FirstEnergy®

Association of Energy Engineers

Transportation Electrification

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Introductions

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Transportation Electrification

What is it?

Why is it important?

What are stakeholders doing to promote it?

How can I electrify?

Transportation Electrification

What is it?

Transportation electrification involves **transitioning personal cars, commercial fleets, school/public transit, and shipping and freight from internal combustion vehicles to ones powered by electricity**.

Customers continue to purchase EVs in record numbers, and utilities are working with stakeholders **to create a seamless transition**.

Decarbonizing and improving environments

Optimizing the electric grid and modernizing infrastructure

Reducing overall energy costs

Transportation Electrification

CARBON NEUTRAL by 2050

FirstEnergy's **Goals**

30% GHG Reduction by 2030[2] Key Steps

1

Implementing efficiencies at our two regulated coal-fired generation plants

We are committed to achieving our 2030 interim goal and are implementing efficiencies, such as heat rate improvements from equipment upgrades, operating monitoring systems and auxiliary power reductions, at our two coal plants to help us achieve some emissions reductions. We thoughtfully balance this reduction effort with our obligation to operate our two coal plants prudently according to market trends and customer needs. We expect our reduction pathway to our 2030 interim target to reflect changing market conditions and our responsibility to reliably serve our customers rather than a steady, consistent decline in emissions.

2

Converting one-third of our light-duty and aerial truck fleet to electric and hybrid alternatives

Steps in Action

We are making progress toward our goal to electrify 30% of the light-duty and aerial truck fleet. As of October 2022, we've ordered enough electric or hybrid replacements to reach 10% electrification.

The first hybrid electric bucket trucks were delivered in 2021. Because utility trucks typically idle for 65% of their total engine hours (with one hour of idling equivalent to approximately 25 miles of driving), these hybrid trucks significantly reduce emissions by using a high-capacity battery pack motor to power the hydraulic lift, thereby reducing traditional gas engine idling.

3

Repairing and replacing transmission breakers that leak SF_6[3]

We run leak analytics reports and leverage gas imaging technology in the field to identify the source of SF_6 leaks. In 2022, these strategies helped us to identify one of our highest-leaking breakers in New Jersey and are also helping to inform the corresponding repair/replace plan.

[2]The targeted 30% reduction is a cumulative Scope 1 emissions reduction and does not signify a 30% reduction in each Scope 1 subcategory (stationary combustion, mobile fleet, SF_6).

[3]Gas commonly used by energy companies as an electrical insulating material and arc extinguisher in high-voltage circuit breakers and switchgear. If escaped to the atmosphere, it acts as a potent greenhouse gas with a global warming potential significantly greater than CO_2.

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Electric
vs.
Gas

Maintenance Costs

EV's have fewer moving parts which means:

- No oil changes
- No filter changes
- No belts or hoses to wear out
- Less wear and tear on brake pads due to "regenerative" braking

Operating Costs

Fuel costs for EV's are lower

Convenience

- **Majority of charging is done at home**
- **Range is lower with EV's but within average time of daily commutes**

Health & Wellness

- **EV's are cleaner and quieter to operate**
- **Reduces pollution over time**

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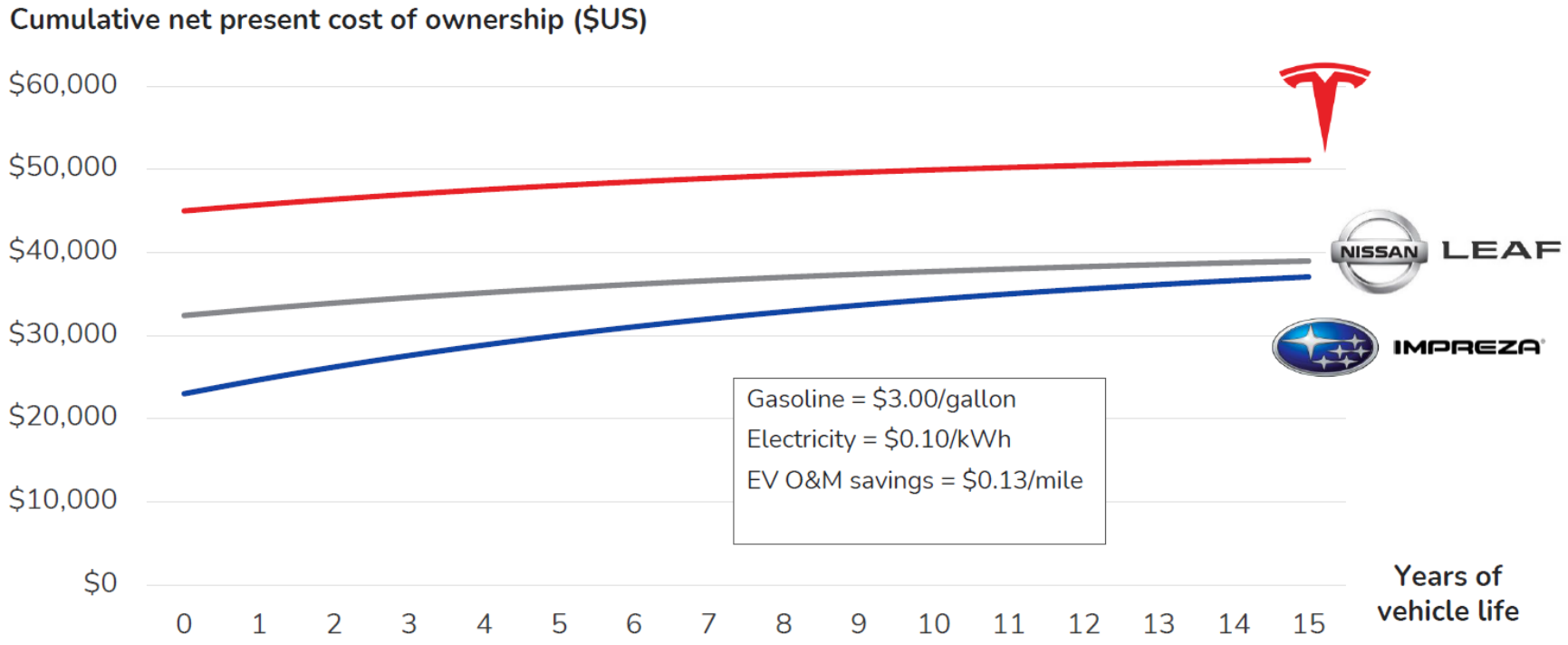
Electric
vs.
Gas

Battery costs are not *quite* low enough for EVs to reach economic parity for the typical individual driver…but they're on track to opening up more & more of the mass market



Source: DOE Vehicle Cost Calculator, Alternative Fuels Data Center, Accessed 3/28/22

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Electric
vs.
Gas

Select Gas Vehicle

2021 | Chevrolet | Spark - Automatic (variable ge

Monthly Fuel Cost*

$92 /mo.

$1,108 /yr.

Select EV Type ◉ All-Electric Vehicle ○ Plug-in Hybrid EV*

2021 | Chevrolet | Bolt EV (3.49 mi/kWh)

Monthly EV or PHEV Cost*

$23 /mo.

$283 /yr.

Local fuel price per gal	Est. MPG of vehicle		Est. miles/kWh	Est. utility kWh rate*
$ 3.35	33	RESET ALL	3.49	$ 0.0905

If you join our Off-Peak Rewards program you may earn around $5-$10 per month for charging between 11 p.m. and 6 a.m. and on weekends.

Estimated Savings*

$68/mo.

$825/yr.

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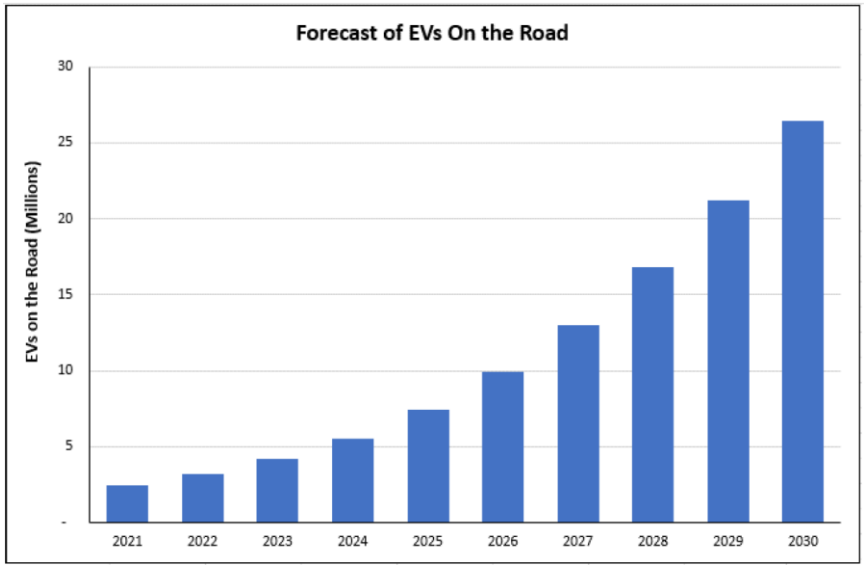
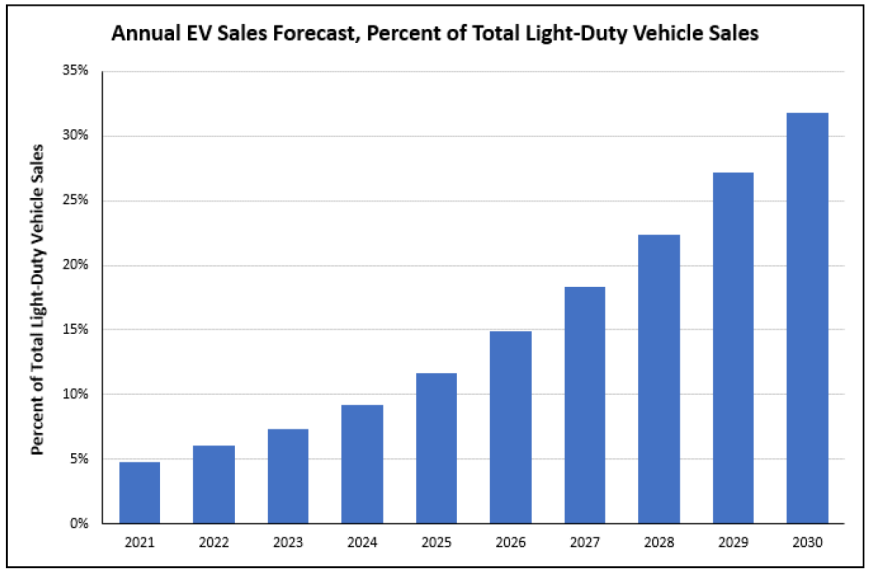
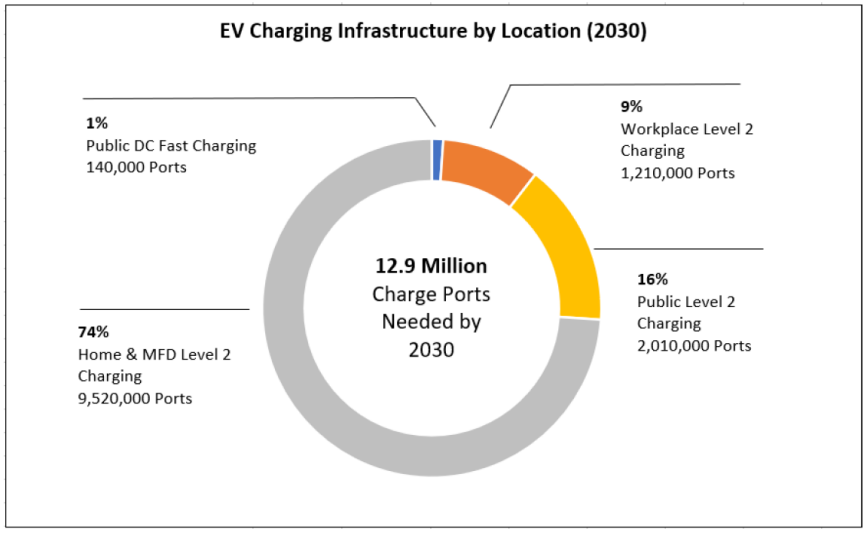
Forecasting







The EV market is driven by:

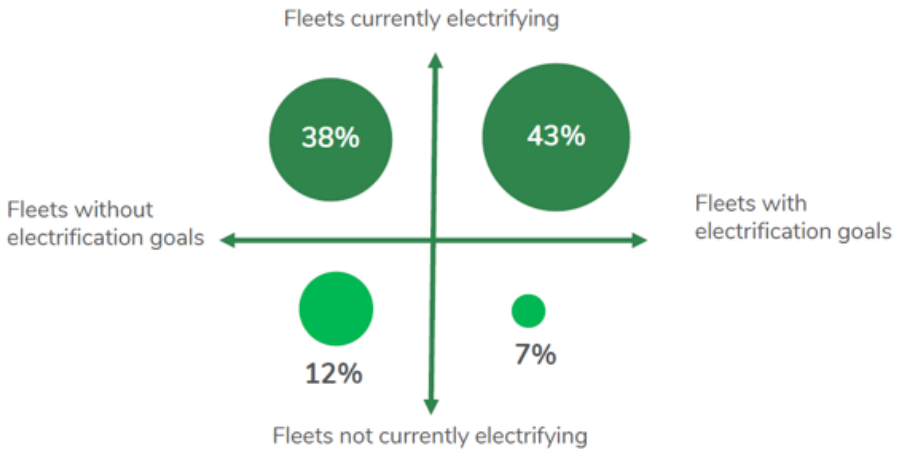
- **Customer awareness**
- **Types of EV's available and their affordability**
- **Availability of charging stations**

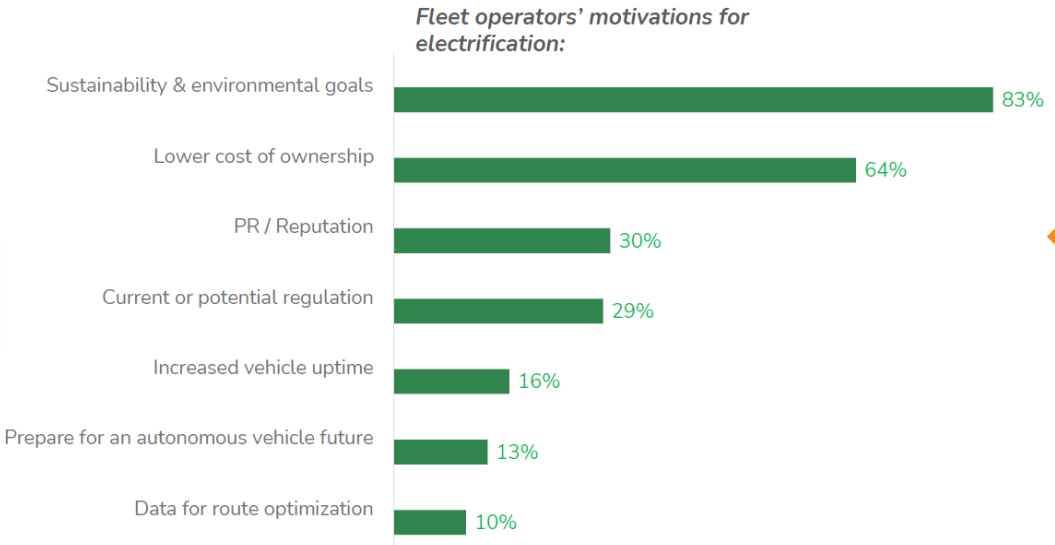
Source: EEI: Electric Vehicle Sales & Charging Infrastructure Required Through 2030 (June 2022)

Transportation Electrification

Fleet

Nearly all major fleet companies either have or are developing goals to electrify their fleets or replace with alternative fuels





If you are thinking about electrifying your fleet, engage your utility in discussions ASAP

Source: EIP: The Future of Cities and Transit (November 2021)

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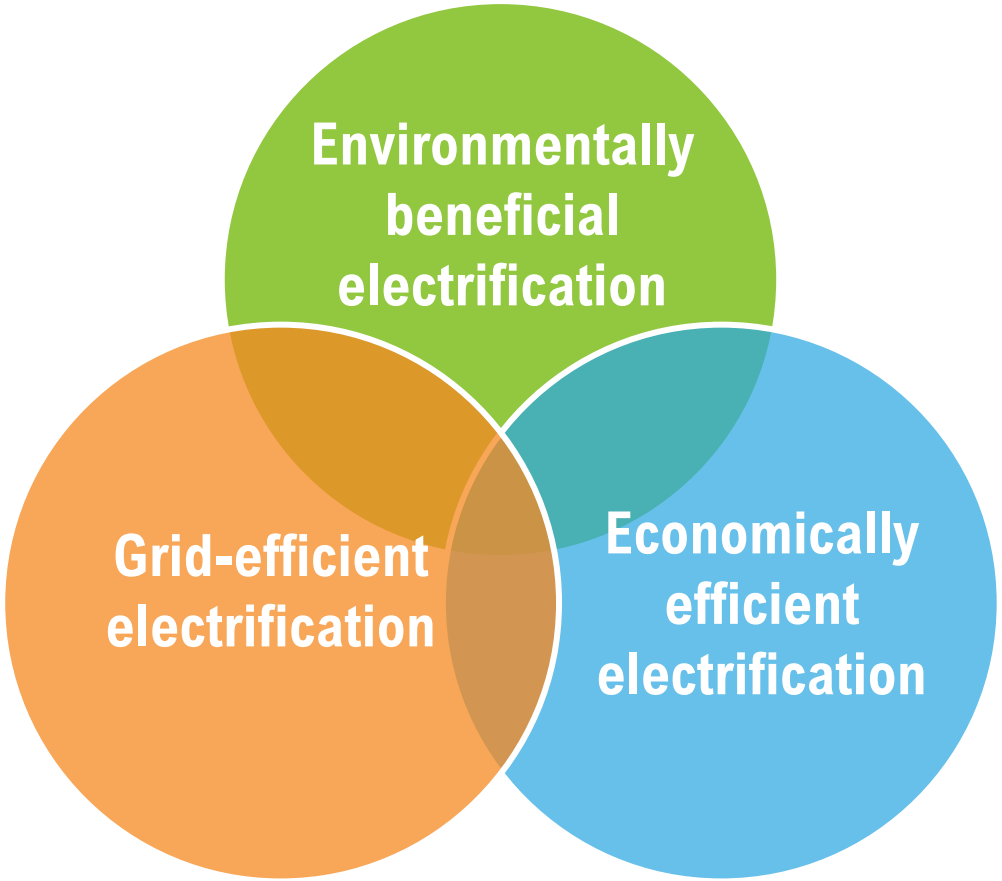
Why is it important?



Source: E-Source

Potomac Edison Completes First Battery Storage Project to Support EV Charging and Ease Demand on Grid

Battery paired with EV fast-charging stations installed in Myersville

Click here to learn how FirstEnergy is helping to strengthen the grid by incorporating battery storage

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Distribution Planning 101

Why is it important?

- Distribution Planning provides for the safe, reliable, orderly and economic expansion for an electric utility distribution system
- Involves forecasting load on distribution circuits and identifying thermal overloads for equipment and conductors
- Ensures proper delivery of steady state voltage to electric utility customers
- Involves development and maintenance of the distribution system electrical models to allow power flow studies and analyze load growth scenarios, circuit contingencies and bulk load additions
- Typical distribution system voltage include 12.47/7.2kV,13.2/7.6kV, 34.5/19.9kV, 4.8kV Delta

Distribution Circuit Load Forecasting

Why is it important?

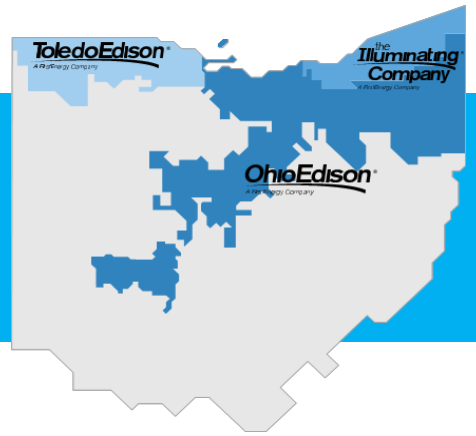
- **Historical and Projected Circuit Loading**
  - Circuit feeder level and Distribution Substation level
- **Measure raw peak load data corrected for any switching operations**
- **Perform weather normalization**
- **Forecast load additions**
  - Planner can choose from exponential, geometric, logarithmic, mid-point, straight line or user defined load growth curve
  - Add in known bulk load additions
  - Subtract any planned load transfers
- **Compare forecasted load to circuit feeder rating and substation equipment ratings**
- **Forecast completed for a 12-year period**

Planning for Electrification

Why is it important?

- **Completed a study showing impacts due to high adoption of light duty vehicles.**
- **Challenge of accurate predictions**
  - Customer propensity to adopt EV's
  - 2,000,000 transformers, 8000 distribution circuits, 3000 substations
- **Consideration for standardized distribution transformers and secondary conductors.**
  - Internal Practice on how to size transformers
- **Regional Study of the impact of medium and heavy-duty vehicles.**
- **Work closely with Regulators, Legislators, Dept of Transportation.**
  - Highway corridors
  - Identification of 3-phase facilities with capacity.
- **Explore time of use and managed charging options.**
- **Carefully planned expansion of capacity when needed.**

Investment in Smart Grid Technology:
Ohio Grid Modernization II



FirstEnergy Corp.'s Ohio utilities – Ohio Edison, Cleveland Electric Illuminating Company and Toledo Edison – filed a plan with the Public Utilities Commission of Ohio (PUCO) that would **expand investments in smart grid technology**, including equipment to help reduce the frequency and duration of power outages for customers.

The filing proposes a four-year, $626 million investment plan

- Filed plan builds upon system upgrades completed since the PUCO approved the utilities' Grid Mod I plan in 2019
- To date, the Grid Mod I program has resulted in improved outage restoration times for customers in areas where the smart technology was installed

> "The projects we've completed under Grid Mod I have proven to be successful in reducing many power interruptions. This has laid the foundation for us to further enhance service reliability across our entire service area in Ohio. While events out of our control, like severe weather or vehicle accidents, still have the potential to cause outages, the proposed plan will allow us to enhance our results from Grid Mod I and expand the work to areas of our service territory that have not yet benefited from these enhancements."
>
> – Sam Belcher, Senior Vice President of FirstEnergy Operations

Ohio Grid Modernization II: Key Components

Advanced Meter Infrastructure (AMI) 700,000 meters	**Installation of smart meters** along with communications infrastructure and data management systems. Smart meters enable customers to better track their energy consumption and eliminate estimated readings.
Distribution Automation (DA) 236 circuits	**Installation of automated equipment** to automatically isolate problems, minimize the number of customers impacted by an outage, and quickly restore electric service.
Integrated Volt Var Control (IVVC) 219 circuits	**Installation of voltage regulating equipment** that can provide energy savings by reducing the amount of electricity that must be generated, and allows all customers served by a single power line to receive the same flow of safe, reliable power by evenly distributing electricity down the line.
Advanced Distribution Management System (ADMS)	Provides the ability to **detect and locate outages more quickly** and provide more accurate and timely storm restoration information.

Ohio Grid Modernization II: Pilot Programs

- **Lateral Electronic Circuit Protection**
  - Installing automated devices in neighborhoods throughout Ohio Edison and Toledo Edison's service areas, particularly in areas prone to animal- or tree-related outages
  - The devices work like a circuit breaker in a home that shuts off power when trouble occurs, with the added benefit of automatically reenergizing power lines within seconds for certain types of outages to keep power safely flowing to customers
- **Distributed Energy Resource (DER) Pilot**
  - Installing a battery energy storage system designed to support increased EV charging load along the Ohio Turnpike and enhance grid reliability
- **EV Charging Pilots**
  - **Residential EV Charging** – incentives up to $750 for up to 600 residential EV charging ports
  - **Commercial EV Charging** – incentives up to $2,000 per EV charging port for up to 300 commercial customer locations
  - **Commercial Vehicle-to-Grid ("V2G") Charging** – incentives up to $20,000 for up to 6 commercial or governmental customers with 10 or more electric vehicles capable of bidirectional power flow
  - Programs designed to support the adoption of electric vehicles (EV) across the company's Ohio service territories

Ohio Grid Modernization II: Benefits

"The benefits of Grid Mod II for our Ohio customers through enhanced reliability, energy efficiency opportunities and innovative products and services are estimated to exceed the costs of the program by nearly $280 million in today's dollars.

We are excited to enhance the delivery of safe, reliable power through this investment while also promoting modern experiences and emerging technologies that can ultimately help lower energy bills to our customers."

– Sam Belcher, Senior Vice President of FirstEnergy Operations

Transportation Electrification

What are stakeholders doing to promote it?

Our vision is a seamless and **reliable** economy-wide electrification effort to **reduce carbon emissions** and power a more **sustainable future** for the **customers and communities** we serve.

Sustainable

- Becoming the **cleaner energy alternative** for all our customers
- Partnering with customers to transition from traditional experiences to **modern enhancements**
- Encouraging new **economic development** opportunities across FirstEnergy's footprint
- **Attracting green investors** by embracing solutions for a sustainable future
- **Inspiring top talent** to innovate solutions for safe and sustainable opportunities

Reliable

- Being a **trusted energy partner** to help ease and accelerate customers' switch to electrified solutions
- Investing in our distribution grid to **support the increasing demand** for electricity
- Managing charging to **optimize energy demand**
- Increasing domestic sources of energy to **support national security**

Efficient

- Providing **cost savings to customers** by fuel switching
- Leveraging data analytics to provide customers with **better insight** into their energy usage
- **Offering innovative, time-varying rates** that give customers the opportunity to **save money** by shifting their electricity use to off-peak periods

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What are stakeholders doing to promote it?

- **National Electric Vehicle Infrastructure (NEVI) Formula Program**
  - As part of the Infrastructure Investment and Jobs Act signed into law last year, Ohio will have access to $140 million for EV charging infrastructure
  - The funds will flow through ODOT and will initially be used to build out a DC Fast Charging network along designated Alternative Fuels Corridors
  - The Federal criteria are that there should be a minimum of one public site containing 4 – 150kW chargers within 1 mile of the corridor and no more than 50 miles apart
  - The due date for interested firms to submit their proposal has been extended to January 18, 2023. ODOT hopes to select successful proposers in March 2023.
  - To view NEVI details, visit DriveOhio Website

ENERGY.GOV

Additional OH Laws and Incentives can be found here: OH Laws & Incentives

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How can I electrify?

- **Consider if transportation electrification is right for you**
- **Determine best charging methods**
- **Contact utility early to help with electrification planning**
- **Research and utilize available incentives**
- **Share data with utilities for future research opportunities**
- **Engage in conversations with policymakers**

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Thank You