Planning for an Electric Future:

Trends, Technology, Transit and a Small Mountain Town’s Implementation Journey

September 8th, 2021
4:00-5:00pm
Meet the Panelists

Sarah R. Davis, AICP
Founder + CEO
S. R. D. Consulting

Joanna Hamblin
Sr. Marketing Manager
Motiv Power Systems

Vanessa Solesbee, CAPP
Parking & Transit Manager
Town of Estes Park
Learning Objectives

1. Gain a basic understanding of Electric Vehicle (EV) market trends and the environmental case for transportation electrification
2. Learn about the planning, physical infrastructure, technical and stakeholder considerations for EV adoption and implementation
3. Understand the operational realities of adding electric transit vehicles to your fleet – from advancements in battery technology to considerations for the built environment
4. Explore the benefits, challenges and considerations for municipal governments and private companies looking to go electric
Agenda

1. Electric Vehicle (EV) Market Trends
2. Electric Vehicle Types
3. Considerations for Going Electric
4. Planning for EV Infrastructure
5. Town of Estes Park Case Study
6. Fleet & Transit Case Studies
EV Market Trends

1.8M+ EVs in the US
10.2M+ EVs on the Road Globally

THE ELECTRIC CAR PAST AND FUTURE

1832
First crude EVs developed
1900-1912
EVs reach their heyday
1920-1925
Cheap Texaco crude oil fuels decline in electric vehicles
1971
Electric lunar rover is first manned vehicle to drive on moon
1973
General Motors unveils prototype for urban EV
1974-1977
U.S. carmaker Sebring Vanguard produces more than 2,000 CityCar EVs, which have range of 80-97km
1990-1992
New U.S. environmental regulations renew interest in EVs
1996
GM releases EV1, first mass-produced EV by major automaker
1997
Toyota introduces Prius, world’s first mass-produced hybrid
2008
Tesla launches commercial production of Roadster EV
2009-2013
U.S. government installs 18,000 residential, commercial, public chargers
2010
Nissan releases all-electric Leaf
2014
China’s BYD Auto releases F3DM, world’s first plug-in hybrid
2016
GM releases Chevy Bolt, its first electric car
2017
India’s power minister suggests country aims for EV-only sales by 2030
2020
Tesla targets annual sales of 1 million cars
2025
VW targets annual sales of 2-3 million EVs by this year
2030
Up to 200 million EVs projected to be in circulation
2040
EVs projected to account for 32% of global auto sales


Price photo by Reuters, others by Getty Images
Colorado EV Dashboard

Vehicles on the Road

<table>
<thead>
<tr>
<th>Make</th>
<th>Original Registrations</th>
<th>EVs on the Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart</td>
<td>173</td>
<td>100</td>
</tr>
<tr>
<td>Smith</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Subaru</td>
<td>75</td>
<td>73</td>
</tr>
<tr>
<td>Tesla</td>
<td>19,648</td>
<td>16,528</td>
</tr>
<tr>
<td>Model 3</td>
<td>9,120</td>
<td>7,729</td>
</tr>
<tr>
<td>Total</td>
<td>49,725</td>
<td>39,415</td>
</tr>
</tbody>
</table>

Utility Name

<table>
<thead>
<tr>
<th>Utility Name</th>
<th>Original Registrations</th>
<th>EVs on the Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Hills Colorado Electric, LLC</td>
<td>1,854</td>
<td>1,448</td>
</tr>
<tr>
<td>City of Burlington (CO)</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>City of Colorado Springs (CO)</td>
<td>2,287</td>
<td>1,812</td>
</tr>
<tr>
<td>City of Fort Morgan</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>City of Loveland (CO)</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>Delta Montrose Electric Assn</td>
<td>176</td>
<td>163</td>
</tr>
<tr>
<td>Total</td>
<td>49,725</td>
<td>39,415</td>
</tr>
</tbody>
</table>

Charging Deployment

- Port Count: 3,663
- Level 2 Ports: 3,170
- Level 2 per 1k People: 0.57
- DCFC Ports: 493
- DCFC per 1k People: 0.09
- Networks: 14

Charging Map Selection

- Charging Ports by Network
  - DC Fast Charge Ports Level 2 Ports

Cumulative Charging Ports

- DC Fast Charge Ports Level 2 Ports
Types of Electric Vehicles

- **Conventional Gas**
  - **Powered By**: Gas engine
  - **Battery Travel**: None
  - **Fuel Source**: Gas

- **Conventional Hybrid**
  - **Powered By**: Gas engine & electric motor
  - **Battery Travel**: Short distances
  - **Fuel Source**: Gas

- **Plug-in Hybrid**
  - **Powered By**: Electric motor & gas engine
  - **Battery Travel**: Medium distances
  - **Fuel Source**: Electricity & Gas

- **Battery-Powered**
  - **Powered By**: Electric motor
  - **Battery Travel**: Long distances
  - **Fuel Source**: Electricity

Source: NYSERDA

Increasingly Electric-Powered

Decreasingly Pollutant Emitting
Different Shapes and Sizes
Vehicle Classes at a Glance

Class 1-3
Passenger Cars / Light Commercial

Class 4-6
Medium Duty

Class 8
Heavy Duty

Micromobility

Due to:

- Passenger vehicle deployment volumes, and
- Battery prices decreasing across entire market
Electric Vehicles on the Road
The Impact of Transportation Electrification

AIR QUALITY

ENERGY GENERATION

REDUCED MAINTENANCE + FUEL COSTS

Figure ES-6: 2019 CO₂ Emissions from Fossil Fuel Combustion by Sector and Fuel Type

U.S. primary energy consumption by energy source, 2019

Note: Sum of components may not equal 100% because of independent rounding.
Source: U.S. Energy Information Administration, Monthly Energy Review, Table 1.3 and 10.1, April 2020, preliminary data.
Colorado’s EV Plan 2020

“Large-scale transition of Colorado’s transportation system to zero emission vehicles, with a long-term goal of 100% of light-duty vehicles being electric and 100% of medium- and heavy-duty vehicles being zero emission.”
100% Renewable by 2040

- Decarbonize Colorado’s economy 90% below 2005 levels by 2050
- Many Utilities In-State are Committing to 100% carbon-free energy by 2030-2040
- Expanded energy efficiency and EV programs
Colorado’s EV Programs

Charge Ahead Colorado Grant Funds

<table>
<thead>
<tr>
<th>RAQC</th>
<th>CEO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funding</td>
<td>Charging Stations - Level 2 and Level 3</td>
</tr>
<tr>
<td>Charging Station</td>
<td>Entities located in Colorado outside of the seven county Denver Metro Area.</td>
</tr>
<tr>
<td>Funding Available</td>
<td>RAQC and CEO will fund 80% of the cost of a charging station up to the following set maximums:</td>
</tr>
<tr>
<td></td>
<td>- Level 2, Fleet Only Charging Stations: $6,000</td>
</tr>
<tr>
<td></td>
<td>- Level 2, Dual Port Station (up to 25kW): $9,000</td>
</tr>
<tr>
<td></td>
<td>- Level 3, Multiple Connection Standard Station (minimum 50kW) $35,000</td>
</tr>
<tr>
<td></td>
<td>- Level 3, Ultra-Fast Multiple Connection Standard Station (minimum 100kW) $50,000 (limited availability at the discretion of the awarding agency).</td>
</tr>
<tr>
<td>Note</td>
<td>Please see the Application Guide for more information on charging station types.</td>
</tr>
<tr>
<td>Funding Priority</td>
<td>Priority is directed to those organizations that are excluded from existing state tax credits and incentives. Charging stations eligible for funding include local governments, school districts, State agencies, and non-profit agencies. Apartment/condominium complexes, and businesses that own multi-vehicle parking facilities for fleet, public or guest/visitor are also eligible for charging station funding.</td>
</tr>
<tr>
<td>Note</td>
<td>Funding is directed to private non-profit or for-profit corporations, state agencies, federal agencies, public universities, and public transit agencies, in addition to local governments, landlords of multi-family apartment buildings and homeowner associations (as defined more specifically in C.R.S. Article 33.3 of title 38).</td>
</tr>
</tbody>
</table>

Can Do Colorado eBike Pilot

Colorado EV Corridors
ELECTRIFICATION IS TRANSFORMING THE WORKING WORLD

Internal combustion WON'T drive the vehicles of tomorrow
Why Go Electric?

- When switching to **ALL-ELECTRIC**, you not only save the environment, but you also save on recurring fuel, maintenance, and operation costs.

- Eliminate gasoline
- Eliminate transmission servicing
- Eliminate oil changes
- Reduce brake wear
- Eliminate exhaust components
- Eliminate emissions testing
- Eliminate air filters
- Reduce belts
- Eliminate vacuum lines
Why Go Electric?

FOR FLEET MANAGERS
• Up to 85% O&M savings
• Compliant with new regulations
• Real time data tracking

FOR DRIVERS
• Comfortable and responsive
• No more fuel stops or idling
• Configurable regenerative braking

FOR RIDERS
• Healthier for communities, no tail-pipe emissions
• Cleaner for the environment
• Comfortable, no vibrations
• No noise for quieter rides
8 Key Considerations for Going Electric

1. Evaluate routes & usage patterns
2. Vehicle range, battery performance and quality
3. Sustainability goals
4. Commercial EV fit
5. Charging infrastructure
6. Navigating subsidy landscape
7. Robust support plan
8. Monitor vehicle performance and collect driver feedback
EV INFRASTRUCTURE

LEVELS, CONNECTOR TYPES, AND SITING
EV Charging Levels and Connector Types

**Private**

**AC Level One**

- **VOLTAGE**: 120v 1-Phase AC
- **AMPS**: 12–16 Amps
- **CHARGING LOADS**: 1.4 to 1.9 KW
- **CHARGE TIME FOR VEHICLE**: 3–5 Miles of Range Per Hour

**Public Facing**

**AC Level Two**

- **VOLTAGE**: 208V or 240V 1-Phase AC
- **AMPS**: 12–80 Amps (Typ. 32 Amps)
- **CHARGING LOADS**: 2.5 to 19.2 kW (Typ. 7 kW)
- **CHARGE TIME FOR VEHICLE**: 10–20 Miles of Range Per Hour

**DC Fast Charge**

- **VOLTAGE**: 208V or 480V 3-Phase AC
- **AMPS**: <125 Amps (Typ. 60 Amps)
- **CHARGING LOADS**: <90 kW (Typ. 50 kW)
- **CHARGE TIME FOR VEHICLE**: 80% Charge in 20–30 Minutes

Level 2 Charging Applications

Qualifies for LEED and other Building Standard Points

Residential

Workplace

Source: ChargePoint

Source: Op Connect

Source: S. R. D. Consulting

Public

Fleet
# Elements of Level 3 Charging Stations

<table>
<thead>
<tr>
<th>Charge Post</th>
<th>Parking Stalls</th>
<th>Cabinets + Switchgear</th>
<th>Transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Accessibility</em></td>
<td><em>ADA Compliance</em></td>
<td><em>Proximity to Stalls</em></td>
<td><em>Utility Coordination</em></td>
</tr>
<tr>
<td><em>Plug Type</em></td>
<td><em>Wayfinding + Stall Signage</em></td>
<td><em>Conduit Runs</em></td>
<td><em>Signage</em></td>
</tr>
<tr>
<td><em>Amenities</em></td>
<td></td>
<td><em>Screening</em></td>
<td><em>Access</em></td>
</tr>
<tr>
<td><em>Daily Usage</em></td>
<td></td>
<td><em>Accessibility</em></td>
<td><em>Screening</em></td>
</tr>
</tbody>
</table>
EV Charging is NOT a Gas/Fueling Station

**Zoning**
- L1 + L2 All Zones
- L3
  - Commercial
  - Multi-Family
  - Corridors
- Make Ready Requirements

**Environmental Impacts**
- No Underground Storage Tanks
- No Hazardous Materials
- No Re-Fueling Required
- No Spills or Leaks

**Trip Generation**
- Traditional Gas Station
  - 5-7 min dwell time
  - VS
- L3 - DC Fast Charger
  - Average 40 min

**Safety + Accessibility**
- Lighting
- Access
- Trip Hazards
- ADA

24
Other Site Features to Consider

Parking Requirements

- Recommend or require a proportion of parking spaces be EV charging or EV ready.
- Require a portion of EV charging stalls also be accessible.
- Count EV charging stalls towards meeting parking requirements.

Signage

- Violators subject to $150 fine plus fees. C.R.S. 42-4-1213
Case Study
TOWN OF
ESTES PARK, COLORADO
Estes Park, Colorado

- Home to ~6,000 residents
- Small, mountain town character
- Gateway to Rocky Mountain National Park
- ~4 million annual visitors
EV’s in Estes Park Today

- 84 EVs on the Road; 61 are Fully Electric
- 30+ public charging connectors (Level 2 & 3)
- 17+ charging locations
- 1 (of 2) battery-electric trolley vehicles

Most Popular – Tesla Model 3

Highest Rated Charging Station – The Stanley Supercharger
EV Infrastructure & Readiness Planning

✔ Maximize the Town’s existing EV infrastructure investment, and

✔ Incorporate an action-oriented implementation plan to guide the Town’s future EV investment in infrastructure and fleet

✔ Explore policy, land use and environmental implications

Vehicles of Focus

Light-Duty or Passenger
100% Battery or Plug-In Hybrid

TOWN OF
ESTES PARK
COLORADO

Electric Bikes + Micromobility

Transit + Fleets
Key Considerations

- Awareness and Education
- Visibility and Accessibility
- Funding and Incentives
- Barrier Reduction
- EV Tourism
- Connection with Natural Environment (Scenic Byways)
Sustainability & Resiliency

• 2/3 of Town-owned fleet will be electric (2022); 1/3 of all Estes Transit vehicles
• $3,000+ operational savings to date (2021)
• Reduce 16 different pollutants, most notably CO2 (over 100k lbs. and climbing!)
• Improved Experience for Riders + Pedestrians
Planning for the Future

- Phased Infrastructure Approach
- Identify Funding Strategies
- Adopt Policy + Code Recommendations
- Ensure Regional Coordination
- Explore Time of Use Rates with Utility
- Incorporate Micromobility
SACRAMENTO AREA SCHOOL DISTRICTS (TYPE A SCHOOL BUSES)

Case Study

CHASSIS
• Built on EPIC E-450 with 106 kWh

FLEET
• 11 buses deployed in 2018

PROOF OF PERFORMANCE
• Routes range from 45-75 miles
• 92,000 miles and counting
• Motiv provided driver training and mechanic training to maximize performance and reliability
• > 90,000 miles, > 97% uptime
• CO2 emission savings – 91 metric tons
Case Study

MOUNTAIN VIEW/ GOOGLE COMMUNITY SHUTTLES

CHASSIS
• Built on EPIC E-450 with 127 kWh

FLEET
• 4 shuttles deployed in 2015, 2 more in 2016

PROOF OF PERFORMANCE
• 13-mile loop, 30 stops, 5-6 routes per day per vehicle, 65-85 miles per day
• > 415,000 miles, > 18,000 routes, > 700,000 passengers
• Extremely positive feedback from Mountain View residents, continue to use buses beyond designed project life
• CO2 emission savings – 410 metric tons
Case Study

ARAMARK/AMERIPRIDE DELIVERY VANS

CHASSIS
• Built on EPIC F-59 with 127 kWh

FLEET
• 10 step vans deployed in 2017
• 21 additional vans deployed in 2018 and 2019 across 4 more depots
• 50 additional vehicles planned for 2021

PROOF OF PERFORMANCE
• 13-hour work days with 50-85 mile routes
• 371,000 miles > 98% uptime
• CO2 emission savings – 472 metric tons
## What Role Do You Play?

<table>
<thead>
<tr>
<th>Air Emissions</th>
<th>Energy</th>
<th>Transportation</th>
<th>Education</th>
<th>Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set air emission targets that include transportation.</td>
<td>Work with utilities to ensure adequate infrastructure and appropriate rates are in place.</td>
<td>Future-proof transportation plans to contemplate EVs, charging, + autonomous, connected vehicles.</td>
<td>Inform the public about EVs and their impact on reducing emissions.</td>
<td>Advocate for policies and incentives that breakdown inequitable barriers to EV adoption.</td>
</tr>
<tr>
<td>Work with public health organizations with aligned goals.</td>
<td>Encourage charging providers to co-locate solar and/or battery storage to offset energy demands.</td>
<td></td>
<td></td>
<td>Ensure a whole-city, whole-county, and whole-region approach to EV plans.</td>
</tr>
</tbody>
</table>
Thank You!

Contact Us:

Sarah R. Davis, AICP
S. R. D. Consulting
sdavis@srdconsult.com

Joanna Hamblin
Motiv Power Systems
[Insert Email]

Vanessa Solesbee, CAPP
Town of Estes Park
[Insert Email]
Tracking Legislation, Policies, and Incentives

- **Alternative Fuels Data Center**
  By Department of Energy

- **State Policies Promoting Hybrid and Electric Vehicles Tracker**
  By National Conference of State Legislatures

- **Electric Vehicle Legislation Tracker**
  By PlugInSites
Developments in EV Charging

Vehicle-to-Grid (V2G)

- Using a bidirectional or two-way charger an EV could:
  - Draw from the grid or home system when it is low, and
  - Provide power back to the home or grid when needed.
- Acts as a mobile storage for critical events or to balance capacity demand
- Be Aware: Many vehicle manufacturers will void their warranty if a vehicle is connected to a bidirectional charger.

Source: Clean Technica
Developments in EV Charging

- Solar, Storage, Plus EV Charging
- Microgrid Integration
- Inductive or Wireless Charging
Innovations on the Horizon

- Solid-State Batteries
- Hydrogen Fuel Cell
- Rivian Adventure Network
- Urban Air Mobility