

# Electric Vehicles in Nebraska

Anne McCollister, *Nebraska Community Energy Alliance*

Moe Alahmad, *University of Nebraska-Lincoln*

Heather Siebken, *OPPD*

Scott Benson, *LES*

Joe Francis, *Nebraska Department of Environmental Quality*

Moderator: Dave Rich, *NPPD*



11TH ANNUAL  
Nebraska  
Wind & Solar  
CONFERENCE & EXHIBITION  
PRESENTED BY **NEXTERA**  
ENERGY   
RESOURCES

# Electric Vehicles in Nebraska

---



11TH ANNUAL  
Nebraska  
Wind & Solar  
CONFERENCE & EXHIBITION  
PRESENTED BY **NEXTERA**  
ENERGY   
RESOURCES

October 16, 2018

David D. Rich

NPPD Sustainable Energy Manager

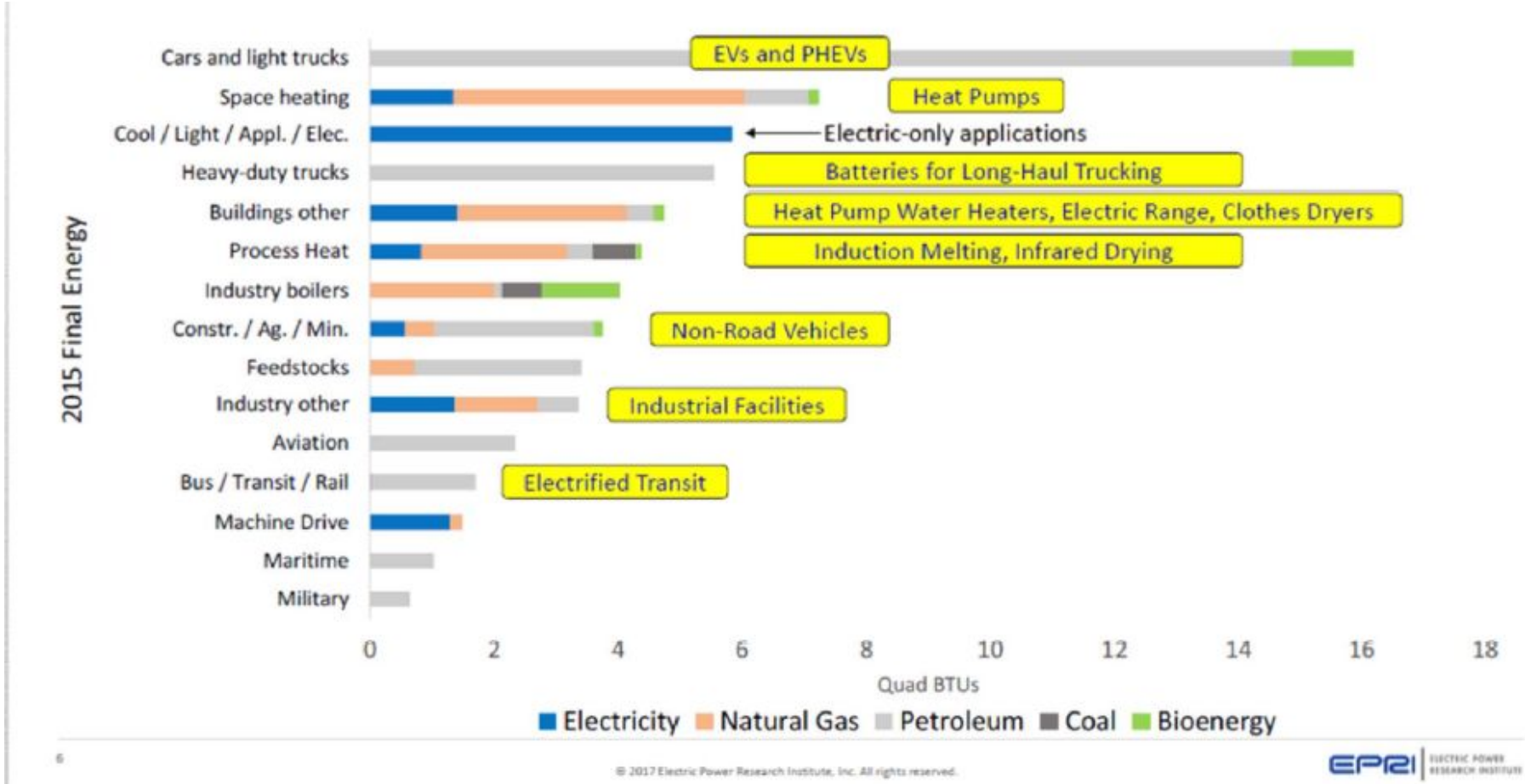


# Electric Vehicles and Renewable Energy

---

*“EVs provide a great new load to take advantage of renewable resources. By integrating smart charging equipment with the electric utilities, EVs can be charged when the renewable resources are providing more energy than what the current load needs. This integrating of smart energy equipment with electric utilities will also allow utilities to effectively manage EV charging load on the distribution system. **The bottom line is this integration will allow all ratepayers to benefit from lower electricity costs with more efficient use of both the generation and distribution systems.**”*

# Electrification Potential Varies by End-Use Application



# Nebraska Power Association

---

- Comprised of the 166 utilities that produce and deliver electricity to Nebraskans.
- NPA EV Task Force
  - Formed May 3, 2017
  - Task Force includes representation from:

NPPD	City of Fremont
OPPD	NMPP Energy
LES	Nebraska Energy Office
Southern Power District	



11TH ANNUAL  
**Nebraska  
Wind & Solar**  
CONFERENCE & EXHIBITION  
PRESENTED BY **NEXtera**  
ENERGY   
RESOURCES

---

---

# The State of Electric Transport in Nebraska

[www.necommunity.energy](http://www.necommunity.energy)



**THE DURHAM SCHOOL**

Anne McCollister & Moe Alahmad  
October 16, 2018



# Electrification Architecture

**(48%) COAL GENERATION**  
Coal is the dominant fuel source in U.S. power generation, and domestic resources are abundant. Concern regarding emissions has led to investments in technology to capture and sequester CO<sub>2</sub> emissions.



**(22%) NATURAL GAS GENERATION**  
Advances in technology have unlocked substantial natural gas resources in the United States. Burning natural gas emits less CO<sub>2</sub> than coal or oil.



**(20%) NUCLEAR GENERATION**  
Nuclear power is an emissions-free source of baseload power. Some uranium is imported, but from stable suppliers like Canada and Australia.



**(9%) RENEWABLE GENERATION**  
Renewable sources of electricity like wind, solar, geothermal, and hydropower are growing sources of emissions-free domestic energy.



**Power Storage**  
Because wind and solar power are intermittent, they require augmentation. Today, natural gas turbines often perform this function, but stationary lithium-ion batteries may ultimately prove more cost-effective.



**TRANSMISSION AND DISTRIBUTION**  
Electricity from America's diverse set of generation sources is delivered to consumers via a widespread network that already exists today.

The U.S. transportation system and the electric power sector are completely separate today. The emergence of grid-enabled vehicles offers the possibility to synergize these two systems for the first time. In doing so, the transportation system would access the fuel diversity and price stability of the electric power sector, thus substantially improving U.S. energy security.



**30 MI**

90% of U.S. vehicle trips are less than 30 miles.



**RESIDENTIAL HOME**  
The primary charging location for most non-commercial grid-enabled vehicles will be at home. By encouraging off-peak charging, policymakers can ensure that GEVs take advantage of substantial spare capacity in the power sector.



**WORKPLACE**  
During the day, while GEVs sit idle at the driver's workplace, a network of lithium-ion batteries could function as a valuable source of peak power supply for the electric grid.



**RETAIL LOCATIONS**  
Access to electric vehicle supply equipment at retail locations could allow drivers to charge while shopping. It would also increase early consumer confidence in GEVs and provide retailers with a marketing opportunity.

Based on 2009 data

REF: <http://www.electrificationcoalition.org/policy/electrification-roadmap>



# NEBRASKA COMMUNITY ENERGY ALLIANCE

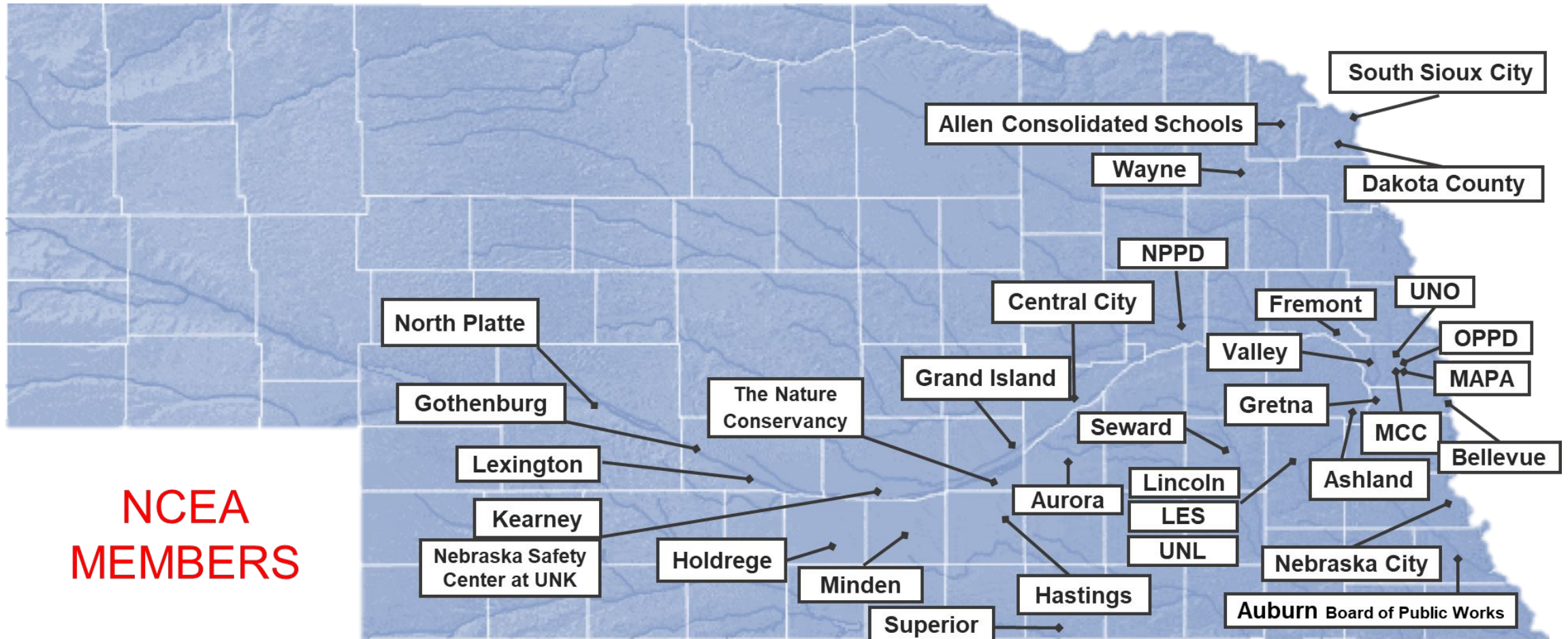
**“Vehicles, and the way they are used, will change more in the next two decades than they have in the last 100 years.” - Colin McKerracher, Bloomberg New Energy Fund**



NCEA, founded in 2014 with **9 members**, has **33 members today**.

**Cost to join as board member – \$1,000/one time**

**Cost to join as associate member - \$250/annual**



# Mission

To build and promote advanced technologies in buildings and transportation.



NCEA defines an *advanced technology* as one that **reduces energy use, lowers greenhouse gas emissions** and **cuts costs**.

NCEA members select **utility-scale solar** (buildings) and **electrified transport** as those representing the two best opportunities to **save energy, reduce GHG emissions and cut costs** to communities.

Our mission is clearly articulated by **Lance Hedquist, City Administrator for South Sioux City, a founder of NCEA, and current chair:**

***“Communities have a choice to simply exist or to lead. Our projects demonstrate leadership and help motivate and excite our citizens.”***



NCEA has built over **\$8 million in solar and electric transport partner projects in Nebraska** in grant funding partnership with the Nebraska Environmental Trust (NET).



**Networked ChargePoint™ LEVEL 2 Charging Station and Electric Vehicles at Seward**



**South Sioux City**

## Electric Transport and Solar Projects

Participating Members	Electric Vehicle	CNG Vehicles	Charging Stations	Solar Energy
<b>22</b>	<b>82</b>	<b>9</b>	<b>41 Commercial</b> <b>250 Residential</b>	<b>3.5 MW</b>



**2019 NET GRANT REQUEST \$536,000**



**CENTRAL CITY**

---

# NCEA Data Analysis

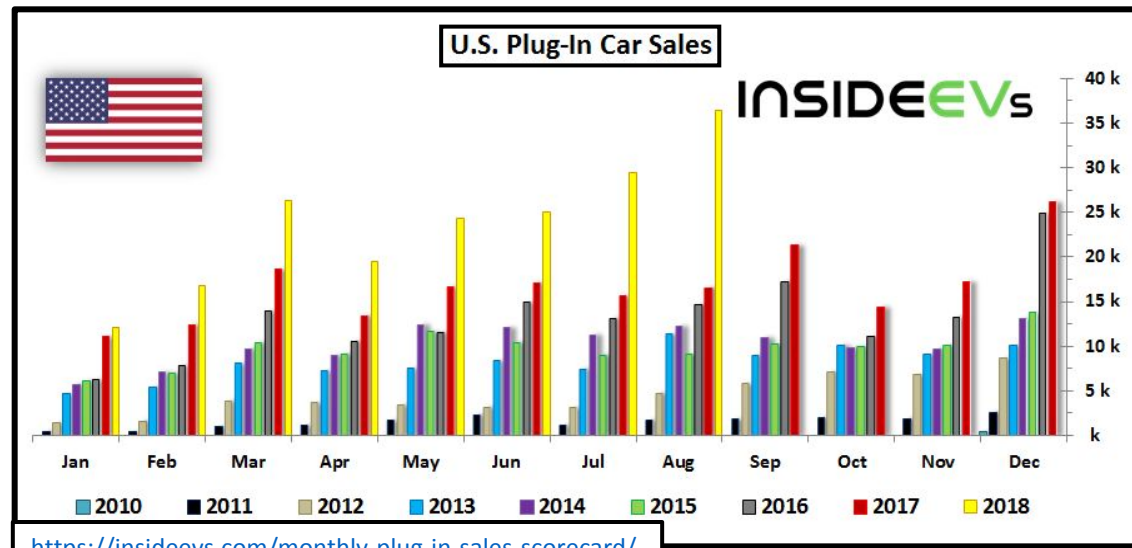
---

---

- **The Case for Infrastructure & Impact**
- **Economic Analysis**
- **Environmental Analysis**

# TRANSPORTATION SECTOR

# of PEVs SOLD in the U.S. annually	Year	#of PEVs
	2015	116,099
	2016	158,614
	2017	199,826
	2018	220,021



<https://insideevs.com/monthly-plug-in-sales-scorecard/>

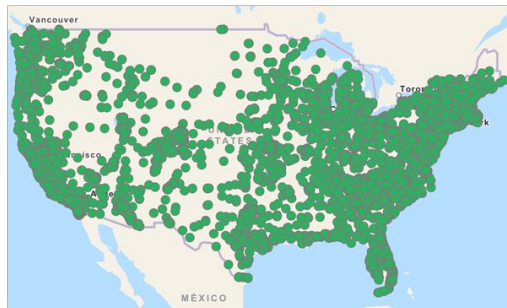
## Residential Charging

LEVEL 1 (120V)

LEVEL 2 (240V)



## Commercial Charging



USA*		
Level 2**	Locations	17,526
	Ports	43,955
DCFC**	Stations	2,483
	Ports	8,837



LEVEL 2 @  
Nebraska City

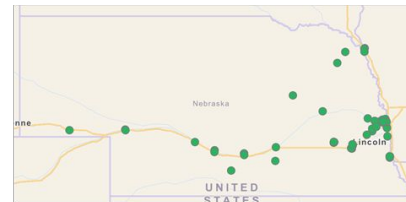
Level 1 (120V)

Level 2 (240V)

DCFC (480V)



LEVEL 3 @ Ashland



NEBRASKA*		
Level 2**	Locations	60
	Ports	118
DCFC***	Stations	6
	Ports	42

# CURRENT STATE OF INFRASTRUCTURE

\*[http://www.afdc.energy.gov/fuels/electricity\\_locations.html](http://www.afdc.energy.gov/fuels/electricity_locations.html)

\*\* Include Dealer locations

\*\*\* Includes Tesla's ports



# FUTURE NEEDS FOR INFRASTRUCTURE

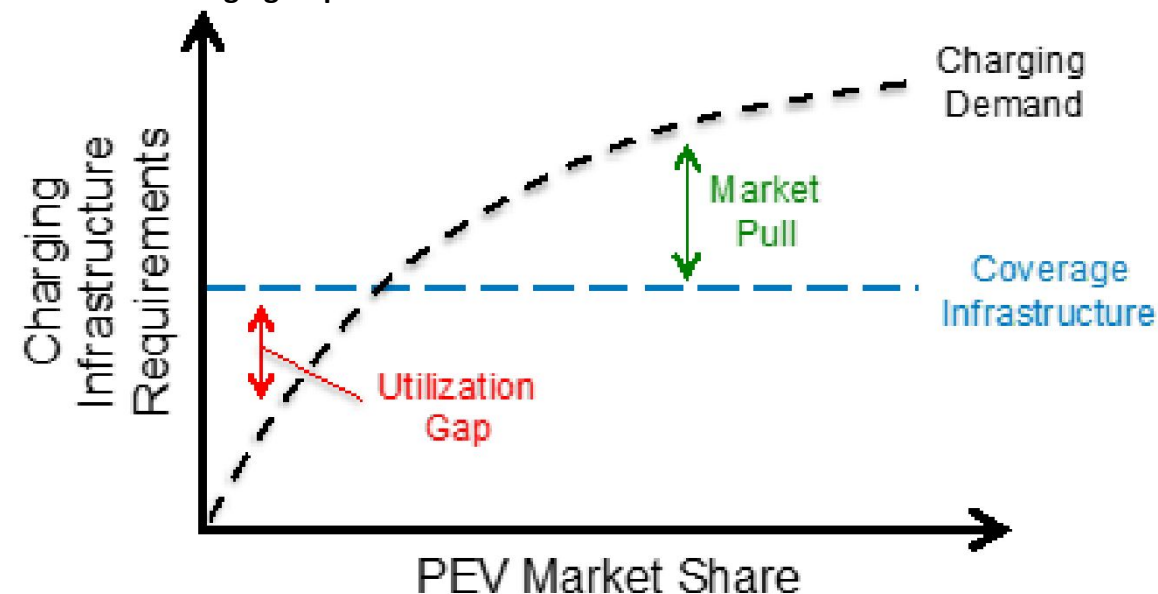
## ADEQUATE CHARGING INFRASTRUCTURE:

- Enable Long Distance travel
- Prevent Range anxiety
- Promote Electric Vehicle adoption

“...two driving forces characterize the charging infrastructure required to support a growing fleet of PEVs:

1. A basic level of **geographic coverage** is required to guarantee nationwide charging opportunities....
2. Over time, a larger network of stations will be required to satisfy **growing charging demand**.....”

PEV charging requirements evolution as a function of PEV market share.



## Central Scenario PEV and Non-Residential EVSE Estimates in 2030, by Community Type (with National Total)

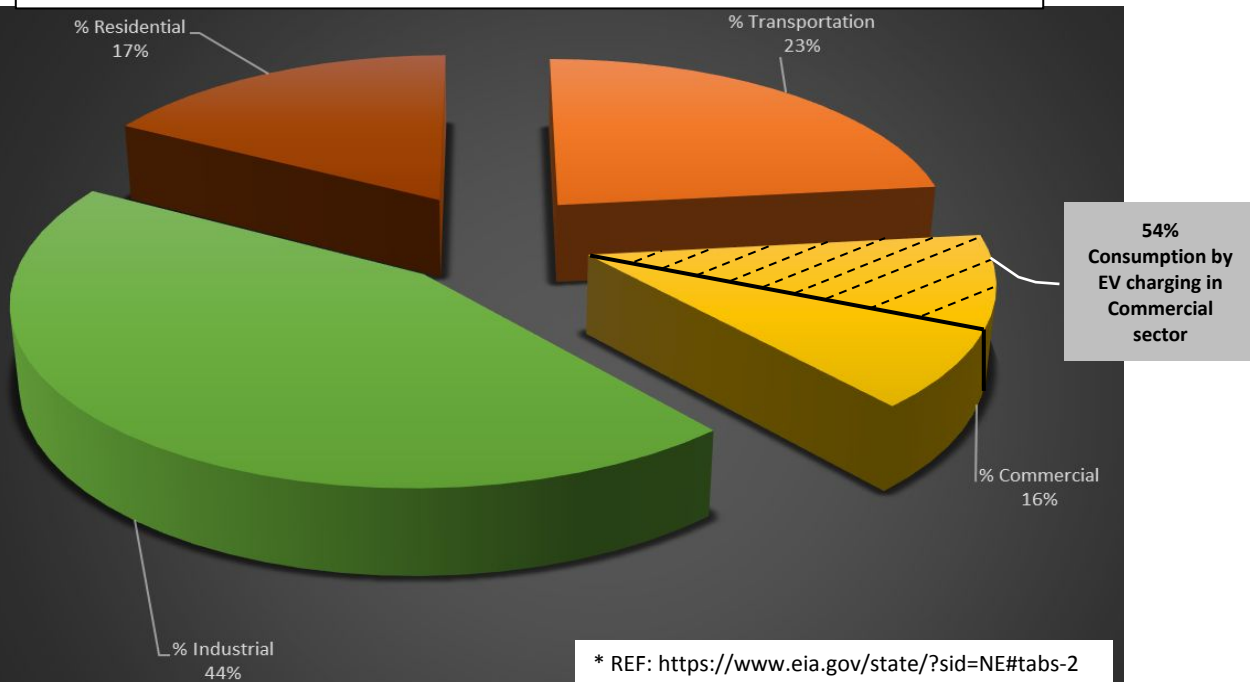
PEV	PEV	Level 2 (Work)	Level 2 (Public)	DCFC (Public)
Cities	12,411,000	278,000	173,000	19,000
Towns	1,848,000	56,000	43,000	4,000
Rural Areas	642,000	28,000	23,000	2,000
<b>National Total</b>	<b>15,000,000</b>	<b>362,000</b>	<b>239,000</b>	<b>25,000</b>

# NEBRASKA DATA & GRID IMPACT

## 2016 Data

ALL Light Duty Vehicles Registered in <b>NEBRASKA</b>		700,277
Average miles traveled per vehicle		11,507
<b>IF</b> All the Light Duty Vehicles Registered in <b>NEBRASKA</b> replaced by BEVs	<b>GWh BEV</b>	<b>3,050</b>
	<b>NE Net Generation (GWh)</b>	<b>36,525</b>
	Miles traveled by all the vehicles	8,058,274,646
	<b>miles/kWh</b>	2.64
Total savings in \$ per mile for all registered vehicles considered as BEVs		<b>\$62,905</b>
<b>CO<sub>2</sub></b> Emissions Reduced for all the registered vehicle considered as BEVs	<b>U.S. TONS / per mile driven</b>	<b>115</b>

## 2016 Nebraska Energy Consumption by end-use sector\*

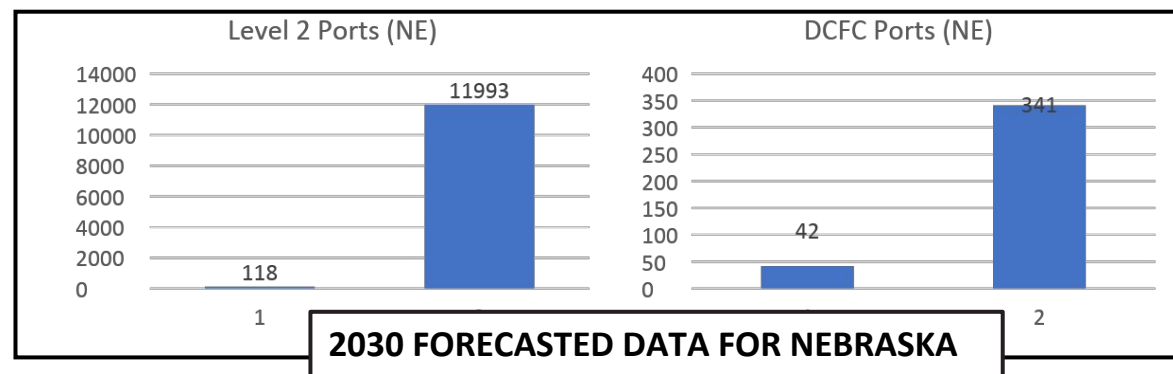
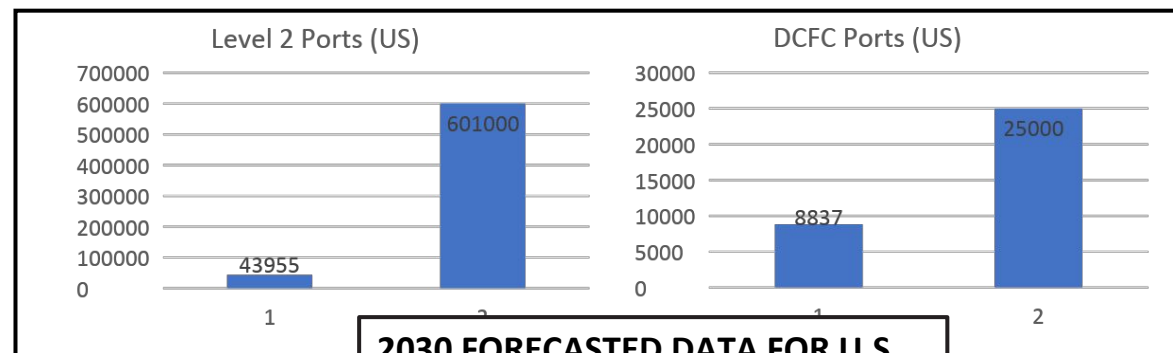


## 2030 FORECAST DATA

Light Duty Vehicles registered in <b>NEBRASKA</b>		2016	2030
	BEV	280	40921
	PHEV	648	81682
	PEV (Total)	928	122603
	% of BEV out of PEV	30.2%	33.4%
	%PHEV out of PEV	69.8%	66.6%

Using 2030 data		
<b>GWh PEV</b>		<b>0.797333</b>
<b>Charging PORTs required</b>	Work Level 2	7064
	Public Level 2	4929
	Public DCFC	341









# The Benefits are Real



Networked ChargePoint™ DC Fast Charger @ Ashland

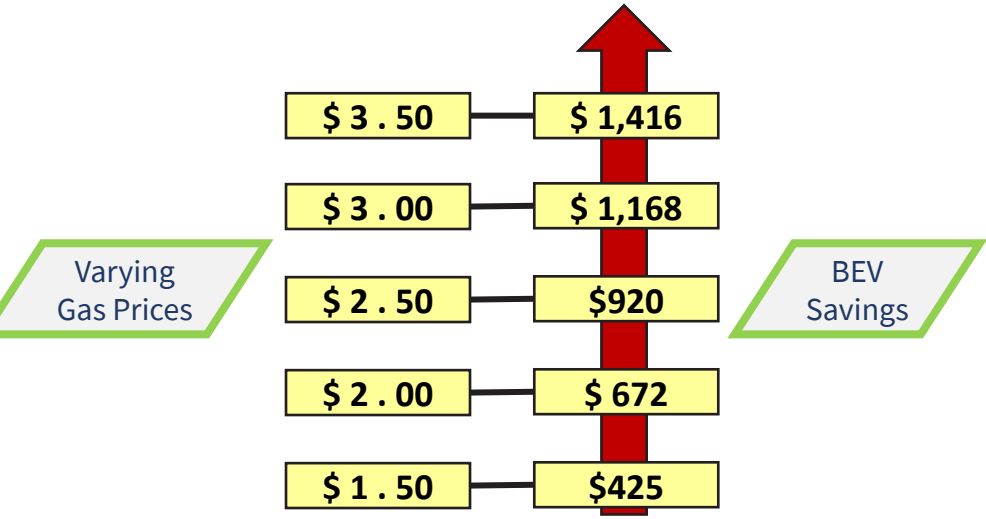
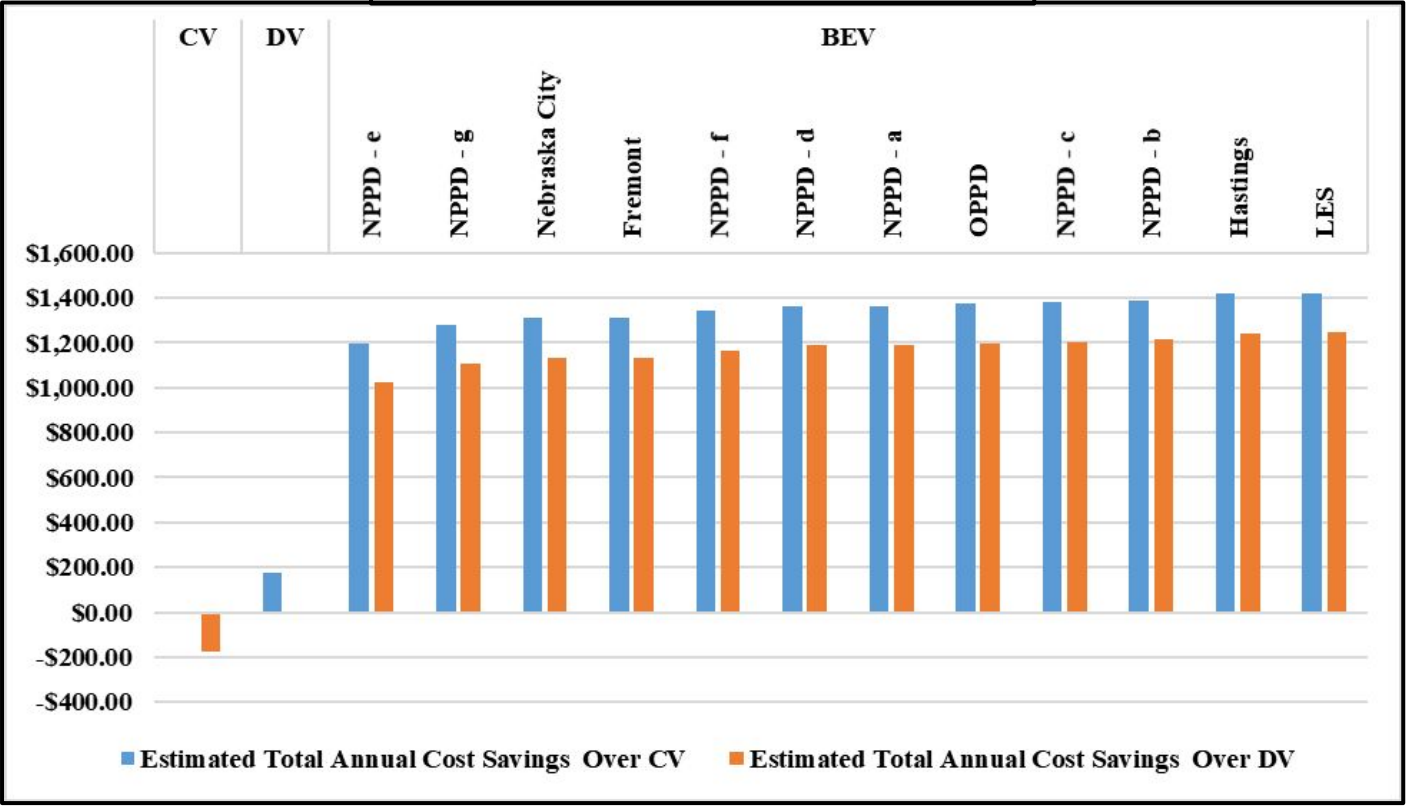
# ECONOMIC BENEFIT ANALYSIS

Fuel				
				NPPD
Cost of Fuel (per gallon)	\$2.632	\$2.953	\$2.00	\$0.1024
Fuel Efficiency	23.21 mpg	28.47 mpg	23.21 mpg	3.323 miles/kWh
Cost of Driving One Mile	\$0.0729	\$0.081	\$0.095	\$0.03071
Savings over CV per year (12,000 miles)				\$951.114

# Maintenance

	CV	DV	BEV
Maintenance Cost per mile	\$0.04	\$0.04	\$0.01
Estimated Annual Maintenance Cost	\$490.13	\$425.70	\$110.44
Savings over CV per year		\$64.43	\$379.69

# Fuel and Maintenance



# ENVIRONMENTAL BENEFIT ANALYSIS

## CO2 Emission

8,887 g per gallon / 23.21 mpg

=

**382.89 g**

10,180 g per gallon / 28.47 mpg

=

**357.576g**

7030 g per gallon / 23.21 mpg

=

**302.88g**

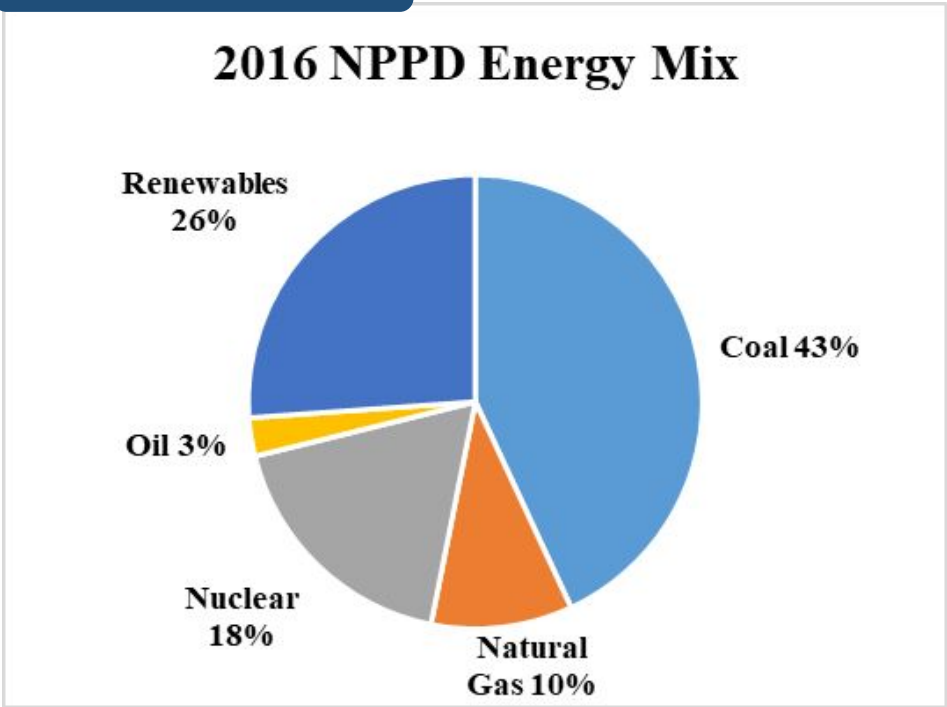
CV: Conventional Vehicle

DV: Diesel Vehicle

CNG: Compressed Natural Gas

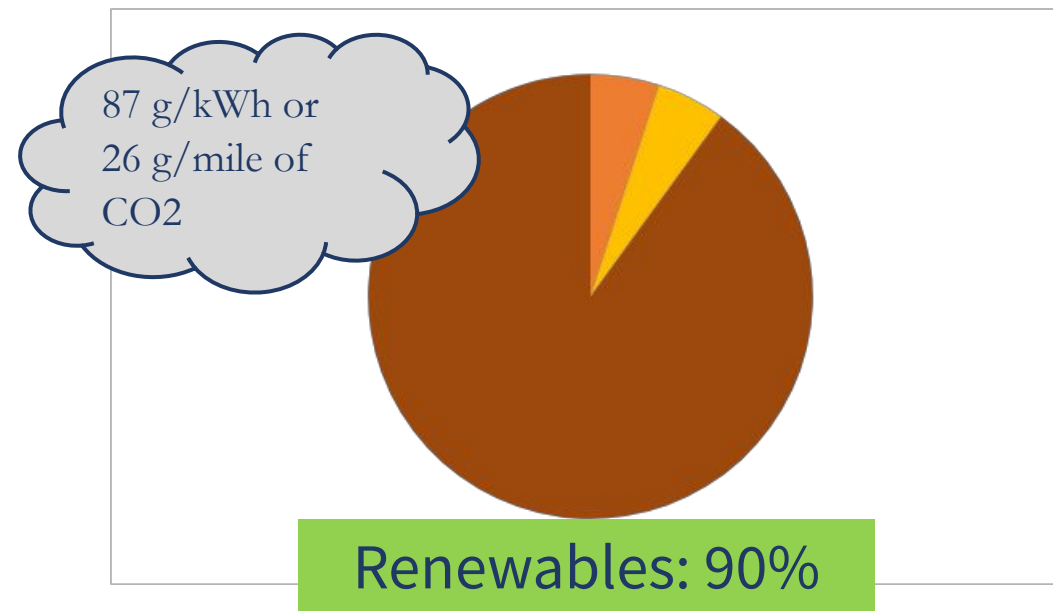
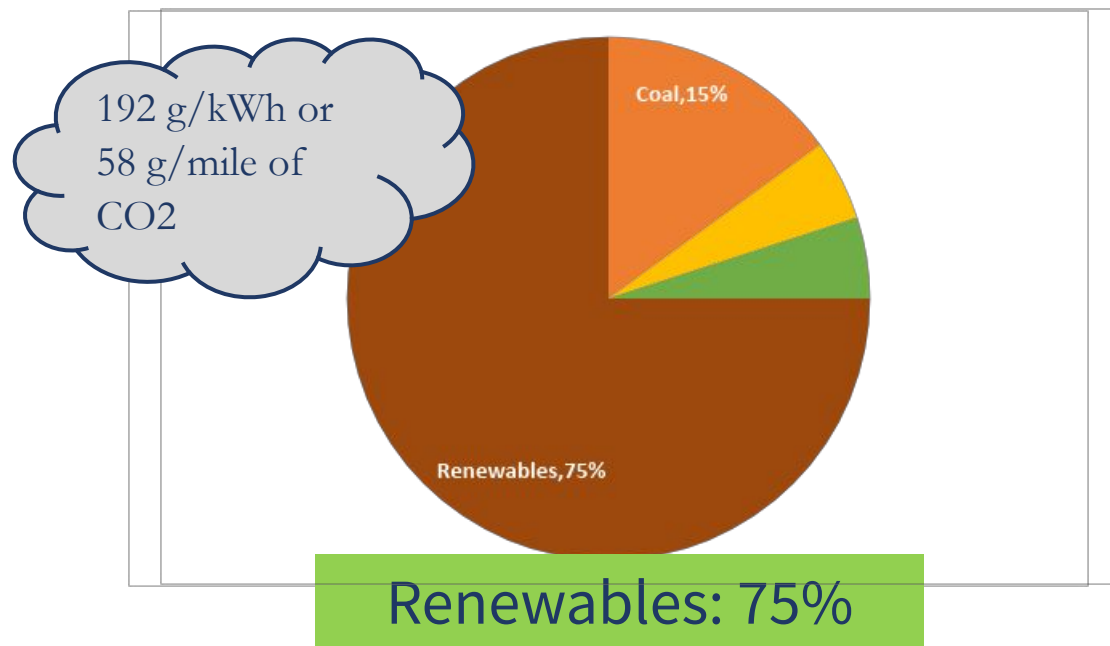
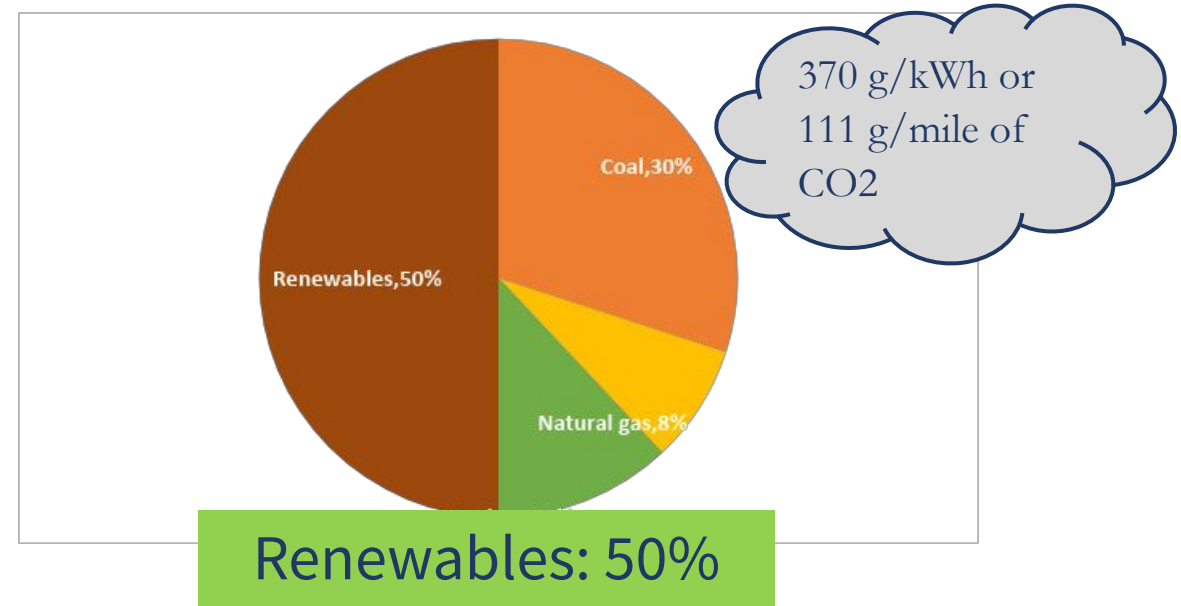
EV: Electric Vehicle

## CO2 Emission



Energy Source	% of Production * g of CO2/kWh = TOTAL g of CO2/kWh
Coal	43.06% * 1051.5 g = 452.8 g
Natural Gas	10.07% * 684.5 g = 68.9 g
Nuclear	18.01% * 0 g = 0 g
Renewables	26.13% * 0 g = 0 g
Oil	2.73% * 1058.2 g = 28.88 g
<b>TOTAL</b>	<b>550.6 g/kWh or 165.7 g/mile of CO2</b>

## WIND AND SOLAR COMPLEMENT ELECTRIC TRANSPORT



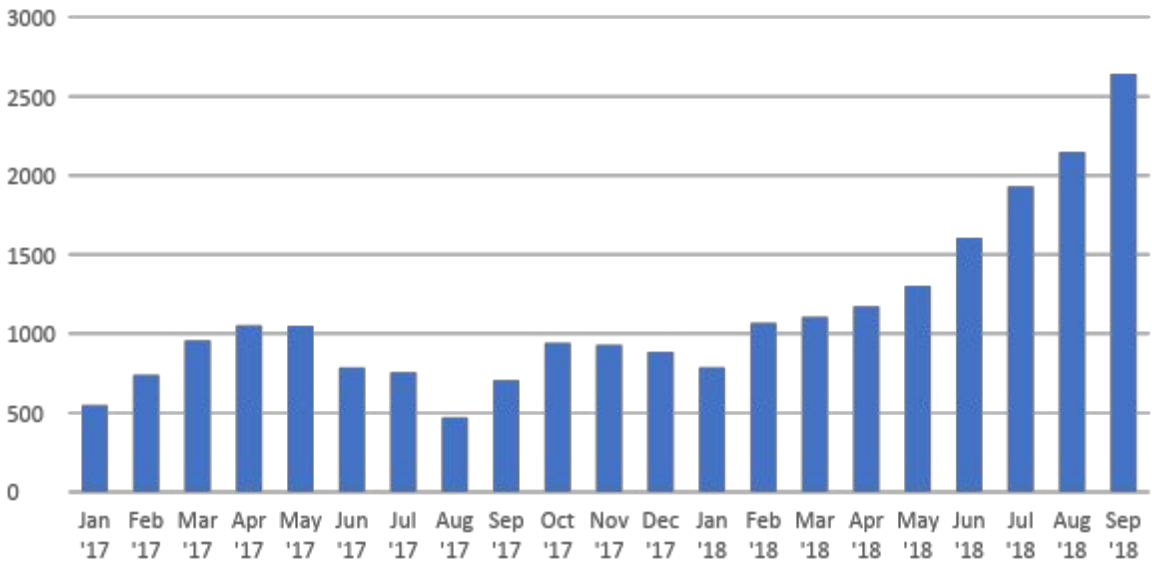
# ECONOMIC & ENVIRONMENTAL BENEFIT DATA

## DATA SINCE NOVEMBER 2014

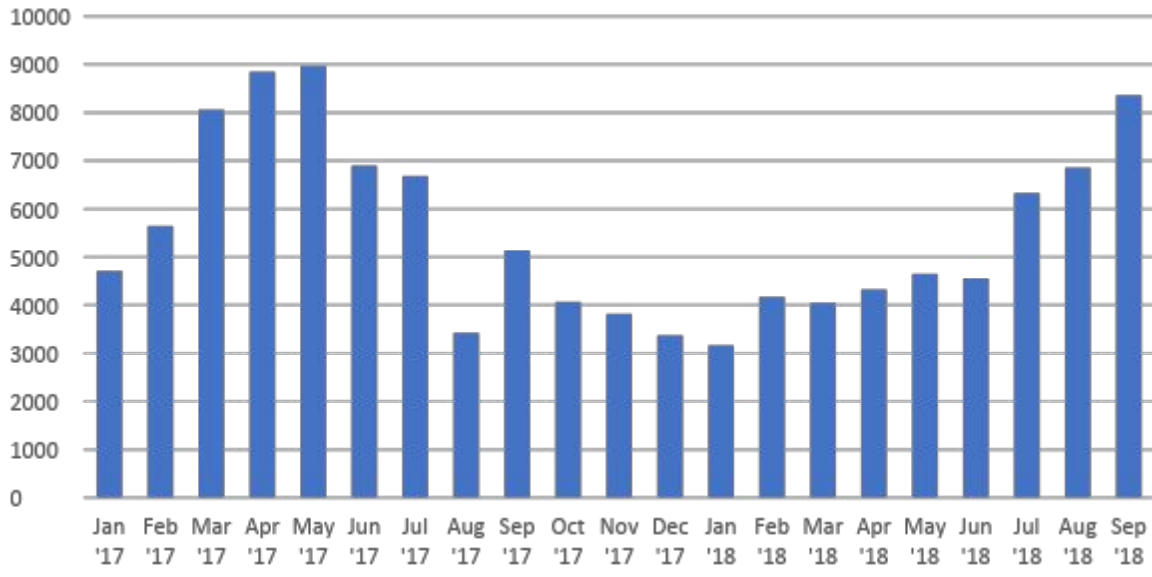
Participating Members	BEV	CNG	Charging Station Ports	Economic Benefits	Environmental Benefits (Emission Reductions) (lbs.)					
					CO2	CO	SO2	NOx	CH4	VOC
<u>23</u>	<u>32</u>	<u>9</u>	<u>95</u>	<b>\$40,979</b>	<b>255,713</b>	<b>5,742.11</b>	<b>(282.686)</b>	<b>186.1562</b>	<b>22.7916</b>	<b>166.1409</b>

**127 U.S. TONS**

**Monthly Economic benefits (in US\$)**



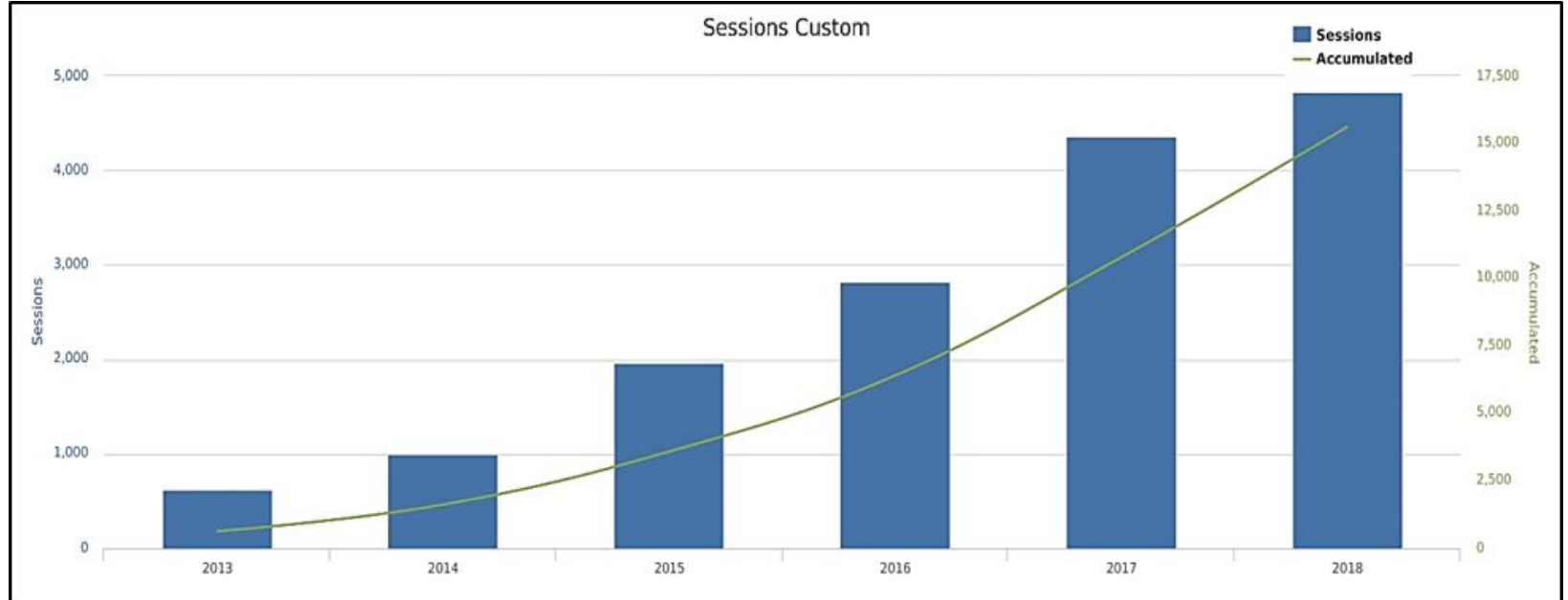
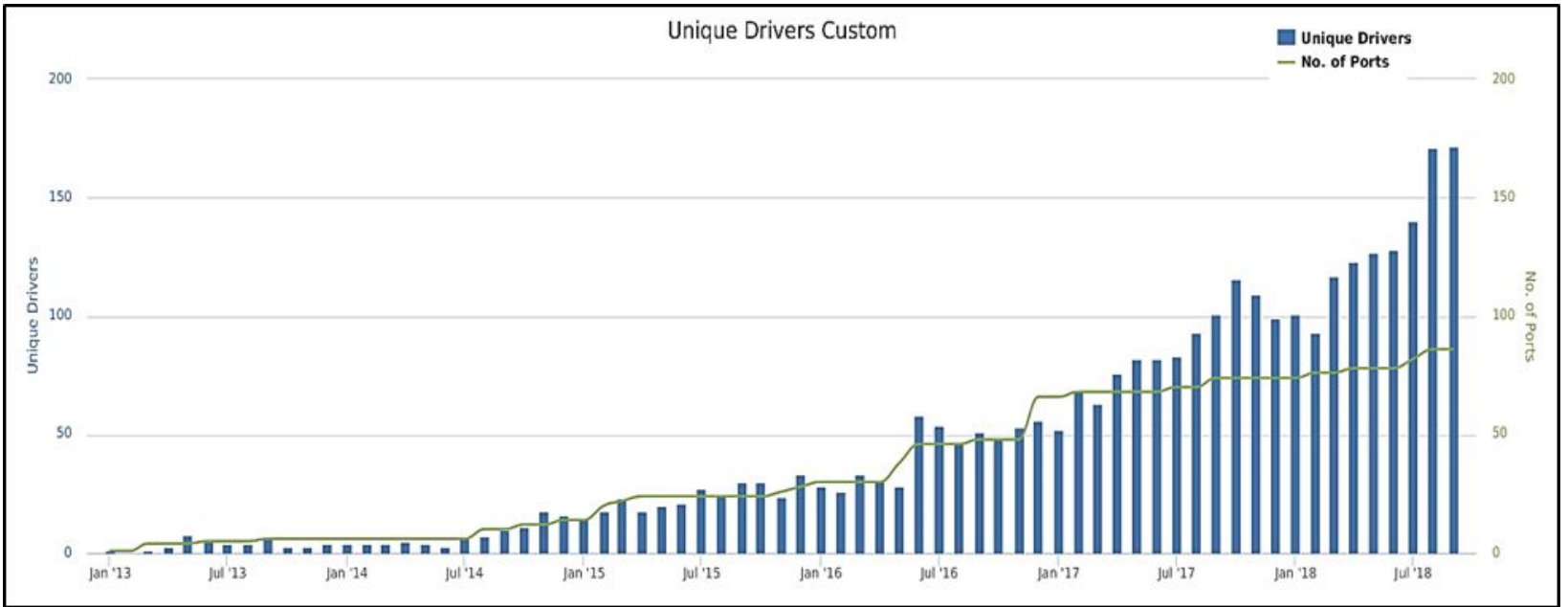
**Monthly CO2 reduction (in lbs.)**

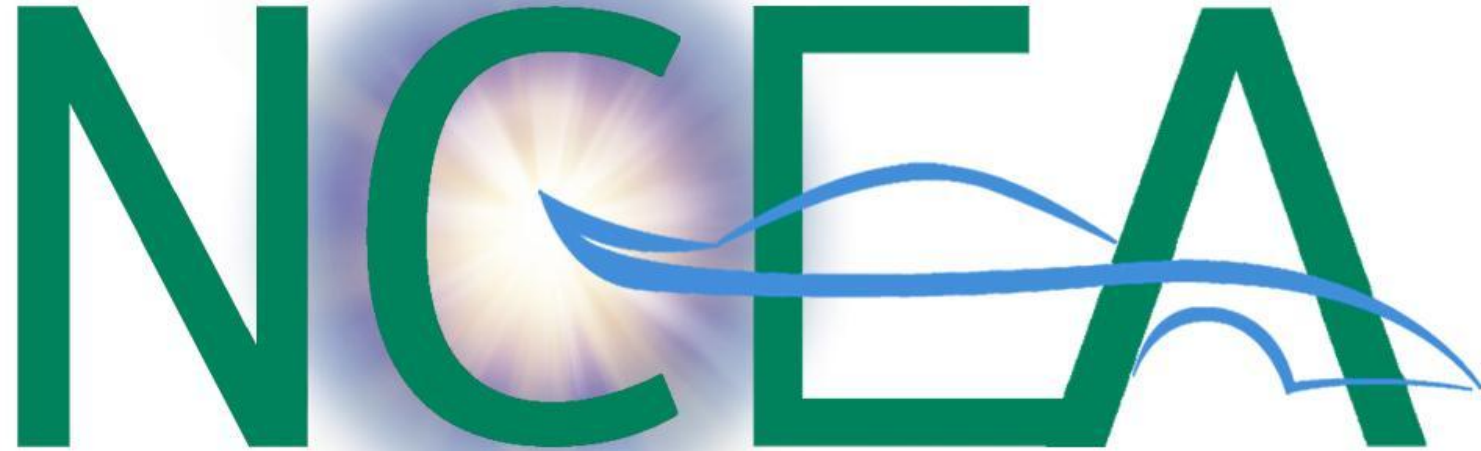




# NEBRASKA CHARGING ANALYSIS

Year	Unique Drivers	No of sessions
2013	19	618
2014	45	1,003
2015	97	1,962
2016	211	2,825
2017	427	4,361
<b>2018</b>	<b>541</b>	<b>4,840</b>
Jan 2018	92	376
Feb 2018	90	488
Mar 2018	117	528
Apr 2018	123	532
May 2018	127	507
Jun 2018	128	463
Jul 2018	140	514
Aug 2018	171	672
Sep 2018	172	760





## Nebraska Community Energy Alliance

**For additional information, contact -**

**Anne McCollister, Director**

Nebraska Community Energy Alliance

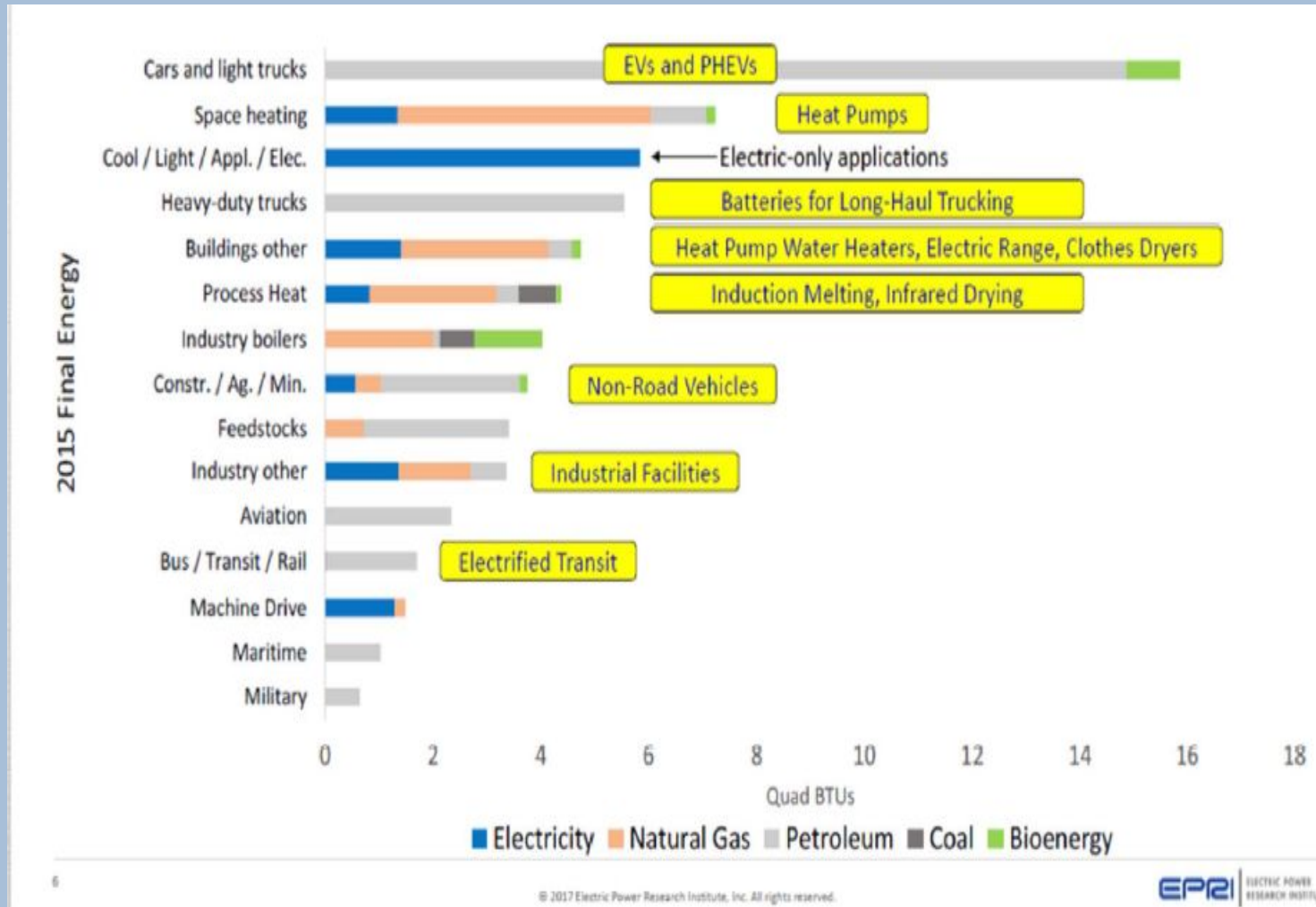
700 South 16th Street, LL

Lincoln, NE 68508

[402-613-9566](tel:402-613-9566) | [anne@etpnebraska.com](mailto:anne@etpnebraska.com) | [www.necommunity.energy/Resources](http://www.necommunity.energy/Resources)



# Electrification Potential Varies by End-Use Application





# Background

- NPA EV Task Force
  - Formed May 3, 2017 – NCEA presented in July 2017
- Committee includes representation from:
  - ✓ NPPD
  - ✓ OPPD
  - ✓ LES
  - ✓ Southern Power District
  - ✓ City of Fremont
  - ✓ NMPP Energy
  - ✓ Nebraska Energy Office

# NDEQ Volkswagen Environmental Trust Long-Term Project Timeline

Dollar amounts shown in thousands; FY 7/1 to 6/30

Project/Activity Category	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
<b>School Bus Replacements</b> \$3,062 (25%)		\$1,801	\$1,261	1 <sup>st</sup> Funding Request to be submitted 9/2018. Funds expected 11/2018.		
<b>Transit Bus Replacements</b> (Lincoln and Omaha) \$1,225 (10%)		\$1,225	Funding Request to be submitted 9/2018. Funds expected 11/2018.			
<b>EV Charging Stations</b> \$1,225 (10%)				\$612,418	\$612,418	
<b>Eligible Actions Based on Demand</b> \$3,062 (25%) Local freight/delivery/construction trucks, airport ground equipment			\$766	\$766	\$766	\$766
<b>DERA (Clean Diesel Program)</b> \$3,062 (25%) Irrigation engine replacements, Refuse truck replacements, ...	\$258 Received 8/27/2018	\$466	\$585	\$585	\$585	\$585
<b>Administrative Costs (~5%)</b>	\$30	\$145	\$130	\$120	\$68	\$120
<b>Total: \$12,248</b>	\$287	\$3,637	\$2,741	\$2,083	\$1,418	\$2,083

# LES EV Initiatives

*Three ways we're preparing for a plug-in future...*

**Scott Benson**

**Manager, Resource & Transmission Planning**

**October 16, 2018**

# 1 LES Net Benefit Calculation – Preliminary Results

Leveraging “national averages” for energy consumption and a benefit/cost methodology typically used to evaluate demand-side management programs, LES calculated an approximate range of net-benefits per residential vehicle (10-year NPV):

	100% On-Peak Charging	100% Off-Peak Charging
EV	\$300	\$1,400
PHEV	(\$200)	\$700

Time of day when customers charge has a *major* impact.


## ② EPRI Study – Drivers and Barriers for Customer Adoption


LES is participating in a survey, coordinated by the Electric Power Research Institute (EPRI), to identify customer awareness and preferences around electric vehicles. Targeted completion is late 2018.


Primary deliverables will include:


- Key drivers and barriers to electric vehicle adoption, helping to inform utility program design.
- Model to help predict the adoption of electric vehicles within the utility's service territory.


### 3 LES Electric Vehicle Study (Nov 2018 – Nov 2020)

 **1** LES customer with an EV or PHEV applies via FleetCarma-hosted website.

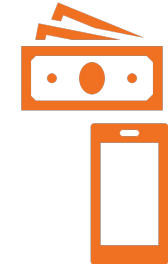
 **2** LES and FleetCarma review applicants; targeting ~~50~~ <sup>~80</sup> that cover a wide range of vehicle types.

 **3** Once approved, FleetCarma ships hardware device directly to participant.

 **4** Participant plugs in device and FleetCarma receives cellular signal to ensure operations.

 **5** LES downloads anonymized data each month, including:

- » Charging session duration, energy use and location.
- » Trip duration, energy use, and distance.

 **6** Participant receives:

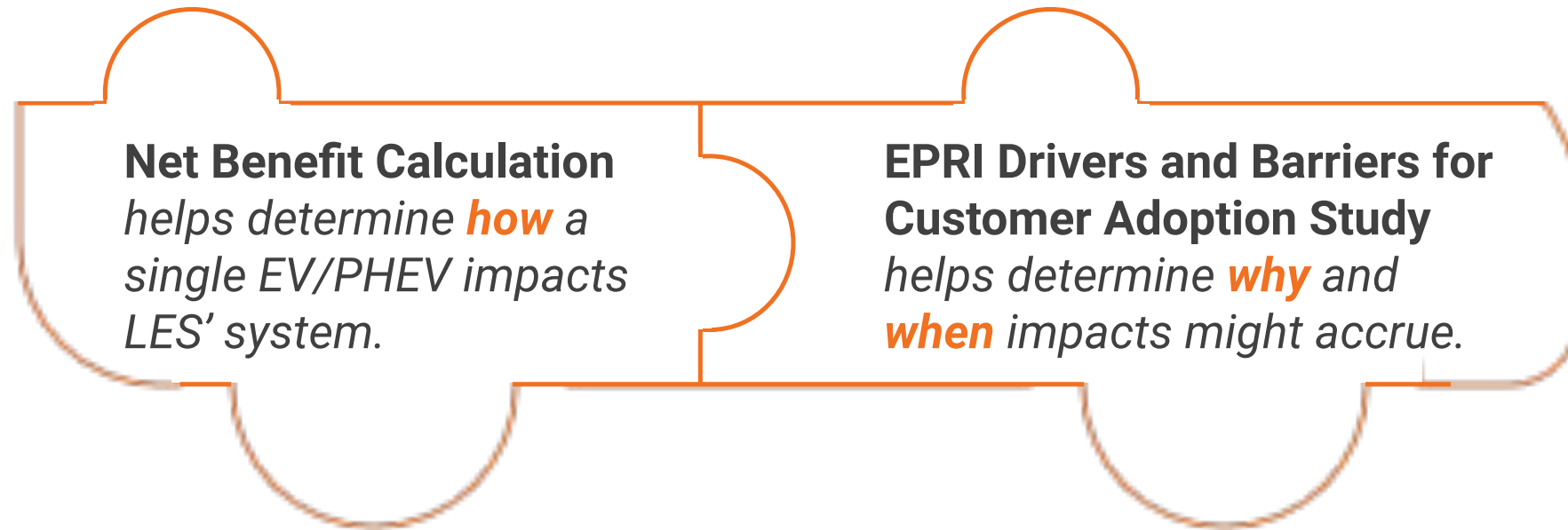
- » \$25 upon data collection.
- » \$25 upon returning device following 2-year study.
- » Easy access to personal charging/trip data via web.



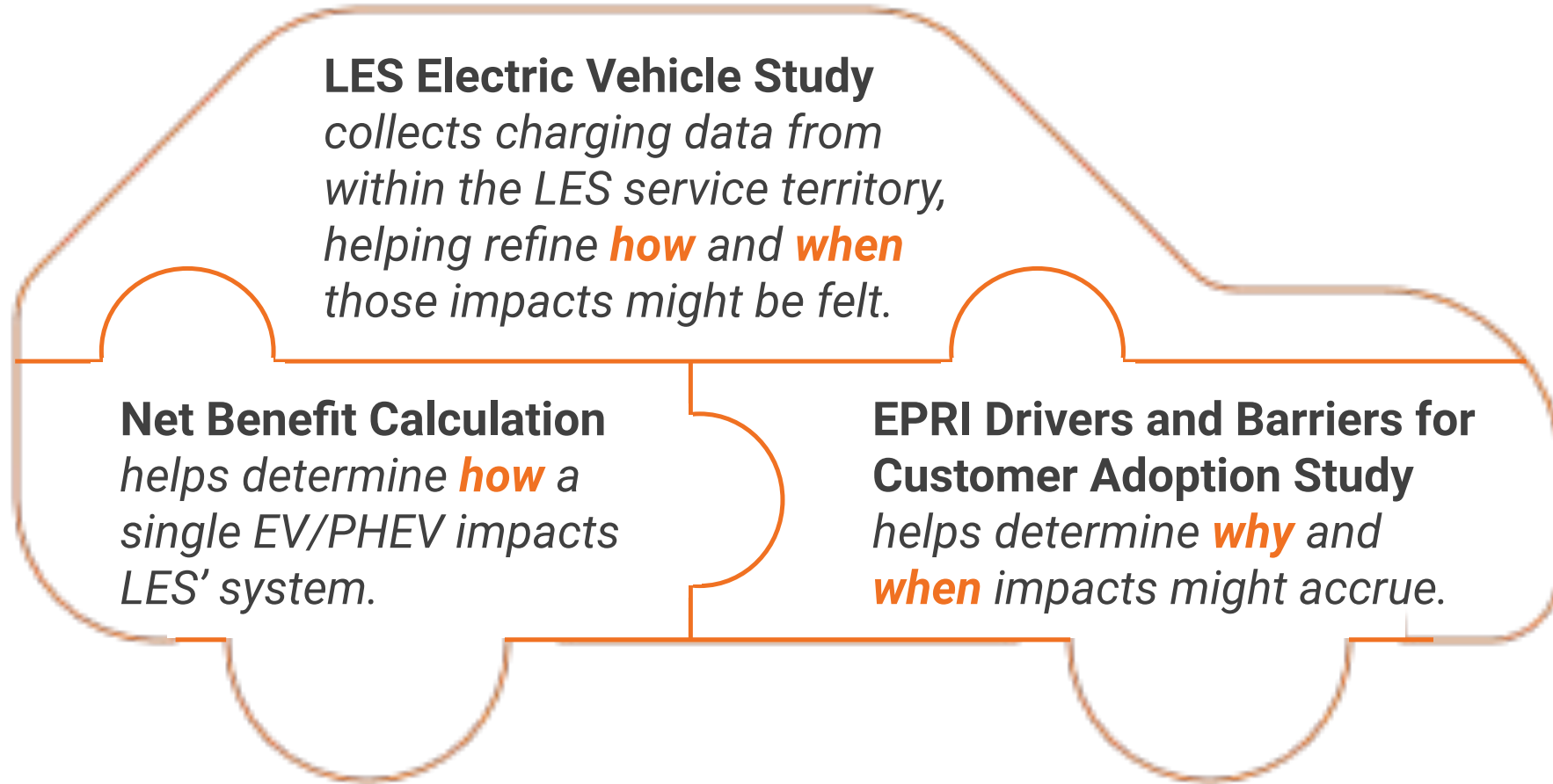
# Piecing Together the EV Puzzle, From the Ground Up...

**Net Benefit Calculation**  
*helps determine **how** a  
single EV/PHEV impacts  
LES' system.*

# Piecing Together the EV Puzzle, From the Ground Up...

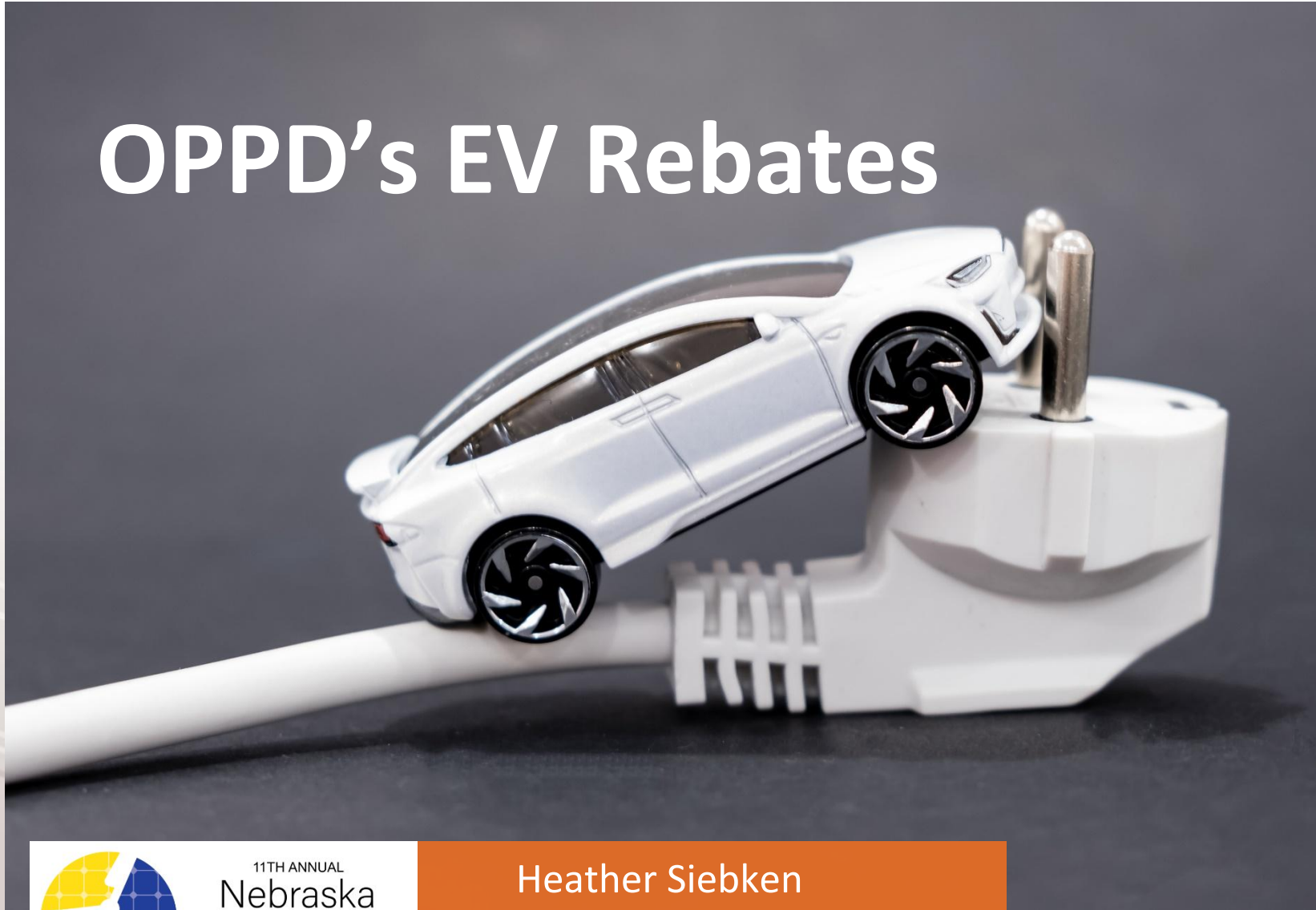


## Piecing Together the EV Puzzle, From the Ground Up...



*Together, these pieces should help answer the larger question...  
**What** should LES be doing to prepare?*

# OPPD's EV Rebates



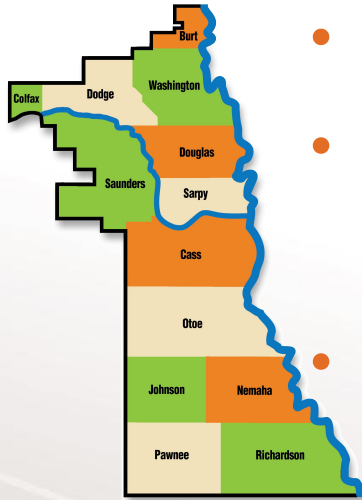
Heather Siebken  
Director, Product Development & Marketing  
October 2018



## Problem statement

How does OPPD create a strategy for electric vehicles that promotes load growth, yet supports customer needs/preferences, helps accelerate adoption in OPPD's territory and maintains our commitment to reliability?

# Market research



- OPPD territory has ~300 registered EVs
- Adoption is low, but growth has been consistent for past three years
- Limited public charging stations across OPPD's territory



Customer knowledge & interest



Charging access

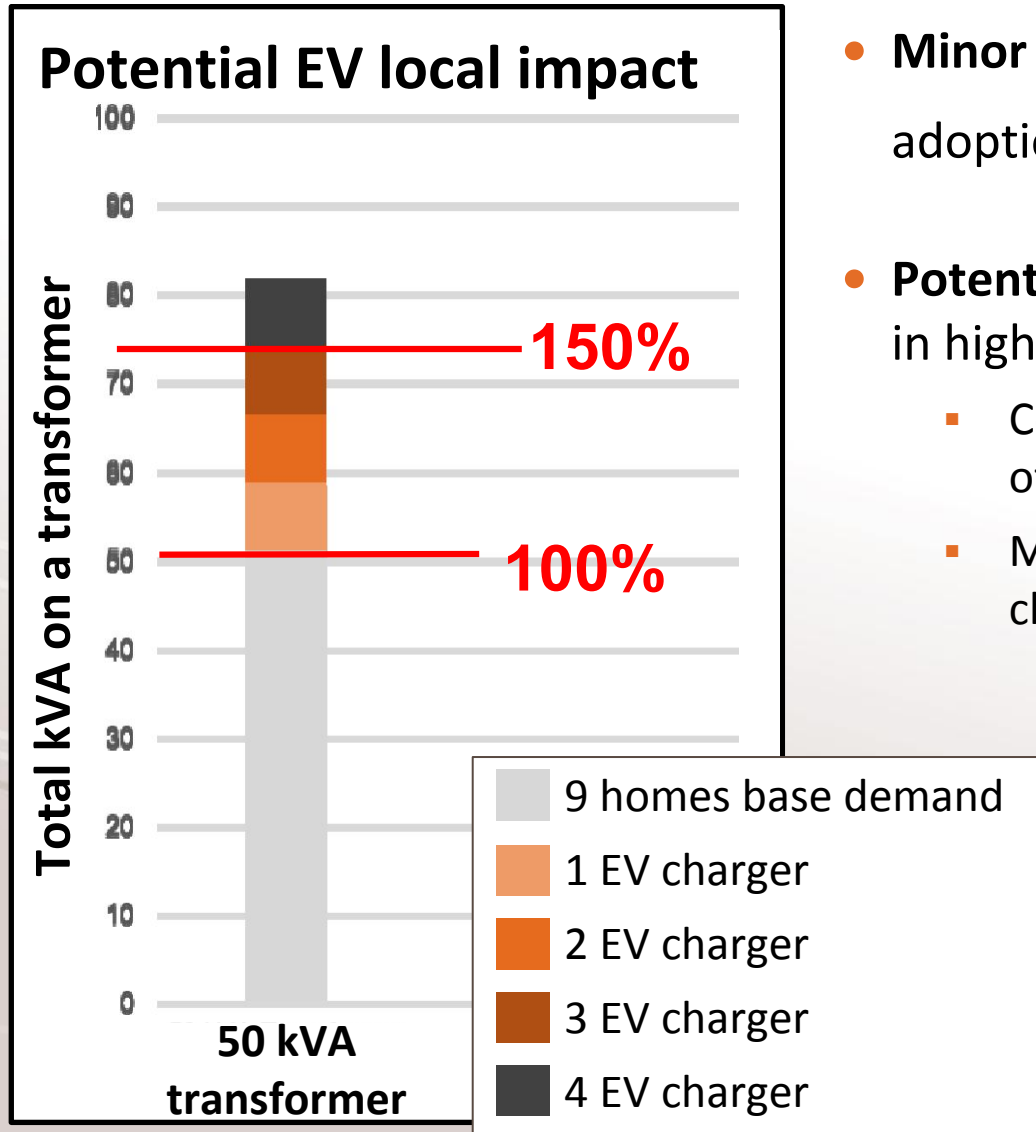


Cost (upfront, operating)



Vehicle performance & availability

# Impact on distribution system

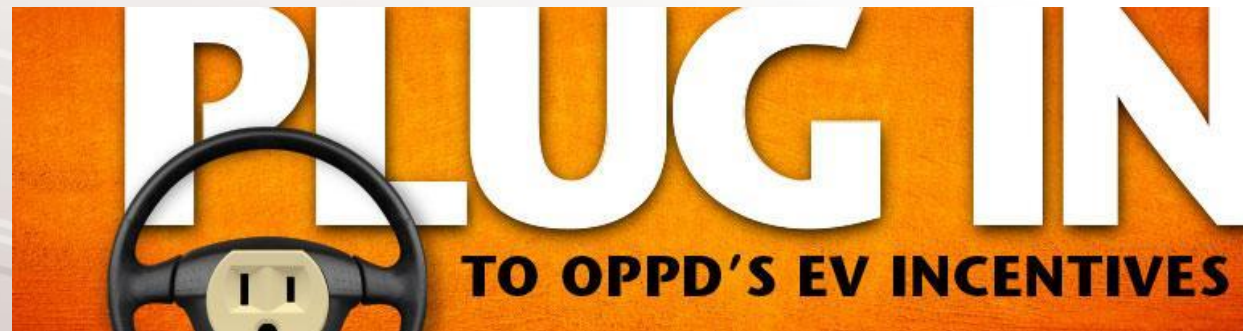


- **Minor impact** to peak load until adoption increases significantly
- **Potential stress** on secondary circuits in high-adoption neighborhoods
  - Coincidence of charging creates risk of transformer failure
  - Methods to encourage off-peak charging should be explored



# OPPD EV pilot objectives

- Means of **collecting research** to make an informed decision about future strategies
- Gather data to **analyze potential for localized stress** on secondary circuits
- **Understand** residential charging behaviors, customers' palate for utility-offered EV program(s)
- **Educate** customers on electric vehicle benefits



# Pilot components

## \$4,500 EV and Charger Rebate – **SOLD OUT!**



- Available to all OPPD customers in Douglas County
- Purchase or lease an all-electric vehicle AND purchase a ChargePoint Home™ charging station
- Agree to share charging data with OPPD

## \$500 Charger Rebate



- Available to all OPPD customers
- Purchase a ChargePoint Home™ charging station
- Agree to share charging data with OPPD

## Dealership Discounts



- \$3,000 incentive towards a 2018 Nissan Leaf
- \$1,000 incentive towards a 2019 Audi E-Tron
- Available to all OPPD customers
- Provide OPPD bill at time of purchase

## Federal Tax Credits Promotion



- Up to \$7,500 available in federal tax credits
- Education provided to all OPPD customers
- Refer to tax advisor to take advantage of the incentives

Thank you!



# NPPD purchased an Electric Vehicle

---

- DC fast charge option
- 238 mile range (ideal conditions)
- 60 kWh battery, 150 kW, 200 hp



# NPPD installed a Public Charge at General Office

- ChargePoint
- Level 2 (240V @ 32A)
- Dual ports
- 7.2 KW each port
- 25 miles per charge hour
- Site is engineered for the future
  - Two conduits
    - DC fast charger 24KW, or
    - Duplicate level 2 charger



# Grant Request and Associated Match

Participating Member	Summary Request	Request from NET	NPPD Match	Total Cost
<b>NPPD</b>	\$500 Rebate for each Chargepoint Home™ charging station (up to 50)	\$12,500	\$12,500	\$25,000
	\$4,000 Rebate for each electric vehicle (up to 15)	\$60,000	0	\$60,000
	Three Level 2 Charging Stations (CT 4021) - \$7,210 each	\$10,815	\$10,815	\$21,630
	Three 3-year Commercial Data Plan - \$1,410 each	\$2,115	\$2,115	\$4,230
	\$100 Rebate for electrical wiring in each new home construction (up to 400)	\$20,000	\$20,000	\$40,000
	<b>SUB TOTAL</b>	<b>\$105,430</b>	<b>\$45,430</b>	<b>\$150,860</b>



# Questions?

---