

SMART GRID

How is the future of electricity distribution changing for consumers, and what is SMART GRID?

SMART GRID

Every day people use electricity in some way — to turn on lights, make a piece of toast, watch television, take a soak in the hot tub, do the laundry, prepare meals — all activities that are routine and safe just with the flip of a switch or remote. In today's high tech world we may take for granted what it takes to provide that convenient source of power — until the power goes out.

For most consumers, electrical generation and transmission are out-of-sight and out-of-mind. But as ever increasing demand for electricity pushes our distribution system to its limits, power shortages and other problems are something to think about. Where did that electricity come from? How did the power get to your home? How much electrical energy do your appliances use?

If making decisions about how and when you used electricity could influence the cost of your consumption would you be interested? "Smart Grid" is a topic you will be hearing more about. In the meantime, this fact sheet provides some basics.

WHAT IS SMART GRID?

When Smart Grid is mentioned in the media, consumers ask questions like, "Is Smart Grid a thing? ...a system? ...an approach?exactly *what is it?*"

In principle, "Smart Grid" is an upgrade to modernize an electrical power grid. In basic terms "Smart Grid" refers to using advanced control and equipment technologies and integrating digital processing and communications to the electrical production, transmission, distribution and consumption parts of the power grid (see Figure 1).

For power utilities, Smart Grid modifications add continuous, real-time two-way communications and monitoring to the vast electrical grid network, to immediately adjust to anomalies and power demands and loads.

For consumers, home-based "Smart Sockets" and "Smart Meters" offer the convenience of real-time monitoring of electrical use — especially important for large appliances during peak load periods.



Figure 1. To learn how the electrical grid works and about related occupations, visit the interactive Smart City iMap at <http://cleanenergyexcellence.org/occupations/>

Click on the green lights to see smart grid energy jobs.

Image courtesy of Idaho Power.

WHY SMART GRID?

Consumers may be asking, “So why the change? My electrical service works fine.”

Perhaps your electrical service works fine because the utilities are continually and manually monitoring and fixing parts and components of the grid. However, without the advanced controls and two-way communications of Smart Grid, many utilities do not know when a power outage has occurred.

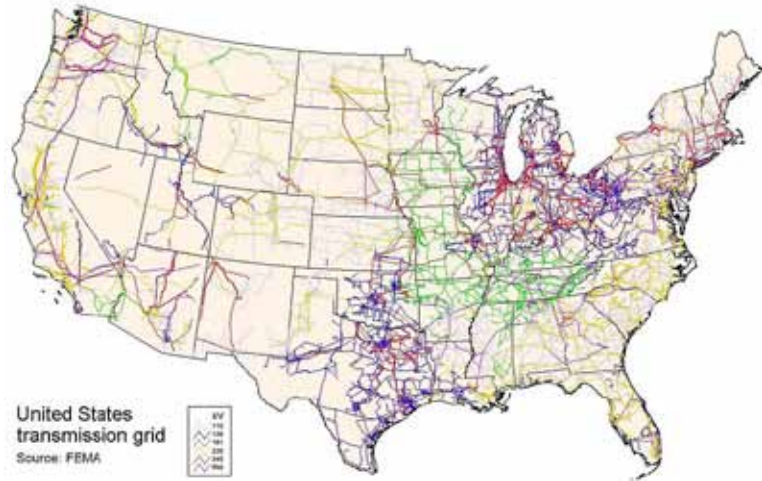
Odd as it may seem, in our high tech world of computerized detectors and gadgets, utilities still depend on consumers to alert them of many system problems.

Most of the 500,000 miles of the nation’s massive electrical transmission grid have not been upgraded since its construction in the 1960s and 70s.

Like in your own home, repairs and patches do the job, but eventually major upgrades are required to meet new demands of codes and safety features to keep up with the electronic and digital age.

The upgrade needs of the nation’s electrical transmission grid aren’t that different from other technology upgrades in our lives. For example, our computers and televisions have dozens of new features to add convenience, reliability, communication and enjoyment.

The bottom line though, is that many parts of the U.S. electrical grid are antiquated. Smart Grid technology is an upgrade to the current system, designed to address current energy needs and ensure reliable distribution.



The U.S. Electrical Transmission Grid To provide adequate and dependable electricity to all consumers, the U.S. electrical transmission grid comprises 500,000 miles of high voltage transmission lines – most constructed over a half century ago.

WHAT BENEFITS CAN SMART GRID OFFER?

With advanced telecommunications, Smart Grid aims to offer benefits that include:

- **Reliability.** Overhauling aging equipment to provide enhanced reliability for consumers.
- **Efficiency.** If the grid were just 5% more efficient, energy savings would equate to permanently eliminating the fuel and greenhouse gas emissions from 53 million cars.*
- **Conservation.** Prolonging the life of the existing grid, thereby saving the cost of constructing new power and transmission systems.
- **Responsiveness.** Rapid diagnosis of and precise solutions to specific grid disruptions or outages. Power system automation can decrease brownouts, blackouts and power surges that can damage computers, TVs and audio equipment.
- **Adaptability.** Allowing the integration and storage of energy from diverse and geographically scattered renewable power sources like wind farms and solar systems.
- **Security.** Protection from grid cyber-attacks.
- **Energy Management.** Smart Grid features allow consumers to monitor and adjust their energy usage. By using smart meters to schedule energy-intensive tasks during low demand periods, consumers may save on electric bills.



*Source: U.S. Department of Energy, *The Smart Grid: An Introduction*





YOUR CONNECTION TO THE GRID

To monitor your energy use, Smart Grid utilities can provide information and high-security tools to respond to electricity grid conditions. Depending on your interest, utility and type of home power meter, a Home Area Network consisting of several smart outlets and an in-home display lets you monitor and control everyday energy use and cost.

The monitoring system works by taking a wireless signal from your power meter, forwarding the meter



data to other devices in your Home Area Network, and uploading energy consumption information over your Internet connection to a remote computer. This computer interprets and presents the data—such as your billing history, weekly consumption, household usage/cost, and energy consumption—on your home computer or in-home device. Used along with a smart thermostat, the Home Area Network can also let you schedule your heating, ventilation and air conditioning systems.

Time of Use (TOU) pricing is one of the most compelling benefits for Smart Grid consumers. TOU can encourage consumers to modify their patterns of energy use to coincide with low electric demand periods. During time of higher energy demand (Peak load periods) the energy price of electricity is higher. During times of lower energy demand (off Peak), the energy price per kWh is lower. This is similar to some cell phone companies that offer discount pricing when users place calls between 9 PM and 6 AM.

TODAY'S GRID

Consumers are non-participative with the power system.

Dominated by central electrical generation - large power facilities such as fossil fuel (coal, gas powered) nuclear, large solar power plants or hydropower plants.

Limited wholesale power markets, not well integrated, limited for consumer.

Focus on outages; slow response to power-reliability issues.

Little integration of electrical system data to monitor and control electrical grid parameters.

Responds to prevent further damage to power grid equipment; focus is on protecting equipment following fault.

Vulnerable to malicious acts of terror and natural disasters.

SMART GRID

Informed, involved, and active consumer. Energy demand response often involving renewables.

Many power generation resources with focus on renewables having interconnection convenience to conventional central generation.

Mature, well-integrated wholesale power markets, growth of new electricity markets for consumers.

Power quality is a priority with a variety of quality/price options; focus on rapid resolution of issues.

Greater access to electrical grid information; focus on prevention issues minimizing impact of consumers.

Automatically detects and responds to problems; focus on prevention, minimizing impact to consumer.

Resilient to attack and natural disasters with rapid restoration capabilities.



THE U.S. ELECTRICAL GRID AND YOUR HEALTH, SECURITY AND PRIVACY

The Internet has already brought about a transformation to the way we live, work, play, and learn, and Smart Grid will utilize many of the same technologies.

Health

Smart Grid involves the installation of some new home equipment, such as smart meters. Research from several national and international organizations suggest that the radiation emitted from wireless smart meters, when installed and properly maintained, result in much lower levels of radio frequency (RF) exposure than many commonly used household devices, particularly cell phones and microwave ovens.

Security

The operation and control of the current power grid depends on a complex network of computers, software, and communication technologies that, if compromised, have the potential to cause damage, including power outages and destruction of electrical equipment.

Privacy

At every stage of the grid system, security controls are being incorporated, tested and reviewed to assure a fail-safe, secure, and private grid.

LEARN MORE:

For more information and to watch a video about Smart Grid visit cleanenergyexcellence.org

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