

Executive Summary

Synopsis

Driven by regulatory, market, and societal pressures, utilities that have historically extracted as much value and efficiency as possible with manual controls are now automating systems by integrating information management technologies with grid operations. Communications technologies are central to this System Automation movement: Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI), Supply Automation, and Supply Control and Optimization applications that are enabled by advanced communications will help utilities to cut costs, maximize assets, and improve customer service and power reliability.

This dramatic change in the business environment offers tremendous opportunity for utilities, but the task is large and complex, and the risks are great. Utilities need long-term technology planning that accounts for each utility's circumstances, is built on sound business cases, and takes into account all stakeholders involved. The Utilities Telecom Council and The Shpigler Group produced this report to help guide energy and water utility managers through the critical investment cycle that will dominate at least the next two decades.

The Next-Generation Utility: Moving Toward a Common Vision

Recent challenges to energy supply systems—such as Hurricane Katrina, the 2003 Northeast blackout that left 50 million consumers in the U.S and Canada without power, and the California energy crisis—have exposed the vulnerabilities of aging utility infrastructures. The Department of Energy (DOE) estimates that losses to the economy due to utility outages, quality disturbances and other events total approximately \$188 billion annually.

Meanwhile, energy demand continues to grow in the U.S. and abroad, while a number of important trends are pressuring utilities to upgrade infrastructures: regulators favor increased industry competition, information-armed consumer groups are making greater demands about pricing and other issues, and governments at home and abroad are

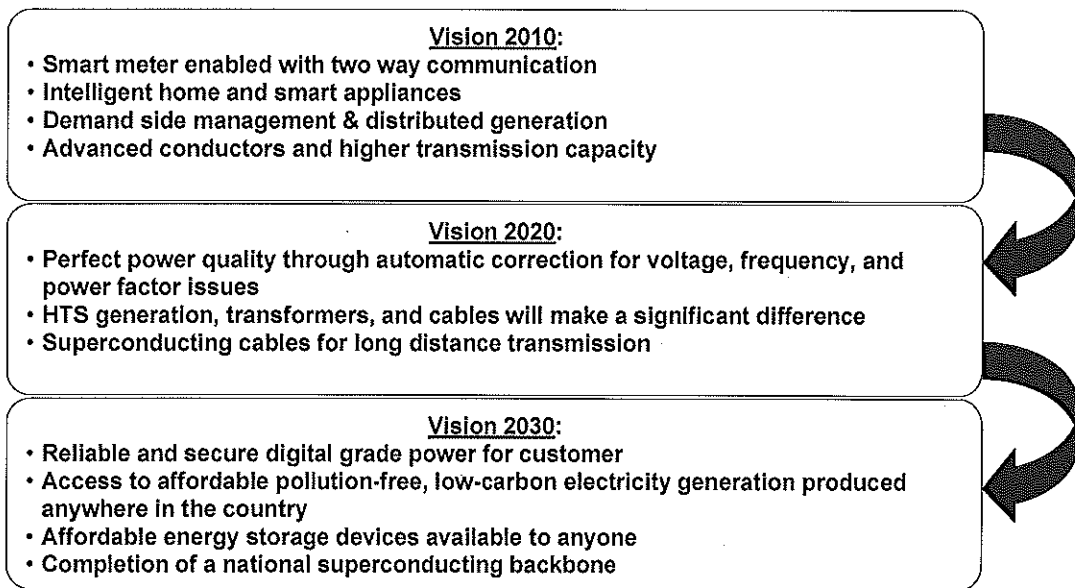
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pressing for cleaner, more reliable energy. Consumers, governments and society want more energy, at better prices, and they want it delivered more reliably than ever before.

The dramatic change in the business environment tasks utilities to take advantage of key technologies to improve the efficiency, quality, reliability and cost of supplying services. Advances especially in communications and information technology enable key next-generation applications, but the risks are high, and the roadmap is far from clear. Collaboration is required to guide the industry in this risky and opaque environment while standards, goals, priorities, and business cases are being evaluated and debated.

The Electric Power Research Institute (EPRI), the Edison Electric Institute and a number of other industry groups have offered visions for a future “Intelligent” or “Smart” utility infrastructure that weds the combination of communications, information, hardware and other technologies into a future “self-healing” grid.

The DOE, meanwhile, has suggested that utilities can upgrade through a staged implementation of automation and new technologies¹ (see chart below).



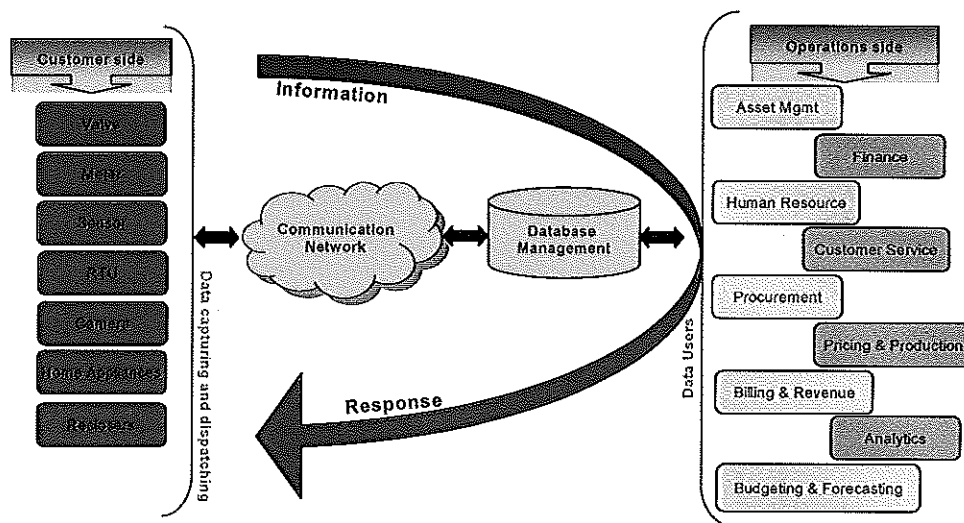
Source: Department of Energy

¹ *Grid 2030: A National Vision for Electricity's Second 100 Years*, U.S. Department of Energy, July 2003.

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Critical Communications Networks

Communications networks serve as the blood vessels of the automation and information system of the Next-Generation Utility. Communications establish a platform for different automation devices to exchange information, ideally enabling all of the elements of the utility's network and operational departments to work in tandem.



Source: The Shpigler Group

In the illustration above, “smart devices” in close proximity to customers—such as smart meters, smart home appliances, Remote Terminal Units (RTUs), video cameras, and sensors—capture key data and information from the customer and the network and relay it to “middleware” or process control systems such as Supervisory Control and Data Acquisition (SCADA) systems. The middleware then forwards the data/information to an operational department where the data is interpreted and appropriate responses are sent back to the smart devices at the periphery.

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Automation Applications: AMR, AMI, and Beyond

Efforts to turn the vision of the Next-Generation Utility into reality are already beginning. Utilities that have historically extracted as much value and efficiency as possible with manual controls are now integrating information management and communications technologies with grid operations. One-way communications systems are being replaced with robust, two-way communications networks that provide greater distribution control and efficiency. Radial topology in network planning is giving way to a network approach, and networks that had not been monitored are being equipped with a myriad of monitors and sensors that both receive and send communications signals.

The key utility system automation initiatives—Automatic Meter Reading (AMR)/Advanced Metering Infrastructure (AMI), Supply Automation, Supply Control and Optimization, and eventually “Self-Healing Grids”—will ultimately enable utilities to reduce costs, improve customer service and power reliability, maximize asset use, and mitigate the effects of an aging utility workforce.

But a great deal of R&D into components, system interoperability, business processes, and financial business cases is yet to be done. Critical components, such as “intelligent” sensors, are still too expensive to install on the thousands of utility substations and transmission lines that cross the U.S. and the potential for return-on-investment is not clear.

Case Studies

Utilities are already making progress with automation, as the case studies in this report illustrate. Each utility is unique, and automated systems will have to take account of the characteristics of each utility. Case studies give utilities an opportunity to study upgrades performed by other utilities with a variety of geographic, consumer, and legacy technology challenges.

The case studies below are discussed in detail in this report:

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Case Study 1: Grant County PUD, a consumer-owned utility serving over 41,000 customers in rural Washington State, initiated substation modernization in 2001.

Case Study 2: Great River Energy (GRE), a cooperative with more than 100 transmission substations covering a 56,000 square mile territory in Minnesota, upgraded its communications infrastructure and substation automation solutions.

Case Study 3: Grand River Dam Authority (GRDA) delivers 1,480 megawatts (MW) of wholesale electricity across Northeast Oklahoma. In 2005, GRDA connected its headquarters with its 60 satellite offices.

Case Study 4: EnergyAustralia, one of the largest energy suppliers in Australia with over 4 million network customers and an electricity network of about 22,275 square kilometers, adopted a new network communications system.

Case Study 5: The Los Angeles Department of Water and Power (LADWP) delivers water and electricity to 3.9 million residents and businesses in Los Angeles, California, and is considered the largest municipal utility in the United States. In 2000, LADWP installed a new real-time AMR wireless meter-reading solution to provide customers with tools to monitor electricity consumption and reduce bills.

Case Study 6: Iberdrola, with more than 16.4 million electricity customers in Europe, is strongly investing in telecom networks. As the owner of NeoSky, one of the most prominent Local Multipoint Distribution Services (LMDS) operators in Spain, Iberdrola has pioneered deployment of power line communications. The company is preparing to provide enhanced capacity and services in its data backbone in major Spanish cities.

Conclusion

This report discusses the trends, drivers, systems, and technologies that will lead utilities into the future. The report's purpose is to provide an overview that helps executive managers and communications professionals within utilities to establish a planning framework, but also to educate other relevant stakeholders—regulators, legislators,

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consumers, and the investment community—about utility upgrade initiatives. Some of the key observations of this report include:

- The opportunity for utilities to explore automation deployment is greater than ever given the drive to address consumer demand, and environmental and energy supply concerns.
- Each utility must be mindful of its unique circumstances as it designs a technology roadmap. Most utilities will begin with the implementation of an advanced communications network followed by AMR/AMI, supply automation, and supply control and optimization.
- A gradual approach to automation helps ensure that acquisition of systems or technologies do not limit future opportunities or create “stranded investments” that become tomorrow’s failed legacy systems. Systems implemented must be upgradeable, scaleable and interoperable with one another.
- Differing utility scenarios have resulted in varying specific applications. Increasing customer satisfaction is often cited as a reason to embark on automation, but each utility must consider its own priorities as it designs a system.
- Building a sound business case for next-generation upgrades is critical. Each utility is different and must take those differences into account in performing economic due diligence. An illustration shown in this report shows one example—a utility with one million electric and gas meters that embarks on an automation program that yields a Net Present Value (NPV) of \$184 million, an Internal Rate of Return (IRR) of 32%, and a monthly operational savings of \$2.70 per meter, with a peak investment of \$100 million.
- State commissions are seeking to implement advanced metering rules in the wake of the passage of the Energy Policy Act 2005 (EPAAct 2005). Utilities that take the initiative by offering proposals to state commissions will likely fare much better than utilities that wait for rules to be imposed upon them.