General Services Administration
Public Buildings Service
Office of Facilities Management

Request for Information: 47PA0120N0001

GSA Proving Ground Program

October 9, 2019

Introduction:

The U.S. General Services Administration (GSA), in collaboration with the U.S. Department of Energy (DOE), is releasing a Request for Information (RFI) to obtain responses from vendors and other interested parties on technologies and energy-saving services that can provide building load flexibility cost-effectively as part of a Grid-interactive Efficient Building (GEB) strategy.

Overview:

GEBs provide an integrated approach for energy efficiency, renewable energy, storage, and smart technologies to coordinate building loads for cost reductions, continuous demand management and grid responsiveness.[1] Buildings consume approximately 75% of U.S. electricity and drive peak generating capacity required by utilities; thus, GEBs are key to a clean, modern and cost-effective grid. Many electrical loads in buildings can be operated in a more flexible manner and, through advanced controls, can be managed to operate at specific times and at different output levels. GSA and DOE project that this capability and continuous demand management can provide solutions to peak demand issues, which will become increasingly valued by utilities over the next decade to provide grid stability.[2,3]

See Appendices A and B, attached hereto and incorporated herein by reference, for additional information on building load flexibility and GEB resources, respectively.

This RFI seeks coordinated packages of measures, controls, services, or any combination thereof that enable building owners to optimize cost-effectively multiple building end-use systems, on-site energy generation and thermal or battery storage, or both, to promote continuous peak demand management. Collectively, these integrated and coordinated building systems and services constitute a GEB.

Why are GEBs important to GSA and DOE?

A 2019 Rocky Mountain Institute study evaluated the value proposition of implementing a GEB strategy across GSA's portfolio of federally owned property. This study found that transitioning an existing facility to a GEB was cost-effective in six representative utility markets under current tariffs, and could deliver significant energy cost savings if deployed portfolio-wide. The full study can be found at: http://rmi.org/gebs_report.

Information obtained through this RFI will be used to validate the actual performance of a GEB in federally or privately owned commercial buildings, or both, in multiple climate zones and

[1] U.S. Department of Energy. 2019. *"Grid-Interactive Efficient Buildings."* https://www.energy.gov/sites/prod/files/2019/04/f61/bto-geb_overview-4.15.19.pdf.
[2] GreenTech Media. 2017. "A California First: Enlisting Distributed Energy for the Transmission Grid." https://www.greentechmedia.com/articles/read/a-california-first-enlisting-distributed-energy-for-the-transmission-grid#gs.qfhu9x.
[3] PG&E Currents. 2017. "How PG&E is Using Demand Management to Make Smarter Use of the Grid." https://www.pgecurrents.com/2014/10/30/how-pge-is-using-demand-management-to-make-smarter-use-of-the-grid/

tariff structures. Outcomes of this evaluation will enable facility owners, utilities and third-party financers to make sound investment decisions on demand flexibility.

Overview of Technologies and Solutions Sought:

Responses to this RFI will be evaluated and considered for inclusion in the GSA Proving Ground (GPG) program (for federal facilities), the DOE High Impact Technology Innovation Catalyst (HIT Catalyst) program (for privately owned facilities), or both. The performance of the GEB technology packages selected for either or both of these programs will be evaluated in occupied, operational buildings. Submissions should consider a structured team approach that includes a package of load flexibility measures and engineering services.

At a minimum, responses to this RFI must encompass three of the following energy saving and demand flexibility attributes (see Figure 1 for a graphical representation of each attribute):

- Energy efficiency: reducing overall building energy;
- Load shed: reducing peak demand for a short period of time;
- Load shift: shifting the timing of energy use to minimize peak demand; and
- Modulation of electrical load at the sub-seconds to seconds level: capability to provide small-scale, distributed grid stability and balancing services by automatically increasing or decreasing power demand or reactive power.[4,5,6]

[4] Utility grid operators are continuously monitoring grid frequency and may benefit from the ability to modulate certain electrical loads as a means to maintain the nominal system frequency of 60 Hz in the United States. By modulating a building's electrical load at the second to sub-second level, utilities could impact grid frequency in real-time. These frequency adjustments may be necessary when larger electrical loads and generation capacity come on or off line.

[5] BuildSys. 2016. "Frequency Regulation Services from Connected Residential Devices: Short Paper." Proceedings of the 3rd ACM International Conference on Systems for Energy Efficiency Built Environments, Pages 119-122, DOI: http://dx.doi.org/10.1145/2993422.2993569.

[6] U.S. Department of Energy. 2019. "Grid-Interactive Efficient Buildings." https://www.energy.gov/sites/prod/files/2019/04/f61/bto-geb_overview-4.15.19.pdf.

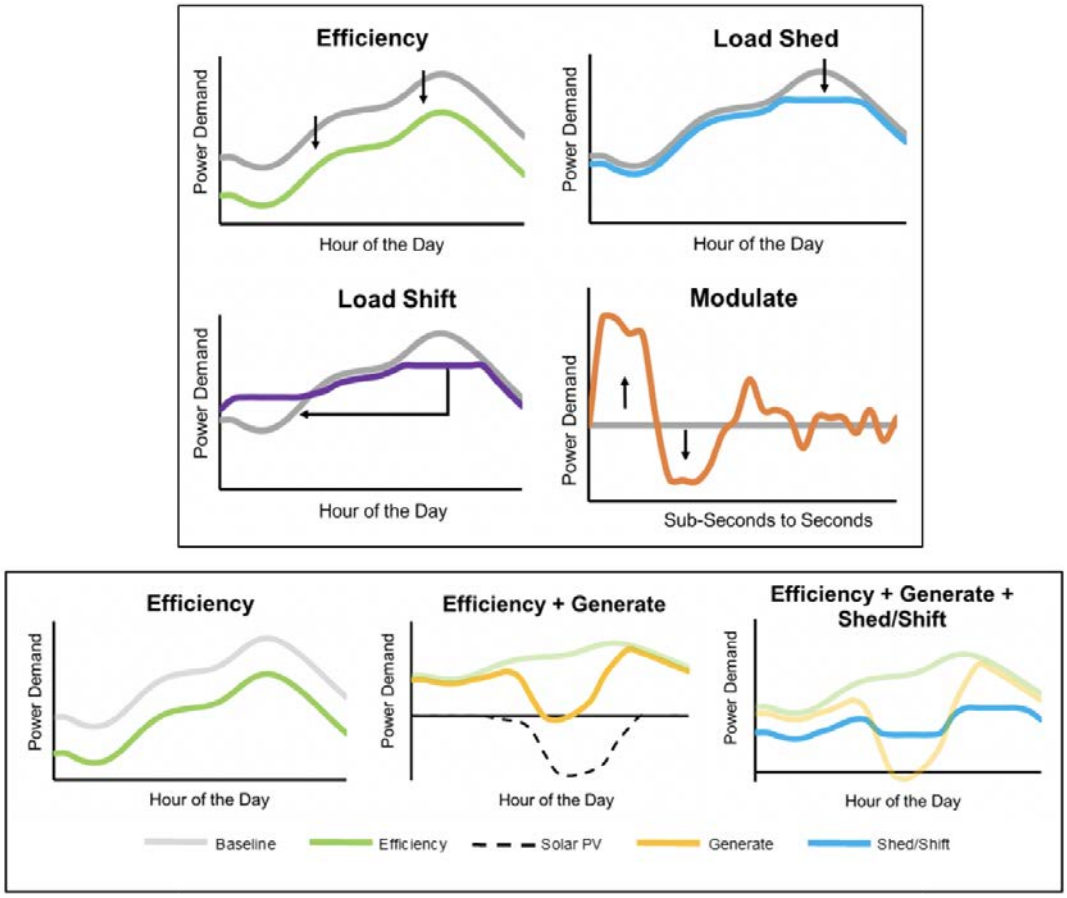

Figure 1. Illustration of the effects of load flexibility strategies on building energy, individually and combined.

To the maximum extent possible, responses to this RFI should also:

- Leverage existing equipment or propose new energy-saving, energy generating or energy storage technologies, or any combination of the foregoing, to achieve the GEB strategy;
- Include a software solution to integrate and coordinate the control of multiple building end-use systems and distributed energy resources. This software solution should include the following capabilities:

    - Minimum:
        - Integrate, control and establish trends of multiple building end-use systems to reduce energy consumption, shed and shift electrical loads to reduce peak demand; and
        - Provide the capability to support decision-making in changing building operations on a frequent basis to reduce peak loads and respond to demand charges, time-of-use utility rates, seasonal variations in utility rates, or other building and occupant needs.

    - If Possible:
        - Offer communication capabilities to react to utility demand response signals and other utility, independent system operators or regional transmission organizations service signals; and
        - Provide the capability to learn building energy consumption trends and use external input to predict energy needs for next day operation.

- Coordinate and optimize the control of multiple building end-use systems, energy generation and storage.

    - Minimum:
        - Coordination of multiple building end-use systems beyond heating, ventilation and air conditioning (HVAC) and lighting. Additional end-use systems include plug loads, onsite generation, energy storage (thermal or battery), electric vehicle charging, or any combination of the foregoing.

    - If Possible:
        - Integration of all systems with automated control and prediction algorithms.

- Include required ancillary energy/engineering services to deliver a comprehensive solution.

It is important to note that this RFI is focused on the integration and coordination of multiple building end-uses to manage peak energy demand; accordingly, responses should not be limited to a single building end-use or technology. For example, battery storage alone does not support comprehensive GEB goals.

Capabilities:

Information submitted in response to this RFI must describe how the proposed measures, controls and services:

- Integrate multiple building systems, enabling them to interact with each other and with the existing building control system and proposed software solution, and, if possible, with the utility grid;
- Aggregate data and dynamically manage and coordinate loads, generation and storage to reduce, shift, shed, or modulate energy use in response to peak demand;
- Demonstrate payback and value at the whole building level; and
- Provide ongoing access to data and training or support to the building operator.

Measurement and Verification:

DOE will fund third-party measurement and verification (M&V) for respondents selected for test bed validation. Information submitted in response to this RFI must propose measurable success criteria, including:

- Estimated percent reduction in annual energy consumption;
- Estimated percent reduction in peak demand and energy demand charges;
- Percent of demand load that can be shifted (*e.g.*, a 5-hour shift in 10% of demand load).

Project Partners:

Responses to this RFI may be submitted by a single vendor or by a team. Submissions by a single vendor must include all capabilities required to deliver the proposed GEB solution. Submissions by a team should identify the team lead. Teams may include:

- Technology and software vendors
- Utilities
- Energy service companies
- Other energy/engineering services.

Teaming Partner List:

GSA and DOE strongly encourage applicants from different organizations, scientific disciplines and technology sectors to form interdisciplinary and cross-sector teams that span organizational boundaries to enable and accelerate integrated and coordinated GEB solutions that were previously viewed as difficult to achieve.

GSA and DOE are compiling a Teaming Partner List to facilitate the widest possible participation for this RFI. The list enables organizations that wish to participate in a response, but may not want to apply as the prime respondent, to express their interest to potential respondents and explore potential teaming arrangements.

The Teaming Partner List will be available as a Google Spreadsheet from the time of this RFI release through the closing date. The Teaming Partner List will be updated at least weekly until the close of the response period to reflect new Teaming Partners who have provided their information. Any organization that would like to be included on this list should submit the Teaming Partner Information Form and submit the following information:

- Organization name;
- Generic organization contact e-mail;
- Generic contact phone;
- Organization type;
- Area of technical expertise; and
- Brief description of capabilities.

By submitting a request to be included on the Teaming Partner List, the requesting organization consents to the publication of the above-referenced information. GSA and DOE request that each organization create a general e-mail address to receive queries. Direct personal e-mail addresses will not be posted. By facilitating the Teaming Partner List, GSA and DOE do not

endorse or otherwise evaluate the qualifications of the entities that self-identify themselves for placement on the Teaming Partner List.

GSA and DOE Test Bed Locations:

Information submitted to this RFI will be used to develop test bed projects for medium- and large-sized commercial buildings that prove GEB capabilities in a replicable way. Appendix C identifies candidate test bed locations and the technical attributes of their building systems. Applicants can submit a package of technologies to deliver GEB solutions for one or more of these locations. Applicants can also recommend their own commercial building to host the test bed.

How to Submit a Response:

Parties wishing to be considered for GSA's Fiscal Year 2020 GPG program or DOE's HIT Catalyst program, or both, including respondents who submitted information in response to previous years' program requests and whose submissions meet the requirements stated above, should respond to this RFI by completing the web-based questionnaire at the link provided below. Only submissions from respondents who fully complete the web-based questionnaire will be reviewed.

The web-based questionnaire can be found at: GPG/HIT Catalyst Questionnaire. Additional information may be requested during the GPG or HIT Catalyst program planning and selection process.

This announcement will remain open until 11:59 PM EST on December 2, 2019. Questions about this announcement should be directed to gpg@gsa.gov.

Information Session:

Representatives from the GPG and the HIT Catalyst programs will host one web-based information session to discuss the federal programs and provide more detail on the RFI questionnaire on Thursday 7 November 2019, 11:00 AM CST - 12:00 PM CST. You can register for the session at: meet.gsa.gov/RFI-2020/event/registration.html. Instructions for access will be e-mailed to registrants.

Fiscal Year 2020 RFI Selection Process:

Teams from GSA and DOE will review and consider technologies submitted for M&V performance studies as part of the GPG program or the HIT Catalyst program, or both. **Neither the GPG program nor** the **HIT Catalyst program will fund technology procurements through this RFI.** Information submitted in response to or arising out of the performance testing under

this RFI will enable the HIT Catalyst program to connect technology providers with field study host sites and identify DOE-funded third parties to verify performance.

To be selected, the respondent must provide compelling responses to the RFI questionnaire and the technology must demonstrate the ability to advance the achievement of the federal goals stated above. To participate in the GPG program, the respondent must either agree to donate the technology unconditionally to GSA in sufficient quantity to test and evaluate its performance or provide alternative financing, such as through a Utility Energy Service Contract. Applicants offering an alternative financing mechanism must submit documentation supporting the financial commitment, as well as an agreement from the financing partner to participate in the program. To participate in the HIT Catalyst program, technology providers must agree to work directly with building owners/operators identified by DOE to supply equipment for monitoring and testing, as well as with laboratory experts to support M&V studies.

Using the collected information, a subset of respondents may be invited to participate in the Fiscal Year 2020 GPG program or the HIT Catalyst program, or both. Responses to the RFI will be evaluated through a multi-stage review process. Based on the evaluation of the submissions, each respondent will be notified whether or not GSA and DOE will request a follow-up presentation. Respondents who are invited to submit additional information will be asked to provide a brief written presentation to GSA and DOE. After considering the follow-up material, if any, and the submissions, a subset of respondents may be asked to participate in additional discussions with GSA and DOE. Respondents are advised that neither GSA nor DOE are under any obligation to provide feedback to respondents with respect to any information submitted under this RFI.

The M&V phase will vary depending on whether a respondent participates in the Fiscal Year 2020 GPG program or the HIT Catalyst program, or both. Expectations, milestones and outcomes will be discussed in greater detail at the time of selection. The fieldwork associated with the M&V phase is generally completed within 6 to 12 months of installation.

GSA and DOE reserve the right to select for inclusion in their respective programs any, all or none of the submissions received. There is no commitment by either GSA or DOE to make any contract awards, nor will GSA or DOE be responsible for any costs or expenses incurred by the respondents in responding to this RFI. Neither GSA nor DOE will provide debriefs for those respondents not selected for inclusion in their respective programs. Responses to this RFI do not bind either GSA or DOE to any further actions related to this matter.

This RFI is issued solely for information and planning purposes and does not constitute a Request for Proposal (RFP). Neither GSA nor DOE will issue an RFP as a follow-up to this RFI. Responses to this RFI are not offers and will not be accepted by the Federal Government to form an agreement or binding contract of any nature. Any information obtained as a result of this RFI is intended to be used by the Federal Government on a non-attribution basis for planning and strategy development; this RFI does not constitute a formal solicitation for proposals or abstracts and your response to this notice will be treated as information only. Information received may be used to assist GSA and DOE in planning the scope of future technology performance studies or deployment efforts and may be shared with other federal agencies. Technology evaluations may be shared between GSA and DOE, and technologies submitted may be selected for the GPG program, the HIT Catalyst program, both of these programs, or neither.

GSA IT Security: Network-based devices and application software hosted internally to GSA's network, as well as cloud-based software solutions must adhere to Federal and GSA-specific IT security standards. Note: These guidelines are applicable only to the GPG program. IT security requirements for HIT Catalyst will be determined on a case-by-case basis.

Background:
GSA's mission is to deliver the best value in real estate, acquisition and technology services to the Federal Government and the American people. GSA supports over 1 million federal civilian workers by managing more than 8,700 federally owned or leased properties comprising 374 million square feet of workspace.

The GPG program enables GSA to make sound investment decisions in next generation building technologies based on their real world performance. Since its inception in 2011, the GPG program has evaluated dozens of next-generation building technologies in real-world operational settings, recommending the most promising for deployment within GSA's real estate portfolio. By discovering best-of-breed innovative technologies early in their development and placing them strategically within federal properties, GSA has become widely recognized as a leader in the commercial building industry and is able to make sound investment decisions that greatly benefit the American taxpayer. More information about the program can be found at gsa.gov/gpg.

The mission of DOE's Office of Energy Efficiency and Renewable Energy (EERE) is to create and sustain American leadership in the transition to a global clean energy economy. Its vision is a strong and prosperous America powered by clean, affordable and secure energy. EERE's HIT Catalyst program weighs changing market conditions against technological innovation to map

out a cohesive step-by-step strategy that enables DOE to leverage work by others, access key partnerships and answer critical scientific and market-related requirements. Elements of the HIT Catalyst program include the use of model- and data-based analytical tools coupled with laboratory and field testing to understand integration trade-offs and long-term research and development requirements that will produce more, cost-effective ultra-low energy commercial buildings. More information about the program can be found at buildings.energy.gov/hitcatalyst.

TERMS AND CONDITIONS:
FAR 52.215-3 Request for Information or Solicitation for Planning Purposes (Oct 1997)

(a) The Government does not intend to award a contract on the basis of this solicitation or to otherwise pay for the information solicited except as an allowable cost under other contracts as provided in subsection 31.205-18, Bid and proposal costs, of the Federal Acquisition Regulation.

(b) Although "proposal" and "offeror" are used in this Request for Information, your response will be treated as information only. It shall not be used as a proposal.

(c) This solicitation is issued for the purpose of gathering information on new sustainable building technologies.

DISCLAIMER AND IMPORTANT NOTES: This RFI is not a Funding Opportunity Announcement (FOA); therefore, EERE is not accepting applications at this time. EERE may issue an FOA in the future based on or related to the content and responses to this RFI; however, EERE also may elect not to issue a FOA. There is no guarantee that an FOA 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 issue an FOA regarding the subject matter. Final details, including the anticipated award size, quantity and timing of EERE-funded awards, will be subject to Congressional appropriations and direction.

PROPRIETARY INFORMATION: Because information received in response to this RFI may be used to structure future programs and FOAs 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. The Federal Government does not guarantee confidentiality of the information received. Although GSA and DOE ask that no confidential business information be submitted, it is GSA's and DOE's practice to protect the provided information and make it available on a need-to-know basis only to Federal Government personnel and contractors who will be using this information on behalf of

the Federal Government. However, neither GSA nor DOE can guarantee that information will be free from access by others, during transmission or while stored in its system or otherwise in GSA's or DOE's custody or control or in the custody or control of another federal agency or their contractors, and the Federal Government and its contractors will have no liability whatsoever for disclosure of such information.

If a respondent chooses to submit business sensitive, proprietary or otherwise confidential information, it must be clearly and conspicuously marked 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 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 with your response marked as follows identifying the specific pages containing the confidential, proprietary or privileged information:

Notice of Restriction on Disclosure and Use of Data:

Pages [list applicable pages by number] of this response may contain confidential, proprietary or privileged information that is exempt from public disclosure. Such information may be used or disclosed only for the purposes described in this RFI 47PA0120N0001. The Federal 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 U.S.C. § 1905. The Federal Government may seek the advice of qualified non-Federal personnel. The Federal Government also may use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The respondents, by submitting their response, consent to GSA and DOE providing their response to non-Federal parties. Non-

Federal parties given access to responses will be subject to an appropriate obligation of confidentiality prior to being given the access. Submissions may be reviewed by support contractors and private consultants.

Primary Point of Contact:
Jay Fine
GSA GPG Program
gpg@gsa.gov

Contracting Office Address:
U.S. General Services Administration
PBS/Office of Acquisition Management
Acquisitions Services Division
1800 F Street, NW
Washington, DC 20405

Points of Contact:
Erica Pelham, Contract Specialist
Erica.Pelham@gsa.gov

Theophilus Hlover, Contracting Officer
Theophilus.Hlover@gsa.gov

Appendix A: Additional Information

Why is building load flexibility important?

Growing peak electricity demand, transmission and distribution infrastructure constraints and an increasing share of variable renewable electricity generation are challenging the electrical grid. As the grid becomes increasingly complex, demand flexibility can play an important role in helping maintain grid reliability, improving energy affordability and integrating a variety of generation sources. Buildings can provide flexibility by reducing energy waste and helping balance energy use during times of peak demand by shedding energy, shifting energy, providing plentiful renewable generation, and reducing the risk of frequency deviations.

Buildings consume approximately 75% of U.S. electricity and drive peak power demand; however, they can also provide solutions to peak demand issues. Many electrical loads in buildings are flexible and, through advanced controls, can be managed to operate at specific times and at different output levels.

Advanced controls and communications enable buildings to adjust power consumption to meet grid needs. This can be accomplished through a variety of control strategies applied to existing equipment, such as lighting, various plug loads and HVAC equipment, along with on-site assets, such as solar photovoltaics, electric vehicle charging and energy storage. These control, energy generation, storage, and control strategies can change the way a building schedules energy use to avoid high peak load costs or to make building operations more resilient. Strategies may include reducing overall energy consumption (energy efficiency), shifting energy to another time period (load *shift*), adjusting the power draw (load *shed*), modulating electrical load at the sub-seconds to second level, or even increasing energy consumption when energy costs are low to store for later use. These concepts are outlined graphically in Figure 1, above.

Today, behind-the-meter distributed energy resources—including energy efficiency, demand response, distributed generation, electric vehicles, and energy storage—are typically valued, scheduled, implemented, and managed separately. The GEB vision is the integration, cross-system interoperability and continuous optimization of these resources for the benefit of building owners, occupants and the grid.

What are grid-interactive efficient buildings?

GEBs provide an optimized blend of energy efficiency, load-flexible technologies and controls for demand management (load shed and load shift), distributed energy generation and energy storage. They are also able to coordinate with and respond to the grid. A GEB has the following characteristics:

- Energy efficient—high-performing building components and equipment;

- Connected—sensors, mechanical, lighting, plug-load equipment, electric vehicles, on-site energy generation, and storage that can be operated and optimized as an interconnected system;
- Smart—analytics supported by ubiquitous sensing and optimized controls that manage building loads in ways that are beneficial to the grid, building owners and occupants;
- Flexible—include building energy loads that can be dynamically shaped and optimized.

The purpose of this RFI is to pilot GEB strategies under different tariff structures and regions to demonstrate savings in both publicly and privately owned buildings. Although many commercial buildings currently have GEB characteristics, very few are being operated to integrate and optimize across resources for comprehensive demand management. Some building automation systems just control HVAC, while more extensive systems can monitor and control multiple building end use systems. Very few building automation systems expand to include the integration of distributed resources that service a building, such as solar, batteries or electric vehicles. The pilots resulting from this RFI will focus on improving building end-use integration and optimization through controls, sensors and data analytics, while better defining demand management cost-saving opportunities.

For respondent reference, the below list of efficiency and load flexibility measures is intended to offer examples of appropriate measures in this space. Teams responding to this RFI should not feel restricted by this list nor should they feel obligated to propose in all measure categories.

- Staging loads in:
    - Air-handling unit fans
    - Electric resistance heaters
    - Laptop battery charging
- LED lighting with advanced lighting controls
- Automated interior blinds
- Electrochromic windows
- Grid-connected appliances
- Space temperature setback
- Morning preheat/afternoon precool
- Thermal mass
- Chilled water and hot water pumping pressure reset
- Static pressure reset
- Increased air filtration to reduce outside air needs
- Demand-control ventilation
- Energy/heat recovery systems
- Thermal energy storage
- Electric battery storage
- Solar photovoltaic array
- Electric vehicle charging.

Appendix B: Additional Grid-Interactive Efficient Building Resources

The following entities offer resources with additional context and information on GEBs:

U.S. General Services Administration:

- [2018] Green Building Advisory Committee Advice Letter on Building & Grid Integration: https://www.gsa.gov/cdnstatic/Bldg%20Grid%20Integration%20Advice%20Letter%202-21-19%20-%20508.pdf

U.S. Department of Energy:

- Grid-Interactive Efficient Buildings Homepage: https://www.energy.gov/eere/buildings/grid-interactive-efficient-buildings
- [2019] Grid Interactive-Efficient Buildings Overview (Report): https://www.energy.gov/sites/prod/files/2019/04/f61/bto-geb_overview-4.15.19.pdf

National Laboratories:

- National Renewable Energy Laboratory:
  Journal of Renewable and Sustainable Energy: Toward a subhourly net zero energy district design through integrated building and distribution system modeling: https://doi.org/10.1063/1.5093917
- Lawrence Berkeley National Laboratory:
  - Advanced Integrated Building & Grid Technologies Testbed, FLEXLAB: https://flexlab.lbl.gov/

Other Energy Organizations and Research Institutions:

- Rocky Mountain Institute:
  - Grid-Interactive Energy Efficiency Buildings Homepage: https://rmi.org/gebs
  - [2019] Value Potential for Grid-Interactive Efficient Buildings in the GSA Portfolio: A Cost-Benefit Analysis (Report): http://rmi.org/gebs_report
- New Buildings Institute:
  - The GridOptimal Buildings Initiative https://newbuildings.org/resource/gridoptimal/
- ASHRAE:
  - Standard 201-2016—Facility Smart Grid Information Model:
    - https://www.ashrae.org/about/news/2016/smart-grid-standard-published-key-piece-supporting-modernization-of-global-grid
    - https://www.energy.gov/eere/buildings/articles/ashrae-buildings-grid-and-resources-face-challenges
- The Brattle Group:
  - The National Potential for Load Flexibility—Value and Market Potential Through 2030: https://brattlefiles.blob.core.windows.net/files/16639_national_potential_for_load_flexibility_-_final.pdf

Appendix C: Technical Attributes of Candidate Test Bed Locations

	Building 1	Building 2
Building Type	Courthouse	Office
Size (ft²)	895,248	1,660,239
Year of Construction	1975	1953
Location	San Diego, CA	Indianapolis, IN
Total annual energy consumption (kBtu/yr)	24,169,581	100,782,932
Energy use intensity (kBtu/ft²/yr)	27	60.7
Annual natural gas or steam consumption (kBtu)	2,214,671	34,698,415
Annual electricity consumption (kWh/yr)	6,434,616	19,368,264
Annual energy costs ($/yr)	$1,135,080.71	$1,543,025.82
Fuel Sources	Electricity and Natural Gas	Electricity and Natural Gas
Approximate electric utility rates	Consumption: $0.12/kWh Demand: $23/kW	Consumption: $0.05/kWh Demand: $13/kW
Modern Energy Efficiency Measures	• LED Lighting and controls • Smart outlets / powerstrips	• Lighting Controls
On-site renewable energy generation	• PV – 350 kW (rooftop)	• Solar Hot Water (110 mmBTU) • PV – 2000 kW
On-site energy storage	750 kW Battery	None
Brand of BMS system	Niagara N4 with JACE 8000 global controllers	Niagara B4
Brand of EMIS	GSALink	GSALink
Heating System Attributes	• 3 - 2000 MBH water tube boilers	• 3 - 300 HP Clever Brooks boiler (NG) • Electric Boiler serves cafeteria
Cooling System Attributes	• 2 – 775 ton and 1 – 650 ton water cooled chillers • Air cooled chiller that serves space that requires 24/7 cooling	• 2 – 1280 ton chillers • 1 – 555 ton chiller
Ventilation System Attributes	• 677 VAV boxes • 17 AHUs	• 51 AHUs • 58 Digital Controls
Future Renovation	• Generator Project (ongoing) • AHU upgrades (planned) • Mechanical repairs (planned)	• 1000+ tenants moving in to building • Replace cooling tower
Additional Notes	Building consists of two adjacent structures joined by a shared basement and a sky bridge.	

	Building 3	Building 4
Building Type	Primary School	Casino, Hotel, Conference, Theater
Size (ft²)	78,100	764,197
Year of Construction	2008	1999
Location	Aurora, CO	Detroit, MI
Total annual energy consumption (kBtu/yr)	9,152,253	300,610,839
Energy use intensity (kBtu/ ft²/ year)	117.2	393.37
Annual natural gas or steam consumption (kBtu)	6,473,491	129,133,000
Annual electricity consumption (kWh/yr)	785,100	50,257,280
Annual energy costs ($/yr)	$119,538.06	$4,387,273.45
Fuel Sources	Electricity and Natural Gas	Electricity and Natural Gas
Approximate electric utility rates	Consumption: $0.00461/kWh Demand: $5.63/kW	Consumption: $0.04/kWh Demand: $16.24/kW
Modern Energy Efficiency Measures	• None	• LED Lighting
On-site renewable energy generation	• PV	• None
On-site energy storage	None	None
Brand of BMS system	Niagara N4	Trane tracer Hybrid with Tridium from Limbach
Brand of EMIS	• Niagara N4 Supervisor • EnergyCAP (utility bill and interval meter monitoring platform)	• SkySpark (planned for 2020)
Heating System Attributes	• Traditional Boiler supplied hot water heat	• Central Heating Plant
Cooling System Attributes	• Chiller supplied chilled water cooling	• Central Cooling Plant
Ventilation System Attributes	• Underground VAV air handlers	• 38 large AHUs via 4 pipe system
Future Renovation	• Infrastructure consolidation behind single primary meter (planned)	• None
Additional Notes		

	Building 5	Building 6
Building Type	Office / Retail	Primary School
Size (ft²)	1,300,000	104,632
Year of Construction	1935	2015
Location	New York, NY	Aurora, CO
Total annual energy consumption (kBtu/yr)	65,917,473	4,254,157
Energy use intensity (kBtu/ ft²/ year)	50.71	40.7
Annual natural gas or steam consumption (kBtu)	68,374	1,542,640
Annual electricity consumption (kWh/yr)	19,299,267	794,700
Annual energy costs ($/yr)	$4,627,196	$101,960.68
Fuel Sources	Electricity and Steam	Electricity and Natural Gas
Approximate electric utility rates	Consumption: $0.10/kWh Demand: $30/kW	Consumption: $0.00461/kWh Demand: $5.63/kW
Modern Energy Efficiency Measures	• LED Lighting	• Led Lighting with Controls • Energy/heat recovery systems • Ground source heat pump
On-site renewable energy	• PV	• None
On-site energy storage	None	None
Brand of BMS system	Trane, converting TAC INET to Tridium	Niagara AX JACE
Brand of EMIS	• Mach Energy	• Niagara N4 Supervisor • EnergyCAP (utility bill and interval meter monitoring platform)
Heating System Attributes	• Steam perimeter radiation • Steam preheat coils on AHUs	• Ground source bores distributed to 81 heat pumps • Air supplied to heat pumps from one of 3 100% OA energy recovery ventilators
Cooling System Attributes	• Variable Primary Chilled water system • Electric chillers • Ice	• Three small chillers deliver chilled water to 2 single zone air handlers
Ventilation System Attributes	• Floor by floor AHUs • VAVs in zones but tenant owned	• 100% OA energy recovery ventilator
Future Renovation	• BMS upgrade away from INET (current) • PICCV Installation (current)	• Infrastructure consolidation behind single primary meter (planned)
Additional Notes		

	Building 7	Building 8
Building Type	Supermarket	Hotel, Casino, Convention, Theater, Restaurant
Size (ft²)	50,451	1,142,681
Year of Construction	2006	2016
Location	Los Altos, CA	Oxon Hill, MD
Total annual energy consumption (kBtu/yr)	7,597,084 [Does not include gas]	278,367,545
Energy use intensity (kBtu/ft²/year)	[Total not available; gas data to be provided]	243.6
Annual natural gas or steam consumption (kBtu)	[Not available; gas data to be provided]	120,419,070
Annual electricity consumption (kWh/yr)	2,226,578	46,292,050
Annual energy costs ($/yr)	$290,575.09 [Does not include gas]	$5,248,577.65
Fuel Sources	Electricity and Natural Gas	Electricity and Natural Gas
Approximate electric utility rates	Consumption: $0.12/kWh Demand: $12/kW	$0.08/kWh (Blended rate including consumption and demand)
Modern Energy Efficiency Measures	• LED Lighting with Controls • Energy/Heat recovery systems	• LED Lighting with Controls • Demand Control Ventilation
On-site renewable energy generation	• PV	• None
On-site energy storage	Yes	None
Brand of BMS system	MicroThermo Controls for HVACR and Lighting	Johnson Controls Metasys
Brand of EMIS	• Parasense	• SkySpark (planned for 2020)
Heating System Attributes	• RTUs	• Central plant driven system • Tri-gen system • 800 kW cogeneration system that provides electricity to the site, heat to the building hot water system, and heat to an absorption chiller, the first stage of cooling
Cooling System Attributes	• RTUs	• Absorption cooler/6 chiller tri-generation system
Ventilation System Attributes		
Future Renovation	• Installation of EV fast charges (separate utility service) (planned)	
Additional Notes		Hotel has Inncom GRIM system for guest room temperature and energy management (300 hotel rooms).

	Building 9	Building 10
Building Type	Office	Office/Courthouse
Size (ft²)	199,258	731,933
Year of Construction	1989	1965
Location	Denver, CO	Denver, CO
Total annual energy consumption (kBtu/yr)	8,218,648	31,293,732
Energy use intensity (kBtu/ ft²/ year)	41.2	42.8
Annual natural gas or steam consumption (kBtu)	N/A	8,832,191.16
Annual electricity consumption (kWh/yr)	2,408,748	6,583,101
Annual energy costs ($/yr)	$279,872.30	$591,666.07
Fuel Sources	Electricity	Electricity and Natural Gas
Approximate electric utility rates	Consumption: $0.04/kWh Demand: $23/kW	Consumption: $0.09/kWh Demand: $25/kW
Modern Energy Efficiency Measures	• LED Lighting (planned 2020)	• Tower has NLight system with Daylighting controls and dimmable fixtures, LEDs, and thermal tank • Courthouse will have LEDs (2020)
On-site renewable energy generation	• PV – 105 kW	• Solar Thermal System (small)
On-site energy storage	None	None
Brand of BMS system	JCI System	Courthouse – Siemens BACnet Tower – Siemens BACnet
Brand of EMIS	• GSA Link	• None
Heating System Attributes	• Primary heat source supplied via fan-powered VAVs (FPVAVs) • 168 VAV boxes on the perimeter with heating coils for supplementary heat • 10 electric heaters for supplemental heating stairwells, entries and garage	• Standard Central Plant • Heating plant consists of three modulating condensing boilers for the Courthouse and three modulating condensing boilers for the tower.
Cooling System Attributes	• Two Carrier model chillers – 250 Ton, centrifugal chillers. Each services 3 AHUs • Two Baltimore Aircoil cooling towers • 15 GSA and tenant owned CRAC unit supplemental cooling systems to support IT closets and data centers	• Standard Central Plant • Tower has chilled beams. • Building has four new chillers and four new cooling towers.
Ventilation System Attributes	• 3 AHUs	• DOAS System
Future Renovation		
Additional Notes		The Courthouse and Tower consists of two structures – the tower has 22 floors and the courthouse has 5 floors.

	Building 11
Building Type	Office
Size (ft2)	594,000
Year of Construction	1969
Location	New York, NY
Total annual energy consumption (kBtu/yr)	57,923,030
Energy use intensity (kBtu/ ft2 / yr)	97.15
Annual natural gas or steam consumption (kBtu)	16,329,000
Annual electricity consumption (kWh/yr)	11,480,533
Annual energy costs ($/yr)	$1,925,339
Fuel Sources	Electricity, Natural Gas, & #2 Fuel
Approximate electric utility rates	Blended: $0.1579 (FY 19)
Modern Energy Efficiency Measures	Participated in internal Load Management program; full asset review and assessment completed for this site by 3rd party engineering firm
On-site renewable energy generation	None (rooftop solar project was slated for this building; timeline TBD)
On-site energy storage	None (there is space on the roof for a system)
Brand of BMS system	Automated Logic
Brand of EMIS	None
Heating System Attributes	3 York Shipley low pressure steam boilers that fire on dual fuel (oil & NG). Provide steam to AHU steam heating coils
Cooling System Attributes	3-770 ton electric chillers provide chilled water to 6 AHUs 19 split systems
Ventilation System Attributes	4 AHUS; 2 additional AHUs for perimeter induction units
Future Renovation	Received funding to convert Lobby & 1st Floor to LED this fiscal year
Additional Notes	Building has numerous server rooms which leads to increased electric demand costs and a higher blended rate; Majority of building is T8 lighting with limited controls and requires updating.