EVs: Grid Impact and Opportunity
Anders Thulin, Siemens eMobility
**Biggest Growth Areas**

**Personnel Use Electric Vehicles (EV) - New Style & Technology**

Some 2020 EV cars coming:

- **Byton M-Byte (China)** - 250 miles
- **Hyundai Kona** - 250 miles
- **Volkswagen ID Cross** - 220 miles
- **BMW iX3** - 220 miles
- **Tesla Y** - 310 miles
- **Rivian** - 400 miles
- **Aston Martin RapidE** - 200 miles
- **Volvo XC40** - 250 miles
- **Ford "mustang" inspired SUV** - 300 miles
Also… if it moves people or goods, it is electrifying

Daimler Delivers Freightliner Electric Truck to Penske in 2019

Amazon converting 100’s of vehicles to EV in 2019

Tesla Truck & Semi-Truck

Rivian - Amazon invests $700 Million comes out 2020 Located in Detroit
kW/charger Market Expansion

From this…

…to this

…and now this

15MW+ Depot
So what?
Simply put...

- Could do more!
- ...Pushing it
- Could do more!
- Need more generation!
Hennepin, 2040

- 1.5M Cars
- 30% Adoption
- Charger avg. 10kW
- 80% of charging happens in the home!
- 4-5GW @ 6PM (if unmanaged)
The World, 2040

3,000 TWh

The US produced 4kTWh in 2017
…but we can do this without just “ADD MORE CAPACITY”
…and we can help Renewables in the process!

Source: CAISO
Managed Charging
What is Managed Charging?

- **PRICE SIGNALS** – TIME-OF-USE, DYNAMIC, HOURLY; EV-ONLY TARIFFS
- **UTILITY OR ISO LOAD CONTROL**
- **AGGREGATOR MANAGED LOAD**
- **REMTELY PROGRAMMED AND REMOTELY CONTROLLED**
- **MICROGRIDS AND NANOGRIDS**

LEVERAGING THE FLEXIBILITY OF AVAILABLE TECHNOLOGY
What is needed for managed charging?

Smart Chargers
Chargers should be “smart” and comply with open technical and payment standards

A smart charger is one that has a **sub-meter, is networked, and is integrated to back-end IT systems**, including billing, charger management, demand response, and consumer apps, be they provided by a utility, EVSP, ESP, aggregator, or other entity.

The **charger-utility link** (the communications from a utility application such as demand response or grid control to the charger) is foundational to grid integration.

Standards are driven by the procurer of the equipment. Utilities can procure EVSEs in quantity, either directly or via rebates and, therefore, can **drive charger standards**.
### Who Benefits?

**Drivers**
- Lower fuel costs
- Lower rates…?
- Information
  - Cost to charge
  - kWh
- Convenience
- Seamless payment

**Site Hosts**
- Improved utilization
- Demand charge optimization
- Management tools
- Equipment monitoring

**Utilities**
- Promote EV adoption
- Load visibility
- Peak demand management
- Grid and market integration
TOU rates work well to manage peak, EV-only TOU tariffs even better
Fuel dollar distribution during a car’s lifetime, gas vs. electric

>90% of cash goes out of state

<table>
<thead>
<tr>
<th>Category</th>
<th>% of Cash</th>
</tr>
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<tbody>
<tr>
<td>Oil companies</td>
<td>66%</td>
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<tr>
<td>Refining</td>
<td>10%</td>
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<tr>
<td>Dist &amp; Mktg</td>
<td>8%</td>
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<tr>
<td>Taxes</td>
<td>14%</td>
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<tr>
<td>Gas stations</td>
<td>2%</td>
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</tbody>
</table>

Internal Combustion Engine vehicle

- Gasoline cost: $22,674
- Where the equivalent dollars go for an EV

Electric vehicle

- EV driver savings: 54%
- Utility ratepayers: 15%
- Public charging: 9%
- Workplace charging: 3%
- In-state generators: 17%
- Taxes: 2%

>90% of cash stays within state

- $3,504 to non-EV owning ratepayers

Sources: Energy Information Administration, Union of Concerned Scientists, Siemens

1 – percentage is lower for oil-producing states

2 – EV charging revenue paid for T&D portion of electricity rates; assumes 90% of charging is off-peak and, therefore, minimal T&D investment is required
Wrap Up

“New Load” is coming in a big way

Massive stress risk on grid

Managed Charging via Smart Chargers

Sustainable Industry Growth

With Utility engagement, the industry will charge ahead
Thank you!

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