**Request for Information (RFI) DE-FOA-0002070:**

**Efficient and Flexible Building Loads**

DATE: January 28, 2019

SUBJECT: Request for Information (RFI)

**Description**

Changes in technology, consumer choice, and grid modernization allow for a future in which buildings play an even greater role in supporting a modern electric grid. Efficient and flexible building loads provide options to increase electricity system reliability and energy affordability, while also supporting a portfolio of generation options in grid modernization. To date, savings resulting from flexible building loads[[1]](#footnote-1) have been primarily achieved through traditional energy efficiency and demand management programs. However, advanced controls, sensors and data analytics developed over the last decade provide new ways to optimize building energy savings and energy use, by autonomously managing a variety of distributed energy resources (DER) including on-site solar panels, energy storage, electric vehicles, and various demand-side assets, while maintaining – and even improving – comfort to occupants, and contributing to a reliable, affordable grid. Substantial research and development (R&D) related to advanced controls, sensors and data analytics is underway, and additional progress is anticipated. Through this RFI, the U.S. Department of Energy (DOE) Building Technologies Office (BTO) seeks input from industry to better understand where flexible building loads research goals can be refined to reflect market needs and inform related R&D activities.

**Background**

Building technologies have significant and demonstrated potential to be utilized as cost-effective solutions to respond to grid conditions through demand-side management (DSM). This potential is significant, in part, because buildings are the primary users of electricity: 75% of all U.S. electricity[[2]](#footnote-2) is consumed within buildings, and building energy use drives 80% of peak demand. In addition to the technical capacity of building technologies to change the timing or amount of energy being used by buildings, the growing capacity and number of building systems and technologies that are internet connected increases the potential magnitude of flexible building loads available to the grid. Recent years have seen an explosion in the number of internet-connected devices and smart technologies that offer building occupants a new level of functionality and convenience, and enable buildings to become more flexible with the timing of energy use. The market for connected and smart thermostats alone is projected to be worth over $4 billion by 2025.[[3]](#footnote-3) As more buildings are equipped with these devices, an increasing number of buildings, particularly small businesses and homes, may be able to participate in demand-side management and the dynamic operation of buildings while still meeting their needs and expectations.

Demand-side resources, such as energy-efficient devices and equipment in buildings, not only save energy and reduce costs for a building owner or occupant, they can also lower electricity system costs for all customers by reducing a variety of new capacity needs. Energy efficiency measures can be combined with grid-interactive strategies, such as demand response and distributed energy storage, to further reduce and change electricity consumption patterns to minimize consumer and electricity system costs, relieve system stress, deliver grid operational benefits through ancillary services, integrate variable renewable energy resources, and possibly provide resiliency benefits. For more details on grid services that buildings can provide through load flexibility, such as reducing transmission and distribution (T&D) capacity, decreasing operating costs, and providing frequency and contingency reserves, see Table 2 below. DOE’s Grid Modernization Initiative[[4]](#footnote-4) is driving many of these same outcomes, along with BTO’s research investment in this area to expand and accelerate broader efforts.

***BTO’s Vision for Flexible Building Loads***

Through its flexible building loads activities, BTO seeks to build on existing energy efficiency efforts, and develop technical capabilities to optimize the interplay between energy efficiency, demand response, behind-the-meter generation and energy storage to increase the flexibility of demand-side management. BTO envisions a future where buildings dynamically operate as part of a low-cost, reliable electricity grid while meeting the needs of building occupants. As a result of this increased building flexibility, American families and businesses can save more money on their utility bills, receive the desired energy-related services, and gain greater control over their energy use – while also enhancing the reliability of the electricity system and the resilience of our buildings and communities.

BTO has a mission to support the R&D, validation, and integration of affordable and energy-efficient technologies, techniques, tools, and services for both existing and new residential and commercial buildings. In service to this mission, BTO is developing a flexible building loads strategy that integrates advanced controls, controls systems, communication, and “intelligence” with energy-efficient building technologies to advance the role buildings can play in energy system operation and planning.

BTO recognizes that:

* Building energy efficiency, storage, behind-the-meter generation and demand response are all important grid resources, both individually and in concert with one another;
* Building end-use energy consumption can be dynamically managed to support grid needs, minimize electricity system costs, meet occupant needs, and provide building services within normal thresholds;
* The local value of power management and services, energy, and energy efficiency change significantly based on location, time of the day, time of year, and across years;
* Greater communications and connectivity offer very large energy management opportunities but also can introduce real and/or perceived risks regarding maintaining privacy and cybersecurity; and
* Building load management and on-site DERs, including electric vehicles, variable renewable energy resources and energy storage all offer a package of behind-the-meter options to optimize energy loads to minimize cost to both the utility customer and the broader electricity system.

**Purpose**

The purpose of this RFI is to solicit feedback from industry, academia, research laboratories, government agencies, building owners and operators, builders, utilities, and other stakeholders on key issues related to the energy flexibility that building technologies can provide. This information will be used by BTO for strategic planning of the broader grid-interactive efficient building technologies R&D portfolio. This is solely a request for information and not a Funding Opportunity Announcement (FOA). EEREis not accepting applications.

**Disclaimer and Important Notes**

This RFI is not an announcement of the availability of any type of funding; therefore, EERE is not accepting applications at this time. EERE may announce a FOA in the future based on or related to the content and responses to this RFI; however, EERE may also elect not to offer any funding related to this topic. There is no guarantee that any funding will be issued as a result of this RFI. Responding to this RFI does not provide any advantage or disadvantage to potential applicants if EERE chooses to make any funding available related to the subject matter. Final details, including the anticipated funding amount and timing of EERE funded awards, will be subject to congressional appropriations and direction.

Any information obtained as a result of this RFI is intended to be used by the Government on a non-attribution basis for planning and strategy development; this RFI does not constitute a formal solicitation for proposals or abstracts. Your response to this notice will be treated as information only. EERE will review and consider all responses in its formulation of program strategies for the identified materials of interest that are the subject of this request. EERE will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that EERE is under no obligation to acknowledge receipt of the information received or provide feedback to respondents with respect to any information submitted under this RFI. Responses to this RFI do not bind DOE to any further actions related to this topic.

**Proprietary Information**

Because information received in response to this RFI may be used to structure future programs and/or otherwise be made available to the public, **respondents are strongly advised to NOT include any information in their responses that might be considered business sensitive, proprietary, or otherwise confidential.** If, however, a respondent chooses to submit businesssensitive, proprietary, or otherwise confidential information, it must be clearly and conspicuouslymarked as such in the response.

Responses containing confidential, proprietary, or privileged information must be conspicuously marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Federal Government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

If your response contains confidential, proprietary, or privileged information, you must include a cover sheet marked as follows identifying the specific pages containing confidential, proprietary, or privileged information:

**Notice of Restriction on Disclosure and Use of Data:**

Pages [List Applicable Pages] of this response may contain confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for the purposes described in this RFI DE-FOA-0002070. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.

In addition, (1) the header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: “Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure” and (2) every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

**Evaluation and Administration by Federal and Non-Federal Personnel**

Federal employees are subject to the non-disclosure requirements of a criminal statute, the Trade Secrets Act, 18 USC 1905. The Government may seek the advice of qualified non-Federal personnel. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The respondents, by submitting their response, consent to DOE providing their response to non-Federal parties. Non-Federal parties given access to responses must be subject to an appropriate obligation of confidentiality prior to being given the access. Submissions may be reviewed by support contractors and private consultants.

**Request for Information Categories and Questions**

**Category 1: Building Technologies R&D and Integration Needs for Increased Load Flexibility**

Achieving building load flexibility at scale requires the identification, development and evaluation of building technology performance features (including systems, equipment, appliances and devices) that could enable greater efficiency, flexibility and more effective integration to provide grid services. Field-testing and validation of energy-efficient and flexible technologies will help provide valuable information to improve BTO building technologies R&D and building energy modeling – especially model predictive control R&D – to ensure the optimal application and performance of technologies.

It is important to note that home and business owners are primarily interested in advanced controls because of the additional comfort, convenience, and safety benefits they can provide. The added ability to provide grid services may make those primary benefits more attainable if proper incentives and compensation mechanisms are provided. Therefore, it is critical to understand the impact of shifting or reducing energy use on occupant needs and building operations. Data collected from laboratory test bed studies and small-scale pilot projects can inform BTO R&D’s characterization of the operational abilities and constraints of building technologies to provide increased load flexibility.

Building technologies that are both energy efficient and grid interactive can help lower coincident peak demand on electricity grids in ways that are potentially lower cost than current approaches. Table 1 distinguishes four ways building technologies can increase load flexibility, and it provides several examples of technologies that can enable that flexibility. The example list includes a wide range of technologies because BTO considers early-stage and materials research that may have significant potential to increase building efficiency and the ability to change end use load profiles and therefore unlock the economic potential of demand-side flexibility.

**Table 1: Building Technologies that Could Improve Load Flexibility**

|  |  |  |
| --- | --- | --- |
|  | **Description** | **Example Technologies** |
| **Flexible Materials** | Technologies that can alter operation using the properties of the materials | - Electrochromic glass  - Phase change materials  - Early-stage technologies: Thermoswitch |
| **Flexible Power Draw** | Technologies that can alter the amount of electric power drawn while remaining operational | - Motor Technologies: Variable Frequency Drives (VFDs), Electronically Commutated Motors (ECMs)  - Electric Appliances: Smart appliances  - Early-stage Technologies: Controllable lighting |
| **Flexible Energy Source** | Technologies that can operate on multiple fuels | - Grid Electric to Local Electric: multi-function fuel-fired heat pumps / micro-scale combined heat & power (mCHP) |
| **Flexible Timing** | Technologies that provide on-site battery or thermal storage that can be charged or discharged on demand | - Battery Storage  - Water Heater & Solid Mass Thermal Storage  - Off-peak Pre-cooling & Ice Production |

***Category 1 Questions – Building Technologies R&D and Integration Needs for Increased Load Flexibility***

1. What are the most important barriers that prevent or inhibit building technologies from contributing to grid services through load flexibility? Please describe both technological and non-technological barriers (e.g. regulatory, market, behavioral) and specify the building sector (e.g. single-family residential, multi-family residential, small commercial, large commercial).
   1. What strategies can be deployed to address these technological and other barriers?
   2. What strategies can be deployed that might result in greater grid resiliency? How might this be measured?
   3. Are there specific issues or challenges to the aggregation of different kinds of DERs (e.g. aggregating EVs, solar, and air conditioning) for grid services that should be addressed? Which are the top priorities?
2. What data or analyses are necessary to make informed decisions about the ability of building technologies to provide specific grid services?
   1. What attributes (e.g. duration of load reduction, load reduction magnitude, response time) are needed to evaluate equipment, appliances, and other devices for the grid services identified in Table 2 on page 12? Please indicate if attributes are unique to specific grid services.
3. What are the R&D opportunities for developing building technologies to be better suited to provide flexible building loads?
   1. Which category of building technologies (e.g. flexible materials, flexible power draw) described in Table 1 above could enable the greatest ability to provide grid services and why? What would be an example application? Please specify the building sector (e.g. single-family residential, multi-family residential, small commercial, large commercial).
   2. What aspects of flexible building loads, at the building end-use or integrated approach of building end-uses, could be improved by further research and field-testing? What research or field-testing needs to be done?
   3. What aspects of flexible building loads at the building end-use or integrated approach of building end-use could be improved by making more and better information available? What information is most useful?
4. What potential concerns might building owners and operators have about using their building technologies to provide load flexibility (e.g. complexity of new technologies, wear on end-use devices, occupant impact)?
   1. What research/solutions are needed to address these concerns?
   2. Does data exist for building technologies that demonstrate an ability to perform various grid services without impeding the primary service’s quality or equipment lifetime? Are there studies or data indicating consumer willingness to alter their usage in response to some incentive? If yes, and it is possible, please share this data with DOE.
5. What early-stage technologies (or collection of technologies) have the potential to provide building load flexibility that could have a significant impact (e.g. peak reduction, decreased energy consumption, renewable integration)? What would be a significant impact/s?
6. Please provide any additional feedback you have on the research, development, verification, and deployment needs for flexible building technologies and systems.

**Category 2: Controls and Communication to Enhance Building-to-Grid Interactions**

The sophistication of building control systems has steadily advanced beyond the relatively limited capabilities of contemporary, reactive controls – ones that meet a building’s short-term thermal and ventilation load requirements – into an era of advanced building control systems. These advanced control systems can draw from additional inputs to simultaneously optimize a much more expansive set of factors. This involves optimizing building operations at a range of time scales from seconds to days, and multiple spatial scales (e.g., device, occupant, zone, whole-building, campus, feeder, and region), incorporating additional inputs (e.g., occupancy patterns, weather forecasts), and employing prediction, data-driven learning and optimization techniques rather than traditional rules.

At any given time, buildings have a certain amount of flexibility to shift energy use to adjust time of use to that of lower price points. However, to capture this flexibility, some form of a building system must be able to interact with both the electricity grid and its building’s equipment. In recent years, standard communication protocols and schema have emerged for demand response (grid-to-building communication). Two of those most common standards are the OpenADR (Open Automated Demand Response) and the NAESB (North American Energy Standards Board) standards for wholesale and retail demand response.

Significant gains have been made in control technologies that enable building technologies to provide a greater variety of grid services. Automated Demand Response (ADR) technology advancements have facilitated the control and response capabilities through embedded logic and algorithms in the controls, which enable automated response within seconds or minutes with virtually no human interaction. This advancement has created opportunities to control building equipment for services other than capacity, including fast and flexible response service.

Buildings must have a mix of load control and communication technologies that:

* Understand and respond to outside signals requesting grid services across a variety of timescales;
* Meet occupant set points and preferences; and,
* Forecast and adapt operation based on exogenous, grid variables.

***Category 2 Questions – Controls and Communications to Enhance Building–to-Grid Interactions***

1. What are the pros and cons of direct, distributed control vs. supervisory, hierarchical control for components, sub-systems, zones, or whole buildings? Please describe scenarios and where aggregation occurs in a scenario.
2. What are the pros and cons of manual/semi-automated vs. automated control for components, sub-systems, zones, or whole buildings? Please describe scenarios and where aggregation occurs in a scenario.
3. What ways might grid needs be communicated to a building component, sub-system, zone, or the entire building?
4. What types of communication, coordination, and control schemes/requirements are necessary among components, sub-systems, and zones to permit the optimization of building operations locally with respect to the optimal operations of grid systems?
   1. What types of infrastructure technologies need to be developed to support communication among components, sub-systems, zones, buildings and the grid?
   2. What types of infrastructure technologies already exist, but are not widely used, that would help support communication among components, sub-systems, zones, buildings and the grid?
   3. How should the optimal operation of building systems be adjusted to accommodate optimal operation of electric vehicles or other mobile systems that may interact periodically with a building?
5. Are the current standards and protocols sufficient for building-to-grid two-way communications? If not, what additional advancements are needed?
6. How should building controls communications integrate with other DERs to ensure the ability of DERs and DER-related systems to successfully communicate?
7. What additional cyber- and other security development needs to be considered that is not being addressed through current state-of-the-art encryption, access control, and protection when designing adaptive controls for enhancing grid interactions?
8. Please provide any additional feedback on the R&D needs related to controls and communication to enhance building-to-grid interactions.
9. Where are the major (real and/or perceived) cybersecurity concerns? How might cybersecurity vulnerabilities be best addressed?

**Category 3: Building Energy Modeling for Load Flexibility**

Building Energy Modeling (BEM) is a physics-based simulation that 1) calculates thermal loads based on climate, envelope characteristics, internal loads, and ventilation rates, 2) accounts for interactions among building systems and end-uses, 3) reports total energy consumption by end-use and fuel-type, 4) accounts for thermal and energy-consumption impacts of all major building systems such as HVAC, lighting, water heating, refrigeration, and plug loads, as well as accounting for control schemes, and 5) provides output at an hourly or finer time step.

BEM supports energy efficiency through a variety of use cases including: design of new buildings and retrofits, design of building control strategies, energy-efficiency code-development and compliance, rating and certificate program development and implementation, energy-efficiency program development and administration, energy-efficiency product design, and policy analysis.

Many of these use cases will have natural extensions to buildings that provide flexible loads and will need to incorporate new metrics and criteria as they are developed[[5]](#footnote-5). As BEM is the alternative evaluation tool behind these use cases, it will have to calculate building flexibility metrics at a temporal resolution that supports the specific application. Conventional BEM engines use discrete-time simulation techniques. Therefore, today’s engines can only model building states at those discrete times. They cannot resolve transitions that occur within intervals. As a result, BEM engines often assume uniform or continuous behavior within a time interval and fail to account for real-world behaviors such as equipment cycling. While these approximations are appropriate for calculating annual energy use to support energy efficiency decisions, they may not be adequate to evaluate metrics that are relevant to a building’s flexibility and the associated grid services that flexibility could provide. To support various grid services, BEM engines will have to simulate at greater time resolutions.

To adequately support building load flexibility analyses, BEM will need to incorporate the flexible component technologies such as those outlined above in Table 1. The inclusion of newer DERs will be especially important in the future, as BEM might be increasingly used to identify and size DERs and compare the energy and cost tradeoffs of these devices as a part of a design and/or operational evaluation. BEM may also need to interface with other models—e.g., power models—in order to support new, grid-interactive efficient building-specific analyses.

BEM will also need to evolve to model building control in a more realistic fashion. As noted above, most BEM engines currently do not model control sequences as they are implemented in buildings; rather, they model the effects that control sequences have over the simulated time-horizon. This is a significant impediment because control engineers must manually translate simulated control into real control sequences, which introduces the possibility of interpretation and implementation errors. This is a critical barrier when considering grid services that buildings provide, in which they must respond more quickly and with greater certainty on delivered energy, demand savings and occupant impacts.

There is an opportunity for BEM to inform the long-range growth forecasts performed by utilities and grid operators. Currently, these models utilize energy-use and economic variables. BEM—specifically large-scale prototypical BEM or more refined urban-scale BEM—can add end-use, technology, program, and regulatory variables to these analyses. BEM has the potential to help utilities and grid operators understand the resource that buildings may provide in planning for power supply, transmission, operation, and demand. BEM may also help them incorporate demand response and other grid services into their analyses. It is less clear whether BEM can help inform the short-term load forecasting currently used to operate energy markets.

***Category 3 Questions – Building Energy Modeling for Load Flexibility***

1. How important is it for BEM to model the potential impact of building load flexibility from building technologies and systems? What level of detail is necessary for building load flexibility to be adequately modeled?
2. What enhancements to BEM engines and capabilities are needed to adequately model the potential impact of building load flexibility from building components and systems? Do these enhancements vary by use case (e.g. building design, energy efficiency certification)?
3. What is BEM’s role in model predictive control (MPC) for different grid services at the component, sub-system, zone, or building level? What benefits does BEM-based or hybrid-BEM MPC provide over black or grey-box data-driven MPC?
4. What is the role of BEM in estimating use and demand flexibility including occupant impacts at the component, sub-system, zone, and building levels?
   1. What BEM enhancements are needed to support this application?
   2. How can sensors and meters support BEM in this application?
   3. How can BEM (large-scale prototypical and urban-scale) help inform utilities and grid operators’ forecasts?
5. What metrics could be used to measure the flexibility of buildings?
6. What standardization of grid services and modeling changes in BEM are necessary to aggregate grid services from different loads?

**Category 4: The Value of Flexible Building Loads**

Demand-side management, in the forms of efficient and flexible energy technologies, has proven to be an effective and capable option of supplying diverse grid services in wholesale markets across the United States. It is difficult to fully quantify the value of demand-side management because the value of energy – and the associated value of energy efficiency, demand response, and storage – can change based on time of the day, time of year, and across years. Demand-side management impacts are rarely measured in a way that allows its contribution to be valued by market and network operators alongside dispatchable supply resources. Increasing connectivity has enabled building equipment to not only provide additional services that help support the grid, but these new technologies also allow the measurement and valuation of energy efficiency and demand response, and could enable it to play a larger part in the energy market.

Connected and controllable equipment, devices, and appliances can enable the optimization of building systems in such a way to provide benefits beyond the building–so that buildings can be net providers, net consumers and/or net neutral to the electric grid. Thus, there is a need to fully recognize the variety of features and capabilities that these equipment, devices, or appliances can provide in buildings, to the electricity grid, and to develop the missing functionality and/or practices that can unlock their full potential.

***Value resulting from flexible building loads***

Flexible building loads can provide value in different ways including[[6]](#footnote-6):

* Reduced energy bills
* Improved reliability
* Reduced grid congestion
* Non-energy benefits
* Market price reductions
* Environmental benefits
* Customer choice and improved service

Several of these benefits are financially valued as grid services. Grid services that can be provided by buildings that allow for flexible loads can be subdivided into services that:

1. Reduce generation costs by offsetting generation capacity investments, avoiding power plant fuel costs, and decreasing operation and maintenance costs, or providing ancillary services (e.g., frequency regulation, and contingency reserves) or
2. Reduce delivery costs by offsetting T&D capacity investments, increasing T&D equipment life, and reducing equipment maintenance, or supporting distribution-level voltage control. Generation and delivery grid services are specified in more detail in Table 2.

| **Table 2. Building Grid Services**  **Flexible building loads can reduce generation, transmission, and distribution costs in a number of ways by reducing or shifting electricity demand of buildings.** | | | |
| --- | --- | --- | --- |
| **Grid Service** | **Building Load Change** | **Avoided Cost** | **Size of Market  Addressable by Buildings** |
| **Generation Services** | | | |
| **Reduce Generation Capacity Costs** | Building reduces or shifts demand during the generation balancing area’s annual peak demand period(s) | Fixed operation and maintenance costs for power plants and capital costs for new generating facilities |  |
| **Reduce Generation Operating Costs** | Building reduces or shifts demand to reduce electricity needs during high-cost periods and improve utilization of low-cost generation | Power plant fuel, operation, maintenance, and startup and shutdown costs |  |
| **Provide Frequency Regulation** | Building modulates its power demand in response to four-second signals from the grid operator to balance electricity supply and demand, and maintain the grid’s frequency at 60 Hz | Power plant fuel, operation, maintenance, and opportunity costs associated with providing frequency regulation |  |
| **Provide Contingency Reserves** | Building reduces its power demand within approximately 10-30 minutes of a signal from the grid operator to make up for a shortfall in electricity supply | Power plant fuel, operation, maintenance, and opportunity costs associated with providing contingency reserves |  |
| **Delivery Services** | | | |
| **Reduce Transmission Upgrade Costs** | Building reduces or shifts demand at a time that reduces local transmission delivery constraints | Capital costs for transmission equipment upgrades |  |
| **Reduce Distribution Upgrade Costs** | Building reduces or shifts demand at a time that reduces local distribution delivery constraints | Capital costs for distribution equipment upgrades |  |
| **Provide Distribution Voltage Support/** | Building modulates its rate of active and/or reactive power draw to control distribution system voltage | Avoided costs for distribution voltage control equipment (e.g. capacitor banks, transformer tap changes) |  |

***Category 4 Questions – The Value of Building Load Flexibility***

1. Do the benefits discussed in this section accurately represent the potential of load flexibility provided by buildings?
   1. Are there additional value streams? What are the key value streams?
   2. How might greater resiliency be valued and measured?
   3. What specific market signals and business models have the potential to create or erode the value of flexible building loads?
   4. What would be a way, either quantitatively or qualitatively, to determine the potential as envisioned in the column entitled “Size of Market Addressable by Buildings” in Table 2 to represent the market potential for buildings to provide various grid services?
2. What are the grid challenges that flexible building loads are best suited to address? Do these challenges vary by region?
3. Are the grid services defined in Table 2 responsive to current and to future grid challenges? Are there additional grid challenges and use cases that flexible loads should address?
4. To what degree can sensing, metering, or a combination of these be used to demonstrate and verify use and demand savings for grid services at the component, sub-system, zone, and building level? What advancements could improve this capability?
   1. To the extent that grid services are provided within the context of programs regulated by state public utilities commissions, what changes would need to occur with the existing evaluation, measurement, and verification (EM&V) paradigm?
   2. To the extent that grid services are serving regional transmission organization (RTO)/independent system operator (ISO) markets, what changes would need to occur to quantify or validate the services provided?

**Request for Information Response Guidelines**

Responses to this RFI must be submitted electronically to [RFI\_GEB2019@ee.doe.gov](mailto:RFI_GEB2019@ee.doe.gov) no later than 5:00 pm (ET) on March 1, 2019. Responses must be provided as attachments to an email. It is recommended that attachments with file sizes exceeding 25MB be compressed (i.e., zipped) to ensure message delivery. Responses must be provided as a Microsoft Word (.docx) attachment to the email, and no more than five (5) pages in length per category of questions, 12 point font, 1 inch margins. Only electronic responses will be accepted.

Please identify your answers by responding to a specific question or topic if applicable. Respondents may answer as many or as few questions as they wish.

DOE will not respond to individual submissions or publish publicly a compendium of responses. A response to this RFI will not be viewed as a binding commitment to develop or pursue the project or ideas discussed.

Respondents are requested to provide the following information at the start of their response to this RFI:

* Company / institution name;
* Company / institution contact;
* Contact's address, phone number, and e-mail address.

1. BTO considers energy efficiency to be a key element of achieving the potential of flexible building loads, intends for energy efficiency to be subsumed within the flexible building loads term, and will use the term flexible building loads in that way throughout the rest of the document. [↑](#footnote-ref-1)
2. U.S. Information Administration (2018) *Annual Energy Outlook 2018*. Washington, DC. <https://www.eia.gov/outlooks/aeo/> [↑](#footnote-ref-2)
3. P. Leuschner and N. Strother, “Smart Thermostats: Communicating Thermostats, Smart Thermostats, and Associated Software and Services: Global Market Analysis and Forecasts,” *Navig. Res.*, 2016. [↑](#footnote-ref-3)
4. <https://www.energy.gov/grid-modernization-initiative> [↑](#footnote-ref-4)
5. BTO is currently conducting analysis to develop metrics to measure the capabilities that different flexible demand building technologies can offer. [↑](#footnote-ref-5)
6. This list of benefits was drawn from: T. Woolf, E. Malone, L. Schwartz, and J. Shenot, “A Framework for Evaluating the Cost-Effectiveness of Demand Response,” Natl. Forum Natl. Action Plan Demand Response Cost-Effectiveness Work. Gr., 2013 [Online]. Available: <http://emp.lbl.gov/sites/all/files/napdr-cost-effectiveness.pdf> [↑](#footnote-ref-6)