



2022 NARUC Annual Meeting and Education Conference

CONNECTING THE DOTS

Innovative/Disruptive Technology and Regulation

High Priority Areas for Accelerating the EV Transition



2022 NARUC Annual Meeting and Education Conference

CONNECTING THE DOTS

Innovative/Disruptive Technology and Regulation

Moderator:

- Hon. Katherine Peretick, Michigan

Two Sessions

- Panel 1: Proactive Infrastructure Investments
- Panel 2: Developing Innovative Rates

NARUC thanks the U.S. Department of Energy for this session.



U.S. DEPARTMENT OF ENERGY

EVGrid Assist

ACCELERATING THE TRANSITION

High-priority Areas for Accelerating the EV transition

November 16, 2022

Christopher Irwin, DOE Office of Electricity



U.S. DEPARTMENT OF
ENERGY

Transportation Electrification is Happening Now

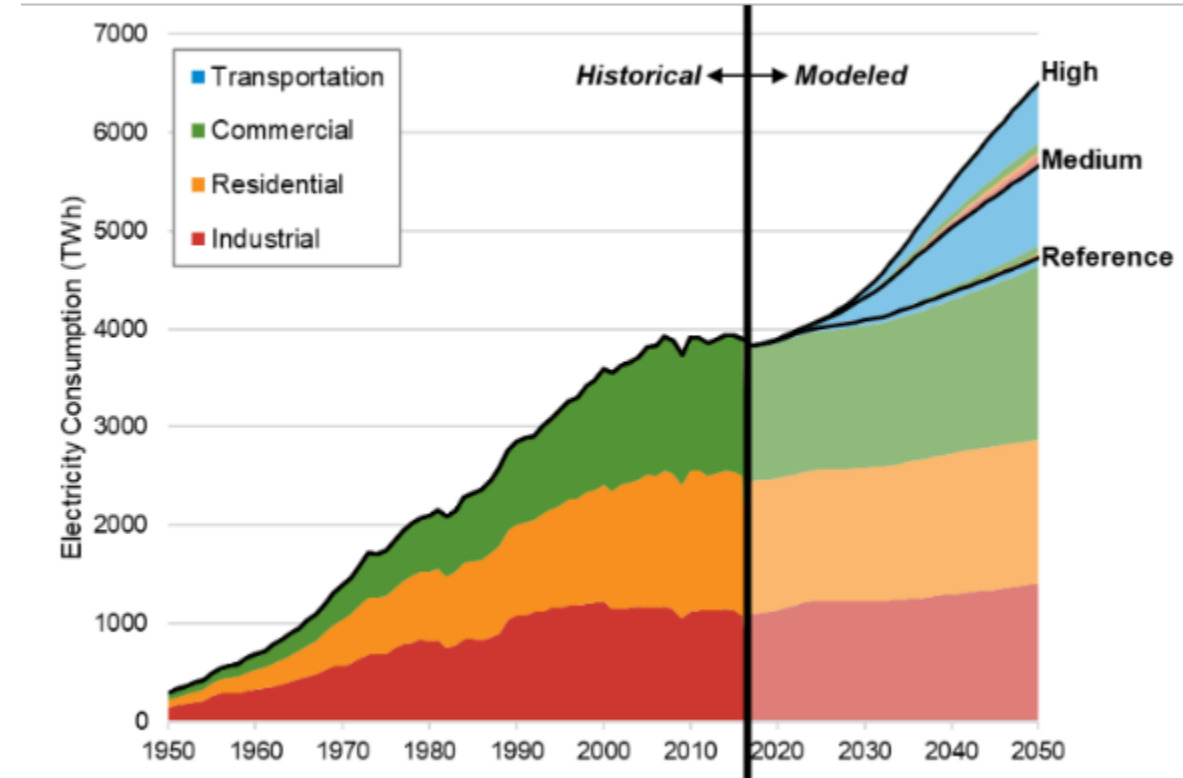
Shaping the Future

What's happening

- Influx of Federal Funding
- Rapid deployment of cost-effective electric vehicles
- Increasing consumer demand

Resulting Impact

- Largest projected new load growth with different operational characteristics
- Brings together electricity and transportation sector in unprecedented ways
- Heightened need for coordination among stakeholders and proactive decision making

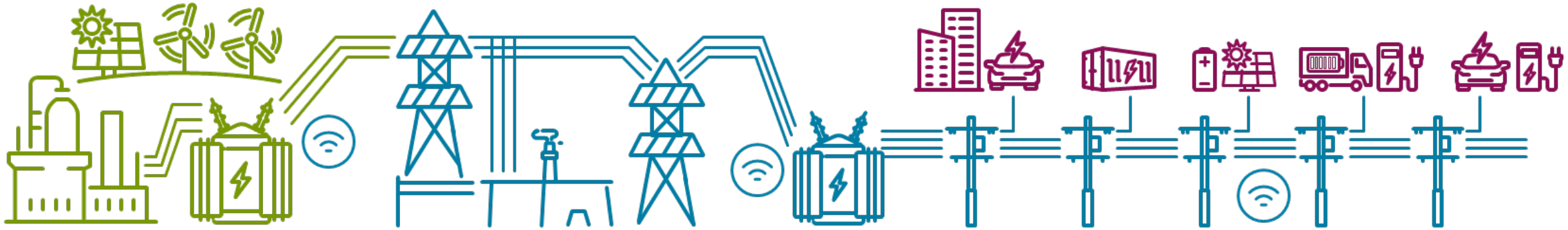


[Electrification Futures Study: A Technical Evaluation of the Impacts of an Electrified U.S. Energy System | Energy Analysis | NREL](#)

Vehicle Grid Integration (VGI) for Electric Mobility

Essential for Achieving Transportation and Power Sector Goals

Decarbonized | Reliable | Resilient | Cost-effective



ENABLED BY

- Renewable Resources
- Reliable Charging
- Sufficient Capacity
- Driver Behavior
- Communications & Controls
- Technical Standards
- Cyber Security
- Retail Rates
- Grid Services Markets
- Actionable Data
- Policy
- Transparency & Oversight
- Investment

EVGrid Assist: Accelerating the Transition

Comprehensive VGI Technical Assistance Initiative

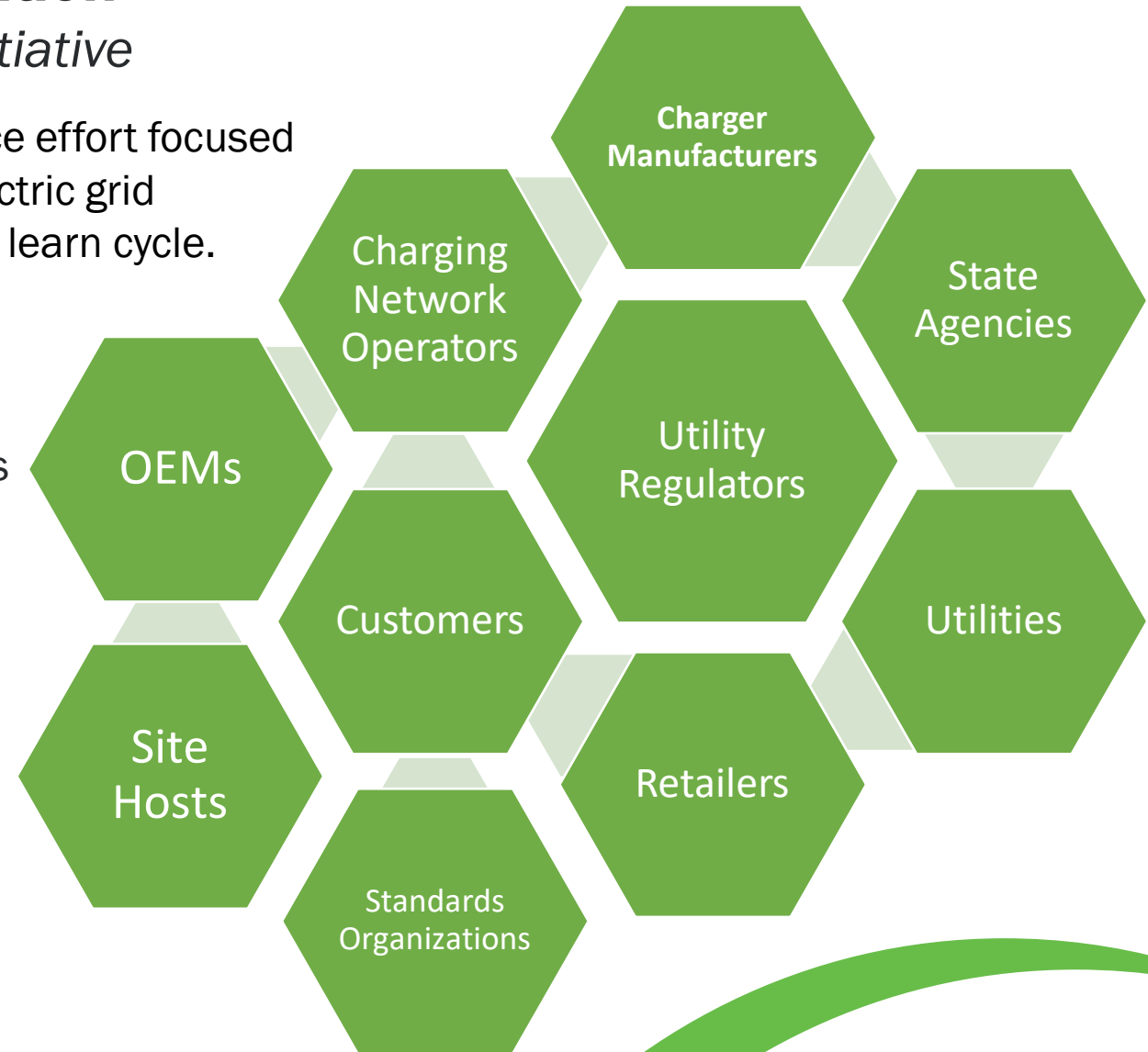
A new cross-DOE coordination and technical assistance effort focused on the interface between vehicle charging and the electric grid considering the full spectrum of the R&D, deploy, use, learn cycle.

Purpose:

- Increase stakeholder knowledge
- Drive actions to resolve VGI challenges and barriers
- Provide pathways for stronger VGI coordination

Objectives: Activate the community to

- Prioritize challenges to solve
- Accelerate planning and decision making
- Enable proactive infrastructure investments and supporting markets, rates and regulations
- More quickly achieve decarbonization goals



PANEL 1:

Proactive Infrastructure Investments

Speakers:

- Christopher Irwin, Program Manager, U.S. Department of Energy, Office of Electricity, Advanced Grid R&D
- Brian Wilkie, Director of New York Transport Electrification, National Grid
- Philip B. Jones, Executive Director, Alliance for Transportation Electrification

Predicting the Pace of Change

- Utilities operate on variety of planning horizons – days to decades
- Traditionally, infrastructure investments are based on well-established methods for forecasting load growth with known usage patterns in predictable locations
- EV adoption rate and customer charging behavior are unknown and lack well-established approaches for predicting it
- Commissions and utilities are trying to balance need to have infrastructure in place to meet customer needs while not wanting to build too early so assets sit idle
- Difficult to predict customer behavior or impacts from policies or changing customer sentiment
- Uncertainty interferes with decision making

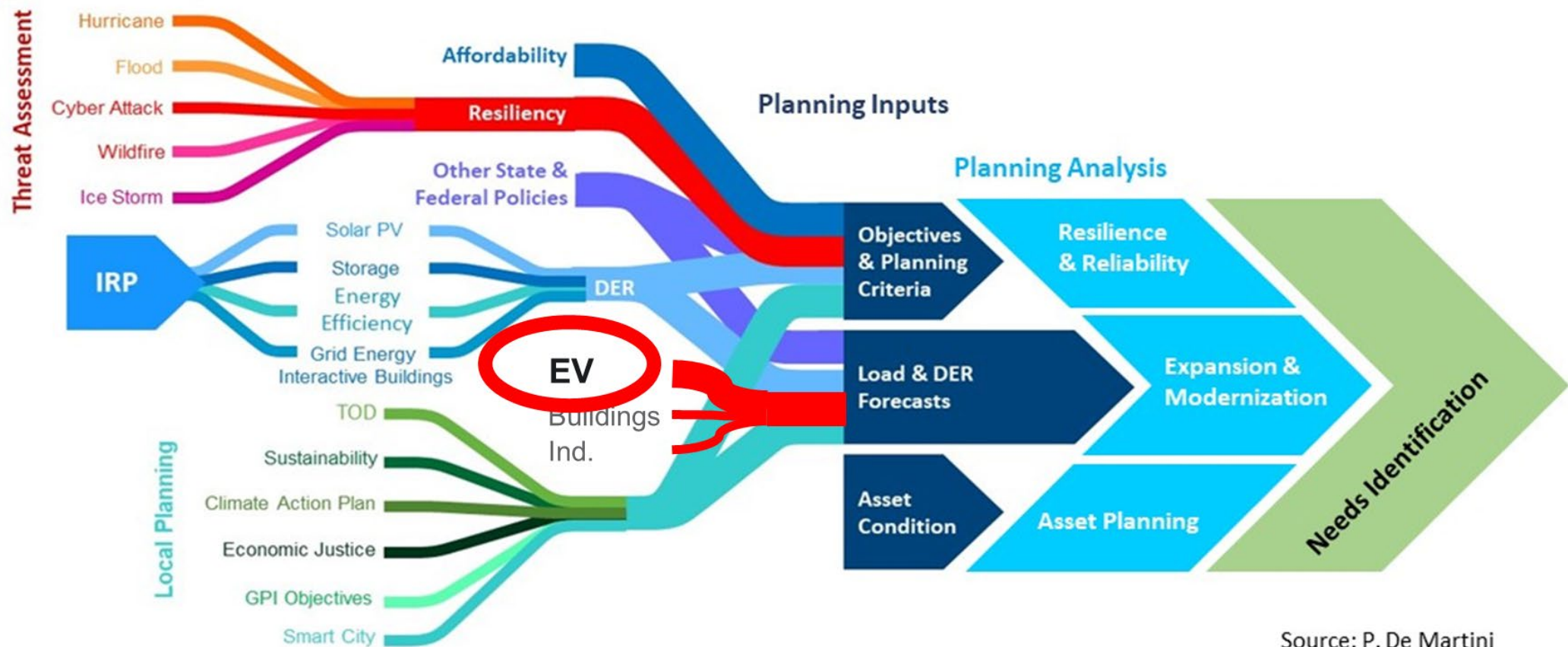


Planning in the Face of Uncertainty

- Proactive planning is essential if infrastructure is to be ready to meet customer demands
- Time required to implement planned and approved utility infrastructure upgrades can be significant so without forecasts, infrastructure investments could be delayed
- Proactive planning requires reducing uncertainty, bounding uncertainty, and/or mitigating the risks of incorrect forecasts
- There are approaches for reducing uncertainty but there is a need to balance effort required with potential for increasing accuracy of prediction



Planning Challenges



Many requirements and facets enter into the planning process.
EVs come on top of all of the other new requirements

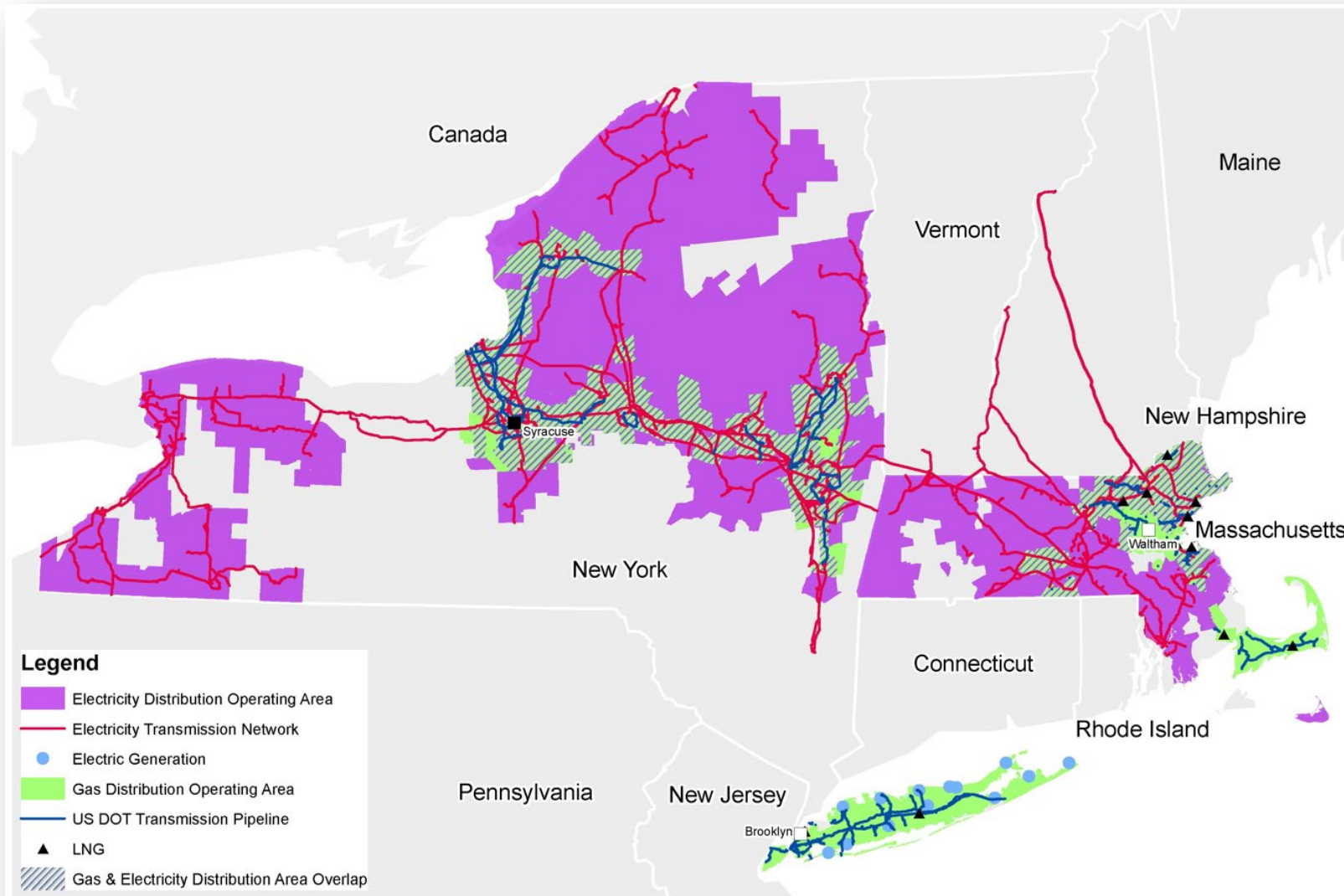
Electrifying Highways: Planning and Building Through Uncertainty

*Note: Slides contain results from
forthcoming public study.*

nationalgrid



National Grid USA: Who We Are

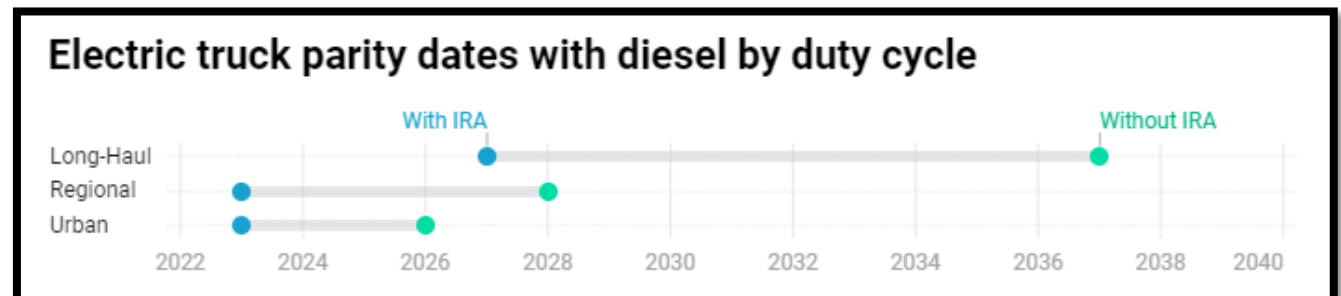


- **Electric, natural gas, and clean energy delivery company** serving more than 20 million people through our networks in New York and Massachusetts
- Make-Ready EV programs in New York and Massachusetts
- Over 4,600 charging ports installed, 49% in environmental justice and disadvantaged communities
- Electrify our entire internal light-duty fleet by 2030. **We plan to electrify 1,617 vehicles in the US by 2030.**

Recent developments have accelerated electrification

Recent legislative and technology developments have accelerated transportation electrification:

1. IIJA establishing the National Electric Vehicle Infrastructure Formula Program providing funding for initial highway charging.
2. The IRA collapsed the gap between total cost of ownership between ICE and EV trucks.
3. Tesla truck: fully loaded 500-mile range, same weight as diesel truck.



Recent analysis from RMI shows how the IRA will bring EV trucks within cost parity with ICE vehicles much sooner than initially expected in our study.

Context: Electric Highways Study

We conducted a first-of-its-kind study with our partners

Experts analyzed traffic data to forecast future fast-charging capacity at over 70 highway sites in NY and MA.

- NY sites include Thruway and non-Thruway sites
- **Light-duty** (passenger) vehicles and **medium- and heavy-duty** (commercial) vehicles
- Forecasts match state mandates for electric vehicle adoption
- Results will help utilities, regulators site operators, and state agencies coordinate and drive cost savings

Electric Highways
Study: Expert
Partners



GEOTAB®



Stable

Stakeholder outreach

- DOE, FHWA, US DOT/DOE Joint Office
- Utility regulators, DOTs, energy offices, legislators
- Fleets and vehicle Manufacturers
- Environmental groups
- Business / investment community
- NYISO and ISO-NE
- Trade associations

Feedback Received: This study creates a model for the nation to follow.

This study complements state NEVI plans, provides a 25-year roadmap for highway electrification



**Large
Industrial Plant**
(40+ Megawatts)



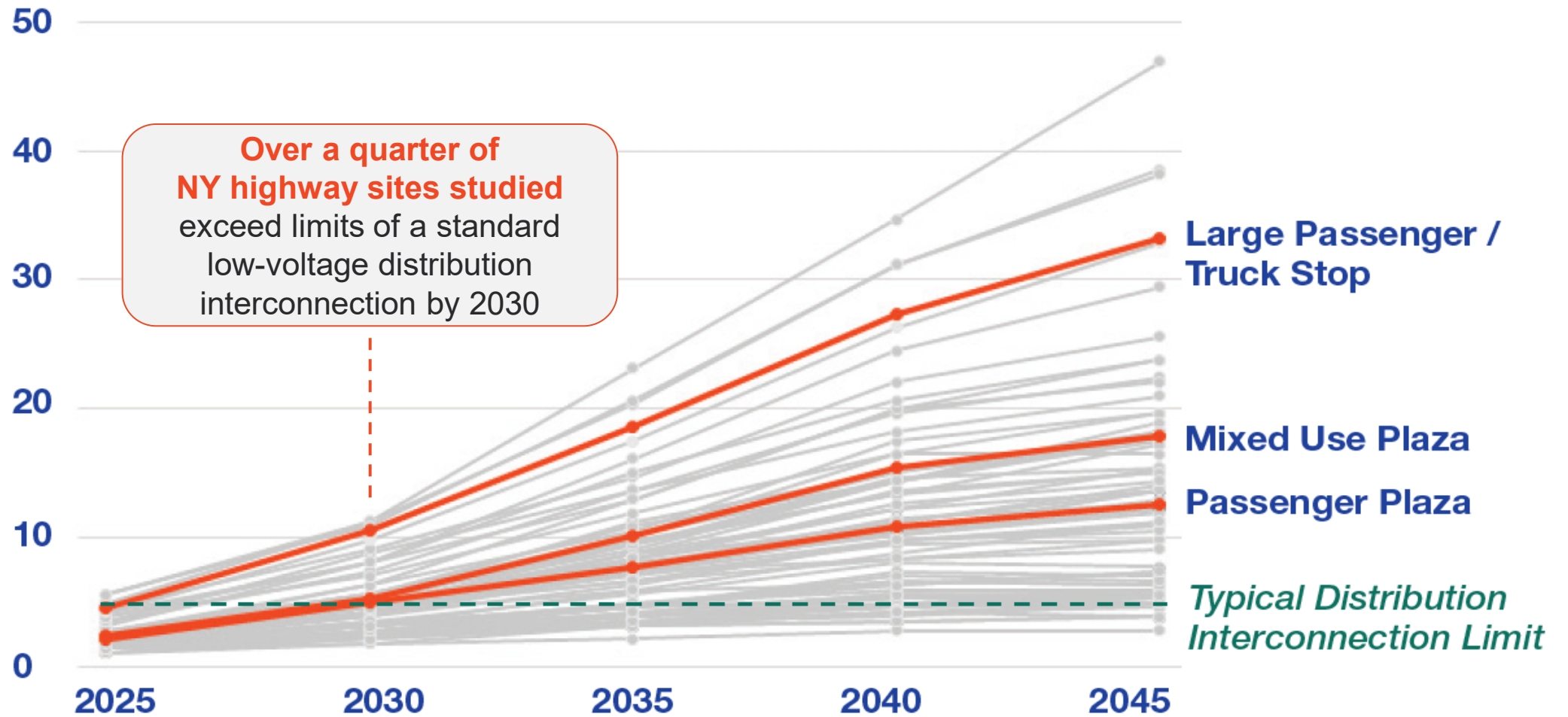
A Small Town
(20 Megawatts)



A Stadium
(5 Megawatts)

Projected charging capacity for 71 Northeastern highway sites

Megawatts of power to meet annual peak demand, over time

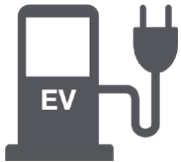


Note: Analysis seeks to match ZEV goals for New York + Massachusetts, makes simplifying assumption that all ZEVs are electric. See study for discussion of assumptions, including role of hydrogen fueling and impact on capacity.

We have a limited window of opportunity

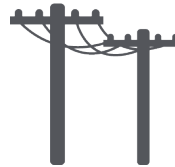
By interconnecting sites to the high-voltage transmission grid, we can deliver the power that drivers need.

~2 Months
to Construct



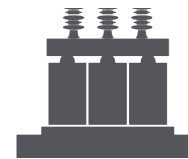
Onsite Upgrades

~1-4 Years to
Construct



Distribution Upgrades

~4-8 Years to
Construct



Transmission Interconnection
and Upgrades

National Grid is seeking to de-risk investment and avoid EV adoption outpacing utility infrastructure.

We as an industry must meet the moment to ensure the electric grid is an enabler—not a bottleneck—to developing a seamless highway charging network.

The exact future of charging is unknown, but the direction is clear

The key lesson for utility planning is that **directional forecasting helps to de-risk anticipatory infrastructure investments.**

| Risks of Anticipatory Investments | Over Building | Building Too Early | Building in the Wrong Place |
|---|---|---|--|
| How we can mitigate those risks through directional forecasting | By analyzing distinct scenarios, we can see sensitivity of energy demand in different charger configurations and sales scenarios. | Consider distribution system thresholds as compared to capacity needs as a clear indicator of investment needs. | Site specific analysis, as opposed to system wide studies, help to direct the investment and charging demand to the lowest cost locations. |

Policy Opportunity: Coordinating Planning and Deployment of Highway Charging

There is an opportunity for utilities, regulators and policymakers to develop **coordinated, actionable plans for highway charging** to accelerate transportation electrification at **lowest total system cost** by enabling utilities to make targeted anticipatory investments in infrastructure to support highway fast charging.

These Action Plans Could:

- **Coordinate the identification of “no regrets” highway sites** for charging deployment
- **Forecast how many chargers are needed at each site** to serve passenger and commercial vehicles
- **“Plug” those sites into neighboring electric transmission (or distribution) lines** to deliver the power necessary for fast-charging
- **Empower utilities to build required upgrades in time** to meet growing demand from drivers by making anticipatory investments in line with directional forecasts.

Benefits:

- ✓ **Drive down costs** by eliminating duplicative investments – bring the chargers to the big wires, rather than the other way around
- ✓ **Avoid long wait times for drivers** by eliminating bottlenecks to charging deployment
- ✓ **Seamlessly enable the EV transition** for passenger and commercial vehicles
- ✓ **Improve air quality and support fleet electrification** in neighboring communities
- ✓ Achievement of climate mandates and market development at **lower total system costs**

Contact

Brian Wilkie

Director - NY Transport Electrification

Clean Energy Development

Brian.Wilkie@nationalgrid.com

nationalgrid



Philip B. Jones

- Executive Director, Alliance for Transportation Electrification (ATE)
<https://evtransportationalliance.org>
- Former President, National Association of Regulatory Utility Commissioners (NARUC)
- Former Commissioner, Washington Utilities and Transportation Commission

Facilitated Discussion

Framing Questions:

- What are successful approaches for planning for new investments?
- What is needed to enable these?
- Is there research or data that is needed that would support investment decisions?

Questions for panelists or
Insights or experience to share?

PANEL 2: Developing Innovative Rates

Speakers:

- Christopher Irwin, Program Manager, U.S. Department of Energy, Office of Electricity, Advanced Grid R&D
- Peter Cappers, Research Scientist, Lawrence Berkley National Laboratory
- Sanem Sergici, Principal, The Brattle Group

EVGrid Assist Activities Related to EV Rates

Supporting Regulators and Utilities

Meta-Analysis

- Inform stakeholder discussions
- Present examples
- Release expected early 2023

Additional Potential Convenings

- Provide a forum to hear multiple perspectives
- Identify barriers or areas of contention (e.g., submetering, demand charges) and approaches for solving them
- Uncover challenges and additional research & validation needs

Direct Support to Commissions and Utilities

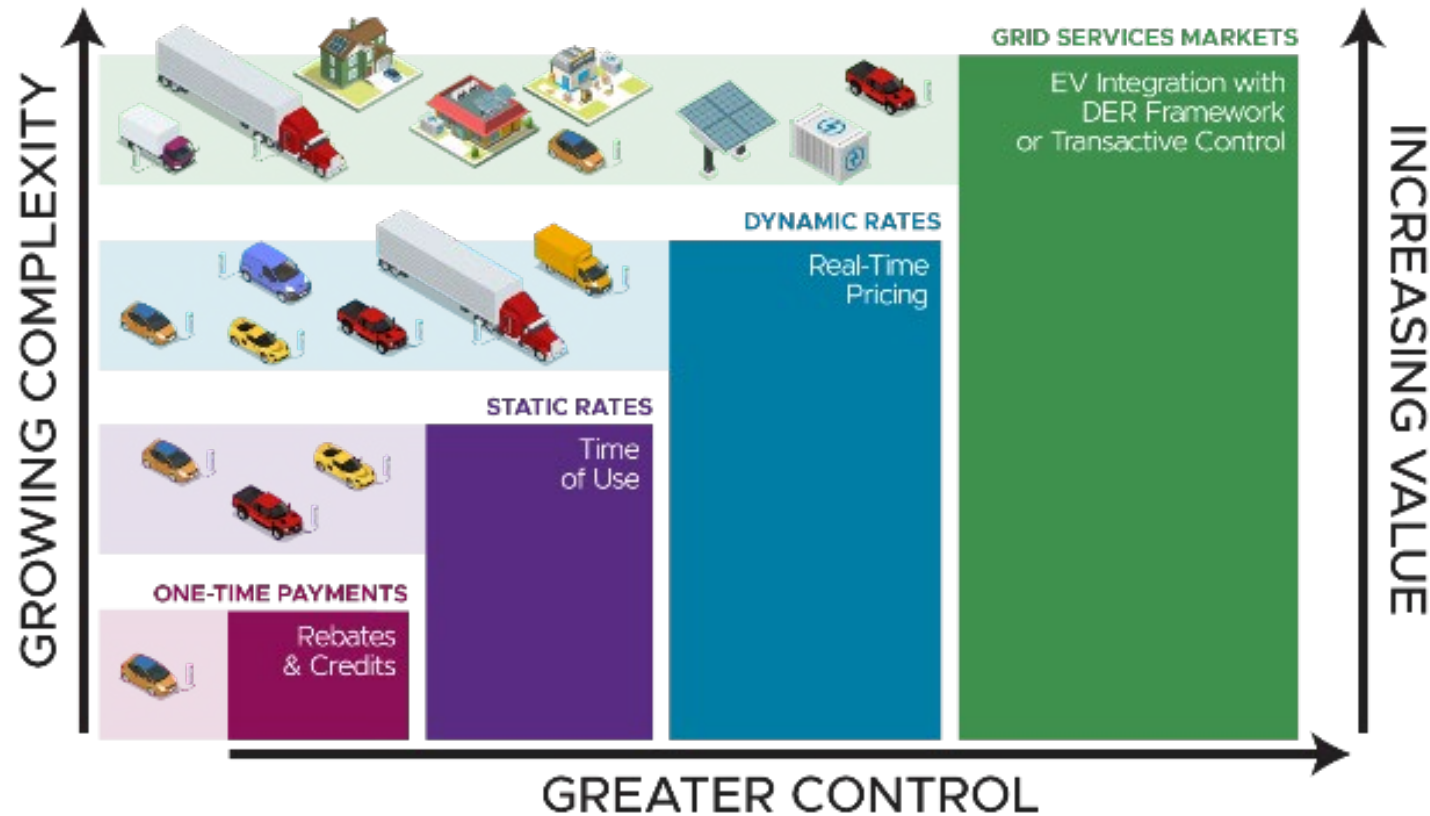
- Individual commissions and utilities
- Convenings around specific topics

Objectives

- Support and inform state-level efforts while respecting local/state jurisdiction
- Speed implementation of new rate designs through peer-to-peer learning
- Provide resources that assist regulators and utilities
- Illuminate barriers and work collectively on solutions
- Identify best practices or successful approaches to ease frustrations

Rates and Incentives

A Spectrum of Approaches



- Incentives can influence the time, place, or amount of a grid service provided
- Cost and complexity to implement differs
- Approaches may change as adoption levels grow
- More sophisticated measures should be seen as adding value on top of simpler incentives, and not replacing them

Mitigating negative impacts to the grid, shaping consumption to align with decarbonized generation, and minimizing utility investments will require a portfolio of incentives

Electric Vehicle Rate Design Overview

Peter Cappers

NARUC Annual Meetings 2022

High Priority Areas for Accelerating the EV Transition

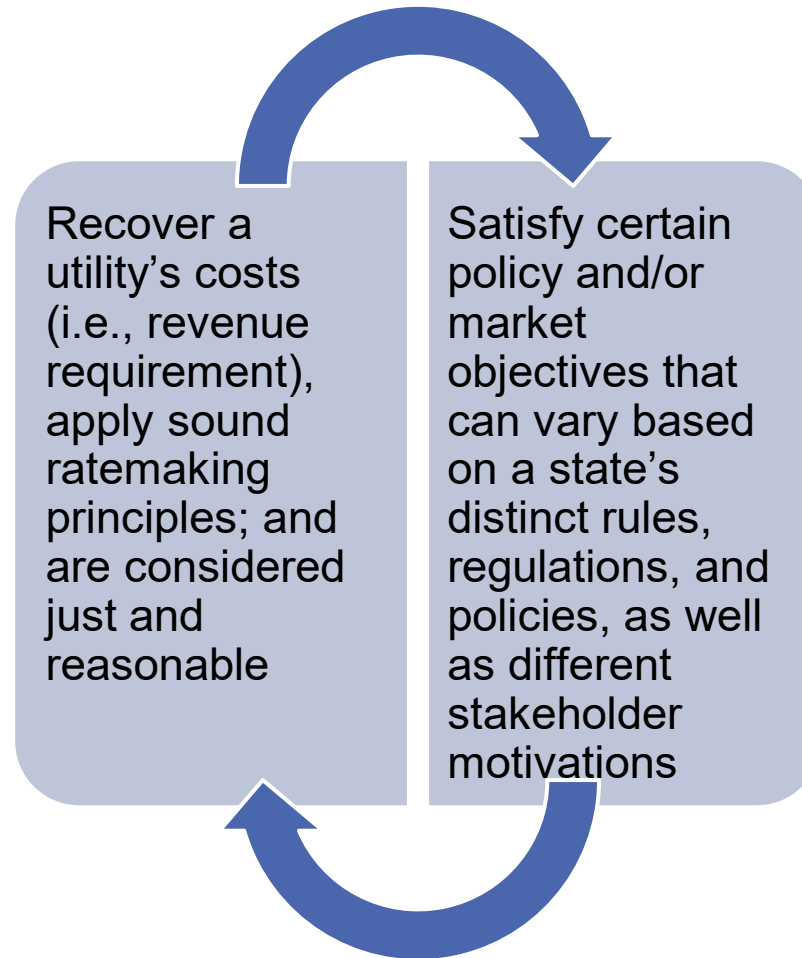
Panel 2: Developing Innovative Rates

November 16, 2022

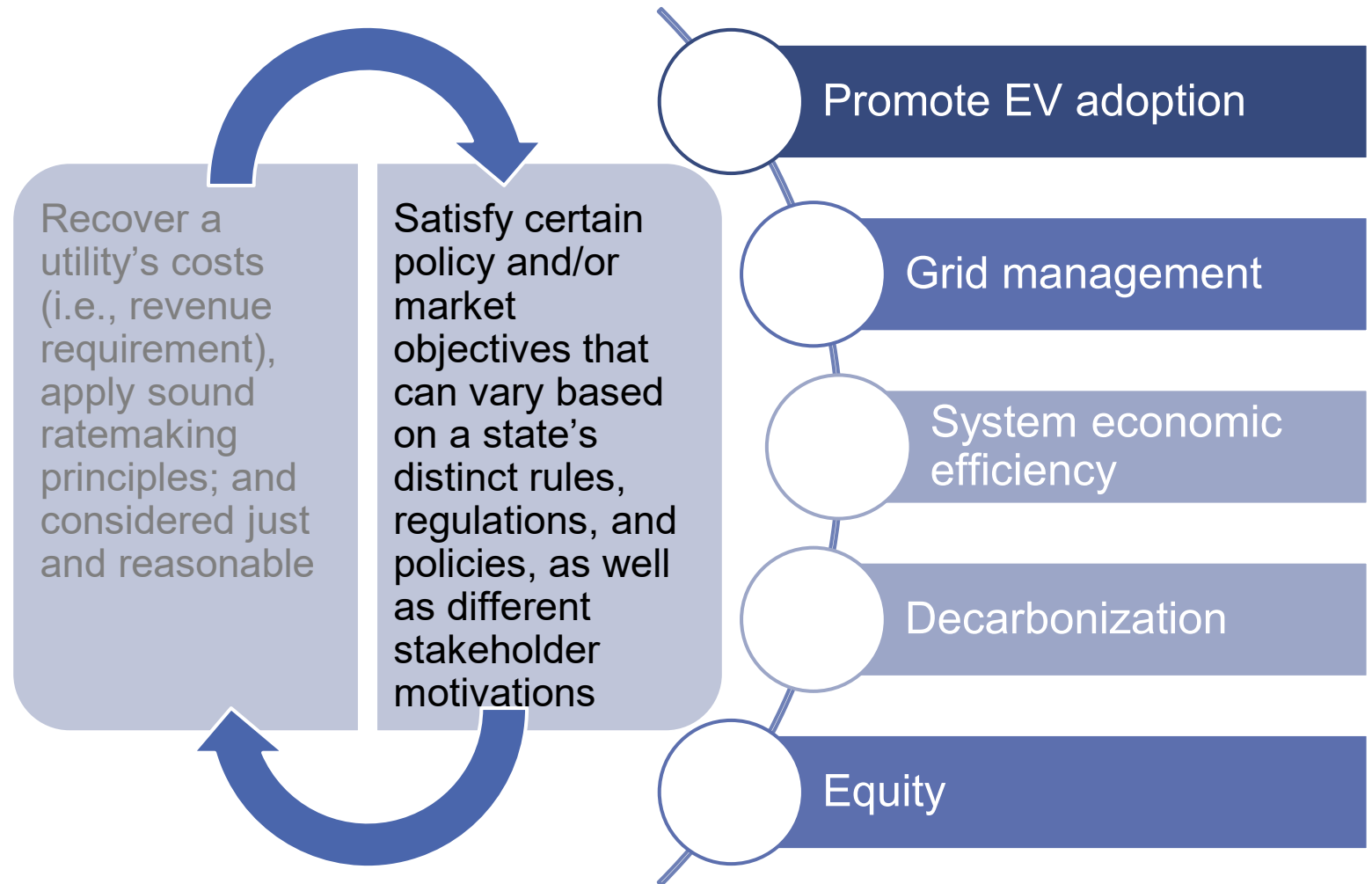
This work was funded by the U.S. Department of Energy's Office of Electricity, under Contract No. DE-AC02-05CH11231.



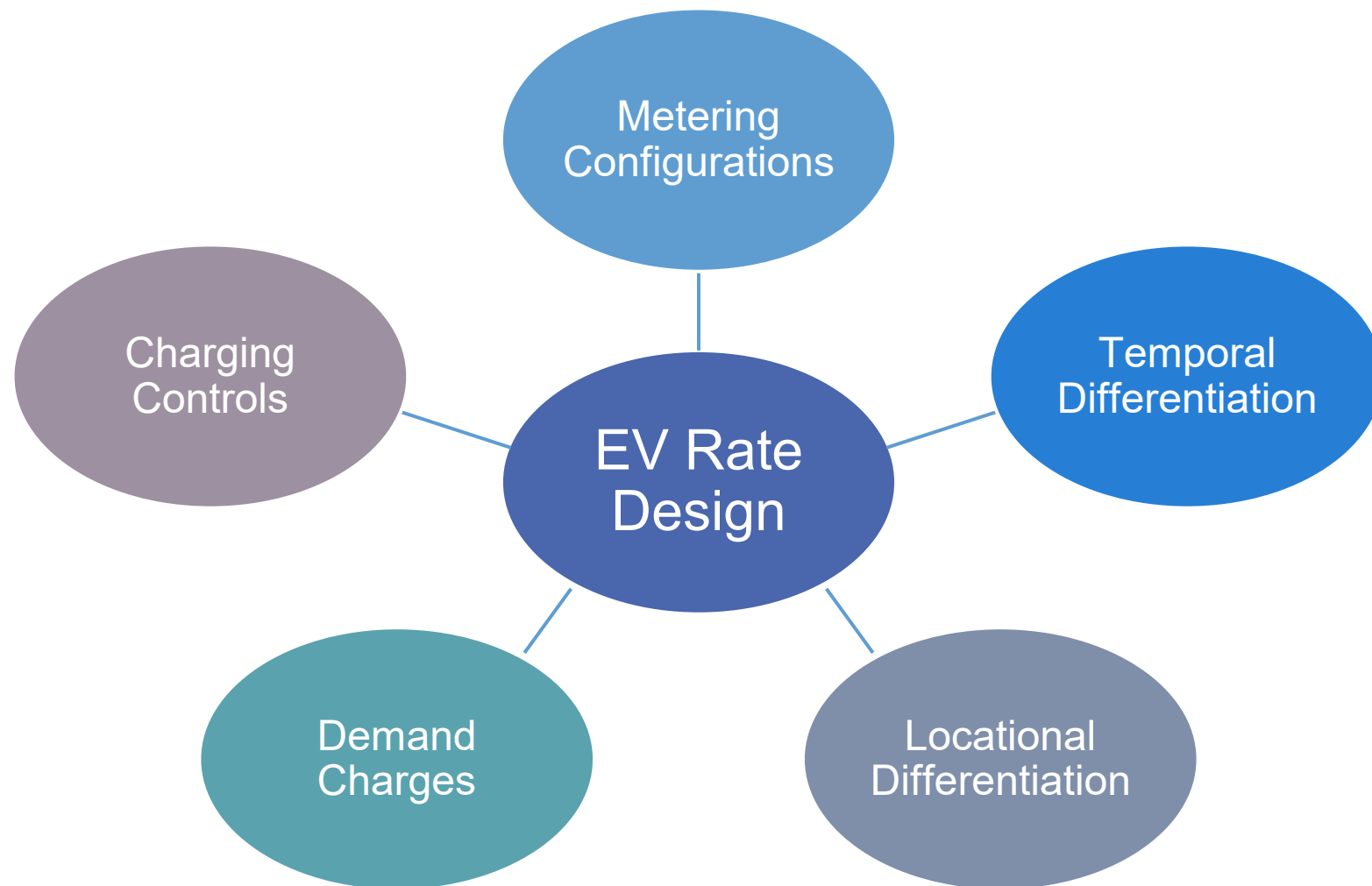
Retail rates are designed based on two broad concepts



Five policy-driven objectives used as the basis for EV retail rate design



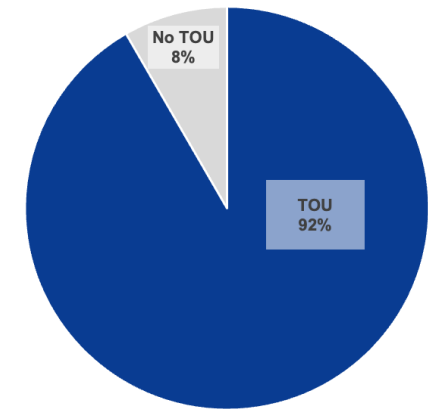
EV rate design typically comprised of five (5) different components



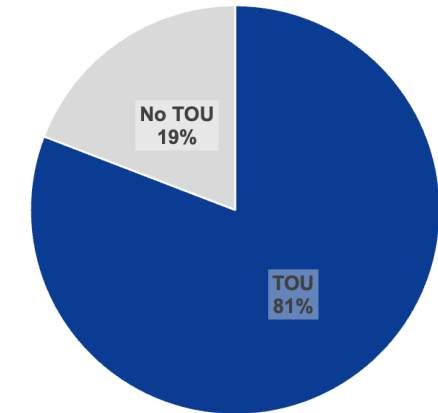
Recent Regulatory and Rate Activity

- **Motivation:** The overwhelming majority of rate activity (>85%) is focused on managing and shifting demand
- **Rate Design:** Static TOU rates are the dominant rate structure (>90% residential; >80% commercial)
- **Demand Charges:** Over 20 states are examining demand charge alternatives for public and DCFC, particularly at lower load factors

Residential Rates



Commercial Rates



Forward-looking considerations for EV rate design

Implications of
EV rate designs
for other DER
objectives and
policies

Alignment of
system value
with EV
charging

Revisiting EV
rate designs as
EV deployments
increase and/or
system
conditions
change



High Priority Areas for Accelerating the EV Transition

Panel 2: Developing Innovative Rates

PRESENTED BY

SANEM SERGICI, PH.D.

PRESENTED TO

NARUC ANNUAL
MEETINGS 2022

NOVEMBER 16, 2022



Primary Mission of Retail Pricing

First and foremost function of retail rates is to recover utility's revenue requirement in the most economically efficient and equitable fashion

At the same time, rates should reflect the structure of the costs incurred to serve them and lead to **efficient price signals** to:

- Encourage optimal consumption decisions;
- Lead to bill stability for customers and revenue stability for utilities; and
- Be easily understandable by customers

When the rate construct is laden with other objectives, such as incentivizing new technologies and subsidizing certain customer groups, rates start to **fall short of delivering on their primary mission**, may lead to inter- and intra-class cost shifts, and convey inefficient price signals that lead to over- or under-consumption of electricity

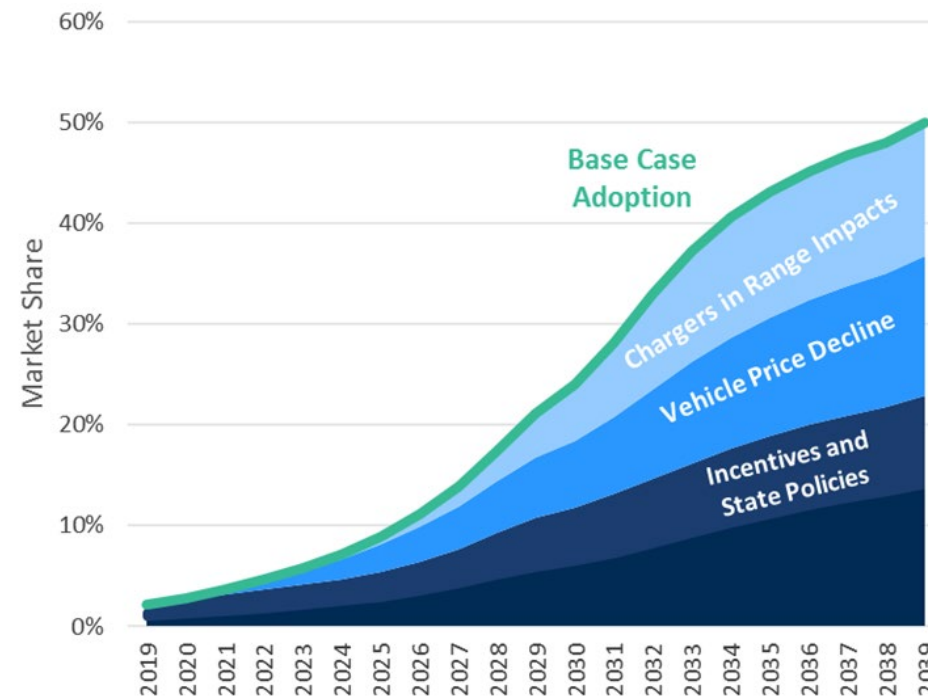
It is important to **maintain cost-reflectivity when designing rates that are favorable for EV charging characteristics** → This is not equal to subsidized rates for EVs

EV Specific Rate Offerings

Utilities offer EV specific rates for a variety of reasons:

- EV rates are typically offered to incentivize economic efficiency of the charging behavior
- To the extent that the EV charging can be moved to low marginal cost price periods; utility costs are minimized and customer bills are reduced
- EV TOU rates also allow deferral of distribution capacity investments in certain load pockets experiencing higher rates of adoption
- They represent a meaningful option to “active managed charging”, for customers who do not want to give control to their utilities
- Some utilities also offer EV TOU rates to drive EV adoption, but the effectiveness of this approach has not been validated by data

Brattle’s econometric EV forecasting model indicates that the availability of EV TOU rates is not a statistically significant driver of adoption



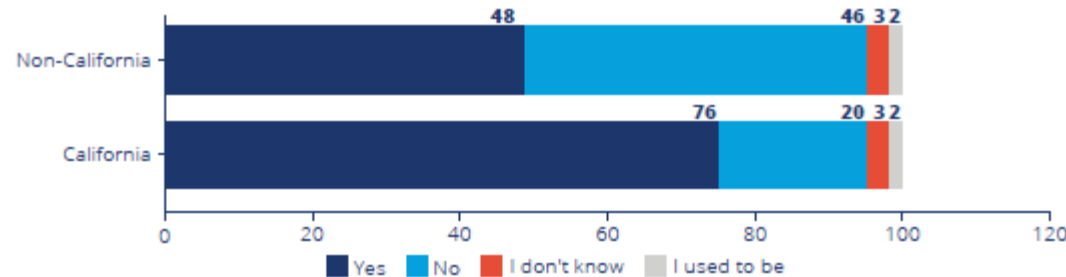
Source: Brattle (2020). Based on historical EV adoption data from 50 states, between 2011-2020.

Residential customer interest in EV TOU rates is high...

... However there is still room for improvement

A 2019 SEPA survey reported that 48% of the EV customers are enrolled in a TOU rate. This statistics is inclusive of customer participation in whole-house TOU rates and EV TOU rates

Figure 11: Percentage of EV Customers Enrolled In a TOU Rate



Source: Smart Electric Power Alliance & Enel X, 2019. N=1,880.

Focus groups indicate EV customers are much more enthusiastic about EV-only TOU rates, but separate metering of the EV load is proven to be a challenge

- L2 chargers can technically provide metering, but often times do not produce billing quality data
- There is a need for a jointly commissioned utility study to understand the challenges of metering through chargers; and acceptable billing precision for EV load

Designing rates for high-demand draw charging stations is more contentious

- Owners of public and commercial charging stations argue that the demand charges are limiting the economic viability of these stations, especially at low utilization rates
- While this may be true, eliminating the demand charges for these stations with low utilization implies cost-shifting to the other customers
- There is not a uniform alternative used by utilities in our survey, and the rates are a product of unique circumstances of each utility's regulatory and public policy environment. Some examples include:
 - Demand charge holidays, demand subscription rates, TOU rates
 - Capped rates and demand limiters for low-utilization customers
 - Demand charge credits, low demand charge/high volumetric rates
- Some of these rate designs include explicit subsidies for these charging stations, while others minimize the cost-shifting to other customers
 - These subsidies are often justified by “state public policy,” in which a state officially embraces “increased electrification” as part of the official state energy policy
 - It will be important to track utilizations of these stations and include sunset provisions for the rate subsidies

Clarity in the face of complexity

That's the Power of Economics™



Facilitated Discussion

Framing Questions:

- What new rates options are most interesting or innovative?
- How are you thinking about how to balance the many objectives of new rate structures for EVs?
- How are consumer preferences/demands balanced with policy objectives?
- How could DOE play a constructive role in addressing hurdles surrounding the development and approval of new rate structures (e.g., information, technology, submetering)?

Engage in the conversation:
Share your insights or experience or ask questions for the panelists?

EVGrid Assist: Accelerating the Transition

Millions of electric vehicles are already hitting the road, with even more to come over the next decade. Successful integration with the electric grid will be essential for reducing emissions, maintaining reliable and resilient electricity, and enabling a seamless charging experience. This initiative will support decision makers as they plan for the future of transportation electrification.

 <https://www.energy.gov/eere/evgrid-assist-accelerating-transition>



SCAN ME
to learn more and sign
up for announcements.



U.S. DEPARTMENT OF
ENERGY



To Contact EVGrid Assist:
EVGrid@hq.doe.gov

THANK YOU