EV Basics, Industry Trends, and User Experience

February 2022
Evergy & Electrification
Serving **1.6 million** customers in Kansas and Missouri

Evergy is focused on **people first** and **moving energy forward**, offering innovative solutions and providing reliable and safe energy to its customers.

Nearly half the power Evergy generates for delivery to homes and businesses comes from **emission-free sources**.
Electrification benefits reach many stakeholders

<table>
<thead>
<tr>
<th>STATE</th>
<th>LOCAL</th>
<th>RESIDENTIAL CUSTOMERS</th>
<th>COMMERCIAL CUSTOMERS</th>
<th>EVERGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meet state targets</td>
<td>Meet sustainability goals</td>
<td>Improved performance and cost savings</td>
<td>Lifecycle cost savings</td>
<td>Flexible load growth</td>
</tr>
<tr>
<td>Reduce emissions</td>
<td>Reduce pollution</td>
<td>Health benefits</td>
<td>Improved performance</td>
<td>Greater capacity utilization</td>
</tr>
<tr>
<td>Funding availability</td>
<td>Economic development</td>
<td>Proactive engagement with utility</td>
<td>Health and noise benefits</td>
<td>Proactive customer engagement</td>
</tr>
<tr>
<td>Develop partnerships</td>
<td>Energy access</td>
<td></td>
<td>Meet sustainability goals</td>
<td>Decarbonization</td>
</tr>
</tbody>
</table>

Utility has a responsibility to serve all customers and manage the grid
Evergy’s role in the TE transition

Shorter-term programs support and inform the utility’s longer-term responsibilities

Support and encourage EV adoption in the short-term

- Primary levers are charging infrastructure and rate design
- Benefits of near-term EV adoption
  - Beneficial load (↓ rate pressure)
  - Data / Relationships
  - Reduce adoption "hockey stick"
- Temporary role until stronger third-party investment emerges

Maximize benefits for all customers in the long-term

- Fill market gaps for underserved customers
- Create proactive, well-planned deployment of EV charging infrastructure
- Ensure many types of EV customers are served (e.g. fleets, rideshare, schools)
- Increase role in managed charging for grid benefits

Core responsibility and opportunity: Manage the transition to electrification at scale
EV Basics & Benefits
The alphabet soup of vehicle powertrains

**ICE**
Internal Combustion Engine
- Founded, 1885 (Karl Benz)

**HEV**
Hybrid Electric Vehicle
- ICE + E-Motor/Battery (small)
- E-motor is charged internally (ICE + regenerative braking)
- Many popular models offer HEV versions (e.g. Toyota Camry)

**PHEV**
Plug-In Hybrid Electric Vehicle
- ICE + E-Motor/Battery (med)
- E-motor charged internally and externally
- Newer PHEVs have battery—only ranges of 30+ miles

**BEV**
Battery Electric Vehicle
- E-Motor/Battery (large)
- Bye bye, gas pump
- New sales are about 2.5:1 BEV / PHEV

Collectively, “EV”

100% Combustible Fuel

100% Electricity
Each powertrain has strengths and weaknesses

<table>
<thead>
<tr>
<th>ICE / HEV</th>
<th>PHEV</th>
<th>BEV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PROS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fueling options/availability</td>
<td>Can function as an EV during daily commute</td>
<td>Smooth, silent, responsive</td>
</tr>
<tr>
<td>Affordability</td>
<td>Great range / Range security</td>
<td>Low fueling costs (non-public)</td>
</tr>
<tr>
<td>No plug-in drama!</td>
<td>Availability of tax credits</td>
<td>Lowest life cycle emissions</td>
</tr>
<tr>
<td>Great range</td>
<td>Plug-in drama - <em>optional</em></td>
<td>Low maintenance requirements</td>
</tr>
<tr>
<td><strong>CONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fueling costs</td>
<td>Mechanical complexity (highest)</td>
<td>Availability of tax credits</td>
</tr>
<tr>
<td>Life-cycle emissions</td>
<td>Maintenance costs</td>
<td>Fuelling options/availability</td>
</tr>
<tr>
<td>Maintenance costs</td>
<td>Model availability / affordability</td>
<td>Range limited / weather impacted</td>
</tr>
<tr>
<td>Mechanical complexity</td>
<td>Waste of money if never plugged-in</td>
<td>Model availability / affordability</td>
</tr>
<tr>
<td>Powertrain space requirements</td>
<td></td>
<td>Technology – maturity</td>
</tr>
</tbody>
</table>

*Slide informed by Edmonds.com*
A few more thoughts on EV emissions…

Lifecycle emissions associated with an EV are less than those from a comparable gasoline vehicle, and battery-electric vehicles have zero tailpipe emissions.*

With Evergy’s commitment to expanded wind generation and reduced carbon output, EVs charging on our grid have the potential to be even greener.

Transportation electrification reduces harmful pollutants, which disproportionally impact low-income and urban communities.

*U.S. EPA estimates that a Chevy Bolt operating in Kansas City (MO or KS) produces 190 CO₂ g/mi compared to 410 CO₂ g/mi for the average new gasoline vehicle. For more, see “A Global Comparison of the Life-Cycle Greenhouse Gas Emissions of Combustion Engine and Electric Passenger Cars”, ICCT (2021)
EV Supply / Demand
Hey Tesla, you’ve got (deep-pocketed) company…

Automakers have pledged over $50 Billion towards domestic EV manufacturing by 2025

Example all-electric vehicle production goals:
- GM: 2035
- Volvo: 2030
- Honda: 2030
- Jaguar: 2025
- Ford: 2030 (Europe)
- Toyota: 70% of U.S. sales to be BEV/PHEV by 2030

U.S. EV start-ups add pressure:
- Tesla
- Rivian
- Lion Electric
- Lordstown
- Proterra
- and more…
Here come the EVs…

Current EV Models Summary

<table>
<thead>
<tr>
<th>Models Offered</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV</td>
<td>61</td>
</tr>
<tr>
<td>BEV</td>
<td>28</td>
</tr>
<tr>
<td>PHEV</td>
<td>33</td>
</tr>
<tr>
<td>EV Models Sold</td>
<td>73</td>
</tr>
<tr>
<td>BEV Models Sold</td>
<td>31</td>
</tr>
<tr>
<td>PHEV Models Sold</td>
<td>42</td>
</tr>
</tbody>
</table>

Upcoming EV Models Summary

<table>
<thead>
<tr>
<th>Models</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upcoming</td>
<td>103</td>
</tr>
<tr>
<td>Models (U.S.)</td>
<td>96</td>
</tr>
<tr>
<td>Vehicle Makes</td>
<td>44</td>
</tr>
<tr>
<td>Avg PHEV Range</td>
<td>30</td>
</tr>
<tr>
<td>Avg BEV Range</td>
<td>256</td>
</tr>
</tbody>
</table>

State EV Models Offered for Sale

Cumulative Upcoming EV Models Over Time

Source: Atlas Public Policy – EV Hub
Here come the EVs…

Projection of EVs in Evergy’s Service Territory (2010 – 2021, actual)

Source: EPRI
EV Owner Experience
Things EV owners love and hate about (B)EVs

*While increasingly capable, BEVs are not (yet) a great fit for all usage profiles*

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**Not Feelin’ It**
- Published vs Real-world range, and the impact of cold temperatures
- Availability of charging stations outside of home and/or work (ex-Tesla)
- Upfront Costs\(^1\)
- Rate of innovation – a blessing and a curse

**I’m Lovin’ It!**
- Ability to charge at home and/or work... no more gas stations!
- Torque / Responsiveness
- Minimal routine maintenance
- Ability to preheat in garage *with the door closed*
- Environmental footprint

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\(^1\) New PHEVs and BEVs may be eligible for a federal income tax credit of up to $7,500. See [Federal Tax Credits for All-Electric and Plug-in Hybrid Vehicles](fueleconomy.gov).

*Expectations Check* - GM and Tesla have phased-out of the income tax credit because both companies have exceeded the EV sales threshold.
The actual Level 2 charging rate is limited to the lower of the car’s onboard A/C charger rating or the circuit capacity. For example, a Nissan Leaf plugged into a NEMA 14-50 outlet (9.6kW) will charge at 6.6kW because the Leaf’s onboard A/C charger is rated at 6.6kW.

Similarly, the maximum rate of charging via DC Fast Charge stations is make/model specific.

- Sedan efficiency is typically within the range of 3.0-4.0 miles per kWh.
- Full-size truck efficiency is more like 1.5-2.0 miles per kWh.

Consult online resources for estimates of how weather effects a given make/model’s efficiency.
Deep dive into EV charging – residential level 2 charging

Soon, Evergy will offer rebates to EV owners/leasees that install L2 home charging

Method 1 – “Smart” Charging Station
- Networked (WiFi)
- Capable of communications with utility (future?)
- Hardwired or plugged into 240V outlet
- Some utilities bill from these devices, making them effectively a separate meter

Method 2 – “Dumb” Charging Station
- No communication capability
- Hardwired or plugged into 240V outlet
- Alternative for EV owners who want to keep their OEM mobile cordset in their vehicle
- Charging controlled/monitored by mobile app (EV OEM and/or third party)

Method 3 – EV OEM Mobile Cordset
- Increasingly, EVs are shipped with dual voltage (120V/240V) cordsets
- Many owners use these cordsets for everyday use at home
- No communication capability (typically)
- Charging controlled/monitored by mobile app (EV OEM and/or third party)
Looking Ahead & References
Some of the places EVs are going….  

*The EV industry has attracted about $100B of investment since 2020*

1) Batteries, Batteries, Batteries!!  
   a. Chemistry - Shifting to “green” raw materials  
   b. Recycling – Improving end-of-life material collection and reuse  
   c. Capability – Increasing charging rate and energy density (range)

2) Consumer Choice  
   a. Nearly every OEM has announced a timeline for phasing-out ICE vehicles

3) Reimagined Utility/Consumer Relationship  
   a. Deeper coordination between utility and customer  
   b. Utility managed charging and/or demand response programs

*Slide informed by Why the future involves e-mobility | McKinsey*
A few references I like…

InsideEVs | Electric Vehicle News, Reviews, and Reports
General EV information for all OEMs. Beware getting sucked down the “drag race” rabbit hole!

Compare Electric Cars: EV Range, Specs, Pricing & More (insideevs.com)
Scroll to the bottom of this page for links to very useful EV comparison charts

Green Car Reports - Hybrid and Electric Car News, Reviews and Buying Guides

Federal Tax Credits for All-Electric and Plug-in Hybrid Vehicles (fueleconomy.gov)
Thank you!

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