Wringing More Value from Building Energy Operations and Upgrades:

Monetizing Demand Flexibility in Public and Institutional Facilities

National Association of
State Energy Officials

Disclaimer

This material is based upon work supported by the U.S. Department of Energy (DOE) through the Pacific Northwest National Laboratory (PNNL), Contract Number 504398. This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Acknowledgments

This report was made possible through the generous support of the U.S. DOE, Building Technologies Office and the PNNL through Contract Number 504398. This report was authored and edited by Rodney Sobin, NASEO Senior Program Director, in February 2021.

The author is grateful for reviews provided by Ed Carley, Sam Cramer, Sandy Fazeli, and David Terry (NASEO); John Agan, Monica Neukomm, and Sean Williamson (DOE); Ken Sandler (U.S. General Services Administration); Phil Coleman and Natalie Mims Frick (Lawrence Berkeley National Laboratory); Kristofor Anderson (Georgia Environmental Finance Authority); David St. Jean (Maryland Department of General Services); Lou Sahlu (Massachusetts Department of Energy Resources); Clay Nesler (Johnson Controls International); Rob Harmon (MEETS Accelerator Coalition); and Cara Carmichael (Rocky Mountain Institute). The author also thanks Garth Otto of NASEO for support on formatting and dissemination of the report. Cover image courtesy of Randy Martin.

Contents

Introduction

Many states, local governments, public school districts, and other institutions—often referred to as the MUSH (municipalities, universities, schools, and hospitals) market—seek greater energy savings from their facilities to save money as well as to meet emissions and other objectives. However, other energy management value streams offer additional rewards to building owners.

This report discusses demand flexibility (DF) as a way to tap value from peak demand management, time-differentiated electricity rates, demand response (DR) programs, and nascent grid-service markets. Beyond offering financial benefits, DF can help improve building performance while also supporting resilience, environmental, and other policy and organizational goals.

To understand new value stream opportunities available through DF, it is useful to review approaches public and institutional building owners use to achieve energy efficiency improvements.

One major existing mechanism is the Energy Savings Performance Contract (ESPC). ESPC is a well-established way for public building owners to perform energy-saving building and facility upgrades while better leveraging taxpayer investments or avoiding the need to expend their own capital.[1] Properly structured, ESPCs pay for themselves though energy bill savings that are guaranteed by energy service companies (ESCOs) that develop and deliver the projects.[2] Depending on the jurisdiction and project, ESCOs may also include water and sewer charge reductions and operations and maintenance (O&M) cost savings in the contract. *Frequently, State Energy Offices assist public agencies and local jurisdictions to improve their energy performance, including through ESPC projects, to save taxpayer money, modernize facilities, support critical facility resilience, and meet environmental goals.*

Typically, energy bill savings come from reduced total energy consumption in kilowatt-hours (kWh) for electricity and British thermal units (Btu) or therms for natural gas.[3] In some cases, ESPC project savings may also include reduced demand charges that come not only from energy efficiency but also from actively managing demand, such as staging and shifting heating, ventilation, and air-conditioning (HVAC) system loads and other equipment to reduce monthly peak building demand. Demand charges often account for 30 to 70 percent of commercial building electricity bills, yet many building owners and operators are not well-informed about how such charges are measured and billed.[4]

However, there are additional, often underutilized, value streams to be earned from improving energy management, particularly via electricity DF and implementation of grid-interactive efficient building

---

[1] A Utility Energy Service Contract (UESC) is a similar mechanism in which a utility plays the role of the ESCO in constructing the project, as well as obtaining capital. UESCs were authorized for federal agencies by the Energy Policy Act of 1992. NASEO is unaware of the UESC-type model being available to states and other non-federal entities, but NASEO is also unaware of any impediment to a state authorizing such a mechanism.

[2] NASEO, Energy Services Coalition (ESC), and National Association of Energy Services Companies (NAESCO), 2019, "NASEO-ESC-NAESCO State ESPC Project and Program Principles" https://www.naseo.org/Data/Sites/1/espc-naseo-esc-naesco-principles-february-2019.pdf.

[3] Propane, fuel oil, and other fuels may also be included.

[4] National Renewable Energy Laboratory, 2017, "Identifying Potential Markets for Behind-the-Meter Battery Energy Storage: A Survey of U.S. Demand Charges," NREL/BR-6A20-68963 https://www.nrel.gov/docs/fy17osti/68963.pdf.

(GEB) upgrades.[5] DF involves shedding, shifting, or modulating (rapid small adjustments to regulate frequency and voltage) electricity loads in response to grid conditions, and can include injection of power to the grid from onsite generation and energy storage. Also, demand flexible "smart" building technologies that enable GEBs can improve building O&M through better controls and diagnostics to enhance building comfort and service, which can increase building value.

DF includes both (1) routine good energy management practices to increase efficiency, reduce peak demand, and take advantage of off-peak energy pricing, and (2) response to utility or grid operator signals—demand response (DR). While some DF measures may entail equipment and control upgrades, others may be low or no cost beyond O&M staff training and updated operating procedures.

Utilities may offer time-of-use (TOU) or other time-differentiated rates in which the price of electricity varies at different times of the day to encourage customers to shift demand away from electricity system peak periods when costs are highest. Utilities and other grid operators (such as Independent System Operators [ISOs] and Regional Transmission Organizations [RTOs]) may also provide DR programs that offer credits or other compensation to incentivize load reduction during periods of very high demand when grid costs and, possibly, stresses may be very high. Some DR "events" and dynamic pricing (like "critical peak pricing") may be called a day ahead in anticipation of very high electricity demand, allowing building operators to pre-cool, pre-heat, or otherwise shift load profiles. Other DR events and dynamic pricing mechanisms may be called hours or less ahead, asking participants to temporarily shed load. Managing building loads to take advantage of time-differentiated rates and DR programs can provide additional cost savings.[6] However, building owners may not be aware of or avail themselves of these opportunities nor do they appear to be widely included in ESPCs and other energy upgrade project models. A U.S. General Service Administration (GSA) study estimated that GSA adoption of demand flexibility measures and practices in its office building portfolio would deliver large energy bill savings as well as provide significant grid benefits (see Box 1).

Still nascent but growing are rate and market designs that reward customers for exporting power back to the grid from onsite generation and/or electricity storage to provide energy, capacity, and ancillary services that allow utilities to better balance supply and demand and meet power quality standards.[7] These too represent emerging value streams for building owners and could be incorporated into building energy services and upgrade projects.

An increasingly recognized value of DF—whether or not directly monetized—is reduction of greenhouse gas (primarily carbon dioxide [CO_2]) and other pollutant emissions. The marginal emissions rate of grid-provided electricity varies over time as demand and the generation needed to meet the demand changes. DF can support public policy goals to reduce emissions by shifting demand from periods when

---

[5] For more on GEBs, see NASEO, 2019, "Grid-interactive Efficient Buildings: State Briefing Paper"; U.S. Department of Energy, 2019, "Grid-interactive Efficient Buildings: Factsheet" and "Grid-interactive Efficient Buildings: Overview"; and Schwartz, L. and G. Leventis, 2020, "Grid-Interactive Efficient Buildings: An Introduction for State and Local Governments." These are accessible by links at https://www.naseo.org/issues/buildings/naseo-geb-resources.

[6] They can also support electricity reliability by reducing grid stresses and can help reduce emissions.

[7] Some ancillary services to assure power quality (such as regulating frequency and voltage) can be performed by modulating demand (for example, water heating and lighting) without sending power back to the grid.

grid power is dirtier to when it is cleaner, including taking advantage of periods of high renewable generation.

Tapping these value steams (summarized in Table 1.) could strengthen the economics of upgrades through ESPC, Energy-as-a-Service (EaaS, described below), or other mechanisms. They may also help buy down the cost of resiliency measures, such as onsite generation, energy storage, and their integration in microgrids as well as structural improvements (e.g., seismic, wind, and fire resistance) that are increasingly salient to public and institutional building owners, operators, and occupants. *State Energy Offices and others with purview over public and institutional facilities should explore these opportunities to economically improve facilities to meet mission needs and policy objectives.*

A first step can be to do a building portfolio analysis to determine locations where DF and GEB approaches may be most cost-effective to pursue and can best meet public or institutional policy objectives such as for enhancing resilience or reducing emissions. Analyses should consider building characteristics and uses that may make them amenable to DF as well as the availability of TOU or other time variable rates, DR programs, grid market opportunities, and incentives that provide monetary value. Existing plans and priorities to upgrade or renovate buildings can be amended to include DF-related improvements.

Table 1. Summary of Monetizable Value Streams from Demand Flexibility*

Energy costs	Lower electricity, natural gas, and other energy bills from reduced consumption due to energy efficiency and conservation.
Demand charges	Lower electricity bill demand charges from reducing peak building or facility demand.
Time-of-use and time-differentiated rates	Lower electricity bills from shifting usage of grid power from higher cost periods to lower cost periods; may include thermal or electrical energy storage; may include onsite generation.
Demand response programs	Revenues or bill credits for reducing demand for grid power (“curtailment”) during utility or grid operator declared periods of very high grid power demand (“DR events”); may include use of stored or onsite generated power; may include participation in a capacity market directly or indirectly (e.g., via DR service provider).
Grid service markets	Revenues or credits from participation in grid service markets, such as for ancillary services, energy, and capacity (overlaps with DR programs); may involve export of onsite generated or stored power to grid; may include direct or indirect (via DR or other service provider) market participation.

* This table does not include utility or state incentives that may be offered for energy efficiency, storage, renewable generation, and other measures. Nor does it include other potential values that may or may not be readily monetizable (e.g., property value increase, insurance premium reduction, productivity improvement) but should be considered, such as enhanced energy reliability and resilience, power quality, building/facility operational benefits, occupant comfort and amenity, and environmental benefits.

This document outlines options and considerations for including DF in building energy services and facility upgrades. It focuses on opportunities afforded by time-differentiated rates—mainly TOU rates—and DR programs as they are often currently available, but other grid service incentives and markets should be kept in mind as opportunities grow. It considers existing building energy services, conventional design-build/design-bid-build projects (which may be funded through appropriations, bonds, loan funds, and other sources), and ESPC and EaaS mechanisms. There is scope for wringing additional value from building energy management and energy upgrades that provide financial reward while also improving building function and comfort, supporting building and grid energy reliability and resilience, and advancing emissions goals.

Box 1: U.S. General Services Administration Studies Value of Building Demand Flexibility

The Rocky Mountain Institute and GSA modeled six prototypical federal office buildings across a variety of regions, climate zones, utility rate structures, and other factors to quantify the value GEBs could deliver to the GSA.[8] The modeled buildings incorporated energy efficiency, demand flexibility, renewable generation, and energy storage measures to manage demand charges and take advantage of TOU rates.

The study found that each modeled GEB could save an average of 30% of annual energy costs with payback periods of under four years. Extrapolated to the portfolio of GSA-owned office buildings, the measures and practices could save GSA $50 million annually or about 20% of the agency's annual energy spending. Upfront investment of $184 million would deliver $206 million in net present value (NPV) over eight years.[9] The study also determined that $70 million per year of benefits to electric systems (and, thus, electricity customers) would result from reduced generation capacity and transmission and distribution (T&D) costs. GEBs would also enhance grid resilience, reduce emissions, and support grid load balancing. With greater demand flexibility, GEBs would provide cost savings and other benefits even as utility rate structures change over time.

The study recommended that GSA incorporate GEB measures in current and future projects and include them within ESPC and similar Utility Energy Service Contract (UESC) projects. Quick payback of GEB measures could buy down the cost of longer payback measures in upgrade projects. The study suggested that building controls and controllable lighting fixtures for reducing peak demand should be within standard specifications and that new construction and major renovations should include advanced specifications for GEB-capable control systems.

GSA, in collaborations with DOE, is initiating GEB demonstrations projects at GSA and private buildings to help identify appropriate building control systems and other GEB technologies.[10] It is also piloting the incorporation of demand flexibility and GEB approaches in ESPC and UESCs.[11]

The study, its findings and recommendations, and GSA experience are useful for State Energy Offices and others since they can apply to public, institutional, and private-sector buildings too.

Building Energy Services

In principle, agencies[12] could direct that building/facility managers and operators take advantage of TOU (or other time-differentiated) rates and participate in DR programs.[13] In practice, facility operators (in-house or contracted) may not be familiar with nor incentivized to learn about and act on such utility tariffs and DR programs.

---

[8] Carmichael, C., M. Jungclaus, P. Keuhn, and K. Porst Hydras, 2019, "Value Potential for Grid-interactive Efficient Buildings in the GSA Portfolio: A Cost-Benefit Analysis" https://rmi.org/insight/value-potential-for-grid-interactive-efficient-buildings-in-the-gsa-portfolio-a-cost-benefit-analysis/.

[9] Ibid. Cost figures included utility incentives; annual cost savings ranged from 7% to 60%; a 3% discount rate over an 8-year analysis period was used for NPV determination; and sensitivity analysis indicated that upfront costs could more than double and still yield positive NPV at all modeled locations.

[10] U.S. General Services Administration, Emerging Building Technologies: Ongoing Assessments, https://www.gsa.gov/governmentwide-initiatives/sustainability/emerging-building-technologies/ongoing-assessments.

[11] Sandler, K., U.S. General Services Administration, e-mail, October 30, 2020.

[12] "Agency" is used henceforth to mean the owner or authority in charge of public or institutional buildings whether or not a governmental entity.

[13] The Federal Energy Management Program (FEMP) maintains a directory of Demand Response and Time-Variable Pricing Programs by state describing and providing links to programs by utility and ISO/RTO territory https://www.energy.gov/eere/femp/demand-response-and-time-variable-pricing-programs.

State Energy Offices can work with agencies that own and operate buildings to inform and educate managers and operators about these opportunities and their benefits as well as provide technical training so operators can implement energy efficiency, peak reduction, load shifting, and other measures while assuring requisite building functionality and occupant comfort.

Agencies could also consider financial incentives whereby a portion of savings is retained by the facility for its budget rather than reverting to the agency or general budget.[14] A portion of savings could also be allotted to bonuses or prizes for operations staff to encourage greater energy efficiency and demand flexibility. Contracted facility operators could have shared savings or bonus compensation included in their contracts for achieving greater energy management performance and bill savings.

Also, third-party DR service providers (sometimes called DR aggregators or curtailment service providers) can be contracted to provide DR and other DF services. These specialized firms work with utilities or may bid into wholesale electricity markets the aggregated demand reduction and flexibility capabilities of multiple customers. They send signals to shed or shift customers' loads (e.g., adjusting thermostat set points, dimming lighting, charging or discharging batteries) in response to utility or grid operator day-ahead or hour-ahead predicted or real-time needs. Day-ahead signals can allow preparative pre-cooling, pre-heating, thermal energy storage, battery charging, or other load schedule shifts. The DR aggregator deals with the technical, financial, and administrative complexity of wholesale electricity market participation while providing compensation to its customers.

GEBs can provide more than demand reduction during DR events. GEBs can support grid power quality when loads are "modulated" (rapidly adjusted down to sub-second scales) and when onsite generation and electricity storage (which can include electric vehicles [EVs]) is tapped. GEBs can serve as "virtual power plants" (VPPs) that offer energy, capacity, and ancillary services by sending power to the grid. In some areas, utilities may offer programs and compensation directly to participating building owners. In other cases, aggregator firms are well situated to provide grid services on behalf of customers. Building owners should consider that some of these applications may entail utilities or aggregators controlling some building system. And they should assure that cybersecurity precautions are taken.

Equipment Procurement and Design-Build/Design-Bid-Build Projects

Under conventional design-build/design-bid-build project procurement, agencies can specify in requests-for-proposal (RFPs) a preference or requirement for grid-interactive capabilities in building management systems[15] and, as appropriate, for individual building energy system components, such as water heating, HVAC, lighting controls, appliances, electronics, and plug loads.[16]

---

[14] Colrick, I., K. Cowart, J. Grasing, and C. Knipfer, 2014, "Incentivizing Energy Efficiency in State Buildings: Achieving Greater Energy Reduction Goals with a Shared Savings Model," Governor's Summer Internship Program 2014, https://shrivercenter.umbc.edu/files/2014/10/Shared-Savings-Policy-Paper_GSIP-2014.pdf. This paper proposed for Maryland a shared savings model with agency retention of certain energy savings, citing examples from the North Carolina University System, South Carolina, Oregon, and City of Chicago Public Schools.

[15] May be referred to as building automation systems, building automation and controls systems, or similar terms.

[16] DOE published a series of technical reports examining grid-interactive demand-flexibility opportunities for whole-building systems as well as major building energy subsystems. These are available at https://www.energy.gov/eere/buildings/grid-interactive-efficient-buildings under "technical reports": Whole-Building Controls, Sensors, Modeling, and Analytics GEB Technical Report (May 19, 2020 webinar slides), Windows

Specifications and designs could include the ability for the building and its equipment to be programmed to stage and schedule loads to reduce peak demand charges and take advantage of time-differentiated rates. Where economically feasible and/or where resilience considerations warrant, thermal and electrical storage and onsite generation can be included in buildings to smooth demand, arbitrage TOU rates, and support facility resilience. The building management system and/or specific subsystems should be able to respond to utility and grid operator DR signals in an automated fashion.[17]

In crafting RFPs and examining proposals, agencies should also consider system standards and interoperability, giving preference to hardware and software that is not wedded to a single vendor but, instead, is compatible and interoperable across manufacturers, service providers, and utilities. Agencies could consider open source software. They can consult with their utilities to assure connectivity and interoperability. Cybersecurity should also be assured to protect building operations and the broader electricity and energy systems.

Agencies can also ensure that purchased and installed systems meet appropriate electrical, fire and other safety standards; are properly commissioned; and that building operators have adequate training and support to assure effective operation.

Energy Savings Performance Contracts[18]

Through savings guarantees and conservation of customers' capital, ESPCs are now a widely-used approach for upgrading public and institutional facilities. ESPCs are very effective for helping achieve energy efficiency improvements and associated financial savings.[19] However, public and institutional building owners generally have not deployed them to realize the values that time-shifting electricity loads, DF, and serving grid markets can provide.

In engaging ESCOs on prospective ESPCs, *State Energy Offices and facility-owning and -operating agencies could explore options for including peak reduction, scheduling to take advantage of time-differentiated rates, DR program participation, and, possibly, interactive grid service markets as additional sources of financial savings.* At a minimum, they can consider peak reduction to reduce demand charges. TOU rates, DR programs, and other value streams may require greater investigation as to their scope, potential financial benefits, and potential financial risks.

An advisory group to the GSA examined these issues in the federal ESPC context—state and local laws, regulations, and procedures may differ. It provided an Advice Letter with recommendations for

---

and Opaque Envelope GEB Technical Report (June 16, 2020 webinar slides), HVAC, Water Heating, Appliances and Refrigeration GEB Technical Report (June 2, 2020 HVAC webinar slides; June 9, 2020 Water Heating, Appliances, Refrigeration slides), Lighting and Electronics GEB Technical Report (May 26, 2020 webinar slides).

[17] DR signals, at base, include signals for shedding load at periods of very high grid costs or stress but can, in more sophisticated programs, include interactive two-way signaling allowing a building and its equipment to provide modulation or other services to the grid.

[18] This section can also apply to UESCs though, as noted, NASEO is not aware of non-federal use of the mechanism.

[19] U.S. DOE, ESPC Toolkit provides many useful resources https://betterbuildingssolutioncenter.energy.gov/energy-savings-performance-contracting-espc-toolkit.

advancing building-grid integration in federal buildings, with particular advice for using ESPC and UESCs as approaches to do so.[20]

The Advice Letter notes that:

- ESPCs generally allow demand savings and should include them,
- ESPCs should use actual utility rates, including demand charges and TOU or other time-differentiation, rather than blended average rates,
- DR programs that provide fixed monthly payments are easiest to incorporate in ESPCs, in contrast to those that vary compensation,
- Education and training on the part of both the ESCO and agency/customer sides is needed to better understand and take advantage of these opportunities, and
- Inclusion of ongoing or continuous flexible demand management may require greater inclusion of O&M services and/or greater financial risk sharing between the ESCO and customer.

A complication of including DF and grid-services in ESPCs is the uncertainty surrounding future rates, markets, and compensation. Guaranteed savings in ESPCs extend over terms that can range to 25 years. Such contracts typically include escalation rate assumptions for future utility rates. However, as the electric grid changes with increased variable solar and wind power generation, electrification of transportation (EVs), and greater penetration of other distributed energy resources (DERs), TOU rate profiles may change in hard-to-predict ways over the course of the ESPC term. Also, DR and other grid market compensation may vary year-to-year depending on grid needs.

Options for accommodating or mitigating risks of changing TOU rate structures include (1) allowing the ESPC to guarantee TOU-based savings for the first three to five years of the contract term, then “deem” out-year future savings based on the initial TOU rate structure in the contract, (2) placing a limit on annual rate changes for purposes of calculating savings under the guarantee, (3) requesting a special tariff from the utility to lock in rates for a longer period, or (4) allowing renegotiation of the TOU-based savings grounded on new rates. However, some jurisdictions may require that actual measured and verified bill savings cover contract costs and not allow use of deemed savings and assumed rates. Renegotiating the contract savings guarantee when TOU rate structures are significantly altered may be possible, but this approach entails significant effort, some financial risk, and may also have legal impediments.

Another option would be to “enhance” the ESPC to include a shared savings or performance bonus for savings that exceed the traditional energy efficiency-based guaranteed savings. It may also be possible to layer onto the ESPC a building operations contract with shared-savings or bonus provisions that, as discussed above in the Building Energy Services section, could incentivize demand flexibility and grid-service provisions. An enhanced ESPC that includes O&M services may then resemble an EaaS agreement (discussed below) or some related arrangement such as an energy asset concession arrangement, depending on particular structure of the contract. Indeed, at times EaaSs can incorporate

---

[20] GSA Green Building Advisory Committee, 2019, “Federal Building & Grid Integration: Proposed Roadmap and Advice Letter,” https://www.gsa.gov/cdnstatic/Bldg%20Grid%20Integration%20Advice%20Letter%20Phase%20II%2012-9-19.pdf.

an ESPC and its guaranteed savings into a broader agreement that harvests operational savings though ongoing service.

Also, as discussed regarding facility services, a DR aggregator can also be engaged to provide services, whether or not associated with the ESPC, as an “enhancement.”

Energy-as-a-Service

EaaS is increasingly offered as a solution for building and facility owners seeking innovative approaches to finance upgrades that improve energy performance.[21] The EaaS model is also being used to advance environmental and energy resilience objectives by being able to incorporate onsite renewable generation, energy storage, combined heat-and-power, microgrids, and EV charging.[22]

Typically, under an EaaS the customer pays a third-party energy service provider a recurring fee—like a utility payment or a subscription—to supply energy services as well as generally including energy facility upgrades that may have ESPC-type savings guarantees. The fee may be fixed, vary with energy consumption (like a utility bill does), be performance-based, or a combination of these.[23] Similar to an ESPC, EaaS customers typically do not spend upfront capital to make improvements to their facilities.

EaaS offerings are highly varied and projects are generally bespoke. They can incorporate a range of financing and contracting components including ESPC as well as:

- Equipment leases or loans,
- Power purchase agreements,
- Efficiency savings agreements,
- Shared savings agreements, and
- Energy asset concession agreements or arrangements.

Often, but not always, the EaaS provider will contract with a financial investor who may then own or have a security interest in the upgraded equipment. If the EaaS provider is not itself an ESCO, it may contract with one to perform construction and installation. The service provider then proceeds to perform O&M for the EaaS contract term. A new variation of EaaS called the Metered Energy Efficiency Transaction Structure (MEETS) offers a somewhat different approach that incorporates utility participation and interest in building upgrades and efficient operation (see Box 2).

An EaaS can be structured, such as by including shared savings provisions, to incentivize the service provider to seek additional utility bill savings and revenue opportunities. These can include taking advantage of time-based rates, DR programs, and grid service markets to provide additional value to the building owner and the grid simultaneously.

---

[21] Cleary, K. and K. Palmer, 2019, “Energy-as-a-Service: A Business Model for Expanding Deployment of Low-Carbon Technologies,” https://media.rff.org/documents/IB_19-09_EaaS.pdf.

[22] For example, Montgomery County (MD) employs a microgrid-as-a-service arrangement at its Public safety Headquarters a https://www.montgomerycountymd.gov/dgs-oes/Microgrids.html.

[23] A fee with a combination of components could, for example, include a fixed component for infrastructure, variable component based on energy use, and a performance-based component reflecting reliability, availability, comfort, or other factors.

Agencies could consider EaaS approaches along with ESPCs as potential public-private partnership mechanisms to advance their energy savings goals and tap additional benefits offered by demand flexibility. The variety and often customized nature of EaaSs thus far requires scrutiny to assure compliance with legal strictures governing procurement. The agency may need to address such questions as:

- Does a proposed arrangement include energy savings guarantees that comply with ESPC authorizing law?
- Does it convey ownership or security interest in equipment at a public facility and, if so, is that permissible? and
- Are shared savings arrangements with private service providers legal?
- Among others.

Further education, case studies, and lessons learned exchanges will be useful.

Box 2: Metered Energy Efficiency Transaction Structure (MEETS)

MEETS offers a somewhat different approach to align interests of customers, EaaS service providers, utilities, and capital providers.[24] First demonstrated for a building in Washington state, the model is being piloted as an *efficiency*-as-a-service offering by Seattle City Light.[25] Under the MEETS model, the EaaS provider becomes an "EnergyTenant™" contractor that pays rent to the building owner in order to make upgrades and operate the building so it delivers energy savings that are metered and sold to the utility via a Power Purchase Agreement (PPA) like traditional electricity supply. The MEETS Coalition and Seattle City Light refer to the resource as Efficiency Energy. The building owner continues to pay the utility for electricity consumed as well as an energy efficiency fee equivalent to metered savings that the utility buys from the EnergyTenant via the PPA. The building owner also keeps ownership of upgraded equipment unlike in some other EaaS structures.

Under MEETS, the building owner's utility bill is the same as if the upgrade did not occur, but it makes money from rent paid by the EnergyTenant and benefits from the increased value of the building. The building owner passes on the utility bills (including for the Efficiency Energy) to the tenants, like all other energy charges. This addresses the "split incentive" between landlords and tenants that has traditionally impeded pursuit of deep energy efficiency retrofits.

The EnergyTenant (EaaS service provider) earns revenue from selling metered Efficiency Energy to the utility through a PPA; that amount being sufficient to pay the financier for capital provided and rent to the building owner, perform contracted O&M of the building, and add profit. The utility is kept "whole" in MEETS unlike with conventional energy efficiency programs that lower volume sales of power. Initially focused on energy efficiency, the model could be adapted to recognize demand savings, TOU arbitrage, DR compensation, and other value streams so long as the demand flexibility can be metered and compared with baseline conditions. Unlike other EaaS forms, the MEETS model's use of a utility PPA may require the utility to obtain regulatory (if investor-owned) or governing body (if public power or cooperative) approval to participate. The utility PPA is also highly credit worthy and may lower the cost of financing.

---

[24] MEETS Coalition, https://www.meetscoalition.org/.

[25] Seattle City Light, Energy Efficiency as a Service, https://energysolutions.seattle.gov/energy-efficiency-as-a-service/.

Summary

Enhancing energy efficiency is a well-demonstrated way for public and institutional facilities to save money while also meeting other policy needs, such as improving environmental performance. Monetary savings can also fund capital upgrades, without expending agency capital if ESPC and EaaS project models are used. However, additional financial benefits from flexible energy demand management and grid-interactive services are often forgone, leaving money "on the table" that could otherwise serve agency mission needs.

Operating buildings to reduce peak loads, take advantage of TOU rate structures, and participate in DR programs can yield greater savings as well as support resilience, emissions, and other goals. Markets for grid-interactive services are also emerging. Agencies can realize such value streams through their own procurement processes, by incentivizing in-house and contracted facility operators, via specialist DR aggregator firms, and by including these value streams in ESPC and EaaS projects.

This document discusses considerations and suggestions for State Energy Offices and facility-owning and -operating agencies to tap these underutilized emerging value streams, summarized in Table 2.

Table 2. Summary Actions to Advance Demand Flexibility in Public Facilities

Building Portfolio Analysis
Analyze building portfolio to determine sites where DF and GEB can be most cost-effective and support policies.
Building Energy Services
Direct facilities to seek cost-effective demand reduction, TOU, DR, and grid-service opportunities.
Educate and train building operators on such opportunities and implementation.
Provide financial incentives to in-house facility operators (shared savings; staff bonuses or prizes).
Provide financial incentives to contracted facility operators (shared savings).
Hire DR aggregator service provider.
Equipment Procurement and Design-Build/Design-Bid-Build Projects
Specify grid-interactive capabilities in building management systems.
Specify grid-interactive capabilities in equipment (e.g., water heaters, lighting controls, thermostats).
Consider interoperability and standards for compatibility among components and with utility (and assure cybersecurity).
Assure proper commissioning and operator training.
Energy Savings Performance Contracts*
Inform and educate agencies, operators, procurement officers, and others on opportunities and fit with ESPC.
Include demand savings explicitly.
Use actual rates (incorporating TOU/time-differentiated pricing) rather than blended rates.
Include DR program participation (easier if fixed payment option is available).
If legal, include shared savings incentive for greater savings.
If legal, consider including 3-5 years of TOU-based savings then deem out years if TOU rate structure changes or limit annual rate changes for purposes of guaranteed savings calculations.
Allow savings guarantee adjustment if major TOU rate structure change occurs or request special tariff from utility to lock in rates for longer period.
Include building operations service contract with incentives as above (Building Energy Services).
Include DR service aggregator services as additional component.
Energy-as-a-Service
Inform and educate agencies, operators, procurement officers, and others on opportunities and fit with EaaS.
Include demand flexibility and grid-interactive functionality and service in EaaS.
Provide shared savings incentive for additional operational savings.

* This section can also apply to Utility Energy Service Contracts (UESCs).

Resources

Carmichael, C., M. Jungclaus, P. Keuhn, and K. Porst Hydras, 2019, "Value Potential for Grid-interactive Efficient Buildings in the GSA Portfolio: A Cost-Benefit Analysis," https://rmi.org/insight/value-potential-for-grid-interactive-efficient-buildings-in-the-gsa-portfolio-a-cost-benefit-analysis/.

Cleary, K., and K. Palmer, 2019, "Energy-as-a-Service: A Business Model for Expanding Deployment of Low-Carbon Technologies," https://media.rff.org/documents/IB_19-09_EaaS.pdf.

NASEO, 2019, "Grid-interactive Efficient Buildings: State Briefing Paper," https://naseo.org/data/sites/1/documents/publications/v3-Final-Updated-GEB-Doc-10-30.pdf.

Sandler, K., 2020, "Integrating Public Buildings with the Grid," NASEO Buildings Committee meeting at the 2020 NASEO Energy Policy Outlook Conference and Innovation Summit," https://energyoutlook.naseo.org/data/energymeetings/presentations/Sandler-GEB-Discussion.pdf.

Schwartz, L., and G. Leventis, 2020, "Grid-Interactive Efficient Buildings: An Introduction for State and Local Governments," https://emp.lbl.gov/publications/grid-interactive-efficient-buildings.

U.S. Department of Energy, 2019, "Grid-interactive Efficient Buildings: Factsheet," https://www.energy.gov/sites/prod/files/2019/04/f62/bto-geb-factsheet-41119.pdf.

U.S. Department of Energy, 2019, "Grid-interactive Efficient Buildings: Overview," https://www.energy.gov/sites/prod/files/2019/04/f61/bto-geb_overview-4.15.19.pdf.

U.S. Department of Energy, Federal Energy Management Program (FEMP), Demand Response and Time-Variable Pricing Programs, https://www.energy.gov/eere/femp/demand-response-and-time-variable-pricing-programs.

U.S. General Services Administration, Emerging Building Technologies: Ongoing Assessments, https://www.gsa.gov/governmentwide-initiatives/sustainability/emerging-building-technologies/ongoing-assessments.

U.S. General Services Administration, 2019, "Green Building Advisory Committee: Federal Building & Grid Integration: Proposed Roadmap and Advice Letter," https://www.gsa.gov/cdnstatic/Bldg%20Grid%20Integration%20Advice%20Letter%20Phase%20II%2012-9-19.pdf.