

NES Electric Vehicle Strategic Plan

August 1, 2023



ABOUT Nashville Electric Service (NES)

Nashville Electric Service is one of the 12 largest public electric utilities

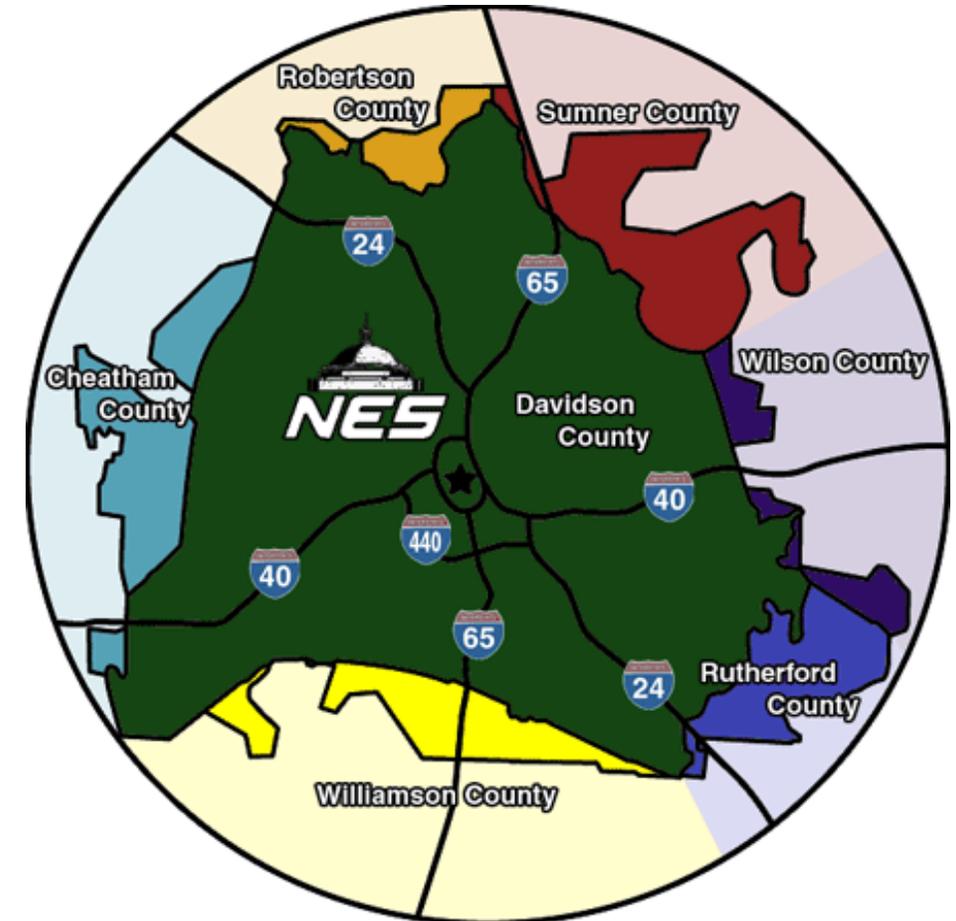
Established in 1939

~435,000 customers

Over 700 square miles – all of Davidson County and portions of 6 others

Purchase all power from TVA

- AA+ bond rating
- Reliable Public Power Provider's (RP3) Diamond Award recipient
- Mission = to provide safe, reliable and affordable power and energy services to the customers and communities we serve.
- EV Mission = to collaboratively pursue initiatives that positively impact our customers and communities while driving transportation electrification forward and staying true to our core values
- EV Vision = to empower ALL customers to realize benefits from vehicle electrification.



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ESG Executive Summary

Environmental

Over **20 initiatives were assessed** to determine carbon abatement cost and potential risks of implementation resulting in the following key findings:

- **Commercial and utility-scale solar** initiatives demonstrate the most potential benefit in the near-term, particularly **Purchasing Renewable Power** from developers
- **Residential rooftop solar** currently produces higher costs than returns given upfront installation cost and low energy rates
- **Energy efficiency** initiatives such as real-time feedback systems and streetlight LED conversions show positive benefits
- **NES operations** initiatives such as **transportation electrification**, **e-billing** and **fleet telematics** show positive benefits

Social

14 initiatives were assessed covering employee engagement, diversity, equity and inclusion as well as community engagement.

Key near-term opportunities identified include:

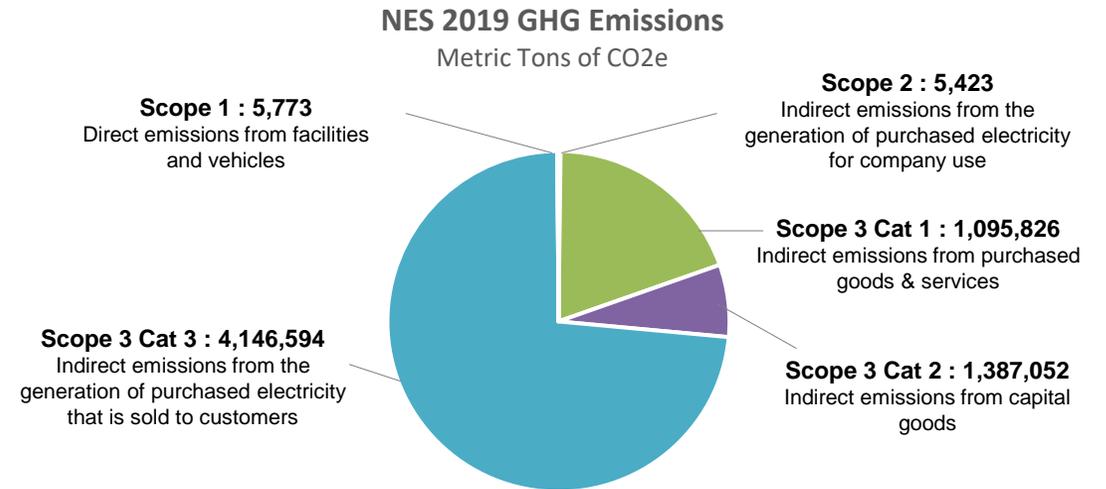
- Employee **engagement survey**,
- Emerging **leaders training** program,
- **Mentorship** program and
- **DE&I training**

Governance

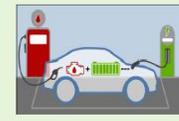
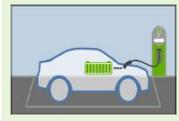
4 initiatives were assessed covering **resiliency** and **supply chain management**

Key near-term opportunities identified include:

- Enhancement of the risk management process to incorporate **long-term assessment and mitigation of climate-related risks**
- Integration of **sustainability in supplier selection** criteria



EV Charging

	ICE	HYBRID	PHEV	BEV
VEHICLE TYPE				
ENERGY SOURCE	FUEL TANK	FUEL TANK BATTERY	FUEL TANK BATTERY	BATTERY
FUEL	GASOLINE	GASOLINE	GASOLINE ELECTRICITY	ELECTRICITY
POWER SOURCE	GAS ENGINE	GAS ENGINE ELECTRIC MOTOR	GAS ENGINE ELECTRIC MOTOR	ELECTRIC MOTOR
FUEL ECONOMY UNITS	MPG	MPG	MPGe or kWh/100 miles	MPGe or kWh/ 100 miles

Charging Capacities:

- Level 1 Charging: ~5 mi/hr, 120V,
 - 1.3 kW to 2.4 kW – equals a Household appliance
- Level 2 Charging: ~20-60 mi/hr, 240V
 - 7 kW – 19 kW – A house
- Level 3 Charging: ~60-600 mi/hr, 480V
 - 50 kW to 350 kW – Small retail center
- Medium, Heavy Duty and some bus chargers
 - 1 MW or more – Large commercial or industrial center

Fast Facts:

- Edison Electric projects 26 Million EV's on US roads by 2030 (OEM projections)
- As of today in the Nashville region:
 - ~1.6 Million registered vehicles (in 7 counties)
 - ~9,300 registered EV's – 0.58% of the total
 - ~200 Available Public Chargers
- At just 25% Electrification with one assigned Level 2 port for each car:
 - Requires 400,000 Charging Ports – located at homes and businesses
 - Unmanaged charging could result in 2,800 MW of additional demand added on top of existing NES load
 - Summer 2022 peak 2,580 MW
 - Each NES distribution feeder will present a unique capacity equation to balance
- Just 0.25% of that charging delivered at Level 3 means 1,000 high demand ports:
 - Unmanaged charging could result in 50 MW of additional demand added on top of existing NES load
 - Level 3 charging needs will come largely from fleets and public charging

Sources: US DOE Alternative Fuels DB
 TN State Dept. of Revenue
 EEI

The EV Challenge for Utilities

- EV adoption is accelerating across all customer and vehicle class segments
- Utility infrastructure and power supply must keep pace
- Fleet electrification is likely to outpace utility planning cycles
- Customer needs for information, programs, rates, and partnership are growing
- Environmental and societal pressures are increasing
- Federal, State, and Local policy, legislation, and funding are accelerants



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A comprehensive Utility EV Strategy is Required

Executive Summary

STAKEHOLDER KEY FINDINGS

46 Interviews with Internal and External Stakeholders

- **Sustainability** is a shared priority across many stakeholders
- Strong intrinsic NES **organizational capability**– ie engineering and marketing
- Customers from all segments are seeking **better engagement** and resources
- **Fleet electrification** challenging internal, Metro, and Commercial entities
- Charging availability and infrastructure must be addressed

STRATEGIC IMPERATIVES

Nashville region is the leading area for EV adoption in Tennessee and TVA

- Nashville region today has ~9,500 EVs – **Roughly 50% of state EV population**
- **Carbon abatement** is a priority
- OEM and other **supply chain challenges** weigh on EV adoption
- EV adoption route to 25/50/75/100% challenges **investment and pacing**
- **Electric distribution infrastructure** must be ready to support EV charging

PEER UTILITY KEY FINDINGS

7 Utility Examples of Public Power EV Readiness

Most utilities adopting a posture of **'Active – leaning in'** to EV needs

Customer engagement is a common theme with information and incentives

Fleets are a focus for most – internal, commercial, mass transportation

Program evolution is a common focus with a willingness to **test and innovate**

NES EV PROGRAM DESIGN

A structured blueprint to guide maturity, initiatives and investments

CURRENT STATE:

Posture is **'Passive'** (Reactive in some areas, Active in Others)

Maturity is **'Emerging'**

FUTURE STATE:

Posture will be **'Active'**

Maturity will be **'Leading'**



Executive Summary

STRATEGY HIGHLIGHTS

A balanced program to address infrastructure investments and customers' EV needs

- Adoption **forecasting will drive** infrastructure planning and NES readiness
- **ESG** is a central tenet supporting carbon abatement and community benefits
- EV support and resources for customers will establish an **'NES First'** brand
- **Partnerships** will bring additional resources and advanced capabilities
- EV offerings are evaluated and delivered from a **triple bottom-line** perspective
- An **expanded rate catalog** is developed for EV charging

INFRASTRUCTURE NEEDS

EV Adoption requires planning focus and committed investment

- NES **system readiness** to meet the EV market as it evolves
- **4kV system** constraints are addressed and resolved
- **Increased** capacity in substation, transmission and distribution systems
- EV specific **planning criteria, design standards, and customer policies** are codified

ORGANIZATIONAL EVOLUTION

A dedicated EV Program team will deliver NES' EV initiatives

- **Leadership** focused on roadmap execution
- A **core engineering** team to develop EV planning and design capability
- **Staffing additions** for outreach, partner engagement, analysis
- NES cross-functional teams will **engage** the overall organization
- Electric vehicle **education plan** is developed and implemented

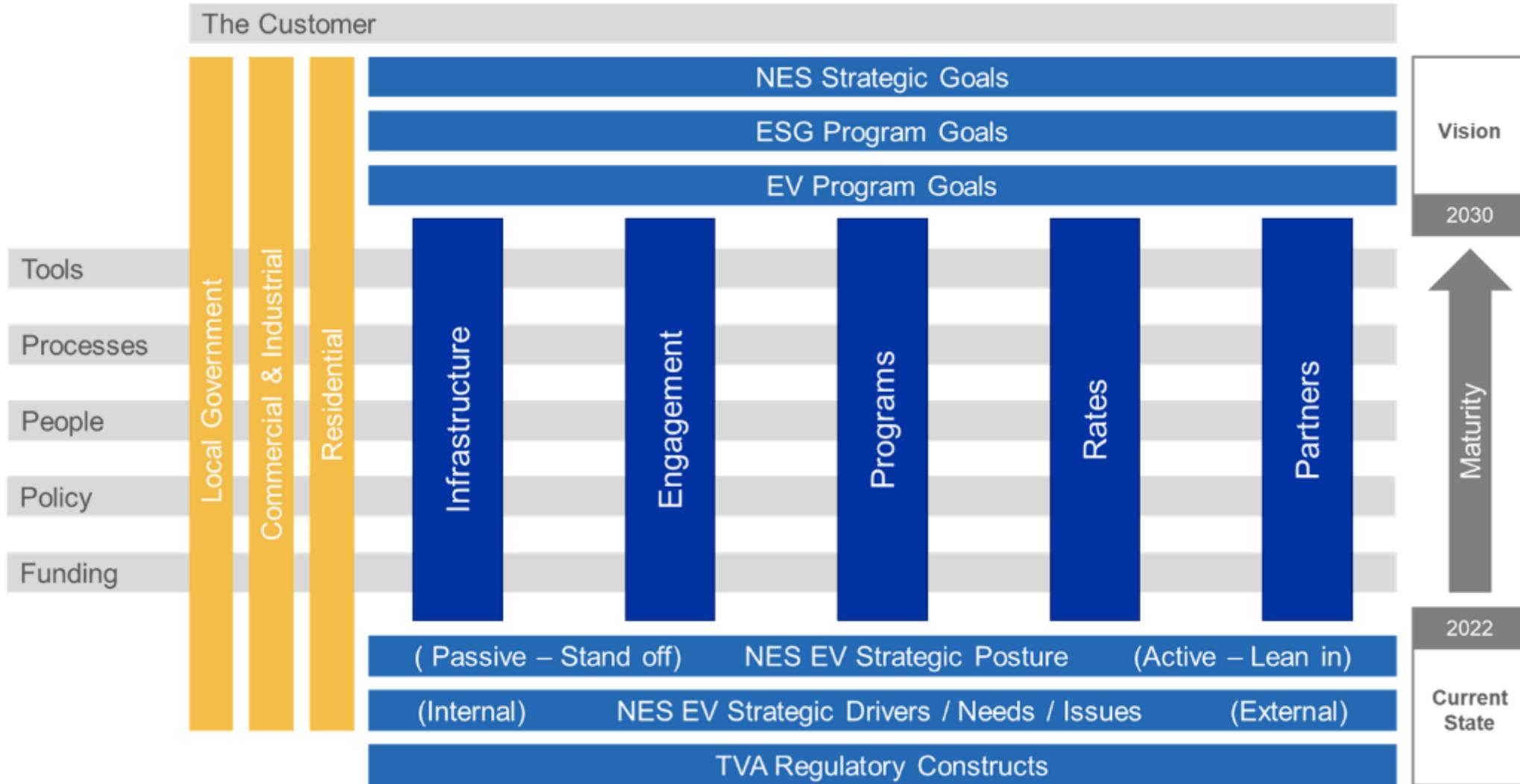
BUSINESS CASE

Costs and benefits will support NES' 20 yr. EV initiatives

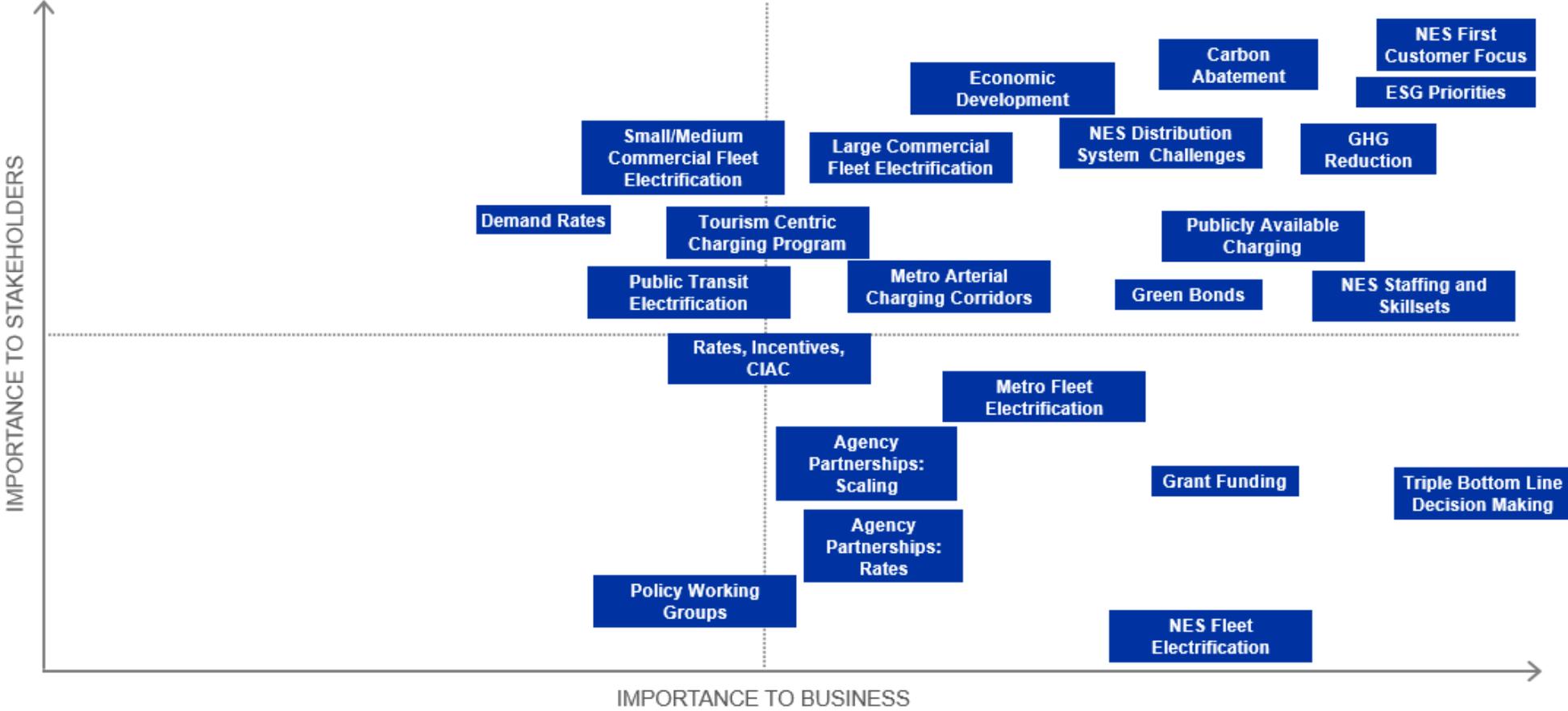
- Infrastructure and program investments will be **significant**
- Sensitivity to adoption pacing indicates **positive NPV and cash flows** for all scenarios including revenue and reliability benefits
- **CO2e abatement benefits are significant** and support NES' ESG strategy
- NES will evaluate new business models and opportunities to **align with the demand** for charging EVs.



EV Strategic Program Framework



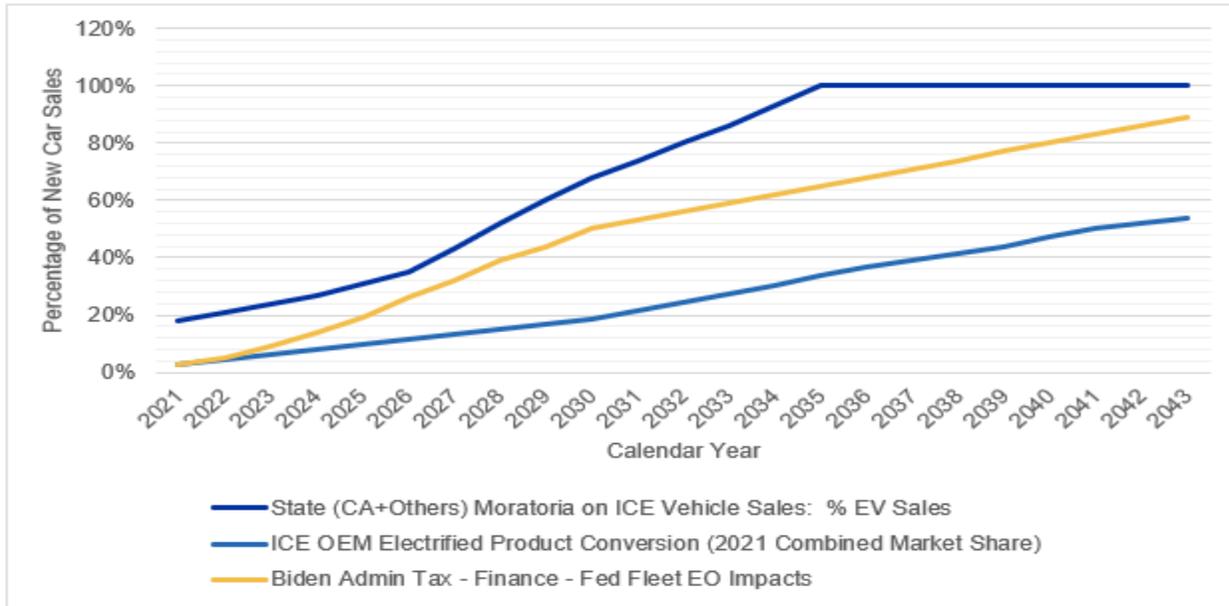
Voice of Stakeholder Materiality Matrix



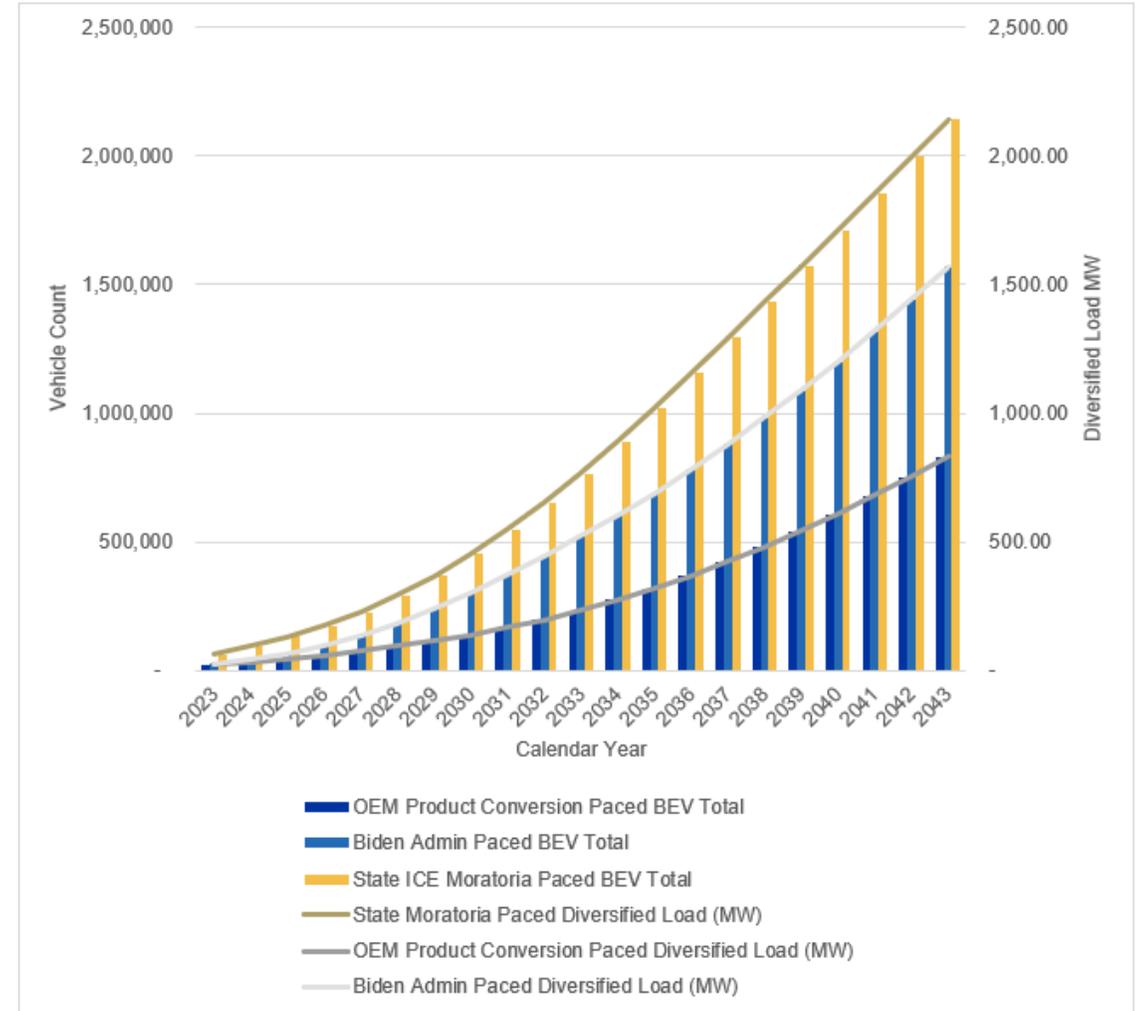
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National EV Adoption Forecasts and Impact

Three Independent National Scenarios Influencing BEV Percentage of Vehicle Sales



Three Independent National Scenarios Potential Applied Impact to NES Diversified Load

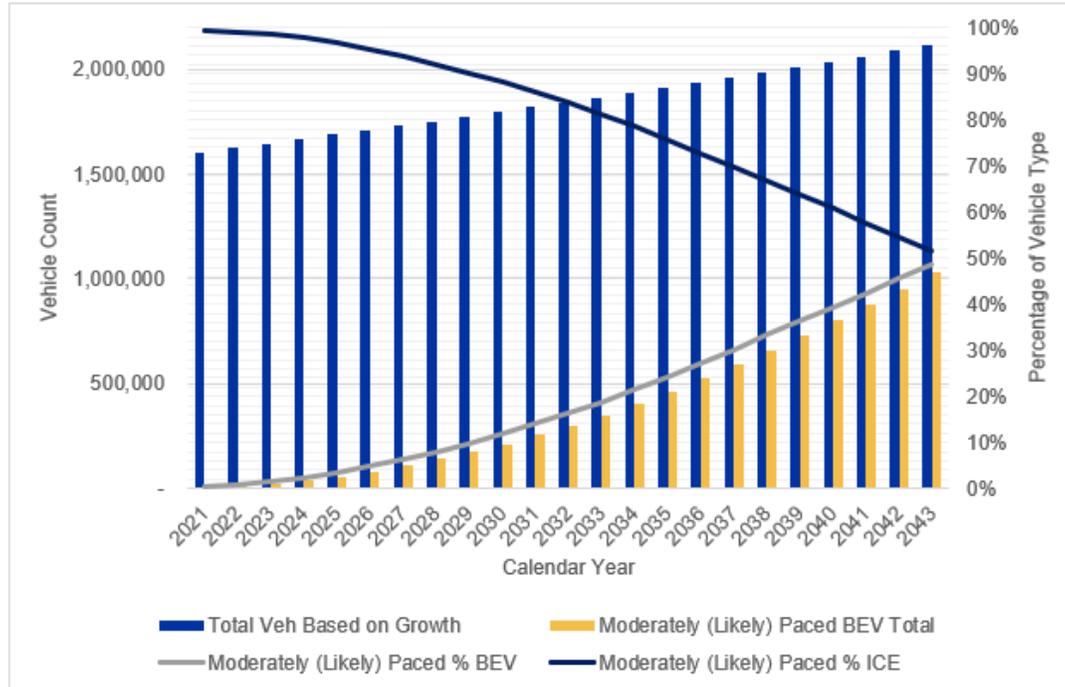


Adoption forecasting and impact modeling drives NES' readiness

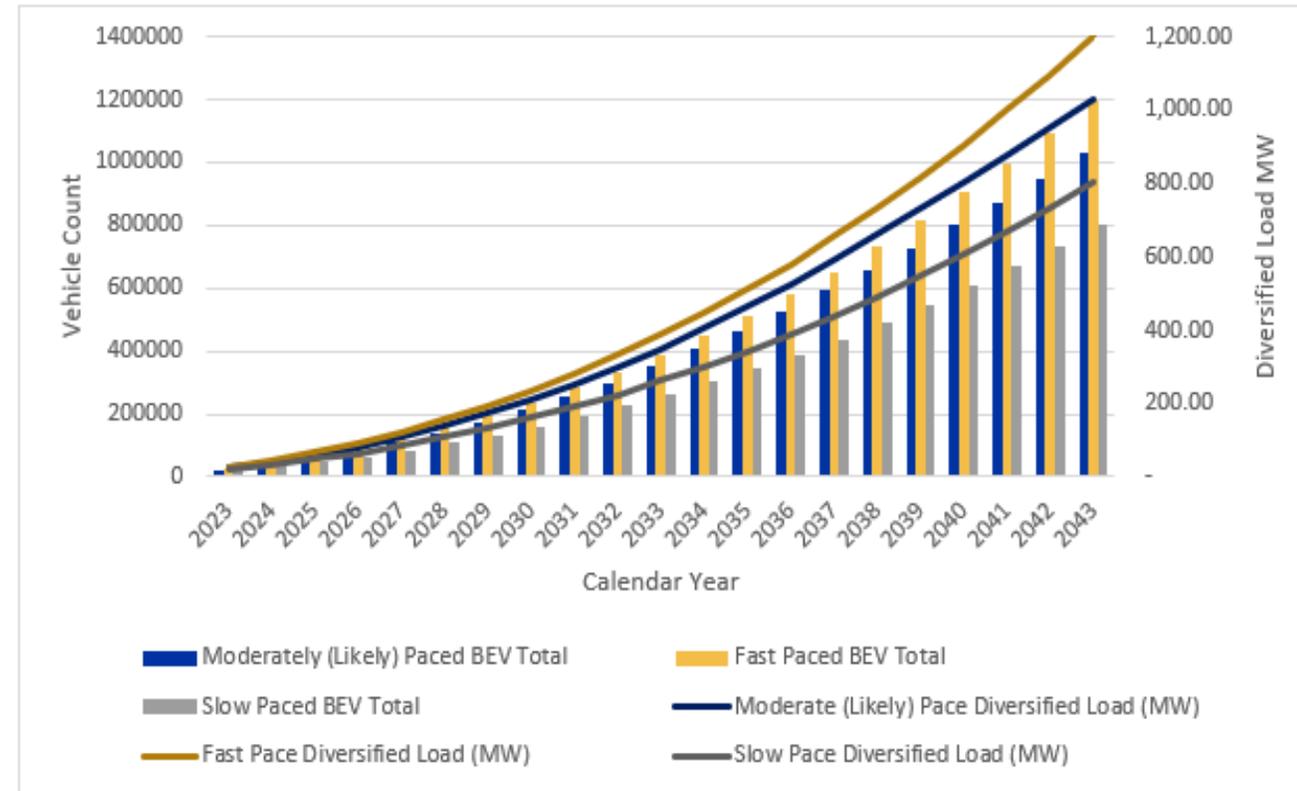
- National drivers **change rapidly** including Federal, State, and Private Industry
- CA State and Federal Impacts attempt to **drive adoption**
- OEM behaviors respond to State and Federal demands while **incorporating economics**
- **NES specific** adoption projections incorporate these insights

Nashville EV Adoption Forecasts and Impact

Moderately (Likely) Paced EV Adoption Projection - Nashville Region (7 Counties)



Three Nashville EV Adoption Scenarios with Related Diversified Demand

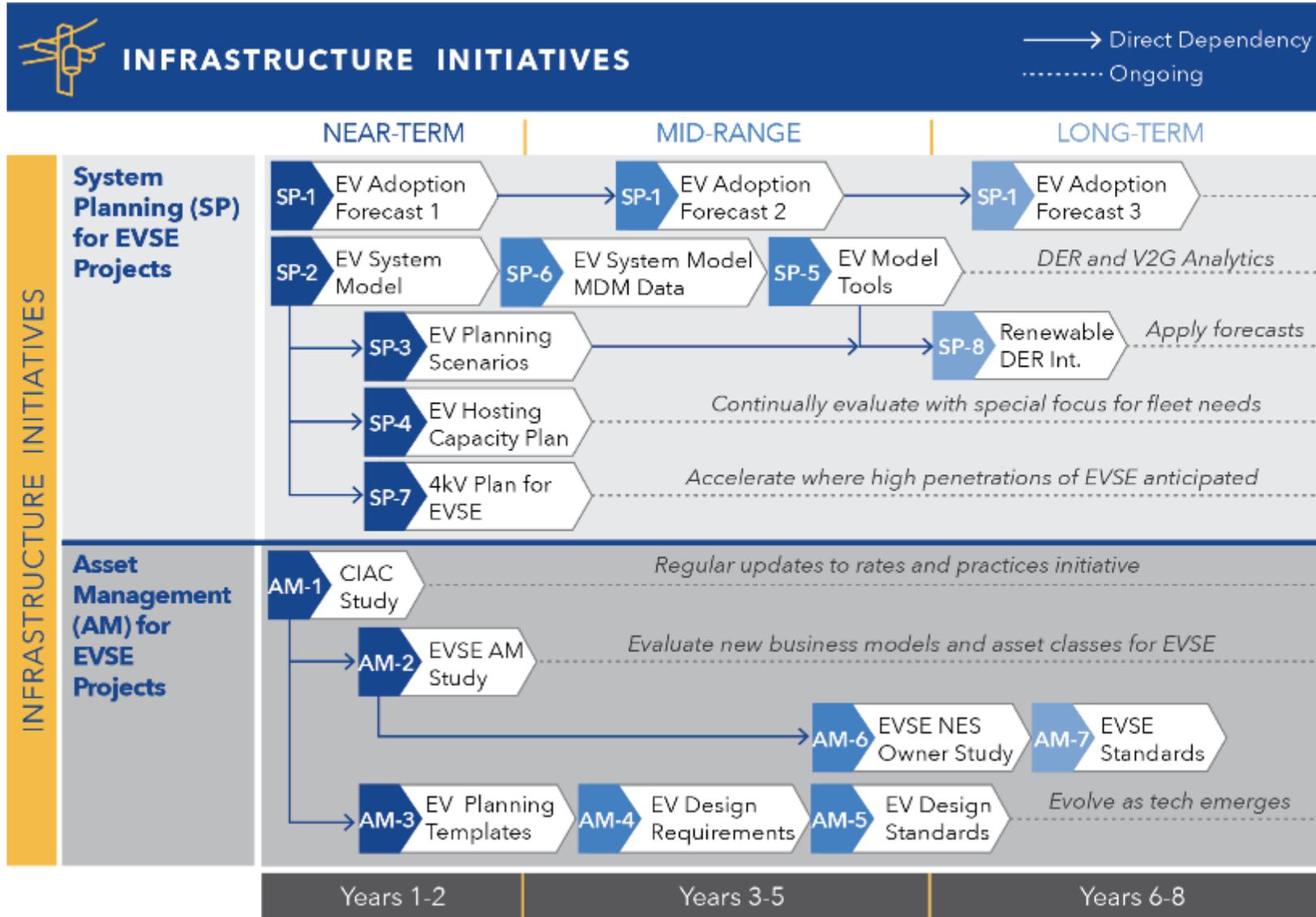


Adoption forecasting and impact modeling drives NES' readiness

- Nashville regional behaviors will be **monitored** and built into planning
- Moderately paced adoption **addresses 1,000,000 BEV and 1,000MW Load**
- Projections are a **snapshot** and will be reviewed and updated regularly
- Load forecasts and investment budgets **follow forecasts directly**



Infrastructure

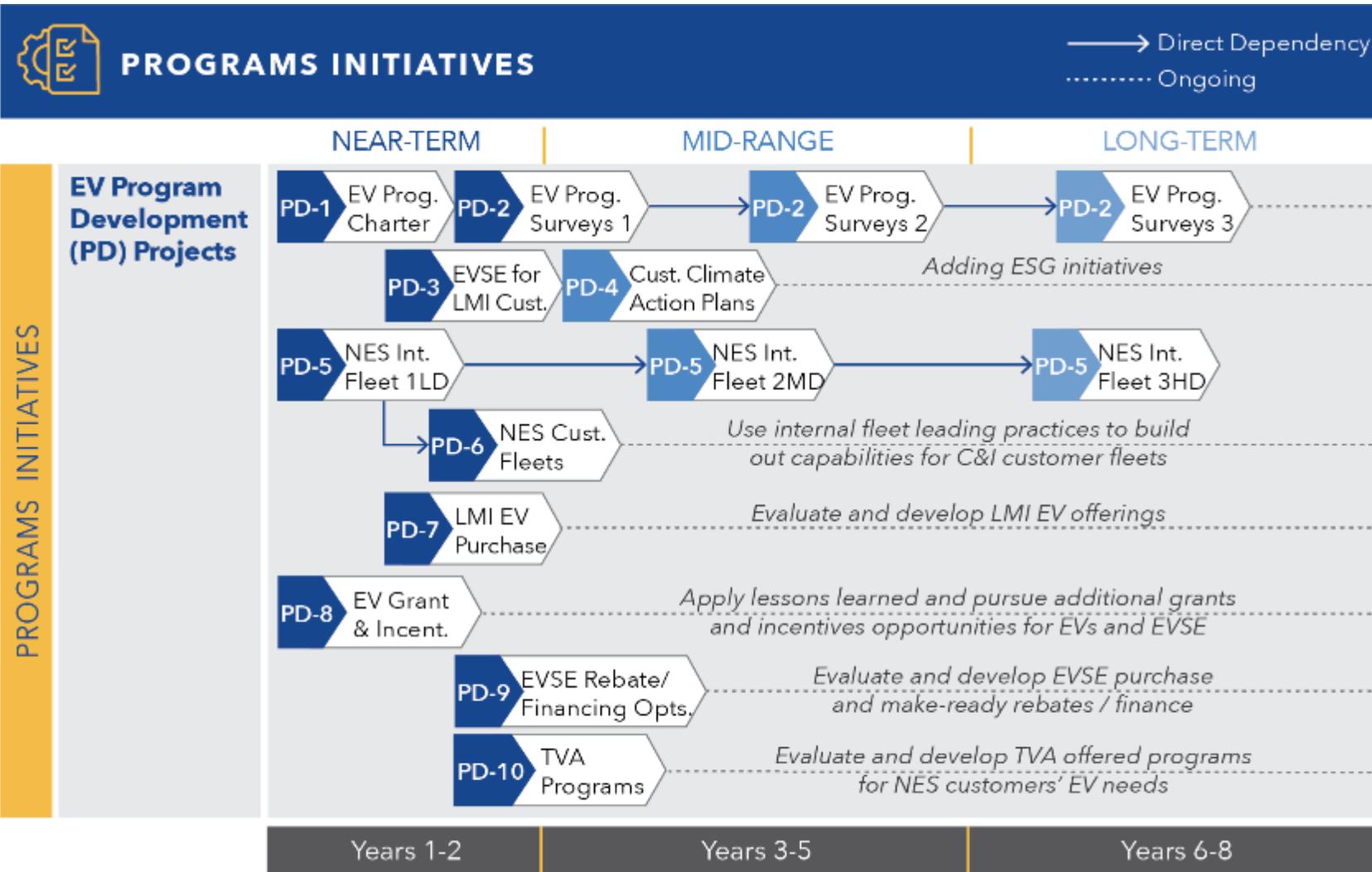


Infrastructure is essential to readiness

- ▶ **Plan and develop** power delivery infrastructure including transmission, substations, and distribution, to meet the requirements necessary to serve EV loads.
- ▶ Provide added **forecasting and system modeling** capabilities for analyzing the impact of EVs to the NES power delivery system.



Programs

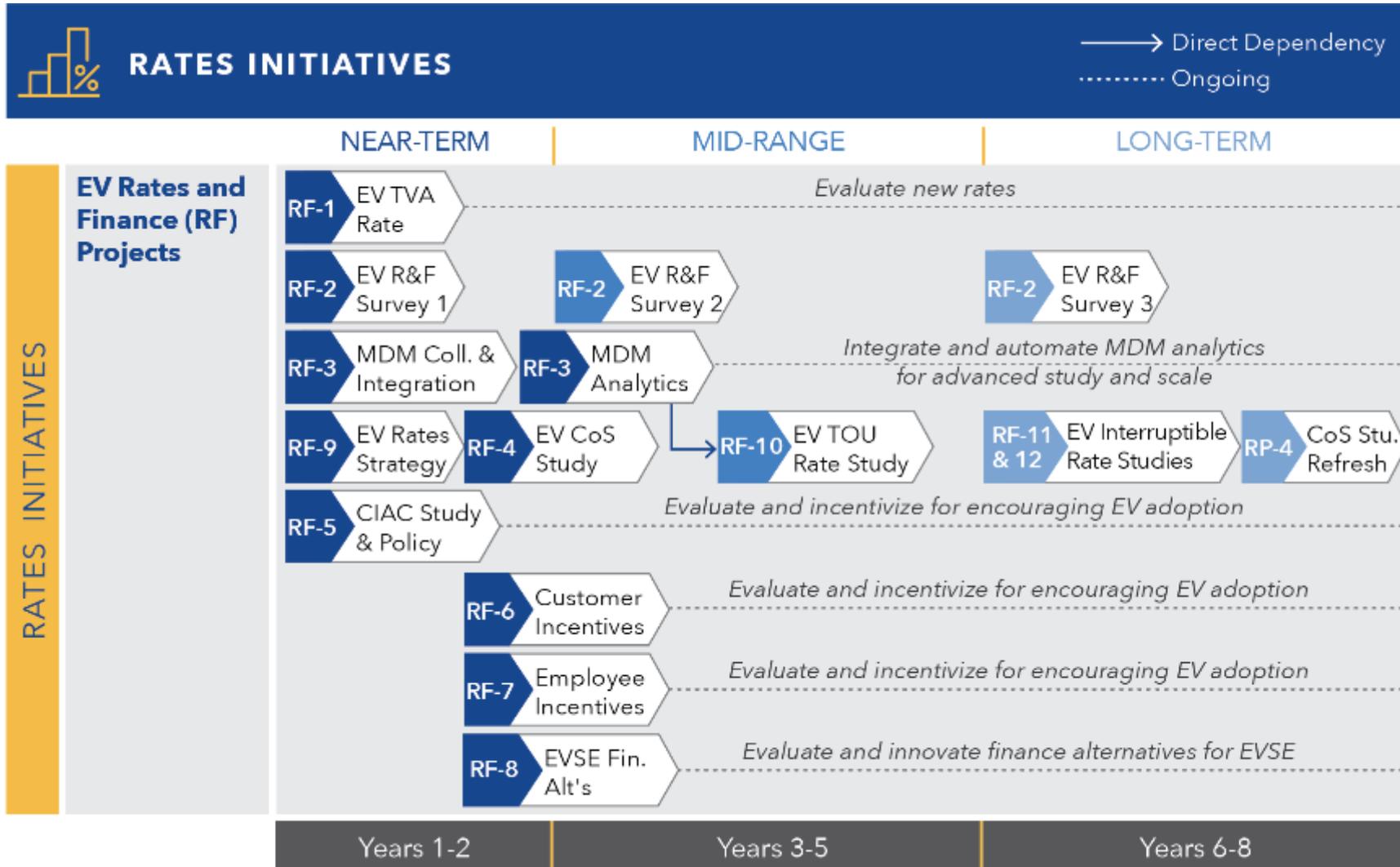


EV Programs deliver meaningful outcomes

- ▶ Establish EV programs that encourage adoption by **continually surveying** NES customer needs and EV market trends.
- ▶ **Identify, study, and charter** viable EV programs that leverage EV-related ESG goals, consider non-traditional NES business models, fleet electrification planning, and green financing.



Rates



Rates to support NES and Customer Needs

- ▶ **Ratify** the EVC energy-only rate and market it to startups and entities that may find demand charges unattractive.
- ▶ Integrate **EV-related impacts** into the Cost-of-Service and CIAC studies and ratemaking cycle.



Partners



Partners bring competencies and bandwidth where needed

- ▶ Identify partners to address grant funding and policy with **emphasis community health and safety** benefits of EVs.

Engage external partners to **develop and deliver an “NES First”** brand for customers.



Cost and Benefit Analysis

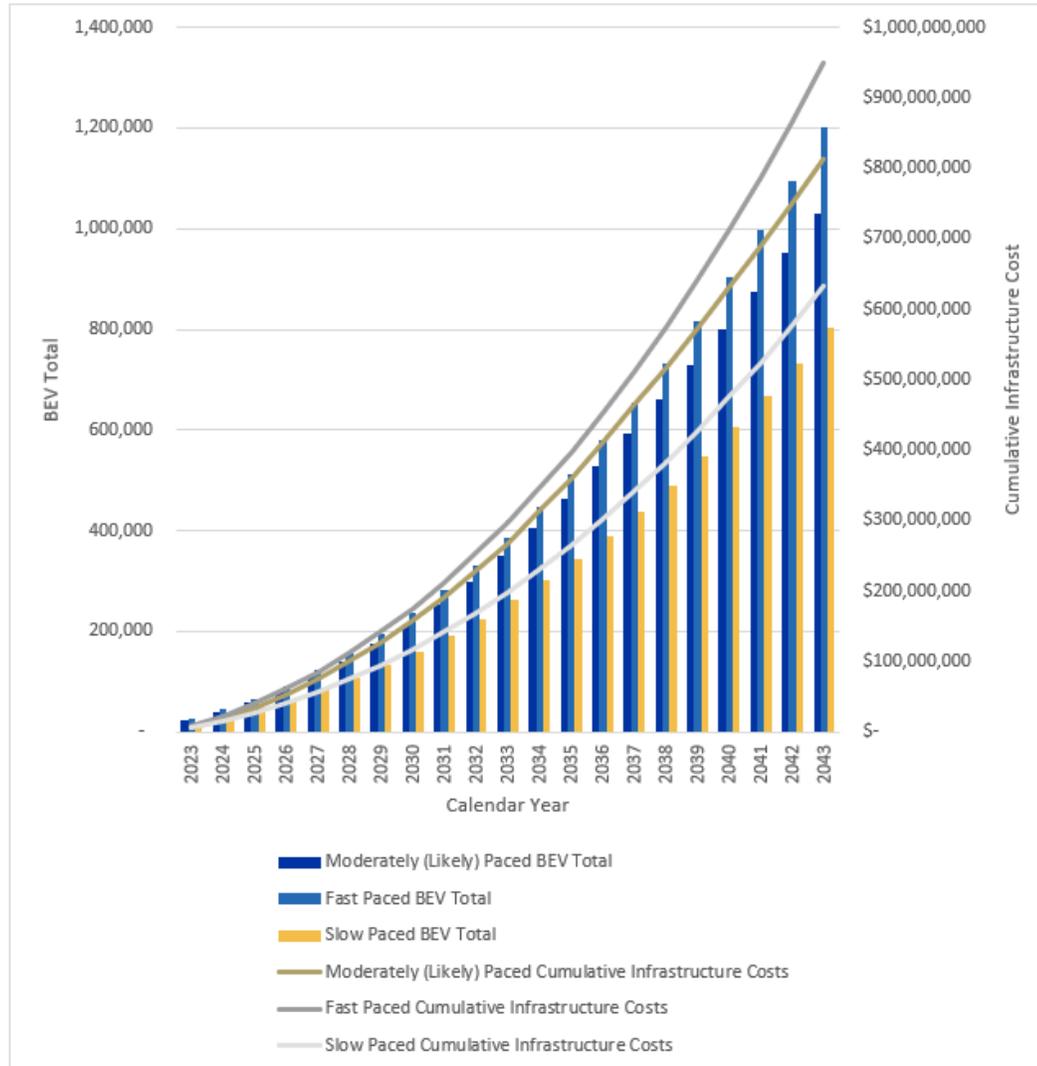
Key Assumptions

- ▶ Based upon Moderate (Likely) EV Adoption Pacing Scenario
- ▶ 1,000 MW EV added load from 1,000,000 light duty EVs diversified non-coincident charging.
- ▶ Added load is evenly distributed across the NES system.
- ▶ No additional capacity available on the 4 kV system
- ▶ Does not include any TVA costs for any impacted transmission lines though discussion is ongoing with TVA regarding an EV hosting strategy.



Infrastructure Investments

Cumulative Infrastructure Costs for 3 Nashville EV Adoption Scenarios



Infrastructure and Program Investment Supports EV Readiness

- ▶ Based upon **Moderate (Likely) EV Adoption** Pacing Scenario
- ▶ **1,000 MW EV added load from 1,000,000 light duty EVs** diversified charging
- ▶ Added load is **evenly distributed** across the NES system.
- ▶ **No additional capacity** available on the 4 kV system
- ▶ All costs including EV Strategic Program Spread over **20-year execution horizon**



Costs Identified by NES Engineering Team

System Category	Amount
4 kV System	\$470M
Distribution System (13.8 kV and 23.9 kV)	\$102M
Substation Additions and Upgrades	\$136M
Transmission	\$95M
Total Infrastructure Cost	\$803M
EV Strategic Program Costs	\$15.2M
Total Anticipated Investment	\$818.2M



Benefits Anticipated

Benefit Category	Amount
NES Net Position Improvement	\$884M
\$50/ton Marginal CO ₂ e Benefit	\$187M
2.25% Net Annual Reliability Benefit	\$18M
Total Anticipated Benefits	\$1,089M



Conclusions

- EVs represent an important opportunity for the NES organization to grow in capabilities, diversify service offerings to its customers, achieve ESG initiatives, and maintain and improve the health of its overall business.
- Transportation electrification requires NES to think about its operations in new ways and will require investments in its people and infrastructure.
- The 4 kV system has no additional capacity available to serve added loads from EV charging, it is a key area for needed investments and should be prioritized through distribution infrastructure planning.
- NES' EV initiatives, activities and investments are projected to exceed Metro Nashville's GHG reduction EV goal by 66%.



Key Recommendations

- Create a marketing and outreach plan that will educate and inform EV adoption delivering an “NES First” commitment.
- Envision transportation electrification as a growth opportunity, not only for the potential of additional revenues from power sales, but also as a key opportunity to provide ESG benefits to the communities we serve as well as other direct benefits to our customers.
- Use transportation electrification initiatives to support sustainability and ESG goals.
- Leverage partnerships to maximize environmental benefits of transportation electrification.
- Integrate EV-related needs into the Cost-of-Service and CIAC studies and ratemaking cycle with a continuous review and revision process with carbon abatement and community benefit metrics included.
- Mine and study EV load data from MDM for advanced ratemaking.
- Evaluate new business models and grant funding opportunities.



Questions

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