

Charting a Common Pathway



EPRI Charts Path to an 'Integrated Energy Network'

By Chris Warren

David Owens has seen it all in the electricity industry. For 36 years at the Edison Electric Institute, he has helped guide the utility trade group's efforts in rates, regulation, energy supply, advancement of new technologies, climate change, and more.

As an industry veteran, Owens has observed dramatic changes as utility customers embrace new technologies in the Internet of Things. "The industry is in a transformation driven by technology and changing customer needs and expectations," he said. "Surrounding that is a desire for cleaner energy." As customers install solar panels, battery storage, electric vehicle charging, and digital energy management systems, the grid's power flows and system operations are becoming more dynamic and complex.

According to Owens, the boundaries that have long divided various parts of the energy sector are beginning to blur, which has major implications for business, consumers, and natural resources. "Cities are trying to improve their street lighting, and they're supporting investment to make buildings smarter," he said. "They're trying to accelerate the development of electric charging stations to make the transportation sector cleaner. They're looking at rebuilding the aging water infrastructure. They're saying, 'Let's make all of this infrastructure and these systems smarter and more integrated.'"

The vision of an integrated "system of systems" for electricity, water, natural gas, and transportation is at the core of EPRI's [Integrated Energy Network](#), unveiled at the February meeting of the National Association of Regulatory Utility Commissioners (NARUC).

"It was exciting to have EPRI present its findings on this topic at NARUC. In this era of changing technology and unprecedented interconnectedness, the days of utilities operating in silos are long gone," said NARUC President Robert Powelson. "Communication across utility sectors is an essential component to integrating new technology and protecting reliability."

The result of research and collaboration with energy industry leaders, the Integrated Energy Network describes both a future and a path to get there.

“There is a cacophony of voices out there with future perspectives,” said Anda Ray, EPRI’s senior vice president, External Relations and Technical Resources, and chief sustainability officer. “What makes this different is that EPRI is not prescribing specific results, but we are pointing to a broad outcome. We’ve identified a common pathway and actions to move forward through collaborative consultation and R&D, creating the opportunity for discussion.”

The Three Pillars

The Integrated Energy Network is an invitation to contribute new ideas and approaches to plan from three perspectives:

- **Using affordable, cleaner energy—through efficiency and electrification.** The world’s rapidly growing and dramatically more urban populations share common needs for cleaner, affordable energy. This can be provided through electrification and the more efficient use of electricity. There are clearer, more reliable options for cleaning electricity than there are for cleaning direct use of fossil fuels. Examples of electrification include advanced manufacturing processes, high-efficiency heat pumps, and electric transportation. EPRI’s [report](#) points out that in many regions today, electrifying vehicles can cut carbon dioxide emissions by 75% and reduce fuel costs by 70%.
- **Producing cleaner energy—through more efficient, environmentally sustainable, flexible generation.** Whether it’s wind, solar, nuclear, or fossil-fueled generation with carbon capture, the potential for affordable, clean electricity has been clearly established, but it requires substantial investment and progress in the power production portfolio. The electricity sector must develop and deploy “next-gen” versions of both workhorse technologies (such as nuclear plants) and the newer contributors (such as photovoltaics). Intermittent renewables must be deployed in portfolios that make effective use of geographic diversity and storage technologies in both utility-scale and distributed applications. New technologies, regulations, and business models are needed to support the deployment of utility power portfolios and extensive distributed energy sources. Capital will be needed also to link larger, more diverse power production assets through interregional high-voltage transmission networks.
- **Integrating energy resources—through new control technologies, communications, standards, and markets.** Natural gas exemplifies the interdependence of energy systems. During winters in the United States, Midwest natural gas supplies are constrained, which could result in simultaneous, downstream constraints on power if those supplies are not integrated to serve both heat and power generation. The Integrated Energy Network points our thinking far beyond a given winter’s supply and demand scenario. Better integration of planning, dispatch, and markets presents an important opportunity to improve flexibility and efficiency for customers and system operators. Other interconnections among electricity, natural gas, transportation, and water systems point to additional opportunity (or need) for integration through smart technologies, communications systems, and secure cyber networks. Near term, the electricity sector’s progress in integrating utility systems with diverse, distributed resources makes the “Integrated Grid” an instrumental milestone in the Integrated Energy Network.

Integration Is Not Inevitable

Given the electricity sector’s progress in achieving the Integrated Grid, will the Integrated Energy Network follow, as night follows day? Even assuming that integration can enhance efficiency, affordability, security, flexibility, and customer choice, it cannot happen on its own.

Today's business models, markets, policies, and regulations are configured for a world in which energy and natural resource sectors connect their respective resources and consumers through separately managed and operated systems. "These siloed systems were created as these industries and technologies developed independently," said Ray. "Without taking deliberate steps to achieve integration, we will delay that time at which we make optimal use of these resources. We have to start this conversation today."

Edison Electric Institute's Owens highlights the need for regulatory reform. "Our regulatory structure has to keep pace," he said. "We need to look at regulatory models that make sure that customers get the right price signals and that encourage the efficient use of energy."

The Integrated Energy Network is a call for broader innovation and collaboration—and sooner—and EPRI is supporting that by:

- **Refocusing research** to look beyond electricity to the interconnections among gas, water, transport, other energy systems, and natural resources. As part of that effort, EPRI will examine new customer expectations and opportunities presented by interconnected industries.
- **Expanding membership** to enable more diverse institutions to participate in EPRI's collaborative research.
- **Increasing communication and outreach** to bolster collaboration with stakeholders across various sectors.
- **Engaging more international stakeholders** to widen the diversity of ideas and perspectives and to support collaborative research.

While new ways of thinking and operating are needed to move forward, EPRI's mission remains the same. "Our charter is to help shape the future of the electricity industry," said Ray. "When we look ahead, we see that the electric power industry's limitations, challenges, opportunities, and potential will be profoundly intertwined with other systems and resources. If we believe this to be true, then we owe it to energy providers, consumers, and society to say, 'the sooner the better' for thinking and acting more collaboratively. And specifically, EPRI has an obligation to examine and accelerate innovations to help advance efficient, cost-effective use of energy."

Integrated Energy Network—What Do We Need to Accomplish?

- Manage energy and natural resources as an integrated system.
- Guide an efficient transition to much more digital, dynamic, and networked energy systems.
- Accelerate the development of cleaner energy technologies—supply, demand, delivery, and storage technologies—that can operate more flexibly.
- Unleash and promote opportunities for efficient electrification.
- Create new business models that build on the strengths of today's energy infrastructure while taking advantage of new technological possibilities.