Using PBR for Electric Vehicle Grid Integration

NARUC Webinar: PBR for Transportation Electrification

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1 EV Opportunities and Challenges
Electrifying vehicles = emissions reductions

- Transportation sector is the largest share of greenhouse gas emissions in the U.S. (28%)
- Light duty vehicles make up a large share (59%)
- Medium and heavy-duty trucks (23%)
- Total = 82%
- Electrifying vehicles could address ~ 23% of U.S. GHG emissions if aligned with clean charging opportunities
EV Charging Opportunity

- 1,000 miles/month @ 25 mph average = 40 hours
- Driven: 40 hours/month
- Charging: 40 hours/month
- Parked: 680 hours/month

Challenge: How do we align those charging hours (and maybe even parked hours) with efficient or optimized grid operations?
Aligning the EV opportunity

• EVs offer a new flexible load that can be integrated into the electric system in a way that maximizes benefits for both EV users and grid operators.
• But if not well aligned, EVs can exacerbate peak, increasing costs and emissions.
• So how do we ensure that EVs are integrated to benefit the grid?
Performance-Based Regulation
Performance-Based Regulation (PBR)

- A means by which regulators can align utility incentives with policy-mandated goals (improved reliability, deployment of DERs, EE, and EVs)
- Stands in contrast to traditional cost-of-service regulation, where incentive for utility is to increase rate of return by increasing sales and investments
PBR May Help Overcome Bad Outcomes

- Good things that are not profitable for the utility that don’t get done (Non-wires Solutions, aggregated DERs)
- Bad things that are profitable to the utility that should be prevented (Gold-plating physical assets)
- Bad incentives not easily seen (Deferring expenses like tree trimming, customer care, underserved communities)
Performance-Based Regulation Steps

- Guiding goals
- Understand Current Incentives
- Develop Measurable performance criteria
- Metrics
- Performance Targets or Outputs
Set Guiding Goals

Examples:
• Make/keep energy affordable for customers
• Increase efficient EV charger deployment
Understand Current Incentives
Develop Measurable Criteria

Examples:
- Declining customer bills
- Track charger infrastructure deployment and usage
Create Metrics

Examples:
• Average monthly bills for residential customers
• Track charging hosts using incentives; require information about those sites
Establish Outputs: Performance Targets

Example:
- 2% reduction in average monthly residential bills
- 5% increase in charging stations and charging station utilization
Performance Tracking Options

- **Public Metrics Only**
  - Metrics are publicized on a publicly available "dashboard."

- **Public Metrics with Ranking**
  - Metrics are publicized and ranked
  - Examples: Denmark DSO efficiency ranking, RIIO

- **Public Metrics with Financial Incentives**
  - Metrics are publically available, and utilities receive financial awards or penalties depending on achievement of the metrics.
  - Examples: NY REV
Applying PBR to EV Integration
Questions regulators can ask when thinking about PBR and EVs

• What are the carbon and pollution reduction goals of the jurisdiction?
• What is the goal of supporting EV build-out? (to serve customers, EV opportunities in underserved communities, grid stability?)
• What education and outreach activities are most helpful for agencies, utilities, car dealerships, car manufacturers and other entities?
Useful Data

1. Circuits and feeders with excess seasonal or year-round daytime capacity to accommodate charging load at peak.

2. The elasticity of demand for on-peak charging versus off-peak charging by charger installation use (residential, commercial/retail, commercial/fleet, municipal/fleet).

3. Average and median utility/ratepayer cost for installation of charging infrastructure by charger installation use as well as by charger and charging station.

4. Utilization of chargers by charger, charging station and charger installation use.
1. Build understanding of EV charging costs, benefits and consumer savings
2. Encourage the development of EV infrastructure while controlling costs
3. Use existing grid resources to integrate EV load to maximize net benefits to all ratepayers
Goal 1: Build understanding of EV charging costs, benefits and consumer savings

<table>
<thead>
<tr>
<th>Goal</th>
<th>Performance criteria</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase customer awareness of special EV charging rates</td>
<td>Utilities will provide customer information on available EV rates through multiple channels of communications</td>
<td>Percent of customers aware of special EV rates through survey</td>
</tr>
<tr>
<td>Increase customer awareness of lifetime economic and environmental benefits of EVs compared with ICEs</td>
<td>The utility will provide customer information on lifetime economic and environmental benefits of EVs compared with ICEs</td>
<td>Percent of customers aware of cost savings from EVs; percent of customers aware of environmental benefits of EVs¹⁷</td>
</tr>
<tr>
<td>Increase customer awareness of time-varying component of rates to save them money and reduce environmental impacts</td>
<td>The utility will provide customers with information on time-varying rates and how these can help customers save money and reduce environmental impacts</td>
<td>Percent of customers aware of time-varying rate discount; percent of customers aware that charging off-peak reduces environmental impacts</td>
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Goal 2: Encourage the development of EV infrastructure while controlling costs

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<tr>
<td>Encourage charging deployment that meets customer needs</td>
<td>Measure effectiveness of incentives for hosts of charging stations to track and encourage customer use</td>
<td>Track number of incentives taken; track utility requirements for charging hosts and charger usage (e.g., removal of demand cap for EV fast chargers for an introductory period of time; payment of EV service connection costs)</td>
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<tr>
<td>Ensure forward-looking behavior to accommodate EV charging infrastructure</td>
<td>Measure effectiveness of incentives to support charging infrastructure</td>
<td>Track number of sites where incentives are provided to future-proof residential and other sites; track compared with benchmark where incentives not taken</td>
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<tr>
<td>Encourage efficient rollout of EV charging infrastructure by using existing infrastructure</td>
<td>Measure effectiveness of incentives for use of existing infrastructure where appropriate</td>
<td>Track use of incentives for using existing infrastructure (e.g., light poles, telecommunications distribution poles) and other synergies with existing electrified public transport lines</td>
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Goal 3: Use existing grid resources to integrate EV load to max. net benefits to all ratepayers

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<td>Decrease investment in generation; minimize distribution system upgrades</td>
<td>Survey to evaluate utility hosting capacity map or heat mapping for use in determining optimal charger locations</td>
<td>Track distribution system upgrades to accommodate EV charging infrastructure, systemwide and by circuits</td>
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<td>Maximize existing distribution system</td>
<td>Develop mapping tool to determine grid locations with capacity for charging stations and how much during specific charging use cases (day for retail, nighttime for municipal fleets, etc.)</td>
<td>Track use of mapping tool as a reference when permitting charging stations; survey users about mapping tool usage and usefulness</td>
</tr>
<tr>
<td>Integrate new EV load to avoid exacerbating any existing load issues</td>
<td>Measure enrollment in time-of-use rates or specific EV rates; calculate EV charging savings when enrolled in time-of-use rates compared with what that same amount of charging would have cost on standard utility rates</td>
<td>Track use of incentives/enrollment in time-of-use rates; track impact on charging behavior when on a time-of-use rate compared with peak; track hours of energy used off-peak and the associated reduction in evening peak due to charging occurring off-peak; calculate new load integrated into the grid in terms of both energy and peak charging demand</td>
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RAP Resources

- Metrics to Measure the Effectiveness of Electric Vehicle Grid Integration
- Next-Generation Performance-Based Regulation: Volume 1 (Introduction—Global Lessons for Success)
- Next-Generation Performance-Based Regulation: Volume 2 (Primer—Essential Elements of Design and Implementation)
- Next-Generation Performance-Based Regulation: Volume 3 (Innovative Examples from Around the World)
- Performance Incentives for Cost-Effective Distribution System Investments
- Protecting Customers from Utility Information System and Technology Failures
About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org

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Level 2 EV Charging is a Lot Like…
An Electric Water Heater!
Really!

Electric Vehicle
- 3.3 – 6.6 kW
- 2,000 – 4,000 kWh/year
- Can avoid morning and early evening peak charging
- Batteries likely equal a full day’s supply

Water Heater
- 4.4 – 5.5 kW
- 2,000 – 4,000 kWh/year
- Can avoid morning and early evening peak charging
- Tank usually covers a full day’s supply
Three “Levels” of EV Charging

**Level 1:** Standard household current (120 Volts)
- 1.5 kW
  - Adds about 4 miles range per hour

**Level 2:** High capacity residential circuit (240 Volts)
- 6.6 kW
  - Adds about 20 miles range per hour

**Level 3:** Fast commercial chargers in public areas with very large electricity connection:
- Up to 350 kW
  - Adds up to 200 miles in 15 minutes