Charging Ahead: The State of Electric Vehicles in North Texas

HDR Lunch and Learn
April 23, 2018

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North Central Texas Council of Governments
Who and What is NCTCOG?

• Voluntary association of local governments
• Established in 1966
• Assists local governments in:
  – Planning for common needs
  – Cooperating for mutual benefit
  – Recognizing regional opportunity
  – Resolving regional programs
  – Making joint decisions
• One of 24 COGs in Texas
• Also serves as MPO

COG = Council of Governments;
MPO = Metropolitan Planning Organization
Regional Electric Vehicle (EV) Efforts

Dallas-Fort Worth Clean Cities

Clean Transportation, Made Easy

Website: www.dfwcleancities.org/evnt
Estimated 2017 Nitrogen Oxides (NOx) Emissions Inventory

Source Category Estimates = 296.77 tons per day (tpd)

- Light-Duty Vehicles: 50.8 tpd
- Medium-Duty Vehicles: 14.86 tpd
- Heavy-Duty Vehicles: 65.11 tpd
- On-Road Mobile: 130.77 tpd
- Non-Road Mobile: 45.54 tpd
- Off-Road Mobile: 25.24 tpd
- Point Sources (Excluding Oil & Gas): 38.30 tpd
- Point - Oil & Gas: 16.50 tpd
- Area Sources: 26.55 tpd
- Oil & Gas (Production & Drill Rigs): 13.87 tpd


**8-hour Ozone NAAQS Historical Trends**

**As of April 1, 2018**

1997 Standard < 85 ppb (Revoked)

2008 Standard ≤ 75 ppb¹ (by 2017)

2015 Standard ≤ 70 ppb (TBD; Marginal by 2020)

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¹Attainment Goal - According to the US EPA National Ambient Air Quality Standards, attainment is reached when, at each monitor, the *Design Value* (three-year average of the annual fourth-highest daily maximum eight-hour average ozone concentration) is equal to or less than 70 parts per billion (ppb).

*2017 data not certified by the Texas Commission on Environmental Quality

*Not a full year of data, current as of 4/01/2018

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Source: NCTCOG TR Dept
EV Basics

EVs

Hybrid Electric Vehicle (HEV)

Plug-In Hybrid Electric Vehicle (PHEV)

All-Electric Vehicle (EV) or Plug-In Electric Vehicle (PEV)
EV Safety & Performance

Safety
- Same rigorous testing as ICEs
- EV-specific safety standards (batteries, chemicals, electric shock)
- Lower center of gravity=decreased likelihood of roll over
- Many EVs have five star crash test ratings

Performance
- Lower center of gravity improves ride quality
- Flexible packaging of battery for dynamic design
- Peak torque production at 0 RPM=excellent acceleration
- Regenerative braking produces less fade and wear
# EV Market Trends

**Better Battery Technology**

- Increased Range
- Faster, Less Frequent Charging
- Decreasing Costs – by 80% in the last 6 years

**Greater Market Variety**

- Vehicle Types – Tesla, Ford to manufacture pickups
- Price Ranges – $20K -- $100+K
- Manufacturers & Models – New Entrants and Increased Number of Models
Electric Vehicles Range (miles) and Battery Size (kwh)

Source: Plug In America, all listed vehicles are 2018 models except for the Hyundai Electric Ioniq, a 2017 model
## EV Charging

### Electric Vehicle Supply Equipment (EVSE)

<table>
<thead>
<tr>
<th>Type</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>AC 100-120 V 12 or 16 amps 1.44, 1.92 kWh</td>
</tr>
<tr>
<td>Level 2</td>
<td>AC 208-240 V 16-80 amps 3.3-19.2 kWh</td>
</tr>
<tr>
<td>Level 3/ DC Fast Charge</td>
<td>DC 200-450 V ≤ 200 amps ≤ 90 kWh</td>
</tr>
</tbody>
</table>
EV Charging

How Long Does it Take to Charge?

- Battery Pack Size
- Rate of Power Flow

Estimated Charge Time =

(Battery Pack Rating) ÷

(Lesser of EV Power Acceptance Rate or EVSE Power Delivery Rate)

https://www.clippercreek.com/charging-times-chart/
### EV Charging Locations

**Day in the life of an average car**

<table>
<thead>
<tr>
<th>Workplace</th>
<th>Leisure Destination</th>
<th>Shopping Centers</th>
<th>Travel Stops</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.5-8+ hours</td>
<td>47 min-2 hours</td>
<td>28-48 min</td>
<td>15-53 min</td>
</tr>
</tbody>
</table>

**Source:** U.S. DOE Workplace Charging Presentation, July 2015
EV Charging Locations

- Public
  - Parking lots/garages
  - Public/municipal
  - Retail
  - Transportation hubs
  - Hotels

- Workplace
  - Business offices
  - Office parks or campuses
  - Industrial facilities
  - Fleets

- Home
  - On-street
  - Multi unit dwelling
  - Single family residential garages and driveways

Education
Medical
Leisure destinations
Non-profit meeting places
Workplace Charging: Benefits

Inexpensive to Provide and Instrumental to Attract and Keep Talent

- Employee Recruitment and Retention
- Further Sustainability Goals
- Green Public Image
- Employee Satisfaction
- Increase Likelihood of Employee EV Purchase

An individual who has access to EV charging at work is 20X more likely to buy a plug-in.

- U.S. DOE
Alternative Fuels Data Center Tools: Station Locator and Route Planner

[Map with stations shown]

- **Broadstone**: 1.0 mi
  - Evoke
  - 1025 Preston Road
  - Plano, TX 75093
  - Level 2

- **Comfort Inn**: 1.2 mi near Plano Medical Center
  - 5021 West Plano Parkway
  - Plano, TX 75093
  - Level 2

- **Plano**: 1.2 mi
  - Parkway Courtyard By Marriott
  - 4901 W Plano Pkwy
  - Plano, TX 75093
  - Level 2
How Does an EV Affect the Grid?

The Electrical Load of 3 EVs Is Approximately Equal to That of 1 Average House
EV Benefits - Emissions

Well-to-Wheels Carbon Dioxide (CO₂) Emissions

State Averages for TX

Electricity Sources:
- Gas: 53.15%
- Coal: 27.18%
- Wind: 10.02%
- Nuclear: 8.80%
- Biomass: 0.32%
- Hydro: 0.21%
- Other Fossil: 0.16%
- Solar: 0.09%

Annual Emissions per Vehicle:

Pounds of CO₂ Equivalent

- All Electric
- Plug-in Hybrid
- Hybrid
- Gasoline

EV Benefits - Emissions

Well-to-Wheel NO\textsubscript{X} Emissions

- **Pump-To-Wheel**
- **Well-to-Pump**
- **Well-To-Wheels**

ICE=Internal Combustion Engine; HEV=Hybrid Electric Vehicle; PHEV=Plug-In Hybrid Electric Vehicle; NGCC=Natural Gas Combined Cycle

Source: Argonne National Laboratory
Well-to-Wheels Emissions Calculator; https://greet.es.anl.gov/results
EV Benefits – Total Energy

ICE=Internal Combustion Engine; HEV=Hybrid Electric Vehicle; PHEV=Plug-In Hybrid Electric Vehicle; NGCC=Natural Gas Combined Cycle

Source: Argonne National Laboratory Well-to-Wheels Emissions Calculator; https://greet.es.anl.gov/results
EV Benefits – Energy Security

I survived the "Great Gas Panic"

Of Thursday
## EV Benefits – Annual Cost

<table>
<thead>
<tr>
<th>Type of Cost</th>
<th>Electric Vehicles</th>
<th>Conventional Gasoline Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2017 Nissan LEAF</td>
<td>2017 Chevrolet Volt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2017 Chevrolet Cruze</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2017 Toyota Camry</td>
</tr>
<tr>
<td>Annual Fuel Use</td>
<td>3,652 kWh electricity</td>
<td>68 gallons gasoline + 2,812 kWh electricity</td>
</tr>
<tr>
<td>Annual Fuel Cost</td>
<td>$402</td>
<td>$473</td>
</tr>
<tr>
<td>Annual Operating Cost</td>
<td>$2,507</td>
<td>$2,730</td>
</tr>
<tr>
<td>Cost per Mile</td>
<td>$0.21</td>
<td>$0.23</td>
</tr>
</tbody>
</table>

**Source:** U.S. DOE Alternative Fuels Data Center Vehicle Cost Calculator [http://www.afdc.energy.gov/calc](http://www.afdc.energy.gov/calc)
EV Benefits – Total Cost of Ownership

Total Cost of Ownership, Vehicle Type Comparison

<table>
<thead>
<tr>
<th>Category</th>
<th>Gasoline</th>
<th>Gasoline PHEV</th>
<th>EV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel tax</td>
<td>$1,244</td>
<td>$642</td>
<td>$9</td>
</tr>
<tr>
<td>Incentives</td>
<td>$0</td>
<td>-$5,000</td>
<td>-$10,000</td>
</tr>
<tr>
<td>License and Registration</td>
<td>$1,726</td>
<td>$1,726</td>
<td>$1,726</td>
</tr>
<tr>
<td>Insurance</td>
<td>$15,946</td>
<td>$15,946</td>
<td>$15,946</td>
</tr>
<tr>
<td>Maintenance and Repair</td>
<td>$28,295</td>
<td>$26,861</td>
<td>$24,932</td>
</tr>
<tr>
<td>Fuel</td>
<td>$17,618</td>
<td>$12,512</td>
<td>$10,881</td>
</tr>
<tr>
<td>Depreciation</td>
<td>$18,701</td>
<td>$26,181</td>
<td>$35,064</td>
</tr>
<tr>
<td>Total</td>
<td>$83,530</td>
<td>$78,868</td>
<td>$78,558</td>
</tr>
</tbody>
</table>

Source: Argonne National lab AFLEET tool (passenger vehicle): https://greet.es.anl.gov/afleet_tool
Regional Trends

North Texas Electric Vehicle (EV) Registrations Trends

As of April 1, 2018
Texas Registration: 11,895
DFW Area: 4,347 (37% of TX)

*Other EV includes the BMW i3, Chevrolet Bolt, Fisker Karma, Ford Focus Electric; Other PHEV includes the BMW i8, Ford C-Max Energi, Ford Fusion Electric, Chevrolet Bolt, Chevrolet Spark EV, Fiat 500e, and Mercedes B250e
Regional Trends

Vehicle Registration by ZIP Code and Infrastructure Availability

EV Charger Types
- Tesla Only Charging Stations
- DC Fast Charging* Stations
- Level 2 Charging** Stations

EV Registration by ZIP Code
- 1-7
- 8-18
- 19-33
- 34-53
- 54-89
- 90+
- None

*Note: DC Fast Charging Stations may include Level 2 Charging Stations
**Note: Level 2 Charging Stations may include Level 1 Charging Stations

April 2018

North Central Texas Council of Governments
### The “Top 5” Lists

<table>
<thead>
<tr>
<th>County</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travis</td>
<td>1,861</td>
</tr>
<tr>
<td>Harris</td>
<td>1,732</td>
</tr>
<tr>
<td>Dallas</td>
<td>1,679</td>
</tr>
<tr>
<td>Collin</td>
<td>994</td>
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<tr>
<td>Tarrant</td>
<td>981</td>
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<table>
<thead>
<tr>
<th>City</th>
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<tbody>
<tr>
<td>Austin</td>
<td>1,564</td>
</tr>
<tr>
<td>Houston</td>
<td>1,135</td>
</tr>
<tr>
<td>Dallas</td>
<td>738</td>
</tr>
<tr>
<td>San Antonio</td>
<td>573</td>
</tr>
<tr>
<td>Plano</td>
<td>293</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Make/Model</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tesla Model S</td>
<td>3,659</td>
</tr>
<tr>
<td>Chevrolet Volt</td>
<td>2,267</td>
</tr>
<tr>
<td>Nissan LEAF</td>
<td>1,451</td>
</tr>
<tr>
<td>Tesla Model X</td>
<td>1,331</td>
</tr>
<tr>
<td>Ford Fusion</td>
<td>897</td>
</tr>
</tbody>
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**Recent Developments: Volkswagen Settlement**

Zero-Emission Vehicle (ZEV) Investment Program Managed through Electrify America, LLC

$1.2 Billion Commitment Nationwide (Excludes California)

<table>
<thead>
<tr>
<th>Cycle 1</th>
<th>Cycle 2</th>
<th>Cycle 3</th>
<th>Cycle 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$300 Million</td>
<td>$300 Million</td>
<td>$300 Million</td>
<td>$300 Million</td>
</tr>
</tbody>
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Charging Infrastructure Installation – Approximately $250 Million

- Long Distance Highway Network ~$190 Million
- Community Charging ~$40 Million

Public Education Initiatives – Approximately $25 Million

ZEV Access Initiatives – Under Development
Recent Developments: Alternative Fuel Corridors

Qualifying Stations:
- DCFC or Level 2
- 5 Miles from Highway
- Public Access
# Available Incentives

## Vehicles

<table>
<thead>
<tr>
<th>Amount</th>
<th>Incentive Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $7,500</td>
<td><strong>Qualified Plug-In Electric Drive Motor Vehicle Tax Credit</strong></td>
</tr>
<tr>
<td>Up to $3,500</td>
<td><strong>AirCheckTexas Drive a Clean Machine Program</strong></td>
</tr>
<tr>
<td>$2,500</td>
<td><strong>Light-Duty Motor Vehicle Purchase or Lease Incentive Program</strong></td>
</tr>
<tr>
<td></td>
<td>Coming Summer 2018</td>
</tr>
</tbody>
</table>

## Infrastructure

<table>
<thead>
<tr>
<th>Amount</th>
<th>Incentive Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $1,000 Per Station</td>
<td><strong>Tesla Charging Partner</strong></td>
</tr>
<tr>
<td>Up to 100% if Government-Owned; 80%</td>
<td><strong>Volkswagen Settlement Environmental Mitigation Trust??</strong></td>
</tr>
<tr>
<td>if Non-Government Owned</td>
<td><em>Texas Plans To Be Determined</em></td>
</tr>
</tbody>
</table>
National Resources

Plug In America: www.pluginamerica.org

The Electrification Coalition www.ElectrificationCoalition.org
National Resources

Alternative Fuels Data Center (US Department of Energy)

www.afdc.energy.gov

- Vehicle Search
- Vehicle Cost Calculator
- Alternative Fueling Station Locator
National Drive Electric Week (NDEW)

Nat’l Drive Electric Week

North Texas 2018

RECORDS ARE MADE TO BE BROKEN.

9.8.18 Grapevine Mills #texasEV DriveElectricDFW.org
For More Information

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LClark@nctcog.org

DFW Clean Cities Coalition Staff
cleanCities@nctcog.org
www.dfwcleanCities.org/evnt