Electrifying State Light-Duty Fleets & Transit

Amanda Graor, Chief Innovation Officer, Mid-America Regional Council

#WeTheStates
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Ryan Daley, CEO, Sawatch Labs

#WeTheStates
Data Driven Fleet
Electrification & Optimization

NGA North Central Transportation Electrification Workshop
April 29, 2019
Sawatch Labs Approach

Telematics

Analytics

Compliance

Management
Estimated Operational Metrics in a 2018 Nissan Leaf

These metrics estimate what the usage numbers would be if the miles driven by your 2008 FORD Fusion had been driven in an EV.

<table>
<thead>
<tr>
<th>VMT</th>
<th>GHG Reduction</th>
<th>CPM Reduction in an EV¹</th>
<th>Operational Savings²</th>
<th>TCO Change²</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,350</td>
<td>80%</td>
<td>15%</td>
<td>$12,000-$15,000</td>
<td>$6,000-$9,000</td>
</tr>
</tbody>
</table>
Are they actually...

- Approaching an ROI?
- Plugging in?
- Fully charged?

Missed Opportunities

- e-vmt > g-vmt

Operators of 3 Ford Fusion Plug-in Hybrid Electric Vehicles were notified on 2018-09-23 that the vehicles were not being charged frequently enough.

Plug-in utilization is calculated by dividing the number of plug-in events by the number of plug-in opportunities.
Employee Mobility

- Fleet Share
- Right miles on the right tech
- Right-sizing
- Multimodal
- Cost, time, sustainability
EV Suitability Assessments with States

**Colorado Fleet Details Path to 200 EVs by 2020**

February 27, 2019 • by Thi Dao


**Utah**
- 1,300 Vehicles across all state departments
- EVSE needs statewide
- Initiated 3/20/19

**Ohio**
- Pilot with ODRC at correctional facilities
- 10 Vehicles
- Initiated 2/1/19
Thank You!

Ryan Daley
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Electrifying State Light-Duty Fleets & Transit

John Walsh, Senior Vice President of Sales, Proterra
Proterra’s Mission
Advancing electric vehicle technology to deliver the world’s best-performing heavy-duty vehicles

- Offices and manufacturing in CA and SC
- 500+ employees, with strong transportation expertise
- >90 customers; >700 vehicles sold
- >265 vehicles delivered; >7,000,000 service miles
- >39,000,000 pounds of CO2 emissions avoided

Strong Transportation Expertise

World-Class Financial Partners
HIGH-QUALITY, ADVANCED MANUFACTURING FOR RAPID EV ADOPITON AT SCALE

Burlingame, California
Battery Manufacturing
Company HQ

Los Angeles, California
Bus Manufacturing
West Coast Operation

Greenville, South Carolina
Bus Manufacturing
East Coast Operation
Announced Proterra customers in the Central US:

- **Illinois**
  - Chicago Transit Authority (CTA)
  - Bloomington-Normal Public Transit System (Connect Transit)
  - Quad Cities METROlink
  - Jones Lang LaSalle

- **Iowa**
  - DART Des Moines

- **Kansas**
  - Wichita Transit

- **Michigan**
  - Blue Water Area Transit

- **Minnesota**
  - Duluth Transit Authority

- **Ohio**
  - Laketran County

- **Wisconsin**
  - La Crosse MTU

>700 buses sold to >90 customers across 41 states/provinces
THE SOLUTION: REVOLUTIONARY APPROACH TO TRANSPORT

THE ONLY TRANSIT PLATFORM DESIGNED SPECIFICALLY FOR EV PERFORMANCE

- **Reliable**
- **Clean** 100+% Less Tailpipe emission
- **Efficient** 25+% Quieter 400+% More fuel efficient
- **Quiet**
- **Demonstrable ROI** 78+% Lower lifetime fuel cost
- **Flexible and scalable**
• Moving toward widespread industry adoption

• Purchase barriers eliminated due to:
  - Improved range
  - Charging standardization
  - Sharp decline in battery costs
  - Service-proven performance
  - Increased total cost of ownership
  - Environmental stewardship
  - Rising health costs associated with fossil fuels
  - Government programs (e.g., grants)
  - Urbanization
MAJOR COMMITMENTS TO 100% EV TRANSIT

EV Transit Bus adoption continues to increase

Source: Frost & Sullivan Heavy Duty Transit Bus North America Powertrain Adoption Forecast

Major cities adopting EV technology for transit buses

- **New York**: 100% EV by 2040, 4,700 buses
- **Chicago**: Piloting since 2014, 2,100 buses
- **Washington D.C.**: 100% EV by 2045, 1,900 buses
- **Seattle**: 100% EV by 2034, 1,500 buses
- **Philadelphia**: Piloting since 2017, 1,500 buses
- **Miami**: 50% EV by 2035, 800 buses

California mandates 100% electric transit buses by 2040

- **New purchase mandates**
  - **25% by 2023**
  - **50% by 2026**
  - **100% by 2029**

12,000 buses across California (17% of nationwide fleet)

Source: National Transit Database; agency websites; 2017 American Public Transportation Association Fact Book
<table>
<thead>
<tr>
<th></th>
<th>Proterra EV</th>
<th>Diesel Bus</th>
<th>CNG Bus</th>
<th>Diesel Hybrid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle</td>
<td>$749</td>
<td>$493</td>
<td>$531</td>
<td>$712</td>
</tr>
<tr>
<td>Energy/Fuel</td>
<td>$94</td>
<td>$381</td>
<td>$336</td>
<td>$297</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$275</td>
<td>$450</td>
<td>$500</td>
<td>$550</td>
</tr>
<tr>
<td>TCO</td>
<td>$1,118</td>
<td>$1,324</td>
<td>$1,367</td>
<td>$1,559</td>
</tr>
<tr>
<td>TCO $'s/Mile</td>
<td>$2.24</td>
<td>$2.65</td>
<td>$2.73</td>
<td>$3.12</td>
</tr>
</tbody>
</table>

Est. over 12 year lifetime / $ in thousands, except TCO $'s/mile

- **Battery-electric vehicles** have the **lowest operational lifecycle** cost:
  - High EV energy efficiency, low electricity rates, and high annual vehicle mileage combine to create significant fuel savings
  - **30% fewer parts** dramatically reduce maintenance and operating costs
  - Electricity prices far **more stable** and predictable than volatile fossil fuel prices

**12-yr Operational Savings per Bus**

- **$462k vs. Diesel**
- **$467k vs. CNG**
- **$479k vs. Hybrid**
Advanced battery technology cost has declined to the point of replacing fossil fuels in the transit market.

Sources: Navigant Research, green.autoblog.com, Electric Drive Transportation Association. xEV = PHEV, HEV, EREV and BEV.
THE PROTERRA CATALYST’S RANGE

PROTERRA CATALYST® E2 MAX SETS WORLD RECORD AND DRIVES 1,101.2 MILES ON A SINGLE CHARGE

*Depending on model. Nominal range = total energy/ projected Altoona efficiency. Actual range will vary with route conditions, battery configuration and driver behavior.
### Annual Diesel Health Impacts in the US  
(Number of cases in 2010)

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premature Deaths</td>
<td>21,000</td>
</tr>
<tr>
<td>Lung Cancer Deaths</td>
<td>3,000</td>
</tr>
<tr>
<td>Hospital Admissions</td>
<td>15,000</td>
</tr>
<tr>
<td>Emergency Room Visits for Asthma</td>
<td>15,000</td>
</tr>
<tr>
<td>Non-fatal Heart Attacks</td>
<td>27,000</td>
</tr>
<tr>
<td>Asthma Attacks</td>
<td>410,000</td>
</tr>
<tr>
<td>Chronic Bronchitis</td>
<td>12,000</td>
</tr>
<tr>
<td>Work Loss Days</td>
<td>2,400,000</td>
</tr>
<tr>
<td>Restricted Activity Days</td>
<td>14,000,000</td>
</tr>
</tbody>
</table>
TRANSIT ELECTRIFICATION POLICY DEVELOPMENTS

- New York’s Truck Voucher Incentive Program offers $150k per Proterra bus
- FAST Act: LowNo grants increased >100% to $55M annually; introduction of innovative procurement methods and leasing options
- Maryland Freedom Fleet Voucher program offers $20k per heavy duty vehicle; BG&E used to purchase 2 Proterra buses

- LA Metro Board passed resolution to convert its entire bus fleet to all-electric by 2030; LA DOT also moving to 100% zero emission by 2030
- Colorado now funds up to $35k per vehicle for Class 8 vehicles
- Stockton, CA announced the nation’s first all-electric bus rapid transit (BRT) route
- Georgia now offers EV public transit buses on master state contract; CA will soon follow
- Chicago’s Drive Clean Truck Voucher Program offers $150k per Proterra bus
- King County announced the purchase of 120 electric buses by 2020; 100% EV by 2034
Through the Volkswagen Settlement, VW agreed to invest $2.925 billion nationwide under Appendix D - the Environmental Mitigation Trust, to reduce NOx emissions.

Of this, $513 million is allocated to the states in the Central Region (highlighted in map). Through the development of Beneficiary Mitigation Plans, these states have allocated approximately $141 million to replace transit and school buses to date, including electrification.

States investing heavily in electric buses include:
- Wisconsin: $32 million for transit bus replacement
- Illinois: $32 million for transit bus and passenger line projects
- Ohio: $15 million for transit bus replacement, $15 million for school bus replacement
- Indiana: $21 million for heavy-duty vehicle replacement, including $8.5 million for school buses
- Iowa: $9.5 million for transit and school bus replacement
- Missouri: $4 million for transit and $12 million for school bus replacement
- Minnesota: $4.1 for transit but replacement.
- Michigan: $3 million for school bus electrification
Grant “applicants may choose to combine formula and Low-No funding” – [FTA Low-No FAQ](#)

1. Use formula funds budgeted for replacement fossil fuel bus for electric bus
2. Reduce up-front capital cost by leasing battery
3. Leverage small Low-No Award to purchase many electric buses

** VW settlement dollars are also now available to use

Case Study: Jackson, Wyoming
- 8 buses with 2018 Low-No Award of $2,290,000

<table>
<thead>
<tr>
<th>Source of Funds</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Formula Funds</td>
<td>33%</td>
</tr>
<tr>
<td>Local Match</td>
<td>13%</td>
</tr>
<tr>
<td>Battery Lease Price Reduction</td>
<td>27%</td>
</tr>
<tr>
<td>Low-No Funds</td>
<td>27%</td>
</tr>
</tbody>
</table>
What Can Utilities Do?

• Customers are confused and unsure about large scale charging solutions; easing the customer experience through utility support can facilitate vehicle adoption
• Establish a transportation electrification group
• Support electrification efforts with lower TOU rates for charging and addressing demand charges
• Rate basing infrastructure build-out
• E.g. PECO developed model legislation that facilitates rate based long-term clean transportation infrastructure & time of use rates for the state of PA (HB 1446)
• Utilities can identify steps in interconnection and local permitting processes that can be streamlined and made more uniform

Why Beneficial?

• Potential to drive down average rates through infrastructure investment in high utilization projects
• Opportunity to strengthen utility service through a smarter grid
• Optimize the load profile on the grid through smart charging and using vehicles as distributed storage devices
• More load on the grid will potentially lead to lower electricity rates or the stabilization of such rates. EVs lead to increased throughput on utility distribution assets and more balanced loads in the generation market.
• Utilities can demonstrate their support for improving air quality and local health benefits, particularly in disadvantaged communities
OVERHEAD CHARGING
Keep your Catalyst buses rolling with easy depot or on-the-road charging, made simple by industry-standard SAE J3105 overhead systems.

- Charge on the road for longer routes or enable 24/7 circulator operations
- Low maintenance costs and high availability
- Compatible with roof-mounted pantographs as well as inverted pantograph systems, offered by Schunk and other suppliers

PLUG IN CHARGING
Regardless of your fleet size, powering up your Proterra buses at the depot is as easy as plugging in a standard J1772-CCS Type 1 charger.

- Universal chargers are offered by Proterra and other suppliers
- Catalyst vehicles can be configured with two charge ports for flexibility at the depot
- Electric buses, utility vehicles and cars can share the same standardized chargers
SMARTER CHARGING
PROTERRA POWER CONTROL SYSTEMS

60KW
For fleets with longer available charge times.
Catalyst E2 charge time: ~6 hours, w/ J1772-CCS plug-in

125KW
For fleets with high uptime requirements
Catalyst E2 charge time: ~3 hours, w/ J1772-CCS plug-in

500KW
For fleets with extended operating hours and high mileage requirements
Catalyst FC+ charge time: ~38 miles per 10 minutes, w/ J3105 overhead

INTELLIGENT
Automated and rules-based vehicle charging

UNIVERSAL
Standards-based, OCPP 1.6 open communications protocol-compatible

REMOTE
Can be located up to 492 feet from dispenser

SCALABLE
Can be installed side-to-side and back-to-back for high-density charger banks

COMPATIBLE CONNECTIONS

60KW for longer available charge times
125KW for high uptime requirements
500KW for extended operating hours and high mileage requirements

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COMPATIBLE CONNECTIONS
Proterra works closely with customer to recommend the **appropriate charging solution** for fleets and facilities planning for scale as the demand for charging increases.

Proterra technologies enable:
- Efficient charge speed
- Dynamic power sharing
- Driver-friendly stations
- Cost-effective operations
- Universal compatibility
- Serviceability
- Low maintenance costs
- High availability

Our experts provide counsel on:
- Site layout
- Energy management
- Real-time energy monitoring
- Site configurations
SAF-T-LINER® EC2™ SCHOOL BUS POWERED BY PROTERRA™

ZERO EMISSIONS
- 100% battery-electric with no tailpipe emissions

FAST CHARGING
- DC charging enables a full charge in ~ 3 hours using Proterra’s 60 kW PCS

HIGH PERFORMANCE
- Efficient, smart, safe drivetrain technology for optimal performance in any climate

PROVEN TECHNOLOGY
- Proterra batteries and drivetrains proven in more than 7,000,000 service miles on transit buses
Proterra Introduces the DuoPower™ Drivetrain for its Catalyst® Zero-Emission Buses at APTA

New drivetrain delivers nearly twice the horsepower and acceleration of a standard combustion engine and 500 percent improvement in efficiency

Proterra, Van Hool Venture to Build Electric Motor Coaches

Daimler invests in electric bus company Proterra; exploring electrification of Daimler's Thomas Built school buses

Proterra and Mitsui & Co., Ltd. Create $200 million Credit Facility to Scale Proterra Battery Leasing Program

Proterra Gives Fleet Operators More Reasons To Go Electric With New Line Of Charging Stations

Global Double Deck Bus Market Leader, Alexander Dennis, Selects Proterra to Power North America's First Electric Double Deck Transit Bus

Emphasizing Connectivity at Scale, Proterra Introduces the APEX™ Vehicle Intelligence System for Heavy-Duty Transit Fleets