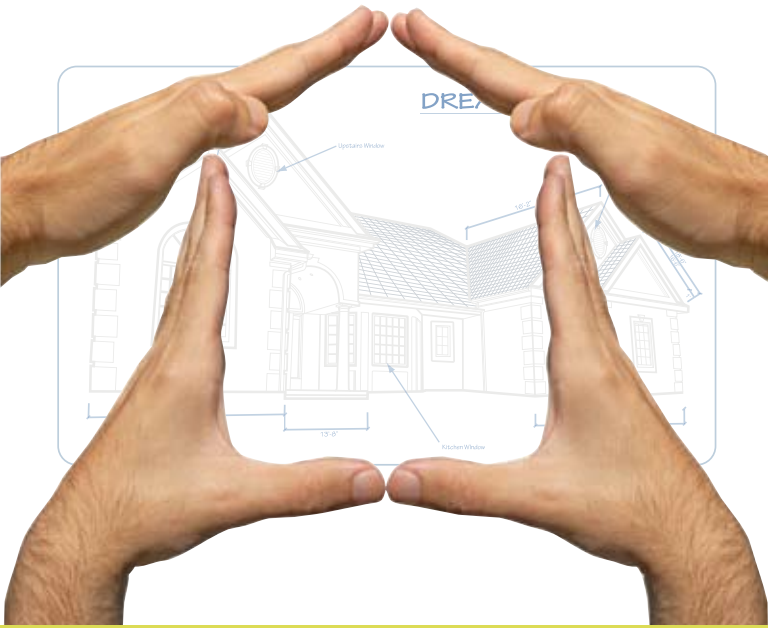
SMARTGRIDCITY™

University of Colorado at Boulder

CHANCELLOR'S **RESIDENCE:**

Smart Home energy management through technology | innovation | efficiency

in partnership with SmartGridCity™



Boulder's first "Smart Home"

The University of Colorado (CU) at Boulder Chancellor's Residence is arguably one of the nation's smartest homes—but perhaps not for the reasons you think. Through a partnership with Xcel Energy and its Smart Grid Consortium Partners, cutting-edge technology installed in this home allows residents to actively participate in decisions about their energy use, reduce their environmental "footprint" and manage their energy dollars.

SmartGridCity: Revolutionizing the way you use power

The Chancellor's Residence is part of a larger effort that is now underway. Xcel Energy, along with its consortium partners, is building the nation's first SmartGridCity in Boulder, Colorado. The project, which was announced in March 2008, is an effort to modernize the energy grid and bring it into the digital age. It involves the densest concentration of "intelligent grid" technologies in a single community to date.

When fully integrated, these technologies have the potential to fundamentally change the way we create, deliver and use energy while offering financial, operational and environmental benefits. SmartGridCity is designed to improve grid performance, delivery of electricity to meet customer's needs and overall power reliability.

The GridPoint Customer Portal will allow participating customers to conserve energy through a password-protected online energy management site.

GridPoint's Energy Manager serves as the intelligent hub of the Smart Home system.

CU Smart Home Software Platform

Technologies from different companies are being tested throughout SmartGridCity. The CU Chancellor's Residence features a software platform from GridPoint, one of Xcel Energy's consortium partners.

GridPoint's software platform applies information technology to the electric grid to provide Xcel Energy with an intelligent network of distributed energy resources that controls load, stores energy and produces power. The platform provides a single interface to manage plug-in hybrid electric vehicles, solar panels, wind turbines, advanced energy storage technologies and household devices such as thermostats, electric water heaters and pool pumps.

The GridPoint Energy Manager is the intelligent hub that receives commands from Xcel Energy's interface and a customer's online energy management portal. Based on these commands, Xcel Energy can efficiently balance supply and demand in a cost-effective and environmentally beneficial manner. Customers can choose to automatically reduce their consumption, manage their energy dollars and shrink their environmental footprint.

Smart Home Benefits:

During periods of peak demand, a smarter grid enables Xcel Energy to reduce load or augment supply. Benefits include a more efficient and reliable grid, the adoption of renewable energy and the ability to defer new power plant construction.

GridPoint's in-home technologies provide the CU Smart Home with:

- online energy management to automatically control energy consumption and costs in accordance with personal preferences,
- a "plug-and-play" solar integration system to easily track solar production and convert solar energy for use in the home,
- instant, clean power to back up critical appliances and devices, such as refrigerators and computers, in the event of an outage; and
- "smart charging" to automatically charge an electric vehicle during off-peak hours, reducing carbon emissions and fuel costs.

Back-up Battery Storage: the CU Smart House boasts up to 47 hours of clean, back-up power designed to protect critical and sensitive loads in the event of an outage.

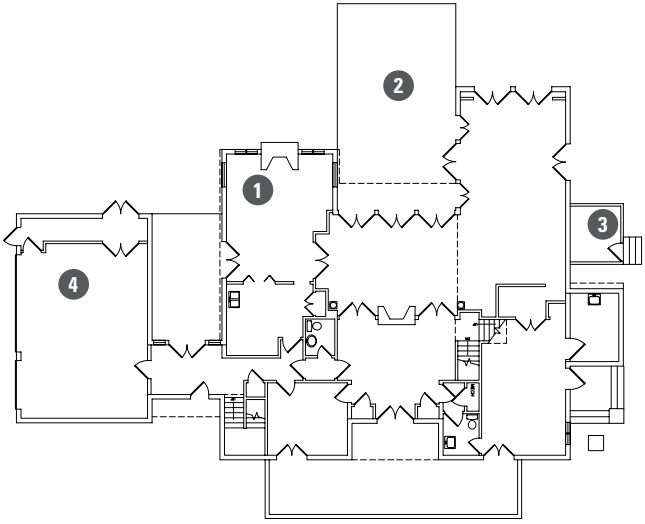
Smart Home Features

1 Online Energy Management

Via a web portal, Smart Home residents can monitor their energy use in near real-time and make choices about when, where and how they use their energy by pre-selecting their preferences. Using the portal, customers track how much energy they are using, what their carbon footprint is and how much renewable energy is being generated by their 6-kilowatt (kw) solar installation.

The portal also allows customers to create a personal energy profile that instructs the home's appliances and devices, such as thermostats and pool pumps, to automatically manage individual loads according to custom preferences such as seasonal, work or vacation schedules. This profile can be set once or continually changed to allow customers to refine their energy usage schedule.

Additionally, customers may choose to subscribe to e-mail or text message alerts to be notified of outages and receive energy reports on consumption and their home's power system performance.



❷ Solar Power Integration

Solar photovoltaic (PV) electricity generation is a clean and sustainable source of renewable energy. The CU Chancellor's Residence features a 6 kW solar panel installation on the roof of the home, installed by Namaste Solar Electric, as well as a sophisticated PV integration system and an online energy management portal.

It essentially offers a "plug and play" solution that makes it easy to integrate solar energy into the grid and the home as well as track its production and consumption. Xcel Energy's Smart Home customers can sell excess renewable energy back to the utility, further reducing their energy costs. Today, solar power helps to:

- Reduce pollution
- Stabilize electric costs
- Lessen our dependence on fossil fuels
- Increase self-reliance and sustainability
- Preserve natural resources and
- Strengthen our energy security

Did You Know?

- Installing one kilowatt of solar power is the equivalent of planting 50 trees.
- For each one-kilowatt hour of installed solar generation compared to fossil fuel generation, our environment will see 1,911 fewer pounds per year of carbon dioxide and six fewer pounds of nitrogen.
- Xcel Energy's Solar*Rewards program allows our customers to receive cash back for installing a new PV system at their home or business in Colorado. Incentives are based on the size of the system installed. Visit **xcelenergy.com/solar** to learn more.

❸ Energy Storage and Instant Back-Up Power

The CU Smart Home includes an energy storage system that provides clean and reliable back up power in milliseconds. This ensures that critical and sensitive loads (such as computers, refrigerators, security systems, hot water heaters) are protected in the event of an outage. And when coupled with the solar panels, there is virtually unlimited back up power available.

❹ Plug-in Hybrid Electric Vehicle with "Smart Charging"

The CU Smart Home has special features designed for drivers of plug-in hybrid electric vehicles (or PHEVs). Unlike a traditional hybrid vehicle, these cars are "powered at the plug."

GridPoint's "smart charging" capability enables Xcel Energy to shift the charging of these vehicles from peak periods, such as when customers typically come home for work, to off-peak. By shifting this load, Xcel Energy can alleviate stress on the grid, offer customers incentives for off-peak charging and reduce carbon emissions. Unlike other smart charging solutions, GridPoint also enables Xcel Energy to manage charging of PHEVs in real-time from any outlet within their service territory. Additionally, online interfaces provide data on vehicle performance, charging behavior and status for both the driver and utility.

With GridPoint's "vehicle-to-grid" capability, a PHEV can also discharge power back to the electricity grid. Emissions are lowered even further when the car's battery is charged using renewable energy from the home's solar panels.

Did You Know?

- PHEVs can get up to 150 miles per gallon and save their owners approximately $2,100 in average fuel costs per year.
- Most of today's PHEVs can be plugged into a standard 120-volt or a 210-volt outlet for "refueling."
- If cars used "smart charging" at various times of the day and night, the nation's grid could provide enough power for up to 73 percent of U.S. cars, vans, SUVs and light duty trucks.

"Over the last three decades, CU Boulder has taken many steps to improve the sustainability of our operations. The energy efficient tools available at the Chancellor's Residence are another example of our efforts to reduce our environmental footprint and we're pleased to be involved in the practical applications of smart home technology."

—***Phil DiStefano***
Chancellor
University of Colorado at Boulder