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Michigan House of Representatives
Energy Policy Committee
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EV Charging: Beyond The Gas Station Model

John Viera

Global Director, Sustainability &
Vehicle Environmental Matters

Our Vision For The Future

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Ford Motor Company was built on the belief
that freedom of movement drives human progress.

It's a belief that has always fueled our passion
to create great cars and trucks.

And today, it drives our commitment to become the world's most trusted mobility company, designing smart vehicles for a smart world that help people move more safely, confidently and freely.

Smart Vehicles in a Smart World

Ford Electrification History

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A rich history in vehicle electrification

- In 1914, Henry Ford and Thomas Edison collaborated on a prototype Electric Model T
- Ford pioneered the development of sodium-sulfur battery chemistry in the 1960s, and put the technology into low-volume production in the 1993 Electric Ecostar van
- The Ford Ranger EV was introduced in 1998, and over 1500 were produced through 2002
- In 2004, Ford introduced the first electrified SUV – The Escape Hybrid
- In 2010/11 Ford ramped up electrified offerings with the Fusion Hybrid, Mercury Milan Hybrid, Lincoln MKZ Hybrid, and Focus Electric BEV
- Ford accelerated electrification in 2013 with major updates to the Fusion and MKZ Hybrids, the addition of the C-Max Hybrid, and the introduction of new Plug-In Hybrids, Fusion Energi and C-Max Energi
- Ford continues to be the second largest producer of Hybrids in the US

Ambitious EV Plans

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Continued acceleration in electrification activity

- Ford, in partnership with BMW, Daimler, and the VW group, is installing a High-Speed DC Fast Charging network (Ionity) covering the major inter-city highway routes in Europe
- Ford recently formed Team Edison to accelerate both the development and adoption of electric vehicles
- Ford will invest $11B in vehicle electrification over the next 5 years
- This investment will produce 40 new electrified vehicles Globally - 24 Hybrid and Plug-In Hybrid, and 16 Battery Electrics, including:
  - Plug-in hybrid vehicles for police and government
  - Electrified versions of our iconic Mustang and F-150
  - A new Fully Electric Performance SUV in 2020, with targeted range of 300 miles

Market Forecast For Electrification

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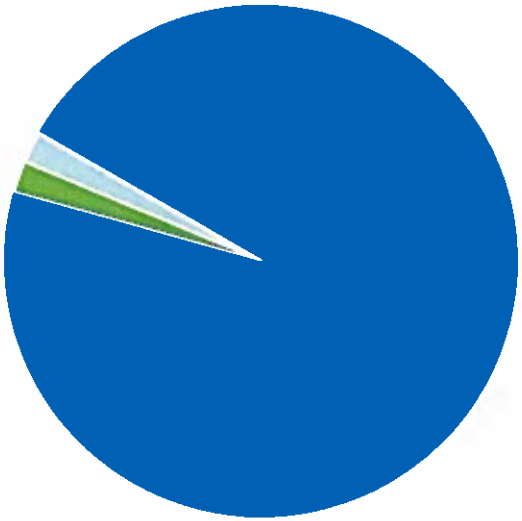
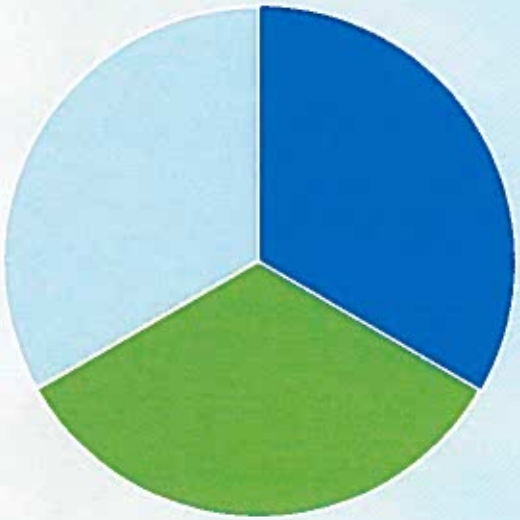
Global Industry 2017



Global Industry Outlook 2030



Internal Combustion Engine (ICE) | Hybrid Electric Vehicle (HEV) | Battery Electric Vehicle (BEV) / Plug-in Hybrid (PHEV)

Source: Aggregated industry projections for Global EV and Hybrid sales rates.

Electrified Vehicles Will Play A Dominant Role By 2030

Key Barriers To EV Adoption

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Range Anxiety: Customers need EVs with 200+ miles of range

Infrastructure

Long-Distance Travel: Fast Charging corridors are needed on inter-city routes across the United States

Public Charging Infrastructure: Customers need readily available, easily visible chargers in their everyday environment

Both Vehicle Design And Infrastructure Availability Play A Role

The Importance Of Public Charging

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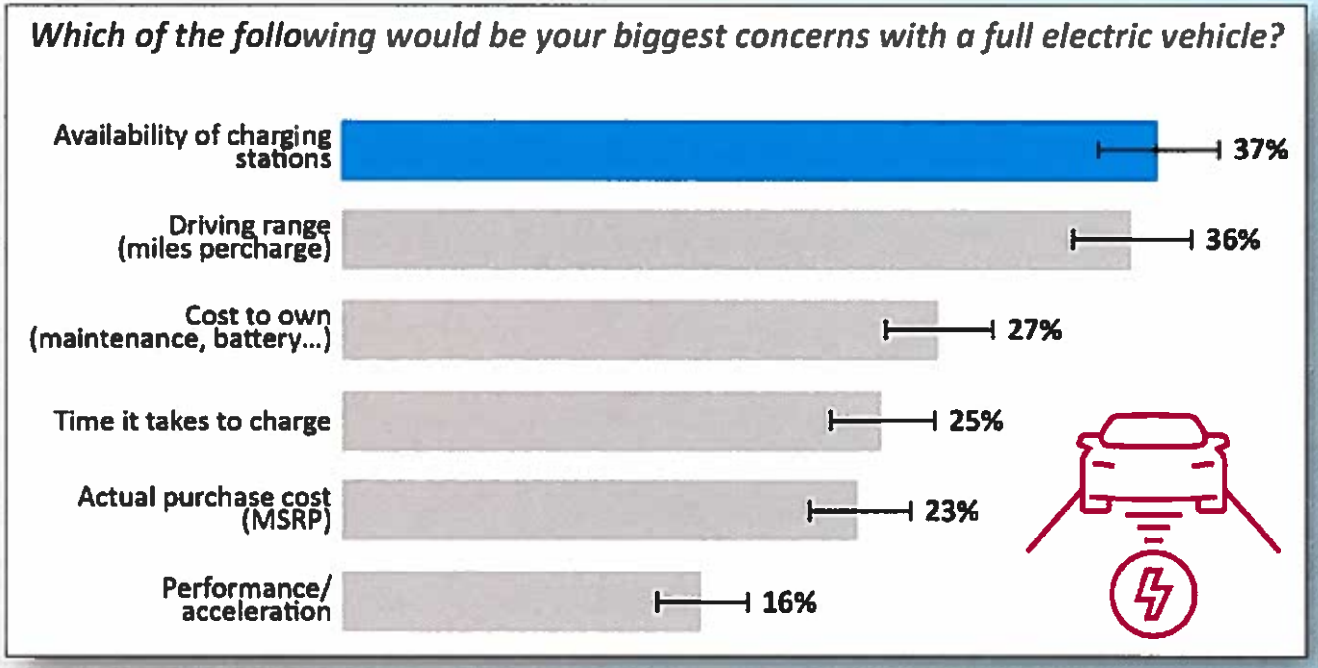
In a 2017 survey of prospective EV customers, JD Power found that:

- 'Availability of Charging Stations' was the biggest concern
- More than 60% did not notice charging stations at all, either near their homes and workplaces, or when traveling
- Just 10% noticed charging stations once a day or more



Source: J.D. Power 2017 Survey (http://www.jdpower.com/resource/mobility-disruptors-what-happened-to-charging-into-the-future)

Availability Of Visible Public Charging Is An Important Factor For EV Adoption

Public Charging Options: United States

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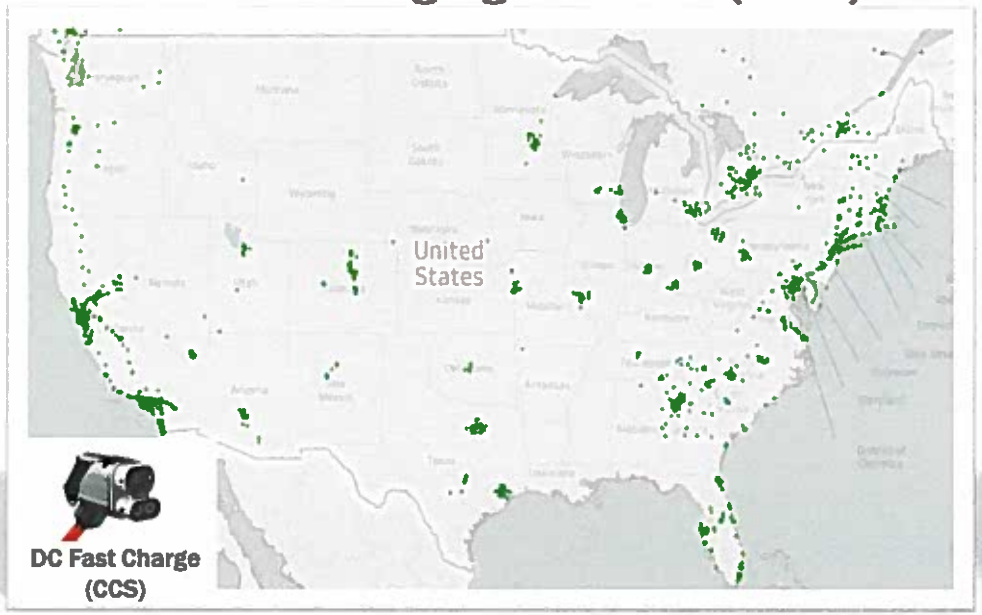
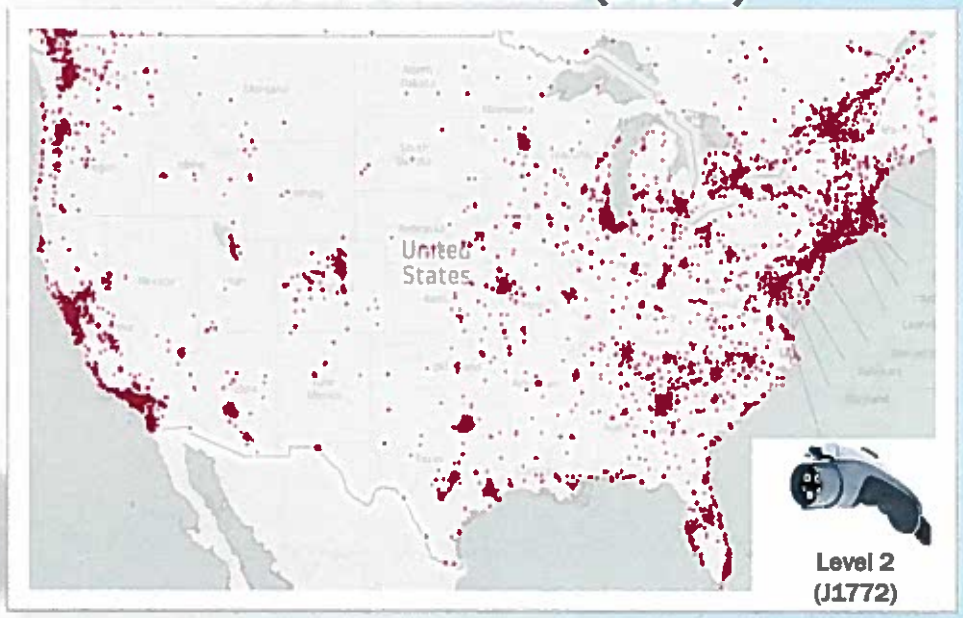
Faster Charge
DC Fast Charging Stations (CCS)



Charge Time with DC Fast Charging Station
~ 1.5 hours*

Slower Charge
Level 2 Stations (J1772)



Charge Time with Level 2 charger
~ 8 hours*

Source: DoE Alternative Fuels Data Center, January 2018. * Charge Time based on 60 kWh battery size, 50kW DCFC station, and 3.84kW L2 station.

Except In Certain Areas, Charging Stations Are Sparse Across The US

Public Charging Options: Michigan

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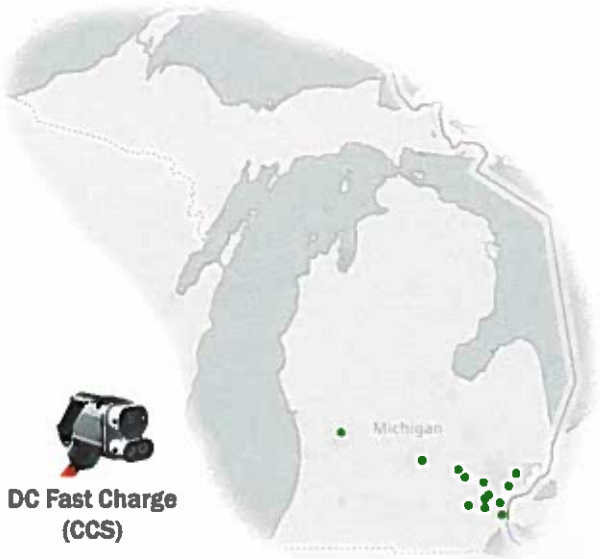
Faster Charge
DC Fast Charging Stations (CCS)



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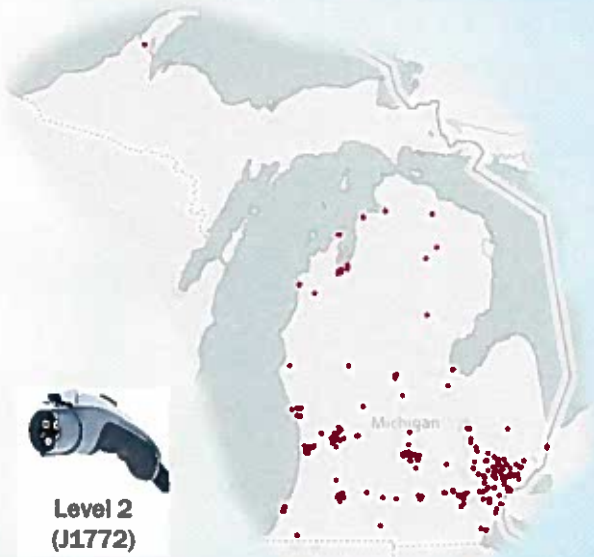

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Source: DoE Alternative Fuels Data Center, January 2018. * Charge Time based on 60 kWh battery size, 50kW DCFC station, and 3.84kW L2 station.

Current Charging Infrastructure For EV Vehicles In Michigan Is Inadequate

Do DC Fast Chargers Replace Gas Stations?

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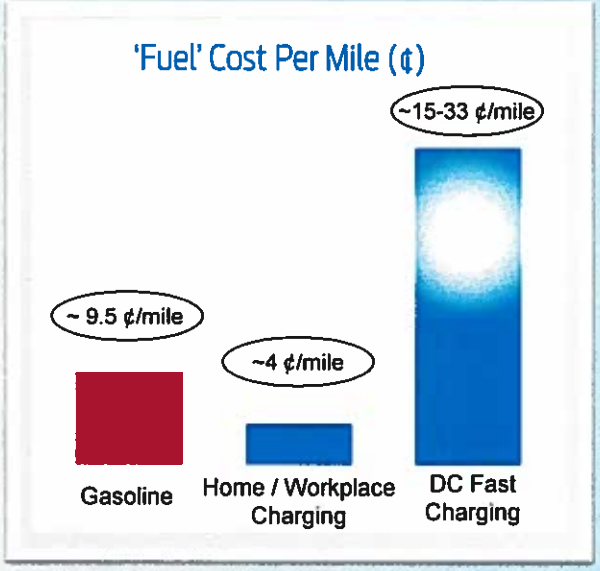
Simply replacing Gas Stations with DC Fast Charging (DCFC) Stations IS NOT an adequate solution for routine charging

- DC Fast Charging will be more expensive* than Home Charging, and more expensive than driving on Gasoline
- DC Fast Charging will take much longer than filling up with Gasoline
- Battery degradation occurs if DC Fast Charging occurs too frequently
- DC Fast Chargers draw power sporadically, and at a high rate: A problem for the Power Grid

But, DC Fast Charging (DCFC) technology IS a critical enabler for widespread EV adoption

- DC Fast Charging stations strategically located along highways are necessary to enable inter-city travel for EVs
- EV drivers in urban locations will occasionally need DC Fast Charging for emergency top-ups



Gasoline: 27 mpg, $2.56/gallon (US avg. on 3/6/2018)
Home/Workplace: 12.5¢ / kw-hr (EIA 2016 US avg)
DC Fast Charge: $0.45 to $1.00 / kw-hr (*BNEF, 2017)
Memo: EV 'mpg' approximately 3 miles per kw-hr

* Bloomberg New Energy Finance analysis cites Utility demand charges, expensive charging equipment, and operational costs

DC Fast Charging Technology Is A Critical Enabler For Widespread EV Adoption But Is A Poor Solution For Everyday Charging

Everyday Charging: Where EVs Park

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Parking is a charging opportunity

Routine Dwell Time

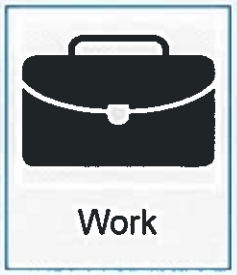
Vehicles are at rest over

23 hrs every day, or more than

95% of each day

Source: AAA

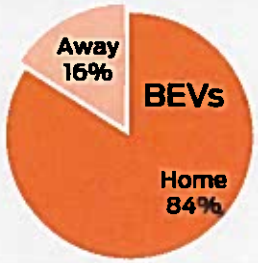
Routine Dwell Locations

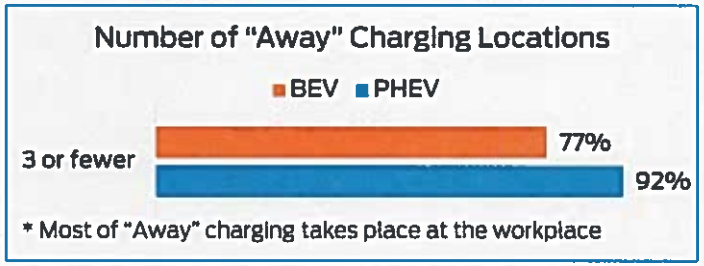


Source: CPUC

Home Charging

Current data shows that EV drivers perform nearly all of their charging at Home (or Workplace if available)





Source: "Plugged In: How Americans Charge Their Electric Vehicles," INL (2015

The Majority Of EV Charging Will Be Done Where Vehicles Park

Workplace Charging Benefits: EV Drivers

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- **High Visibility**: Prospective EV owners will see the chargers daily and gain confidence in their ability to live with an EV
- **Convenience**: For many people, work is a daily destination and a perfect time to charge
- **Apartment Dwellers**: Workplace Charging provides a crucial charging opportunity for those without Home charging
- **Long Dwell Time**: Average 8 hour work day[1]
- **Savings**: Ability to charge at 'level 2' rates ensures minimal electricity cost
- **More Electric Miles**: Ford Employee PHEV drivers who used the Ford Workplace Charging Network regularly saw a 45% increase in electric vehicle miles traveled (eVMT), adding 3400 eVMT annually[2]
- **Positive environmental contribution**: Local and Global impacts

Source: 1. "Average hours employed people spent working on days worked by day of week," Bureau of Labor Statistics (2016). 2. "The Positive Effects of Workplace Charging on EV Ownership and Utilization," Ford Motor Company. Presented at EVS30 Symposium (10/11/17).

Workplace Charging Can Eliminate Barriers To EV Adoption

Workplace Charging Benefits: Government & Utilities

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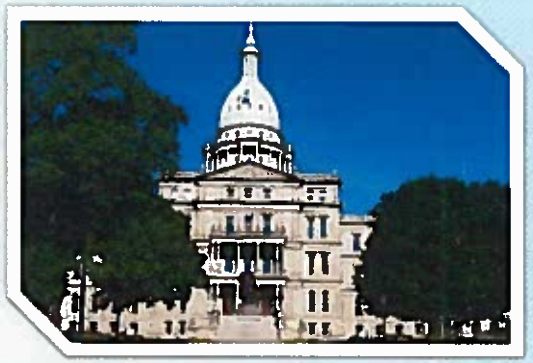
- **Increase EV Adoption**: By promoting and incentivizing Workplace Charging, Governments can impact the adoption and utilization of EVs, furthering the goals of CO_2 reduction, fuel economy improvement, and energy security
- **Speed Transition to Electricity as a Fuel**: Workplace Charging will speed the transition of Transportation to electricity as 'fuel', benefitting Utilities through increased asset utilization
- **Shift Peak Usage**: Utilities benefit as Workplace Charging shifts charging times towards renewables peak generation, and away from late afternoon peak demand
- **Challenges of Workplace Charging:**
  - How do we incentivize workplaces to install chargers?
  - Who will pay for the installation and operation?
  - Where should the chargers be located?



Source: "The Positive Effects of Workplace Charging on EV Ownership and Utilization," Ford Motor Company. Presented at EVS30 Symposium, 10/11/17.

Workplace Charging Will Speed The Adoption Of Electricity As Transportation Fuel

Ford Input On VW 'Appendix D' Funds

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As part of its settlement with the US Government, VW agreed to stablish the Environmental Mitigation Trust Fund. This agreement is known as 'Appendix D' of the larger consent decree. The rules for governance of the Trust Fund allow individual US States discretion in their usage of 15% of the funding.

In February 2018, Ford wrote a letter to each US State recommending that the full 15% of these funds be dedicated to public EV charging. The letter recommended that public charger investment be focused on DC Fast Charging highway corridors and Workplace Charging.

The letter also made a number of complementary recommendations, including:

- Modifying Building Codes to require that new or modified residential and commercial parking be 'made ready' for charger installation
- Implementing incentives, such as utility charger installation support (e.g., transformer upgrades) and free charger permitting
- Ensuring a consistent, pleasant customer experience through payment interoperability, price transparency, mapping information, signage, and accessibility

Ford Recommends Focusing On Highway Charging Corridors & Workplace Charging

In Summary

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- More public EV charging is needed to support projected EV demand
- Ford recommends that public charging efforts be focused on:
  - Highway Corridor DC Fast Charging: essential enabler for long-distance inter-city EV travel
  - Workplace Charging: Outside of home, workplace is the best routine charging location and vital for drivers without a Home Charging opportunity
- Ford supports directing the maximum possible amount of VW's Environmental Mitigation Trust Fund (Appendix D) monies towards public charging investment
- Ford believes that investment in charging infrastructure supports the goal of Michigan's Automotive Strategic Plan:

"Grow the technologies, talents and infrastructure necessary to lead the global automotive market future"

Source: State of Michigan Automotive Strategic Plan (https://www.michiganbusiness.org/cm/files/Auto-Strategic-Plan.pdf)

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Thank You!