

GRID-INTEGRATED BUILDINGS TASK GROUP

Recommendations and Policy Framework

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GREEN BUILDING ADVISORY COMMITTEE (GBAC) GRID-INTEGRATED BUILDINGS TASK GROUP MEMBERS AND DESIGNEES

Task Group Members or Designees

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- Ken Sandler, GSA, DFO
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- Michelle Britt, ICC
- Phil Coleman, LBNL
- Mark Frankel, NBI
- Gabriel Maser, ICC
- Mary Ann Piette, LBL
- Peter Turnbull, PG&E
- Alice Yates, ASHRAE

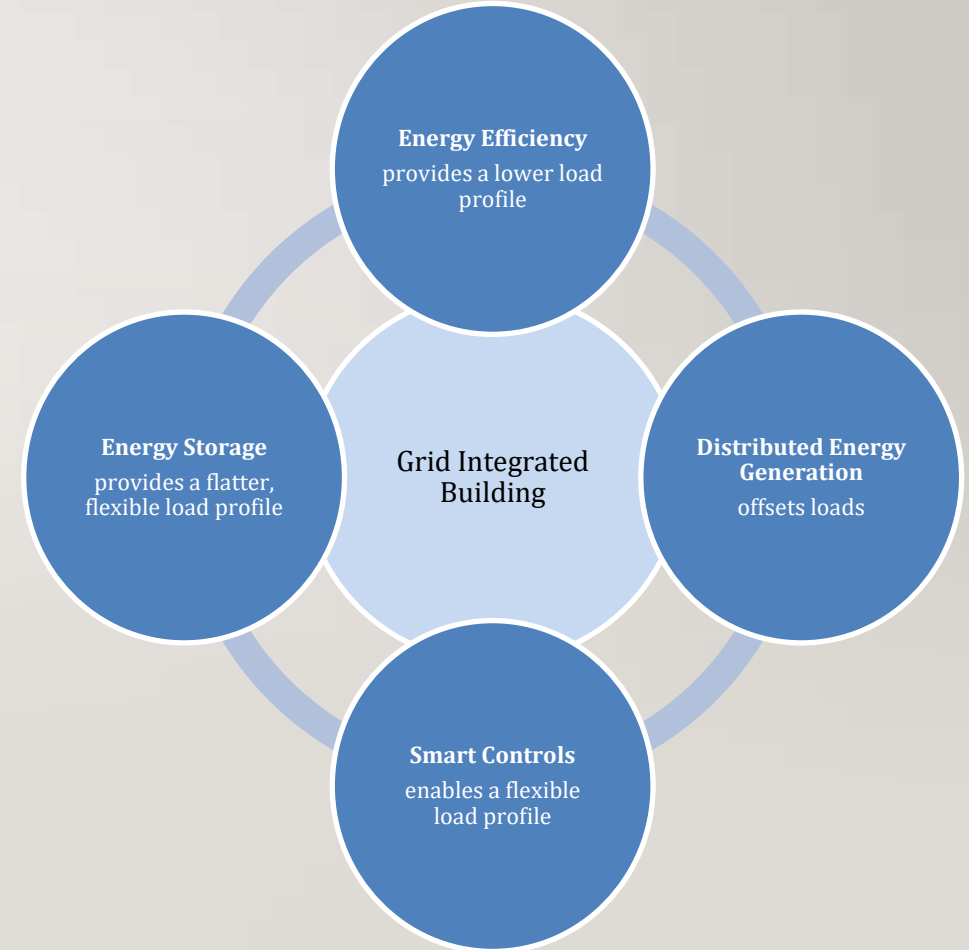
TASK GROUP PROCESS

This document represents the work of the Grid-Integrated Buildings (GIB) task group (TG) – a subcommittee of the General Services Administration (GSA)'s Green Building Advisory Committee (the Committee) that was formed after the Committee's Spring 2018 meeting to develop findings and recommendations on this issue. The GIB TG met on a biweekly basis between June and September 2018 to investigate and help build a common understanding regarding the opportunities for federal buildings and grid integration, and draft this policy framework of building and grid integration actions for the federal government to consider.

WHAT IS A GRID-INTEGRATED BUILDING?

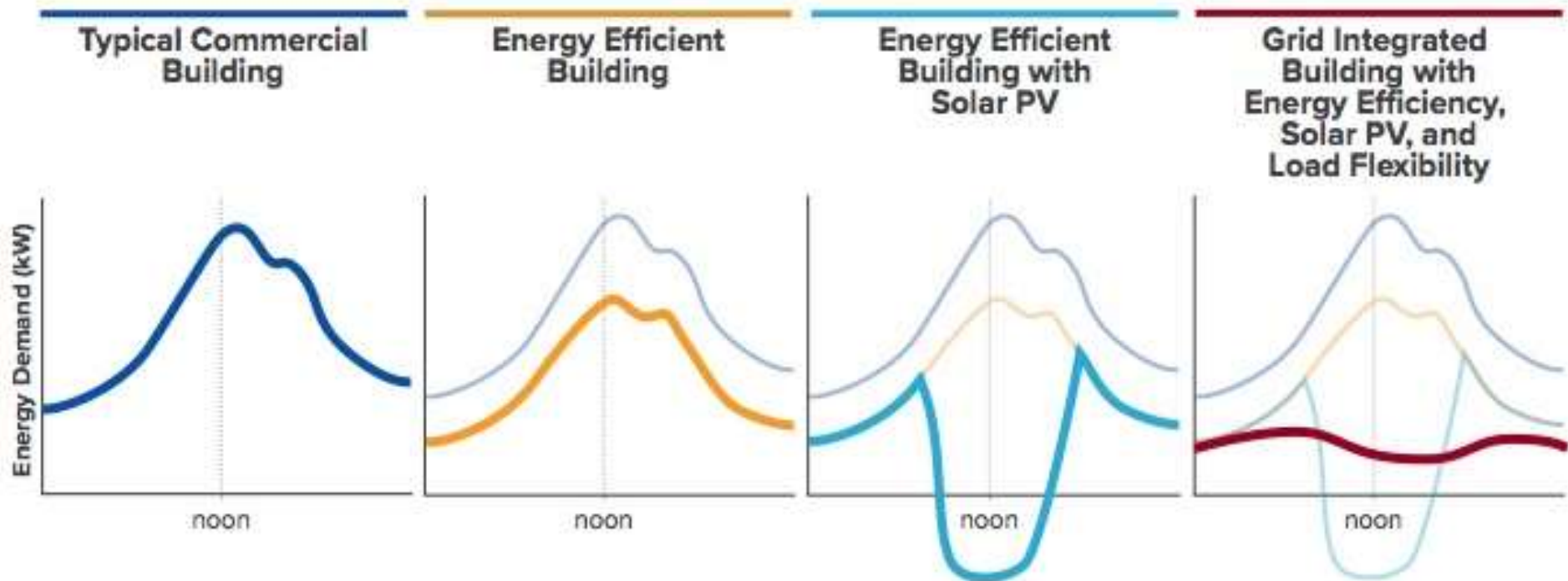
Grid-Integrated Buildings have a holistically optimized blend of energy efficiency, distributed energy generation, load flexible technologies/smart controls, and energy storage.

- Create a lower, “flatter”, more flexible energy load profile
- Have flexible demand
- Are more resilient and productive
- Optimize capital investments
- Reduce operating costs
- Provide access to new revenue for both building owners and utilities



BENEFITS

Grid Integrated Building: Load Profiles



BENEFITS (CONT'D)

Grid-integrated buildings may:

- Unlock lower electric utility bills and save taxpayer money by minimizing demand and capacity charges and allowing the agency to take advantage of Time Varying Pricing (e.g. Time of Use) rate structures.
- Federal facilities may increase their own energy security and resilience, as well as the energy security and resilience of the grid itself.
- These strategies can help advance a variety of federal energy and environmental goals, including minimizing energy consumption, diversifying energy supplies, minimizing carbon emissions, and maximizing utilization of distributed and renewable generation assets, in a coherent and integrated manner.

CASE STUDY I

Marine Corps Base Albany

- **Size:** 3,300 acres, 360 facilities
- **Location:** Albany, New York

Key Grid Integration Features:

- First Navy Zero Energy Base, substantially increasing resilience.
- Energy efficiency: LED lighting, high efficiency transformers, lighting and boiler upgrades, controls and microgrid
- Renewable Energy: 44 MW Solar, 8.5 MW Biomass, 2.1 MW CHP using landfill gas (fully islandable)
- Load Flexibility: Peak shaving with diesel generators
- **Financial:** \$170 M, 23 year ESPC Project



CASE STUDY 2

University of Arizona, Tucson Campus

- **Size:** 378 acres, 216 buildings
- **Location:** Tucson, Arizona

Key Grid Integration Features:

- **Energy Efficiency:** maximized chiller efficiency, reduced runtime, optimized CHP system
- **Energy Storage:** 205 Thermal Ice Storage tanks totaling 30,750 ton-hours of storage
- **Load Flexibility:** Peak shaving by accelerating discharge of thermal storage tanks
- **Financial:** \$423,000 annual savings in energy costs (phase I only), plus maintenance and equipment life savings



GIB TASK GROUP OUTCOME:

Create a Flexible Policy Framework to accelerate the adoption of Grid-Integrated Buildings in the Federal Sector

- Drive cost effective solutions for GSA
- Can be broadly applicable and adopted
- Can be used to inform emerging policies

GIB FRAMEWORK OVERVIEW

Contents

1. Introduction, Mission, Vision and Problem Statement
2. Findings
3. Recommendations: Includes two levels of policy recommendations:
 1. Overarching
 2. Specific (per table shown right)
 1. Contains proposed policy, purpose/intent, policy mechanisms, level of difficulty, impact
 2. 3 levels: At the Utility and operator Engagement Policies, Policies for all buildings and new construction, major renovation
4. Existing Technologies, Implementation Strategies and Case Studies
5. Conclusion and Next Steps

Proposed Policy	Purpose/Intent	Policy Mechanisms	Level of Difficulty	Impact	
	Why is this important? What is the desired outcome?	Suggested mechanisms for policy makers	Once enacted, how easy is it to accomplish? Low-Med-High	How much cost/energy will this save the federal govt? Low - Med - High	
Utility and Operator Engagement Policies					
1	Grid system analysis	In partnership with each grid operator, GSA should understand regional grid load profiles and opportunities to support grid stabilization.	Prior to implementation of building approach, analyze and propose strategies to help mitigate capacity, generation and distribution constraints. This investigation should include the local and regional electric grids, utility and Regional Transmission Operator/Independent System Operator (RTO/ISO) current and forecasted plans. This analysis can be performed regionally (rather than building-by-building) and should be regularly updated as systems and rates evolve.	High	High
2	Understand and Take Advantage of Flexible Data Structures	GSA should align building characteristics and performance (efficiency	Partner with utilities and RTOs/ISOs to conduct rate structure analysis and participate in the most cost-optimal electric rate structures available which ideally reflect the variable cost of	Med	High

MISSION AND VISION

BGITG Mission Statement:

To advance grid-integrated federal buildings that leverage technologies and strategies to dynamically shape energy loads, providing resilience and valuable services to the power grid, while saving money for the taxpayer.

BGITG Vision Statement:

Federal buildings are designed, built, retrofitted and operated to be smart, connected, responsive assets for optimal interaction with the power grid. These solutions provide a compelling business case for GSA through operational cost savings and increased property value, while also reinforcing national priorities like a more resilient power grid. Fully integrated solutions (i.e., a balanced solution of energy efficiency, distributed energy generation, energy storage, and load flexibility) become standard such that the whole strategy is greater than the sum of the parts.

KEY OVERARCHING POLICY RECOMMENDATIONS

Federal facilities should be designed and operated to maximize the benefits of building-grid interactions:

- **New Buildings:** Adopt a policy that will enable all new buildings to strategically integrate with the grid, by optimizing investments in energy efficiency, distributed energy generation, energy storage and load flexibility (including smart controls). All new buildings should target zero energy goals. This will save taxpayers money over time and increase resilience immediately.
- **Existing Buildings:** Adopt best practices for existing operations and maintenance efforts and building retrofit programs to move toward building-grid integration (which includes investment in deep energy efficiency, distributed energy generation, energy storage, and load flexibility).
- **Collaborating With Utilities:** Work with utilities to pilot and implement rate structures that are mutually beneficial – thereby supporting utilities to balance supply and demand, increase resilience and reduce the need for infrastructure investment while aligning incentives and saving money for federal (and commercial) building owners. This would allow investments in grid-interactive technologies to decrease the federal government's utility bills, reduce environmental impacts, and increase financial gains on both sides. Consistently request information about location and time of use-specific energy cost and emissions factors from every utility serving a Federal facility.

SPECIFIC POLICY RECOMMENDATIONS (PAGE 1)

Utility and Operator Engagement Policies

1) Grid system analysis

- In partnership with each grid operator, GSA should understand regional grid load profiles and opportunities to support grid stabilization.

2) Understand and Take Advantage of Flexible Rate Structures

- GSA should align building characteristics and performance (efficiency, storage, renewables, and controls or load flexing technologies) with rate structures to optimize financial returns.

SPECIFIC POLICY RECOMMENDATIONS (PAGE 2)

Policies for All Buildings

3) Plan grid integration improvements over time

- GSA should pilot and implement in the short term, while enabling for future flexibility.

4) Investigate, consider and pilot use of Advanced Metering Infrastructure and OpenADR

- GSA should enable OpenADR (or a similar protocol) for easy participation in demand response markets, streamlining revenue generation for federal buildings.

5) Building Resilience

- GSA and other agencies should arm buildings for passive survivability.

6) Investigate, consider and pilot use of energy storage (including “storage-ready” facilities)

- GSA should enable more participation in transactive energy programs and increase energy resilience.

7) Investigate and promote greater use of distributed energy resources and onsite generation

- GSA should provide site-based distributed energy resources in order to increase resilience and save cost.

SPECIFIC POLICY RECOMMENDATIONS (PAGE 3)

Policies for All Buildings

8) Investigate whether ESPC and UESC projects could incorporate demand charges in pricing and planning, consider and pilot promising approaches

- Allow transactive energy strategies to be part of ESPC/UESC projects

9) Modify federal energy goals that focus only on energy reduction (in kWh and Energy Use Intensity –(EUI)), to also include targets pertaining to demand reduction (in kW), load factor, energy costs, and carbon reduction.

- Reflect the benefits of strategies that reap greater carbon and cost savings than energy efficiency alone (e.g., battery storage or thermal storage)

10) Electrify Buildings

- ~~GSA should shift fuel sources from natural gas, fuel oil, and other non-electric fuels to electricity. Electrification provides greater load flexibility, integration with electric vehicle charging (and eventually bidirectional electricity flow), resilience (having 1 fuel source to back up, not 2+), safety (avoid gas explosions and leakage) and the ability to directly offset energy use with renewably generated electricity.~~

SPECIFIC POLICY RECOMMENDATIONS (PAGE 4)

New Construction or Major Renovation Policies

I 1) Design for Grid Interactivity

- Provide for future load flexibility

I 2) Zero Energy-Ready Building

- GSA should set goals and design new construction projects to have low load shape (very efficient) and enable solar and storage.

I 3) Lifecycle Cost Analysis (LCCA)

- GSA should use lifecycle cost analysis to optimize integrative strategies and minimize long-term costs.

CHALLENGES

Electricity sector challenges:

- Inflexible Central Generation and Distribution Systems Not Responsive to Current Trends
- Integrating Growing Distributed Energy Resources
- Dynamic Grid Load Profile
- Power Grid Resilience

Federal building owner challenges:

- Lack of Information and Resources
- Lack of Integration Among Technologies and Strategies
- Operational Knowledge Gaps and Lack of Control
- Utility Rates
- Inadequate Financing/Contracting Models
- Security Concerns
- Lack of Supportive Policies

POSSIBLE NEXT STEPS

Policy recommendations represent only the start of the process to drive the entire federal government toward adoption of grid-integrated buildings. In order to achieve success, the following implementation steps are needed:

1. Develop a discrete roadmap outlining how to proceed in carrying out this strategy, step by step.
2. Understand existing policies into which these recommendations should be incorporated, including how they might fold into federal facility and utility procurement policies. Understand what policies support these recommendations, and which might impede them.
3. Increase transparency by creating and distributing information about load management opportunities at GSA facilities and utility performance information, critically including location and time of use specific energy costs and emissions factors .

POSSIBLE NEXT STEPS (CONT'D)

Policy recommendations represent only the start of the process to drive the entire federal government toward adoption of grid-integrated buildings. In order to achieve success, the following implementation steps are needed:

4. Identify Federal pilot projects. High level criteria for selecting pilot projects include criteria that identify the best business case for the federal government (e.g., high demand costs, battery storage incentives, etc.)
5. Continue coordinating with agencies and organizations involved in federal grid integrated buildings efforts, including the DOE Building Technologies Office, Lawrence Berkeley National Lab, Pacific Northwest National Lab, National Renewable Energy Lab, GridOptimal Initiative, New Buildings Institute, Rocky Mountain Institute, US Green Building Council, Northeast Energy Efficiency Partnerships, American Council for an Energy-Efficient Economy, International Energy Agency's Energy in Buildings and Communities Programme (Annex 67), and others .
6. Work to align grid integrated solutions with financing mechanisms including performance based contracting financing (ie. ESPC's, UESC's and EUL's) and appropriated funding.
7. Use educational resources, such as GSA's SFTool, to educate key federal audiences on grid integration strategies and solutions.

GROUP DISCUSSION – SCALING AND NEXT STEPS

- Questions or suggestions?
- To increase impact, how can we (GSA and GBAC) encourage broad distribution?
- How can we encourage adoption?
- How should we leverage the powerful network of key industry stakeholders established through this work?