New Jersey EV Market Study

BPU EV Working Group Preview

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• Goals, Scope, and Methodology

• The Adoption Scenarios

• Key Findings
  ➢ Current New Jersey Market Conditions
  ➢ Charging Segments
  ➢ Economic Impacts
  ➢ Emission Impacts
  ➢ Utility and Infrastructure Considerations

• Next Steps
Goals, Scope, and Methodology

• Key Questions:
  ➢ Where is the NJ EV market today?
  ➢ What are the opportunities for growth?
  ➢ What are the costs and benefits of expanded EV adoption?
  ➢ What are the implications for infrastructure and utilities?

• Scope
  ➢ Focus on light duty vehicles
  ➢ Consider various scenarios from 2018-2050
  ➢ Evaluate economic impacts
    ✓ Impacts on electricity prices
    ✓ Impacts on EV driver operating costs
    ✓ Impacts on Social Cost Of Carbon
    ✓ Evaluate costs from both market development and potential upgrades
  ➢ Evaluate environmental impacts
    ✓ CO2 emissions
    ✓ Nox emissions
    ✓ Two different emission accounting methods
  ➢ Specifically consider “natural” and “managed” vehicle charge scheduling

• Next Steps
“Tops Down” For Economic And Emissions Impact Assessment

This Study Is Based On:

- New Jersey Conditions
- Charging Data From Industry
- Detailed Dispatch Simulations
- Detailed Distribution System Data
- Analysis Of Utility Tariffs
- Synthesis of Numerous Studies
- Calibration For New Vehicle Characteristics
Under Scenario Two (Leadership) – Approximately 31.5% of Fleet Is A Plug-In By 2035. Global Leadership Benchmarks Are Fleet 30% Penetration By 2030 (mostly in Europe).
Findings: Current NJ Market Conditions

PEV Sales Have Accelerated In NJ Over The Last Year, And Now Exceed National Growth (79% in NJ 2016 over 2015, vs ~30% YTD 2017 Nationally)

New Jersey Lags Other Adoption-Leaders By Almost A Factor Of Two, Which Demonstrates “Untapped Potential” For Increased PEV Penetration.

New Jersey Also Lags These EV Market Leaders In Public Charging Plug Density, By About A Factor Of 5 (~150 plugs/1000 PEVs, vs 38 plugs/1000 PEVs for NJ).

Source: Registered PEVs in NJ, as of Dec 31, 2016, provided by NJ DEP in July 2017
Analysis by Mark Warner, ChargEVC
Findings: Charging Segmentation

**Residential Chargers**
- Private Home Chargers
- Multi-Family (& hotels)

**Semi-Public Chargers**
- Workplace Chargers
- Fleet Chargers

**Public Chargers**
- Community Chargers
- Corridor Chargers

### Long Dwell Time (Authorized Users)
- Must Do Charging, Very Fast

### Short Dwell Time (Public Users)
- Convenience Charging, Slower OK

Private Home Chargers: Autoscan
Multi-Family (& hotels): Autoscan
Workplace Chargers: Autoscan
Fleet Chargers: Autoscan
Community Chargers: Autoscan
Corridor Chargers: Autoscan
Findings: Gross Economic Impact

- **Key Economic Impact Dynamics**
  - **Energy Cost Savings** (affects all rate payers)
    - Wholesale energy costs go down as a greater fraction of MWHRS are in cheaper off-peak times
    - Fixed costs (capacity, transmission, distribution) dilute as MWHR volume increases
    - Energy cost impacts could increase substantially if V2G capabilities used to shave peak load
    - Actual impact on rates will depend on numerous other factors (contracts, tariff design, etc)
  - **Social Cost Of Carbon Savings** Scale With Reduced CO2 emissions (affects society overall)
    - Based on federal SCOC factors applied against CO2 emissions only
  - **Operating Expense Reductions For PEV Drivers** (maintenance and fueling)
    - At today’s prices, 4.49 cents/mile for electricity (BEV), vs 10.67 cents/mile for gasoline

![Gross Savings By 2035](image1)

![Gross Savings By 2050](image2)
Findings: Energy Cost Impacts

- Ratepayer Savings Are Substantial, Even When Considering Only Energy Impacts
- Benefits Scale Strongly With PEV Adoption Level
- Managed Charging Increases Economic Benefit Over Natural Charging

- These Impacts Are Realized By All Ratepayers
Findings: NET Economic Impacts

• **Economics Are Still NET POSITIVE After Accounting For Estimated Costs**
  - Roadmap Costs ($550M)
    - Vehicle purchase rebate ($300M)
    - DCFC Network ($100M)
    - Other L2 Programs ($150M)
  - System Impact Costs (upgrade all 1-Ph xFrmrs, $2.2B)
    - Note: system reinforcement can potentially deliver benefits beyond handling EV-load

• **Energy Only Net Savings (Scenario Two, Managed) Through 2035:**
  - $4.34B Nominal Sum, $1.96B NPV
  - These benefits apply to ALL Ratepayers and continue to increase through 2050

• **Net Benefit Increases If Non-Energy Economic Benefits Included**
Findings: CO2 Impacts
(transportation only)

Significant Reductions In Net CO2 Emissions

- No significant difference between managed or natural charging schedule results
- Method Two shows slightly higher beneficial impact
- By 2040, For Roadmap Case (S2, M2):
  - C02 reduced by 33% wrt baseline in 2040
  - C02 reduced by 29% wrt baseline in 2018
- For GWRA Goals:
  - Gas CO2 emissions must reduce to 8.4M tons
  - By 2050 (using method two):
    - S1: 28.1 M tons
    - S2: 21.7 M tons
    - S3: 10.3 M tons
    - These results assume BAU generation
  - Transition to Scenario Three AND further Grid De-Carbonization Needed To Achieve Full GWRA Goals
### Findings: Infrastructure Impacts

#### Assuming Mostly Managed Charging

<table>
<thead>
<tr>
<th>Phase</th>
<th>PEV Adoption</th>
<th>S2:</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOW</td>
<td></td>
<td></td>
<td>~ 5 – 10 Yrs</td>
</tr>
<tr>
<td>Phase I</td>
<td>~ 10% PEV Adoption</td>
<td>~2 EVs/xFrmr</td>
<td>~2025</td>
</tr>
<tr>
<td>Phase II</td>
<td>~ 30% PEV Adoption</td>
<td>3 – 4 EVs/xFrmr</td>
<td>~2035</td>
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<tr>
<td>Phase III</td>
<td>~ 2050 PEV Penetration</td>
<td>S2: ~60%</td>
<td></td>
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</tbody>
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### NOW

**Minimal, But Non-Zero:**
- Mostly isolated xFrmr impacts
- Most common in cluster scenario
- Service upgrades may be needed
- xFrmr upgrades probably within existing operations profile
- xFrmr upgrade may be combined with other upgrade motivations
- Impacts: ~tens of $million/yr
- **Note:** above 5% penetration, multiple Evs per xFrmr assured

### Cluster Impact Response:

- xFrmr upgrades becoming common, cluster impacts likely
- **Impacts:** ~$100's $million/yr
- Still can be mostly “reactive”, but early and detailed monitoring of adoption geography beneficial
- Customer charging levels (in KW) and timing (natural or managed) will have a big influence on the extent of impacts

### Proactive Reinforcement:

- Planned/pre-emptive reinforcement programs probably needed. Extent of upgrades depends on fraction of charging that is time-optimized.
- **Impacts:** ~$100's $million/yr
- Total Impacts At Full Electrification: ~$2.2B (over 25 yrs)
- Required upgrades will probably be motivated by other reinforcement motivations, so costs shouldn’t be allocated exclusively to EV loads.
• Completing Member Review And Internal QA On Study Report
• Currently Expecting To Publish Full Report In Mid-December
• Follow-Up Activity To Advocate For The Roadmap Program, And Support Members That Are Developing Associated Programs
• Numerous Areas For Follow-Up Research Under Discussion