The Electrifying Truth
The Impacts of Vehicle Electrification
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1832</td>
<td>First EV Prototype</td>
</tr>
<tr>
<td>1880</td>
<td>First EV in the US</td>
</tr>
<tr>
<td>1887</td>
<td>NYC pilots first Electric Taxis</td>
</tr>
<tr>
<td>1912</td>
<td>ICVs become more popular than EVs</td>
</tr>
<tr>
<td>1935</td>
<td>EV’s all but gone</td>
</tr>
<tr>
<td>1960-79</td>
<td>High oil prices, Arab Oil Embargo of 1973 spark renewed interest</td>
</tr>
<tr>
<td>1997</td>
<td>Toyota Prius</td>
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<tr>
<td>2006</td>
<td>Tesla</td>
</tr>
<tr>
<td>2021</td>
<td>3.5% of all new vehicle sales are EV or PHEV</td>
</tr>
</tbody>
</table>
What is Fueling the Drive Toward EVs
What we’re going to hear

Vehicle Manufacturer Perspective
Brian Marshall - Haldex

Power Grid Perspective
Rusty Hartman, PE - Olsson

Municipality Perspective
Alex McElroy - SEMPO
Electric Vehicles

AN INDUSTRY PERSPECTIVE
## Ambitious Goals on EVs

<table>
<thead>
<tr>
<th>Original equipment manufacturer</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
<th>2029</th>
<th>2030</th>
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<tbody>
<tr>
<td>BMW Group</td>
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<td>25</td>
<td>15-25%</td>
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<td>BAIC Group</td>
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<td>Changan Automobile (Group)</td>
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<td>Daimler</td>
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<td>25%</td>
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<td>Dongfeng Motor Co</td>
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<td>FAW</td>
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<td>60%</td>
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<tr>
<td>Ford</td>
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<td>40</td>
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<td>100%*</td>
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<td>GM Group</td>
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<td>Honda</td>
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<td>40%*</td>
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<td>Hyundai-Kia</td>
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<td>Mazda</td>
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<td>Renault-Nissan</td>
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<td>Maruti Suzuki</td>
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<td>Stellantis</td>
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<td>Toyota Group</td>
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<tr>
<td>Volkswagen</td>
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<td>Volvo (Geely Group)</td>
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- **% of sales electric**
- **Annual sales (million)**
- **New EV models (number)**
- **Cumulative sales (million)**

- * European market only
- ** Chinese and US markets only
- † Includes both EVs and FCEVs

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**Automotive**

**Commercial Vehicles**

**Transit**
Technical Opportunities

Battery Efficiency

Total Vehicle Cost

Quality/Reliability

Source: *Bloomberg
Legislation & Incentives

- EPA Regulations
- Vehicle Purchase Rebates
- Energy Cost Incentives
- Renewables
Consumer/ Owner Influence

- Vehicle Range
- Psychology of Change
- Customer Perceived Value
- Customer Perceived Quality
- Ownership Models
The Future of the Grid

Rusty Hartman, PE
Aging Grid And Infrastructure

• Average Utility Infrastructure Age Nationwide Beyond Life Cycle

• Aging Workforce to Design/Maintain/Replace

• Case in Point - 1948 Allis Chalmers Transformer Removed from Service in 2020.
Distributed Generation
Can We Support It?
Can We Utilize The Power?

• Rooftop Solar

• Community Developments

• Becoming More Cost Effective Everyday for Individual Investment

• Battery Storage – The Great Unknown (10 Year Lifespans Currently)
EV Commitments From Different Automotive Manufacturers
FedEx Commits to Carbon-Neutral Operations

March 3, 2021

MEMPHIS, Tenn., March 3, 2021 – FedEx Corp. (NYSE: FDX), home of the world’s largest cargo airline, announced today an ambitious goal to achieve carbon-neutral operations globally by 2040.

To help reach this goal, FedEx is designating more than $2 billion of initial investment in three key areas: vehicle electrification, sustainable energy, and carbon sequestration.

This includes a pledge of $100 million to Yale University to help establish the Yale Center for Natural Carbon Capture, accelerating research into methods of carbon sequestration at scale, with an initial focus to quantify greenhouse gas emissions equivalent to current airline emissions.

“We have a responsibility to take bold action in addressing climate challenges,” said Fred Smith, Chairman and CEO, FedEx Corp. “This goal builds on our longstanding commitment to environmental stewardship throughout our operations, while at the same time investing in long-term, transformational changes to evolve FedEx and our entire industry.”

Key steps toward reaching the carbon neutral goal include:

- **Vehicle Electrification.** By 2040, the entire FedEx parcel pickup and delivery (PUD) fleet will be electric. This will be accomplished through phased programs to purchase zero emission electric vehicles. For example, by 2025, 50% of FedEx Express global PUD vehicles purchased will be zero emission. By 2040, 100% of all purchases will be zero emission.
- **Sustainable Customer Solutions.** FedEx will work with customers to offer end-to-end sustainable solutions across their supply chains through carbon-neutral shipping offerings and sustainable product packaging.
- **Sustainable Fuels.** FedEx will continue to invest in alternative fuels to reduce air and land vehicle emissions.

EMERGING TECHNOLOGY

Trucking is on the cusp of major change; our guidance reports explore up and coming technologies that will positively impact fuel economy.

**Electric Trucks**

An Overview

A foundation for understanding the key arguments for and against this rapidly evolving powertrain alternative.

**Autonomous Vehicles**

Self-Driving Efficiency

Advancements in technologies that enable vehicles to be self-driving have progressed significantly.
Charging Stations

- Home Based
- Conventional Gas Stations
- Rest Stops
- Long Highway Stretches
- Alternative Technologies
  - Inductive Charging
  - Rapid Charge Stations
  - Quick Change Battery Solutions – Not On GM’s Ultium Platform

https://www.tesla.com/supercharger
Existing Missouri EV Charging Stations

*Information Provided by PlugShare

© 2021 Olsson
Missouri Rest Stops

- Eight Welcome Centers
- 14 Rest Areas
- 23 Truck Only Parking Sites
Back To The Grid Itself

• How do we handle a greater demand load with a longer “peak” time?

• New transformers will not see the “cool down” or “de-excitation” times that previous units did

• Utility substation transformers have a 25-to-40-year service life historically

• New lean manufacturing techniques coupled with cost savings measures are yielding a 10-20% decrease in that life span.
Integrating home charging stations in 90% of the homes in the U.S. by 2035 and the demand model based on those installs alone increases approximately 300%
More integrated charging in parking garages, lots, airports and beyond during working hours.
Contact

Rusty Hartman, PE
rhartman@olsson.com
417.483.2275
Geographic Area

• Southeast Missouri
• Small MPO
• Urbanized Area Pop. 54,854
• Consists of:
  ▪ City of Cape Girardeau
  ▪ City of Jackson
  ▪ Portions of Cape Girardeau County, MO
  ▪ Portions of Scott County, MO
  ▪ Portions of the Village of East Cape, IL
  ▪ Includes SEMO Port and Cape Girardeau
Background

• 2021 – 2045 Metropolitan Transportation Plan

• Unified Planning Work Program
  ▪ Electric Vehicle Readiness Plan
  ▪ Research
  ▪ Established Steering Committee
  ▪ Developed a Request For Proposal
    • Scope/Goals/Deliverables
Electric Vehicle Readiness Plan

• Scope:

  ▪ **Stakeholder Outreach**: Utilities, Charging Infrastructure Companies, Car Manufacturers and Dealers, Policy Makers, Local EV Enthusiasts, etc.

  ▪ **Assessment**: Development Codes, Existing Conditions, Critical Barriers and Gaps, Key Needs, Potential Programs and Partnerships, EV Infrastructure, Trends, etc.

  ▪ **Equity Analysis**: Access to traditionally underserved such as multifamily housing residents, renters, lower-income, communities of color, non-English speakers, etc.
Electric Vehicle Readiness Plan cont..

• Scope:
  - **Strategic Locations**: Locations based on current demand, anticipated growth, Existing Grid Capabilities, Distinction between Public/Private, Appropriate Level Charger, Cost Estimates, etc.
  - **Needed Programs & Policies**: Barriers and Methods to increase EV usage, Fleet Electrification, Grid Optimization, Innovative Charging Options such as curbside, streetlight, solar, and wireless.
  - **Strategy & Recommendations**: Implementation Plan, Key Partnerships, Necessary Legislation; Recommendations on infrastructure, services, policies, programs.
  - **Funding Guidance**: Funding Opportunities, Incentives, Rebates, Grants, Funding Sources (local funds, private funds, public grants, other options..)
RFP Solicitation

- July/August Solicitation
- Solicited 23 firms directly
- Zero Proposal Responses
- Surveyed Firms – 12 responses
- Regrouped, Trying Again
Thank You!
The Electrifying Truth
The Impacts of Vehicle Electrification
Collaboration
Public Infrastructure Spending as a Share of Gross Domestic Product (1956-2014)

https://www.americanactionforum.org/research/infrastructure-spending-trends/
G20 Infrastructure Spending by 2040

Projected public and private infrastructure investment as a percentage of gross domestic product (GDP), 2016-2040

Notes: Includes Group of 20 (G20) individual members. Investment gap is the difference between projected investment and the investment required to match the best-performing peer countries, accounting for differences in country characteristics. Projected investment assumes countries continue to invest at current levels and accounts for economic and population growth.

Source: Global Infrastructure Hub.

Source: https://www.cfr.org/backgrounder/state-us-infrastructure
Urban vs. Rural
Discussion