Grid Interactive Efficient Buildings

Global Energy Efficiency Benchmarking, and Low Energy Buildings and the Role for Smart Management Systems

Alexander N. Fitzsimmons

Deputy Assistant Secretary for Energy Efficiency/A, U.S. Department of Energy

September 18, 2019
The Future of Power: Today vs Tomorrow

Today’s one-way power system is evolving into a flexible, grid-interactive, IoT-powered network of distributed energy resources.
Grid Interactive Efficient Buildings
Characteristics of Grid Interactive Efficient Buildings

**EFFICIENT**
Persistent low energy use minimizes demand on grid resources and infrastructure

**CONNECTED**
Two-way communication with flexible technologies, the grid, and occupants

**FLEXIBLE**
Flexible loads and distributed generation/storage can be used to reduce, shift, or modulate energy use

**SMART**
Computing, data analytics, and machine learning supported by sensors and controls co-optimize efficiency, flexibility, and occupant preferences
Characteristics of Grid Interactive Efficient Buildings

- **Efficiency**
  - Power Demand vs. Hour of the Day

- **Load Shed**
  - Power Demand vs. Hour of the Day

- **Load Shift**
  - Power Demand vs. Hour of the Day

- **Modulate**
  - Power Demand vs. Sub-Seconds to Seconds
Characteristics of Grid Interactive Efficient Buildings

Source: Rocky Mountain Institute
This Smart Neighborhood in Birmingham, Alabama integrates high-performance homes, energy efficient systems and appliances, connected devices, and a microgrid on a community-wide scale for the first time in the Southeast.

With 62 homes, it supports the community’s energy needs by using microgrid technology with PV panels, battery storage, and a backup natural gas generator. These features help maximize the efficiency of the grid, while providing cost savings.

The microgrid can operate both independently or together with the wider grid and can also control individual end-use equipment such as appliances and HVAC equipment in the home. This adds to community resilience.

Alabama Power partnered with homebuilder Signature Homes, researchers at Southern Company, U.S. Department of Energy’s Oak Ridge National Laboratory, the Electric Power Research Institute, and others on this project.
Future Research to Advance Grid Interactive Buildings

- Quantifying the impact of demand flexibility on occupant preferences as well as the value of those impacts
- Determining the impacts of demand flexibility on equipment lifetime
- Determining the role of demand flexibility in different energy market contexts
- Quantifying the potential of demand flexibility in groups and districts of buildings
- Understanding regulatory constraints for aggregation to exercise inter-building demand flexibility and energy exchange and identifying business models