

Grid-Interactive Efficient Buildings Support Federal Facility Decarbonization

The Federal Energy Management Program (FEMP) plays a key role in helping agencies understand and meet energy-related goals, including those surrounding smart buildings technologies and grid-interactive efficient buildings (GEBs), which can support decarbonization. GEB enables demand flexibility that has the potential to reduce electrical infrastructure costs and transform the grid edge, where buildings connect to the power grid.¹ GEB technology can offer a significant impact in energy and cost reductions.² FEMP's expertise includes identifying, sharing, and demonstrating best practices among federal agencies, as well as providing technical support and developing tools and resources.

What Is GEB Technology?

A grid-interactive efficient building (GEB) is an energy-efficient building that uses smart technologies and on-site distributed energy resources to provide demand flexibility while co-optimizing for energy cost, grid services, and occupant needs and preferences, in a continuous and integrated way.

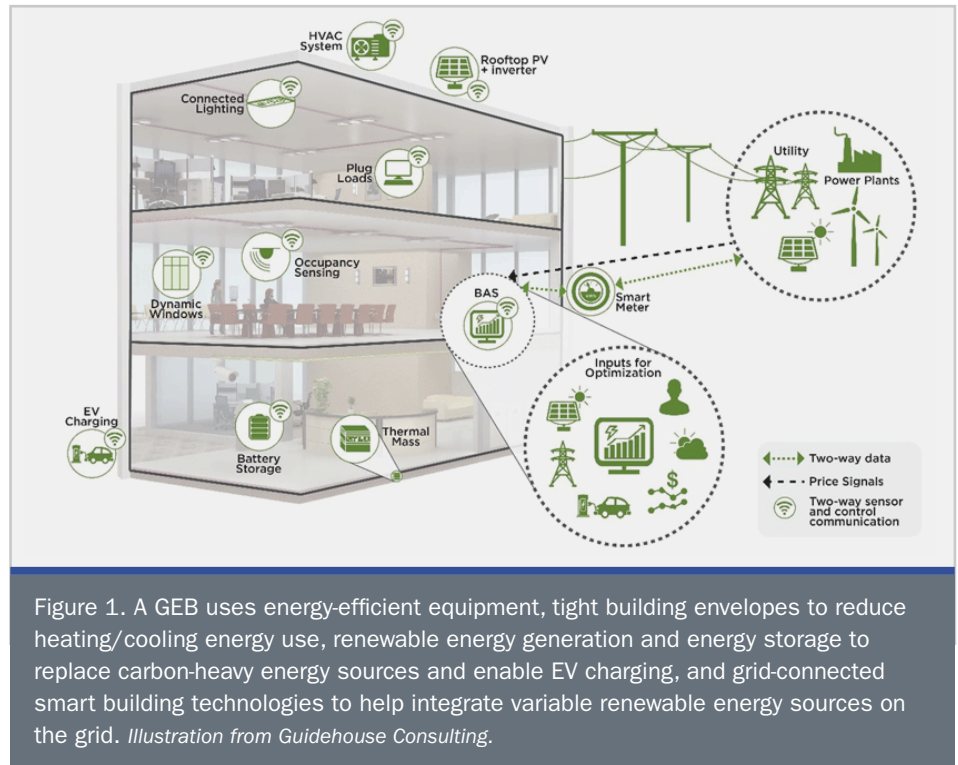


Figure 1. A GEB uses energy-efficient equipment, tight building envelopes to reduce heating/cooling energy use, renewable energy generation and energy storage to replace carbon-heavy energy sources and enable EV charging, and grid-connected smart building technologies to help integrate variable renewable energy sources on the grid. *Illustration from Guidehouse Consulting.*

What Is Decarbonization?

Decarbonization is reducing and eliminating carbon emissions from energy consumption on-site. Decarbonization strategies help reduce carbon emissions by optimizing building energy efficiency, eliminating on-site emissions from energy use, and powering facilities and fleets with carbon pollution-free electricity—generated from renewable energy sources such as wind, solar, and geothermal.

GEBs can support decarbonization by optimizing energy use and reducing carbon emissions during peak demand events. GEB solutions and smart technologies can offer energy efficiency and flexibility. GEB technology can also lower the building's energy consumption through monitoring, fault detection, and energy conservation operational changes. Distributed energy generation and energy storage are key GEB technologies that support building decarbonization. For example, in the future, bidirectional electric

vehicles (EVs) employed as mobile battery storage can provide resilience and demand-response capabilities, in support of decarbonization, to a site's building infrastructure. When paired with similarly capable electric vehicle supply equipment (EVSE), a bidirectional EV can receive energy (charge) from the EVSE and provide energy to an external load (discharge).

Incorporating GEB and Decarbonization

When retrofitting or modernizing a federal building to enable a decarbonized future, it is important to understand the goals and timeline of the building, agencies, and legislation. A detailed master plan or roadmap will save effort and time during technology and equipment upgrades. Understanding the responsibilities of each stakeholder is important to a successful program. Energy sources, utility tariffs, management and facility teams, equipment, and technology are critical to enable GEB and decarbonization.

¹ Department of Energy Office of Energy Efficiency & Renewable Energy. 2024. "Decarbonizing the U.S. Economy by 2050: A National Blueprint for the Buildings Sector." DOE/EE-2830, April 2024. <https://www.energy.gov/eere/decarbonizing-us-economy-2050-national-blueprint-buildings-sector>.

² Jungclaus, Matt, Cara Carmichael, and Phil Keuhn. 2019. "Value Potential for Grid-Interactive Efficient Buildings in the GSA Portfolio: A Cost-Benefit Analysis." Rocky Mountain Institute. http://www.rmi.org/GEBS_report.

Risk and Responsibility

Defining roles and responsibilities is critical for a successful GEB project. There are risks involved with equipment that is not properly maintained and operated. It is important to train the staff to ensure successful GEB operations in relation to decarbonization and risk awareness. Define who oversees maintenance, who pays for equipment failures, who performs the monitoring, when equipment needs to be updated, and more.

Utility Interaction

Communication with utilities is critical when maximizing benefits of GEB for decarbonization. Implementing GEB technology with a mix of energy efficiency measures, renewable energy, and energy storage helps to avoid higher peaks and increased demand charges. Interacting with the grid enables utility savings from demand response (DR) events. DR programs provide customers the opportunity to save money, through incentives and avoidance, by reducing demand during peak periods or utility notified demand events. Understanding utility rate structures with time of use is not only a way to save money but necessary to lower emissions. Typically, utilities call demand events to avoid turning on peaker power plants, which can have an impact on emissions.

Funding

Many funding routes to improve the cost of a GEB and decarbonization project are available. Most utilities offer incentives for energy efficiency projects when new equipment is involved. AFECT grants are available for projects which incorporate decarbonization strategies and technologies. Information for other funding sources, such as performance contracts (energy savings performance contracts and utility energy service contracts), is available in FEMP's Best Practices for Smart GEB-Ready Performance Contracts fact sheet.

Conclusion

Incorporating GEB and decarbonization technologies and equipment into new and existing buildings helps reduce the



Figure 2. Commercial buildings labs emulate the grid and environment with real building equipment and the ability to switch to any building or location.

Photo by Dennis Schroeder, NREL 62082

barriers to achieving net zero status. It is important to keep everyone involved and informed when working toward a net zero carbon goal, as GEB and decarbonization technologies require collaboration between federal sector facility, procurement, and utility teams.

Learn More

Learn more about the following FEMP programs and initiatives:

Grid-Interactive Efficient Buildings: energy.gov/femp/grid-interactive-efficient-buildings-federal-agencies.

Electrification and Decarbonization Strategies: energy.gov/femp/electrification-and-decarbonization-strategies-federal-agencies.

Demand Response and Time-Variable Pricing Programs: energy.gov/femp/demand-response-and-time-variable-pricing-programs.

Funding Opportunities and AFECT Grants: energy.gov/femp/federal-energy-management-program-funding-opportunities.

Energy Savings Performance Contracts: energy.gov/femp/energy-savings-performance-contracts-federal-agencies.

Utility Program and Utility Energy Service Contracts: energy.gov/femp/utility-program-and-utility-energy-service-contracts-federal-agencies. ■

Key Resources

- **Browse training opportunities:** www7.eere.energy.gov/femp/training
- **Learn about federal energy management requirements:** www7.eere.energy.gov/femp/requirements/
- **Request technical assistance:** www7.eere.energy.gov/femp/assistance
- **Read FEMP news and subscribe to FEMP Digest:** energy.gov/femp/femp-newsroom
- **Follow FEMP on LinkedIn:** www.linkedin.com/company/doefemp/



For more information, visit:
energy.gov/femp