

Enabling Tomorrow's Electricity System

Report of the Ontario Smart Grid Forum

Backgrounder: The Case for Smart Grids

What is a Smart Grid?:

- A smart grid is a modern electric system. It uses sensors, monitoring, communications, automation and computers to improve the flexibility, security, reliability, efficiency and safety of the electricity system.
- It increases customer choice by allowing consumers to better control their electricity use in response to prices or other parameters.
- A smart grid includes diverse and distributed energy resources and accommodates electric vehicle charging.
- It brings all elements of the electricity system – production, delivery and consumption – closer together to improve overall system operations for the benefit of consumers and the environment.
- A smart grid is not, one single project, but a series of initiatives by a variety of organizations that combine to create a modern electricity system capable of serving the digital age.

Benefits of a Smart Grid:

A Greener Electricity System

- Smart grids enable a more efficient use of electricity and promote overall reductions in energy use. According to the Electric Power Research Institute, smart grid technologies have the potential to reduce electricity consumption in 2025 by 10 to 15 per cent in the United States.
- Smart grids better facilitate the integration of distributed generation and new energy resources such as solar, wind and storage.
- Ontario leads the country in wind power capacity. Wind power is highly variable increasing and decreasing electricity production depending on when the wind blows. Smart grid technologies are emerging to offset this variability and allow for greater levels of wind capacity. For example, wind production during off-peak hours could be stored through flywheel technology or advanced batteries to be available during on-peak hours when it's needed most. Demand response could similarly be activated through smart grid technologies at times when wind supply is not able to meet local needs.

An Empowered Consumer Base

- As one of the largest and most sophisticated smart metering systems in the world, Ontario's smart meter initiative provides an essential platform for the development of smart grid capabilities.

- Ontario's smart meter effort signals the beginning of a more empowered, engaged consumer base that is more active in their energy use decisions. With the move to time-of-use rates, and potentially other variable rates such as the hourly price, many consumers will become more price responsive and reduce their energy use during demand peaks.
- Smart meters also provide a gateway to more sophisticated offerings such as energy monitors, home automation systems, electric cars and in-home generation such as solar panels and wind turbines.
- IESO research in Milton and Newmarket, where time-of-use rates are in effect, shows that two-thirds of electricity consumers believe variable rate pricing encourages them to be more efficient users of electricity.

Increased Reliability and Efficiency

- Smart grids move power around the system more efficiently – reducing congestion on the transmission and distribution lines and making better use of existing delivery infrastructure.
- Using smart grid technology, distributors have the ability to anticipate and address problems before they lead to outages. They can automatically reconfigure the grid to reduce the impact of faults that do occur. With a smart grid, your local distribution company will instantly know if the power is out in your home, even if you are not there to report it.

Green Jobs and Economic Stimulus

- As business and industry become increasingly reliant on digital technologies, the power quality and reliability provided by smart grids are critical to support computer systems, servers, medical equipment and other micro-processor-based devices.
- Smart grid technologies are a catalyst for innovation. R&D and manufacturing jobs will be created to support development of smart grid technologies and products.
- The economic development potential created by smart grid technologies is considerable. According to a recent study prepared by Gridwise, an alliance of electricity industry stakeholders in the U.S., a \$16-billion investment over the next four years would trigger smart grid projects worth \$64 billion, creating 420,000 direct and indirect jobs.
- Ontario's Centre of Excellence for Energy currently supports research into eight different smart-grid-related projects, representing \$12 million in investment.

Improved Distribution System Capabilities

- Most distribution systems were designed to deliver energy from the high-voltage transmission system to electricity consumers. As increasing levels of generation and demand response take place within distribution service areas, the task of operating a distribution system becomes more complex. Smart grid technologies provide

distributors with the sophisticated tools they need to more efficiently operate the system and ensure a safe and reliable electricity delivery service.

Increased Production from Local (and Renewable) Generation

- The province is in the process of incorporating substantial amounts of renewable generation within local distribution systems. By the end of 2008, the Ontario Power Authority had executed contracts for more than 1,400 MW of wind, solar, hydro and biomass generation projects through its Renewable Energy Standard Offer Program, all connected to the local distribution system.
- Tools and processes will be required to allow distributors, transmitters and the system operator to monitor the output of local generation and ensure that it does not compromise service to customers.

More Effective and Wide-Scale Demand Response Efforts

- Demand response is emerging as an important tool to maintain reliability and mitigate the system's impact on the environment. By shifting or reducing their energy use in response to price and other signals, consumers who provide demand response help reduce peak electricity use.
- By sending and collecting information about system needs, smart grid technologies provide for more efficient and effective demand response initiatives. They also allow small scale consumers to provide demand response, whether they change their energy use depending on the price, or participate in incentive programs to reduce peak demand.

Support Electric Vehicle Deployment

- With the phase-out of coal generation in the province, plug-in hybrid electric vehicles provide a unique opportunity for Ontario to reduce greenhouse gas emissions through fuel switching.
- Smart grid technologies enable the most efficient use of electric vehicles – using communications infrastructure to ensure that they are charged up at optimal times. For example, many motorists will choose to charge their batteries overnight when demand (and prices) are lowest and/or spread out the time they charge up over a longer period of time.