A Self-Healing Network

By Massoud Amin

The North American electric power system developed over the last hundred years without a conscious awareness and analysis of the implications of its evolution under the forces of deregulation, system complexity, power-market impacts, terrorism, and human error.

The possibility of power delivery beyond neighboring areas was a distant secondary consideration. The modern grid will require the widespread deployment of information systems, sensing, communication and control, as well as new investment in generation, transmission and distribution. The goal will be to transform the infrastructure into a smart, self-healing grid.

The grid can be operated close to the limit of stability given adequate situational awareness combined with better communication and controls. Given that in recent decades we have reduced the generation and transmission capacity of the electric power grid, we are flying closer to the edge of the stability envelope. Ongoing programs at the Electric Power Research Institute and the U.S. Department of Energy are pursuing greater grid reliability.

Several reports and studies have estimated that for existing technologies to evolve and for the innovative technologies to be realized, a sustained annual R&D investment of $10 billion is required. However, the current level of R&D funding in the electric industry is at an all-time low. The investment rates for the electricity sector are the lowest rates of any major industrial sector with the exception of the pulp and paper industry. The electricity sector invests at most only a few tenths of a percent of sales in research. This is in contrast to fields such as electronics and pharmaceuticals, in which R&D investment rates have been running between 8 and 12 percent of net sales.

Funding and sustaining innovations, such as the self-healing grid, remain a challenge as utilities must meet many competing demands on precious resources while trying to be responsive to their stakeholders. That tends to limit R&D investments to immediate applications. In addition, utilities have little incentive to invest in the longer term. For investor–owned utilities, there is added pressure caused by Wall Street to increase dividends.

Energy policy and technology development and innovation require long-term commitments as well as sustained and patient investments in innovation, technology creation and development of human capital. Given economic, societal, and quality-of-life issues and the pivotal role of the electricity infrastructure, a self-healing grid is essential.

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