

CLIMATE REPORT



ENERGY FOR A
**BRIGHTER
FUTURE**



FirstEnergy[®]



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MESSAGE FROM THE CEO

At FirstEnergy, our mission is to make customers' lives brighter, the environment better and our communities stronger.

As part of this commitment, we're reducing our environmental impact as we build, strengthen and modernize the energy grid of the future. In 2015, we set an aggressive goal to reduce carbon dioxide (CO₂) emissions companywide by at least 90 percent below 2005 levels by 2045. As of December 31, 2018, we have reduced our CO₂ emissions by 62 percent.

This goal is only the beginning. A strong, secure and sustainable electric system relies on a modernized grid and advanced technologies that improve the environmental performance of our operations while enhancing system resiliency and service reliability for customers. We also are integrating industry best practices as we develop a comprehensive climate strategy that aligns with our fully regulated, customer-focused distribution and transmission business.

Our core values of environmental stewardship and corporate responsibility are also vitally important to our stakeholders. We are actively engaged with customers, investors, regulators, legislators, environmentalists and others to discuss climate-related matters, and remain committed to open and honest dialogue as we make the transition to a cleaner, smarter and more sustainable energy future.

Through this engagement, we recognize that stakeholders are interested in understanding how climate-related issues and risks could impact our company and learning more about our preparations for a potential low-carbon economy. To address these and other questions, our climate report includes the analysis of a 2-degree Celsius global climate scenario and the possible effect on FirstEnergy.

Built on a foundation of strong governance practices and policies, robust risk management systems and a rigorous approach to strategic planning, we are preparing for potential climate risks and are well-positioned to capitalize on the opportunities resulting from a lower-carbon future.

The past two years have brought rapid change to FirstEnergy as we shed our unregulated generating fleet and transitioned to a fully regulated electric utility company. We are pleased to present this climate report as part of our commitment to providing our customers and communities with energy for a brighter future.

Sincerely,



Charles E. Jones
President and Chief Executive Officer



Charles E. Jones
President and Chief Executive Officer

25K

MILES OF TRANSMISSION LINES

277K

MILES OF DISTRIBUTION LINES

6M

CUSTOMERS

65K

SQUARE-MILE SERVICE TERRITORY

ENERGY FOR A BRIGHTER FUTURE

FirstEnergy's 10 utility operating companies form one of the nation's largest investor-owned electric systems, with more than 277,000 miles of distribution lines serving over 6 million customers across a nearly 65,000-square-mile area of Ohio, Pennsylvania, New Jersey, West Virginia, Maryland and New York. Our transmission subsidiaries operate approximately 25,000 miles of transmission lines connecting the Midwest and Mid-Atlantic regions.

OUR MISSION

We are a forward-thinking electric utility powered by a diverse team of employees committed to making customers' lives brighter, the environment better and our communities stronger.

Our utility customers count on our distribution and transmission systems to deliver power to their homes and businesses, and to bring greater comfort, convenience, safety and productivity to their lives. Electricity is integral to meeting the needs of modern society. According to the U.S. Energy Information Administration (EIA), Americans used 13 times more electricity in 2017 than in 1950.¹ While efficiency improvements have slowed the electric consumption growth rate in recent years, the value electricity provides continues to increase. In fact, the analysis highlighted in this report, consistent with most climate scenarios, shows that the electric power sector can play a meaningful role in reducing the carbon intensity of electricity and moving to greater electrification of the economy.

From our field operations and offices to our regulated generating facilities, we are continually looking for and acting on opportunities to decrease our environmental impact and empower our customers with solutions that can reduce the region's carbon footprint. Some of these efforts are discussed throughout this report.

We are also engaged with industry organizations on climate-related issues through numerous initiatives designed to help support a low-carbon future, including:

- Participating in the Electric Power Research Institute's (EPRI) sustainability programs and its project on climate policy scenarios and greenhouse gas reduction goals. From this effort, EPRI published a study analyzing and characterizing current scientific knowledge related to climate policy risk evaluation and greenhouse gas reduction goals. The report identified technical issues and insights that provide a scientific foundation for informed discussion, analyses and decisions.
- Reporting on climate- and water-related issues through the CDP global disclosure system.
- Participating in the Edison Electric Institute's Environmental, Social, Governance (ESG)/Sustainability Template initiative to help provide the investment community with more consistent ESG/Sustainability data and information.
- Monitoring emerging developments regarding climate-related management and reporting with various financial entities.
- Supporting market design through the PJM Interconnection (PJM) stakeholder process to develop a framework that properly incentivizes and compensates resilient, fuel-secure, zero- and low-emission resources and integrates energy storage options while maintaining a safe and reliable system.

This report describes FirstEnergy's business model as a fully regulated utility company, our risk management and governance processes, and how those processes are used to address climate-related issues. It also discusses how FirstEnergy can act on opportunities and mitigate risks associated with a lower-carbon future.

In 2018, FirstEnergy reached a milestone in its previously announced strategy to exit the competitive generation business and become a fully regulated utility company with a stronger balance sheet, solid cash flow and more predictable earnings. On March 31, 2018, the Board of Directors of FirstEnergy Solutions (FES) made a voluntary filing under Chapter 11 of the United States Bankruptcy Code for FES, its subsidiaries and FirstEnergy Nuclear Operating Company (FENOC), to facilitate an orderly financial restructuring. The filing did not involve FirstEnergy or our Distribution, Transmission, Regulated Generation segments or Allegheny Energy Supply subsidiary.

As a result of the filing, FirstEnergy no longer has a controlling interest or operational control of FES, FENOC and their assets, which are now subject to the jurisdiction of the Bankruptcy Court. The entities were deconsolidated from FirstEnergy's consolidated financial statements as of March 31, 2018.

By January 1, 2020, FirstEnergy's portfolio of fossil fuel generation is expected to consist only of its regulated coal plants in West Virginia (Harrison and Fort Martin).

¹https://www.eia.gov/energyexplained/index.php?page=electricity_use



LOOKING BEYOND 2021, WE HAVE IDENTIFIED MORE THAN
\$20 BILLION

IN ADDITIONAL TRANSMISSION PROJECTS THAT WILL UPGRADE
AGING INFRASTRUCTURE, INCREASE NETWORK AUTOMATION AND
COMMUNICATION, AND ADD SYSTEM CAPACITY.

MOVING FORWARD AS A REGULATED UTILITY COMPANY

We have made a significant shift in our corporate strategy over the past several years. FirstEnergy is now a fully regulated utility company, focused primarily on our transmission, distribution and remaining regulated generation business. This strategy enables us to align our focus with market and technology trends and consider opportunities that support a lower-carbon future and our customers' expectations. The following discussion highlights key elements of our strategy as it relates to climate-related risks and opportunities.

TRANSMISSION

FirstEnergy owns one of the largest transmission systems in PJM with approximately 25,000 line miles connecting the Midwest and Mid-Atlantic regions. The transmission system is an essential part of our work to build a reliable, more resilient and lower-carbon grid. Through our *Energizing the Future* program, we are upgrading and modernizing our transmission system to ensure customers benefit from a smarter, stronger and more secure power grid for years to come.

Since launching *Energizing the Future* in 2014, FirstEnergy has completed 600 to 700 projects per year focused on three main areas of investment: upgrading or replacing aging equipment to harden our transmission infrastructure, reduce outages and cut maintenance costs; enhancing system performance through technology upgrades; and building redundancy and adding operational flexibility that enables our grid operators

to more swiftly respond to changing grid conditions. Together, these projects are producing measurable results for customers, including a 37 percent reduction in equipment-related outages on the transmission system serving The Illuminating Company, Ohio Edison and Toledo Edison utilities in Ohio, as well as our Penn Power service area in western Pennsylvania.

From 2014 to 2018, we invested nearly \$5.6 billion on grid improvement projects, and we are on track to invest approximately \$1.2 billion per year on our transmission system from 2019 through 2021. Of the \$1.2 billion per year, we expect over 75 percent of the investment to go toward enhancing grid reliability. Looking beyond 2021, we have identified more than \$20 billion in additional projects designed to help us meet the evolving energy needs of our customers, ensure service reliability into the future, add resiliency to our transmission system, meet potential future load growth in our service area, and increase physical and cyber security.

The electric grid is evolving to meet our customers' needs and a changing energy landscape. Extensive investments are required to integrate new renewable and distributed energy resources and respond to a rapidly changing energy mix. FirstEnergy continues to evaluate and deploy innovative transmission technologies, such as fiber-optic communications, advanced conductor technology and enhanced power device monitoring. We are collaborating with other utilities and industry groups such as EPRI to evaluate emerging technologies that will further strengthen and secure the grid.

Four of the five states in which FirstEnergy principally operates (Ohio, Pennsylvania, New Jersey and Maryland) are deregulated states. With a few exceptions, FirstEnergy's utilities are prohibited from owning generation in these states. This includes renewable generation assets such as solar and wind, as well as energy storage when storage is defined as a generation asset. In addition, in deregulated states, utilities are generally not permitted to own electric vehicle charging stations, unless granted permission from the appropriate state commission.



DISTRIBUTION

Our distribution business strategy is focused on building a more dynamic, intelligent and secure network that will change the way energy is delivered and provide additional opportunities for enhancing our customer-focused services. Toward that end, we're investing in projects intended to create a more resilient, flexible distribution system, while evaluating new opportunities that enable emerging technologies, such as utility-scale solar, energy storage and electric vehicles, to modernize our distribution system and meet the future energy needs of our customers. We plan to invest up to \$1.7 billion per year in our distribution operations from 2019 to 2021. Investments will go toward improving the

reliability of the distribution system, creating smarter grid opportunities, and maintaining service and reliability performance.

While our plans to build a smarter energy infrastructure are consistent across all 10 of our electric distribution utilities, our approach recognizes that each utility is at a different stage in its grid modernization efforts and each system has unique needs. The following section highlights key components of our strategy to modernize our distribution system.

GRID MODERNIZATION

We are focused on improving the reliability and resiliency of our distribution network through a significant grid

modernization effort. Since 2010, we have constructed and studied smart grid technology through pilot projects in Ohio, Pennsylvania and New Jersey. These projects have produced quantifiable improvements in network reliability and resiliency. We have filed plans with regulators across our footprint to upgrade our grid with more demand-responsive and smart technologies.

As we work to more fully develop the smart grid, we will continue to monitor and study the evolution of technology and adapt in ways that will benefit our customers. We partner with industry experts to inform our internal analyses and guide our modernization efforts, and we have worked with the United States Department of Energy (DOE) and EPRI to develop a Grid Modernization Roadmap. This roadmap will identify the next distribution system platform capabilities to enable higher reliability, resiliency, and distributed energy resource integration and utilization.



Advanced Metering Infrastructure (AMI) is a key part of a modernized grid. We continue to be active throughout our utility service area in the research, development and deployment of AMI and other web- and application-based tools that can provide customers with data to better manage their electricity use and effectively lower their carbon footprint.

In Pennsylvania, our Met-Ed, Penelec, Penn Power and West Penn Power utilities have installed smart meters for more than 2 million customers as part of a state-mandated AMI deployment plan, and expect to complete deployment of these devices for nearly all customers in the state by mid-2019. Smart meters will almost eliminate the need for estimated readings and help customers make more informed decisions about their energy usage. In the future, these devices may help us better detect power outages and restore service more quickly and efficiently.

Our three Ohio utilities – Ohio Edison Company, The Cleveland Electric Illuminating Company and The Toledo Edison Company – have a settlement pending before the Public Utilities Commission of Ohio that includes phase-one capital investments in grid modernization of up to \$516 million over three years. This includes deploying 700,000 smart meters, installing distribution automation equipment on at least 200 distribution circuits, adding voltage-regulating equipment on at least 202 circuits to provide energy efficiency benefits and implementing an Advanced Distribution Management System.



A primary aspect of our strategy is building a strong modernized distribution platform that aims to improve the reliability and resiliency of the grid with the potential to enable a lower-carbon future. A key first step in this effort is developing a Standard Distribution Circuit model that will be the basis for future infrastructure investment strategies. This model would provide the strong foundation that is essential to implement the necessary communication system; deploy smart devices that enable distribution automation and volt/VAR optimization; and empower the safe, reliable deployment of electric vehicle charging stations and distributed energy resources. This concept has been incorporated into our recent Ohio Grid Modernization filings and JCP&L Reliability Plus Infrastructure Investment Program filing with the New Jersey Board of Public Utilities (BPU). Included in the strategy are the installation of advanced reclosers, expanded supervisory control and data acquisition software, creating and strengthening circuit ties, expanding AMI, and distribution automation. As the

electrical infrastructure is upgraded, we are also updating the critical systems used to support the network, including major projects related to our distribution and outage management processes.

Rebuilding our network as a smarter grid will require a sustained effort and significant investments in time and resources. However, we believe these technologies will help FirstEnergy meet the changing needs of the grid while we efficiently manage the delivery of power.

CUSTOMER ENGAGEMENT

Another key aspect of our distribution business strategy focuses on customer engagement. We remain committed to delivering safe, affordable, secure and reliable electric services that address the changing needs and expectations of our customers. With our transition to a fully regulated utility company, we are well-positioned to respond to and fulfill evolving customer preferences.

Our grid modernization initiatives include opportunities to engage residential, commercial and industrial customers. For example, our industrial customers can use FirstEnergy's Electric Advantage program to enhance their productivity and competitiveness while meeting sustainability goals using efficient electric products such as electric forklifts and infrared heating systems for drying products and coatings.

Residential and commercial customers can make use of our new value-added products and services that can help them save energy and improve the quality of their lives. For instance, customers with smart meters can access our Energy Analyzer tool on their smartphones to view energy consumption data. The tool provides energy savings tips and data that can help them better understand their energy usage and manage their monthly electric bills.

Further, FirstEnergy continues to excel in proactive customer engagement with our largest multi-site commercial accounts. Our National Accounts program works closely with this customer segment to offer single-point-of-contact convenience for efficiently managing a wide range of electric service needs. Overall, FirstEnergy

manages more than 200 national brands that include retailers, restaurants and other industries, representing tens of thousands of electric meters in the company's footprint.

Energy efficiency measures help reduce the region's carbon footprint. FirstEnergy complies with, and often exceeds, all state and federal energy efficiency requirements. In 2018, with the help of our utilities, our customers achieved energy efficiency savings of over 1.4 million megawatt hours (MWh) across our service area. This translates to a direct reduction of potential emissions that helps FirstEnergy and our customers contribute to a lower-carbon future. These energy savings are equivalent to a CO₂ reduction of nearly 1 million metric tons, or one year of electric use for 175,000 homes, according to the U.S. Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator.

To support our goal of surpassing the established state targets, we provide multiple energy efficiency and peak demand reduction programs with hundreds of eligible measures that enable customers to reduce electric consumption, peak demand and the associated environmental impacts. There are programs designed for residential, commercial, industrial, and government/institutional customers.

EMERGING TECHNOLOGIES

We value our role as a trusted advisor to our customers and an ally in meeting their energy, sustainability and climate goals. For this reason and others, we formed an Emerging Technologies Strategy group in 2018. This new group is dedicated to exploring advanced technologies that benefit customers and support federal and state policy efforts to improve grid performance and energy security. Many of these technologies are also critical for supporting a lower-carbon electric system and reducing the carbon intensity of the overall economy through greater electrification. These technologies build on our existing regulated business platform while offering customers the flexibility and functionality they want.



Examples of this strategy include:

- We are partnering with EPRI to conduct a state-level assessment of expanded efficient electrification for Ohio. The project will identify cost-effective and resilient solutions to produce and use clean energy. 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; conducting a comprehensive customer and societal assessment of electrification technologies; and

developing and gaining stakeholder acceptance. Results may show CO₂ reduction opportunities.

- In connection with Clean Fuels Ohio, we sponsor ride-and-drive events to raise consumer awareness of the availability and benefits of Plug-in Electric Vehicles (PEVs), and we have installed electric vehicle charging stations at locations in Ohio.
- To better understand the risks and opportunities associated with local energy grids powered by onsite

energy resources, we are involved in several studies of microgrid technology. The state of New Jersey has entered into two memoranda of understanding with the DOE to study the potential of developing a microgrid. JCP&L provided a letter of support for the microgrid feasibility study and will assist with the study by sharing certain information about the company's distribution and transmission infrastructure.

FIRSTENERGY'S MON POWER AND POTOMAC EDISON'S INTEGRATED RESOURCE PLANNING

Our Mon Power utility owns two coal-fired plants in West Virginia, the 1,098 MW Fort Martin Power Station and the 1,984 MW Harrison Power Station. Recovery of investments in these operations are subject to approval by the West Virginia Public Service Commission under traditional, cost-based utility ratemaking. As a part of their regulatory obligations, Mon Power and Potomac Edison file an Integrated Resource Plan (IRP) for their generation fleet serving West Virginia customers at least every five years. The continual evaluation of our IRP helps engage state regulators, customers and other stakeholders and set a clear path of progress toward the completion of our CO₂ reduction goal. Opportunities that could be identified from this process include possible transmission enhancements, regulated renewable generation opportunities, energy efficiency and demand response initiatives. Mon Power and Potomac Edison will work through this process to evaluate what would be in the best interest of West Virginia customers and support FirstEnergy's CO₂ reduction goals.

GENERATION FLEET

As part of our transformation to a fully regulated utility, we have significantly reduced the size of our generation fleet. At its peak, FirstEnergy owned or controlled more than 23,000 megawatts (MW) of generating capacity, which was mostly from coal-fired plants. These assets included a mix of regulated and competitive generation facilities. As environmental regulations and market conditions changed, the company made decisions to close older generating facilities and sell or retire other units and facilities. Following these retirements and sales, our generating fleet and associated CO₂ emission levels were significantly reduced. Once FES emerges from bankruptcy and is fully separated, FirstEnergy's generation fleet will include just two coal-fired facilities in West Virginia (the Harrison and Fort Martin power stations), and ownership interests in pumped-storage hydro facilities in Virginia (Bath County), and in New Jersey (Yards Creek). Together these four generating facilities comprise 3,779 MW of generating capacity.

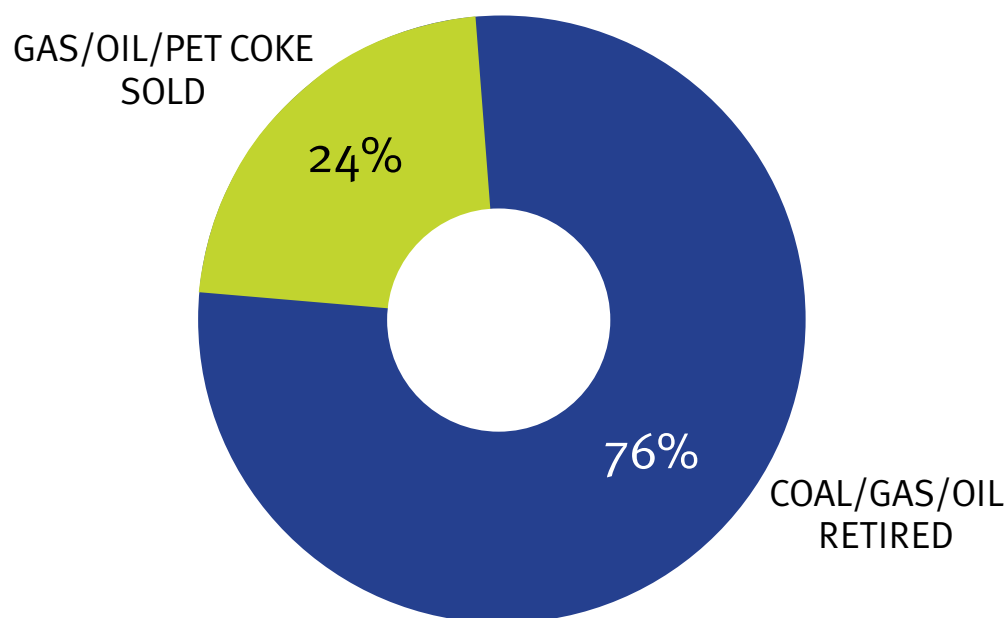
As previously described, in most states where FirstEnergy operates, our utilities are not permitted to own wind or solar generation. However, we continue to support the option for utility-owned renewable generation that is located in our footprint, allowed by the state public utility commissions, recoverable through cost-of-service based rates and in the best interest of customers.

CO₂ REDUCTION GOAL

In 2015, we set an aggressive goal to reduce CO₂ emissions by at least 90 percent below 2005 levels by 2045. We use CO₂ emissions from our generating facilities (as reported to the U.S. Environmental Protection Agency for compliance with the Clean Air Act) as the metric to assess our progress toward the established goal, and we believe our 90 percent reduction target is in line with the ambition of the 2015 Paris Agreement within the United Nations Framework Convention on Climate Change.

FIRSTENERGY ASSET RETIREMENTS AND SALES As of December 31, 2018.

As a percentage of total megawatts of generating capacity retired or sold.



We have made significant progress toward achieving our CO₂ emissions reduction goal.

By the end of 2018, we reduced CO₂ emissions by 62 percent from our 2005 baseline, which represents a total reduction of about 59 million tons of emissions.

The 62 percent reduction was accomplished through various actions, including:

- retirement of 28 units at 12 coal-fired power plants with a total capacity of 5,753 MW
- retirement of six units at four oil or gas-fired power plants with a total capacity of 197 MW

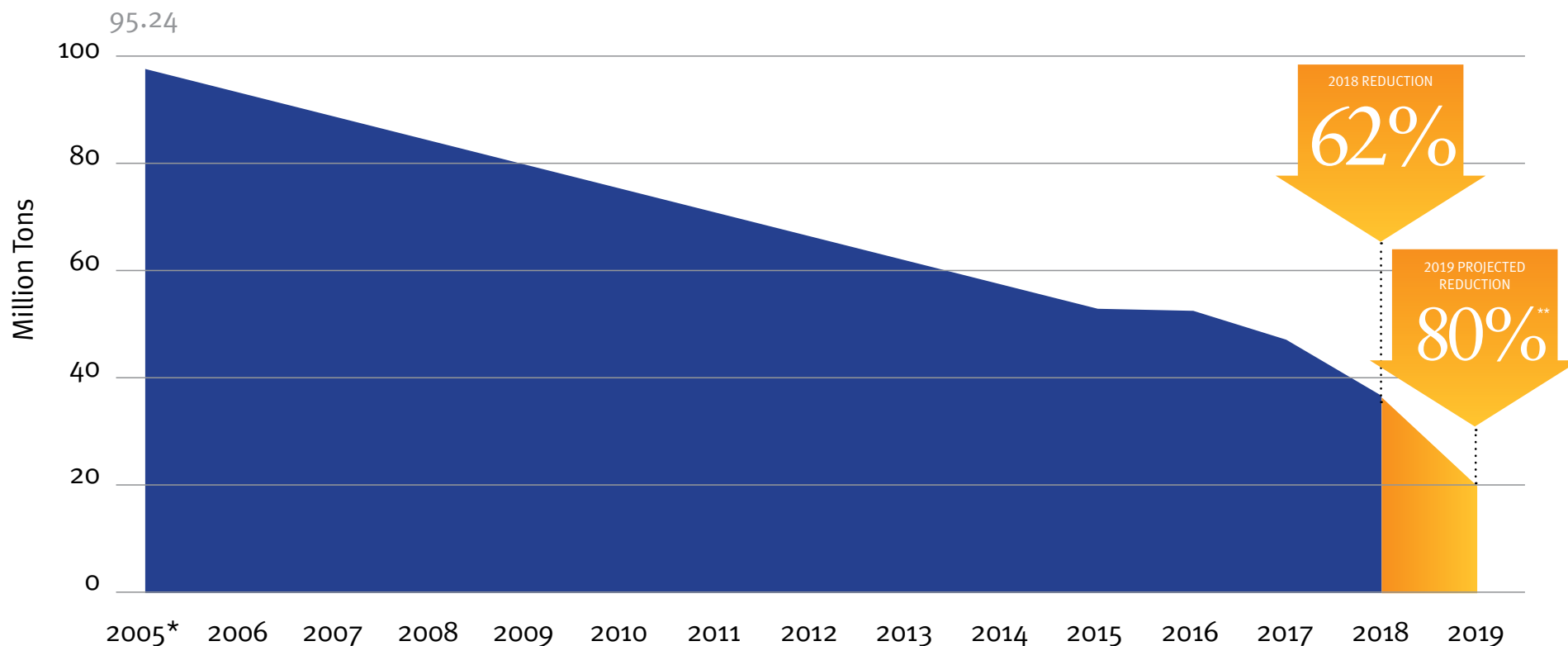
- sale of 26 units at 10 oil or gas-fired power plants with a total capacity of 1,795 MW
- sale of one unit at a fossil fuel-fired plant with a total capacity of 136 MW
- lower generation output at remaining power plants due to market conditions

Upon FES's emergence from bankruptcy, which is expected to be completed in 2019, FES will be legally separated from FirstEnergy which will no longer be accountable for the emissions associated with three additional fossil fuel-fired generation facilities, resulting in further reductions

to FirstEnergy's CO₂ emissions. At that time, we anticipate FirstEnergy's carbon emissions will be 80 percent below our 2005 baseline – placing us well ahead of schedule to achieve our goal of a 90 percent CO₂ reduction by 2045.

We intend to continually evaluate our goals in relation to our regulated generation portfolio and assess opportunities to further reduce our related CO₂ emissions, including analysis of our opportunities under integrated resource planning.

FIRSTENERGY CO₂ REDUCTION As of December 31, 2018.



2005 is base year
for CO₂ reductions

*The 2005 baseline data includes the emissions from the Allegheny Energy fleet, although the merger did not occur until 2011.

**Timing is dependent on FES's emergence from bankruptcy.

GOVERNANCE STRUCTURE

FirstEnergy delivers shareholder value through diligent risk management processes and policy oversight. We assess and manage carbon and climate risks through defined processes and key groups within the organization.

EXECUTIVE AND BOARD-LEVEL OVERSIGHT

FirstEnergy President and Chief Executive Officer Charles E. Jones is responsible for the management of climate-related issues for the company, and our Board of Directors provides oversight. Senior company executives provide regular updates with the Board and relevant Board committees on topics related to climate issues, including business strategy, legislative and regulatory policies and climate initiatives.

FirstEnergy's Board has an established and engaged committee that is responsible for oversight and feedback related to FirstEnergy's climate strategy. The Corporate

Governance, Sustainability and Corporate Responsibility Committee comprises independent Directors and meets five times per year. Each meeting includes an update on issues related to corporate responsibility, including Environmental, Social and Governance (ESG) related initiatives. Company management updates the committee on timely issues as appropriate.

STRATEGY AND CORPORATE RESPONSIBILITY ORGANIZATION

Built upon the pillars of our mission statement, FirstEnergy's corporate responsibility strategy to inform, engage and achieve results is rooted in our foundation of

strong corporate governance practices and policies that promotes transparency and accountability. This strategy is based on an overarching corporate responsibility model that helps our company be sustainable and accountable to ourselves and our stakeholders; be conscious of the impact we have on our internal and external stakeholders; operate in ways that enhance the environment and the communities in which we live and work; and be sustainable now and into the future.

FirstEnergy's senior vice president of strategy is responsible for overseeing the company's corporate responsibility strategy. This Strategy organization includes a dedicated staff whose goals are to make our customers' lives brighter, the environment better and our communities stronger through ESG and corporate responsibility initiatives. In 2019, we are focused on expanding these initiatives to inform, engage and achieve our sustainability goals for our stakeholders.

EXECUTIVE-LEVEL COMMITTEE

FirstEnergy established a cross-functional, executive-level steering committee to review and guide governance topics, including risks and opportunities associated with the climate. Members of this group include senior leadership from the Community Involvement, Corporate Secretary, Environmental, Human Resources, Investor Relations, Risk and Strategy departments. In addition, the Strategy organization has created an internal development process in which a cross-functional team assesses and prioritizes potential initiatives and shares its recommendations with the executive-level steering committee.



FirstEnergy's Board of Directors as of April 1, 2019.

SHAREHOLDER ENGAGEMENT AND OUTREACH

FirstEnergy's strong, integrated approach to corporate governance includes effective outreach to a broad base of shareholders throughout the year on a variety of topics.

Our corporate governance shareholder engagement team comprises FirstEnergy Board members, company executives and representatives from the Corporate Secretary, Environmental, Executive Compensation, Investor Relations and Strategy departments. This collaborative, year-round program results in productive dialogue among the Board, the company's leadership team and shareholders. Shareholder feedback and suggestions are reported to the Board or the appropriate committee for consideration.

We believe it is important to engage regularly with our shareholders, so we maintain an active outreach program. Our shareholder engagement efforts focus on a variety of topics, including corporate responsibility and climate-related disclosures. This outreach gives us an opportunity to discuss our continuing goal of implementing strategies that are in the best interest of our shareholders.

FirstEnergy will continue to focus significant efforts on engaging our shareholders and the investment community and will consider their views when making business decisions.

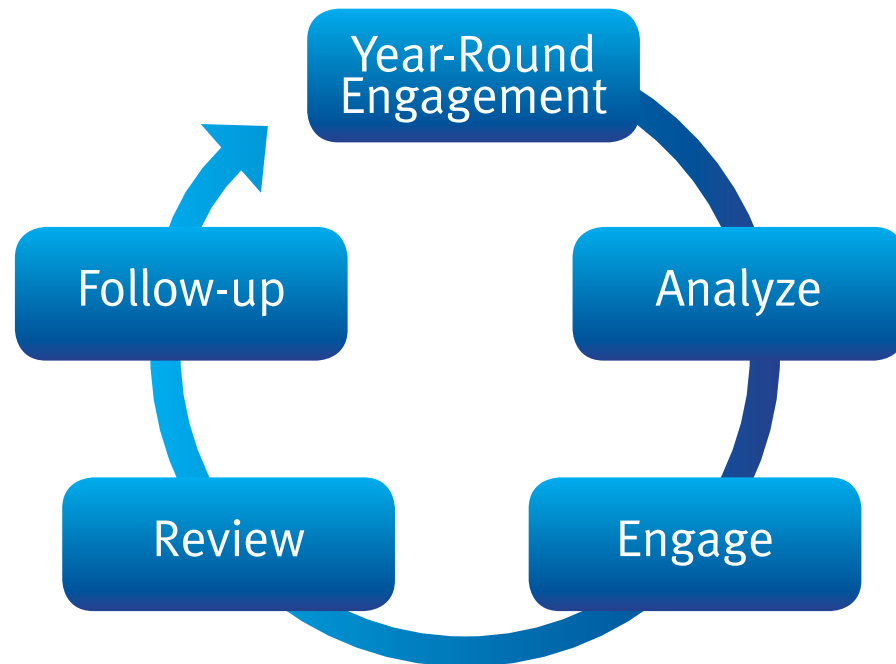


Prior to Annual Meeting

Corporate Governance Committee and, as needed, Board or various committees of Board, review the feedback from our outreach and discuss any potential changes to our corporate governance and executive compensation practices in light of shareholder feedback.

Annual Meeting Voting

Publish Proxy Statement. Follow up on previous conversations, discuss Board's decisions and reasoning, review vote proposals.



Off-Season Engagement

Based on the results of the review process, we reach out to shareholders to discuss topics of interest regarding our corporate governance and executive compensation practices, and listen to any shareholder concerns and priorities.

Post Annual Meeting Review

Corporate Governance Committee and, as needed, Board or various committees of Board, analyze and review shareholder voting and feedback and identify any topics of interest.

ENTERPRISE-WIDE RISK MANAGEMENT

Proactive and thoughtful management of our distribution, transmission and generation infrastructure is essential to delivering safe and reliable electricity to customers. FirstEnergy is focused on understanding risks that could impact its system and using the organization's strength to turn them into opportunities that maximize shareholder value while providing exceptional service to customers.

RISK IDENTIFICATION AND ASSESSMENT

A formal, comprehensive Enterprise-Wide Risk Management (EWRM) program is in place to ensure FirstEnergy thoroughly assesses and addresses risks and opportunities that could impact its electric system, including those posed by changes in the climate. These risks are assessed on a short- (0-1 years), medium- (1-3 years), and long-term (3-5 years and beyond) basis, with emphasis on long-term planning for potential climate-related issues. The EWRM's framework identifies individual risks at the enterprise, business unit or project level and groups them into four main categories (strategic,

operational, compliance and financial), all of which have potential ties to climate.

- **Strategic risks** that could affect FirstEnergy's ability to achieve long-term business goals and objectives
- **Operational risks** that could challenge the safe, reliable operation of the transmission and distribution network
- **Compliance risks** that involve regulatory and legal issues
- **Financial risks** that could impact the company's earnings, debt, credit or reporting requirements

Risks that could impact the business more than five years in the future are evaluated and analyzed to understand the potential long-term impacts of identified strategic programs. The Enterprise Risk Management (ERM)

group works closely with the business units to identify emerging risks that could have an impact on our financial results. ERM facilitates risk workshops as needed to provide stakeholders with a forum to discuss operations, objectives, challenges and risks including, but not limited to, new products and services. Risk workshops are held with key stakeholders at both the discovery phase as well as the development phase. ERM conducts bow tie analysis to understand the drivers of emerging risks, recognize the potential consequences or impacts, and identify the appropriate mitigation strategy. As more information becomes available, ERM works with the business unit to strengthen the mitigation plan as necessary to minimize the impact on the business. Once vetted, these programs are reviewed with senior management, rolled out and continuously monitored for risks, opportunities and impacts. By understanding the full range of potential events, we can position FirstEnergy to seize growth opportunities through new value-added products and services, invest in our infrastructure to better serve customers and properly align our operations as a regulated utility.

To help facilitate reporting, identified risks are placed into sub-categories such as environmental, social, governance and sustainability. Two keys to the successful integration of the EWRM are understanding the risks that may prevent the achievement of goals and objectives, and using the strengths of the organization to pursue opportunities to improve results and maximize shareholder value.

Strategic
risks that could affect
FirstEnergy's ability to
achieve long-term business
goals and objectives

Compliance
risks that involve
regulatory and legal
issues

Operational
risks that could challenge
the safe, reliable operation
of the transmission and
distribution network

Financial
risks that could impact
the company's earnings,
debt, credit or reporting
requirements

RISK MANAGEMENT

FirstEnergy's Risk Management group works collaboratively with Internal Auditing to establish a continuous review of risks and governance processes to effectively manage risks. The process utilizes a single-risk universe of our company to engage key stakeholders and subject matter experts in an ongoing dialogue regarding risks. Risks are assessed for materiality to determine their likelihood, the potential impact on earnings or cash flow, and anticipated timing and effectiveness of the current mitigation plan. This assessment helps us prioritize our response to each risk and capitalize on opportunities to maximize shareholder value. When appropriate, detailed mitigation plans are developed, implemented and regularly reviewed to measure progress.

The EWRM process and oversight of risk management is supported by FirstEnergy leadership, the Board of Directors and the Board's Audit and Finance Committees. Risks are presented to these committees on a short- and long-term basis to increase the transparency of the risks and allow each committee to play an active role in the oversight process. In addition, all risks and opportunities are reviewed to ensure alignment with strategic goals.

A large component of our EWRM addresses severe weather events, threats such as electromagnetic pulses, geomagnetic disturbances and other significant occurrences in our service territories. We continually forecast, monitor and plan for emergency situations that could impact our ability to deliver power to our customers. When significant outages occur, we rely on the industry's Mutual Assistance Network – a voluntary partnership of electric companies from across the country – to help restore power to our customers as quickly and safely as possible. We have developed an extensive internal Emergency Response Organization, which incorporates key principles and concepts of the National Incident Management System. The Incident Command System is fully structured and deployed throughout FirstEnergy, and all functional areas conduct internal exercises at least annually to test key systems, processes and training.

We also participate in working groups, training opportunities and conferences at all levels of the public and private sectors to ensure operational readiness, build key relationships, stay abreast of technological advancements, and openly share processes and lessons learned from our after-action review process. We devote considerable time and resources to developing plans to meet physical and cyber-security threats. Among other measures, we are hardening our facilities and evaluating

and testing our physical and cyber disaster response plans and processes to ensure maximum readiness against these potential attacks. We evaluate threats to our system's communications network by employing Threat Intelligence Management to detect and enhance responses to cyberattacks. This approach improves our ability to work with our government partners to enhance system security and the resilience of critical infrastructure.



SCENARIO ANALYSIS

Given the inherent uncertainty in predicting and modeling future conditions, caution should be exercised when interpreting the information provided. The results are not indicative of, and this assessment does not represent, a preferred or expected outcome or view of the future. Please see cautionary note regarding forward-looking statements located on the back cover of this report.

This scenario is not used as FirstEnergy's forecast due to the high variability, uncertain timing and magnitude of developments as described in the International Energy Agency's 2-degree scenario (2DS). FirstEnergy has a robust long-term planning process that facilitates its strategy development and long-term financial planning. We rely upon this process to, among other things, promulgate multi-year financial forecasts; inform our decisions related to debt, equity and investments; perform scenario analyses; and provide earnings and cash flow guidance to the investment community.

FirstEnergy recognizes that the application of global climate scenario model results to a specific business in a specific geography is an emerging practice. Standardized interpretation of results is critical and reinforces the need to be grounded in the science, have flexibility, embrace uncertainty and work to thoughtfully engage in discussions around 2DS analyses. FirstEnergy believes this analysis represents the best-available methodology to examine climate-related risks.

We look forward to continuing this dialogue with our stakeholders.



Globally, and across all industries, stakeholders are increasingly requesting that companies analyze risks associated with climate change. The Taskforce on Climate-Related Financial Disclosures (TCFD) recommends that companies consider conducting a 2DS analysis to help evaluate how a lower-carbon future might impact its business over time. Two-degree global climate scenarios set a pathway and global CO₂ emissions trajectory that are consistent with limiting average global temperature

increase to a range no more than 2 degrees Celsius above pre-industrial levels with a certain probability. The following discussion describes FirstEnergy's process to apply a 2DS to our operating area. This analysis complements the ongoing market and technology assessments used to inform our strategic planning efforts. Further, this analysis provided us with an opportunity to theoretically test a potential outcome to understand how our business fares in a low-carbon future.

TWO-DEGREE SCENARIO ANALYSIS

Our analysis is based on the International Energy Agency's 2DS (IEA 2DS).² In selecting a scenario to study, our objective was to evaluate a rigorous 2DS with sufficient detail to provide meaningful insights for our business and geography. We also prioritized a publicly available analysis to promote greater transparency in the process. The structure of our analysis was guided by recommendations from the TCFD as well as a report published by Ceres and authored by MJ Bradley & Associates (MJB&A).³ We also took into consideration other third-party produced 2-degree scenarios, including "beyond 2-degree" scenarios that are consistent with an October 6, 2018, Special Report on Global Warming of 1.5°C (SR15) from the Intergovernmental Panel on Climate Change (IPCC).

FIRSTENERGY'S RATIONALE FOR CHOOSING THE IEA 2DS:

Credibility: The IEA is a well-known and respected organization that provides key world energy statistics that are widely used by policymakers and business stakeholders to assess their climate strategies. The Energy Technology Perspectives (ETP) model was published in June 2017 and had dozens of expert reviewers and contributors from around the globe.

Economywide scope: The ETP model used by IEA includes the energy supply, building, industrial and transportation sectors.

Ambitious reductions: The IEA 2DS outlines an ambitious energy system pathway that achieves an 80 percent reduction in multi-sector CO₂ emissions by 2050 in the U.S. With respect to the power sector, IEA's 2DS achieves a 97 percent reduction in U.S. CO₂ emissions by 2050.

Transparent and detailed results: The ETP model includes U.S.-level results with detailed assumptions and spreadsheets of the modeling outputs in five-year increments from 2025 to 2060, including 2014 historic data.

Power sector details: Electricity production from coal (with no carbon capture sequestration) is reduced by almost 70 percent by 2030 and is close to zero by 2035.

Note: All reductions are based on IEA's 2014 baseline.

While the IEA 2DS publication provided a strong basis for this analysis, we took additional steps to interpret the IEA U.S. national-level modeling results for the FirstEnergy operating area to study the potential impacts to the company. We engaged MJB&A to utilize its State Emission Pathways Tool (STEP) to develop state-level detail from the IEA 2DS for the five states where FirstEnergy primarily operates: Ohio, Pennsylvania, West Virginia, New Jersey and Maryland. Through this process, we worked with MJB&A to focus on scenario parameters that were relevant to our regulated utility business such

as load growth, transportation electrification, building electrification and renewable generation growth. MJB&A's STEP Tool provides state-level granularity, although it does not provide detail at the level of our operating company footprint (i.e., parts of states). The analysis also utilized the U.S. EIA's Annual Energy Outlook 2018 to a limited extent to guide some trends in energy use through 2030. This more specific application of IEA's 2DS was critical to allow us to study potential impacts to our company.

²IEA's 2DS is included in IEA's *Energy Technology Perspectives* (ETP) 2017 publication.

³Climate Strategy Assessments for the U.S. Electric Power Industry, 2018 by Ceres, Inc.

⁴This scenario assumes that most of the existing nuclear capacity in the region, apart from announced retirements, continues to operate through 2050. Within the five-state region, only Oyster Creek (NJ) and Three Mile Island (PA) were assumed to retire because they had announced retirement dates. 17 GW of nuclear capacity remains in operation.

⁵The IEA ETP discusses the importance of energy storage technology for managing the grid and the IEA 2DS scenario envisions 21 GW of energy storage capacity by 2025 worldwide; however, they do not provide a U.S. estimate.

TWO-DEGREE SCENARIO RESULTS

The IEA 2DS envisions that a 90 percent reduction in multi-sector U.S. CO₂ emissions by 2060, along with other reductions across the globe, would be necessary to limit global temperature rise to below 2 degrees Celsius. When applied to our operating states, the scenario results show significant changes in energy use across all sectors of the economy, with the largest contribution from electricity generation and transportation sectors. Among the states where we serve electric customers, the electricity and transportation sectors currently account for the largest share of emissions (38 and 31 percent, respectively) and therefore, contribute the most reductions for achieving the overall emissions goals.

ELECTRIC SECTOR

The electric generating fleet across our five-state region is almost completely restructured in the scenario. Renewables and other zero-carbon resources dominate the generation mix by 2050, accounting for almost 75 percent of electricity produced within the region by 2050. Nuclear generation accounts for almost 20 percent of generation followed by natural gas combined-cycle plants at 3 percent and coal with carbon capture and storage at 2 percent.⁴ All existing coal plants operating in the region (approximately 40,000 MW of capacity) are retired by 2035. Achieving this level of decarbonization would require a significant increase in utility-scale renewable energy projects with higher average capacity factors than are currently available, transmission expansions to access regions with better renewable resource potential and an increase in energy storage capacity.⁵

The scale of the investment required by the IEA 2DS highlights the importance of the region's existing approximate 19 gigawatt (GW) nuclear generating fleet. If that nuclear capacity retires or becomes unavailable, the region would need an additional 50 GW of renewable capacity, assuming a 30 percent capacity factor.

END-USE ELECTRIFICATION AND EFFICIENCY

IEA's 2DS describes the rapid and widespread electrification of end-use technologies, including motor vehicles and heat pumps, required to achieve a 90 percent reduction in U.S. CO₂ emissions.

Emissions in the transportation sector (excluding aviation fuel) are reduced by 70 percent by 2050. To achieve this, motor gasoline and diesel consumption each decline by about 70 percent. Passenger cars are almost completely electric by 2050 (90 percent of in-use vehicles), which requires virtually 100 percent of vehicle sales to be electric by at least 2035. To achieve further transportation sector emission reductions, other vehicle classes are also assumed to adopt electric vehicle models by 2050, including 50 percent of in-use light trucks, 75 percent of buses and 60 percent of single-unit trucks.

While residential, commercial and industrial customer consumption accounts for a smaller share of overall emissions, they make crucial contributions to meeting economywide emissions goals. To reduce residential sector emissions, 80 percent of homes using natural gas and almost all homes using oil as primary heating fuels are converted to electric heat pumps. Buildings also achieve significant annual efficiency gains, reaching 0.7 percent per year for houses and 1 percent per year for commercial buildings through 2050.

The potential changes to energy sources, delivery and end use as contemplated by the IEA 2DS and as outlined above in the regions we serve could present both risks and opportunities to FirstEnergy as described in the following sections.



TWO-DEGREE SCENARIO IMPLICATIONS – RISKS AND OPPORTUNITIES

Our regulated utility business strategy is aligned with current market and technology trends and provides a strong foundation for our company's growth. At the same time, FirstEnergy's business strategy is consistent with efforts to transition to a lower-carbon energy future and the degree of change described by the IEA 2DS. More specifically, the regulated utility industry, including our regulated utility business, is uniquely positioned to enable electrification in the transportation, buildings and industrial sectors, and support associated multi-sector CO₂ emission reductions. The potential risks and opportunities our regulated utility business might face in such a scenario is discussed in the analysis below.

RISKS

As described in the scenario analysis section, dramatic changes are anticipated in the IEA 2DS. The scale and pace of those changes present risks to our transmission and distribution system and generation fleet, as well as financial risks to our customers and our company. In the following discussion, we discuss risks that are integrated into FirstEnergy's risk planning process that could present themselves in the hypothetical IEA 2DS in the states where we operate.

STRATEGIC RISKS

As a fully regulated utility, the implications to FirstEnergy of the changes outlined in the IEA 2DS present strategic risks since the ability to implement the required changes are dependent on future public policy and regulatory decisions that would allow for regulated utilities to own renewable generation and electric vehicle charging stations. Federal and state regulatory frameworks would need to adapt to the changing market, operational and technological conditions to achieve the decarbonization described in the scenario. These changes would necessitate market reforms and pricing mechanisms that create financial incentives to integrate renewable generation, incentivize retirements of fossil plants and support expansion of the transmission grid. Policy and regulatory reforms would be needed at an accelerated

pace to ensure regulated utilities have enough resources to provide safe, reliable and affordable service that is responsive to customer preferences.

We actively engage with federal and state legislators, regulators, customers and other stakeholders to facilitate an open and constructive dialogue on changing market conditions and appropriate measures required to maintain high-quality service for our customers. In addition, we work with state and federal policymakers to educate and advance FirstEnergy's position on legislative and regulatory proposals that shape FirstEnergy's future. Policymakers who understand our vision, mission and strategies can help support our efforts toward a brighter energy future.

OPERATIONAL RISKS

The majority of risks to FirstEnergy as described in the IEA 2DS are operational in nature and would particularly impact our transmission and distribution system. These risks include impacts of a changing generation mix in a carbon-constrained economy and implications of increased electrification of end-use technologies. These broad categories are detailed in the following sections.

A Changing Generation Mix: The IEA 2DS offers one potential scenario in which conventional coal generation

The IEA 2DS emphasizes the need to nearly double the electric industry's current level of investment in transmission and distribution networks by 2040. This includes investment in a smarter, more flexible grid.

has been eliminated and zero-carbon resources (not including nuclear) account for almost 75 percent of the generation mix. In MJB&A's STEP Tool analysis, this includes the addition of approximately 2,500 MW of renewable or other zero-carbon emitting resources per year through 2025 in the states where FirstEnergy operates. Additional non-emitting resources must then be added at an accelerated rate from 2026 through 2035 to compensate for the loss of coal and gas generation, as well as the increased load from transportation and the adoption of electric heat pumps. Given the scale of this challenge, keeping pace with this level of capacity additions would require a heavy emphasis on transmission expansions. The IEA 2DS emphasizes the need to nearly double the electric industry's current level of investment in transmission and distribution networks by 2040. This includes investment in a smarter, more flexible grid.

The potential operational risks of this decarbonization could challenge a utility's ability to provide safe, reliable and affordable service to customers. Risks include the inability to implement utility-owned generation projects due to regulatory constructs in some states; the need for growth in energy-storage technologies; and a transmission and distribution system that is unable to reliably support a grid with fewer dispatchable resources. One specific example includes the risk of distributed energy resources. Without additional technology advancements, distributed energy resources present operational challenges as their increased penetration results in multiple power flows. This could create anomalies with voltage regulation and circuit protection, causing outages and ultimately reliability concerns for our customers.

Increased Electrification of End-use Technology: The IEA 2DS envisions a future with widespread electrification, including extensive use of electric vehicles and widespread

conversion to heat pumps in residential, commercial and industrial buildings. In a highly electrified economy such as the one described in the IEA 2DS, the loss of power would not just mean loss of lighting and refrigeration; it would also mean losing the ability to heat homes and businesses, power transportation and communication systems, and operate water and sewage pumps. According to MJB&A's analysis of the IEA 2DS, transportation load on the electric system increases from virtually zero today to more than 95 million MWh per year by 2050 across the five-state region where we operate. To put that in perspective, 95 million MWh represents an approximately 20 percent increase over total current electric consumption within the region. This increase would result in the need to accommodate dramatic increases in load during peak and non-peak hours, thereby potentially causing an operational risk to the transmission and distribution system.

Utility companies such as FirstEnergy will have a central role in modernizing and hardening systems to meet service obligations, accommodate a changing generation mix, and move toward electrification of end-use technologies. The company's *Energizing the Future* transmission investment program and comparable improvements on the distribution system are critical to providing a more flexible system that can respond to the continually changing demand and power flows on the system. FirstEnergy will continue to work with developers, researchers and policymakers to better understand and work through these challenges and help advance new technologies that are critical to the effective and efficient operation of the changing distribution system. Our ability to sustain reliable and resilient electric service is critical to our region's economic success and security. It also will be critical to building a low-carbon energy infrastructure.

COMPLIANCE RISKS

Compliance with future carbon policies such as carbon pricing mechanisms could have material adverse effect on our earnings and competitive position. Examples of clean energy policies that could be relied upon to drive investments outlined in the IEA 2DS include Renewable Portfolio Standards and energy efficiency targets. While FirstEnergy has a strong track record of meeting or exceeding state targets for renewables and energy efficiency, dramatic expansion or acceleration of these programs could pose significant compliance risks if new compliance schedules exceed an orderly pace of investment.



We also face potential compliance risks associated with our two regulated coal plants located in West Virginia. The IEA 2DS sets a carbon reduction trajectory to require the retirement of all existing coal plants in our five-state region by 2030. As described in the strategy section of this report, our Fort Martin and Harrison power stations are regulated by the West Virginia Public Service Commission under traditional cost-based, utility ratemaking. We believe the compliance risk due to carbon policies at these units is relatively low because any investment or operating decisions will be subject to state approval and cost recovery. We will work with state regulators, customers and other stakeholders to evaluate future operating decisions for these plants, ensuring they are in the best interest of our customers and support our CO₂ reduction goals. However, new policies that require an aggressive time schedule for retiring or repowering these units could pose a risk to our ability to have a stable, reliable, secure and cost-effective power supply for our customers.

FINANCIAL RISKS

We are committed to providing reliable and cost-effective electricity to our customers. This could prove challenging in a carbon-constrained economy as identified in the IEA 2DS due to investments needed to strengthen our transmission grid, integrate technology on our distribution system and support a changing generation fleet. The IEA 2DS would require an acceleration of these investments, leading to costs that could impede our ability to provide affordable service or receive timely cost recovery.

As a fully regulated company, we recover our investments and associated expenses for utility operations through the regulated ratemaking process. Although we currently have regulatory recovery mechanisms in place that limit our financial risk, the future recovery of investments in line with the IEA 2DS could require new or different approaches to ensure timely recovery of required investments.

FIRSTENERGY USES DIFFERENT TYPES OF COST RECOVERY MECHANISMS ACROSS ITS REGULATED BUSINESSES.

DISTRIBUTION

The regulatory framework differs in each of the five states served by our utilities, and not all mitigation strategies are employed in every state. In general, however, financial risks to the company are actively mitigated in the following ways:

- Recovery mechanisms, including riders and surcharges, are implemented to reduce regulatory lag and provide timely recovery of our investments. These riders enable the company to invest in areas focused on our customers including, but not limited to, distribution grid modernization, vegetation management and infrastructure improvements.
- Rate cases are the mechanism used to align base rates with changes in revenues and expenses.
- Fully projected future test year – our four Pennsylvania operating companies use this regulatory framework, which naturally allows for capturing any projected revenue loss (i.e., energy efficiency impacts) as well as increased costs and investments.
- Storm cost recovery – to mitigate the financial risk of storms, FirstEnergy's regulated subsidiaries have established approved deferral mechanisms and storm reserves.

TRANSMISSION

- There are two regulatory recovery mechanisms in FirstEnergy's regulated transmission segment: forward-looking formula rates and stated rates. Forward-looking formula rates, also known as projected revenue requirements, allow for the timely recovery of expenses and return on investments, as well as faster conversion of capital spend to cash. With stated rates, capital spend is supported by the revenues received from the prescribed rates. Historically, approximately 80 percent of transmission spend is within the forward-looking formula rate companies, and 20 percent is within the stated rate companies.

GENERATION

- Generation cost recovery for FirstEnergy's regulated generation fleet committed to West Virginia is similar to distribution cost recovery because it consists of traditional cost-based, utility ratemaking. Cost recovery generally consists of: (1) collection through base rates of generation costs that are generally fixed and insensitive to changes in electricity consumption, such as capitalized generation facilities; and (2) collection through expanded net energy cost rates of generation variable costs, such as fuel, purchased power and PJM costs incurred to provide service to customers. While generation rates fluctuate with auction results in many of our jurisdictions, in West Virginia, the expanded net energy cost component of rates can modulate potentially volatile changes in the variable component of generation costs.

We will work with state regulators, customers and other stakeholders to evaluate future operating decisions for these plants, ensuring they are in the best interest of our customers and support our CO₂ reduction goals.

OPPORTUNITIES

Our ongoing grid modernization efforts, together with our focus on delivering new technologies and services that meet the future energy needs of our customers, support the transition to a more secure, resilient, efficient and lower-carbon electric grid. The IEA 2DS presents a scenario in which this transition accelerates, and – at the same time – the role of electricity expands to support carbon reduction efforts in more sectors of the economy, including transportation, buildings and industry. This future presents significant opportunities for FirstEnergy.

Although FirstEnergy is no longer a major producer of electricity, its transmission and distribution utilities would play a critical role in accomplishing the decarbonization of the generation fleet and the multi-sector electrification presented in IEA's 2DS. FirstEnergy works closely with the region's electric system operator, PJM, to ensure that the transmission system can reliably support system and customer needs. In this way, FirstEnergy will continue to play a critical role enabling the ongoing changes to the electric generating fleet.

Through our Emerging Technologies Strategy group, we are developing or capitalizing on technologies and investments to enhance distribution system safety, reliability, resiliency and economic growth in our service territory.

TRANSMISSION AND DISTRIBUTION

As the operator of one of the largest investor-owned electric systems in the United States, we would be called upon to make substantial investments in our system to facilitate the changes outlined in the IEA 2DS. The scenario assumes rapid and widespread electrification of end-use technologies, including motor vehicles and buildings. Electrification amplifies the benefits of a low-carbon grid by substituting direct fossil fuel use with low- and zero-carbon electricity. Energy efficiency is also an important element in beneficial electrification to reduce total energy use and manage costs.

Some of the key technology opportunities that we have been evaluating or actively deploying include smart grid technology, distributed energy resources, energy storage, electric vehicle chargers and energy efficiency. We are also evaluating opportunities for microgrids to improve

the reliability and resiliency of the electric system during natural disasters.

SMART GRID TECHNOLOGY

Meeting the evolving needs and changing expectations of consumers and enabling their adoption of new technologies requires a modern electric grid that is more intelligent, flexible and secure. For grid modernization to occur, distribution platform enhancements will be necessary, including smart grid technologies. These upgrades will improve grid resiliency and reliability, benefiting customers in the near term, while providing the bridge to the implementation of other, more advanced smart grid technologies and integration of distributed energy resources. Smart grids also provide an opportunity for our customers to benefit from potential demand response programs.

We will continue to explore smart grid technology opportunities, particularly in ways that will benefit our customers and support a low-carbon energy system.

DISTRIBUTED ENERGY RESOURCES

A diverse portfolio of technologies will be needed to deliver secure and affordable energy services while also reducing emissions. Our Emerging Technologies Strategy group is exploring opportunities that will support greater adoption of distributed energy resources, such as rooftop solar and distributed battery storage. In MJB&A's analysis, zero-emitting generation expands by more than 300 percent by 2050. Distributed energy resources will help meet that future resource need as the technology continues to improve and costs decline.



ENERGY STORAGE

We are evaluating energy storage as a potential asset to our transmission and distribution operations. IEA's ETP emphasizes that meeting the 2DS targets will require continued growth in energy storage technologies and coherent policies to complement the promising technological developments. For customers to benefit from greater operational flexibility that results in enhanced grid reliability, we could, under an appropriate regulatory construct, deploy, own, operate, control and maintain energy storage systems to support transmission or distribution operations as a utility asset and as a regulated investment. Energy storage could be used to support multiple applications, such as energy management, backup power and load leveling as well as frequency regulation, voltage support, grid stabilization, reliability and resiliency. State support of energy storage that is owned and operated by utilities to enhance service reliability would likely increase the momentum in its adoption.

PEVs AND INFRASTRUCTURE

The IEA 2DS requires rapid and widespread electrification of end-use technologies, including a large number of electric vehicles. Consistent with the goal to reduce economywide emissions, we support moving forward with transportation electrification. However, it is important that there is electric distribution company engagement from the beginning of this transition. Regulated electric utilities like FirstEnergy are well-positioned to offer public charging services for electric vehicles because utilities can best plan and manage regular maintenance and upkeep to avoid long PEV service equipment downtime, optimize charging retail rates and plan for long-term infrastructure rollouts that are not subject to short-term profitability goals. Utilities also can identify PEV charging station sites in optimal locations across the service territory, considering low-income and disadvantaged neighborhoods, travel corridors – which can help induce tourism – and optimal placement for grid interconnections.

Electric utility support for electric vehicle adoption, charging infrastructure and the efficient use of electricity will yield tremendous environmental benefits, including



significant CO₂ reductions, by lowering emissions from transportation fuels.

We will continue to research opportunities to support electrification of the transportation sector. For example, in Maryland, our Potomac Edison utility received approval to establish a utility pilot program featuring rebate and EV charging infrastructure offerings. The programs will include customer and company-owned charging stations and customer outreach components.

ENERGY EFFICIENCY

Energy efficiency is an important element of the IEA 2DS, as it will help to reduce total energy use and manage costs for customers. Our energy efficiency team has experience implementing a wide array of customer programs that promote more efficient technologies to reduce total energy use, thereby lowering CO₂ emissions. As part of energy efficiency program design and development, our operating companies explore and evaluate emerging technologies for potential application in future efficiency and demand

reduction programs. Through partnerships with EPRI, we have contributed to research advancing knowledge in areas of efficient appliances, heating ventilation and air conditioning technologies, light emitting diode lighting, smart thermostats and data center technologies.

Throughout our operating region, states provide a range of mechanisms to recover costs associated with energy efficiency programs and in some instances to recover lost revenue associated with energy efficiency or demand reduction programs. For example, in Ohio our electric utilities are required to implement programs that achieve certain energy savings benchmarks starting in 2009, with a cumulative energy savings benchmark of 22.2 percent by 2027. The costs of these plans are recovered through existing rate mechanisms. Programs that rely upon the unique positioning and expertise of electric utilities would likely be accelerated under the IEA 2DS to further reduce the customers' energy intensity.

MICROGRIDS

Although not necessarily a carbon abatement strategy, the use of microgrids could potentially improve the reliability and resiliency of critical electric utility infrastructure during natural disasters. Therefore, microgrids are viewed as a potential opportunity for FirstEnergy in a carbon-constrained economy as a service enhancement for our customers. For example, microgrids may complement utility electric service by providing an added layer of outage resilience for critical service providers such as municipalities, universities, schools, hospitals and military bases during major adverse events. Microgrids could also complement utility electric service for buildings on common property that are managed as one, or for communities susceptible to power outages due to extreme weather events or other system anomalies.

Due to economies of scale, we believe that utility-owned renewable generation is more cost effective for customers than individually owned renewable generation, and that a sensible and realistic plan for increasing renewable generation is to leverage the role of the electric distribution company.

GENERATION

UTILITY-OWNED RENEWABLE REGULATED GENERATION

Due to economies of scale, we believe that utility-owned renewable generation is more cost effective for customers than individually owned renewable generation, and that a sensible and realistic plan for increasing renewable generation is to leverage the role of the electric distribution company. The cost of utility-scale solar, for example, is a fraction of the cost of a rooftop, residential system, enabling dramatically more capacity to be installed for the same level of investment. Electric distribution companies in many cases are best able to develop, build, own, safely operate and maintain one or more large utility-scale projects interconnected with the grid. Electric distribution companies have the engineering expertise and knowledge of the intricacies of the distribution system to optimize the locational net benefit of renewable resources. This could provide us with an opportunity to more clearly demonstrate a commitment to renewable generation, and further incentivize us to exceed renewable portfolio standard mandates. We will continue to explore opportunities for utility-owned renewable generation in the states where we operate.

The role of renewable and other zero-carbon generation is central in the IEA 2DS. We could consider investments in utility-owned, regulated renewable generation under a conducive regulatory construct; however, this would require changes to current law in several of the states we serve.

COAL-FIRED PLANTS IN WEST VIRGINIA

There may be opportunities for co-firing at the Harrison and Fort Martin power stations. Co-firing with natural gas would reduce CO₂ emissions by reducing coal consumption. It could also ensure the Mon Power generation fleet continues to produce low-cost electricity with reduced environmental impacts, while leveraging the abundant low-cost natural gas prevalent throughout the region.

As Mon Power updates its IRP, it will continue to evaluate a range of options to address its capacity obligations in West Virginia with the goal of leveraging opportunities to decrease its carbon footprint.

INCREASED VALUE OF HYDRO ASSETS

FirstEnergy's ownership interests in pumped-storage hydro facilities in Virginia (Bath County – 487 MW) and

New Jersey (Yard Creek – 210 MW) can assist in integrating intermittent renewable energy resources by pumping water when renewable output is high and releasing water to spin turbines when renewable output is low. Pumped-storage hydro is the leading source of energy storage capacity within the U.S.⁶ The value of these resources could increase in the future as more renewables are deployed in the region.



⁶Source: https://www.eia.gov/analysis/studies/electricity/batterystorage/pdf/battery_storage.pdf



MAKING THE TRANSITION TO A CLEANER AND SMARTER ENERGY FUTURE

As a fully regulated utility with a sound, customer-focused growth strategy, FirstEnergy is committed to its mission statement: to be a forward-looking electric utility, powered by a diverse team of employees committed to making customers' lives brighter, the environment better and our communities stronger.

Through our evaluation of a 2DS, we have envisioned an ambitious reduction in economywide carbon emissions over the next several decades. We have studied the implications of this scenario on our five-state service area to better understand the risks and opportunities to our business. While this scenario is not used as a part of our current planning forecast, we are confident that we are already well-positioned to mitigate those risks, and we are exploring and acting upon many of the related opportunities that can benefit our shareholders, customers and communities. These actions include the continued implementation of our Corporate Responsibility, Emerging Technologies, Regulated Generation, and Transmission and Distribution strategies, as discussed in this report. The insights gained from this scenario will help inform our strategic planning process.

We will continue to monitor risks and opportunities to better understand their implications in a future described by the 2DS and advocate for regulatory and legislative changes that will support opportunities for regulated businesses that operate in deregulated states. We will continue to refine our analysis and share our efforts and progress with stakeholders in future reports.

We look forward to continuing this engagement with our stakeholders as we provide energy for a brighter future.

APPENDIX

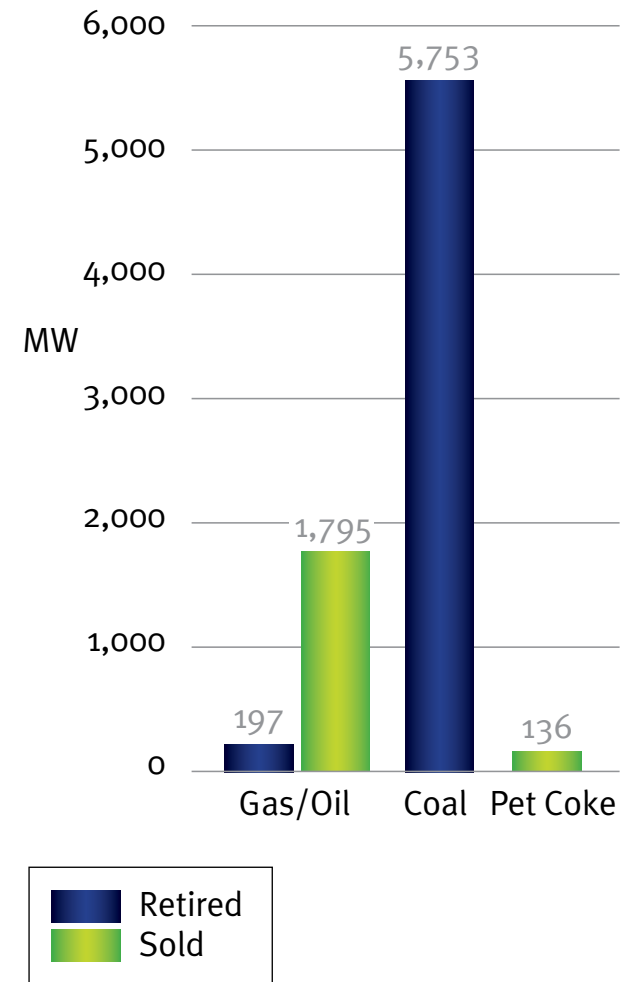
FIRSTENERGY COAL PLANT RETIREMENTS As of December 31, 2018.

PLANT	UNITS	MW RETIRED	YEAR RETIRED
Albright	3	292	2012
Armstrong	2	356	2012
Ashtabula	1	244	2015
Bayshore	3	495	2012
Eastlake	5	1,233	1-3 - 2015; 4-5 - 2012
Hatfield's Ferry	3	1,710	2013
Lake Shore	1	245	2015
Mitchell	1	288	2013
R. Paul Smith	2	116	2012
R.E. Burger	3	406	4-5 - 2010; 3 - 2012
Rivesville	2	126	2012
Willow Island	2	242	2012
TOTAL	28	5,753	

FIRSTENERGY GAS/OIL PLANT SALES/RETIREMENTS As of December 31, 2018.

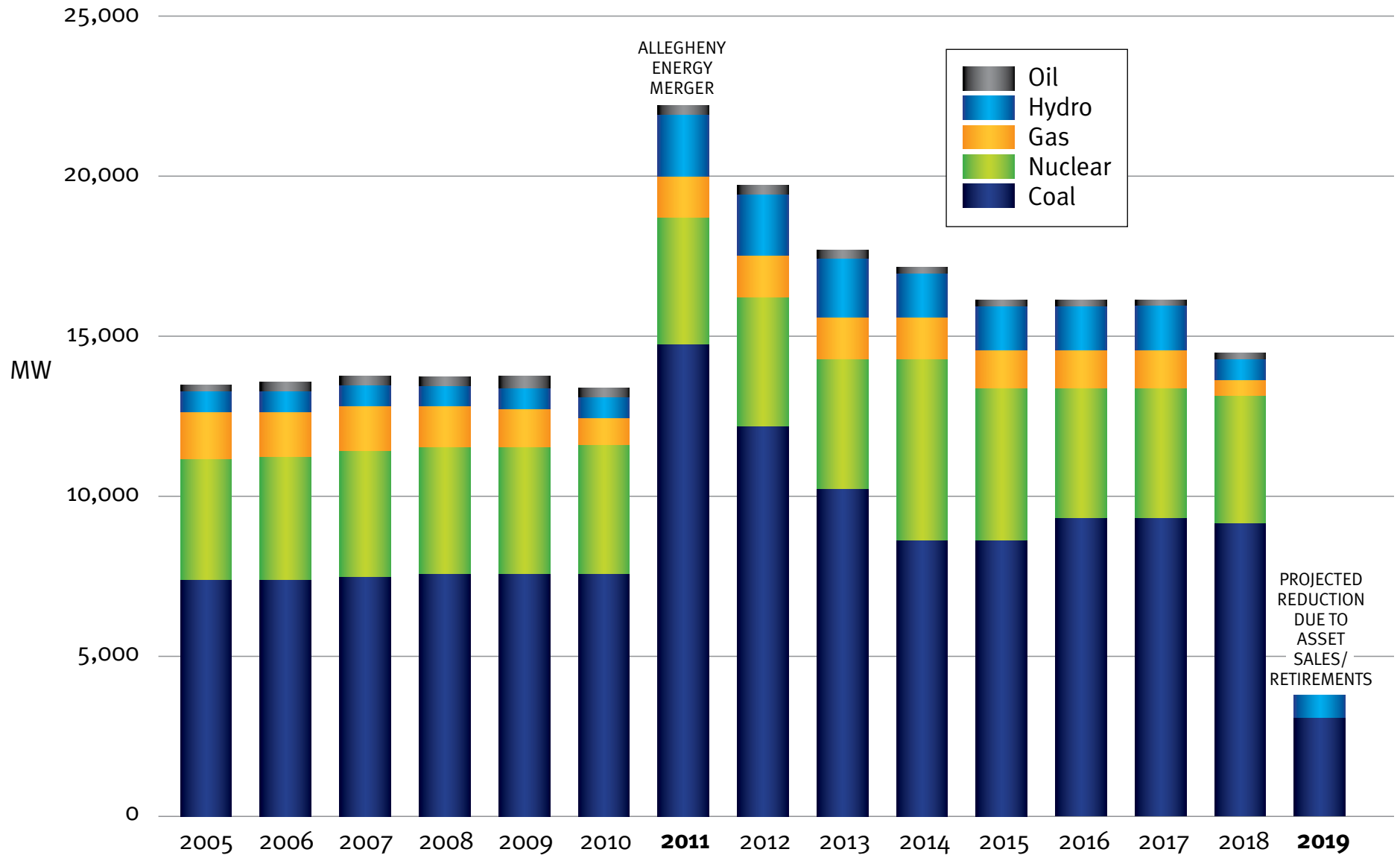
PLANT	GAS UNITS	OIL UNITS	PET COKE UNIT	MW RETIRED	MW SOLD	YEAR SOLD	YEAR RETIRED
AE Chambersburg 12 & 13	2	0		–	88	2017	
AE Gans 8 & 9	2	0		–	88	2017	
AE Springdale	5	0		–	638	2017	
Bay Shore 1		1	1		153	2018	
Buchanan	2	0		–	43	2018	
Burger		1		7			2015
Edgewater	0	2		48	–		2010
Forked River*	1	1			86	2008	
Hunlock 4	1	0		–	45	2017	
Mad River	0	2		60	–		2013
Mitchell	0	1		82	–		2013
Richland	5	1		–	432	2011	
Stryker	0	1		–	18	2011	
Sumpter	4	0		–	340	2010	
Total Gas/Oil Retired	0	6		197	–		
Total Gas/Oil Sold	22	4		–	1,795		
Total Pet Coke Sold			1		136		

FIRSTENERGY GAS/OIL, COAL, PET COKE SALES/RETIREMENTS As of December 31, 2018.



* PPA ended in April 2018

FIRSTENERGY CAPACITY EVOLUTION As of December 31, 2018.



Net Capacity sourced from ABB Velocity Suite.
Capacity values represent ownership as of the end of each year (2019 is projected).

FirstEnergy tracks and evaluates a wide range of industry metrics for its business planning and investments, including technology costs, fuel prices and load forecasts. Key indicators (or “signposts”) specific to the 2DS analyzed in this report are listed in the table below with baseline values and potential 2030 values for FirstEnergy’s five-state region. These metrics are intended to provide leading indicators for market and policy developments that are in line with the 2DS.

CATEGORY	METRIC	BASELINE (YEARS VARY)	APPROXIMATE 2DS LEVEL: 2030
ELECTRICITY GENERATION (WITHIN THE FIVE-STATE REGION)			
Generation Fuel Mix	% coal generation	42% (2015)	15%
	% zero carbon generation ¹	32% (2015)	60%
	% natural gas generation	22% (2015)	20%
Emissions (million short tons)	CO2 emissions	301 (2015)	160
END-USE ELECTRIFICATION AND EFFICIENCY			
Electric Vehicle Market Share (%) ²	Regional average	0.65% (2017)	Greater than 50% ³
	Ohio	0.37% (2017)	
	Pennsylvania	0.55% (2017)	
	West Virginia	0.15% (2017)	
	New Jersey	0.91% (2017)	
	Maryland	1.05% (2017)	
Public Charging Stations/Outlets (#) ⁴	Ohio	417/956 (2019)	20,000+ outlets
	Pennsylvania	421/983 (2019)	20,000+ outlets
	West Virginia	87/207 (2019)	4,000+ outlets
	New Jersey	279/704 (2019)	10,000+ outlets
	Maryland	583/1,535 (2019)	8,000+ outlets
Energy Efficiency (\$ million) ⁵	Energy Efficiency Program Budgets	\$1,364	Stable or increasing
Housing Units that Use Electricity as Their Main Heating Fuel (%) ⁶	East North Central Census Region	20% (2015)	20% - 30%
	Middle Atlantic Census Region	15% (2015)	
CLIMATE POLICY			
Federal or State Policies Targeting Significant Greenhouse Gas Reductions	Electric Sector	Maryland, New Jersey ⁷	Region-wide
	Other Sectors (i.e., Transportation)	None	Region-wide

¹ Zero carbon generation includes renewables, nuclear, fossil generation with carbon capture and sequestration, and hydroelectric.

² Electric vehicles (PHEV and BEV) as a percent of total light duty vehicle sales <http://evadoption.com/ev-market-share/ev-market-share-state/>. Regional average is weighted by vehicle sales (Auto Alliance as of Dec. 31, 2017).

³ The passenger fleet will turn over in 15-20 years. To get to 90% electric vehicles by 2050 about 90% of new vehicles would need to be electric by 2035.

⁴ Level 2 and DC Fast. U.S. Department of Energy. Alternative Fuels Data Center. Accessed February 2019. The 2DS estimate was calculated using DOE’s EVI-Pro Lite tool (default assumptions), fitting the data to a logarithmic scale, and extrapolating to a 25% electric vehicle penetration scenario.

⁵ Consortium for Energy Efficiency, Inc. 2017 State of the Efficiency Program Industry: Budgets, Expenditures, and Impacts. March 21, 2018. Efficiency Program Industry by State and Region Appendices, 2017 (sum of five state region). Represents both Electric and Gas efficiency program budgets.

⁶ U.S. EIA. Residential Energy Consumption Survey. May 31, 2018.

⁷ Maryland: RGGI, H.B. 1106; New Jersey: A-3723, S-2313, Executive Order No. 28.

Forward-Looking Statements: This report includes forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995 based on information currently available. Unless the context requires otherwise, as used herein, references to “we,” “us,” “our,” and “FirstEnergy” refer to FirstEnergy Corp. Forward-looking statements are subject to certain risks and uncertainties and readers are cautioned not to place undue reliance on these forward-looking statements. These statements include declarations regarding management’s intents, beliefs and current expectations, and typically contain, but are not limited to, the terms “anticipate,” “potential,” “expect,” “forecast,” “target,” “will,” “intend,” “believe,” “project,” “estimate,” “plan” and similar words. Forward-looking statements involve estimates, assumptions, known and unknown risks, uncertainties and other factors that may cause actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by such forward-looking statements, which may include the following: the ability to successfully execute an exit from commodity-based generation; the risks associated with the Chapter 11 bankruptcy proceedings involving FirstEnergy Solutions Corp. (FES), its subsidiaries, and FirstEnergy Nuclear Operating Company (FENOC) (FES Bankruptcy) that could adversely affect FirstEnergy, FirstEnergy’s liquidity or results of operations, including, without limitation, that conditions to our settlement agreement with respect to the FES Bankruptcy settlement agreement may not be met or that such settlement agreement may not be otherwise consummated, and if so, the potential for litigation and payment demands against us by FES, FENOC or their creditors; the ability to accomplish or realize anticipated benefits from strategic and financial goals, including, but not limited to, our strategy to operate and grow as a fully regulated business, to execute our transmission and distribution investment plans, to continue to reduce costs through FE Tomorrow, which is the FirstEnergy initiative launched in late 2016 to identify our optimal organization structure and properly align corporate costs and systems to efficiently support FirstEnergy as a fully regulated company going forward, and other initiatives, and to improve our credit metrics, strengthen our balance sheet and grow earnings; legislative and regulatory developments at the federal and state levels, including, but not limited to, matters related to rates, compliance and enforcement activity; economic and weather conditions affecting future operating results, such as significant weather events and other natural disasters, and associated regulatory events or actions; changes in assumptions regarding economic conditions within our territories, the reliability of our transmission and distribution system, or the availability of capital or other resources supporting identified transmission and distribution investment opportunities; changes in customers’ demand for power, including, but not limited to, the impact of state and federal energy efficiency and peak demand reduction mandates; changes in national and regional economic conditions affecting us and/or our major industrial and commercial customers or others with which we do business; the risks associated with cyber-attacks and other disruptions to our information technology system that may compromise our operations, and data security breaches of sensitive data, intellectual property and proprietary or personally identifiable information; the ability to comply with applicable state and federal reliability standards and energy efficiency and peak demand reduction mandates; changes to federal and state environmental laws and regulations, including, but not limited to, those related to climate change; changing market conditions affecting the measurement of certain liabilities and the value of assets held in our pension trusts and other trust funds, or causing us to make additional contributions sooner, or in amounts that are larger, than currently anticipated; the risks associated with the decommissioning of the retired nuclear facility owned by FirstEnergy subsidiaries; the risks and uncertainties associated with litigation, arbitration, mediation and like proceedings; labor disruptions by the unionized workforce of FirstEnergy subsidiaries; changes to significant accounting policies; any changes in tax laws or regulations, including the Tax Cuts and Jobs Act, adopted December 22, 2017, or adverse tax audit results or rulings; the ability to access the public securities and other capital and credit markets in accordance with our financial plans, the cost of such capital and overall condition of the capital and credit markets affecting us; actions that may be taken by credit rating agencies that could negatively affect either our access to or terms of financing or our financial condition and liquidity; and the risks and other factors discussed from time to time in FirstEnergy’s Securities and Exchange Commission (SEC) filings. Dividends declared from time to time on FirstEnergy’s common stock, and thereby on FirstEnergy’s preferred stock, during any period may in the aggregate vary from prior periods due to circumstances considered by FirstEnergy’s Board of Directors at the time of the actual declarations. A security rating is not a recommendation to buy or hold securities and is subject to revision or withdrawal at any time by the assigning rating agency. Each rating should be evaluated independently of any other rating. These forward-looking statements are also qualified by, and should be read together with, the risk factors included in FirstEnergy’s SEC filings with the SEC, including but not limited to the most recent Annual Report on Form 10-K and subsequent Quarterly Reports on Form 10-Q, together with any subsequent Current Reports on Form 8-K. The foregoing review of factors also should not be construed as exhaustive. New factors emerge from time to time, and it is not possible for management to predict all such factors, nor assess the impact of any such factor on our business or the extent to which any factor, or combination of factors, may cause results to differ materially from those contained in any forward-looking statements. We expressly disclaim any obligation to update or revise, except as required by law, any forward-looking statements contained herein as a result of new information, future events or otherwise. All data accurate as of publication date.

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