

The benefits of the smart grid include: more efficient transmission of electricity; quicker restoration of electricity after power disturbances; reduced operations and management costs for utilities, and ultimately lower power costs for consumers; reduced peak demand; increased integration of large-scale renewable energy systems; better integration of customer-owner power generation systems, including renewable energy systems; and improved security, to name but a few. The smart grid will allow a new class of utility customers to be both providers and consumers of power.

Thwarting Voltage Collapses

The 2003 voltage collapse occurred because electricity demands had reached a critical level. For this reason, it is essential for utilities to be able to determine whether the power system is in danger of a blackout. This can be done by placing phasor measurement units (PMUs, or *synchrophasors*) at critical locations in the network. PMUs provide instantaneous representations of currents and voltages thus enabling transmission operators to assess in real time the state of the system and detect signs of stress. As a result, not only are they able to improve transfer capacity and manage congestion but also to integrate renewables more effectively.

Integrating Renewable Energy Sources

All told, alternative sources of energy (sun, wind, water, organic waste, geothermal energy etc.) make up a rather meagre percentage of the electricity generated in the United States. Researcher teams from different disciplines are currently working together to bring about the expansion of this percentage through approaches that support high levels of renewable energy generation and storage. These new approaches promote the emerging concept of 'prosumers' – a combination of the words 'consumers' and 'producers'. An example of prosumers are homeowners who consume electricity from a public utility while at the same time produce power onsite from solar panels on their homes' roof becoming thus energy producers and storers themselves.

Conclusion

Although smart grid technology is already a reality in several U.S. cities, and the smart grid momentum is growing, it is estimated that the entire grid renovation will take decades to be completed. In the meantime, this transformative technology seems much more promising if it is combined with the installation of phasor networks and the integration of renewable energy sources.

► Answer the following questions:

- How could the massive blackout that occurred in the USA in 2003 have been avoided?
- Has the work of expert committees set up to investigate the causes of the 2003 outage managed to completely eradicate blackouts in the USA?
- How can the vulnerability of the transmission system to blackouts be reduced?
- Does the author express any doubts about the efficiency of the smart grid?
- Some renewable sources are mentioned. Is biomass included? (*Biomass*: organic matter used as a fuel.)
- How can a prosumer contribute to electricity production?
- Can you describe in your own words the role of a phasor network?
- Can you identify phrases in the text which refer to the fact that the conventional grid is being gradually abandoned?



Failing...

One of the meanings of the verb *to fail* is *to stop operating, working, or functioning normally*.

Look at the examples:

- *The old man's heart failed.*
- *The brakes failed and the vehicle crashed into a wall.*
- *The cascade of events happened because the alarm software had failed.*

As you can see, there is no need to add phrases such as 'to work', 'to operate', or 'to function' after the verb.