

THE EVOLVING ENERGY ECOSYSTEM: SMART GRIDS TO SMART ENERGY*

The electric power grid, known as the most complex and most substantial machine on the globe, is an interconnected energy infrastructure made up of power generation, transmission, and distribution. As technology transforms the electric grid, the rapidly emerging microgrids, intelligent sensors, 2-way communication, digitization, and automation of energy management processes have laid the foundation to not only smart grids but also smart energy. Again, the democratization and decentralization of diverse energy sources have also added to this shift.

As technology transforms the grid, each nation's power grid is at a critical juncture. While there are many gaps and opportunities to improve energy efficiency, production, distribution, transmission, and storage, it will be interesting to see how nations determine the appropriate balance between the competing interests of different energy sources to enable digitization, automation, decentralization, and modernization of the electric power ecosystem. So, amidst many competing and conflicting interests, how are nations conceptualizing the future design of the evolving power grid system? As nations evaluate the technical obsolescence of its grid, what is the impact on safety, security, and sustainability?

As the technology transformation allows for two-way communication between the grid and its customers, the rapidly evolving automation that is on its way to making the grid intelligent consists of not only controls, computers, and automation, but also many other technologies like the internet of things and blockchain. These technologies work with the electrical grid to respond digitally to the rapidly changing electric demand in real time.

Moreover, consumers becoming producers of energy is fundamentally changing energy economics. The reason behind that is over the years, the power flow was one-way: from generation to transmission to distribution to consumers. Now, as consumers become producers of energy due to maturing solar panels, wind turbines, and other sources of energy, the power flow is 2-way.

The emerging smart grid represents an unprecedented opportunity to move the energy industry into a new era of smart energy which would foster reliability, availability, accountability, and efficiency that would contribute to a nation's economic health. From efficient transmissions of electricity to rapid restorations of power, cost efficiency to lower electricity rates, increased integration of diverse energy sources to increased intelligence of energy needs, the smart grid will bring many benefits to the evolving smart energy ecosystem.

That brings us to an important question: how are nations preparing for the evolution of their energy infrastructure? While it will take some time for the evolving smart grid to bring smart energy to all nations, the evolving energy ecosystem will fundamentally change the energy equation for the future of humanity.