SMART Series

EVs, ZEVs, and More: Electrifying Transportation in NC
SMART Series

presented by

THE RESEARCH TRIANGLE PARK
The Research Triangle Cleantech Cluster (RTCC) is an initiative of business, government, and academic leaders focused on accelerating the growth of the Research Triangle Region’s cleantech economy.
RTCC Board of Directors
RTCC Leadership Members
Building a Cleantech Corridor between RTP & Charlotte

- 3-year partnership
- $1.5m Project
- Focus Areas
  - Corridor Committee
  - Cleantech Accelerator
  - Ecosystem Expansion

North Carolina Cleantech Corridor
Cleantech Corridor Deliverables

Cleantech Commercialization Committee
- Enroll 20 industry and municipality mentors to advise startups in the Accelerator Program
- Identify 5 critical cleantech/smart cities technology gaps
- Connect 5 municipalities addressing a similar problem (i.e. electrification, storage, etc.)
- Identify 5 joint development opportunities between municipalities and utilities
- Launch 1 joint cleantech venture between Raleigh and Charlotte

Accelerator Program
- Graduate 12+ startups per year
- Identify 18 commercialization opportunities for accelerator startups (pilots, contracts, etc.)
- Assist in the delivery of 7 commercialization opportunities (resulting in revenue)
- Advise Catalyst startups in raising $150,000+ in funding in year one
- Identify 5 joint research opportunities between startups and universities

Ecosystem Expansion
- Add 4 new municipal members to the ecosystem; prioritizing smaller, distressed communities
- Add 4 new corporate members to the ecosystem
- Advise 200+ regional students through programming
- Connect 15 students with ecosystem job opportunities
- Commercialize 3 underlying IP opportunities from ecosystem partners
- Hold 14+ Ecosystem Outreach Events
SMART Series

EVs, ZEVs, and More: Electrifying Transportation in NC
SMART Series: EVs, ZEVs, & Electrifying Transportation in NC

Moderated by

Rick Sapienza
Director, Clean Transportation Program
NC Clean Energy Technology Center
RTCC SMART Series: EVs, ZEVs, and More
How NC Governments, Utilities, & Industry Are Driving Electrification of Transportation

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What is a ZEV (zero emission vehicle)?

• A vehicle that has zero tail pipe emissions.
  – Includes: EVs/BEVs and FCEVs
Electric Vehicle Benefits

- Performance and reliability
- Lower maintenance (brakes, fluids, no exhaust system, no starter, no transmission, no spark plugs, no catalytic converter, . . .)
- Low operating costs (2.5-3.0 cents/mile)
- Zero tail pipe emissions
- Energy independence
- Fuel diversity
NC Numbers for Vehicles

- 2018 NC PEV Market Share: 1.02%
- 2018 National Average: 1.33%
- 2018 Range: 0.24% (ND) to 7.84% (CA)
- ~6,500 EV Registrations
- ~10,000 PEV Registrations

Source: https://evadoption.com/ev-market-share/ev-market-share-state/ and NCDMV
Technology Adoption Curve

Microwave Oven:
- 1st commercial microwave 1947
- 9 of 10 kitchens in US 1997

HEV/EV History:
- GM EV1 1996
- Nissan Altra EV 1998

## Snapshot of US Public AFV Infrastructure

<table>
<thead>
<tr>
<th>US Public Alternative Fuel Stations</th>
<th>Stations</th>
<th>Plugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propane</td>
<td>467</td>
<td></td>
</tr>
<tr>
<td>CNG</td>
<td>921</td>
<td></td>
</tr>
<tr>
<td>LNG</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>EV L1</td>
<td>1,086</td>
<td>2,200</td>
</tr>
<tr>
<td>EV L2</td>
<td>17,948</td>
<td>45,177</td>
</tr>
<tr>
<td>EV DCFC</td>
<td>2,517</td>
<td>9,013</td>
</tr>
<tr>
<td>TOTAL EV</td>
<td>21,551</td>
<td>56,390</td>
</tr>
<tr>
<td>Ethanol</td>
<td>3,301</td>
<td></td>
</tr>
<tr>
<td>Biodiesel (&gt;B20)</td>
<td>197</td>
<td></td>
</tr>
</tbody>
</table>

Source: [https://afdc.energy.gov/stations/#/find/nearest](https://afdc.energy.gov/stations/#/find/nearest) (March 2019)

**NC Ranks #8 in number of EV Charging Station Locations**

156,000 Public Gas Stations in US

Stations & 707 EVSE, 1,162 plugs in NC (June 2019)
Number of US Charging Stations by State

January 2018

In the US, about 15% of public chargers are DC Fast Charging

Source: https://insideevs.com/number-of-charging-stations-in-u-s-increased-to-48000-15000-in-california/
Regional EV Operation Pollution Ratings

Life Cycle Manufacturing & Operating Emissions

>60 PEV options 2019 (May 2019)

Source: https://insideevs.com/compare-plug-ins/
MD/HD Electric Options Growing
50 States of Electric Vehicles

Quarterly report detailing state & utility activities related to EV

Studies & Investigations, Regulation, Utility Rate Design, Market Development, Financial Incentives, & Deployment

Tracking regulatory and legislative activity since Q4 2017

Access Executive Summaries & Learn More at https://nccleantech.ncsu.edu/the-50-states-reports
SAVE THE DATE: August 7-8, 2019
Pre-Conference Events August 6th
Durham Convention Center, Durham NC
SUSTAINABLEFLEETEXPO.COM
North Carolina State University
NC Clean Energy Technology Center
Clean Transportation Program
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https://lucidmotors.com/stories/lucid-air-hits-235-mph
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Policy Advisor
Office of NC Governor Roy Cooper
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Electric Transportation Manager for NC Duke Energy
Electric Utility Role

- Inform
- Encourage
- Demonstrate
- Foundational Infrastructure
Duke Energy NC ET Pilot Program (Proposed)

North Carolina

Rebates
- Residential charging stations
- Fleet charging stations

School Buses
- School bus charging infrastructure and battery

Transit Buses
- Transit bus charging infrastructure

Public Charging
- Multi-family charging
- Public Level 2 charging
- Public fast charging network
Electric Vehicles

Shaping the future and providing smarter, cleaner transportation.

Take Charge. Drive Electric

www.duke-energy.com
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Scott Williams
Regional VP for EV Infrastructure
ABB
JUNE 20 2019 SCOTT WILLIAMS

EV Infrastructure
Product Group presentation
Public and commercial car charging – Use cases
Charging service should match charging application and demand

<table>
<thead>
<tr>
<th>Public and commercial EV Charging</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AC destination</strong></td>
</tr>
<tr>
<td>3-22 kW</td>
</tr>
<tr>
<td>4-16 hours</td>
</tr>
</tbody>
</table>

- Office, workplace
- Home
- Multi family housing
- Hotel and hospitality
- Overnight fleet
- Supplement at DC charging sites for PHEVs
- Office, workplace
- Hotel and hospitality
- Parking structures
- Dealerships
- Urban fleets
- Public or private campus
- Sensitive grid applications
- Retail, grocery, mall, big box, restaurant
- High turnover parking
- Convenience fueling stations
- Highway truck stops and travel plazas
- OEM R&D
- Highway corridor travel
- Metro ‘charge and go’
- Highway rest stops
- Petrol station area’s
- City ring service stations
- OEM R&D
Influence on range and availability by AC slow and DC fast charging

Possibility to strongly extend the range of a BEV by DC fast charging

- Only AC slow charge (8 hrs)
  - Availability: 16 hours
  - Total range: 300 km

- AC slow charge (8 hrs) + 2x DC fast charge (each 30 min)
  - Availability: 15 hours
  - Total range: 900 km

- Extreme: for e.g. fleet owners: 3x DC fast charge (each 30 min)
  - Availability: 22.5 hours
  - Total range: 900 km
ABB as well in IONITY as in ELAM (Electrify America)

First public liquid cooled cable installations on May 3rd, 2018 in the USA, and on June 21st, 2018 in Europe

IONITY / ABB

IONITY will implement and operate a network of approximately 400 fast charging stations across 24 European countries by 2020.

ABB has been selected as technology partner and supplier for Terra HP charging systems by IONITY.

ELAM /ABB

Over a 10-year period ending in 2027, Electrify America will invest $2 billion in ZEV infrastructure, access, and education programs in the United States.

ABB has been selected to supply its Terra HP charging stations as part of the biggest electric vehicle infrastructure project to date in the United States.
ABB DC fast charge installations
Proven technology in the field since May 2010, now in 74 countries

Actual
Argentina, Australia, Austria, Azerbaijan, Bahamas, Belgium, Brazil, Bulgaria, Canada, China, Chile, Colombia, Croatia, Cuba, Czech, Denmark, Ecuador, Egypt, Estonia, Faroe Islands, Finland, France, Germany, Georgia, Greece, Greenland, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malaysia, Mexico, Monaco, Montenegro, Morocco, The Netherlands, New Zealand, Norway, Peru, Philippines, Poland, Portugal, Reunion Island, Romania, Russia, Saudi Arabia, Serbia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Arab Emirates, Ukraine, United Kingdom, USA.

Total more than 10,500 pcs DC fast charging units sold (≥10 kW), of which more than 1,200 pcs 150-450 kW High Power Charging systems (for car and bus)
ABB, eMobility and EV Charging

ABB’s focus and investments in eMobility are also recognized in the market place

ABB and Formula E

Together, Formula-E and ABB are defining the roadmap for electric mobility through motor sports.

Jaguar I-PACE eTROPHY Series

Jaguar I-PACE eTROPHY announces ABB as Official Charging Partner

ABB will provide custom-made, compact Terra fast chargers for the series

Fortune Magazine’s August 20th 2018

Recognizing ABB’s groundbreaking leadership in e-mobility, Fortune Magazine today selected ABB as #8 on its 2018 “Change the World” list, a global ranking of companies whose innovative work is making a significant, positive social impact around the world.
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Upcoming Events

July 12 (Charlotte): Cleantech Corridor Kickoff

July 29-31 (Boone): Appalachian Energy Summit

Aug. 7-8 (Durham): Sustainable Fleet Technology Conference & Expo

Sept. 11-13 (Atlanta, GA): Smart City Expo Atlanta

Oct. 8-10 (National Harbor, MD): Smart Cities Connect

Nov. 19-21 (Barcelona, Spain): Smart City Expo World Congress