Electric Vehicle Market and Infrastructure

Iowa Energy Summit
November 7, 2019
Quick facts - US electric vehicle market

More than 1.19M EVs on the road in the US

361,000 EVs sold in 2018 (up 81% over 2017 sales; Q4 up 120%)

2018 EV-related annual energy sales: 2.1 TWh (up 35% from 2017)

41 EV models today in the US, anticipated ~130 by 2023 (1/3 SUVs or crossovers)

$300B+ being invested globally by automotive industry

Each EV is about 2,500 kWh each year in additional, largely flexible load

Source: Electric Power Research Institute
Over 1.3M PEVs on U.S. roads (Sept. 2019)

Over 3,500 on the road in Iowa

Source: Electric Power Research Institute
National EV sales by automaker

<table>
<thead>
<tr>
<th>Automaker</th>
<th>Cumulative Number of EVs Sold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tesla</td>
<td>487,015</td>
</tr>
<tr>
<td>General Motors</td>
<td>222,413</td>
</tr>
<tr>
<td>Nissan</td>
<td>146,940</td>
</tr>
<tr>
<td>Ford</td>
<td>118,152</td>
</tr>
<tr>
<td>Toyota</td>
<td>111,507</td>
</tr>
<tr>
<td>BMW</td>
<td>94,875</td>
</tr>
<tr>
<td>Fiat Chrysler</td>
<td>43,727</td>
</tr>
<tr>
<td>Volkswagen</td>
<td>43,173</td>
</tr>
<tr>
<td>Honda</td>
<td>32,875</td>
</tr>
<tr>
<td>Hyundai-Kia</td>
<td>27,021</td>
</tr>
</tbody>
</table>

**Key Facts**

- To date, five automakers have sold more than 100,000 EVs—Tesla, General Motors, Nissan, Ford, and Toyota. The current cap for the federal tax credit is 200,000 vehicles.

- These same five automakers account for nearly 80% of total EV sales.

Source: InsideEVs.com and HybridCars.com

Source: Edison Electric Institute
Top 10 EV sales by model

<table>
<thead>
<tr>
<th>Model</th>
<th>Cumulative Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tesla Model 3</td>
<td>253,196</td>
</tr>
<tr>
<td>Chevrolet Volt</td>
<td>156,684</td>
</tr>
<tr>
<td>Tesla Model S</td>
<td>154,242</td>
</tr>
<tr>
<td>Nissan LEAF</td>
<td>138,653</td>
</tr>
<tr>
<td>Toyota Prius Prime</td>
<td>109,003</td>
</tr>
<tr>
<td>Tesla Model X</td>
<td>79,577</td>
</tr>
<tr>
<td>Ford Fusion Energi</td>
<td>66,679</td>
</tr>
<tr>
<td>Chevrolet Bolt</td>
<td>55,006</td>
</tr>
<tr>
<td>Ford C-MAX Energi</td>
<td>42,231</td>
</tr>
<tr>
<td>BMW i3</td>
<td>40,497</td>
</tr>
</tbody>
</table>

Source: InsideEVs.com and HybridCars.com

KEY FACTS

- The top 5 EV models—Tesla Model 3, Chevrolet Volt, Tesla Model S, Nissan LEAF, and Toyota Prius Prime—account for nearly 60% of total EV sales.

- To date, four new EV models have been released in 2019. Three were battery electric vehicles: Audi e-tron, Hyundai Kona, and Kia Niro. One was a plug-in hybrid: Subaru Crosstrek.
Electric vehicle models increasing

Customer choice increasing with ~130 EVs on market by 2023
Average BEV driving range increasing to 264 miles

Source: Electric Power Research Institute
Why electric vehicles?

• De-carbonization – Global momentum
• Technology advancements
  – Longer range batteries
  – Decrease in costs
  – Increase in light, medium and heavy duty EV models
• Lower fuel costs
  – Increase efficiencies
  – Less parts = less maintenance
• Energy independence
  – Reduce reliance on foreign oil
  – Energy created locally
  – Wind and solar energy

Source: United States Environmental Protection Agency
Where is EV charging taking place?

- **Public (DC) charging (~5-10%) – SRP, 2018 3%**
  - Necessary for adoption
  - Four challenges:
    1. Separate networks
    2. Different plugs
    3. Infrastructure costs, rates, utilization
    4. Increasing power levels

- **Workplace charging (~15%) – SRP, 2018 16%**
  - Extends electric range of PHEVs, short-range BEVs
  - Minimal distribution grid impacts
  - One plug
  - Challenges with parking and accessibility

- **Home charging (75-80%) – SRP, 2018 81%**
  - Many customers charge at 120V AC or use an existing 240V dryer outlet
  - Minimal distribution grid impacts
  - Existing infrastructure companies serve this market
  - Opportunities for TOU rates, smart charging, and further customer study
  - ~2,800 kWh/residential EV/year

Public charging is mainly DC Fast Charging

Source: Electric Power Research Institute
EV Charging - grid impact considerations

- Currently studying light-duty EV impacts
- Planning for overall impact of commercial and industrial electrification
- Taking into account all customer fleet and operational applications
- Medium-and heavy-duty trucks charging from 150kW to 4.5MW per truck
- New charging standards for medium-and heavy-duty trucks being developed

Clustering of EVs due to Socio-Economic Patterns

Source: Electric Power Research Institute
EV DCFC infrastructure opportunities in Iowa
Innovative solutions + education and outreach

• Research, development and implementation:
  – High speed vehicle charging stations
  – Battery storage
  – Shared mobility
  – V1G (vehicle to grid – unidirectional managed charging)
  – V2G (vehicle to grid – bidirectional managed charging)
  – V2H (vehicle to home power)
  – Smart meters
  – Renewables integration
  – Smart cities

• Consumer education:
  – Ride and Drive events
  – Community events
  – Panel discussions
  – Customer events (e.g., facilities, safety, etc.)
Alliant Energy EV fleet initiatives

Workplace Charging Stations
• 50 - Level 2
• 10 - Level 3

Fleet Electrification
• 9 plug-in hybrid electric fleet vehicles
• 7 hybrid fleet vehicles
• 1 battery electric fleet vehicle
• 41 hybrid electric aerial bucket lifts
• 36 electric forklifts
• 5 electric ATVs
• 2 electric power line pullers
Electric Fleet Options

- Transit/school buses
- Semi-tractors
- Transport refrigeration
- Delivery vehicles
- Spotter trucks
- Refuse vehicles
- Marine/port equipment
- Airport ground equipment
- Railroad equipment
- Forklifts
- Agricultural equipment
- Construction equipment
Electrification Programs

• Rebates
  • Help offset EV infrastructure capital costs

• Residential – Smart Charging
  • Level 2 home EV charging stations
  • Demand response capable

• Commercial, community or multihousing
  • Level 2 EV charging stations
  • Demand response capable

• Off-road electric equipment
  • Class 1, 2 and 3 electric forklifts
  • Electric-capable transport refrigeration units (eTRU)
  • Custom incentive – pre-approval required
• Over 350 attendees
• Over 30 presentations
• Over 50 exhibitors
• Over 50 alternative fuel display vehicles
• Over 70 ride and drive participants
Questions?

Contact our *Electrification* team

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Iowa Department of Transportation
Electric Vehicle Update

Iowa Energy Summit
November 7, 2019
Topics

- Volkswagen settlement update
- Electric vehicle impacts on the Road Use Tax Fund
  - Report
  - Legislation
- Alternative Fuel Corridors - FHWA
Volkswagen settlement of 2016 EPA complaints of Clean Air Act violations

- Sale of approximately 580,000 diesel motor vehicles with “defeat devices”
- Result is settlements that invest in projects that reduce emissions of nitrogen oxides

Settlements

- Zero-Emission Vehicle (ZEV) Investments - Electrify America
- Environmental Mitigation Trust allocations to states
ZEV Investments - Electrify America

- VW required to spend $2 billion over 10 years
  - ZEV infrastructure
  - Access to ZEV’s
  - ZEV education

- Three existing Iowa locations (all along I-80)
  - Council Bluffs: Walmart parking lot on Manawa Centre Drive
  - Waukee: Kum & Go off Grand Prairie Parkway
  - Williamsburg: Casey’s off Williamsburg interchange
Environmental Mitigation Trust

- Iowa’s allocation $21 million
- Administered by Iowa DOT working with state agency working group
- Allocation within Iowa based on Beneficiary Mitigation Plan
- Priorities
  - Achieve significant, quantifiable reductions in NOx emissions
  - Maximize cost effectiveness
  - Ensure health and environmental benefits for adversely impacted areas
  - Complement other programs/initiatives
  - Implement Iowa Energy Plan
<table>
<thead>
<tr>
<th>Mitigation Category</th>
<th>Funding Percentage</th>
<th>Estimated Application Cycle Total</th>
<th>Estimated Trust Fund Total</th>
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</thead>
<tbody>
<tr>
<td>Class 4-8 Buses</td>
<td>45%</td>
<td>$3,150,000</td>
<td>$9,450,000</td>
</tr>
<tr>
<td>Freight and Port Drayage Trucks</td>
<td>15%</td>
<td>$1,050,000</td>
<td>$3,150,000</td>
</tr>
<tr>
<td>Non-Road Transport and Equipment</td>
<td>10%</td>
<td>$700,000</td>
<td>$2,100,000</td>
</tr>
<tr>
<td>ZEV</td>
<td>15%</td>
<td>$1,050,000</td>
<td>$3,150,000</td>
</tr>
<tr>
<td>DERA</td>
<td>15%</td>
<td>N/A</td>
<td>$3,150,000</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td></td>
<td>$21,000,000</td>
</tr>
</tbody>
</table>
Awards from the first round of funding to be announced soon for -
- Buses
- Trucks
- Non-road transport and equipment

ZEV Round One: Program announcement in December 2019 seeking applications for grants to install charging infrastructure

Two remaining rounds for all categories

VW website: iowadot.gov/VWSettlement/default.aspx
Electric Vehicle Impacts to the RUTF

- Iowa DOT required to develop report estimating impacts to Road Use Tax Fund due to high efficiency vehicles
- Report included estimated impacts, evaluation of mitigation alternatives, and mitigation recommendations
- Iowa DOT provided report to the Iowa Legislature on December 31, 2018
- Study evaluated electric, hybrid, and hydrogen fuel cell vehicles
Electric Vehicle Impacts to the RUTF

- As of July 1, 2018 Iowa EV registrations totaled:
  - BEV - approximately 700
  - PHEV - approximately 1,750
- As of June, 2019 Iowa EV registrations totaled:
  - BEV - approximately 1,300
  - PHEV - approximately 2,400
- Likely factors impacting growth:
  - Increased model availability (Tesla Model 3)
  - Availability of charging infrastructure
**Electric Vehicle Impacts to the RUTF**

<table>
<thead>
<tr>
<th>Year</th>
<th>Low Scenario</th>
<th>Medium Scenario</th>
<th>High Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>$317,000</td>
<td>$317,000</td>
<td>$317,000</td>
</tr>
<tr>
<td>2020</td>
<td>$488,000</td>
<td>$520,000</td>
<td>$564,000</td>
</tr>
<tr>
<td>2025</td>
<td>$1,858,000</td>
<td>$2,684,000</td>
<td>$11,117,000</td>
</tr>
<tr>
<td>2030</td>
<td>$7,083,000</td>
<td>$14,207,000</td>
<td>$45,221,000</td>
</tr>
<tr>
<td>2035</td>
<td>$19,603,000</td>
<td>$47,748,000</td>
<td>$129,260,000</td>
</tr>
<tr>
<td>2040</td>
<td>$39,975,000</td>
<td>$115,200,000</td>
<td>$241,316,000</td>
</tr>
</tbody>
</table>

Reduction in Iowa RUTF due to BEV and PHEV
Electric Vehicle Impacts to the RUTF

- Goals for mitigation:
  - Low administrative costs
  - Equitable
  - No net change in RUTF
  - Constitutional protection of revenue
  - Captures all users
    - Passenger vehicles
    - Commercial vehicles
    - Out-of-state vehicles
Electric Vehicle Impacts to the RUTF

- Bill passed legislature this session to implement (HF 767)
- Add a per kWh fee excise tax rate of $0.026 per kWh
  - Applies only at non residential charging locations
  - Utilize taxing system similar to existing LNG and LPG (point of sale collections)
- Effective July 1, 2023
Electric Vehicle Impacts to the RUTF

• Add a supplemental registration fee for passenger EV
  • Applies to electric passenger vehicles weighing less than 10,000 pounds

<table>
<thead>
<tr>
<th></th>
<th>CY 2020</th>
<th>CY 2021</th>
<th>CY 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEV</td>
<td>$65</td>
<td>$97.50</td>
<td>$130</td>
</tr>
<tr>
<td>PHEV</td>
<td>$32.50</td>
<td>$48.75</td>
<td>$65</td>
</tr>
<tr>
<td>Electric Motorcycle</td>
<td>$4.50</td>
<td>$6.75</td>
<td>$9</td>
</tr>
</tbody>
</table>
Electric Vehicle Impacts to the RUTF

• Add a hydrogen fuel excise tax rate of $0.65 per diesel gallon equivalent (2.49 pounds of hydrogen)
  • Utilize taxing system similar to existing LNG and LPG (point of sale collections)
  • Effective January 1, 2020
Alternative Fuel Corridors - FHWA

- National network of alternative fuel and charging infrastructure
- Annual formal corridor designations
- Encourage multi-state and regional cooperation
- Develop national signage and branding
Alternative Fuel Corridors - FHWA

- “Corridor Ready,” - A sufficient number of facilities exist on the corridor to allow for corridor travel using one or more alternative fuels
- “Corridor Pending,” - An insufficient number of facilities currently exist on the corridor to allow for corridor travel using one or more alternative fuels
- Designation status for each fuel type were based on the following criteria:
- *EV charging*: EV charging\(^1\) facilities at 50 mile intervals along designated EV corridors.

\(^1\) facilities at 50 mile intervals along designated EV corridors.
Alternative Fuel Corridors - FHWA
Questions?

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DC Fast Charging Network Update
IAEE Energy Summit
November 7, 2019

Andrew Lewis
Lead Engineer – Electric Distribution
Overview

• Introduction
• Electric Vehicle (EV) Adoption Constraints
• MidAmerican Energy’s EV Programs
• DC Fast Charging Network
• Discussion/Q&A
Adoption Constraints

- What’s holding back the large-scale adoption of EVs?
  - Customer Knowledge and Perception – Consumers expect to be able to drive EVs in the same manner that they drive internal combustion engine (ICE) vehicles.
  - Cost of Vehicles, Charging Equipment and Fuel – Consumers expect a price point similar to that of ICE vehicles and expect to pay the same or less as standard fuel.
  - Range Anxiety – Consumers expect to be able to “fuel” their vehicle anywhere and in a similar amount of time as they would spend at a fuel pump.
MidAmerican’s Role

• Partnerships, education and program expansion:
  – Develop strategic partnerships to establish roles and responsibilities in the advancement of EVs
  – Utilize and expand MidAmerican EV fleet, install charging infrastructure to allow fleet travel across MidAmerican’s service territory and implement employee charging program

• Incentive program:
  – Vehicle purchase incentive: provide $500 toward the purchase or lease of a qualifying new EV
  – Non-residential charger incentive: provide $1,500 toward the purchase of a qualifying charging installation (workplace, retail, commercial, etc.)

• Support the development and deployment of DC Fast Charging infrastructure throughout MidAmerican’s service territory
DC Fast Charging Network

- MidAmerican Energy is constructing 15 DC Fast Charging stations throughout its service territory in Iowa
- Qualifying locations were selected in order to maximize charging availability along the Interstate 80, Interstate 29 and Highway 20 corridors
- Site hosts were selected through an application process which was open through the month of August
  - 78 applications were received
  - Selected site hosts will be announced in November
- Construction has already started on the first site, and all sites are planned for completion by the end of 2020
Electric Vehicle Initiatives
DC Fast Charging Network

- MidAmerican Energy has selected Greenlots as the EV solutions and network provider for its initial stations.
- Two chargers will be located at each site, capable of providing a full battery charge to most compatible EVs in 30 to 45 minutes.
- Charger locations will be made available on the Greenlots app and PlugShare; driver support services will be available at all hours.
- Customers will provide payment for the charging services to the site host at the station through the Greenlots app or by credit or debit card.