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Beyond Appropriated Funding: An Innovative Financial Equation for Building Energy Resilience

by Kevin Vaughn and Philip Barton

Executive summary

Energy resilience is vital to the safety and security of the United States. Federal agencies are seeking ways to put energy security plans in place but are often stymied by the lack of appropriated funds. New innovative paradigms combining energy management, incentives, and financing contracts are emerging to minimize the impact on appropriated funds. This white paper details these options and provides federal government agencies with insights on how to maximize these benefits.

Introduction

Today, energy resilience is an increasingly important imperative within the U.S. federal government, especially for the U.S. Department of Defense (DoD) and its military departments. Energy resilience directly impacts the ability of any government agency to fulfill its mission, and without a plan in place for it, security and operational risks increase and there are costly economic ramifications as well. Historically, energy outages have cost the federal government more than $500,000 a day.[1]

Directives on the parameters and execution of energy resilience abound, so government officials are well aware of what paths to take to implement such plans. However, funding the construction, operations, and maintenance costs of these implementations is a different story.

The limited availability of appropriated funds today can severely impact energy security – unless it is combined with other financial resources. Several innovative, proven approaches now exist to supplement appropriated funds that government agencies can utilize to put energy resilience programs into place.

Cost savings from energy management initiatives, along with state and local incentives, can be combined with alternative funding contracts to significantly reduce the financial burden on appropriated funding. These programs not only provide the necessary funding for energy resilience, but they also inherently build the cornerstones of an energy resilience program in and of itself. For instance, several energy management initiatives could result in the building of a microgrid, which could save a single military base anywhere from $8 million to $20 million over the 20-year life of the microgrid.[2]

This white paper will explore the importance of energy resilience and how to utilize a new financial paradigm for funding it. It will also discuss the role of microgrids, share resilience successes at military installations, and describe four steps that government agencies can take to achieve energy resilience.

[1] "Annual Energy Management and Resilience (AEMR) Report Fiscal Year 2016," Department of Defense, July 2017

[2] U.S. Military Could Save Over $1 Billion and Boost Energy Security, New Research Finds," The Pew Charitable Trusts, January 2017

The importance of energy resilience

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

Source: U.S. Department of Defense

The U.S. Department of Defense (DoD) is this country's largest government agency. As such, its dedication to energy resilience is a good representation of the importance of energy security throughout the entire federal government.

For the DoD, achieving energy resilience can be a significant task, as it owns or manages the greatest number of government facilities. There are over 500 installations worldwide, with over 500,000 buildings that include barracks, commissaries, data centers, office buildings, laboratories, and equipment maintenance depots.[3] With this amount of real estate, the DoD is understandably one of the government's largest energy consumers. Therefore, the potential for creating strong resilience programs are significant, but until these are in place, there is not only security risk, but also costly ramifications.

Outages: Not only risky, but costly

Recent government research points to the vulnerabilities and costs associated with electric, gas, and water utilities disruptions.[4]

- Over 700 utility outages lasted eight hours or longer in FY 2016, an increase from the 127 events reported in FY 2015.
- The majority of these were a result of U.S. and overseas electric disruptions.
- The collective financial impact of these utility outages, which were caused by acts of nature, equipment failure, or planned maintenance, was approximately $500,000 per day (see Table 1).
- In FY 2016, equipment failure (reliability or mechanical issues) accounted for 45% of the reported utility outages (see Figure 1). The second largest cause, at 42%, was planned maintenance, while the remaining outages occured because of acts of nature, such as weather or storms.

Offsetting some of these costs could directly fund an energy resilience program.

Table 1

FY 2013 – FY 2016 Cost Per Day of DoD Utility Outages.

Source: U.S. Department of Defense

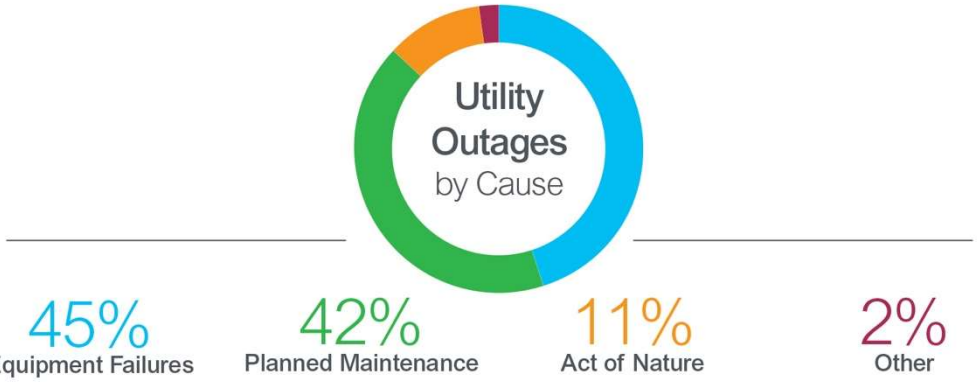
[3] "Energy Assurance and Resilience," SERDP and ESTCP

[4] "Annual Energy Management and Resilience (AEMR) Report Fiscal Year 2016," Department of Defense, July 2017

Figure 1

FY 2016 Utility Outages by Cause

Source: U.S. Department of Defense



A new equation for funding energy resilience

In its Annual Energy Management and Resilience Report, the DoD recommends "treating installation energy as a force multiplier in support of military readiness."[5]

Enabling energy security is clearly a priority of the government. Now, with the innovative funding described in the three steps below, the DoD can blend initiatives it has already undertaken with other cost-saving opportunities to fully execute its desired energy security programs. Here is a quick overview of this strategic approach.

Step #1: Start with savings from cost-effective energy management. Energy management projects, such as retrofitting older facilities, reducing energy usage, shifting loads, generating and storing energy onsite, and installing microgrids can reduce utility costs. The savings can then contribute to funding energy resilience programs.

Step #2: Add in federal, state, and local incentives. In addition to the cost savings of the above programs, there are also incentives that the federal government can use. Tax credits, rebates, and incentive savings offered by government agencies, state governments, and utilities can add more funds to an energy resilience budget.

Step #3: Support these initiatives with alternative funding sources. Energy-related contracts, such as Energy Savings Performance Contracts (ESPC), Utility Energy Savings Contracts (UESC), Enhanced Use Leases (EUL), and Power Purchase Agreements (PPA) provide private funding for resilience. Another emerging funding resource is Energy-as-a-Service (EaaS), which is offered through third parties.

When the above options are fully taken advantage of, the investment needed from appropriated funding is reduced significantly.

Here's a deeper look at how these steps – many of which the government has already implemented – can help find budget dollars for resilience projects.

Step #1: Cost-savings energy management initiatives

Research from Noblis, a strategy and research organization, suggests that with energy efficiency measures, the DoD could reduce its energy consumption by up to

[5] "Annual Energy Management and Resilience (AEMR) Report Fiscal Year 2016," Department of Defense, July 2017

35%. Noblis even goes as far as to state that conservatively, the DoD is leaving $1 billion, or 25% of its $4 billion annual utility bill, on the table.[6]

Here are a few of the programs that could contribute to better energy management and savings.

Building retrofits. Projects such as upgrading lighting, heating and cooling systems, installing building automation systems, and other building improvements can result in energy credits, utility rebates, and reduced utility bills.

Load management. A variety of options exist that can help better manage energy usage. These not only reduce the amount of energy consumed, but also help cut back on the cost of energy itself.

- **Peak shaving or demand response**. Utility companies have higher rates in place for peak high-demand periods of usage, so strategies can be developed to work around this. For instance, the Defense Logistics Agency (DLA), a DoD support unit that sources energy for military forces, has a demand response program in place. This program provides incentives for using less electricity during peak periods. Since the program began, the government has saved over $35 million.[7]
- **Load shifting**. Here, energy sources can be shifted to other less costly ones, such as battery-powered energy storage systems or the renewable energy sources discussed below, to avoid high-demand, high-cost utility rates.
- **Distributed energy resources (**DERs). DERs are small-scale power generation sources or storage that are alternatives to traditional sources. Government installations often use generators, backup generators, and on-site power systems (such as renewable energy sources, see below) as DERs.
- **Energy storage**. Energy can be generated and stored for future demand and use during high-peak usage periods. As an example, electricity can be stored during non-peak times, when it is up to 40% less costly than at peak times.[8]
- **Microgrids.** A microgrid can integrate, control, and monitor these load management strategies to maximize resilience and cost savings.

Operations and maintenance (O&M). Operations and maintenance (O&M) is another cost saving measure that can contribute funds to resilience programs. In addition, proper O&M has an economic benefit by promoting energy efficiency and extending the life cycle of energy systems, as equipment failure is the largest cause of costly utility outages (see Figure 1).

Typically, proper O&M measures could save 5% to 20% annually on energy bills. However, according to a U.S. Department of Energy guide on O&M best practices, predictive maintenance could save even more, with benefits such as: [9]

- A 10-time return on investment
- 25% to 30% reduction in maintenance costs
- 70% to 75% elimination of breakdowns
- 35% to 45% reduction in downtime
- 20% to 25% increase in production

[6] "Power Begins at Home: Assured Energy for U.S. Military Bases," Commissioned by The Pew Charitable Trusts, January, 2017
[7] "Fiscal Year 2017 Fact Book," Defense Logistics Agency Energy
[8] "Energy Storage"," SERDP and ESTCP
[9] "Operations and Maintenance Best Practices Guide," U.S. Department of Energy, August 2010

Renewable energy. Replacing traditional energy sources, such as coal and other fossil fuels, with less costly ones is another option. The DoD's DLA has already contracted more than $800 million in renewable energy programs such as solar, wind, or biomass.[10]

Renewable energy is an attractive alternative to fossil fuels because it provides long-term budget certainty. With the price volatility found in today's fossil fuels markets, unpredictable prices could cost the government substantially more than lower cost alternatives. For instance, solar power can be generated and used during peak times to offset of the costly high-demand electricity mentioned above. The use of solar power can not only reduce overall electricity usage, but it also helps avoid demand charges. In addition, when added to other DER sources, renewable sources can increase resilience during electric grid outages.

Renewable energy sources are also benefiting from rapidly evolving technological, manufacturing, and installation advances – all of which are making these options more viable and affordable.

Microgrids. As mentioned earlier, a microgrid could save a single military installation between $8 and $20 million over the 20-year life of the system.[11] Because of the advanced technology built into microgrid controls, such as sensors, metering, and analytics, installations can optimize energy sources, loads, and usage to maintain resilience. A microgrid control system:

- Collectively manages all the energy management, DERs, storage, and renewable resource initiatives described above.
- Optimizes energy usage and ensures a high degree of energy resilience.
- Creates and delivers a strong efficiency plan that reduces and streamlines current energy demand and better aligns critical and controllable loads.
- Allows for the generation of power, creating cost-savings as energy generation is transfer to more economical generations.
- Provides a model for more predictable energy costs.

Step #2: Federal, state, and local incentives

There are a variety of funding sources, such as the tax credits, rebates, and incentives found in the Energy Saver tool.[12] The Database of State Incentives for Renewables & Efficiency (DSIRE) is another resource that indicates where renewable energy credits or certificates (RECs) are available.[13] Utility companies are yet another option for cost-saving incentives for the installation of energy-efficient equipment and conservation projects.

The Production Tax Credit (PTC) and Investment Tax Credit (ITC) offer other incentive opportunities for the government that can help bring the price of wind and solar energy to below the projected market cost for traditional energy.[14]

Several of the incentives listed above are paid to the owner of the asset producing the benefit. To maximize these incentives, it may be in the government's best interest for a third party to take title to the assets, which is allowed by several of the contracts options described below.

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[10] "Fiscal Year 2017 Fact Book," Defense Logistics Agency Energy

[11] "U.S. Military Could Save Over $1 Billion and Boost Energy Security, New Research Finds," The Pew Charitable Trusts, January 2017

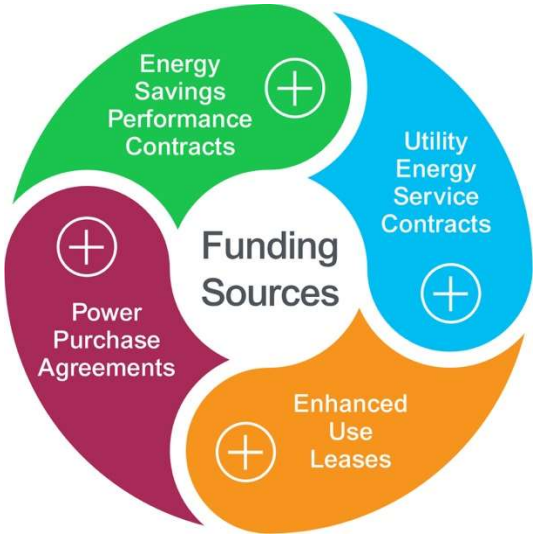
[12] "State-Specific Renewable Energy Tools and Resources," and "Tax Credits, Rebates, & Savings,"Energy.gov

[13] "Database of State Incentives for Renewables & Efficiency," DSIRE

[14] "Renewable Electricity Production Tax Credit (PTC)," Energy.gov

Step #3: Alternative funding sources

The DoD and other agencies have been using alternative funding sources for many years now. Here is a quick overview of the options available.



Energy Savings Performance Contracts. Energy Savings Performance Contracts (ESPC) provide financing for energy and operational efficiency upgrades as well as O&M projects, where the programs are paid for by the energy savings generated. Many of the energy management and efficiency strategies identified above can be put in place by an energy services company (ESCO) who would fund the project and guarantee a certain amount of savings over the life of the project. With an ESPC, the ESCO provides financing, assumes performance risk, and continues in an ongoing partnership to ensure savings.

Utility Energy Service Contracts. Utility energy service contracts (UESCs) can be used for energy efficiency and renewable energy projects. With these contracts, utility companies provide energy management services such as project assessment, design, financing, installation, and performance assurance. Oftentimes these contracts can be implemented without any capital investment or use of appropriated funds.[15]

Enhanced Use Leases. The government encourages the use of underused property through Enhanced Use Leasing (EUL) Program. According to the U.S. Government Accountability Office (GAO), EULs may include long-term leases of 25-50 years to private developers for the installation of renewable energy systems in exchange for cash or in-kind services.[16]

Power Purchase Agreements. Power purchase agreements (PPAs) help the government fund on-site renewable energy projects without any up-front capital costs. As part of the Federal Energy Management Program (FEMP), developers can install and take ownership of renewable energy systems on federal property. Energy service agreements (similar to PPAs) can be used in conjunction with ESPCs; in exchange, agencies agree to purchase the power generated by the system.[17] There are also renewable energy certificates available to offset installation costs.

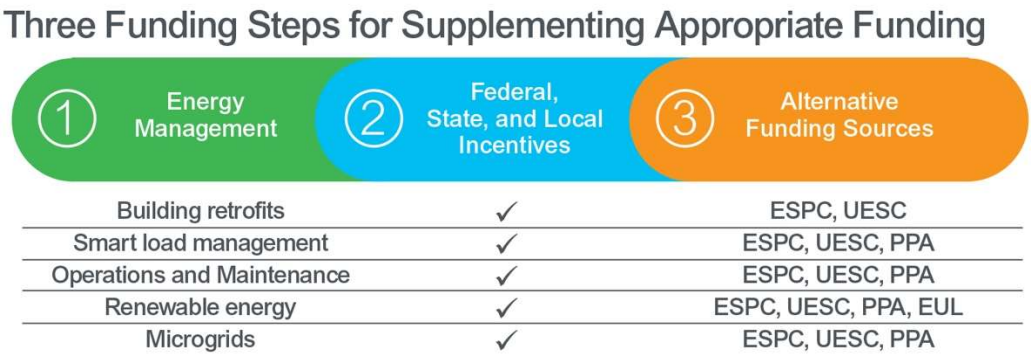
Energy-as-a-Service. Finally, military departments like the United States Air Force are exploring an innovative emerging concept for alternative funding called Energy-as-a-Service (EaaS).[18] According to Navigant Research, EaaS is a vendor-based energy business model that can provide turnkey energy. In this model, third-party

[15] "Utility Energy Service Contracts for Federal Agencies," Energy.gov
[16] "Defense Infrastructure: Additional Data and Guidance Needed for Alternatively Financed Energy Projects." United States Government Accountability Office, June 2017
[17] "Federal On-Site Renewable Power Purchase Agreements," Energy.gov
[18] "Air Force seeks energy innovation ideas," Air Force Installations, Environment and Energy, July 2017

vendors or utility services companies can deploy technical, financing, or procurement solutions.[19] Federal agencies could contract with an EaaS vendor for energy procurement, on-site generation, energy efficiency, and energy infrastructure O&M services. An EaaS can result in a comprehensive approach to the resilient and secure delivery of energy.

A cost-effective, comprehensive approach

As seen above, the government has many options for funding energy resilience programs, as well as the annual sustainment and O&M costs. A comprehensive plan that includes all many of the programs mentioned above can dramatically decrease the amount of appropriated funds necessary for an energy resilience program.



Use cases

Energy security microgrid: Marine Corps Air Station, San Diego, California

The Marine Corps Air Station (MCAS) Miramar in San Diego, California is building a microgrid to enhance its energy security. Once fully operational, the microgrid will provide resilience, incorporate renewable energy, and allow operations at its mission-critical facilities to continue if the utility power grid is compromised or damaged.

This project will not only enhance future renewable energy implementation, but also help reduce utility demand charges by facilitating demand response programs and enabling better management of energy loads throughout the installation.

Construction includes the build-out of a new diesel and natural gas power plant and the refurbishment of an existing building into an advanced energy and water operations center (EWOC). The EWOC will provide microgrid and plant operators and base energy personnel with direct control of the integrated microgrid control system. The microgrid will also integrate existing power generated from renewable energy sources, including biogas from a local landfill and solar photovoltaic (PV) generation, and future energy storage.

The microgrid island at Miramar will cover more than 100 mission-critical facilities, including all flight line operations.

This is a joint venture between Black & Veatch and Schneider Electric. The project is scheduled to be completed in 2018.[20]

Energy cost-saving infrastructure improvements:

[19] "Energy as a Service Commercial and Industrial Energy as a Service Applications and Deployment Models: Global Market Analysis and Forecasts," Navigant Research, 2017

[20] "Black & Veatch and Schneider Electric to design and build microgrid at Marine Corps Air Station Miramar," Black & Veatch and Schneider Electric, July 2016

Naval Base Coronado and Naval Base San Clemente Island Naval Stations, California

The Naval Base Coronado (NBC) and Naval Base San Clemente Island (NBSCI) sites have initiated a comprehensive ESPC-funded infrastructure improvement project. Once complete, the improvements will generate $114 million in guaranteed energy cost savings over the 19-year project term. The project will help the United States Navy meet many of its short and long-term strategic goals, including resilience and sustainment.

This extensive project encompasses upgrades to 90 buildings, including a large data center and electrical upgrades, as well as renewable energy and traditional energy conservation measures. The project will increase the reliability and capacity of mission critical facilities, reduce overall operational and maintenance costs, and add renewable sources to the Navy's energy portfolio.

The project addresses facility challenges, such as aging infrastructure and rising overhead costs, along government mandates, which are essential to the maximum efficiency of these sites. A key component of the project includes upgrades to the Grace Hopper Data Center at NBC, one of the Navy's largest mission-critical data centers. The Navy will consolidate several data centers and improve the security of information stored and disseminated at the facility through greater reliability. The project will reduce power usage effectiveness (PUE) from 2.53 to 1.2 and lessen consumption of server floor area from 60% to 20%, making room for new IT equipment with built-in redundancy.

The upgrades will help the Navy dramatically improve the reliability of these mission-critical sites.

This is a Schneider Electric project and is scheduled to be completed in 2018.[21]

Energy consumption reduction and renewable energy: The United States Coast Guard Sector San Juan, Puerto Rico

In 2010, the United States Coast Guard (USCG) addressed rising fuel prices and poor grid reliability in Puerto Rico through an ESPC. The financial burden and need to increase energy security and reduce cost were the main drivers for the implementation of multiple energy conservation measures (ECMs) in over 300 buildings on the island.

The project resulted in a building automation system (BAS) optimization, variable refrigerant flow/volume (VRF/V) cooling units, improved indoor air quality, lighting retrofits and controls, building envelope improvements, water conservation, and renewable energy.

An energy services agreement (ESA), which is similar to a power purchase agreement (PPA), was implemented for this project. An ESA is a financing method that enables various tax incentives based upon third-party ownership of the renewable energy assets to reduce the cost of the project. Under this ESA, a third party has taken ownership of the photovoltaic systems, and will capture and pass along financial benefits to the Coast Guard.

[21] "Schneider Electric Partners with the US Navy to Deliver $114 Million in Guaranteed Energy Savings," April 2016

The Coast Guard purchases the electricity generated at a fixed, escalated rate over 23 years. This allows the Coast Guard to consume renewable power at a predictable price below what they were paying for "brown power," without having to purchase or maintain the systems.

The Coast Guard receives the advantages of energy savings, reduced maintenance, improved occupant comfort, and enhanced reliability. At the time, this project was the largest photovoltaic endeavor for the Coast Guard.

"Within the Coast Guard, this project is significant not only because of its scale, but also because of its scope," said Daniel Gore, program manager at the time for the U.S. Coast Guard Energy Program. "By targeting renewable energy installations, infrastructure upgrades, and energy conservation measures, the Coast Guard has successfully combined innovative technology with reduced maintenance burdens – an ideal project model."[22]

The 3 megawatts of distributed solar photovoltaic systems are generating 4,185,830 kWh per year, exceeding the guaranteed savings of the ESPC by almost 5%. This translates to nearly $1.1 million in energy production. All other ECMs are combining to achieve a verified $877,287 in annual utility savings.

This project received the following awards:

- DOE – Federal Energy and Water Management Award — Outstanding Project
- DHS – Green Innovation Award Winner
- DOE – Presidential Award – DHS Nominee
- NAEP – National Association of Environmental Professionals — Nomination for Environmental Excellence Award

Schneider Electric completed this project in April 2012.[23]

Energy-efficiency improvement: Almeric Christian Federal Building, St. Croix, U.S. Virgin Islands

This $6.4 million project used an ESPC to help the Almeric Christian Federal Building in St. Croix, U.S. Virgin Islands become one of the first federal buildings to achieve 100% zero net energy consumption and zero carbon emissions annually.

As part of U.S. General Services Administration Deep Retrofit Challenge, this project includes the installation of energy efficiency improvements and renewable energy systems.

The ESPC for the three-story, 57,872 square foot building guarantees a total of over $13 million in energy savings through a combination of energy efficiency improvements and renewable energy production. These improvements were made without appropriated funds and savings in the first year of the 19-year contract amounted to over $500,000.

The project will help manage challenges unique to the remote, tropical location, such as the variability and high cost of electricity on the island. In addition to controlling rising utility costs, the performance contract allows remote reporting of sub-me-

[22] "U.S. Coast Guard Finds Success with Collaborative Funding Method for Renewable Energy Project," Renewable Energy World, November, 2011

[23] "United States Coast Guard Implements Milestone Energy Savings Project with Schneider Electric," Schneider Electric, 2014

ter data and the elimination of transformer flooding issues due to surface storm water. Included in the project are chilled water system upgrades, and building automation system upgrades, including optimization, sub-metering integration and modifications with government guidelines. There were also lighting and HVAC improvements.

"These Energy Savings Performance Contracts offer so many benefits to the government and are just one additional way GSA is looking to make our facilities more energy efficient, reduce our carbon footprint, save taxpayer dollars by reducing costs and help meet our goal of making a more sustainable government," said Denise L. Pease, GSA Regional Administrator. "These contracts offer the federal government the opportunity to reap long-term benefits of energy and cost savings without making an initial investment."

The expected annual energy savings totals 962,916 kWh, which is 100 percent of the building's baseline usage.

This is a Schneider Electric project and was completed in 2014.[24]

How to get started

As a government agency considers energy resilience, it can start to build a comprehensive plan based on the information in this white paper. After examining the various options, the agency can determine which contractual and financing vehicles are best to use to not only meet its energy security goals, but all specific energy reduction goals.

Then, when the agency is ready to get started, it can follow these key implementation steps for energy resilience and security.

1. **Reduce energy use and load.** Reducing the amount of on-site fossil fuel energy usage is traditionally the first step toward creating cost savings from energy-related initiatives that can generate funding for energy resilience. The lower the usage rate and the smaller the load, the less onsite generation there is. Initiatives here can reduce energy costs by up to 30%.
2. **Install onsite generation to meet the reduced load.** Renewable energy sources can be installed and implemented to back up fossil generation.
3. **Install energy storage.** Once renewable energy sources are in place, then the energy from them can be stored for future, more economical usage.
4. **Install microgrid control system.** To maximize the first three steps, the optimization of these resources is critical. A microgrid can control and optimize the energy in an intelligent, highly functional manner that reduces energy consumption through measurement, monitoring and control of energy usage.

Conclusion

For the federal government, energy resilience is no longer a question of if and when such a project should be undertaken – but more of how to fund it. Many of the funding sources described here are familiar, but combining them in this innovative approach can dramatically reduce dependency on appropriated funds. And when implemented, these proven strategies will advance energy security initiatives and help federal agencies protect their mission-critical installations.

About Schneider Electric

Schneider Electric helps federal government agencies turn some of their greatest challenges into opportunities. Our comprehensive programs allow agencies to tackle

[24] "General Services Administration Achieves Net Zero Energy Through Energy Savings Performance Contract with Schneider Electric," Schneider Electric, February, 2014

a wide variety of complex resilience projects through a single solutions provider that can reduce the amount of appropriated funds needed.

With Schneider Electric, the government can leverage guaranteed energy and operational savings to redirect existing budget dollars to fund infrastructure and technology modernization, resilience initiatives such as microgrids and renewable energy, as well as critical mission-readiness projects such as datacenter optimization.

In addition to guaranteed savings, Schneider Electric provides performance guarantees.

Schneider Electric is a DOE ESPC IDIQ and Army ESPC MATOC contract holder and has developed award-winning federal infrastructure projects including an ESPC with the U.S. Coast Guard, which earned the DOE Federal Energy Management Program's Project of the Year award. Additionally, Schneider Electric served as the energy management partner for the first federal building to achieve net zero energy through its ESPC project with the U.S. General Services Administration in St. Croix, U.S. Virgin Islands.

To date, Schneider Electric has been:

- Awarded $330 million in DOE IDIQ ESPC projects.
- Successfully implemented more than 675 ESPC (federal and non-federal) projects across the nation.
- Helped clients around the world save more than $1.9 billion.

About the authors

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