Grid–Integrated Vehicles in the Southeast

Regents’ Professors Marilyn Brown and Deepak Divan
Presentation at INTERSECT 2018 Conference
April 18, 2018
The Energy Ecosystem is Transforming

- Distributed resources are growing:
  - 80 GW of combined heat & power
  - 14 GW of distributed solar
  - half million EV charge cycles are being managed
- Smart meters (100% + Fiber in Chattanooga Electric Power Board)
- Real-time rates are next
- What role might grid-integrated vehicles (GIVs) play in this new ecosystem?

The Creation of “Prosumers” and the “Sharing Economy”

- Consumers are becoming producers as well as consumers – “Prosumers”
  - Facilitated by the falling cost of solar panels
  - Home battery systems are on the move
  - Many more EV models available and a growing charging infrastructure

Grid-integrated vehicles could become another form of “prosumerism”
# Policy Ecosystem Reviewed

## EV Policies

<table>
<thead>
<tr>
<th>Federal</th>
<th>State</th>
<th>Local</th>
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</thead>
<tbody>
<tr>
<td>• Tax credit for EVs</td>
<td>• EVSE provision in new construction</td>
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<tr>
<td>• Energy storage policies (FERC order 841)</td>
<td>• Public Charging Infrastructure</td>
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### Energy Storage Policies

- California has directed its utilities to acquire 500 MW of energy storage by 2020
- Massachusetts has ordered its utilities to procure 200 MWh of energy storage by the end of 2019
- New York has proposed Energy Storage Deployment Program with a 2030 procurement target
- Maryland has adopted a 30% ITC for storage facilities
- Nevada has passed storage incentives

## Rates, Metering & ICT Policies

<table>
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<th>Time-of-Use Pricing</th>
<th>Selling connectivity + electricity</th>
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<td>Critical Peak Pricing</td>
<td>Demand charges</td>
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<tr>
<td>Real-Time Pricing</td>
<td>Net metering policies</td>
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### State Policies

- **Policy** | **Number of States** |
  - Fleet Requirements | 28 |
  - Electric Vehicle Supply Equipment | 27 |
  - Financial Incentives | 23 |
  - Exemption from Emissions Testing | 14 |
  - Utility Incentives | 13 |
  - HOV Access | 13 |
  - Reduced Licensing/Registration/Road Charges | 4 |
Grid Resilience is our New EV Focus

A. Adapted from:
National Academy of Sciences, 2017

Prior to an Event
The ability to absorb shocks and keep operating

During an Event
The ability to manage a disruption as it unfolds

After an Event
The ability to get back to normal as quickly as possible

Incident-Focused

Post-incident Learning

1. Prepare
2. Ameliorate
3. Quickly Recover
4. Observe, Learn and Improve

Regional transmission organization scale:

Distribution system scale:

Feeder scale:
Grid Resilience Services Identified

How much are these services worth?
What is their marketplace value: today and in the future?
Can they enhance grid resilience?
Emerging Business Models Scoped

Customers/Vehicle Owners
- Individual EV owners
- Leasing vehicles
- Ownership of vehicles
- Ownership of charging infrastructure
- Role of fleet owners
- Managed charging by third-parties

Non-utility participants
- Ownership of vehicles & charging infrastructure
- Leasing infrastructure and vehicles
- Participating as aggregators, providing subscriptions
- Ride-sharing
- Special contracts among ride share companies & aggregators

Original Equipment Manufacturers (OEMs)
- Managing charging remotely
- Owning charging infrastructure
- Providing ICEs as back-up for long distance travel
- Role of vehicle renting companies

Utilities
- Ownership of charging infrastructure
- Contracts for services of grid-integrated vehicles
- Open market trading
- Participating in the market as aggregators

Georgia Tech Energy Policy and Innovation Center
DOE-Electricity Advisory Committee Survey Launched

Challenges and opportunities of G2V, V2B and V2G – Technical, socio-economic, financial, and regulatory

6. a) How much of a challenge do you think the following technological factors present to a full deployment of all modes - G2V, V2B, and V2G?

6. b) How much of a challenge do you think the following socio-economic/financial factors present to a full deployment of all modes - G2V, V2B, and V2G?

6. c) How much of a challenge do you think the following policy/regulatory factors present to a full deployment of all modes - G2V, V2B, and V2G?
Analysis Steps Underway

- Input–output analysis of jobs
  - Create bills of goods for EV and ICE vehicles
  - Changing auto contributions to economic sectors & regions

- Macroeconomic analysis using NEMS 2018
  - Assessment of large-scale penetration of EVs
  - Ability of V2G to enhance grid resilience
Stakeholders Engaged

- November 2017 webinar
- March 2018 Presentation to DOE Electricity Advisory Board (& Asst. Secretary Bruce Walker)
- March 2018 meeting at Chattanooga EPB
- Future meetings in spring and summer
Products & Timeline

Policy Brief: February, 2018
EAC Survey & Work Product: January–May, 2018
Technical Paper with NEMS and I–O Modeling: May–August, 2018