Electric Vehicles
Impacts to the Grid and Society

HDR

10/9/19
Presenters Today

Angela Piner

Fernando Garcia
01 Evolution of Electric Vehicles
02 Electrification Benefits
03 Electrification Challenges
04 Where to Start?
05 EV Program Models
06 The Future is Now
01

Evolution of Electric Vehicles

Tesla Model Y photo credit: Daniel Cardenas
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“I do not believe the introduction of motor-cars will ever affect the riding of horses.”

- Scott Montague,
  United Kingdom member of parliament, 1903
Fifth Avenue in New York City on Easter Sunday in 1900
Unknown photographer, 1900
Easter 1913, NYC. Fifth Avenue Looking North. George Grantham Bain Collection
Vehicle Electrification

- Global Trends - Investments
  - OEMs
  - EV Charging Stations
  - Battery Technologies
- Policy Driving Adoption
- Economic Benefits are Taking Over
- Focus on All Electric (not Hybrids)
- **2030** is known as **Pivot Point**
Quick Facts

• ~1.3M+ EVs on the Road in the U.S. (July 2019)
• 42 EV Models on the Road Today
• ~140 EV Models Expected by 2023
• By 2040 Electric Buses will Account for More than 80% of Annual Bus Sales
• Charging an EV ~ $1.21/gallon of Gas (in the US)
EV Adoption Rates

Did Internal Combustion Engine (ICE) Sales Peak in 2016?

US Electric Vehicles Sales & Market Share: 2008-2018

Peak ICE vs. EVs: US Light Vehicle Sales 2011-2018*

Data: GoodCarBadCar.net, InsideEVs, Auto Manufacturers Alliance/HIS Markit, Automotive News | Chart: Loren McDonald / EVAdoption.com
EV Adoption Rates

• What Influences Adoption?
  • Vehicle Cost
  • Range Anxiety
  • Access to Charging Stations
  • Charge Time
  • Vehicle Types

• How does MI compare nationally?
  • In 2018 ranked 18th as percent of sales
  • In 2018 less than 1% of all light duty vehicle sales in the US were EVs in Michigan
Electric Providers and EVs

- IOUs are most Active Developing EV Programs
- Municipalities and Cooperatives are Primarily in the Early Stage

02
Electrification Benefits
Community Benefits of EVs

- Emission Reductions ➔ Improved Air Quality
- Improved Load Utilization ➔ Cost Savings
- Integration of Renewable Resources
- Economic Development / Tourism
- Pathways to Smart Cities
- Noise Reduction
Customer Benefits of EVs

• Savings per Year as High as $1,000 - $1,500 vs Fossil Fuel
• Savings in Maintenance
• Emission Reductions
• Resiliency at Home as Power Source (Future)
Electric Provider Benefits of EVS

- Load Growth ➔ Increased Revenue
- Manage Load ➔ Procure Cheaper Off-Peak Power
- Manage Load ➔ Avoid Additional Generation Capacity
- Manage Load ➔ Defer Investments
- Customer Savings ➔ Customer Satisfaction
03
Electrification Challenges
Electric Provider Challenges

• Access to Funding for EV Programs
• Electric Mobility Complexities
• Rapid Technology Changes
• Roadmap Prioritization
• Utilization for Initial Charging Stations
• Network Management Solutions
Risks of Ignoring EVs

• Costly System Upgrades
• Unmanaged Charging = Load Spikes
• Unmanaged Peak Load Shifts
• Miss Opportunity to Support Customers
• Miss Load Growth Opportunities
Case Study
Fernando’s Home Load
Case Study

• Purchased Model 3 Tesla in December
  • 75kWh battery
  • 310 mile range

• Changed Rates to Time of Use (TOU)
  • Fixed $16/month
  • Rates = Winter $0.24/kWh
    Summer $0.52/kWh
  • “Super Off-Peak” $0.09/kWh
    12am-6am
Case Study

- Pre-EV purchase bill:
  - $100/month in Electricity
  - $140/month in gas
  - Average Use ~ 400 kWh/month

- Post-EV purchase:
  - $140/month
  - Average Use ~ 850 kWh/month

✓ $100/month in Savings
✓ EV Doubled House Load!
04
Where to Start?
Electric Providers’ Role
Focused on Residents, Members, and Community’s Best Interests

**EDUCATION**
- Encourage Adoption
- Become Trusted Resource
- Strengthen Community Presence
- Increase Customer Engagement
- Implement Employee Training

**ROADMAP**
- Track EV Ownership
- Incentives
- Rebates
- Rates
- Program for Employees
- Roadmap for Fleet Conversion

**IMPLEMENTATION**
- Community Outreach Program
- Pilot Projects
- Utility Fleet Conversion
- Full Deployment Projects
05
Electric Providers EV Program Models
Electric Company Investment Models

Source: EEI, Accelerating Electric Vehicle Adoption
EV Charging Programs (California)

• Policy Drives EV adoption

• Small Pilot Programs to Learn
  • SCE Charge Ready, 1,200 Ports, $20M
  • SDG&E Power Your Drive – 3,500 Ports - $45M
  • PG&E EV Charge Network – 7,500 Ports - $130M

• Large Programs
  • SCE Charge Ready Transport, 8,490 ports, $343M
  • SDG&E – MD/HD Program - $107M
  • PG&E Fleet Ready– 6,500 ports - $236M

250,000 ZEV Chargers by 2025
>$1B EV Charging Infrastructure
# EV Charging Programs (Michigan)

## Utility Incentive Programs

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<tr>
<th>Utility</th>
<th>Program Details</th>
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<tr>
<td>Consumers Energy</td>
<td>• EVSE (3,000 Level 2) residential rebate up to $400</td>
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<td>PowerMIDrive</td>
<td>• EVSE (200 Level 2) business rebate up to $5,000</td>
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<td>$10M – 3 Year Program</td>
<td>• EVSE (24 DCFC) business rebate up to $70,000</td>
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<td></td>
<td>• Time-of-Use Rates</td>
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<tr>
<td>DTE</td>
<td>• EVSE (2,800 Level 2) residential rebate up to $500</td>
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<tr>
<td>Charging Forward</td>
<td>• EVSE (1,000 Level 2) business rebate up to $2,500</td>
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<td>$13M – 3 Year Program</td>
<td>• EVSE (32 DCFC) business rebate up to $20,000</td>
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<td></td>
<td>• Time-of-Use Rates with separate meter</td>
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<tr>
<td>Indiana Michigan Power</td>
<td>• EVSE residential rebate (purchase - installation) up to $500</td>
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<td></td>
<td>• Time-of-Use Rate with separate meter</td>
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<tr>
<td>Lansing Board of Water &amp; Light</td>
<td>• EVSE residential rebate (purchase - installation) up to $1,000</td>
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<td>• Time-of-Use Rate with separate meter</td>
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The Future is Now
Bus Transit Programs & MD/HD Preparations

- Transit Agencies Transitioning to BEB
- Amazon + Rivian (100,000 Electric Vans)
- All Electric Class 8 Semis Testing
- CharIn MW Charger Standard Development
- Truck OEMs Electric Future (Daimler)
- Utilities Planning for MD/HD Highways

Exhibit 8
Power Requirements (kw) of One Class-8 Truck “Mega-charging” Event (1,600 kW)
Compared With Power Requirements of Other Vehicles and Homes

1.6 MW

1 =

1,200 Average US Homes (@1.25 kW)
30 DC Fast Chargers (@50 kW)
250 Level 2 Chargers (@6 kW)
26 Overnight Depot Chargers (@60 kW)

Current Technology Advancements

- Battery Technology Advances
- Wireless (Induction) Charging
- Managed Charging (V1G)
- Vehicle to Grid (V2G)
- Rates (Dynamic)
- Autonomous Vehicles
Major Disruptions

• 95% of U.S. Passenger miles traveled by 2030 will be on-demand autonomous electric vehicles
• Annual demand for new cars will collapse after 1st fully autonomous vehicle
• No more auto insurance or parking in cities

Source: Tony Seba & RethinkX - Rethinking Transportation 2020-2030, May 2017
Questions?

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