Smarter grids

Dear Reader,

A modern business paradigm advises us to "work smarter, not harder." Time and energy invested in analyzing the way we work often yield greater gains than intensifying our efforts without changing our approach. What is true for one's personal situation is equally applicable to larger systems. In the case of transmission and distribution networks, changes in the way the grid is being used are raising the question of how best to handle these changes. Is it acceptable to require existing infrastructure to "work harder," ie, closer to the limits of existing equipment, thus exposing customers to an increased risk of failures and blackouts? Or is a "smarter grid" the better solution?

Overall consumption is rising, and the combined effects of market liberalization and the growing share of renewables are further adding to the stress on the grid. The availability of wind and solar energy is by nature intermittent and difficult to predict. Furthermore, renewable energy is often generated in remote locations where local grid infrastructure is weak. The roles of consumers and of the distribution grid are being redefined: Consumers with their own local generation are evolving to become "pro-sumers." The former distribution grid is thus also becoming a collection grid for distributed generation.

The traditional "work harder" approach would imply meeting the growth in variability with an increase in spinning reserves. This is not only costly but can partly negate the environmental advantage of renewable generation. The "work smarter" approach takes a more comprehensive view of the transmission system. Whereas the control system of a traditional grid assumes the demand side to be a "given," smart grids will increasingly incentivize consumers to modify their consumption patterns to suit availability.

A control system's ability to make optimal decisions depends on its accurate and up-to-date knowledge of the system status. Obtaining data starts with sensors at strategic locations on the grid. Although sensors will grow in their ubiquity, it is surprising how much data is already available in existing equipment. So besides adding further sensors, smart grids must address the communication needed to share this data, and indeed the control nodes that must act on it.

Some of these topics were discussed in the 3/2009 edition of *ABB Review* (Delivering power). The present issue builds on this, taking a comprehensive look at all major aspects involved in smart grids. For the generation side, HVDC Light® technology is used to connect wind farms, and at the same time improve the stability of the grid through its reactive-power control capability. A pioneering storage technology is also presented, offering short-term protection against variability.

On the operations and control side, a series of articles looks at improvements in network management software and technology. The best of control systems is of little use, however, if equipment does not perform as expected. We address service and maintenance for transformers, and also improvements in medium-voltage switchgear.

Moving on to the domestic perspective, smart meters give residents immediate feedback on their energy use and also facilitate the billing models that incentivize a reduction of peak loads. Finally, an intuitive control system helps home owners save energy.

I trust this issue of *ABB Review* will highlight ABB's ability to support all stakeholders – from transmission operators to home owners – in meeting the challenges of the smart grid.

Enjoy your reading.

Peter Terwiesch
Chief Technology Officer
ABB Ltd.