NC ENERGY POLICY COUNCIL

February 21, 2018

North Carolina Energy Policy Council

AGENDA

10:00 a.m. Wednesday February 21, 2018
William G. Ross Jr. Environmental Conference Center
Nature Research Center
121 West Jones Street, Raleigh, North Carolina
27603

1. **Call to order, opening remarks, and approval of the minutes from the November 9, 2017, Council meeting (5 min)**
   Lieutenant Governor Dan Forest, Chair

2. **Discussion of Electric Vehicles: Infrastructure, Demands, and Priorities (2 hours)**

Break (15 min)

3. **Financing Opportunities; Volkswagen Settlement Agreement (1 hour and 10 min)**

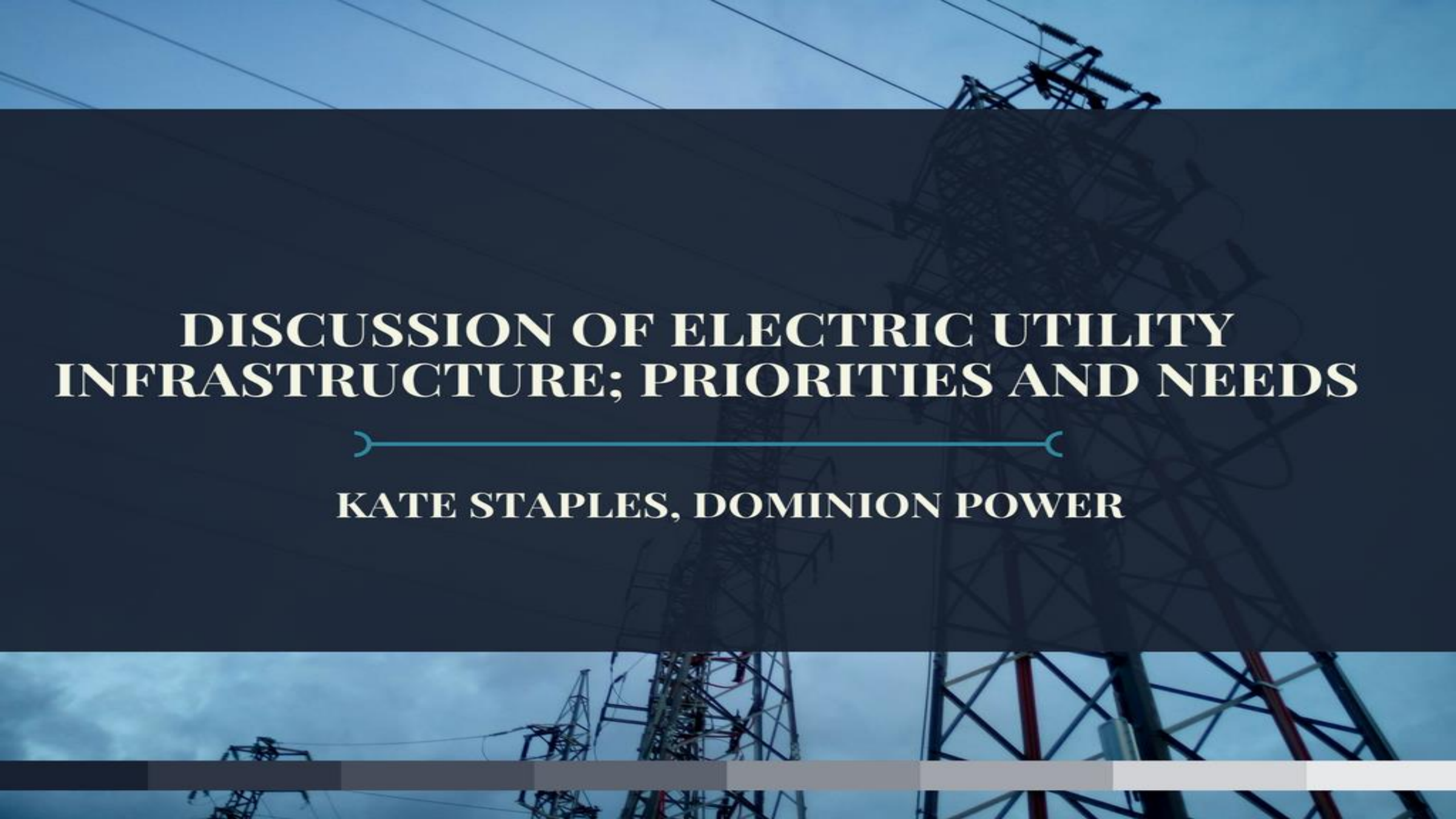
4. **Council discussions and actions (10 min)**

5. **Public comment (10 min)**

6. **Closing remarks and adjourn (5 min)**
   Lieutenant Governor Dan Forest, Chair

DISCUSSION OF ELECTRIC VEHICLES:

INFRASTRUCTURE, DEMANDS, AND PRIORITIES



DISCUSSION OF ELECTRIC UTILITY INFRASTRUCTURE; PRIORITIES AND NEEDS

KATE STAPLES, DOMINION POWER

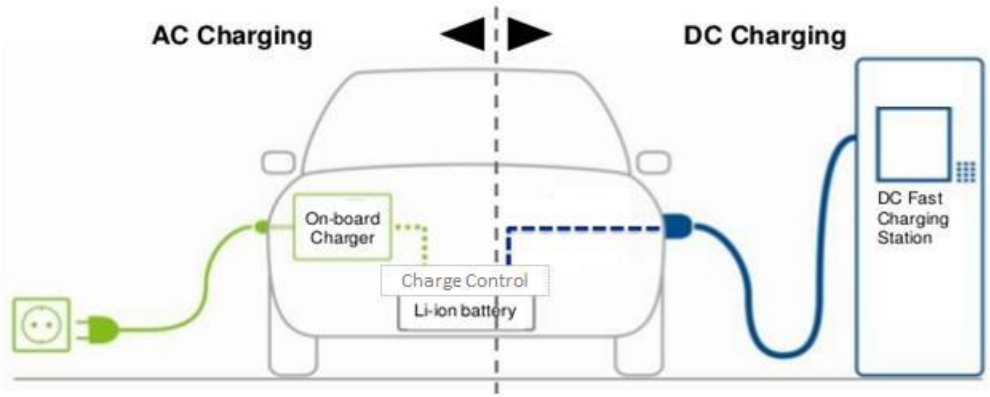
North Carolina Energy Policy Council

Electric Vehicles and Utility Infrastructure

February 21, 2018

Dominion Energy

Electric Vehicle Charging Infrastructure Levels



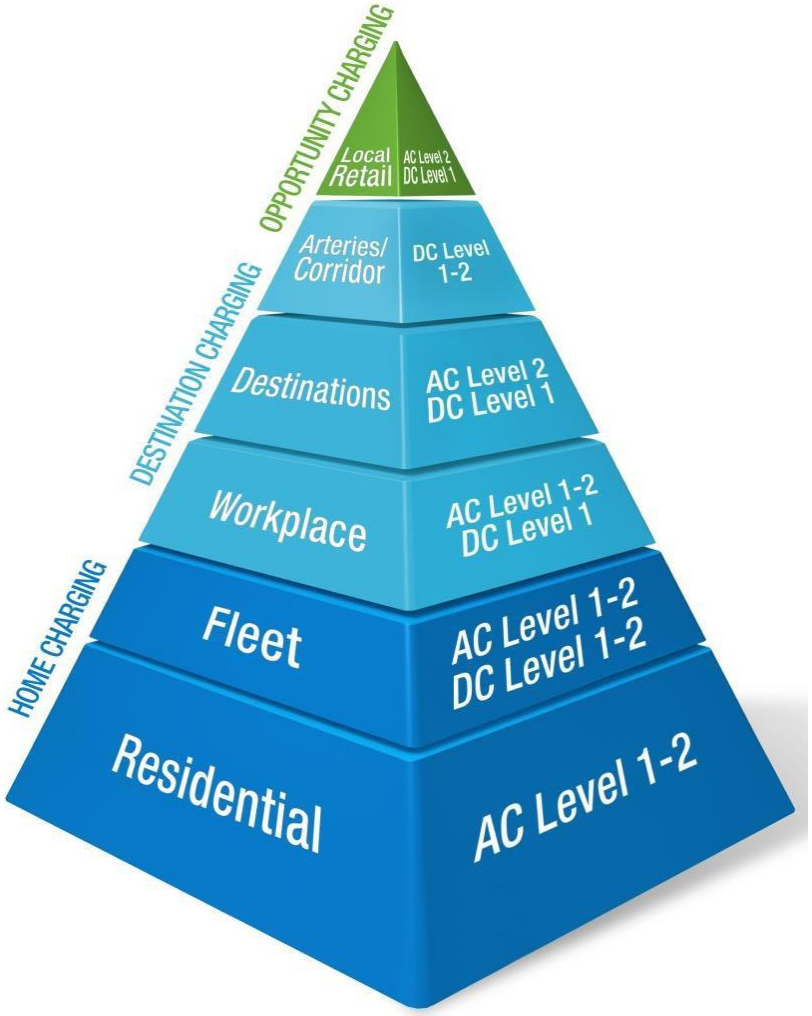
Charging Level	Range Added by Time/Charger Power	Supply Power	Connector	Equipment Cost Estimate	Installation Cost Estimate
AC Level 1	4 mi/hour @ 1.4kW 6 mi/hour @ 1.9kW	120v AC; 20A (12-16A continuous)	Vehicles come with a portable charging cable	$300-$1,800	$0-$3,000
AC Level 2	10 mi/hour @ 3.4kW 20 mi/hour @ 6.6kW 60 mi/hour @ 19.2kW	208/240v AC; 20-100A (16-80A continuous)	J1772 connector	$400-$6,500	$600-$12,500
DC Fast Charging (Level 3)	24 mi/20 min @ 24kW 50 mi/20 min @ 50kW 90 mi/20 min @ 90kW	208/480v AC; 3 Phase input current proportional to output power	•SAE Combo •CHAdeMo •Tesla	$10,000-$40,000	$4,000-$50,000

Sources: EPRI, Clean Cities Advanced Energy, ABB

Dominion Energy

Electric Vehicle Charging Infrastructure Locations

- **Home charging** accounts for more than 80 percent of residential and fleet charging.
- **Workplace charging** is a great employee benefits and it extends daily electric range.
- **Public charging** allows for long distance travel and mass adoption.



Source: EPRI

Dominion Energy

Electric Vehicle Charging Infrastructure Locations (cont'd)

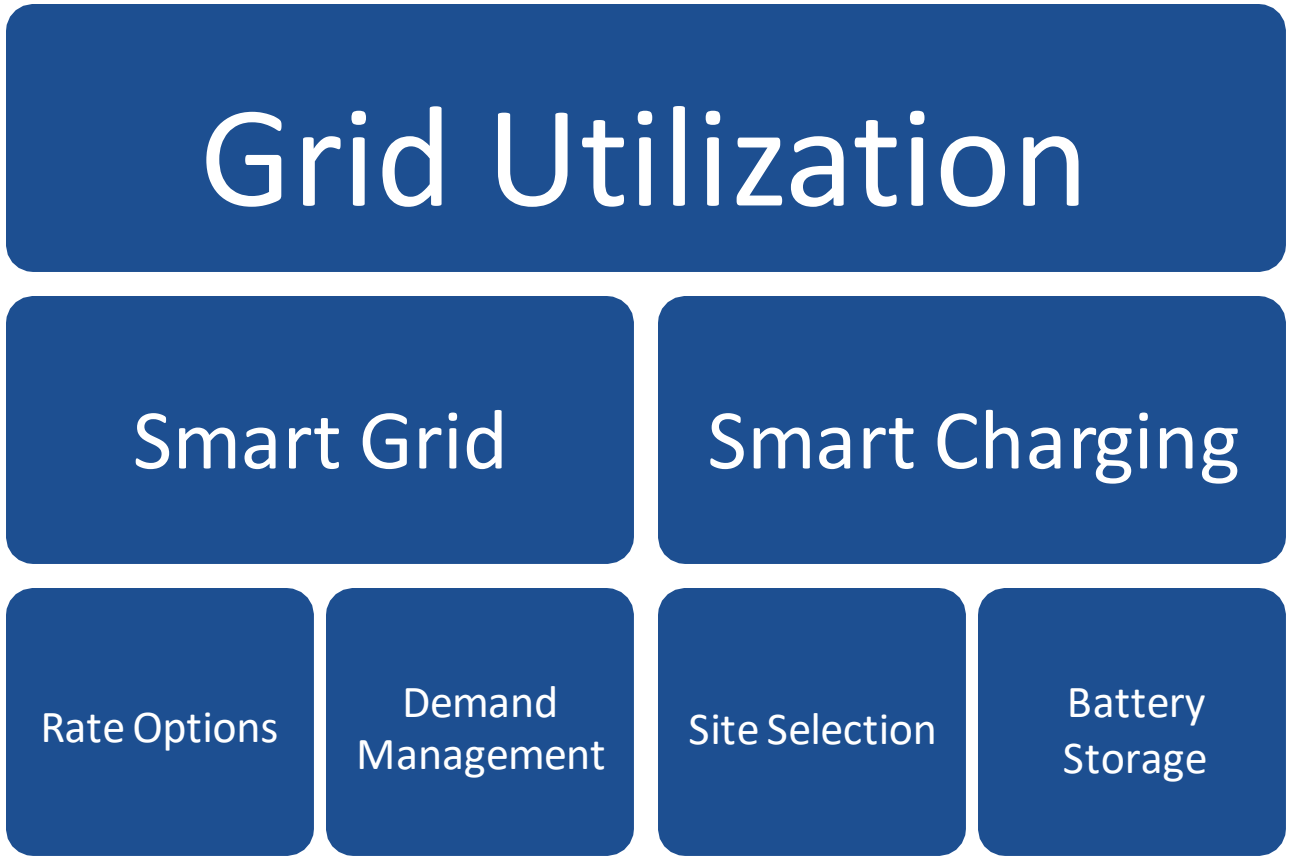
Source: Proterra

Source: Uber

Source: Port of Long Beach

Dominion Energy

Opportunities for Electric Utilities



Dominion Energy

Kathleen Staples

Dominion Energy Virginia/Dominion Energy North Carolina

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OUTLOOK AND PROJECTIONS FROM NC DEPARTMENT OF TRANSPORTATION

HEATHER HILDEBRANDT, NCDOT

NORTH CAROLINA
Department of Transportation







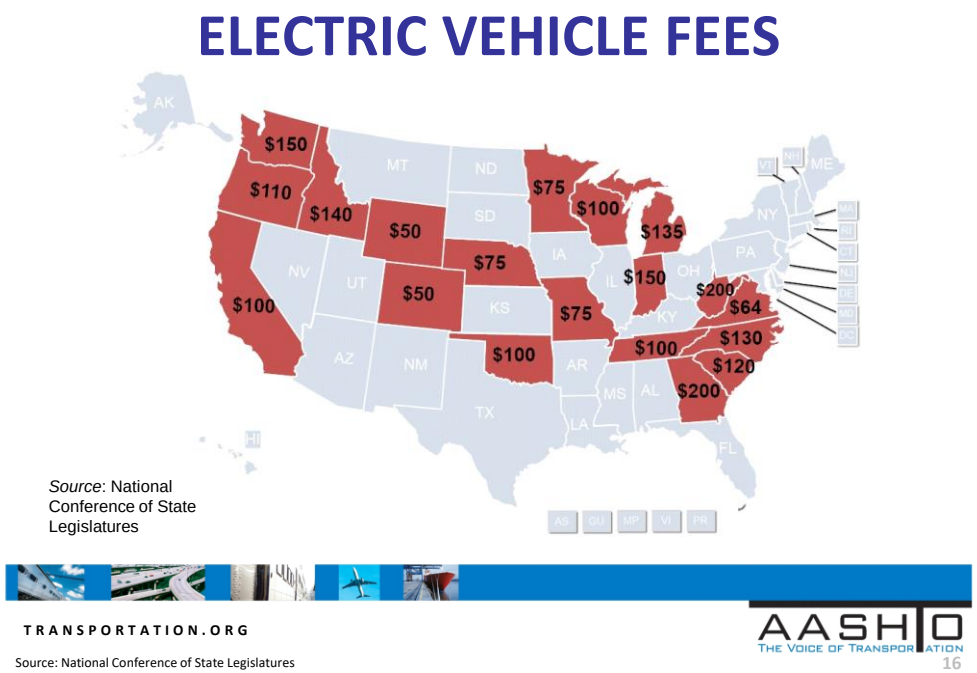
Electric Vehicles: NCDOT Policy/Impacts

Heather J. Hildebrandt

February 21, 2018

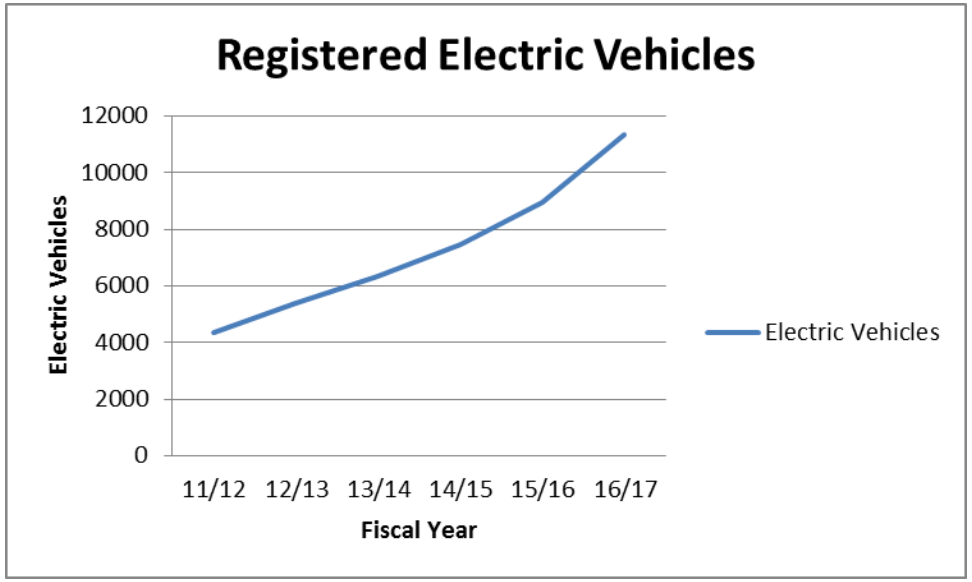
Road Use and Maintenance

- Annual fee at registration offsets loss of revenue typically collected as a fuel tax per gallon of fuel
  - Originally $100/year
  - Now $130/year



EV Ownership

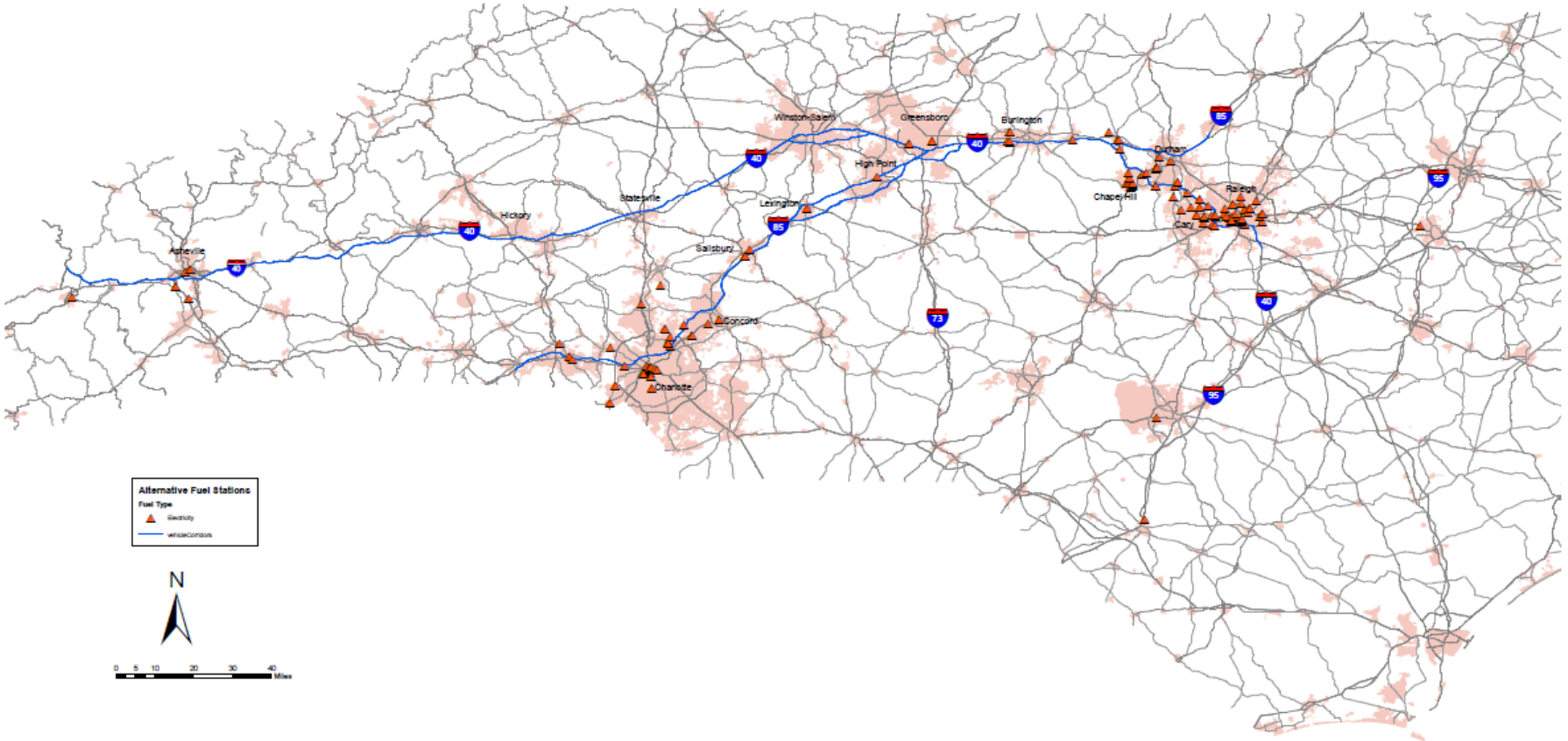
- Approximately 8.8 million vehicles registered in 2014
- Less than 1% EV



Alternative Fuel Corridors

- Proposed EV Corridors between Triangle and Asheville and Triangle and Charlotte
  - Mostly “signage pending”
  - Exit signage and way finding signs needed

Electric Vehicle Charging Corridors



Signage

- EV Charging can be added to FOOD LOGO signs
- EV Charging can be added to FUELS signs
  - Canopy, well lit, open to public, emergency call box.

Exit 99, US-64 W

Public Transit Division

- Good interest throughout the state
  - Vehicles on order by Go Durham, Go Triangle, and Fayetteville
  - Considering electric buses in Greensboro and Asheville

Infrastructure at Rest Stops

- Pilot with four charges started in 2012
  - 14 months
  - 146 vehicles
  - $44 of electricity
- Removed due to conflict between state and federal laws

CMAQ

- Federal program through FHWA
- Provides funds to projects that reduce congestion and improve air quality
  - Electric Buses/ fleet vehicles
  - Charging infrastructure eligible across state

Volkswagen Settlement

- NCDOT will be working with Division of Air Quality on project selection and implementation of program
- Electrify America chose Raleigh as one of the sites for community-based charging

Questions?

Heather J. Hildebrandt

Air Quality-CMAQ Program Manager

Transportation Planning Division

hjhildebrandt@ncdot.gov

919-707-0964

OUTLOOK AND PROJECTIONS FROM PRIVATE SECTOR

MARCY BAUER, EVGO

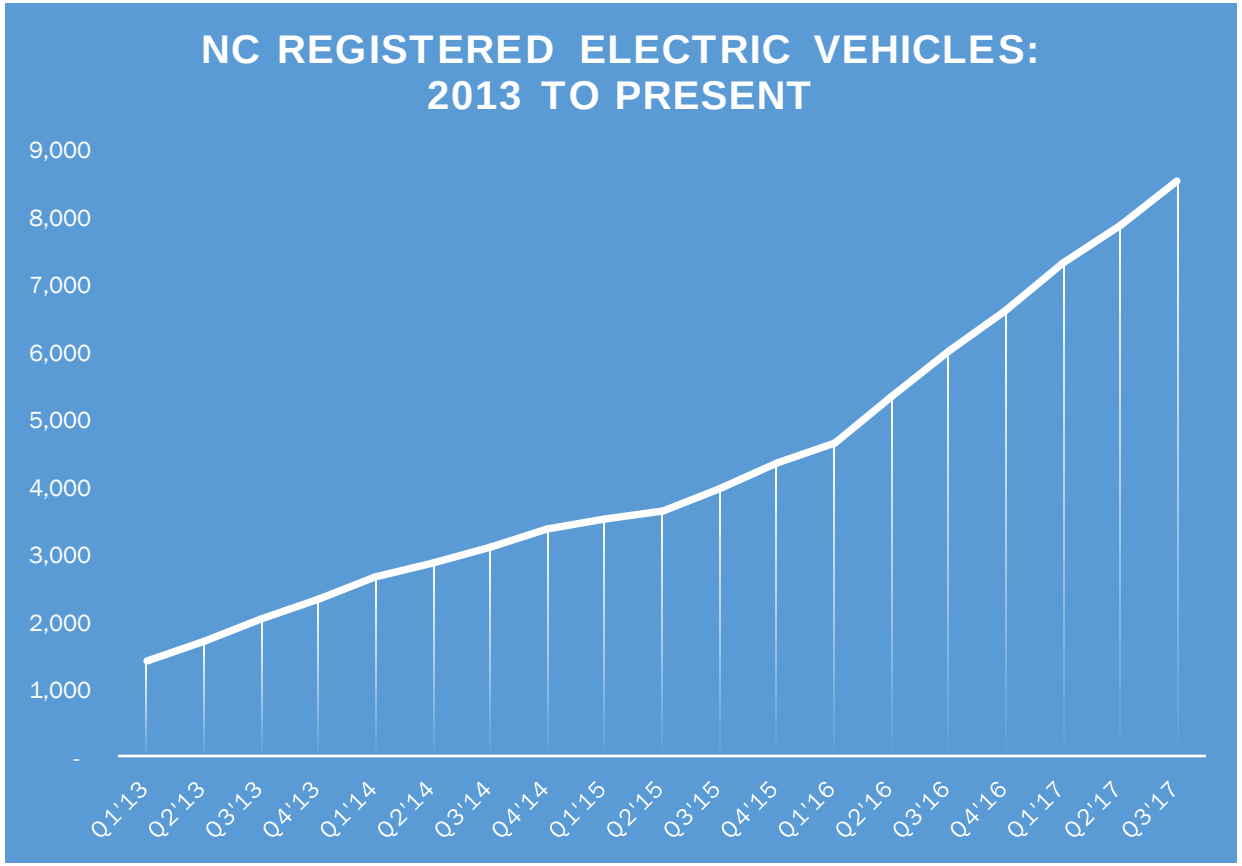
EV Charger Industry Perspectives On:

- Projected EV Adoption
- Benefits of networked chargers
- Challenges to deploying charging infrastructure
- Recommendations for overcoming challenges

Marcy Bauer
Director, Key Clients and Programs
Marcy.Bauer@EVgo.com

EVgo

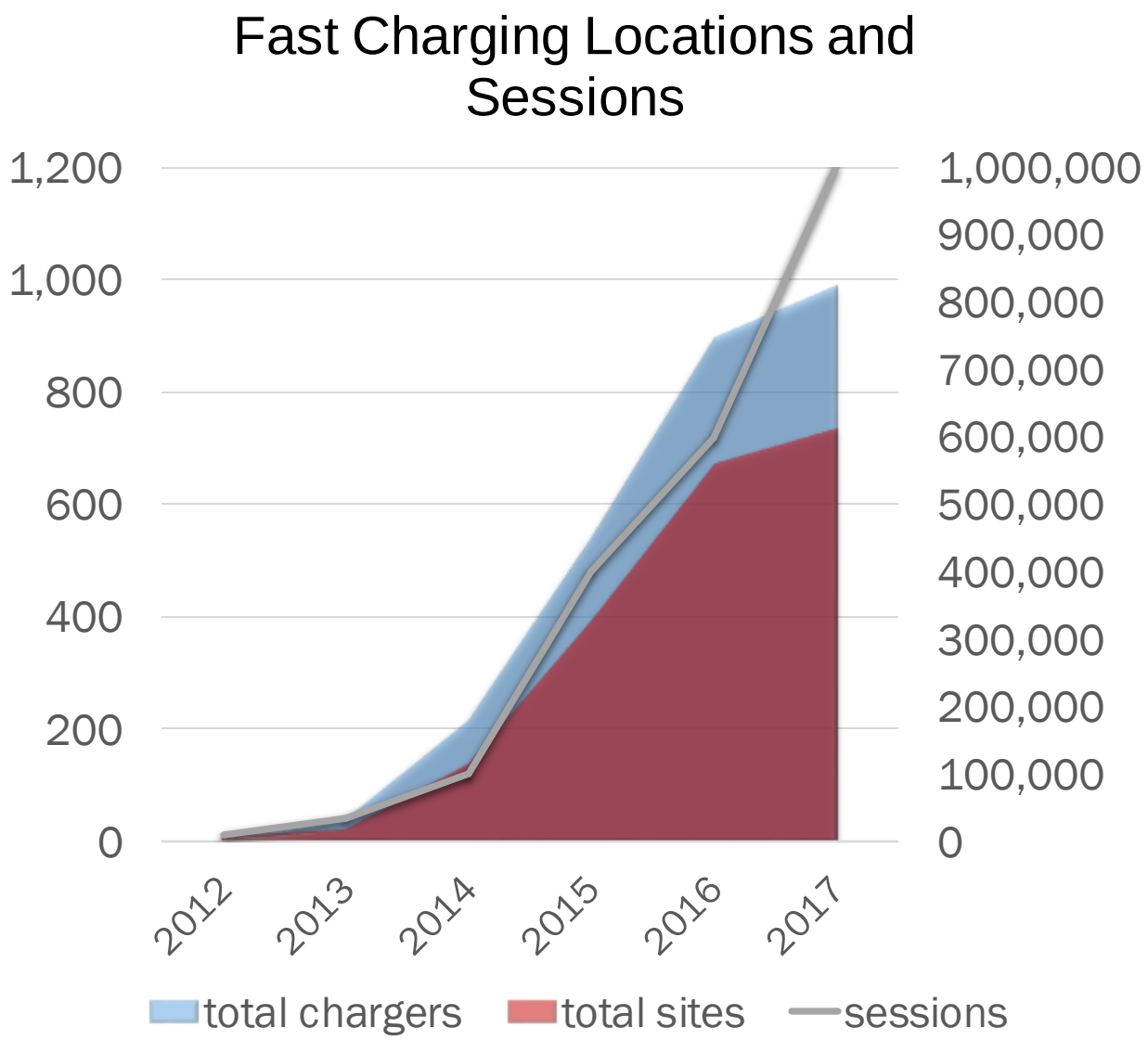
NC: Electric Vehicle Growth Has Been Strong



- ✓ **8,500+ on the road**
- ✓ **42% YOY Growth**

Slide Content Courtesy of Chargepoint

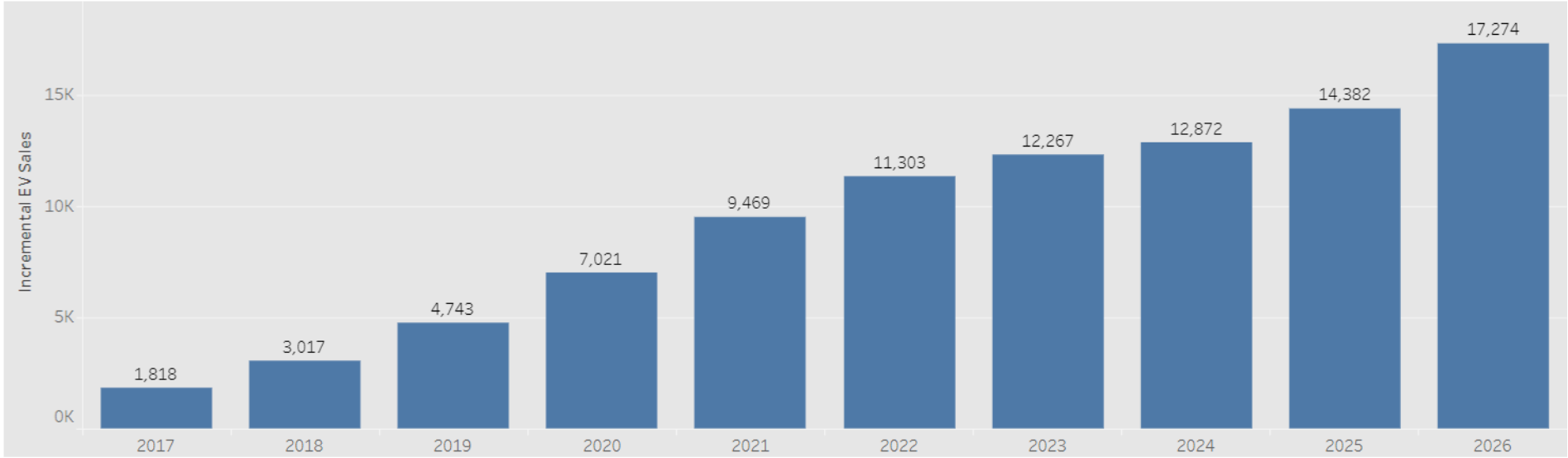
EVgo Network Growth



- Average of 1 session per site per day at the 22 EVgo fast charger sites in NC
- Highest use EVgo site (Fremont CA):
  70 sessions per day (18 per charger)

EVgo

NC: Projections Show Even Stronger Growth



Source: Navigant 2017 Forecast

- ✓ Projection shows that by 2026, EV sales will increase to nearly 10x over today's sales.
- ✓ Driven by more choices for drivers and falling battery prices.
- ✓ Supported by more availability of charging infrastructure, both Level 2 and DCFC.

Slide Content Courtesy of Chargepoint

More Infrastructure Needed to Meet EV Driver Needs

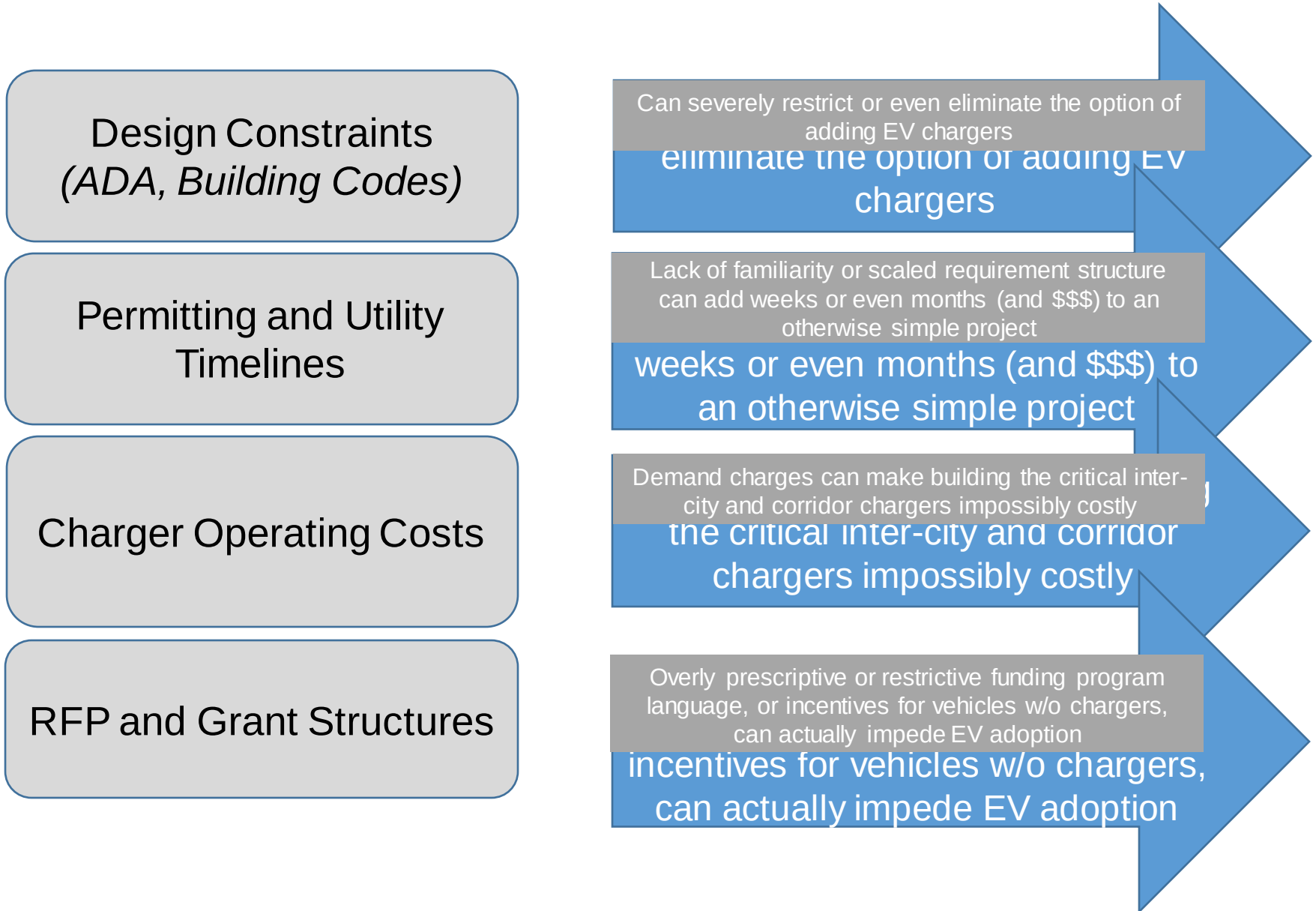
NREL Plug in EV Infrastructure Analysis: 2030

State	Total PEV	%BEV	Workplace L2 Plugs	Public L2 Plugs	Public DCFC
NC	475,000	47%	12,900	8,900	1,020

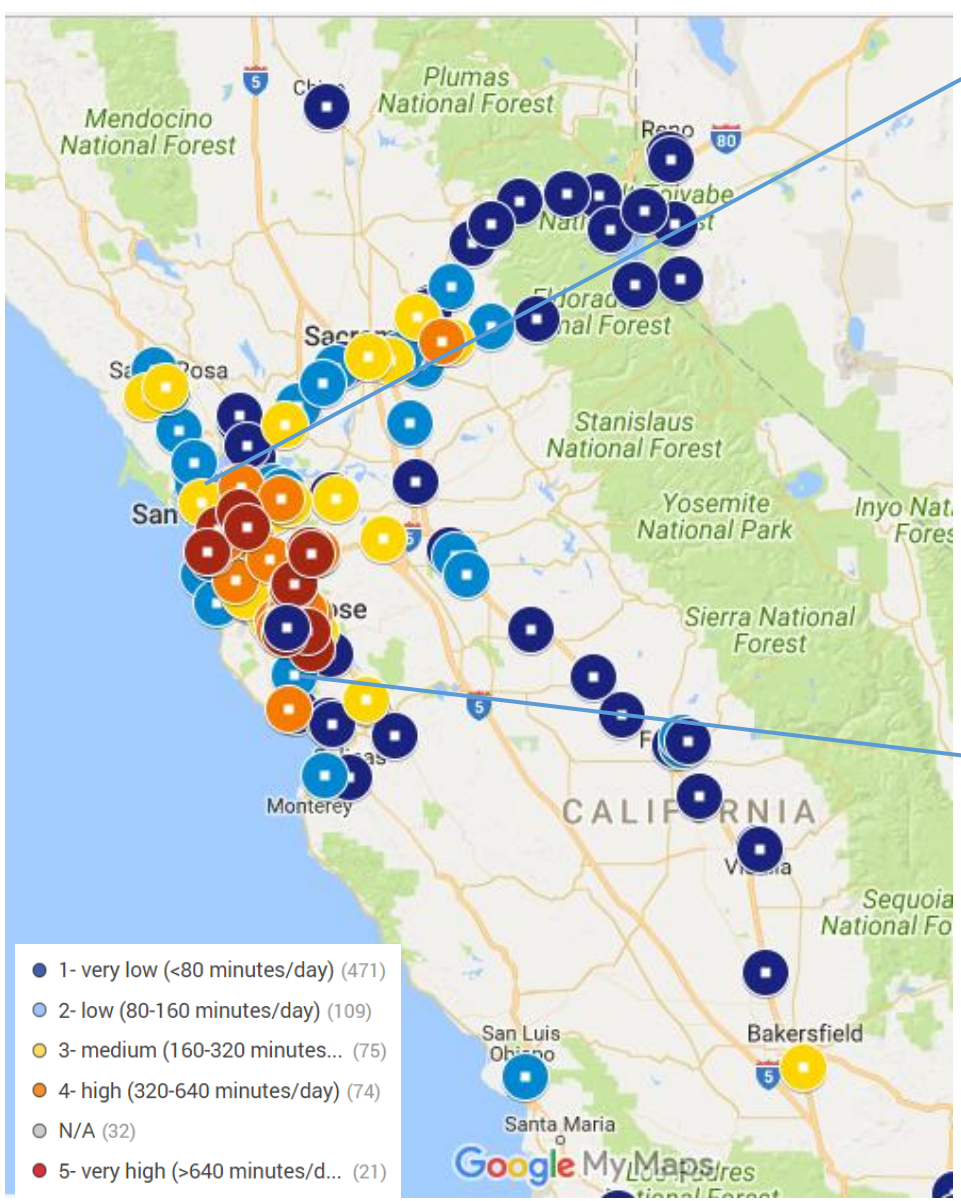
- Current infrastructure is not enough to meet the demands of today's NC EV driver, not prepared for future growth.
- Transportation is getting autonomous, electrified, and shared – requires significant investment in EV charging.
- States must prepare for mass electrification and smart charging – set targets to scale EV charging and prepare for mass EV adoption.

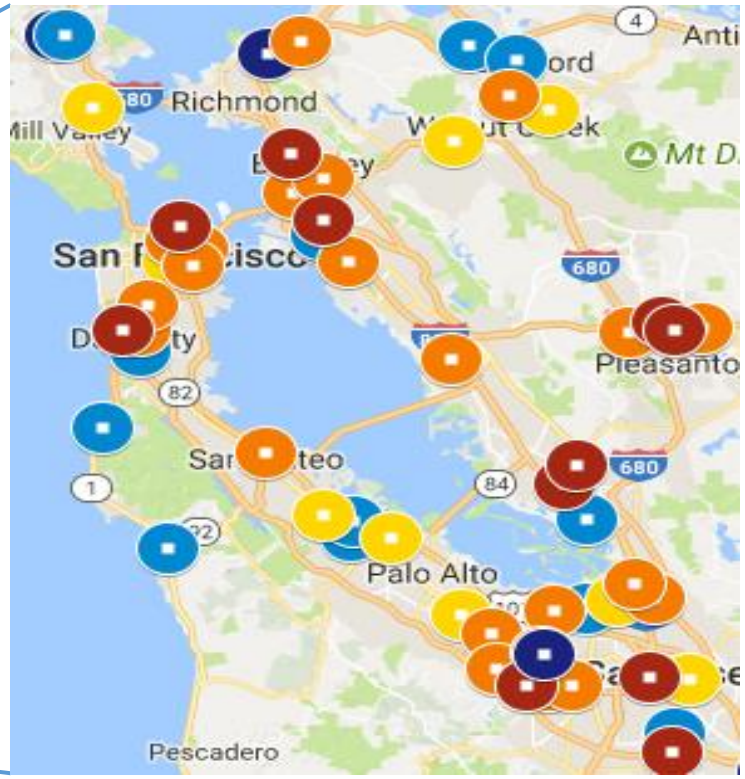
Slide Content Courtesy of Chargepoint

EV Charger Deployment Challenges



Urban Charging Versus Corridor Charging



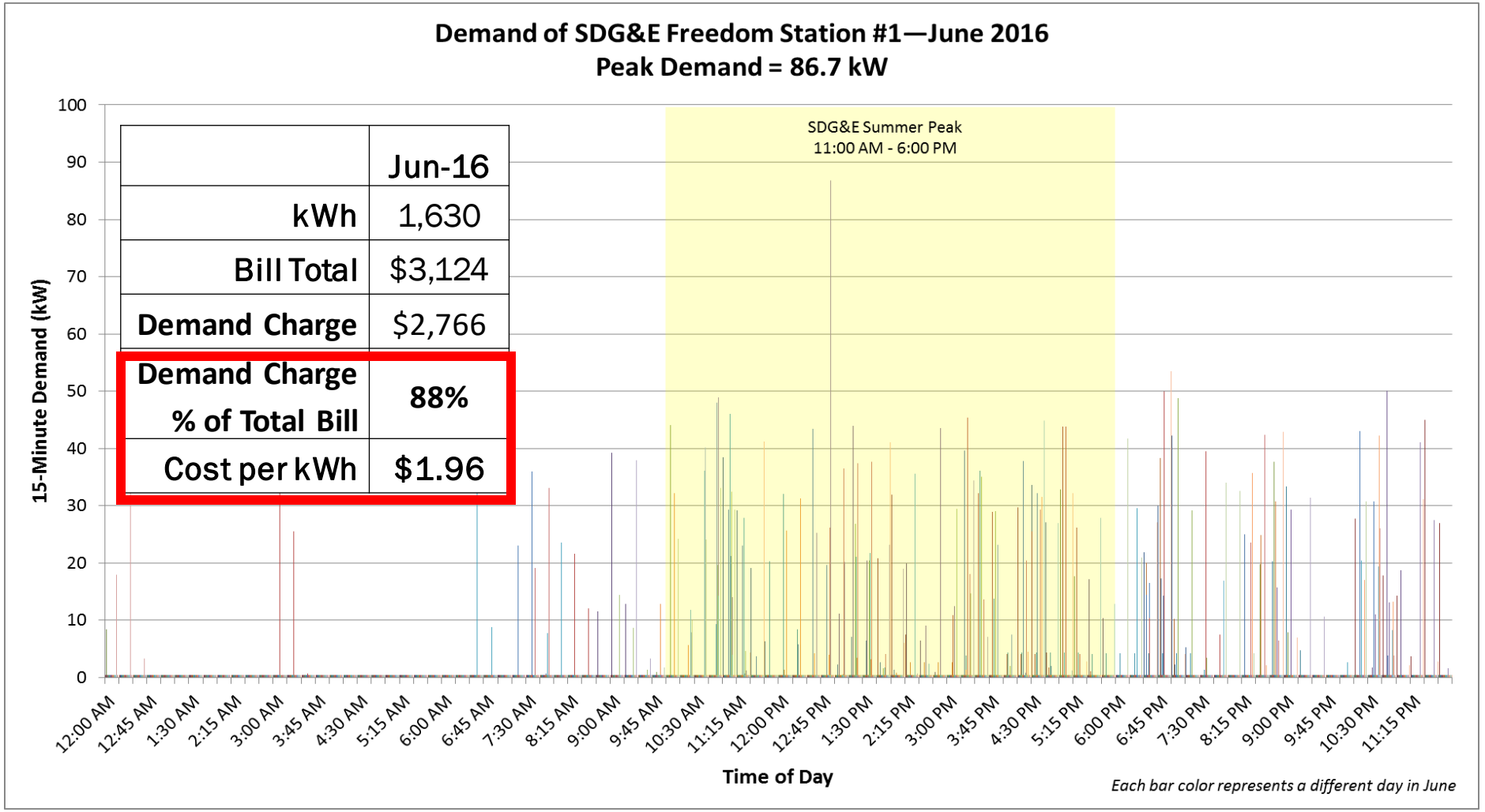


Any charging network will inherently have low and high utilized stations.

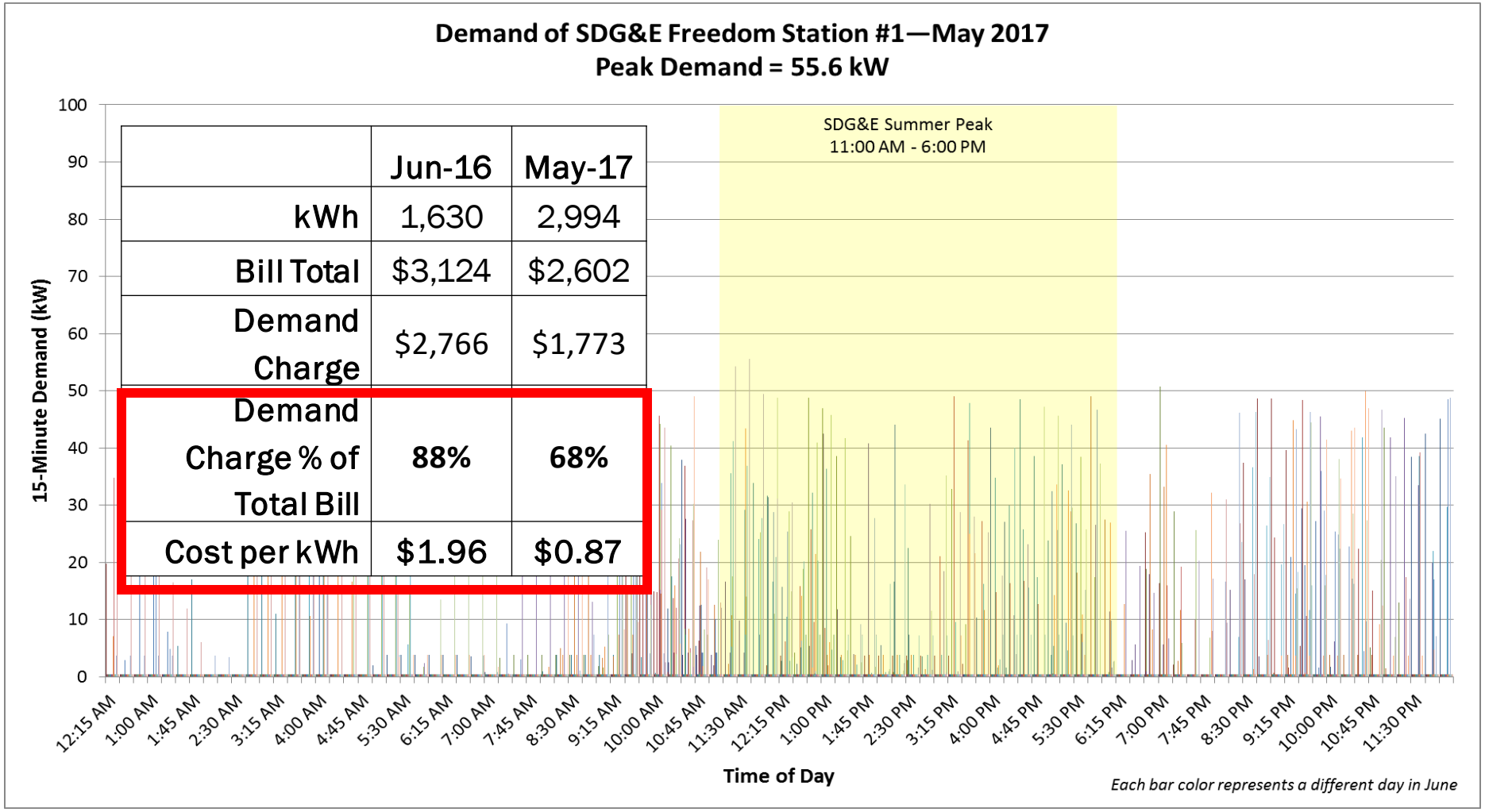
Even the low utilization sites are important to drivers

EVgo

EV Charger Deployment Challenge: Demand Charges

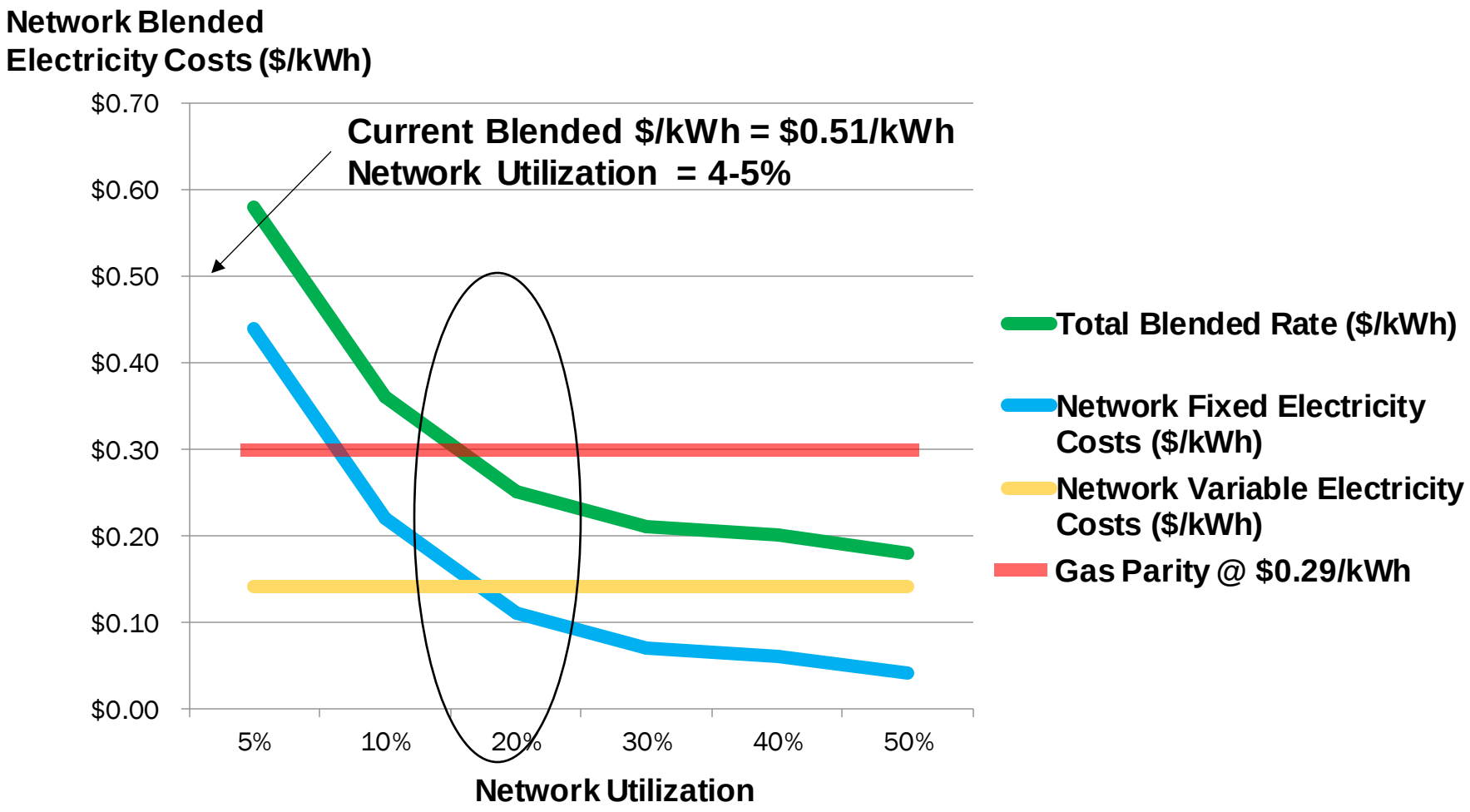


EV Charger Deployment Challenge: Demand Charges



	Jun-16	May-17
kWh	1,630	2,994
Bill Total	$3,124	$2,602
Demand Charge	$2,766	$1,773
Demand Charge % of Total Bill	**88%**	**68%**
Cost per kWh	**$1.96**	**$0.87**

Electricity Costs AND Utilization



Based on EPA estimates of 1 gallon of gas = 33.7 kWh and EIA estimates of $3/gallon of gas in CA ($ 2.50 nationwide)
Gas is $.07/kWh nationwide, $.09 in CA
https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=38428&id=38187 https://www.eia.gov/petroleum/gasdiesel/

EV Charger Deployment Challenges & Recommendations

Challenge	Recommendation
Design Constraints *(ADA, Building Codes)*	EV Ready Codes / Ordinances Charger as amenity, not parking space type
Permitting and Utility Timelines	AHJ & Utility Engagement *(Rapid Response)*
Charger Operating Costs	Utility Engagement *(Electricity Rate Restructure, Make-ready)* State EV Adoption Goal
RFP and Grant Structures	Industry Engagement Up Front

Electric Vehicle Charging Stations: Advancing Smart Transportation

David Schatz

Director, Public Policy

November 8, 2017

Smart Charging is 21st Century Infrastructure

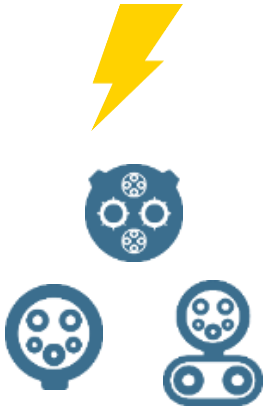
- Transportation is getting autonomous, electrified, and shared.
- States must prepare for mass electrification and charging.
- States that embrace innovation and competition will attract private investment and advanced tech.

1

Locate a station via a mobile app

2

Tap RFID card or phone to station to link to account



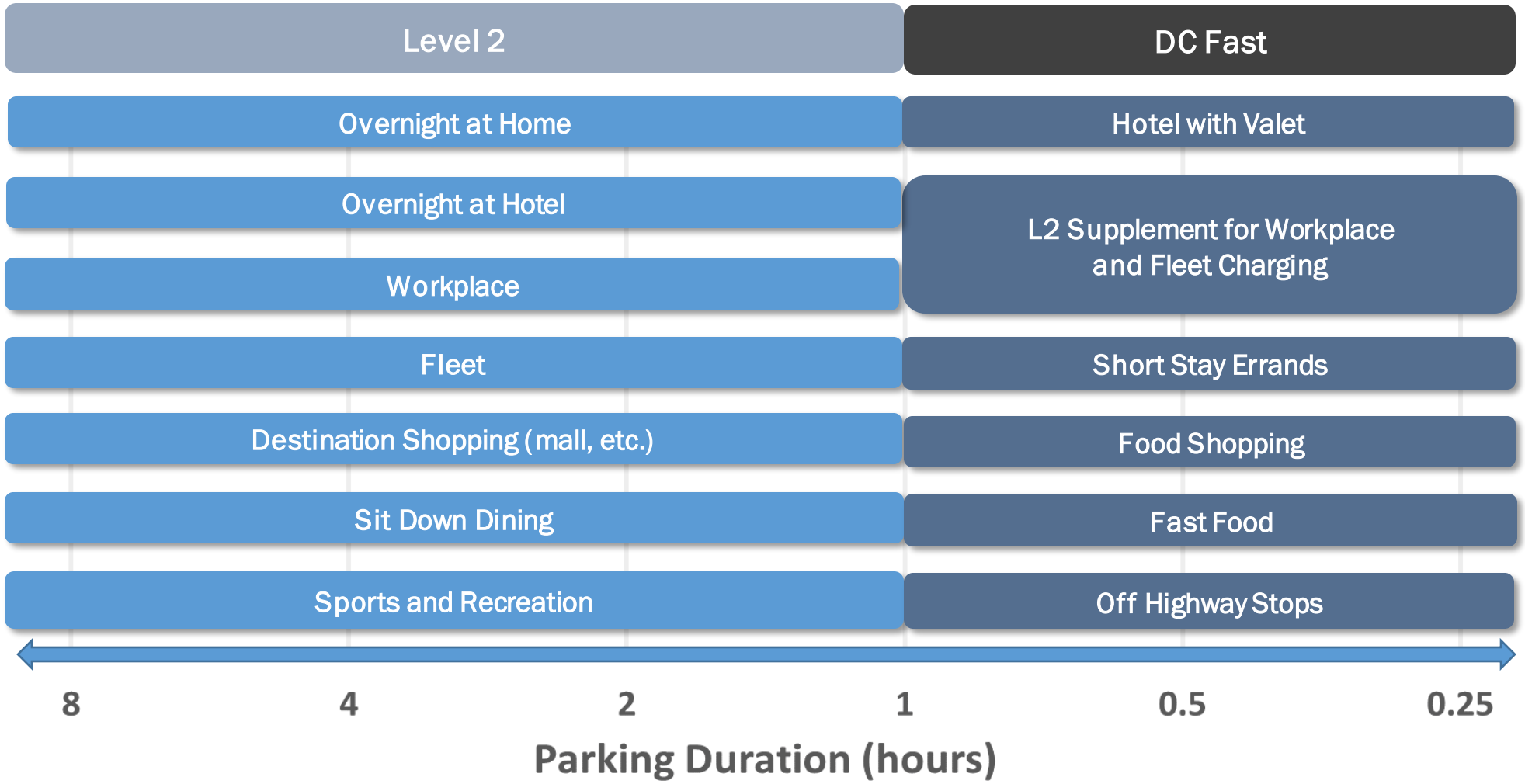
3

Start charging session

4

Check status on app/ receive notifications; True up drivers fee (if needed)

Charging Type by Use Case



Connected EV Charging – Value for All

EV Drivers

- Availability
- Information
- Convenience
- Seamless payment
- Consistent user experience

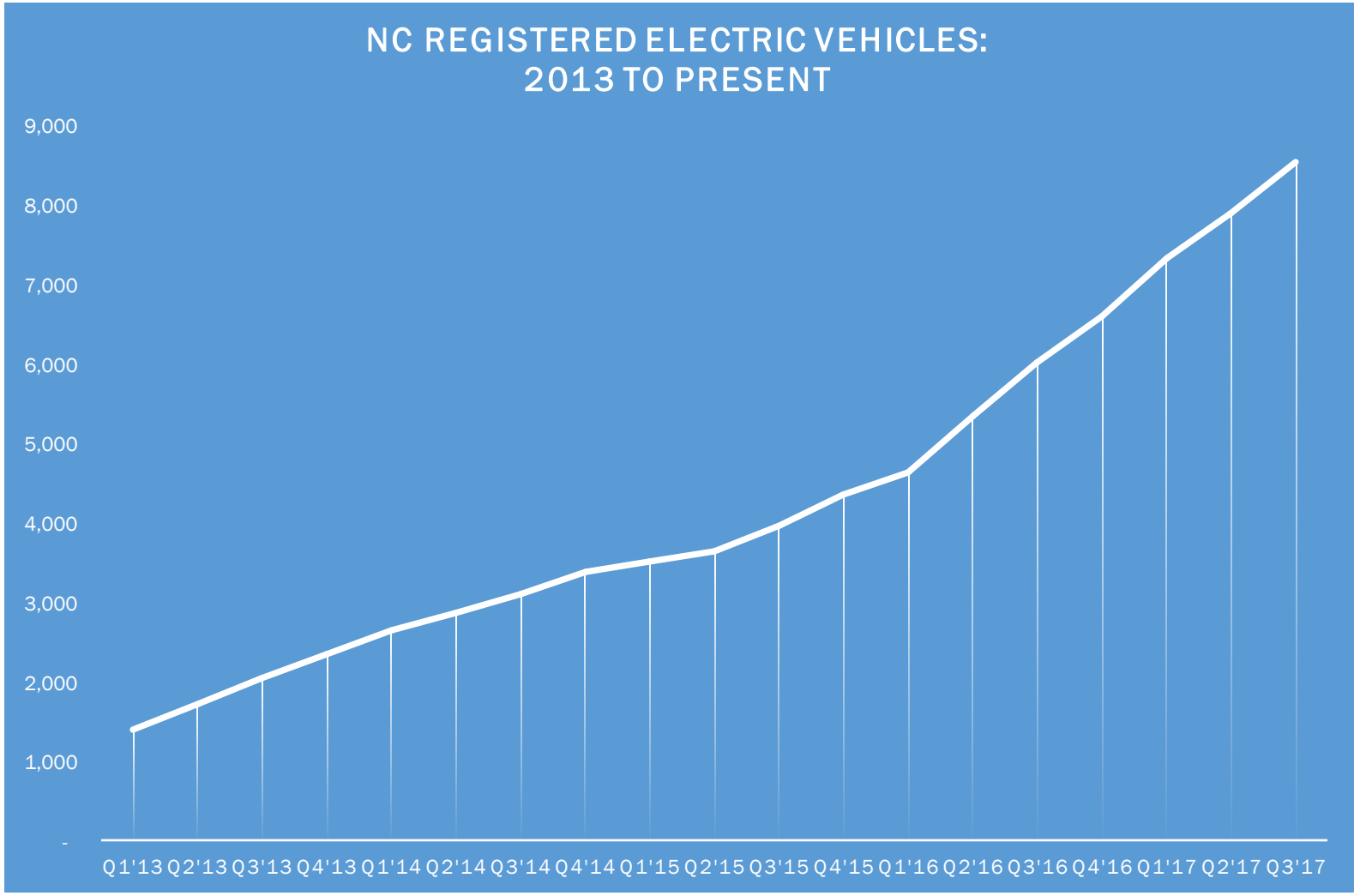
Site Hosts (Commercial)

- Maximize utilization
- Customizable tools
- Simple operation
- Limited administration
- Continuous upgrades
- Ensure uptime

Utilities

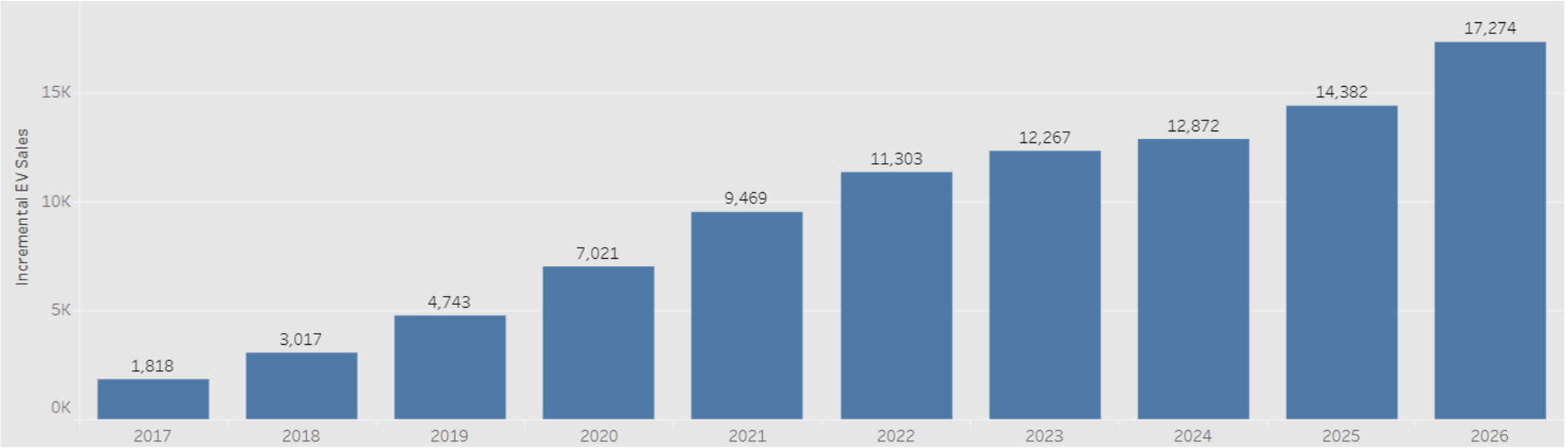
- Support EV adoption
- Visibility into the grid
- Data for load forecasting
- Load Management
- Flexible lever
- Seamless integration

NC: Electric Vehicle Growth is Strong



- ✓ 8,500+ on the road
- ✓ 42% YOY Growth
- ➢ .06% of all NC cars

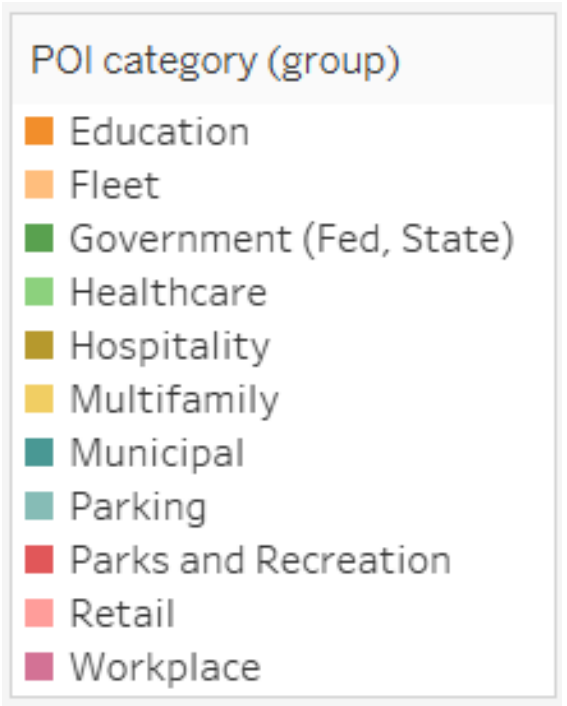
NC: Projections show even stronger growth



Source: Navigant 2017 Forecast

- ✓ Projection shows that by 2026, EV sales will increase to nearly 10x over today's sales.
- ✓ Driven by more choices for drivers and falling battery prices.
- ✓ Supported by more availability of charging infrastructure, both Level 2 and DCFC.

Current ChargePoint Deployments by Category



EV Ready Ordinance Addresses Major Barrier for Installing in Buildings

- EV ready ordinances typically specify a ratio of parking spots at nonresidential and multifamily buildings (and sometimes single/dual family homes) that must have the electrical capacity, pre-wiring, and conduit to support EV charging equipment.
- EV ready building codes help future-proof buildings, and are the most cost-effective way to bring EV charging to infrastructure to cities.
- Dozens of cities, counties, states, provinces, and countries across North America and Europe have adopted EV ready building codes.

More infrastructure is needed to meet the demands of EV drivers

NREL Plug in EV Infrastructure Analysis: 2030

State	Total PEV	%BEV	Workplace L2 Plugs	Public L2 Plugs	Public DCFC
NC	475,000	47%	12,900	8,900	1,020

- Current infrastructure is not enough to meet the demands of today's NC EV driver, not prepared for future growth
- Future growth of EVs requires significant investment in EV charging
- State must set targets to scale EV charging and prepare for mass EV adoption

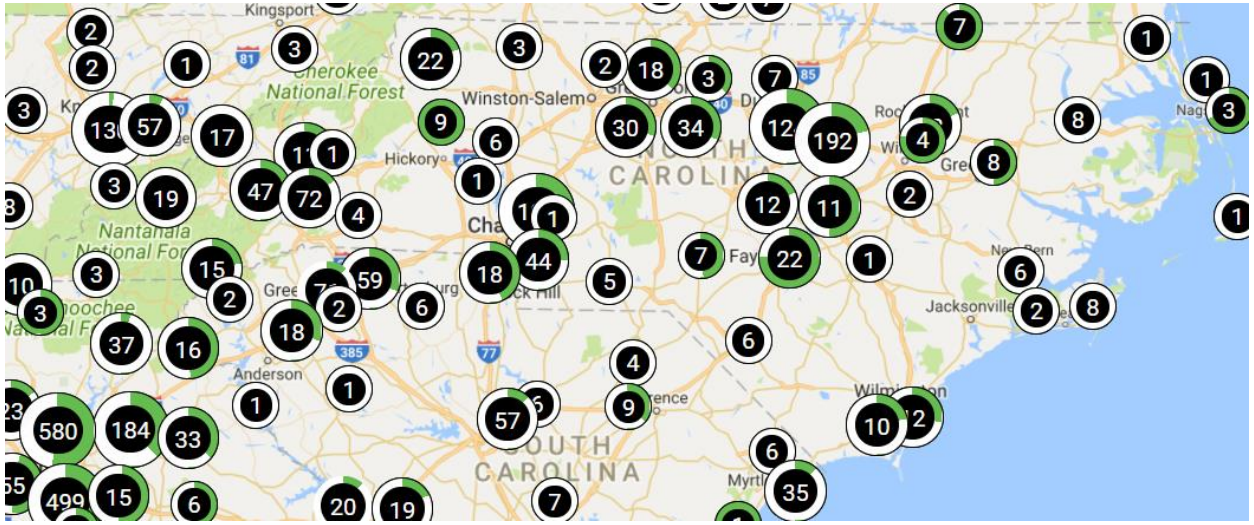
Competitive Market for EV Charging

- North Carolina's market for EV charging is served by a competitive market that has been deploying in the State for nearly 10 years.
- Site hosts currently choose from a range of products and services from multiple providers.
- Protecting that competitive market is critical, as it keeps costs low and maintains an innovative sector.

~~Preparing for Future EV Growth~~

1. Set goals for EV sector
2. Support EV charging deployment
3. Utility engagement
4. Clarify regulations
5. Start with government fleets
6. Incentives work

1,000+ EV Charging Ports in NC



UPDATE ON ELECTRIFY AMERICA

MICHAEL TUBMAN, ELECTRIFY AMERICA

EV PENETRATION IN RURAL AND DISPROPORTIONATELY AFFECTED COMMUNITIES

DIONNE DELLI GATTI, ENVIRONMENTAL DEFENSE FUND
RORY CHRISTIAN, ENVIRONMENTAL DEFENSE FUND
KRISTIE ALDRIDGE, NC ELECTRIC MEMBERSHIP COOPERATIVE

Electric Vehicles in rural and disproportionally affected communities

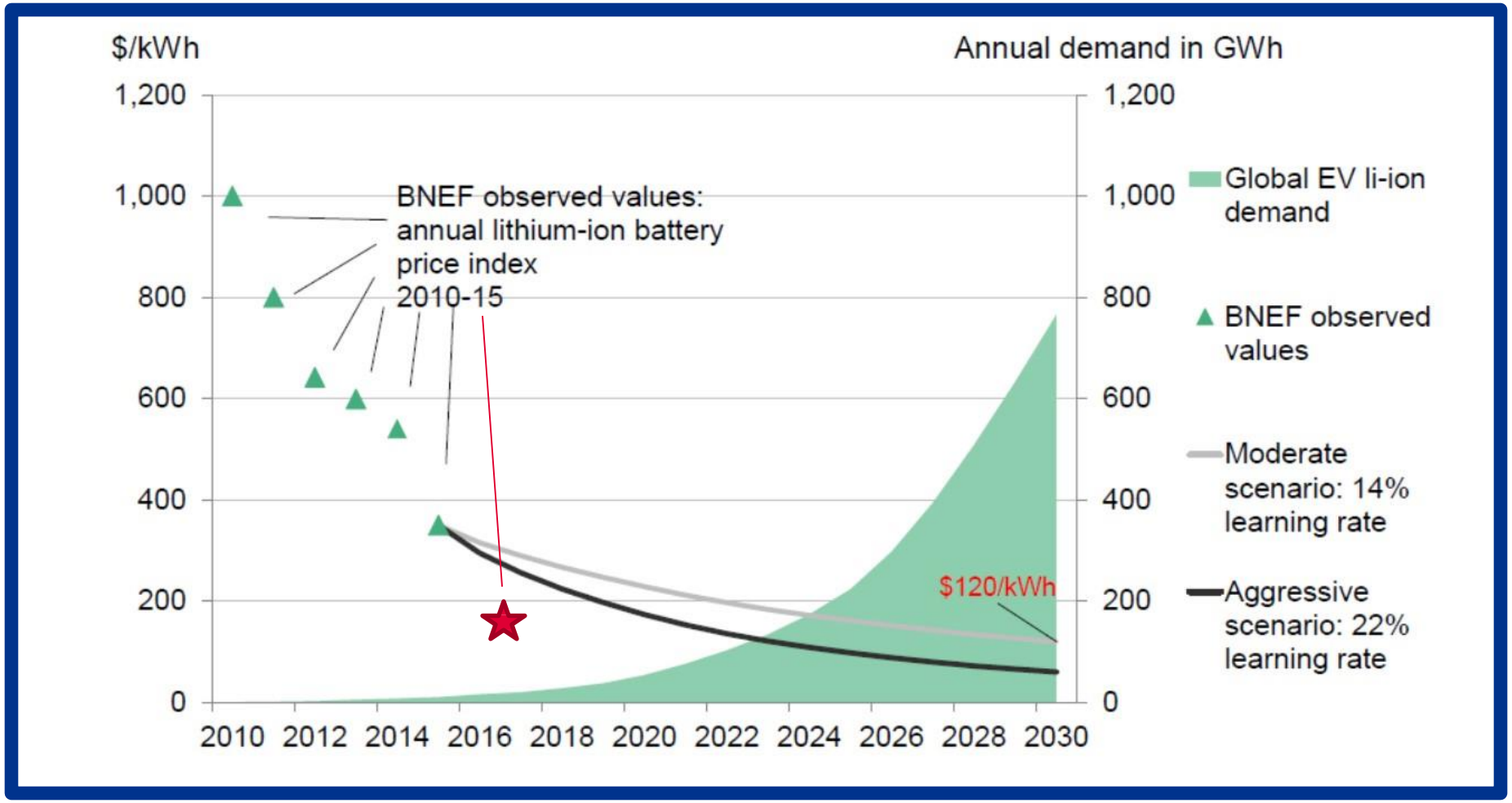
Rory Christian,
Clean Energy Director

EDF
ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work


Ford

EV Battery Packs

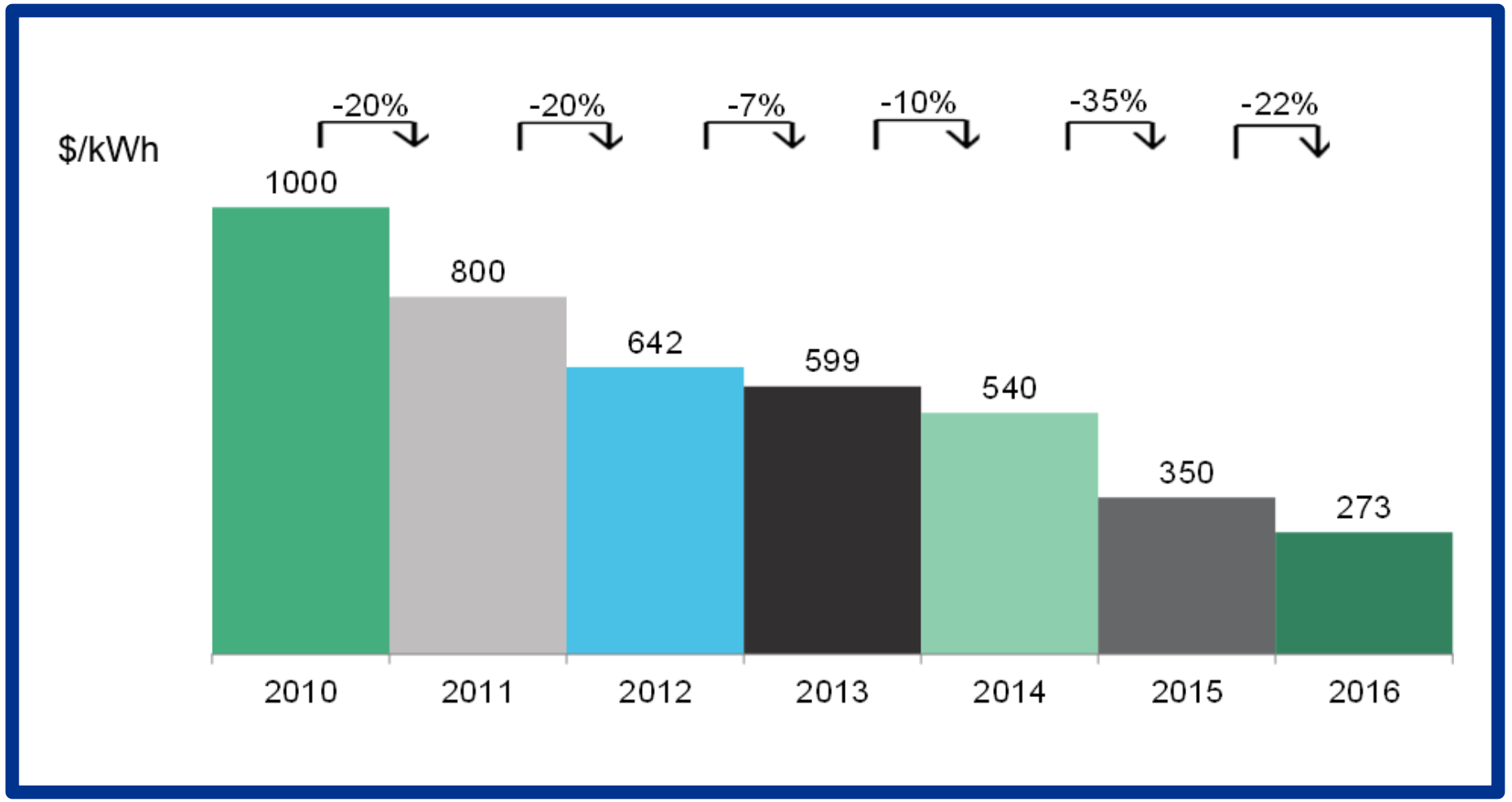
EV Lithium-ion battery pack costs and global lithium-ion demand from Evs 2010-2030 ($/kwh, GWh)



Source: Bloomberg New Energy Finance.

EV Battery Packs

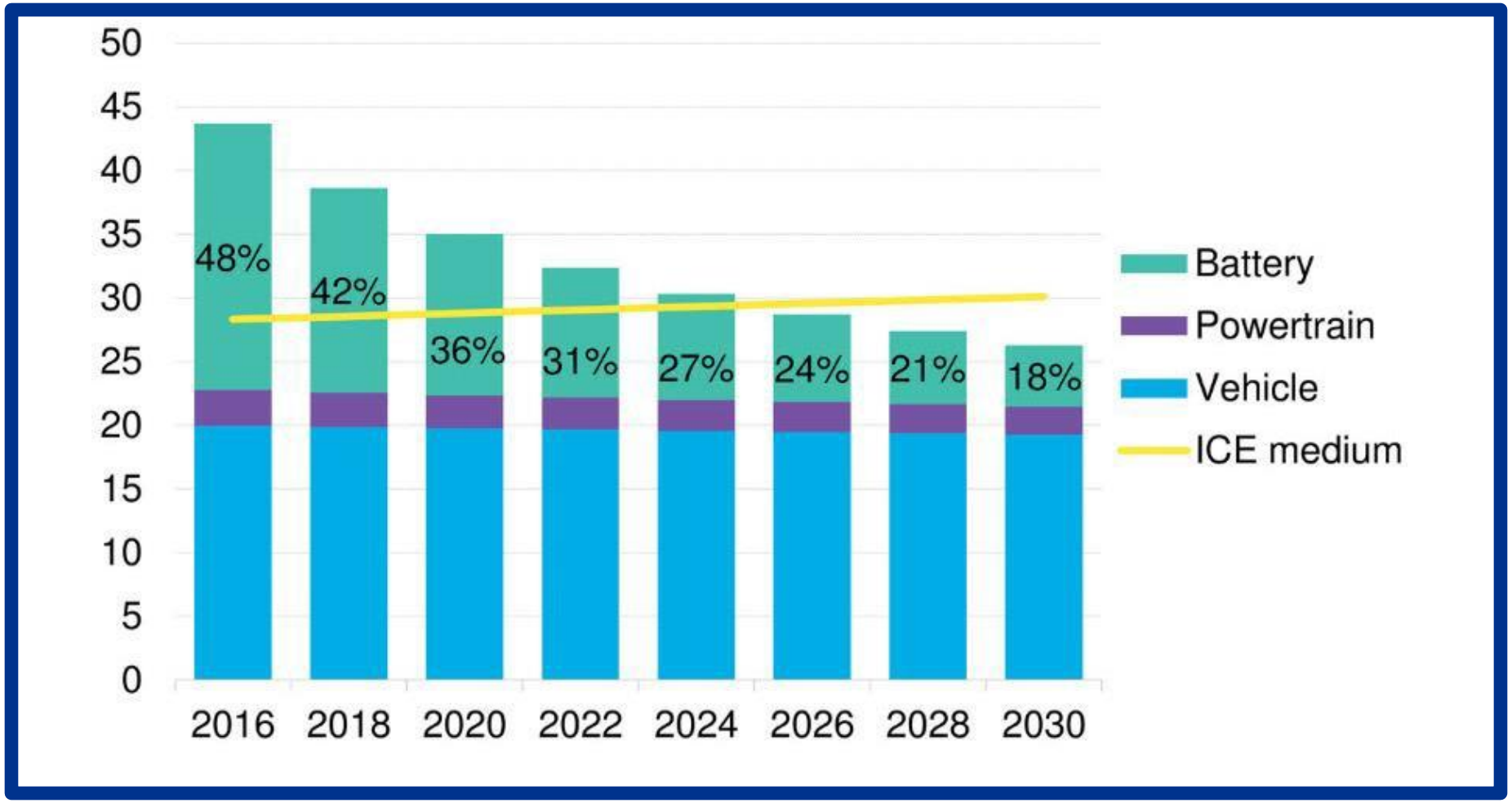
BNEF lithium-ion battery price survey, 2010-16 ($/kWh)



Source: Bloomberg New Energy Finance.

Cost of Ownership

U.S. medium segment vehicle price estimates, Thousands 2016$



Source: Bloomberg New Energy Finance.

Maintenance Schedule for your 2017 Chevrolet Bolt EV

Certified Service	7,500 miles	15,000 miles	22,500 miles	30,000 miles	37,500 miles	45,000 miles	52,500 miles	60,000 miles	67,500 miles	75,000 miles	82,500 miles	90,000 miles	97,500 miles	105,000 miles	112,500 miles	120,000 miles	127,500 miles	135,000 miles	142,500 miles	150,000 miles
Rotate tires, if recommended for the vehicle, and perform Required Services.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Replace passenger compartment air filter (or 2 years, whichever comes first).			✓			✓			✓			✓			✓			✓		
Drain and fill vehicle coolant circuits.																				✓

Maintenance Schedule for your 2016 Chevrolet Cruze Limited

Certified Service	7,500 miles	15,000 miles	22,500 miles	30,000 miles	37,500 miles	45,000 miles	52,500 miles	60,000 miles	67,500 miles	75,000 miles	82,500 miles	90,000 miles	97,500 miles	105,000 miles	112,500 miles	120,000 miles	127,500 miles	135,000 miles	142,500 miles	150,000 miles
Rotate tires, if recommended for the vehicle, and perform Required Services. Check engine oil level and oil life percentage. Change engine oil and filter, if needed.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Replace passenger compartment air filter (or 2 years, whichever comes first).			✓			✓			✓			✓			✓			✓		
Replace engine air cleaner filter (or every 4 years, whichever occurs first).						✓						✓						✓		
Replace spark plugs and inspect spark plug wires.													✓							
Replace spark plugs. Inspect ignition coils boots. (Applies to: 1.4 L)								✓								✓				
1.8L Engine Only: Rplace timing belt, idler pulley, and timing belt tensioner (or every 3 years, whichever comes first). (Applies to: 1.8 L)													✓							
Change automatic transmission fluid, if equipped. If filter is serviceable, change filter. (Applies to: Severe)						✓						✓						✓		
Change manual transmission fluid. (Applies to: Manual, Severe)						✓						✓						✓		
Drain and fill engine cooling system (or every 5 years, whichever comes first).																				✓
Change brake fluid (or every 3 years, whichever occurs first).						✓						✓						✓		
Change clutch fluid (or every 3 years, whichever occurs first). (Applies to: Manual)						✓						✓						✓		
Inspect evaporative control system.						✓						✓						✓		
Inspect engine accessory drive belts for fraying, excessive cracks or obvious damage (or every 10 years, whichever occurs first).																				✓

Photos and data: Chevrolet

PlugInConnect.com

CONVENTIONAL VEHICLES

ELECTRIC VEHICLES

$6,000 — Routine Maintenance — $2,000

$10,800 — Fuel — $8,813

$16,800 — Total Cost — $10,813

Total Cost calculated does not include the replacement of an EV battery. Warranty coverage will vary depending on manufacturer, check with your dealership or manufacturer to discuss warranty terms and conditions.

Hawaii Energy

Industry Commitments

- Tesla's Model 3 started to roll off the assembly line
- Daimler $740 million investment in EV batteries
- Cummins projects a fully electric truck platform by 2019
- Lyft pledged to provide a billion rides a year powered by electricity by 2025
- Porsche 2023 target for 50% of production be EVs
- Volvo Cars "all the models introduced starting in 2019 will be either hybrids or powered solely by batteries"

National Commitments

- France declared it would be all electric by 2040
- India challenged itself to be gas free by 2030
- Britain announced that it will ban the sale of all diesel and gas-powered cars after 2040
- Norway anticipates all new car sales will be Evs by 2025
- China took the global lead in terms of number of EVs on the road
  - 1 in every 5 new car sales are EVs
  - The world's largest EV charging network with over 167,000 charging stations.

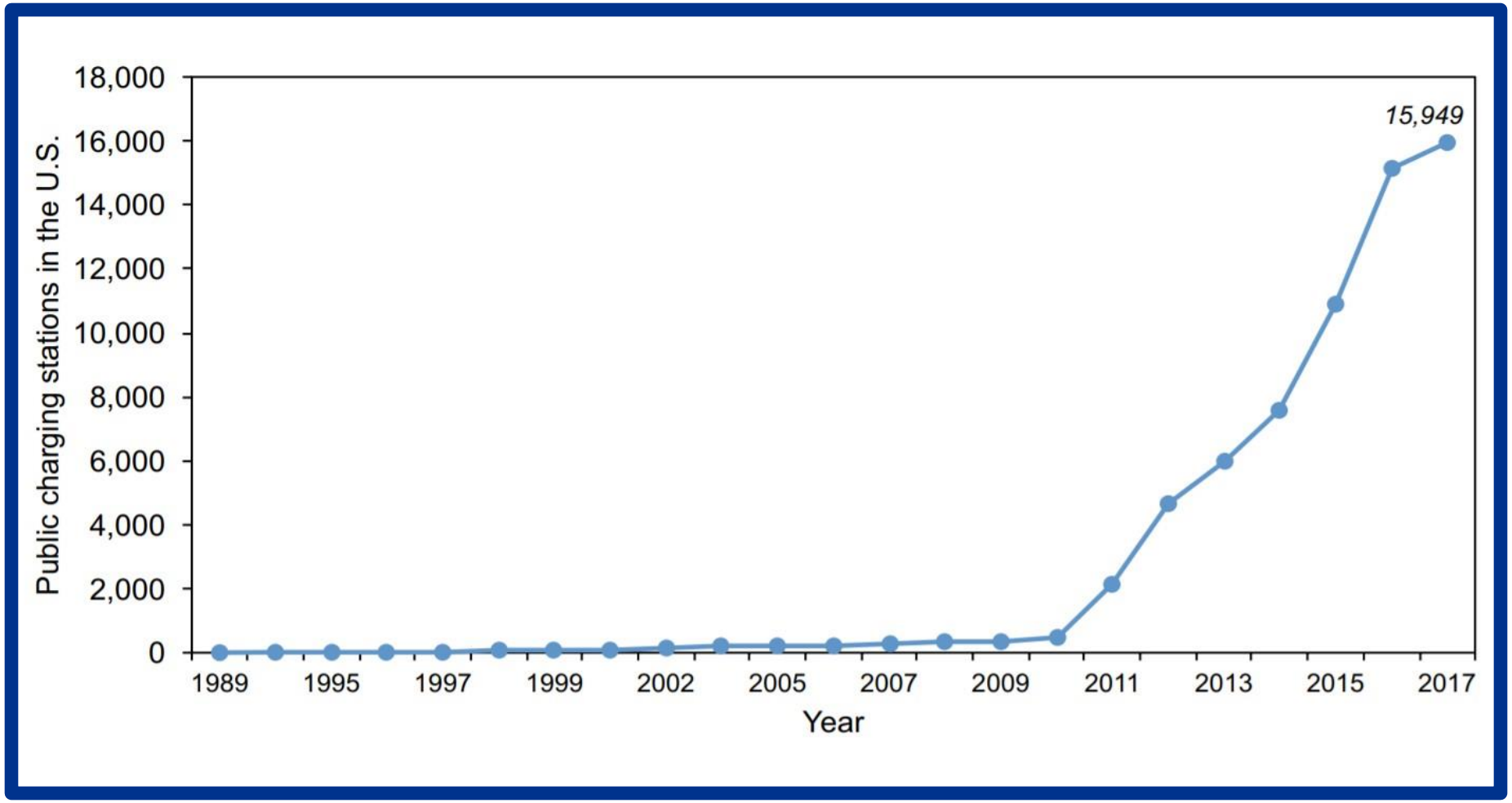
Compelling Factors

- National and sub-national commitments helping to spur development of new EV models.
- Increased competition throughout the vehicle supply chain lowering costs.
- Production scale increasing steadily and improving overall production economics
- Better performance at lower costs

Source: http://ev-sales.blogspot.com, www.eafo.eu, http://insideevs.com


Electric
Vehicle
Parking
Only
EV
ONLY

U.S. Public Charging Stations



Source: AFDC

U.S. Public Charging Stations

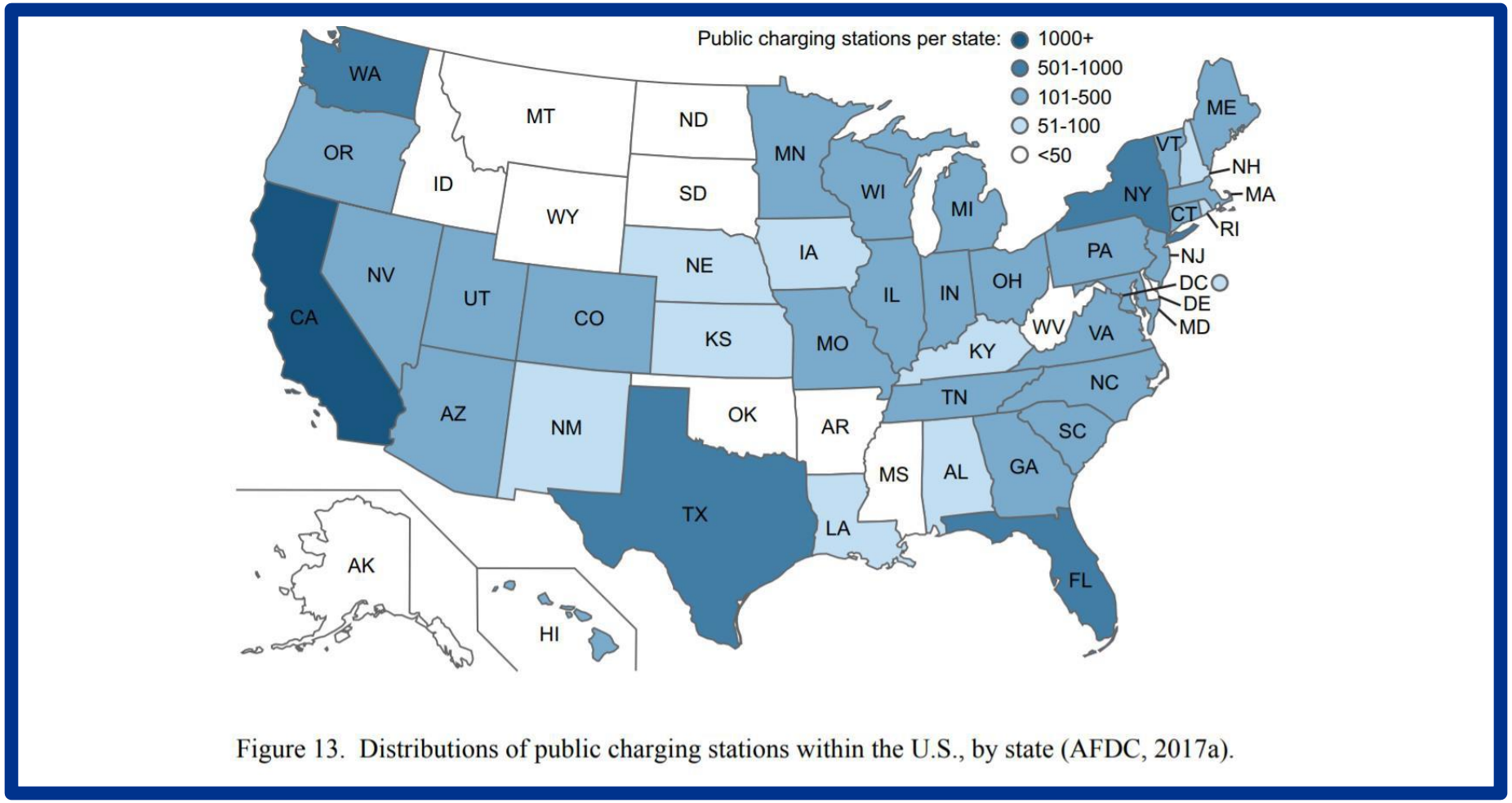


Figure 13. Distributions of public charging stations within the U.S., by state (AFDC, 2017a).

Source: AFDC

Electric Buses Potential

- Over 14,000 school buses operate daily on routers throughout North Carolina
- The average bus travels 76 miles daily
- Average cost per student $600
- Usage profile aligned with grid needs
- Potential to reduce long term costs over time
- Improved local air quality

http://www.actrees.org/files/Research/parks_on_property_values.pdf

U.S. Public Charging Stations

“It is imperative that the investment and resulting benefits be available to as many of North Carolina’s residents as possible, including those who reside in the rural communities many of which are served by the state’s many electric co-ops.”

Dionne Delli-Gatti
Environmental Defense Fund

Source: AFDC

Infrastructure Investment Impact

Local Population

- Property Values
- Community Viability
- Employment
- Education

Government

- Attracting Business
- Property & Employment Tax
- Benefits to Utilities

http://www.actrees.org/files/Research/parks_on_property_values.pdf

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919-923-0318

Rory Christian
rchristian@edf.org
212-616-1337

EDF
ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work

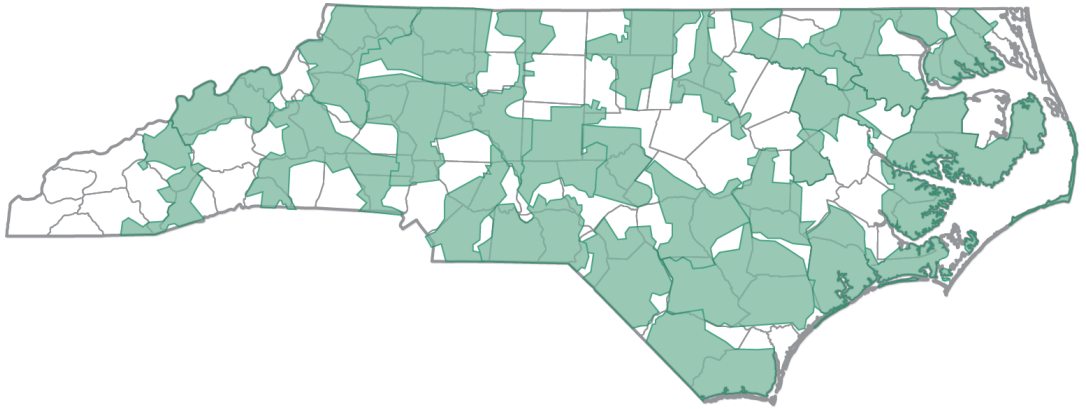
Investing in charging infrastructure

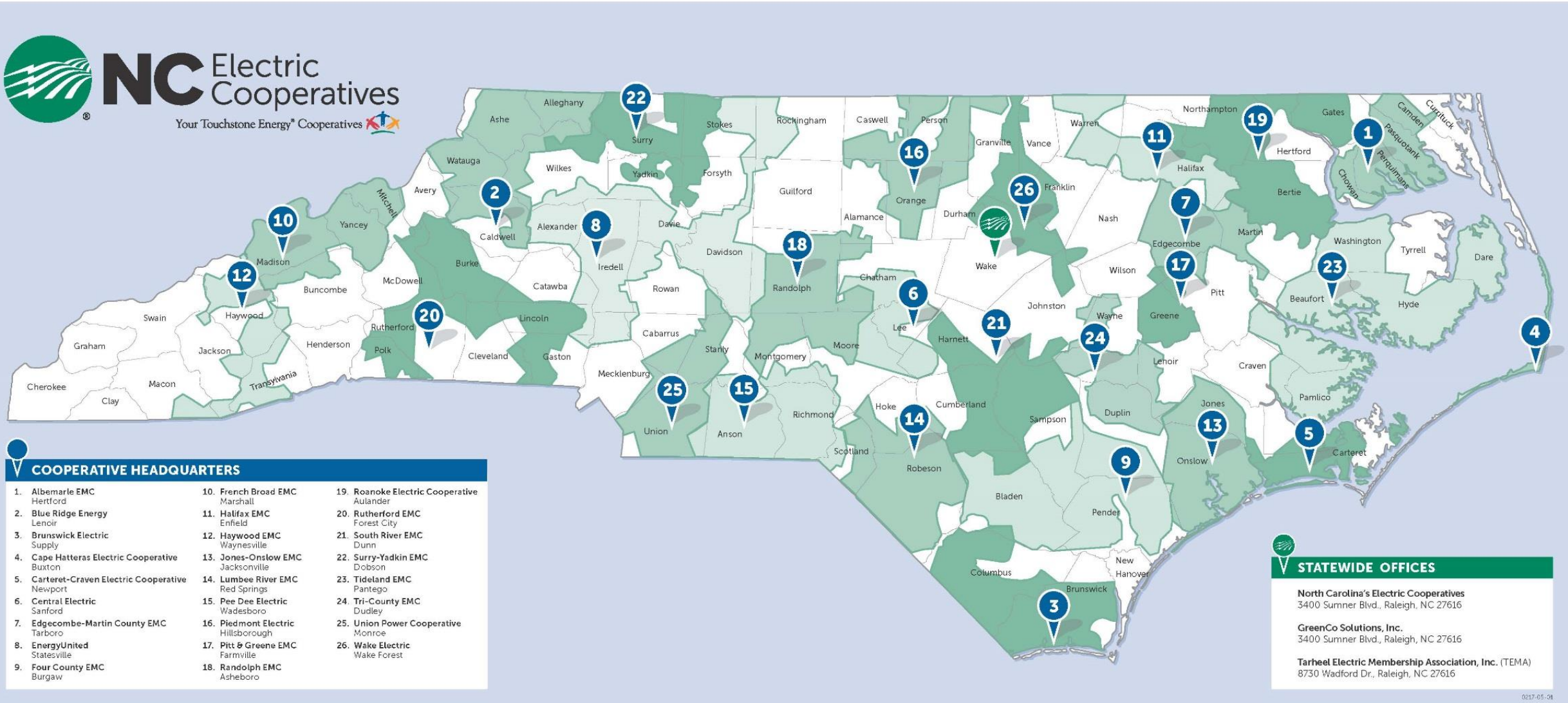
Creating opportunities for rural communities

Energy Policy Council, Feb. 21, 2018

NC Electric Cooperatives

Your Touchstone Energy® Cooperatives




NC Electric Cooperatives
Your Touchstone Energy® Cooperatives
Alleghany
Ashe
Watauga
Avery
Mitchell
Yancey
Madison
Buncombe
Swain
Graham
Jackson
Haywood
Henderson
Transylvania
Cherokee
Clay
Macon
McDowell
Rutherford
Polk
Burke
Caldwell
Wilkes
Alexander
Catawba
Cleveland
Lincoln
Gaston
Iredell
Surry
Stokes
Yadkin
Davie
Forsyth
Rowan
Cabarrus
Mecklenburg
Union
Anson
Stanly
Montgomery
Richmond
Davidson
Randolph
Rockingham
Guilford
Alamance
Caswell
Person
Orange
Chatham
Lee
Moore
Hoke
Scotland
Robeson
Granville
Vance
Warren
Franklin
Durham
Wake
Harnett
Johnston
Cumberland
Sampson
Bladen
Columbus
Brunswick
Pender
New Hanover
Nash
Wilson
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Lenoir
Duplin
Onslow
Halifax
Northampton
Edgecombe
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Pitt
Greene
Jones
Craven
Pamlico
Carteret
Hertford
Gates
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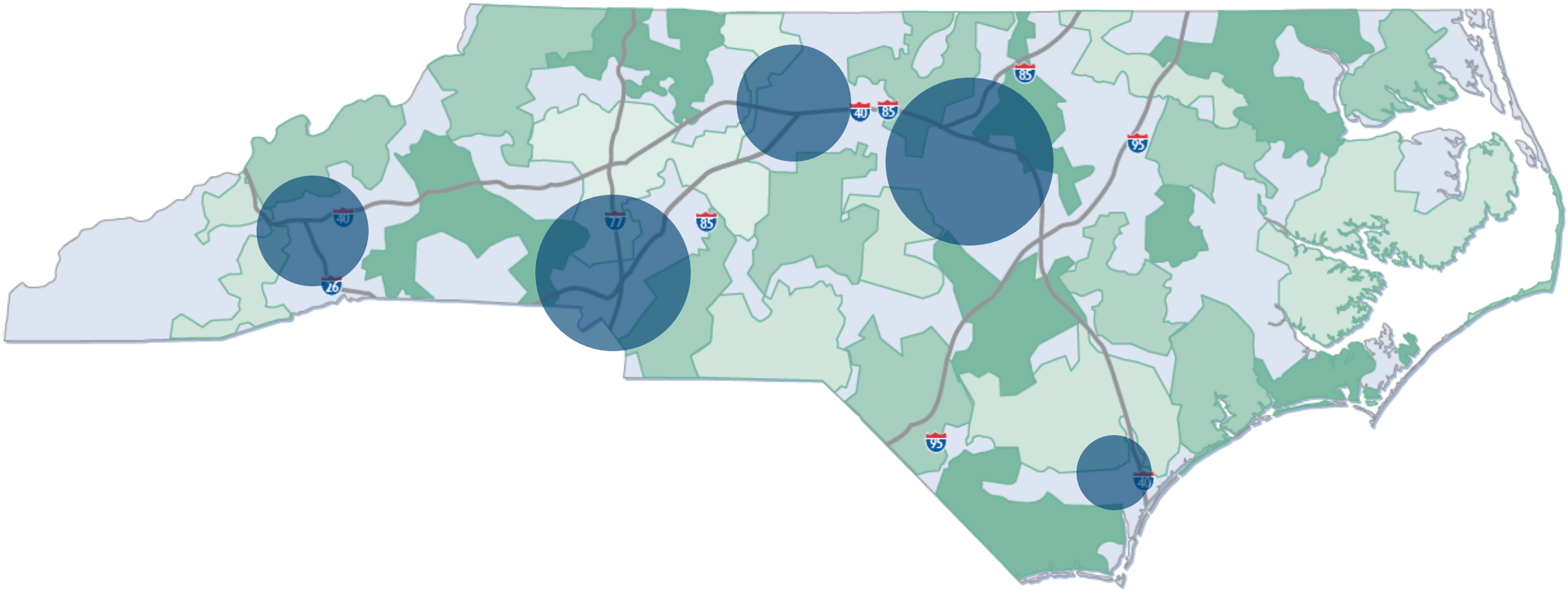
COOPERATIVE HEADQUARTERS
1. Albemarle EMC Hertford
2. Blue Ridge Energy Lenoir
3. Brunswick Electric Supply
4. Cape Hatteras Electric Cooperative Buxton
5. Carteret-Craven Electric Cooperative Newport
6. Central Electric Sanford
7. Edgecombe-Martin County EMC Tarboro
8. EnergyUnited Statesville
9. Four County EMC Burgaw
10. French Broad EMC Marshall
11. Halifax EMC Enfield
12. Haywood EMC Waynesville
13. Jones-Onslow EMC Jacksonville
14. Lumbee River EMC Red Springs
15. Pee Dee Electric Wadesboro
16. Piedmont Electric Hillsborough
17. Pitt & Greene EMC Farmville
18. Randolph EMC Asheboro
19. Roanoke Electric Cooperative Aulander
20. Rutherford EMC Forest City
21. South River EMC Dunn
22. Surry-Yadkin EMC Dobson
23. Tideland EMC Pantego
24. Tri-County EMC Dudley
25. Union Power Cooperative Monroe
26. Wake Electric Wake Forest
STATEWIDE OFFICES
North Carolina's Electric Cooperatives
3400 Sumner Blvd., Raleigh, NC 27616
GreenCo Solutions, Inc.
3400 Sumner Blvd., Raleigh, NC 27616
Tarheel Electric Membership Association, Inc. (TEMA)
8730 Wadford Dr., Raleigh, NC 27616

Current infrastructure focus

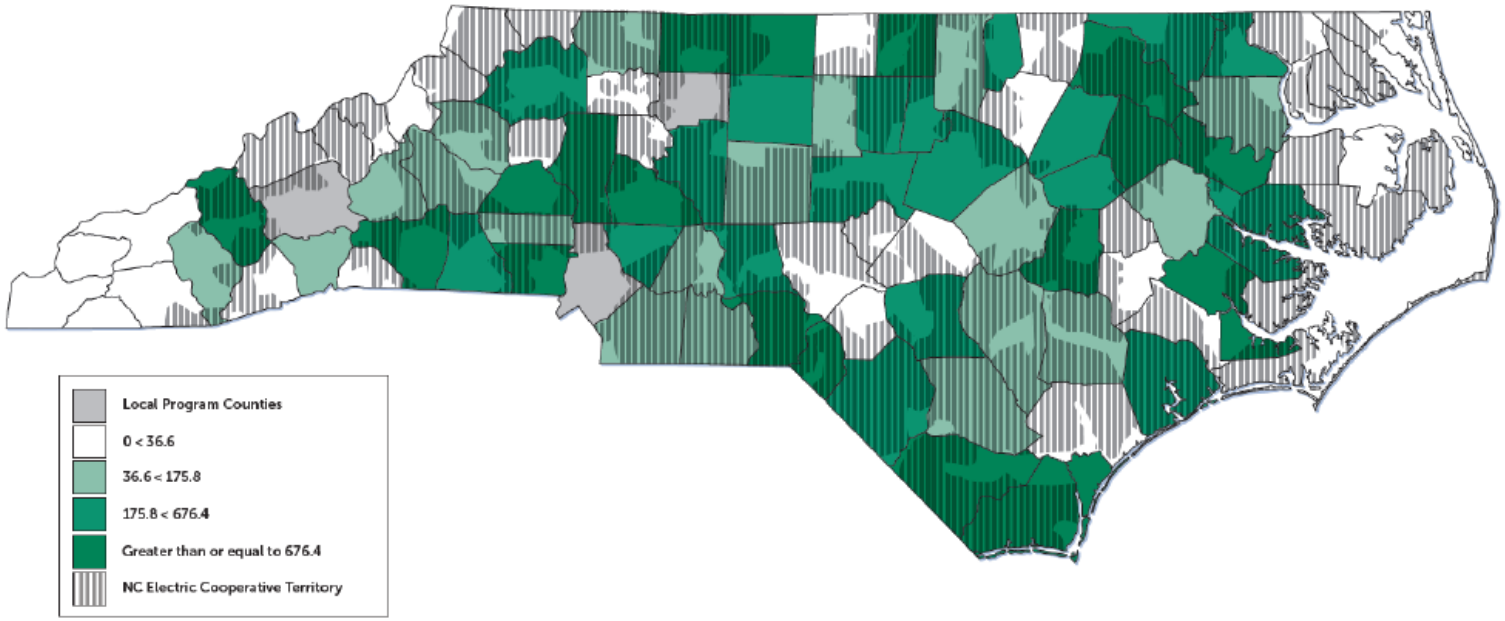


Investing in EV charging

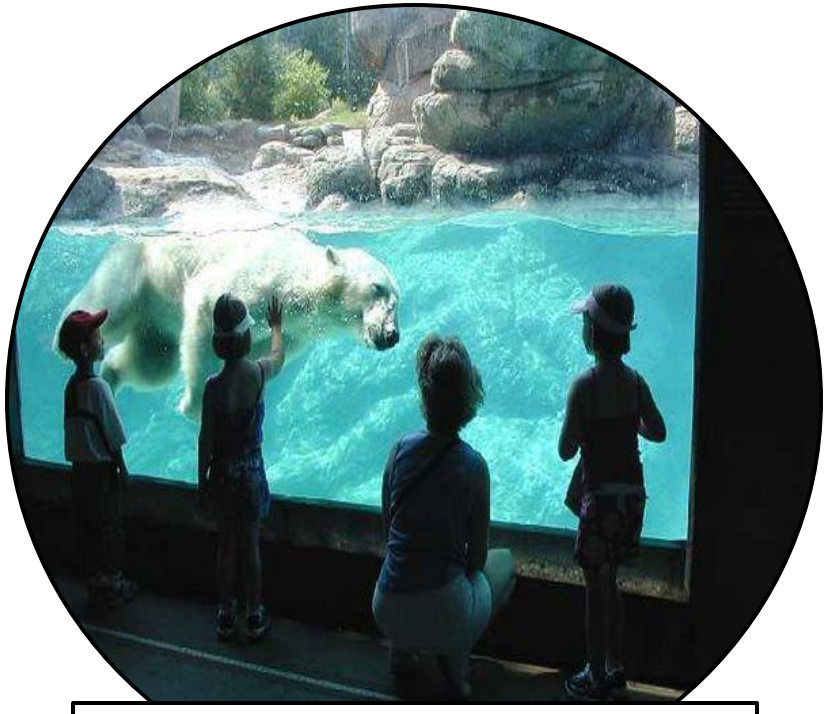
1. Reduces emissions in rural communities
2. Provides rural economic development opportunities
3. Propels tourism

Reducing overall emissions in rural NC

NC Electric Cooperative Territories are Situated in NC Counties with the Highest Point Source NOx Emissions (Unit Tons, 2015)



Facilitates rural economic development

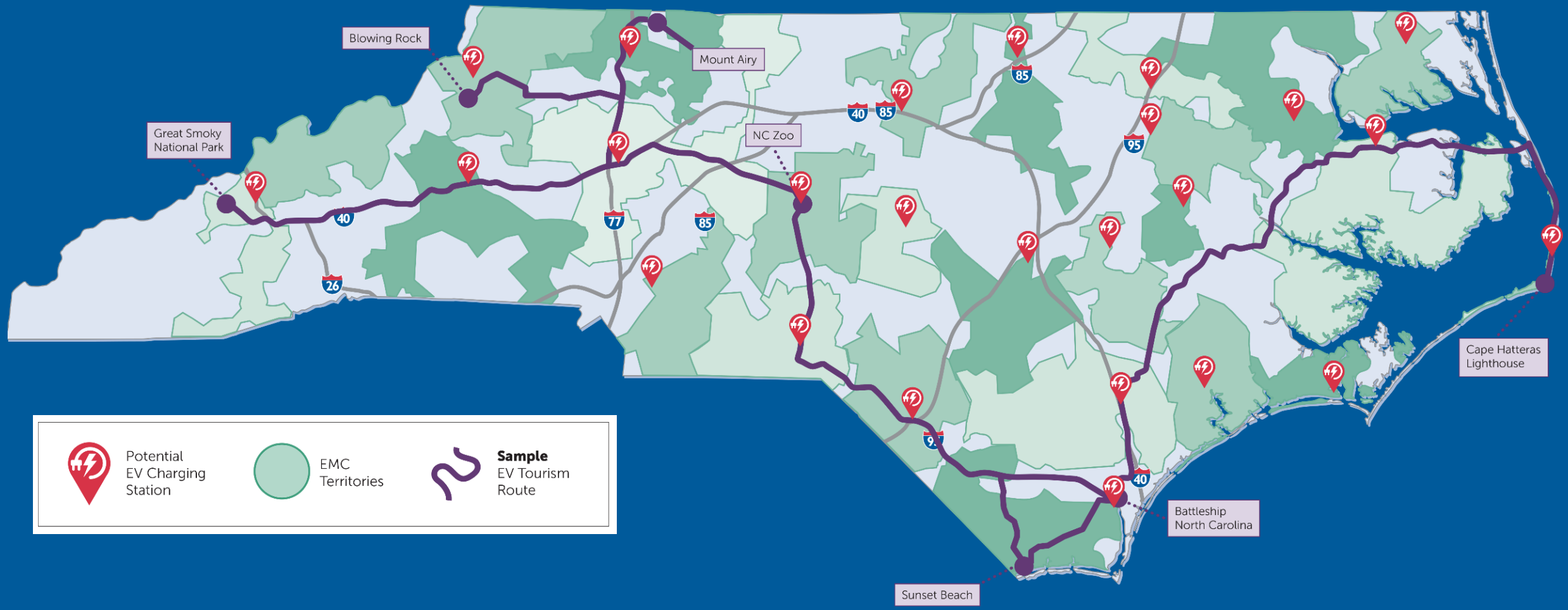


Randolph Electric Membership Corporation
Your Touchstone Energy® Cooperative

Wake Electric Membership Corporation
A Touchstone Energy® Cooperative

Propels tourism

Propels tourism



Investing in EV charging

1. Reduces emissions in rural communities
2. Provides rural economic development opportunities
3. Propels tourism

North Carolina Energy Policy Council

AGENDA

10:00 a.m. Wednesday February 21, 2018
William G. Ross Jr. Environmental Conference Center
Nature Research Center
121 West Jones Street, Raleigh, North Carolina
27603

1. **Call to order, opening remarks, and approval of the minutes from the November 9, 2017, Council meeting (5 min)**
   Lieutenant Governor Dan Forest, Chair

2. **Discussion of Electric Vehicles: Infrastructure, Demands, and Priorities (2 hours)**

Break (15 min)

3. **Financing Opportunities; Volkswagen Settlement Agreement (1 hour and 10 min)**

4. **Council discussions and actions (10 min)**

5. **Public comment (10 min)**

6. **Closing remarks and adjourn (5 min)**
   Lieutenant Governor Dan Forest, Chair

FINANCING OPPORTUNITIES

VOLKSWAGEN SETTLEMENT AGREEMENT

VW SETTLEMENT UPDATE

BRIAN PHILLIPS, DIVISION OF AIR QUALITY, NCDEQ

Nothing Compares
NORTH CAROLINA

Volkswagen Settlement Update
February 21, 2018

Brian Phillips, Mobile Sources Supervisor
N.C. Division of Air Quality
Department of Environmental Quality

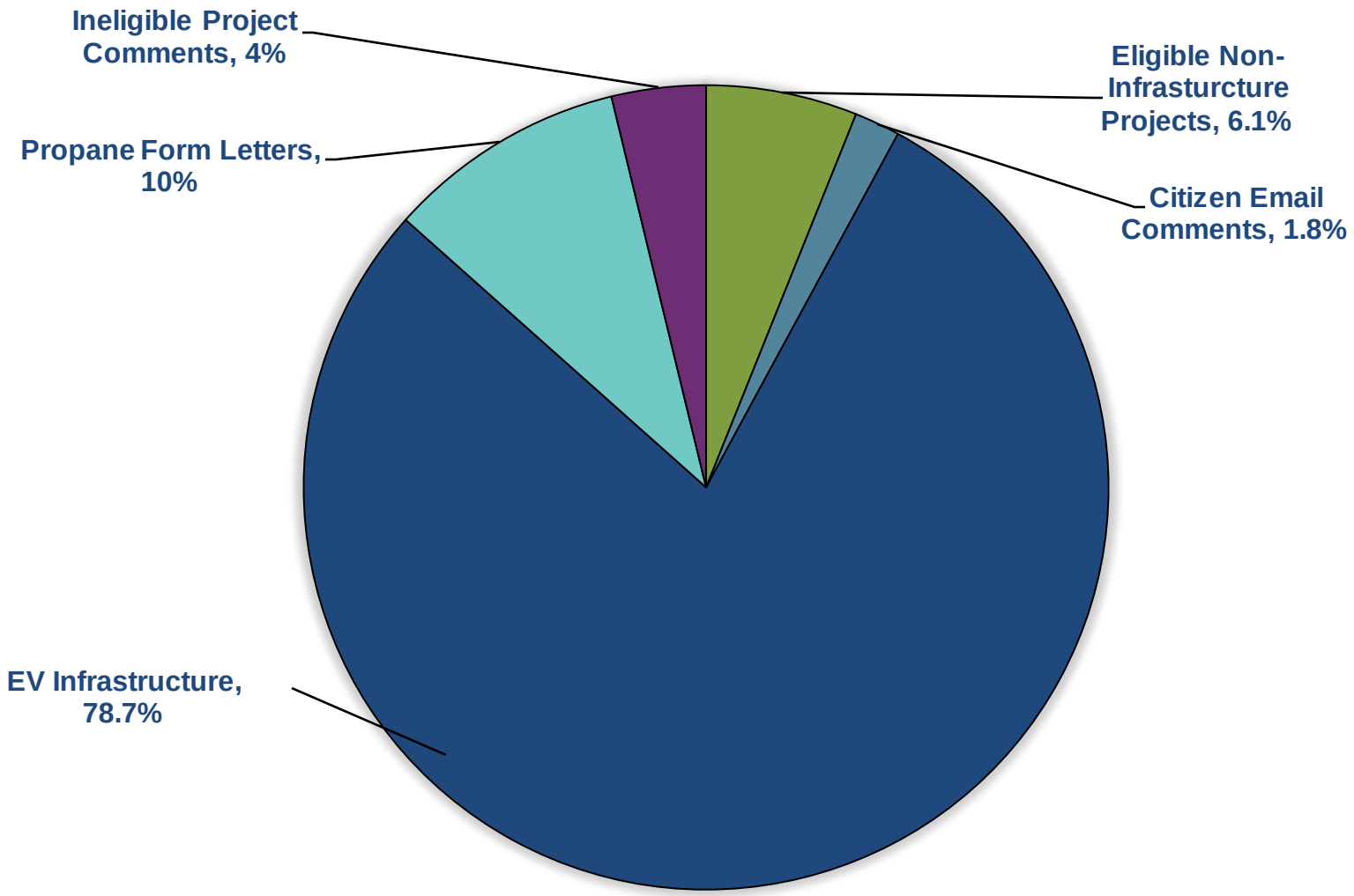
Current Actions

- **The state of North Carolina was officially named a state beneficiary by Wilmington Trust, the trustee on January 30, 2018.**

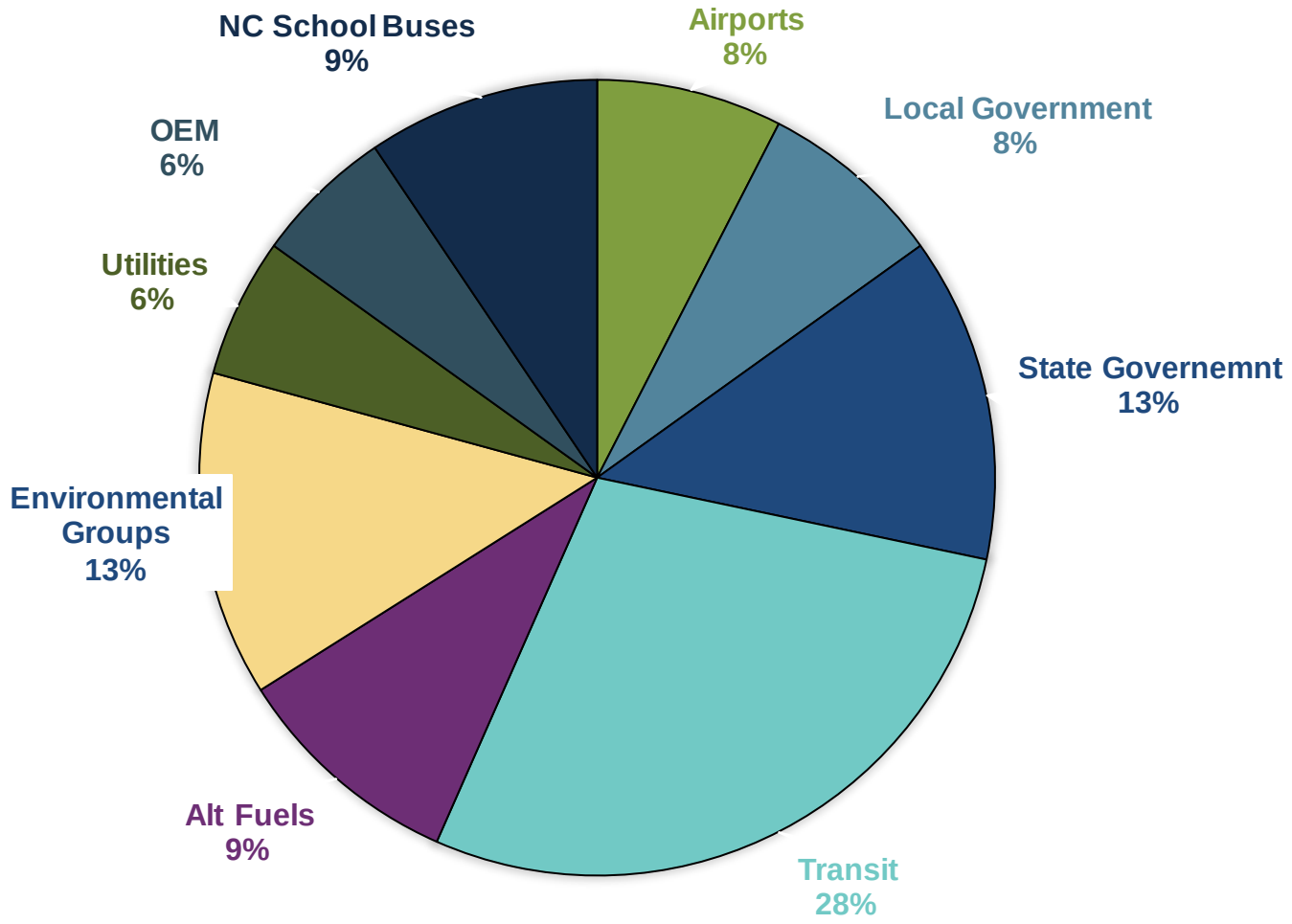
- **A summary of comments received from the Request for Information was posted on the DAQ Volkswagen web page on January 31, 2018. Copies of all comments received are also available on our web page.**

- **Working on a draft mitigation plan that takes comments into consideration.**

Comments Received

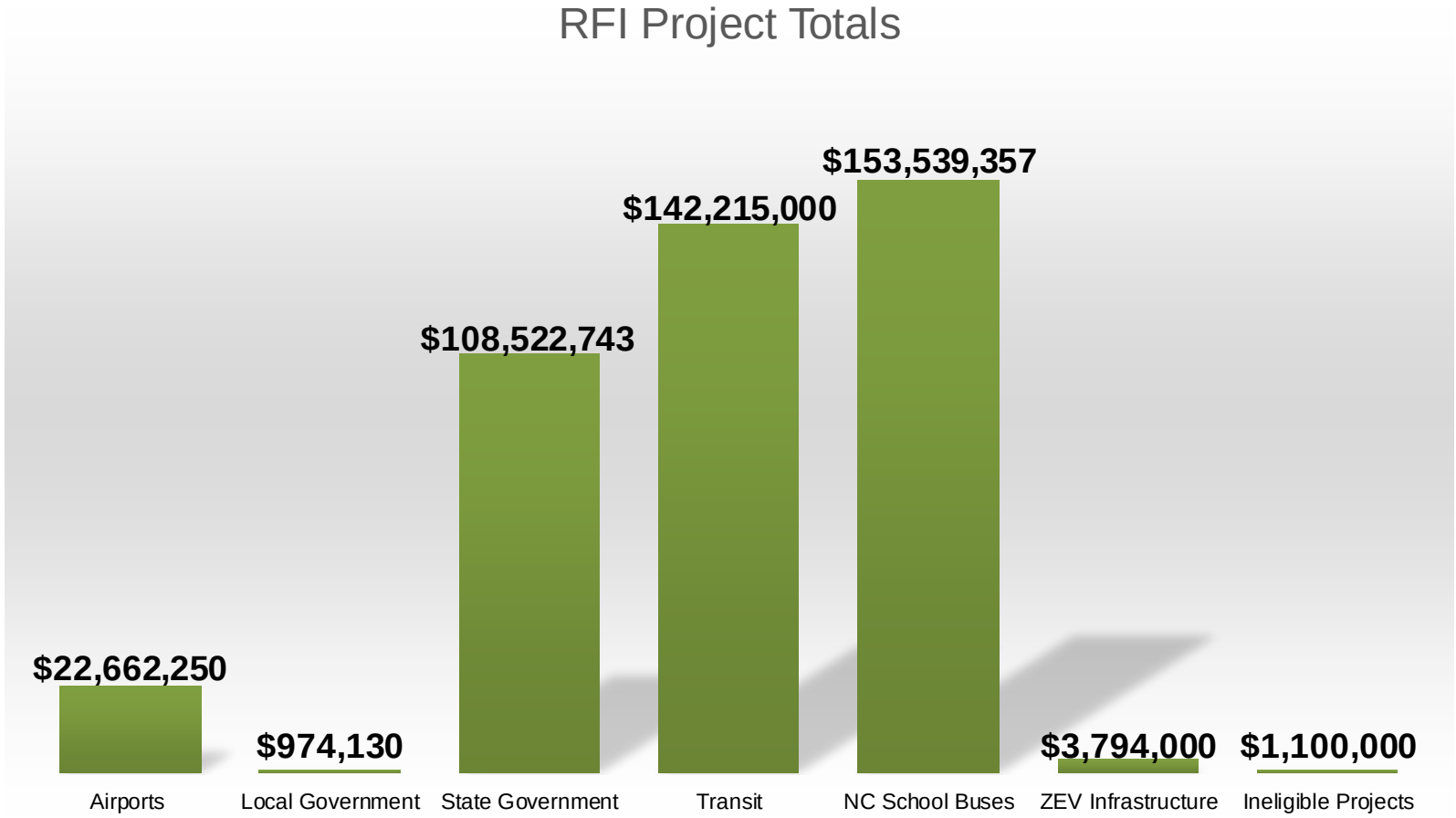


Comments Received For Eligible Non-Infrastructure Projects



Department of Environmental Quality

Request for Information Project Totals



North Carolina's allocation of the VW Settlement is approximately $92 million. DAQ received project descriptions totaling over $409 million for the Request for Information.

Department of Environmental Quality

Key Points from Responses

Alternative Fuels

- Of the 872 comments, we received 84 identical comments (10%) in support of including propane powered vehicles in the N.C. Mitigation Plan.
- Many of these same commenters are in support of propane-run fleet and freight vehicles, in addition to school buses.

Electrification Infrastructure and Electric Vehicles (EVs)

- Of the 872 comments, we received 679 identical comments and seven unique comments (79%) in support using the full allowable 15% of funds for EV infrastructure projects.
- The 679 identical commenters also encouraged DEQ to prioritize electric vehicles and buses for replacement whenever possible with the other 85% of the settlement funds and not to use funding for natural gas, propane or diesel vehicles.

Key Points from Responses

Eligible Equipment

- Some commenters stated preferences for project types that they feel will bring the most benefits to North Carolina.
- We received five unique comments (1%) supporting the replacement of school buses.
- Commenters submitted project concepts and comments for replacing old school buses with clean diesel, propane, natural gas and electric buses of which three commenters submitted project concepts for replacing existing school buses with 100% electric school buses.
- 15 commenters (2%) support funding replacement of transit buses with clean diesel, hybrid diesel, propane, natural gas and electric engines. Seven of the 15 project concepts included replacement of existing transit buses with 100% electric buses.
- Commenters also supported using funds to replace diesel trucking fleets, port equipment, ferries, locomotives, agricultural, airport support and construction equipment.

Key Points from Responses

Environmental Justice and Health Impacts

- **Seven (1%) commenters support use of the VW funds for environmental justice concerns. Most of these comments focus on helping overburdened communities to include fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income status.**

Key Points from Responses

Ineligible Ideas

- A wide range of ineligible concepts were received.

- Ideas include using funds for light rail-related projects, pedestrian and bike pathways, supporting clean energy and infrastructure development, offering rebates for the purchase and ownership of EVs, supporting research and funding to add new vehicles to existing fleets.

Next Steps

- DAQ is working on a draft mitigation plan that takes comments into consideration.
- Develop draft project selection criteria.

- <u>Timeline</u>
  - Draft Mitigation Plan released – mid-late March 2018
  - Stakeholder's meetings & webinars – Spring 2018
  - Final Mitigation Plan – Spring/Summer 2018

Contacts

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Email: brian.phillips@ncdenr.gov

Phyllis Jones, Grant Administrator

Phone: 919-707-8424

Email: phyllis.d.jones@ncdenr.gov

https://deq.nc.gov/about/divisions/air-quality/motor-vehicles-and-air-quality/volkswagen-settlement

PROPANE AS AN ALTERNATIVE FUEL

JOHN JESSUP, PRESIDENT & CEO, NC PROPANE GAS ASSN.

WAYNE MOORE, OEM &AFTERMARKET PROGRAMS MANAGER, AGILITY FUEL SOLUTIONS

CHELSEA JENKINS, EXECUTIVE DIRECTOR FOR GOVERNMENT AFFAIRS, ROUSH CLEAN TECH

North Carolina Propane Gas Association

Propane is a big deal in NC

- A billion dollar industry in NC

Propane is a big deal in NC

- #1 nationally in total retail locations and bulk plants
- We deliver over 400 million gallons of propane in North Carolina every year

- We have customers and locations in all 100 counties of North Carolina

Propane is a big deal in NC

- Over 400 licensed dealers in North Carolina eager to serve the school bus market, and there is plenty of price competition.
- 95% of Propane in the US is produced domestically
- Many companies offer free dispensing equipment with multi-year contract

North Carolina Propane Gas Association

- *"The replacement vehicles would largely be new diesel-powered school buses, with some **propane-powered school buses**, as well as pilots of fully electric school buses and the associated charging infrastructure."*

  Kevin Harrison – Dept of Public Instruction

"...Riding on outdated school buses each day can pose significant risks to students' health. Since school bus replacement is already a State responsibility, using the VW settlement to replace older school buses gives us a terrific opportunity to invest in something that will reduce student health risks and improve student safety." ...We hope North Carolina will join other states in considering using VW settlement money for school bus replacement purposes."

Leanne Winner - The North Carolina School Boards Association

North Carolina currently has 8 Propane school buses

State	Total
Alabama	217
Alaska	29
Arizona	367
Arkansas	1
California	1431
Colorado	230
Connecticut	484
Delaware	98
Florida	610
Georgia	324
Idaho	54
Illinois	625
Indiana	299
Iowa	171
Kansas	10
Kentucky	50
Louisiana	79
Maine	65
Maryland	110
Massachusetts	256
Michigan	423
Minnesota	518
Missouri	88
Montana	79
Nebraska	475
Nevada	48
New Hampshire	73
New Jersey	51
New Mexico	1
New York	602
North Carolina	8
North Dakota	8
Ohio	539
Oklahoma	11
Oregon	883
Pennsylvania	878
Rhode Island	83
South Carolina	103
Tennessee	22
Texas	2600
Utah	37
Vermont	2
Virginia	191
Washington	186
West Virginia	20
Wisconsin	649
Wyoming	15

North Carolina Propane Gas Association

- We believe the best use of VW funds is to purchase propane school buses and to repower the existing used fleet of diesel buses, thereby reducing emissions in the most cost-effective way, protecting our children from emissions, and saving State funds.

North Carolina Propane Gas Association

- John Jessup, President/CEO
- jjessup@ncpga.org

NCPGA Training Center

5109 Hollyridge Dr., Raleigh, NC

(919)787-8485

www.ncpga.org

What is an engine repower?

A repower is a strategic and cost effective way to significantly reduce emissions, while allowing the original vehicle body and chassis to be maintained.

The proposal is to replace the VT365 Navistar Engine.

The VT365 engine is found in Type C school buses with model year 2007 and older.

Agility 488LPI Engine

Why propane repower benefits North Carolina

The average lifetime of a school bus is 12 to 15 years. Replacing the diesel engine with a liquid propane gas (LPG) engine repower package will provide additional years of operation using an environmentally cleaner, quieter and more reliable product compared to diesel.

In North Carolina, 800+ diesel-powered IC school buses have experienced premature diesel engine failure well ahead of the useful life of the vehicle.

By repowering a diesel-powered bus with a clean burning propane-powered engine, NOx emissions go down by a staggering 92 percent when replacing pre-2007 diesel buses.

Benefits of operating an LPG engine provides social, economic and environmental benefits:

- Lower fuel cost & operating cost per mile driven Lower maintenance costs
- Cleaner burning fuel
- Lower NOx emissions

Repower is a cost effective alternative

An engine repower is a strategic way to significantly reduce the emissions from an engine, but allow the original vehicle body and chassis to be maintained. This is more cost-effective than replacing the entire vehicle.

Eligible Mitigation Project Category	Average Cost
Repower with LPG engine	$35,000
Propane school bus replacement	$95,000
Compressed Natural Gas school bus replacement	$125,000
Electric Vehicle school bus replacement	$300,000

North Carolina repower proposal

- Powertrain Systems, a division of Agility Fuel Solutions, based in Salisbury, North Carolina is the sole vendor, providing jobs and economic growth to the state.
- Agility Fuel Solutions has a dedicated GM 8.0L propane fueled engine certified to meet EPA and CARB emissions regulations.
- The engine marketed to OEM's and fleets under the brand name Agility 488LPI is available with a complete state of the art liquid propane injection system that has been proven in the market for the past 10 years.
- CleanFUEL USA, now owned by Agility Fuel Solutions, has 15 years of aftermarket and conversion experience. Those same employees are spearheading this project for Agility.
- The 488LPI engine and fuel system is sold to a major OEM in North Carolina who utilize it in their school bus, truck and delivery truck applications.
- In early 2018, the engine and fuel system manufacturing and assembly will move to our 200,000-sq. ft. state of the art facility in Salisbury, North Carolina.

Location: Salisbury, North Carolina

- ✓ **Provides Natural Gas, Propane, Hydrogen, Hybrid & Electric fuel solutions**
- ✓ **Tier One supplier to Freightliner Custom Chassis & Thomas Built Buses**

Products	• Bus Systems • Refuse Systems • Truck Systems • Fuel Management Modules • Full Installations
Manufacturing Equipment	• CNC Laser • CNC Roll Form • CNC Press Brake • CNC Machining • Mazak CNC • Deburr • Mill • Multi Axis Extrusion Machine • Robotic Tube Bending • Automated Paint Shop • Installation
Footprint	200,000 Sq. Ft. / 18,580 Sq. M
Capacity Utilization	20% (Based on 2 shift Operation) –24,000 systems/year
Certifications	ISO 9000 and TS16949 in process

OEM supplier: school bus market

488 LPI Engine

- OEM, Thomas Built Bus manufactured in High Point, NC
- Agility 488LPI assembled and shipped from Salisbury, NC
- Long block 8.0 Liter engine from General Motors
- Liquid Propane Injection by Agility Fuel Solutions
- Engine built specific for propane market
- Hardened valve seats (intake and exhaust) for durability
- Roller rocker arms
- Allison transmission
- Coavis fuel pump

ROUSH CLEANTECH

BLUE BIRD

School Bus Replacement: A Cost Effective Solution to NOx Reductions

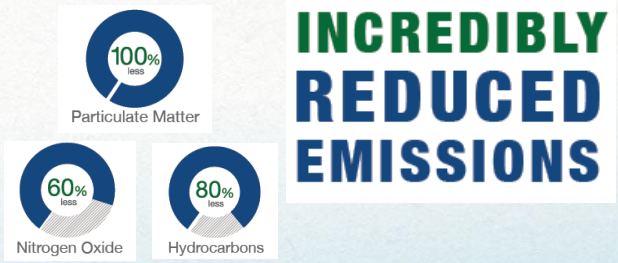
Why Propane

COST SAVINGS

NOISE REDUCTION

COLD STARTS

LOWEST EMISSIONS



Partners that Deliver

POWERED BY PROPANE

Blue Bird Propane Buses Operating in the US

OVER
12,000
SCHOOL
BUSES

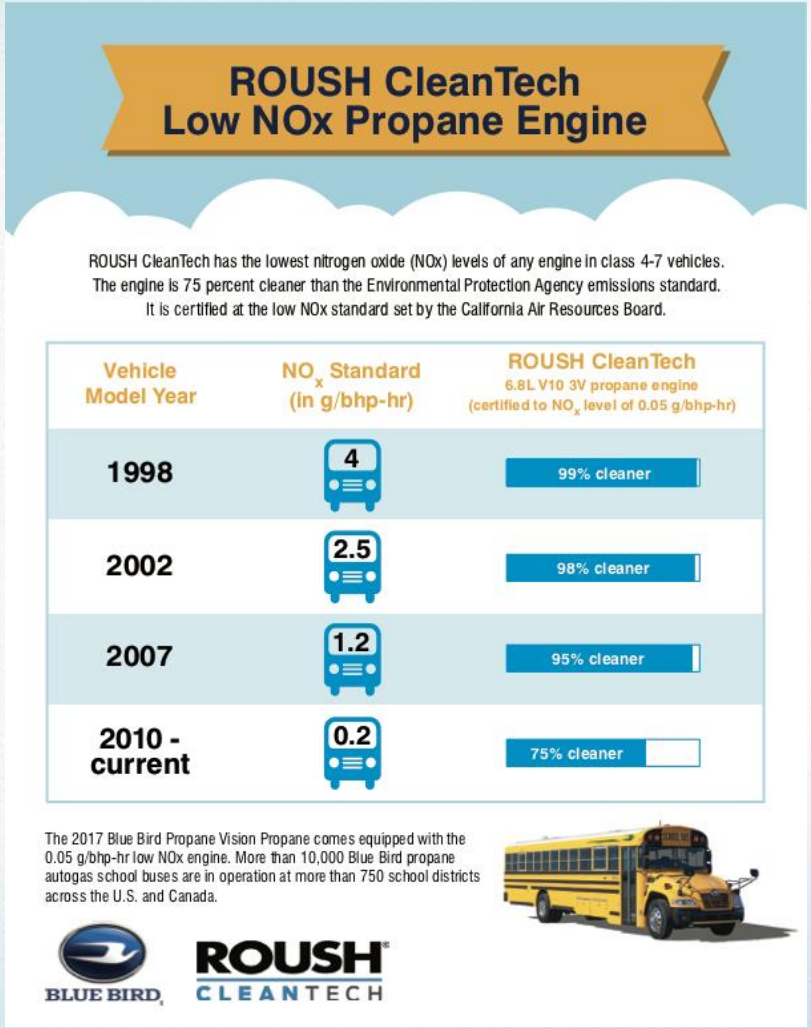
OVER
750
SCHOOL
DISTRICTS

Roush Status of Low NOx

June 7th 2017 ROUSH CleanTech announces achievement of very low NOx with the 6.8L V10 Engine.

- For the 2017 MY RCT LPG Blue Bird Buses are now certified to **0.05 g/bhp-hr NOx**.
- This is achieved with **no extra hardware or increased variable cost.**
- The low NOx levels were achieved through careful, significant calibration changes and a CSSR (cold start spark retard) approach.

Standard Changes for NOx



The ROUSH / Blue Bird low NOx propane engine is 75% cleaner than the current EPA standard, which diesel engines are certified to, and is 99% cleaner than pre-1998 diesel school buses.

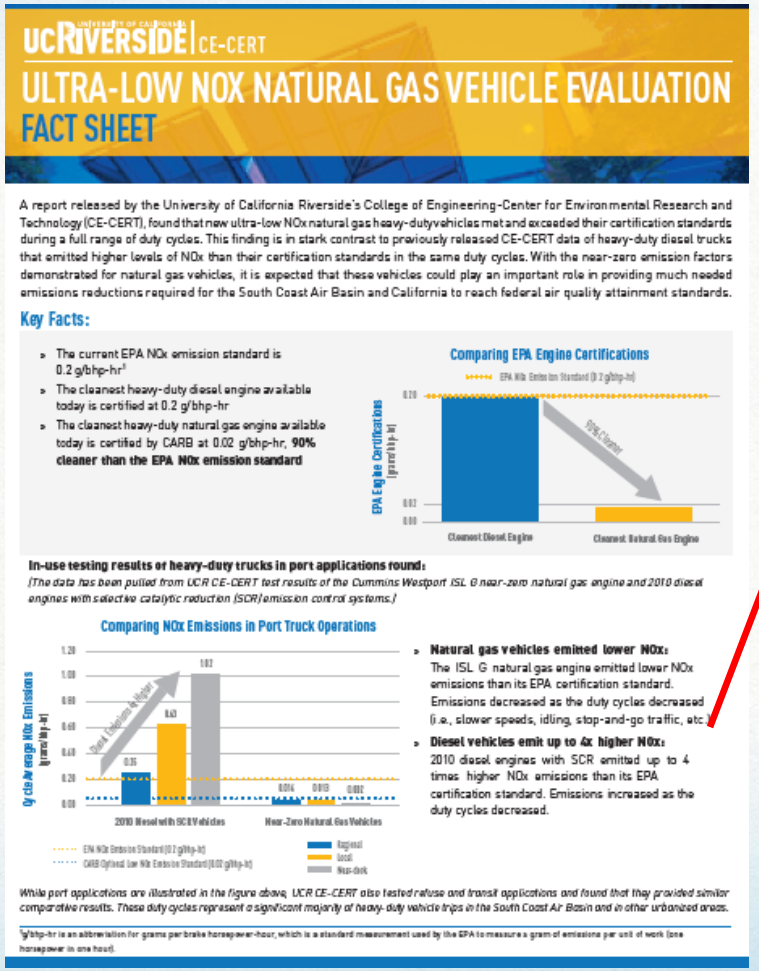
In-Use Diesel Emissions Studies

- ICCT: Negative health impacts from diesel-sourced NOx emissions are increasing, despite regulatory limitations
  - Lab-certified vehicles met mandatory emission limits but exceeded NOx emission limits for heavy-duty diesel vehicles, by 1.45 times on average in real world operation
  - Excess diesel NOx emissions contributed to an estimated 1,100 premature deaths in the United States in 2015
- UC-Riverside: SCR systems on today's new diesel vehicles fall short of controlling NOx emissions in many duty cycles

These studies beg the question…

Is it wise for states to use funds derived from high-emitting diesel vehicles to now fund high-emitting diesel vehicles?

Certification versus Reality?



UC RIVERSIDE | CE-CERT

ULTRA-LOW NOX NATURAL GAS VEHICLE EVALUATION FACT SHEET

A report released by the University of California Riverside's College of Engineering-Center for Environmental Research and Technology (CE-CERT), found that new ultra-low NOx natural gas heavy-duty vehicles met and exceeded their certification standards during a full range of duty cycles. This finding is in stark contrast to previously released CE-CERT data of heavy-duty diesel trucks that emitted higher levels of NOx than their certification standards in the same duty cycles. With the near-zero emission factors demonstrated for natural gas vehicles, it is expected that these vehicles could play an important role in providing much needed emissions reductions required for the South Coast Air Basin and California to reach federal air quality attainment standards.

Key Facts:

- The current EPA NOx emission standard is 0.2 g/bhp-hr[1]
- The cleanest heavy-duty diesel engine available today is certified at 0.2 g/bhp-hr
- The cleanest heavy-duty natural gas engine available today is certified by CARB at 0.02 g/bhp-hr, **90% cleaner than the EPA NOx emission standard**

Comparing EPA Engine Certifications

EPA Engine Certifications (grams/bhp-hr)

Cleanest Diesel Engine

Cleanest Natural Gas Engine

In-use testing results of heavy-duty trucks in port applications found:

(The data has been pulled from UCR CE-CERT test results of the Cummins Westport ISL G near-zero natural gas engine and 2010 diesel engines with selective catalytic reduction (SCR) emission control systems.)

Comparing NOx Emissions in Port Truck Operations

Fleet Average NOx Emissions (grams/bhp-hr)

2010 Diesel with SCR Vehicles

Near-Zero Natural Gas Vehicles

- **Natural gas vehicles emitted lower NOx:** The ISL G natural gas engine emitted lower NOx emissions than its EPA certification standard. Emissions decreased as the duty cycles decreased (i.e., slower speeds, idling, stop-and-go traffic, etc.).
- **Diesel vehicles emit up to 4x higher NOx:** 2010 diesel engines with SCR emitted up to 4 times higher NOx emissions than its EPA certification standard. Emissions increased as the duty cycles decreased.

While port applications are illustrated in the figure above, UCR CE-CERT also tested refuse and transit applications and found that they provided similar comparative results. These duty cycles represent a significant majority of heavy-duty vehicle trips in the South Coast Air Basin and in other urbanized areas.

[1] g/bhp-hr is an abbreviation for grams per brake horsepower-hour, which is a standard measurement used by the EPA to measure a gram of emissions per unit of work (one horsepower in one hour).

- **Natural gas vehicles emitted lower NOx:** The ISL G natural gas engine emitted lower NOx emissions than its EPA certification standard. Emissions decreased as the duty cycles decreased (i.e., slower speeds, idling, stop-and-go traffic, etc.).
- **Diesel vehicles emit up to 4x higher NOx:** 2010 diesel engines with SCR emitted up to 4 times higher NOx emissions than its EPA certification standard. Emissions increased as the duty cycles decreased.

DATA UPDATE:

Two studies currently underway in West Virginia (WVU) and in CA (SCAQMD) that are measuring in-use emissions of a diesel school bus and a propane school bus. Results should be available in 2018.

Dramatic Results for NOx in Emissions Models Based on In-Use Studies

2016 AFLEET Results: School Buses

Standard Argonne AFLEET Emissions Outputs				
Fuel	Purchase Price	NOx Reduced	$/lb	Cost Effectiveness vs. Propane
Propane	$ 95,000	537.0	$ 177	
Diesel	$ 90,000	330.5	$ 272	-35%
Electric	$ 300,000	593.4	$ 506	-65%

2017 AFLEET Results: School Buses

Argonne AFLEET 2017 w Diesel In-Use Multipliers				
Fuel	Purchase Price	NOx Reduced	$/lb	Cost Effectiveness vs. Propane
Propane	$ 95,000	893.7	$ 106	
Diesel	$ 90,000	67.7	$ 1,330	-92%
Electric	$ 300,000	1,119.0	$ 268	-60%

Source: Argonne National Laboratory AFLEET Tool. School Bus purchase pricing shown above are national averages based on 2019 model year Blue Bird Vision school buses (propane, diesel, electric and CNG options with same configuration).

Argonne National Laboratory conducts applied research to develop sustainable innovative technologies to improve the efficiency of resource and energy utilization; to minimize our dependence on imported energy; and to enhance our national security. The AFLEET tool was developed by Argonne and the Department of Energy to examine both the environmental and economic costs and benefits of alternative fuel and advanced vehicles. The tool uses data from Argonne's GREET fuel-cycle model to generate necessary well-to-wheels petroleum use and GHG emission co-efficients for key fuel production pathways and vehicle types. In addition, Environmental Protection Agency's MOVES model and certification data are used to estimate tailpipe air pollutant emissions..

AFLEET Results: NOx Cost Effectiveness

Argonne AFLEET 2017 Emissions Outputs			
Fuel	Purchase Price	NOx Reduced	$/lb
Propane	$92,400	893.7	$103
Diesel	$83,500	67.7	$1,234
Electric	$350,000	1,119.0	$313
CNG	$113,500	818.6	$139

Propane is 92% more cost effective at reducing NOx as compared to diesel.

Source: Argonne National Laboratory AFLEET 2017 Tool. School Bus purchase pricing based on North Carolina 2019 model year Blue Bird Vision school buses (propane, diesel, electric and CNG options with same configuration).

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$47.3M Alternative Fuel School Bus Program

$47.3M Scenario: Alternative Fuel School Bus Program	TOTAL
Total Buses Operating in State (# Units)	16,496
Est. Cost of 2019 Model Year Diesel Bus ($)	$83,500
Est. Cost of 2019 Model Year Propane Bus ($)	$92,400
Est. Cost of 2019 Model Year CNG Bus ($)	$113,500
Est. Cost of 2019 Model Year Electric Bus ($)	$350,000
Total North Carolina VW EMT Allocation ($)	$94,678,714
School Bus Program Funding Scenario ($)	$47,339,357
Propane Bus Incentive ($), 50% of Total Bus Cost	$46,200
CNG Bus Incentive ($), Based on 50% of Total Bus Cost	$56,750
Electric Bus Incentive ($), Based on 50% of Total Bus Cost	$175,000
Number of Estimated Bus Replacements, Propane Scenario	1,025
Number of Estimated Bus Replacements, CNG Scenario	834
Number of Estimated Bus Replacements, Electric Scenario	271
% of NC school bus fleet, propane scenario	6.21%
% of NC school bus fleet, CNG scenario	5.06%
% of NC school bus fleet, electric scenario	1.64%

Assumptions:

- *Total number of school buses estimated using R. L. Polk data.*
- *School bus pricing estimated and based upon model year 2019 Blue Bird Vision Type C school bus with fuel type option as indicated.*
- *Incentives are recommended portion NC DEQ to provide to grant recipient. Recipient to provide 50% as matching funds.*

$47.3M Alternative Fuel School Bus Program

Propane School Bus Scenario: $47.3M Funding	
Assumptions: 1,025 school buses replaced, 2007 average model year replaced with 2019 model year Vision propane bus, 15 year service life, 12,600 miles per year	**POTENTIAL IMPACT**
Cost of Propane School Bus ($)	$92,400
# of Propane School Bus Replacements (assuming 50% cost share)	1,025
% of NC School Bus Fleet Replaced	6%
Total Funding Proposed ($)	$47,339,357
Total NOx Reduction (lbs)	915,784
Cost Effectiveness ($/lb)	$103
Petroleum Reduction (gallons)	27,665,858
Est. Total Children Impacted Daily (# of Children)	73,776

A $47.3 million investment in a North Carolina alternative fuel school bus program could produce the following results:

- *Replacement of 6% of the North Carolina school bus fleet*
- *Reduction of 915 thousand pounds of NOx emissions*
- *Over 73 thousand children impacted daily*
- *Cost $103/pound of NOx Reduced*

Key Message

SCHOOL BUSES ARE
A COST EFFECTIVE WAY
TO REDUCE NOx!

Prioritize Alternative Fuels/
Cost Effectiveness

Allow Rural Areas to
Participate

Argonne AFLEET 2017 Emissions Outputs			
Fuel	Purchase Price	NOx Reduced	$/lb
Propane	$92,400	893.7	$103
Diesel	$83,500	67.7	$1,234
Electric	$350,000	1,119.0	$313
CNG	$113,500	818.6	$139

Other Takeaways

- Alternative Fuels are proven, especially propane in a school bus application.
- Propane contributes to the North Carolina economy, and NC is lagging in adoption compared to many other states.
- States can see immediate and measurable benefits.
- Sustainable program after funds exhausted.

12,000 SCHOOL BUSES

QUALIFIED VEHICLE MODIFIER

OVER **750** SCHOOL DISTRICTS

Other Key Messages

Vehicle Model Year	NO_x Standard (in g/bhp-hr)	ROUSH CleanTech 6.8L V10 3V propane engine (certified to NO_x level of .05 g bhp-hr)
1998	4	99% cleaner
2002	2.5	98% cleaner
2007	1.2	95% cleaner
2010 - current	0.2	75% cleaner

- Near zero emissions propane engines are here today
- Path to renewable propane exists today
- Spending on diesel may not result in lowering of NOx
- Significant cost per mile reduction vs diesel based on TCO

THANK YOU!

SCHOOL BUS RESOURCE CONTACTS:

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Gregory Poole Bus Sales
North Carolina Blue Bird Dealer

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UTILITY FINANCING OPPORTUNITIES

LANG REYNOLDS, DUKE ENERGY

Duke Energy
Electric Transportation

Electric Transportation = Economic Development

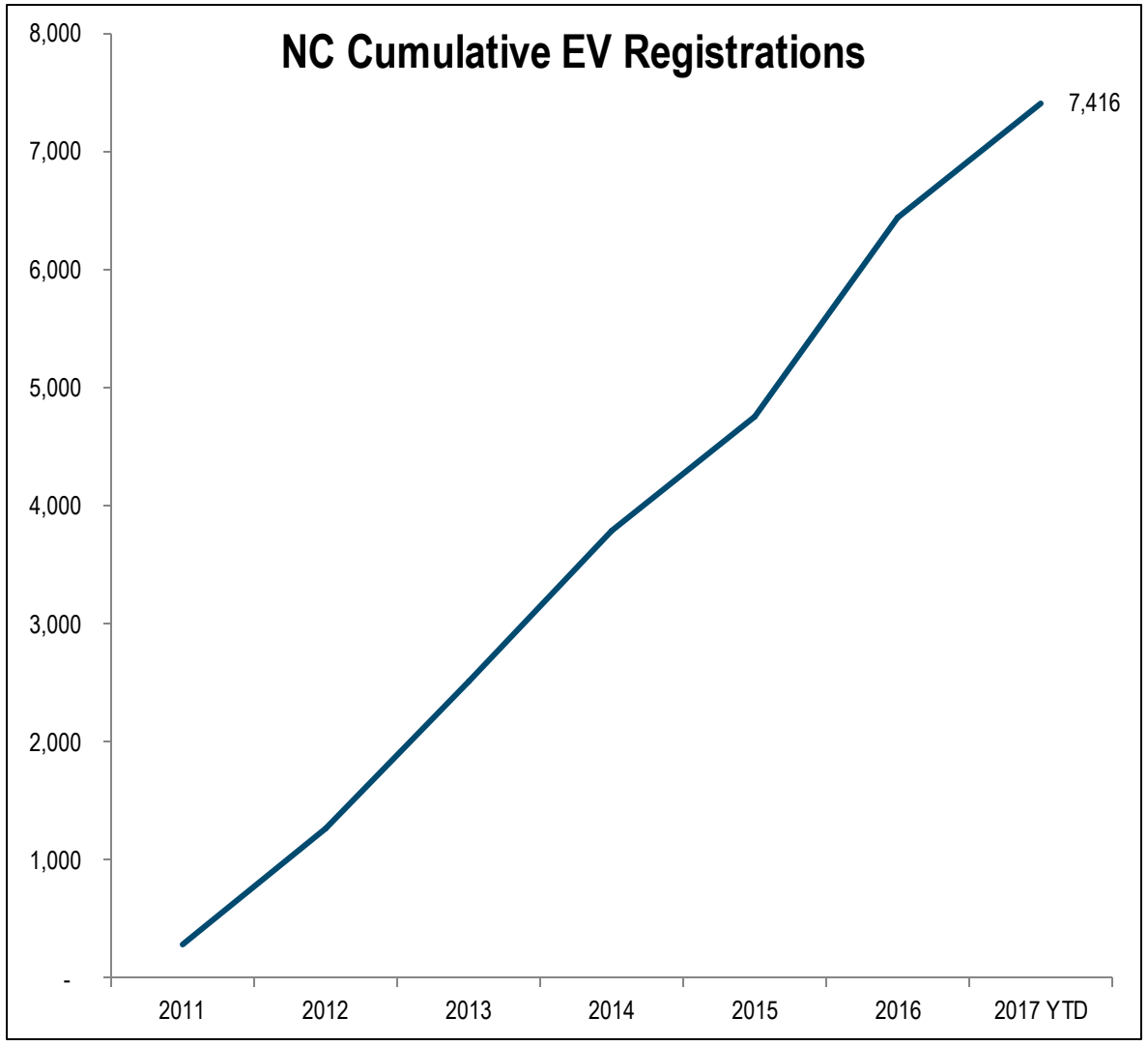
- Fuel and maintenance cost savings remain in-state.
- Improved air quality facilitates continued industrial recruitment.
- Automakers are expanding electric drive manufacturing and supply chain.
- Downward rate pressure preserves attractive electricity costs.

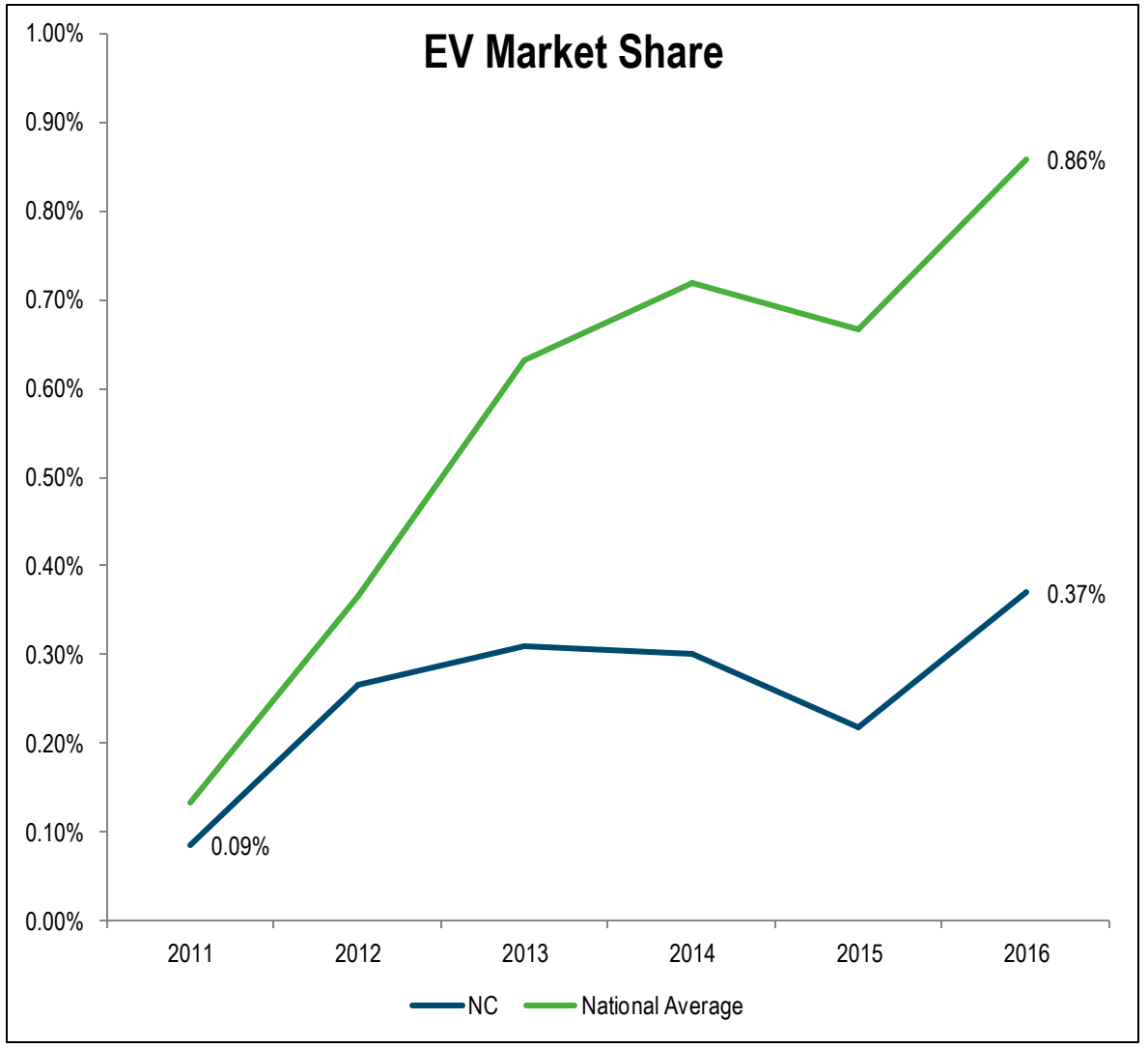
Electric Transportation Market – Not Just EVs

- Road

- Non-Road

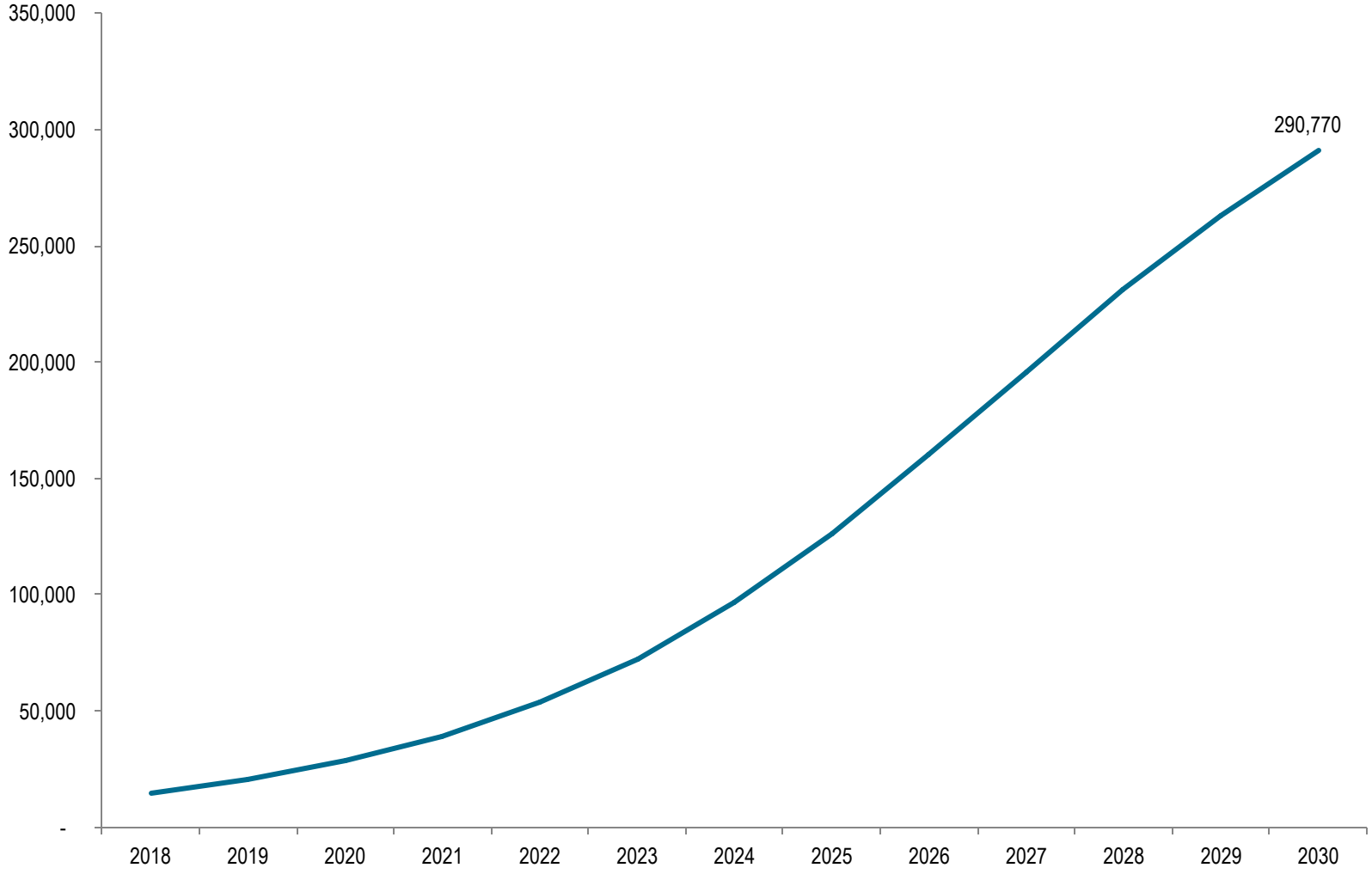
North Carolina – EV Sales Trends





Future Growth and Grid Impacts

Current Forecast:
Cumulative DEC+DEP EV Registrations



Current Forecast:
2030 Peak Load Impact
(Unmanaged)

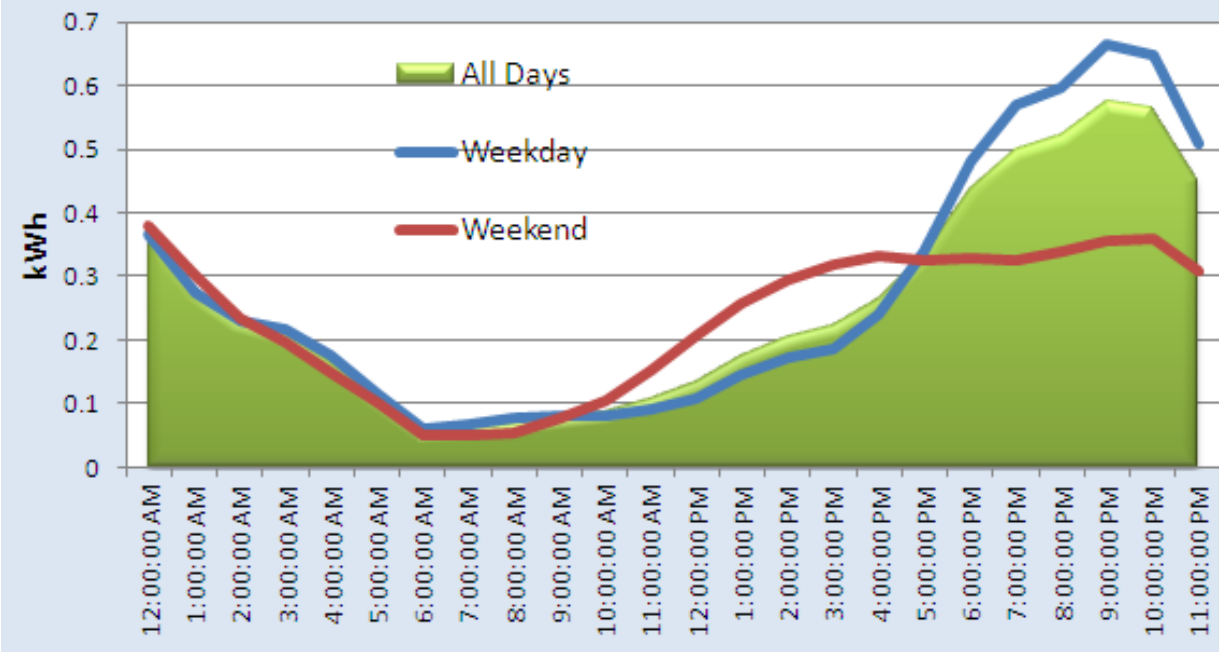
Summer	(HE17)	DEC 79 MW
		DEP 44 MW
Winter	(HE08)	DEC 11 MW
		DEP 6 MW

Growth in electricity demand from EVs not currently forecasted to require any incremental generation capacity.

Grid Impacts of Electric Transportation

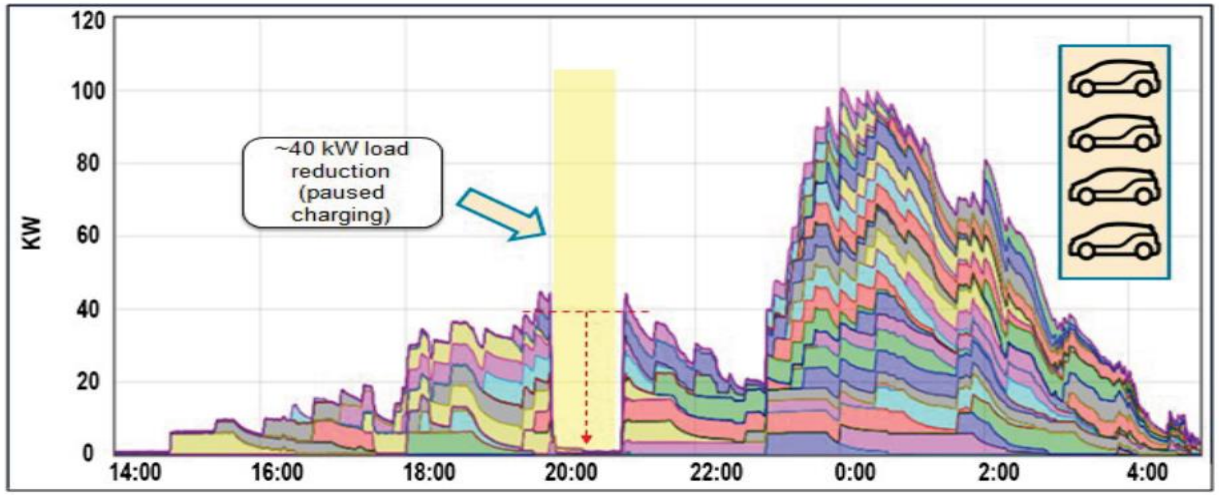
- EV charging is a very flexible load which can be managed to occur when beneficial for the grid.

Unmanaged



Source: ChargeCarolinas Data

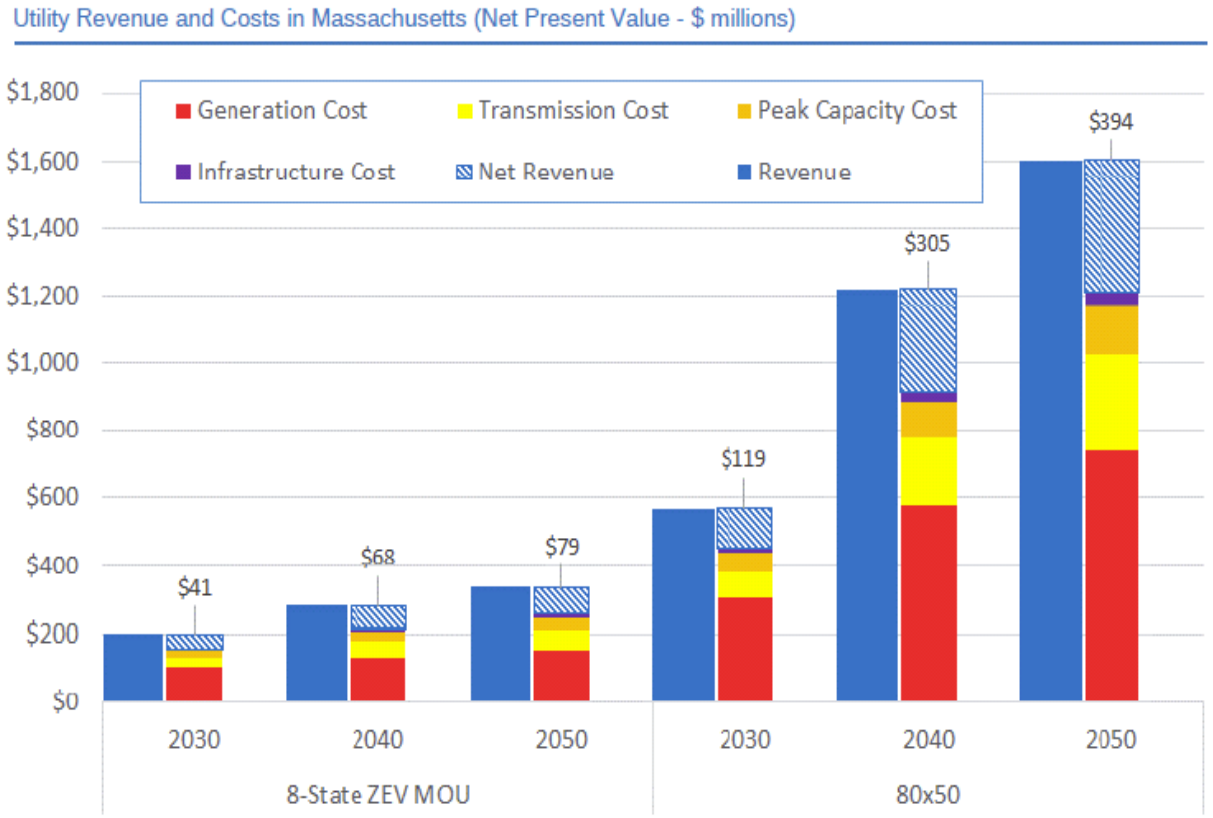
Managed



Source: Pacific Gas & Electric

Grid Benefits – EVs Can Benefit All Electric Customers

- Electric Transportation increases electric system utilization and can provide downward rate pressure.



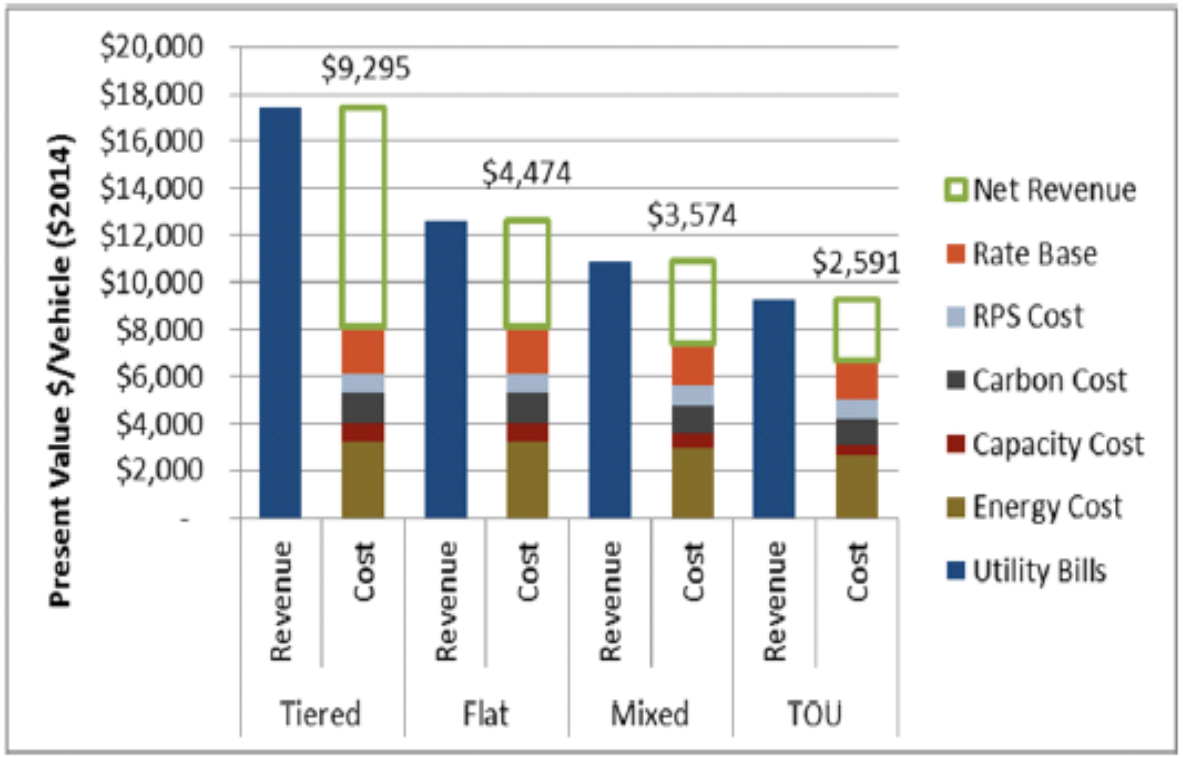


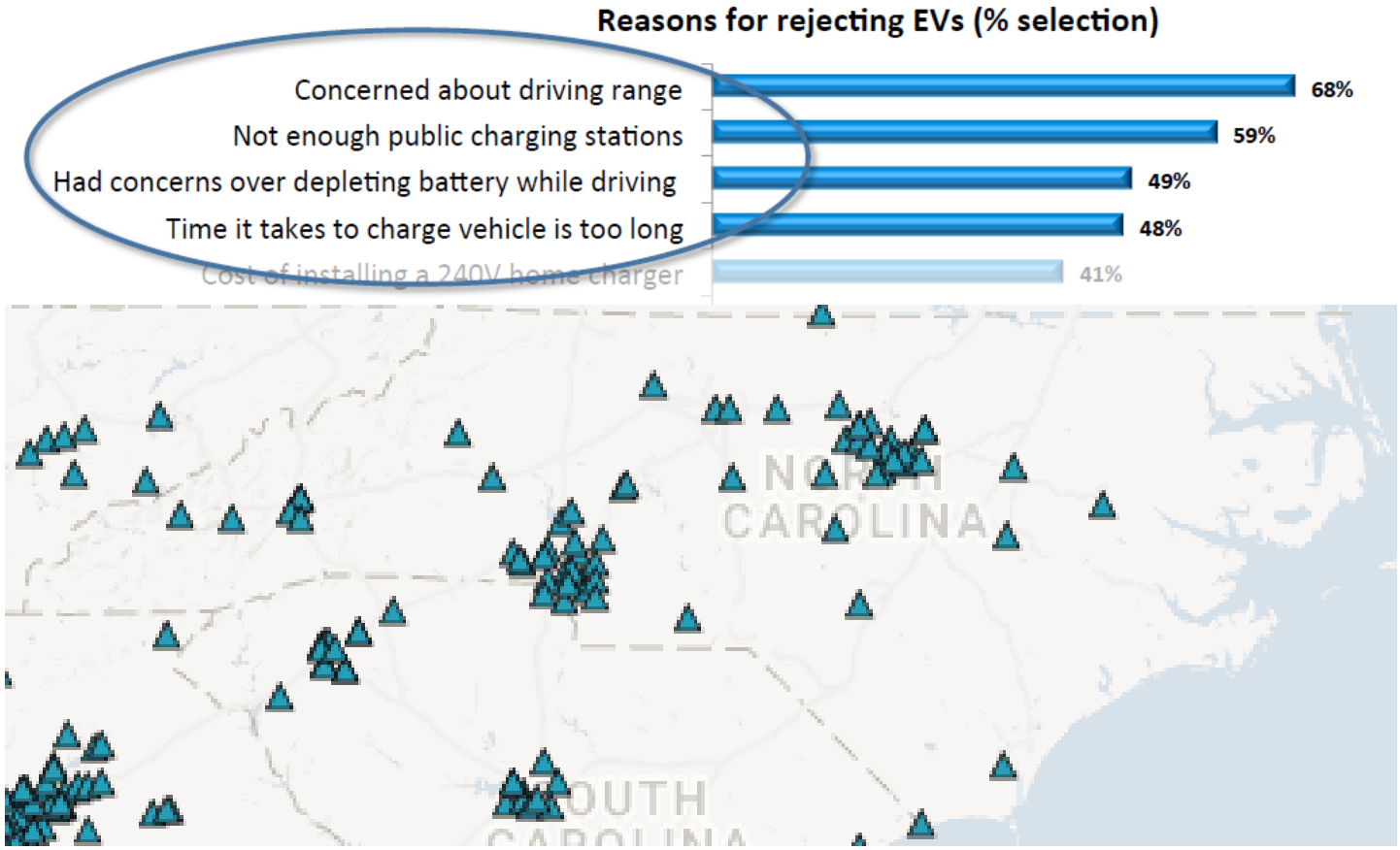
Figure 2. Utility Customer Benefits: Present Value of Revenue and Costs per Vehicle (Ratepayer Impact Measure Cost-test)

Source: MJ Bradley, E3

Market Barriers - Infrastructure

- Charging access is a barrier to adoption.
- North Carolina:

  64 Public DC Fast Charge Stations
- "Infrastructure Gap" exists between current state and facilitating future adoption.
- Challenging economics

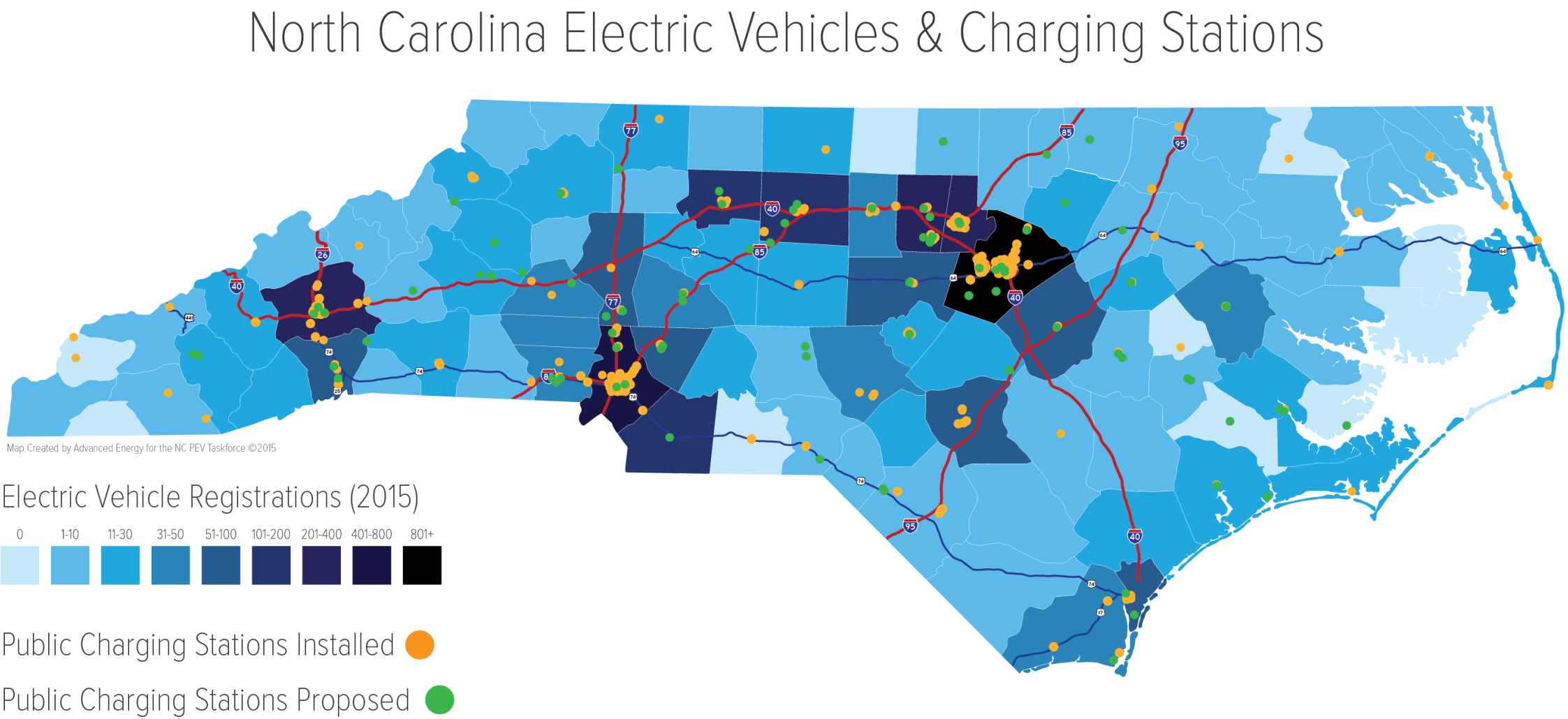


Source: https://www.afdc.energy.gov/fuels/electricity_locations.html

Closing Considerations

- Electrification of transportation is a global trend.
- Increased EV adoption can provide economic, environmental, and grid benefits.
- No adverse grid impacts have been experienced from EV adoption; none are expected in the near future.
- Making progress:
  - Set a Goal
  - Align Incentives
  - Remove Barriers

NC EV Charging Infrastructure Grants



Electric Vehicle Data Source: National Renewable Energy Laboratory, R.L. Polk, 2015 (data pulled by Triangle Clean Cities Coalition)
Charging Station Data Source: AFDC Alternative Fueling Station Locator Data, U.S. Department of Energy

Duke Energy Initiatives Past and Present

- ChargeCarolinas:
  - 2012-2013 DE installed +100 residential L2 EV charging stations.
- EEI Fleet Electrification Commitment:
  - 5% of all fleet purchases must be plug-in electric (DE fleet >10,000 vehicles).
  - 100% of new sedans are now plug-in electric.
- Electric Transportation Infrastructure Grants (NSR Settlement).
  - $3.0M total to be distributed 2017-2021
    - $1.0M - 200 public L2 EV charging stations.
    - $1.5M - Truck Stop Electrification and Electric Transport Refrigeration Unit deployment.
    - $0.5M – Electric transit bus charging infrastructure.
- DE Florida EV Infrastructure Pilot – 530 charging stations, $8M program.

Automaker OEM Electrification Announcements

OEM	Year	Mild Hybrid	Regular Hybrid	EV (PHEV/BEV)	Total Models	Quote
Volvo	2019	X	X	X		"All cars from 2019 will have an electrified option."
Jaguar / Land Rover	2020	X	X	X		"Every vehicle from 2020 will have an electrified version."
Lincoln	2022	X	X	X		"Electrified versions of its models."
Ford	2023	X	X	X	18	"18 electrified models in five years (Ford Corp)."
BMW	2025	X	X	12	25	"25 electrified vehicles by 2025"
Mercedes	2025	X	X	10		Up to 25% of production by 2025."
Aston-Martin	2025			X		"Electrify all production cars in 2025."
Hyundai	2025	X	X	X		"10% of sales will be electrified by 2025."
Audi	2025	X	X	X		"30% of sales will be electrified by 2025."
VW Group	2025			X	~~30~~ **80**	"Launch ~~30~~ **80** electric cars globally among VW's brands by 2025. Investing ~~$10B~~**$24B**.'
Uber	2020		X	X		"All-electric or hybrid in London by 2020."
Uber	2025			X		"All-electric or plug-in hybrid in London by 2025."

Source: EPRI

Aggressive Global Commitment to Transportation Pollution

Country	Year of Proposed Ban
Norway	2025
Netherlands	2030
Germany	2030
Scotland	2032
UK	2040
France	2040
India	2030

City	Year of Proposed Ban
Stuttgart	2018*
Munich	TBD
Oslo	TBD
London	2025
Madrid	2025
Paris	2025
Athens	2025
Mexico City	2025

North Carolina Energy Policy Council

AGENDA

10:00 a.m. Wednesday February 21, 2018
William G. Ross Jr. Environmental Conference Center
Nature Research Center
121 West Jones Street, Raleigh, North Carolina
27603

1. **Call to order, opening remarks, and approval of the minutes from the November 9, 2017, Council meeting (5 min)**
   Lieutenant Governor Dan Forest, Chair

2. **Discussion of Electric Vehicles: Infrastructure, Demands, and Priorities (2 hours)**

Break (15 min)

3. **Financing Opportunities; Volkswagen Settlement Agreement (1 hour and 10 min)**

4. **Council discussions and actions (10 min)**

5. **Public comment (10 min)**

6. **Closing remarks and adjourn (5 min)**
   Lieutenant Governor Dan Forest, Chair

FUTURE MEETINGS:

The Energy Policy Council will tentatively meet quarterly on the third Wednesday of the month. While this schedule is tentative and subject to adjustment, please reserve the following dates:

Wednesday May 16, 2018

Wednesday August 15, 2018

ADDITIONAL INFORMATION:

Persons having questions about the Council meeting or other matters related to the Council may contact Council staff Timothy Webster at timothy.webster@ncdenr.gov