The Value of Grid Interactive Buildings in the GSA Portfolio

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NAESCO National Association of Energy Service Companies

Key differentiators of grid interactive buildings

Attribute	Today	Future
1. Interoperability and intelligence from building to grid	• DR programs, often manual, fairly static	• Ability to receive and respond to utility price signals • Ability to send load flex potential
2. Interoperability and intelligence across building systems	• BMS system for major loads (HVAC) • Individual system controls (Lighting, storage)	• Single, overarching integrator to monitor and control all loads, inc. plug loads and storage • Ability to optimize for cost, carbon, reliability, etc.
3. Load flexibility and demand-focused optimization	• Thermal energy storage • Battery storage	• Intelligence to track and map demand, shift or shed rapidly based on inputs such as price, weather, carbon, events, etc.

Overview of grid interactive buildings value analysis in the GSA Portfolio

This study provides a fact base to demonstrate the value of a grid interactive building strategy for the GSA (and other building owners).

6 locations

- CA, NY, GA, MD, AZ and CO
- Variety of climate zones and rate structures, representative of portfolio

29 measures

- Focused on demand reduction

Localized labor and materials costs

- Using vendor-supplied equipment costs and location-based labor and material factors

2 Fuel Scenarios

- Assuming 70% of GSA's buildings are dual fuel, 30% are electric only

1-2 utility rate structures per location

- Variation in consumption and demand charges, and time value.
- Represents current and potential rate structures

DR Value and Program Terms

- Based on quotes and program terms from aggregators

Modified DOE Reference Model

NPV of measures and bundles

Energy and demand reduction metrics

Portfolio-wide patterns and guidance

Sensitivity analysis

Three core values of grid interactive buildings

Direct Benefits to GSA	Societal Value	Indirect Value
• 30% average annual cost savings • Project-level payback under 4 years • Flexibility to accommodate future rate structure changes • Increases resilience, reliability	• Reduce grid-level T&D and generation costs • These savings ultimately benefit the government and taxpayers • Future rate structures will more directly share grid-level savings	• Demonstrates federal and real estate industry leadership • Enables deeper savings in ESPCs and UESCs • Better building control can improve comfort, health, and productivity • CO2 savings

Large, untapped opportunity today

	First Cost	Annual cost savings	Payback w Incentives* (yrs)	NPV w Incentives*
Fresno, CA	$2,458,955	$612,178	3.66	$2,394,044
New York, NY	$2,013,386	$429,315	2.30	$2,082,640
Denver, CO	$282,357	$122,803	0.90	$681,692
Phoenix, AZ	$664,291	$207,468	3.15	$665,675
College Park, MD	$107,138	$48,251	2.22	$167,069
Atlanta, GA	$190,687	$59,072	2.89	$166,790
Average (unweighted)		**$246,514**	**2.52**	**$1,026,318**

*Incentives include local rebates and incentives available to the federal government. This does not include demand response revenue.

- **High net present value and short paybacks** across all locations, largely due to low first cost measures such as controllability and staging existing equipment.
- Investing now will **secure financial returns,** enable savings to persist as rate structures change.
- The **best returns** are in locations with **high demand charges, time of use rates, and seasonal variation** – and utility rate structures overall are trending in this direction.

Grid interactive buildings measure findings

Cost-effective in <u>almost every</u> location	Cost-effective in <u>most</u> locations	Cost-effective in <u>some</u> locations

• LED lighting and controls upgrades
• Staging to reduce peak demand:
  • Laptop battery charging
  • AHU fans
  • Electric resistance heaters (all-electric only)
• Space temperature setback to reduce peak demand
	• Electric battery storage
	• Solar PV energy generation
	• A solar + storage “bundle”
		Static measures with minor impact on peak demand
		• Increased air filtration to reduce OA needs
		• Low-E window films
		• Heat recovery (heat pipes)
		• New chilled water plant
		• Demand control ventilation
		
		Flexible measures that are location specific
		Advocate for, adopt, and respond to advanced rate structures

A GSA grid interactive buildings strategy should prioritize:

a. **Investment in fully controllable systems.** For example, many GSA buildings have LEDs, but fully controllable fixtures provide much more value.

b. **Staging of large building loads** like electric heating, AHU fan motors, and plug loads. Staged loads are an untapped source of demand savings and require little-to-no new equipment.

c. **Consistent demand management and peak shaving**. Year-round demand management delivers greater value than demand response in most scenarios.

d. **Battery storage and solar PV.** These technologies make economic sense in most locations, but to varying degrees. Falling first costs make these technologies more important for future projects.

Key characteristics of a cost-effective grid interactive buildings site

- Medium to large-sized commercial office buildings
- Locations with high concentrations of same agency buildings regional leadership and motivated building managers
- Locations where Grid interactive buildings measures will be more cost-effective:
  - Favorable rate structures, which could include
    - Locations with high demand charges
    - Locations with moderate demand charges and high consumption charges
    - Locations with time-of-use, real-time pricing, or other
  - Examples: New York, California, Colorado
- All-electric buildings, because the grid interactive buildings opportunity is greater due to a higher electric load

On the horizon…

1. GSA GPG Pilot
2. GSA Green Building Advisory Council ESPC/UESC guidance for grid interactive buildings
3. Getting to Zero Forum

RMI seeks to partner on leading edge projects and programs around grid interactive buildings

- Technical optimization and economic analysis
- Agency and organization program development
- Sharing successes

Additional Resources

- Rocky Mountain Institute - Grid interactive buildings Homepage
  - https://rmi.org/gebs
- U.S. General Services Administration – GEBs Advice Letter
  - https://www.gsa.gov/cdnstatic/Bldg%20Grid%20Integration%20Advice%20Letter%202-21-19%20-%20508.pdf
- DOE BTO – GEBs Homepage
  - https://www.energy.gov/eere/buildings/grid-interactive-efficient-buildings
- Berkeley Lab – FlexLab
  - https://flexlab.lbl.gov/
- New Buildings Institute – GridOptimal Initiative
  - https://newbuildings.org/resource/gridoptimal/
- More from ASHRAE, NREL, NASEO, ACEEE, and many others…