

Demand Response in Residential Energy Code

Building Energy Code Technical Brief

INTRODUCTION

Grid-interactive efficient buildings (GEBs) contain smart technologies and communications capabilities that enable energy efficiency and demand response (DR) methods, benefiting a building or home's occupants, the electrical power grid, and the environment.

Expansion of energy codes to include GEB capabilities supports DR communication standardization and broader deployment of technologies such as smart home energy management systems, energy storage, behind-the-meter generation, and electric vehicles.

These technologies can match intermittent renewable energy with building electric loads, decrease peak grid load, allow buildings to respond to utility price signals, support grid reliability, and cultivate a clean-energy economy.

The Department of Energy (DOE) created a technical brief to assist state and local governments in incorporating DR provisions directly into their respective codes, and to help inform future International Energy Conservation Code (IECC) code development.

The technical brief builds upon language contained in the New Buildings Institute's Building Decarbonization Code, as well as language considered in 2021 IECC efforts. The brief, which also includes information and analysis developed by Pacific Northwest National Laboratory (PNNL), supports consistency of approach and provides a degree of certainty for a wide range of residential housing stakeholders.

The brief provides two DR strategies for residential buildings:

- smart thermostats with demand-responsive control
- electric water heating incorporating demand-responsive controls and communications.

IMPACTS

- GEBs can play a key role in helping assure access to an affordable, reliable, sustainable, and modern U.S. electric power system.
- Nationwide adoption of GEBs and associated DR technologies represents a major energy and environmental opportunity. It's estimated that up to \$200 billion in U.S. electric power system cost savings could be realized over the next two decades, along with associated reductions in carbon dioxide emissions of 6 percent annually by 2030.
- DOE's GEB vision seeks to triple energy efficiency and demand flexibility of the buildings sector between 2020 and 2030.
- Incorporating GEB considerations in energy codes can benefit all consumers by:
 - matching short-term availability of intermittent renewable energy sources, such as wind and solar, with building electric loads
 - decreasing peak load on the electrical transmission and distribution networks to alleviate

the need for network upgrades to handle new electric loads

- allowing buildings to respond to utility price signals and provide grid services that control network characteristics, such as line frequency, system inertia, and network voltage, and help prevent network and generation outages
 - allowing electricity suppliers to offset their short-term market imbalance by controlling flexible load on the network
 - providing a market signal to companies and investors to develop products and processes that align buildings with the transition toward clean economic growth.
- The installed costs for smart thermostats and electric water heaters with DR control are modest (often in the hundreds of dollars) and depend on the design of the home.
 - When DR requirements are part of the model energy code, it will not require homeowners or buildings to participate in DR programs, but guarantees that residential buildings are capable of doing so.

BACKGROUND

DOE and PNNL have developed a series of technical briefs supporting national, state, and local initiatives to update and advance building energy codes. Each brief is presented in a module-based format, centered on technologies, measures, or practices that can be incorporated as “plug-ins” to building energy codes. These are made available for adoption directly by state and local governments pursuing advanced energy savings and greenhouse gas emission reductions, or for future consideration as part of the national model energy codes, such as the IECC or ASHRAE Standard 90.1. The collection of briefs supports DOE’s mission to provide technical assistance supporting states and local governments, helping them to successfully implement their building codes, as well as pursue energy and climate goals.

LEARN MORE

Find the full technical brief, including supporting technical information and sample code language, at https://www.energycodes.gov/sites/default/files/2021-10/TechBrief_GEB_Oct2021.pdf.

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