



Delivering the Energy Grid of the

FUTURE

CHUCK JONES

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Headquartered in Akron, Ohio, FirstEnergy is a forward-thinking electric company powered by a diverse team of employees committed to making customers' lives brighter, the environment better, and our communities stronger.

Smarter, Stronger Infrastructure for a Changing Industry

The past two years have brought significant change to FirstEnergy as we exited our competitive generation business and transitioned to a regulated electric company. While we executed the many, sometimes difficult, steps of this process, we never lost sight of our mission to make our customers' lives brighter, the environment better, and our communities stronger.

Our employees are committed to making our mission a reality by charting a new path forward in an industry undergoing rapid change, fueled by shifting customer expectations, emerging technologies, and an evolving energy mix. In November, we will publish our five-year strategic

plan, which outlines our vision for the future and describes how we will address the changing needs and preferences of our diverse customer base; enable a strong, secure, and technologically advanced electric system; and leverage emerging technologies to enable the energy grid of the future.

As we prepare to meet our customers' future needs, we'll continue to strengthen our electric infrastructure. We're making significant investments in equipment and technology that can enhance service reliability, improve resiliency against severe storms and other threats to the energy grid, and help us restore power quickly when outages occur. These infrastructure investments are particularly critical now, as electric companies face the challenge of updating infrastructure amid a rapidly changing industry. >>

Jessica Scharrer, an Ohio Edison substation electrician, tests and installs transmission and distribution equipment.

FirstEnergy

In the past few decades, electric companies have been directed by grid operators to complete enhancements needed to accommodate growth and keep electricity flowing to customers. At the same time, our industry is undergoing a transformation that will require even more from our electric infrastructure. This includes enabling microgrids, renewables, and distributed energy resources; widespread electrification of transportation, industrial equipment, and home products; continued development of smart cities; and increasingly advanced energy management tools and data. We'll need to contend simultaneously with an increased risk of extreme weather, as well as more frequent and sophisticated cyber threats. All of this requires a much more complex, integrated, secure, and technologically advanced energy grid.

Ensuring a brighter future for our customers requires long-term investments and bold steps to modernize and upgrade electric infrastructure. Though many of these improvements are invisible to customers, they are essential to modernizing the energy grid and to enabling a reliable and resilient lower-carbon energy future. It's crucial that these necessary, customer-focused projects continue to be approved and built.

Modernizing the Transmission System

FirstEnergy's subsidiaries own one of the largest transmission systems in PJM Interconnection, with lines running from Ohio to New Jersey. Through our *Energizing the Future* initiative, we're upgrading and modernizing our transmission system to improve the reliability, resiliency, and security of FirstEnergy's portion of the bulk electric system that is shared by our entire nation.

Our *Energizing the Future* projects are focused on three main areas of investment: upgrading or replacing aging equipment to reduce outages and maintenance costs; enhancing system performance through technology upgrades that modernize the energy grid; and adding

redundancy and operational flexibility to enable grid operators to respond more swiftly to changing conditions. Our cumulative investment in *Energizing the Future* from 2014 through 2018 reached \$5.6 billion.

However, customers are willing to pay for these infrastructure projects only if they provide benefits. Our *Energizing the Future* investments are driving significant performance improvements that benefit our customers. Since 2014, we've achieved the following improvements in our Ohio service area and our Penn Power service area in western Pennsylvania:

- 52 percent reduction in equipment-related outages on the transmission system;
- 46 percent reduction in the duration of equipment-related outages on the transmission system;
- 34 percent reduction in transmission-caused distribution outages;
- 52 percent reduction in the number of customers affected by these outages;
- 49 percent reduction in the duration of these outages.

We expect similar results for customers in other parts of our service territory as we expand our *Energizing the Future* program and continue modernizing our energy infrastructure. Looking ahead, we have identified additional customer-focused projects across our transmission system aimed at increasing network automation, adding operational flexibility, and hardening our infrastructure and assets against physical and cyber threats.

As electric companies move forward with necessary transmission investments, refined project management processes are needed to enhance performance and to ensure accurate and timely cost reporting. Our *Achieving Performance Excellence* (APEX) initiative provides a consistent, streamlined, and transparent process to manage the hundreds of transmission projects in various stages of planning, development, and construction each year.

Developed with input from more than 450 FirstEnergy employees and contractors, APEX helps our transmission group



L to R: Brandon Dickriede, relay tester; Stephen Ciukaj, advanced relay technician; and Levi Propst, engineer III, work to develop new energy grid solutions at FirstEnergy's Center for Advanced Energy Technology in Akron, Ohio.

standardize project management from inception to completion; implement improved and integrated systems and tools for executing projects successfully; and institute new organizational support functions to strengthen project design, procurement, and construction.

Safety is an unwavering core value at FirstEnergy. We remain committed to working safely, following all safe work practices, keeping each other safe, and eliminating life-changing events. As part of our relentless focus on safety, we will continue to improve communication, build trusting relationships, increase safety awareness and hazard recognition, and focus on fundamental personal safety training, tools, and education.

Working with Our Communities

As we continue to modernize our electric system, we are committed to protecting the environment and the communities we serve. We work to identify transmission line routes and substation locations that minimize impacts on community development, cultural features, sensitive

land uses, and ecological areas, while also considering the economic and technical feasibility of each project.

We work closely with community leaders and property owners to solicit public input when siting new energy infrastructure, including transmission lines and substations. Our public participation efforts include:

- Hosting open houses and soliciting input from municipal leaders, property owners, and community members;
- Soliciting and evaluating community feedback to develop preferred and alternative line routing options;
- Utilizing 3D project simulations to paint a clear picture of how proposed facilities will appear when complete;
- Making finalized project plans and line route maps available to the public through various communications, including individual landowner contact, fact sheets, and project websites.

Whenever possible, we strive to site transmission facilities within existing rights-of-way, an industry best practice that reduces impacts on communities and the environment.



Jordan Bobbins, a Potomac Edison substation electrician, installs a second transformer at our Moorefield Substation in West Virginia to enhance service reliability for customers.

Building a Technologically Advanced Distribution System

Our vision for the distribution grid of the future is an intelligent platform that enhances our customers' electricity service, resulting in a stronger, more valuable, and empowering energy experience. We're envisioning a future where every vital link to homes and businesses—electricity, natural gas, water, and ultra-fast broadband access—will merge into one integrated system.

To prepare for this more dynamic, intelligent, and secure distribution system, we are strengthening our grid's foundation by building a more robust and reliable communications network and replacing or upgrading aging equipment. We have previously announced that our 10 electric distribution companies are planning infrastructure investments of up to \$1.7 billion per year through 2021.

For example, our three Ohio companies—Ohio Edison, The Illuminating Company, and Toledo Edison—are investing up to \$516 million over three years in grid modernization, as approved by the Public Utilities Commission of

Ohio. The program aims to reduce the frequency and duration of outages and to help our customers make more informed decisions about their energy usage with advanced metering and communications. Projects include deploying 700,000 smart meters; installing distribution automation equipment; adding voltage-regulating equipment to provide energy efficiency benefits; and implementing an Advanced Distribution Management System that enables improved monitoring, analysis, and control.

In addition, our JCP&L Reliability Plus Infrastructure Investment Program builds on service reliability enhancements we made in our New Jersey service area in recent years with an additional \$97 million investment through December 2020. This program includes more than 1,400 projects aimed at enhancing the reliability and resiliency of overhead power lines. We plan to replace existing equipment with new smart devices, expand our vegetation management program to address tree-related outages, and use emerging technologies, including new electronic fuses and communications, to enable automation for distribution equipment.

One key project already underway is the installation of 1,700 new TripSaver automated reclosing devices on neighborhood power lines. These devices help limit the frequency and duration of power interruptions by detecting issues automatically, isolating outages, and pinpointing the location of problems to help speed restoration.

Similar investment programs in Maryland, Pennsylvania, and West Virginia also are designed to ensure continued service reliability and to prepare for the distribution grid of the future.

Securing the Electric System and Protecting Our Infrastructure Investments

Today, our electric system is expected to withstand cyberattacks and extreme weather events—and limit the impact of outages when they occur. With the threat of extreme weather becoming increasingly common, it's crucial that electric companies protect their infrastructure investments. Through our transmission and distribution modernization efforts, FirstEnergy is working to harden energy grid defenses and to enhance the resiliency of our infrastructure.

We recognize that threats to critical energy infrastructure could jeopardize public safety and potentially leave millions of customers without electricity. As cyberattacks increase in number and sophistication, we're proactively identifying and mitigating cybersecurity threats—not simply reacting to them. As part of our cybersecurity efforts, we are:

- Deploying devices that provide physical and electronic protections, logging, and monitoring;
- Increasing the use of data analytics to help predict, prepare for, and mitigate threats;
- Implementing third-party tests that use “friendly hackers” to validate our technical cybersecurity control effectiveness and remediate any deficiencies we identify;
- Enhancing the security and reliability of our transmission-related cyber assets

by deploying Critical Infrastructure Protection (CIP) standards and planning an on-site CIP audit of our electric operations to demonstrate our compliance;

- Conducting an independent assessment of every aspect of our cybersecurity program to identify improvements and to update our cybersecurity roadmap through 2022.

We will continue to defend against physical and cybersecurity threats by conducting predictive analyses to mitigate threats proactively and by evaluating and hardening our infrastructure and security defenses.

Enabling the Energy Grid of the Future

In the not-too-distant future, a smart, resilient, and dynamic energy grid will empower and connect our customers in ways we've never seen before. Autonomous electric vehicles (EVs) will become commonplace. Smartphone applications and in-home displays will digitally manage everything in the home. Solar-conductive building materials will replace solar panels, and the electrification of home products and industrial equipment, such as forklifts, will continue to grow. Most important, new technology will integrate millions of these private energy sources seamlessly with our energy grid.

As we look excitedly toward this future, our focus is reliability and resiliency. We are preparing our system for these advancements and others—microgrids, renewables, and distributed energy resources—so we can always seamlessly deliver the electricity our customers depend on every day.

On our transmission system, we're accelerating the deployment of innovative technologies through our Center for Advanced Energy Technology (CAET). This 88,000-square-foot facility is one of the first and most comprehensive testing and training centers for energy grid technology in the country. We designed it to be a centralized, hands-on environment, where our engineers and technicians can

develop and evaluate new technology and energy grid solutions and simulate a variety of real-world conditions. The facility includes classroom and training space where we can prepare our workforce to use new equipment and processes safely as we upgrade, maintain, and ensure the security of the energy grid.

In addition to supporting our grid modernization efforts, CAET also creates opportunities for us to advance best practices across the industry. We expect to collaborate with peer companies, research institutes, and key stakeholders, such as device manufacturers, that potentially could utilize our state-of-the-art facility.

Our transmission group is driving innovation by engaging employees to identify solutions for improving the engineering, design, construction, operation, and maintenance of our energy grid. Through our newly implemented Innovation Hub, we're leveraging our diverse and high-performing team by encouraging employees to share their ideas, explore new technologies, and create inventive solutions.

On our distribution system, we're working to leverage research and innovation that can deliver customer-focused service enhancements while making the environment better through emissions reductions and energy efficiency improvements.

Electric transportation, for example, reduces direct carbon emissions, improves air quality, and distributes the benefits of clean energy throughout the economy and the industry is growing rapidly. EEI and the Institute for Electric Innovation

predict that nearly 19 million EVs will be traveling on U.S. roads by 2030, requiring more than 9 million charging stations.

That's why we're advocating for charging station availability across our service territory and preparing our energy grid to enable transportation electrification.

To support Maryland's goal to have 300,000 zero-emission vehicles on the road by 2025, our Potomac Edison company is participating in a pilot program to expand the availability of EV charging stations. As part of this effort, Potomac Edison is installing company-owned public charging stations, including fast chargers, throughout its Maryland service area. Both residential customers and multi-unit dwelling property owners will be eligible for rebates. Our expertise at building electric infrastructure will help position Maryland as a leader in EV technology, and this pilot will allow Potomac Edison to gain knowledge about EV charging patterns and impacts to its distribution system in preparation for continued growth in electric transportation.

We're also partnering with the Electric Power Research Institute (EPRI) to conduct a state-level assessment of expanded efficient electrification for Ohio. Our goal is to understand the impact of efficient electrification by analyzing how a state's energy system could evolve over time, under various policies and across multiple end-use sectors. We also will conduct a comprehensive customer and societal assessment of electrification technologies to

FIRSTENERGY'S AKRON CONTROL CENTER operates and monitors transmission operations across two-thirds of the company's bulk transmission system in areas served by Ohio Edison, The Illuminating Company, Toledo Edison, Penn Power, Met-Ed, Penelec, and Jersey Central Power & Light (JCP&L). As one of the nation's most advanced transmission control centers, it plays a vital role in enabling us to provide reliable electric service to our customers. Built with sustainable and green building features and practices, the facility earned the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Silver Level certification. Our Fairmont Control Center in West Virginia monitors operations in areas served by Mon Power, Potomac Edison, and West Penn Power, and also is LEED certified.



FirstEnergy engages employees to identify innovative solutions for improving the engineering, design, construction, operation, and maintenance of our energy grid.

develop stakeholder acceptance.

We're assessing other emerging technologies to modernize our distribution system and enable the energy grid of the future. We support research to better understand efficiency opportunities in next-generation heat pumps, advanced data center infrastructure, smart thermostat developments, and advanced building design. We also work with universities on energy storage and grid integration research projects, and we have partnered with EPRI on a feasibility study to help us understand how microgrids can be integrated with our electric system efficiently to enhance resiliency for customers.

As we continue to prepare our energy grid for new technologies, we will work with our stakeholders to understand which investments are most valuable to the electric system and our customers.

Energy for a Brighter Future

As our industry and customers continue to evolve, a more resilient and reliable energy

grid is increasingly important. With a strong grid, the lower-carbon future our customers want can become a reality. By focusing on our transmission and distribution infrastructure, and making the necessary technological advancements, we can meet our customers' rising expectations and capitalize on opportunities resulting from emerging technologies and a changing energy mix.

We are energized by the possibilities ahead and confident that our company and dedicated employees are prepared to meet any challenge as we work together to deliver energy for a brighter future.



CHUCK JONES is president and CEO of FirstEnergy.