



The Smart Grid

With electric cars soon to be rolling off assembly lines, America needs to make sure its power distribution system can handle the new demand for electricity. The Smart Grid is an enhancement to our current system, designed to use two-way communication between appliances and power grids to use electricity more efficiently than ever before—giving both consumers and producers a boost.

How does the Smart Grid work?

The Smart Grid updates the existing power grid to employ real-time, two-way communication between power suppliers and their residential, commercial and industrial customers. Power suppliers provide their customers with pricing information that is based on electricity demand for a given period during the day. Customers use that information to guide power usage. For example, an electric car owner may decide to recharge his car late at night, when electricity rates are much lower compared to the early afternoon. Or a manufacturer may choose to run high-energy operations during a time of day when the demand of electricity is lower and the price more economical.

Smart Grid advantages

- ▶ Consumers have more control over the source of their power and the price they pay for it.
- ▶ Utilities can route power more efficiently without overloading the grid—and compromising its reliability—by analyzing real-time information about where power is needed and what energy sources are available.
- ▶ As energy use is shifted to off-peak periods, fewer power plants will need to be built, and electricity needs will be met by cleaner and more efficient sources.

Implementation timeline

In some places, elements of the smart grid are already starting to appear! Several states, including Illinois, are rolling out smart-metering infrastructure to residential consumers, which allow them to receive real-time electricity price signals. Bit by bit, the old electricity paradigm will give way to the new.

The Smart Grid and energy storage

The Smart Grid will facilitate the use of large-scale energy storage systems that will become more important as renewable energy technologies spread. Large-scale energy storage will mitigate disruptions in electricity flow across the grid as variable sources like solar and wind power ramp up and down. With this capability, the Smart Grid would



Newly developed Smart Grid technology will ensure that energy is efficiently produced, distributed and consumed.

not only reserve power, but route it even more efficiently. Argonne chemical and materials scientists and engineers—already renowned for innovations in advanced batteries for vehicle electrification—are working to develop large-scale energy storage systems.

Argonne and the Smart Grid

A multidisciplinary team of Argonne researchers is exploring concepts that would lead to the larger implementation of the Smart Grid.

- ▶ Argonne's Center for Energy, Environment and Economic Systems Analysis is examining electricity trends and researching how new technologies and control strategies can improve the performance of electric power systems to ensure adequate, affordable, reliable, and sustainable electricity supply to consumers.
- ▶ Argonne transportation researchers are participating in the development of an international standard for electrical outlets and plugs for the anticipated growth in the plug-in hybrid electric vehicles and all-electric vehicle markets.
- ▶ Argonne has also partnered with Sweden to develop charging stations for automobiles.