procure energy conservation measures (ECMs) without additional appropriations.

- Legal authority: [42 USC § 8287 et seq.](#), up to 25 years
- Payments come from guaranteed energy cost savings
- M&V required to validate cost savings and ECM performance
- DE projects can be bundled with other ECMs
 - DE projects can be government or privately owned
- Main types of federal ESPCs:
 - DOE indefinite-delivery, indefinite-quantity (IDIQ)
 - DOE ENABLE
 - Site-specific/stand-alone with DOE-qualified ESCOs

ESPC Energy Sales Agreement

Privately Financed

Privately Owned

Uses long-term ESPC authority for DE projects on federal buildings or land; DE is privately-owned and agency purchases the electricity.

- Similar to PPA, but implemented as ECM within an ESPC
- O&M/repair & replacement provided by the ESCO
- ESA ECM can be bundled with other ECMs
- Private ownership allows tax incentive benefits
 - Agency must retain equipment title by end of contract
 - Title transfer at fair market value
- Differences from typical ESPC:
 - Payment based on kWh generation; price in ¢/kWh
 - Maximum contract term: 20 years
 - Savings accrue immediately

*Either the blended rate or a rate that only considers cost offset by the ESA ECM

Power Purchase Agreement

Privately Financed

Privately Owned

Developer installs, owns, operates, and maintains DE project on federal land, and agency purchases electricity produced.

- Legal authorities:
 - [40 USC 501](#) (FAR Part 41, GSA authority requires delegation, 10-year term)
 - [WAPA](#) (20-year term, possibly longer)
- Agency may have option to purchase system at end of contract
- Developer could be any third-party, including site's serving utility company
- Stand-alone project, not bundled with efficiency ECMs

Utility Service Contract (USC)

Privately Financed

Privately Owned

Bilateral agreement between a federal agency and its serving distribution utility for service connection, demand side management services, “special facilities services” or other service options.

- Legal authority: [40 USC 501](#) (FAR Part 41, GSA authority requires delegation, 10-year term)
- Partnership with utility
- Allows for special facilities to be financed, installed, owned, and maintained by the utility on customer side of the meter
- Payments made over time with “facilities charge,” upfront agency funds, or combination
- Explore where mutually beneficial, for example:
 - Savings /appropriations insufficient to cover microgrid costs
 - Microgrid more cost effective than utility grid upgrade
 - Other ancillary services benefit utility grid

Performance Must Be Clearly Defined

Contract must include clear performance requirements

- **Level of reliability (critical to include in contract terms)**
 - How much redundancy
 - Which loads will be served by DE
- **DE recovery and robustness**
 - How fast the DE can recover from an outage
 - How well the DE can withstand interruptions to grid service, and for how long
- **Specified damages for failures to meet performance requirements**
 - Table of damages for DE outages of varying lengths and frequencies

Project Development and Implementation

Define Project

Objectives
Priorities
Acquisition Plan

RFP

Specifications:
Services
Construction
Performance

Develop Project

Baseline
Design
Cost / Savings
Performance Plan
Contract Award

Implementation

Construction
Commissioning
Proof of
Performance
Training

Performance

Operations,
Maintenance,
and Performance
Assurance
activities

~ 1-2 years

1-2 years

Up to 25 years*

* Performance Period term depends on the procurement vehicle. ESPC and UESC allow 25 years; ESPC ESAs allow 20 years; PPA and USC allow 10 years for most agencies, or more under specific circumstances

Potential Sources of Savings

- **Comprehensive project including efficiency ECMs**
 - Reduce critical loads
 - Include ECMs with shorter payback periods
- **Reduced/eliminated O&M expenses (e.g., replacing aging/maintenance intensive equipment)**
- **Other avoided costs, for example:**
 - CHP may obviate need for individual building boilers
 - Planned on-site distribution system upgrades included in microgrid installation
- **Utility savings (e.g., demand reduction, ancillary services)**
- **Rebates, incentives, other value streams**
- **Appropriations or grants may be leveraged for resilience not covered by energy savings**

Potential Incentives and Value Streams

All technology options may qualify for incentives and/or result in revenue streams while grid connected

- **Potential value streams:**
 - Demand charge savings, energy arbitrage, demand response, ancillary services, REC sales
- **Potential Incentives:**
 - Rebates, other state/local incentives
 - Federal ITC and MACRS; state/local incentives such as property and sales tax exemptions

Federal Solar Investment Tax Credit (ITC)

ITC for developers with tax appetite; improves PV project cost-effectiveness

- Recent legislation extended the ITC phase-down schedule by two years*
 - 26% before 2023
 - 22% before 2024
- ITC amount based on “commence-construction” year
 - See [IRS Notice](#) for additional detail*

**Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY**

Investment Tax Credit Requirements for Privately Owned Solar Photovoltaic Systems on Federal Sites

The federal investment tax credit (ITC) is an economically valuable tax incentive offered to taxable business entities that invest in certain energy technologies.¹ The ITC is based on a percentage of the qualifying upfront capital costs of a project and directly reduces a business's tax liability (i.e., the taxes paid).

This fact sheet focuses on ITC considerations for privately owned solar photovoltaic (PV) projects on federal land and buildings, although some of the considerations may be applicable to other technologies² and non-federal entities.

Benefits of Privately Owned PV Systems on Federal Sites

Although federal agencies are not eligible for the ITC, they can still benefit from the tax credit if the PV system is on a federal building or land and is privately owned. These systems can be procured under financing mechanisms such as energy savings performance contract energy sales agreements (ESPC ESAs) and power purchase agreements (PPAs).

A nearly 15,000-panel solar PV array was installed under an ESPC ESA at the U.S. Department of Commerce's National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland. The installation will be privately owned for the 20-year ESPC ESA term for tax incentive purposes and NIST will purchase the electricity produced. The array is predicted to save NIST a minimum of \$3.5 million in its first 20 years of operation. Photo courtesy of NIST.

There are several benefits to private ownership of PV systems on federal land or buildings.

- Federal agencies are not required to provide upfront capital investment.
- The private owner is responsible for all operations, maintenance, and equipment repair and replacement until the end of the contract.³
- The private owner can monetize the tax benefits and pass these savings on to the federal agency in the form of a lower contract price for electricity.

Solar ITC Value and Stepdown

The 2019 value of the solar ITC was 26%. The ITC amount is set to decline from 2020 to 2022. The 2020 value of the ITC is 22%, the 2021 value is 20%, and the 2022 value is 18%. The ITC amount is set to decline from 2023 to 2025. The 2023 value of the ITC is 20%, the 2024 value is 18%, and the 2025 value is 16%.

ITC Stepdown Schedule

In order for a project to be eligible for the ITC amount in a specific year, it needs to meet the IRS requirements for “commence construction” in 2019-2021.⁴ The commence construction deadlines for PV projects, and the corresponding ITC amounts, are shown in Table 1. All projects that commence construction by the end of 2022 must be placed in service by the end of 2023. The private owner to the project must be in place by the end of 2023.

Year of Commence Construction	ITC Amount
2019-2021	26%
2022	22%
2023	20%
2024	18%
2025	16%

ACT NOW!

¹ As set forth in Section 48 of the Internal Revenue Code, ITC-eligible technologies include solar, geothermal, wind, biomass, and certain energy storage technologies. The ITC amount varies by technology.

² Energy storage that is combined with PV or other qualified energy technologies could benefit from the ITC as well.

³ For ESPC ESAs, the federal agency is responsible for those costs after the end of the contract.

⁴ See IRS Notice 2013-59 for additional detail.

The third-party project owner should seek qualified tax advice

Summary

- **Microgrids are typically complex and expensive**
- **Discuss goals/needs with utility early**
- **Third-party financing may fund all or most microgrid components**
 - Leverage appropriations / incentives / value streams
 - Bundle with efficiency measures
- **Phased approach requires planning for future expansion, functionality, and use agreements**
- **FEMP assistance and resources are available**

Case Studies and Resources

FDA White Oak ESPC

FDA's Federal Research Center

White Oak Campus (3.9 million sq. ft.)
Silver Spring, MD

Project Investment Value

\$280 million, 3-phase project with Honeywell
(Original TO award in 2010)

Results

- Campus is now five groups of interconnected buildings with shared utility infrastructure: energy efficient, secure, resilient, and capable of expanding to meet future needs
- Multifuel, integrated 55 MW central utility plant micro-grid operates through disruptions to utility grid
 - Campus has operated in island mode 80+ times since completed in 2014

Annual Savings

\$52 million avoided utility and O&M costs
915,000 MMBtu

<https://www.energy.gov/eere/femp/honeywell-helps-deliver-resiliency-and-cost-savings-food-and-drug-administrations-white>

Sources of savings

- Combined heat and power plant
- Chiller improvements
- Utility demand management
- PV
- Lighting
- Building envelope modifications
- Other building energy performance enhancements

Naval Construction Battalion Center USC

Naval Construction Battalion Center (NCBC)
Gulfport, MS

Utility partnership with enhanced use lease and power purchase agreement to increase resilience

Phase 1

- Enhanced use lease: 3.5 MW on-site PV (completed 2017)
- 25-year PPA: WGL Energy – owns, operates, maintains PV; Mississippi Power Co. (MPC) buys electricity and distributes through grid

Phase 2

- MPC design and install microgrid (2020)
 - Incorporate 1 MW of PV from Phase 1
 - Add lithium-ion battery storage and Tier 4 diesel generation

Scalability

- Microgrid will provide >33% of NCBC electrical load
- Modular configuration allows for 3x additional capacity

<https://www.energy.gov/eere/femp/downloads/navy-ratchets-resilience-through-agencyutility-collaboration>

Benefits

- Microgrid provides 1/3 of electrical load
- Reduced diesel use
- Eliminates building backup generators
- Developed PV on underutilized brownfield
- Modular design to allow future expansion

FEMP Procurement Resources

- [DOE ESPC](#)
- [ESPC ESAs](#)
- [UESC](#)
- [Power Purchase Agreements \(PPA\)](#)
- [Financing Microgrids in the Federal Sector](#)
- [Procurement Specifications Templates for On-Site Solar Photovoltaic: For Use in Developing Federal Solicitations](#)

The screenshot shows the DOE website page for Energy Savings Performance Contract Energy Sales Agreements. The page has a green header with the title. Below the header, there is a breadcrumb trail: Home > Energy & Project Procurement Development Services > Distributed Energy > Requirements > Energy Savings Performance Contract Energy Sales Agreements. The main content area includes a paragraph defining an ESPC, a list of benefits, a section on how to start an ESPC, and two boxes at the bottom: 'DOE IDIQ ESPC' and 'DOE ESPC ENABLE'. A sidebar on the right lists 'ESPC ESA RESOURCES' including a fact sheet, ITC fact sheet, NIST case study, DEA case study, webinar series, and toolkit.

Energy Savings Performance Contract Energy Sales Agreements

Home > Energy & Project Procurement Development Services > Distributed Energy > Requirements > Energy Savings Performance Contract Energy Sales Agreements

An energy savings performance contract energy sales agreement (ESPC ESA) is a project structure, similar to a power purchase agreement, that uses the multiyear ESPC authority to implement distributed energy projects—referred to as ESA energy conservation measures (ECMs)—on federal buildings or land. The ESA ECM is initially privately owned for tax incentive purposes, and the federal agency purchases the electricity it produces with guaranteed cost savings. An ESPC can be used for the acquisition of utility services per 48 CFR § 41.102(b)(7) (2015).

ESPC ESA RESOURCES

- ESPC ESA Fact Sheet
- ITC Fact Sheet
- NIST Case Study
- DEA Case Study
- ESPC ESA Webinar Series
- ESPC ESA Toolkit

Benefits of ESPC ESAs

- ESPC ESAs do not require any upfront capital from a federal agency for the ESA ECM.
- ESPC ESAs provide guaranteed cost savings, and a federal agency only pays for the electricity that is generated, minimizing federal risk.
- The energy service company (ESCO) may be able to take advantage of federal and other tax incentives and can sell the renewable energy certificates generated by the ESA ECM to reduce the ESPC ESA price.
- The ESCO is responsible for ESA ECM operations and maintenance, and for equipment repair and replacement, which also reduces federal risk.

Start an ESPC ESA

To start an ESPC ESA, an agency should review the ESPC ESA requirements and contract vehicle options. For questions, more information, or assistance:

- Contact a federal project executive
- Request assistance from the Federal Energy Management Program (FEMP) through the FEMP Assistance Request Portal.

ESPC ESA Contract Vehicle Options

DOE IDIQ ESPC
Master contract that allows federal agencies to work with 21 DOE Qualified ESCOs holding the current DOE IDIQ ESPC contract.

DOE ESPC ENABLE
Procurement process to implement basic ECMs under an ESPC. More than 20 DOE Qualified ESCOs are on Federal Supply Schedule BA, SIN 246-53.

FEMP Resilience Resources

- [FEMP Resilience Planning](#) webpage
 - Case studies, FEMP courses
- [Technical Resilience Navigator](#) tool
- [Pre-screening for distributed energy opportunities](#)
- [Distributed Energy Resource Cybersecurity Framework](#) (DERCF)
- [Distributed Energy Technologies for Resilience](#)

DE Screening Tools & Resources

- NREL Tools Help Identify and Evaluate Renewable Energy Projects Factsheet
- REopt Lite
- Technology Cost and Performance Matrix
- Resource Maps
- Incentives and Utility Policies
- CHP: Technical Assistance Partnership (TAP)

REopt Lite

The REopt[®] Lite web tool helps commercial building managers:

- Evaluate the economic viability of grid connected PV, wind, and battery storage at a site
- Identify system sizes and battery dispatch strategies to minimize energy costs
- Estimate how long a system can sustain critical load during a grid outage.

REopt Lite offers a no-cost subset of features from NREL's more comprehensive REopt model. REopt Lite also offers an application programming interface (API) and open source code.

Send questions and tool feedback to REopt@nrel.gov

Step 0: Login and Gather Data

Registering and logging in is optional, but you must be logged in to:

- save your evaluations
- create a custom electricity rate
- build a critical load profile
- manage your typical and critical load profiles

Data needed for a Financial run:

- ☑ site location
- ☑ site electricity rate
- ☑ building type plus annual energy consumption OR a custom load profile

Project Feedback

We want to hear from you! Tell us about your REopt Lite experience!

Contact Information

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Questions

- Have HHS, sub-agencies, or individual sites made specific energy and/or resilience goals above and beyond the statutory goals?
- What facilities in HHS may have the highest need for a microgrid?
- After seeing this presentation, where do you feel your knowledge is lacking?
- What are you interested in learning more about?

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