Clean Corridors #3: Electric-Powered Trucks, Idle-Reduction Technology and Infrastructure

Northeast Clean Freight Corridors Workgroup

July 27, 2017
2:00 – 3:30 p.m. EDT

Pictures Above:
FHWA Designated AFV Corridors
Agenda

- Welcome & Overview
- Progress Against Roadmap
- Webinar Topic #3 – Electric Powered Trucks, Idle-Reduction Technologies and Infrastructure
- Workgroup Discussion
2017 NECFC Workgroup Roadmap

1# Clean Corridors: Where We Stand, 2017 Roadmap & Partner Updates
May 25, 2017

2# Gaseous and Liquid Alternative Fuel Technologies and Infrastructure
June 22, 2017

3# Electric-Powered Trucks, Idle Reduction Technology & Infrastructure
July 27, 2017

4# Priority Locations & Facility Types for Truck and Intermodal Idle Reduction and Alternative Fueling
August 24, 2017

5# Setting the Stage for NEDC Partners Meeting – “Filling the Infrastructure Gap”
September 7, 2017

2017 NEDC Partners Meeting
September 25&26, 2017
NJ Institute of Technology

NORTHEAST DIESEL COLLABORATIVE
FOR SUSTAINABLE TRANSPORTATION, GOODS MOVEMENT AND CONSTRUCTION
NEDC Partners Meeting

Growing the Market for Clean Technologies, Improving Communities and Advancing the Economy

Join NEDC Partners in Newark, NJ to learn and exchange strategies for advancing the future of clean transportation and goods movement in the Northeast.

September 25 & 26, 2017

New Jersey Institute of Technology
The Atrium at Campus Center
150 Bleeker Street
Newark, NJ 07102

Register for the NEDC Partners Meeting here. RSVP for Hotel Accommodations here.
Discussion Objectives

1. Understand the status and opportunity for truck idle-reduction and refrigeration technologies, medium- to heavy-duty hybrid and electric vehicles and infrastructure in the Northeast.
   - Existing and Emerging Technologies
   - Demonstration, Incentives and Growth Opportunities
   - Expanding Infrastructure for Transportation Electrification

2. Identify ways the NECFC Working Group can add value; provide a platform for information-sharing, and support regional planning and coordination efforts.
Discussion Leader Line Up
Clean Corridors #3: Electric-Powered Trucks, Idle-Reduction Technology and Infrastructure

- **Linda Gaines**, Ph.D., Center for Transportation Research, U.S. DOE Argonne National Laboratory
  
  *Onboard & wayside technology for truck idle reduction and refrigeration.*

- **Bill Van Amburg**, Senior Vice President, CALSTART
  
  *Status of electric & hybrid truck market, the road map to commercialization, and opportunities for the Northeast*

- **Patrick Bolton**, Senior Project Manager, New York State Energy and Research Development Authority
  
  *Successes in promoting truck technology demonstration and deployment, and building supporting infrastructure.*

- **John Shipman**, Department Manager of Demand Management, Customer Engagement and Electric Vehicle Programs, ConEdison
  
  *Utility perspective on the electrification of transportation, including heavy-duty applications.*
Idling Reduction: Technology and Economics

Linda Gaines
Argonne National Laboratory
lgaines@anl.gov

NECFC Webinar #3
Date: July 27, 2017
All sizes of vehicles idle!
In many cases, power is required for a service.

**Light Duty**
- Passenger vehicles including taxis, police cruisers, and light trucks

**Medium Duty**
- Utility vehicles, delivery trucks, shuttle buses, and ambulances

**Heavy Duty**
- Long-haul trucks, tour buses, school buses
Technology can enable idling reduction

- Auxiliary power units (APUs)
- Heating and cooling technologies
- Automatic engine start/stop (AESS) systems
- Telematics
- Electrified parking spaces (EPS; also called truck stop electrification [TSE])
### Compendium of available equipment coming soon

Lists equipment, vendors, prices, and much more

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Safer Corporation</td>
<td>VIESA Ecological Cab Coolers</td>
<td>Air Conditioner</td>
<td>EPA SmartWay</td>
<td>Yes</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Vans</td>
<td>Construction</td>
<td>Sleeper cab tractor</td>
<td>$1,937</td>
</tr>
<tr>
<td>Griffin</td>
<td>Griffin Idle Reduction System</td>
<td>APU (Battery)</td>
<td>No</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Armored vehicle</td>
<td>Armored vehicle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idle Free Systems</td>
<td>Idle Free Electric APU</td>
<td>APU (Battery)</td>
<td>Yes</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td>School bus</td>
<td>School bus</td>
<td>School bus, Day cab or sleeper cab tractor</td>
<td></td>
</tr>
<tr>
<td>Navitas</td>
<td>Idle-Reduction Battery Systems</td>
<td>APU (Battery)</td>
<td>Yes</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td></td>
<td>Ambulance</td>
<td>Ambulance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PACCAR</td>
<td>Peterbilt SmartAir</td>
<td>APU (Battery)</td>
<td>Yes</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td></td>
<td>Day cab or sleeper cab tractor</td>
<td>$7,800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rosenbauer America</td>
<td>Green Star IRT</td>
<td>APU (Battery)</td>
<td>Yes</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td></td>
<td>All diesel emergency vehicles</td>
<td>All diesel emergency vehicles</td>
<td>All diesel emergency vehicles</td>
<td>$5,000</td>
</tr>
<tr>
<td>Smart Power Solutions</td>
<td>Stealth Power</td>
<td>APU (Battery)</td>
<td>Yes</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Ambulance, Fire truck, Police, service, or utility vehicle</td>
<td>Ambulance, Utility vehicle</td>
<td>Ambulance, Sleeper cab tractor Utility vehicle</td>
<td>$4,295</td>
</tr>
<tr>
<td>Thermo King TriPac-E</td>
<td></td>
<td>APU (Battery)</td>
<td>Yes</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td>Sleeper cab tractor</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Auxiliary power units provide full service

- Power is provided for heat, A/C, electronics, etc.
- Powered by small diesel or battery
- May be wayside-power compatible
- Exempt from federal excise tax
- Region 1&2 states have APU weight exemptions
- Available for police cars up to long-haul trucks
Air conditioners cool the passenger compartment

- Engine-off A/C is powered by energy stored in battery or large block of ice while the truck is running
  - Increases operational fuel use by a small amount
  - Stored energy will not cover 34-hour restart
- May be shore-power compatible
- Evaporative coolers are an option for hot, dry climates
- Suitable for police cruisers up to long-haul trucks
Heaters are inexpensive

- Heat the cab/sleeper using <10% of the fuel used in engine idling
  
  *Air heaters* supply warm air to the cab/sleeper
  
  *Coolant heaters* heat the circulating coolant, providing some cab heat
- Suitable for all vehicles (*e.g.*, snow plows)
- Available for alt fuels as well as diesel

*FIGURE 3 Airtronic D2 Bunk Heater (Photo: Courtesy of Espar)*
Idle management systems turn the engine off

Idle timer
- Turns engine off after a preset amount of idle time
- Provides credit under Phase 2 GHG rules

Automatic engine shut-down/start-up system
- Turns engine off and restarts it based on cabin temperature and/or battery-charge level
- Especially useful for police vehicles at emergency sites
- May wake up sleeping driver
Connecting vehicles enables idling reduction
...and other smart transportation benefits, without automation

• Telematics systems vary in capability and sophistication
  • Simplest record vehicle position, speed, idling time for later download
    • Enable compliance with ELD mandate and HOS regulations
  • Can include real-time 2-way communication between driver and dispatcher
    • Coaching proper driving habits
    • Route and schedule changes
    • Vehicle diagnostics

• Transponders communicate with tolls, border crossings, weigh stations

• More efficient loading, fewer empty backhauls

• DOT Freight Advanced Traveler Information System (FRATIS) schedules truck movements at port and could reduce detention time
Single system EPS requires no on-board equipment

Electrified Parking Spaces (EPS) also known as Truck Stop Electrification (TSE)

Provides:
• Heating/cooling via duct
• Electrical outlets
• Internet/TV
• No e-TRU connection

No special on-board equipment needed (except inexpensive window adaptor)

Utilization 1.3%- 27.5%, average 10%

Installation at dedicated terminals achieves better results

Used with permission of IdleAir
Dual system EPS enables plug-in of on-board equipment

Provides electricity for on-board:
- Auxiliary power system
- Heater or air conditioner
- Other devices

Can plug in e-TRU at some locations

Hourly cost lower than single-system

Average utilization 0.4%, maximum 7.7%
EPS usage strongest in summer

FIGURE 24 Single-System Usage 2011–2014 (Courtesy of IdleAir)
And in the South
But there are 5 active sites in Northeast

<table>
<thead>
<tr>
<th>Location</th>
<th>Zip Code</th>
<th>Capacity Factor (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breezewood, PA</td>
<td>A 15533</td>
<td>5.74</td>
</tr>
<tr>
<td>Carlisle, PA</td>
<td>B 17013</td>
<td>22.1</td>
</tr>
<tr>
<td>Myerstown, PA</td>
<td>C 17067</td>
<td>19.6</td>
</tr>
<tr>
<td>Milton, PA</td>
<td>D 17847</td>
<td>7.4</td>
</tr>
<tr>
<td>Penns Grove, NJ</td>
<td>E 08069</td>
<td>12.9</td>
</tr>
</tbody>
</table>

All are single system EPS.
**EPS viability depends on high utilization**

**Installation at terminals is proving successful**

<table>
<thead>
<tr>
<th>Company</th>
<th>System</th>
<th>Type</th>
<th>Locations</th>
<th>Spaces</th>
<th>Rate/h</th>
<th>e-TRU capable</th>
<th>Cost per space</th>
<th>Maximum utilization</th>
<th>Average utilization</th>
<th>Payback at maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>ShorePower</td>
<td>Dual</td>
<td>Truck stop</td>
<td>35</td>
<td>1160</td>
<td>$1.00</td>
<td>Yes</td>
<td>$5000</td>
<td>7.7%</td>
<td>0.4%</td>
<td>8 y</td>
</tr>
<tr>
<td>IdleAir</td>
<td>Single</td>
<td>Truck stop</td>
<td>60+</td>
<td>1500</td>
<td>$1.85</td>
<td>No</td>
<td>$8000</td>
<td>27.5%</td>
<td>10%</td>
<td>2.5 y</td>
</tr>
<tr>
<td>IdleAir</td>
<td>Single</td>
<td>Terminal (bobtail)</td>
<td>~10</td>
<td>--</td>
<td>--</td>
<td>No</td>
<td>&lt;$5000</td>
<td>high</td>
<td>high</td>
<td>rapid</td>
</tr>
</tbody>
</table>

See all locations at [https://www.afdc.energy.gov/tse_locator/](https://www.afdc.energy.gov/tse_locator/)
Reasons are proposed for poor utilization

- There are not enough locations, and some are not convenient or are not well equipped with amenities truckers need, like showers.

- At many locations, there is not sufficient parking, and the EPS spots are often blocked by other trucks that are not plugged in but can find no place else to park.

- Many truckers do not know about the service, and truck stop management does not necessarily promote it effectively.

- The signage is sometimes inadequate.

- Some truck drivers might use the service if their companies reimbursed them or if they could use their fuel cards to pay.

- Many fleets are uninterested in using EPS, and, at low fuel prices, the service is less attractive financially.
Over $2/gal, all options reduce high idler’s costs. Equipment may not pay back for low idlers or cheap fuel.
Equipment pays back rapidly for high idlers

Payback Time (1000 h/y)

Payback Time (2000 h/y)

VW settlement funds can be used for IR

“DERA Option” (Eligible Mitigation Action 10) sets funding limits

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Eligible equipment</th>
<th>Maximum covered</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel truck or bus</td>
<td>Verified IR technologies</td>
<td>25%</td>
<td>1995-2009 engine*</td>
</tr>
<tr>
<td>Truck</td>
<td>Electrified parking spaces</td>
<td>30%</td>
<td>Equipment + labor</td>
</tr>
<tr>
<td>Locomotive</td>
<td>Verified IR technology, including shore power</td>
<td>40%</td>
<td>Unregulated, Tier 2+</td>
</tr>
<tr>
<td>Ship</td>
<td>Marine shore power</td>
<td>25%</td>
<td>---</td>
</tr>
<tr>
<td>Various</td>
<td>Replacement of engine or vehicle with electric</td>
<td>45-75%</td>
<td>---</td>
</tr>
</tbody>
</table>

*APUs and generators not eligible on vehicles with 2007-2009 MY engines

More information about eligibility requirements at:
You can estimate your own payback

**Idling Reduction Savings Calculator**

For an interactive Excel version of this calculator, please go to [http://www.transportation.anl.gov/downloads/idling_worksheet.xls](http://www.transportation.anl.gov/downloads/idling_worksheet.xls)

**Calculate Costs for Avoidable Idling**

1. Calculate fuel used for idling:
   - If you don’t know, see reference table on reverse.
   - $gallons/hour \times hours/year = gallon/year$
   - $gallon/year \times $/gallon = $avoidable/ year +

2. Calculate miles/year:
   - $miles/vehicle \times hours/year = mile/year$
   - $mile/year \times $/mile = $avoidable/ year +

3. Calculate maintenance cost:
   - $maintenance/vehicle \times $/mile = $avoidable/ year +

4. Calculate capital cost:
   - $capital/vehicle \times $/mile = $avoidable/ year +

5. Total Avoidable Costs $avoidable/ year +

**Calculate Costs for Idling Reduction (IR) – Device and/or Electrified Parking Space (EPS)**

6. Calculate fuel cost for IR device:
   - $fuel/vehicle \times $/mile = $avoidable/ year +

7. Calculate operating cost for on-board IR device:
   - $total/vehicle \times $/mile = $avoidable/ year +

8. Calculate capital cost:
   - $capital/vehicle \times $/mile = $avoidable/ year +

9. Calculate savings from IR:
   - $gallons/vehicle \times gallon/year = gallons saved/year$

**Much Fuel Is Used for Idling?**

<table>
<thead>
<tr>
<th>Size Indicator</th>
<th>GVWR (lbs)</th>
<th>Idling Fuel Use (gal/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No load</td>
<td>With load</td>
</tr>
<tr>
<td></td>
<td>AML 1</td>
<td>AML 1</td>
</tr>
<tr>
<td></td>
<td>AML 1 &amp; 2</td>
<td>WWU</td>
</tr>
<tr>
<td></td>
<td>NREL</td>
<td>ORNL</td>
</tr>
<tr>
<td></td>
<td>ORNL</td>
<td>TMC</td>
</tr>
</tbody>
</table>

**Other Idling Reduction Resources**

- [www.vehicles.energy.gov/idlebox](http://www.vehicles.energy.gov/idlebox)
- [http://cleantechnics.net/idlebox](http://cleantechnics.net/idlebox)
- Argonne National Laboratory [http://www.transportation.anl.gov/energy/idling.html](http://www.transportation.anl.gov/energy/idling.html)

Thank You!

- Patricia Weikersheimer
- DOE Clean Cities Program

IdleBox tools in use
Palm Beach, FL
Backup Slides
Fact sheet includes fuel use, costs, and payback

<table>
<thead>
<tr>
<th>Power Source</th>
<th>Services</th>
<th>Fuel Use (gal/hr)</th>
<th>Typical Equipment Cost ($)</th>
<th>Charge ($/hr)</th>
<th>Typical Payback(^a) (yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idling</td>
<td>All</td>
<td>0.6–1.5</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Auxiliary power unit</td>
<td>All</td>
<td>0.2–0.5</td>
<td>8,000–12,000(^b)</td>
<td>NA</td>
<td>3.6</td>
</tr>
<tr>
<td>Diesel-fired heater</td>
<td>Heat</td>
<td>0.04–0.08</td>
<td>900–1,500(^b)</td>
<td>NA</td>
<td>0.6</td>
</tr>
<tr>
<td>Heat recovery</td>
<td>Heat (limited duration)</td>
<td>Negligible</td>
<td>600</td>
<td>NA</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Storage cooling</td>
<td>Air conditioning</td>
<td>0.15</td>
<td>8,500–8,800(^b)</td>
<td>NA</td>
<td>5</td>
</tr>
<tr>
<td>Automatic engine start/stop system</td>
<td>All (intermittent)</td>
<td>0.25</td>
<td>1,500–2,500(^b)</td>
<td>NA</td>
<td>1</td>
</tr>
<tr>
<td>EPS (single system)</td>
<td>All</td>
<td>NA</td>
<td>5(^c)</td>
<td>1.85(^d)</td>
<td>NA</td>
</tr>
<tr>
<td>EPS (dual system)</td>
<td>All</td>
<td>NA</td>
<td>Up to 2,500(^c)</td>
<td>1.00</td>
<td>1</td>
</tr>
</tbody>
</table>

NA = not applicable; EPS = electrified parking space.
\(^a\) Assumptions for payback: $3.00/gal fuel, 1,800 hr/yr idling, 0.8 gal/hr for idling, 0.3 for APU; mid-range prices; heat and AC each run 6 mo/yr; vehicle fuel economy 7 mpg; auto start-stop assumed to run engine 30% of stationary time. Changes in any of the assumptions (e.g., hours idled per year) will affect payback time.
\(^b\) Includes installation. (North American Council for Freight Efficiency [NACFE] and the Carbon War Room: Confidence Report on Idle-Reduction Solutions, 2014.)
\(^c\) Cost for window adaptor for single-system EPS and cost for onboard equipment for dual-system TSE.
\(^d\) This is a standard rate, but discounts are available for stays >10 hours. In addition, power-only service is available for $0.99/hr.

Notes: Linda Gaines & Idle-Reduction

• In process of putting together a compendium.
• BACs only capable of 10 hour service.
• Idle shutdown doesn’t also start up.
• Dedicated terminals see much higher single system TSE utilization, in part because trailer is often elsewhere, and tractors don’t take quite so much room.
• For dual-system TSE funded with stimulus $, utilization was very disappointing at all but one location (see %).
• IdleAir has extremely good AC, so see higher use in summer (and in south).
• Blue dots are misleadingly large relative to red dots, but actual utilization of Shorepower is lower than Idleair.
• It’s very clear that best utilization & growth is at terminals.
• Shorepower’s report to DOE gave lots of reasons why use was so low; not sure any really explains it. Building out over corridors didn’t seem to solve the problem.
• With fuel as cheap as it is right not, it doesn’t really pay to use IR of any sort unless you’re going to be idling lots of hours.
• Shorepower starts paying back at exactly the price per hour that corresponds with price per gallon.
Status of Electric and Hybrid Trucks and Buses
NEDC Webinar    July 27, 2017
Bill Van Amburg, CALSTART
### Available Vehicles

» List expanding almost daily

» New entrants coming soon
Tesla Semi

» Part of announced Master Plan Part 2
» Also to include high volume passenger transport, maybe pickup

Jerome Guillen, formerly with Daimler and Cascadia platform, heading up Tesla truck development
Toyota Fuel Cell Truck Demo
» Win DOE funding for Class 6 PHEV
» Proposing 50% fuel economy, discuss downsized engines and range-extender architecture
» At EVS-29, discuss Class 4 and 6 P&D PHEVs, Class 7-8 PHEV transit

Cummins PHEV Development
Understanding, Supporting the Emerging Market

» Developing strategy for targeted key M/HD investments over three years

» Investments to drive outcomes on the top pathways to achieve 2030+ goals

CALSTART Providing Technical Support to Develop CARB 3-Year M/HD Funding Plan
Battery Costs Below 2020 Expectations

» Battery cost dropping faster, steeper than forecast
» Old forecast: $300/kwh by 2020
» New data: leaders <$200/kwh
» This is part of the story of emergence of e-trucks and buses

Nature Climate Change report:
http://www.carbonbrief.org/blog/2015/03/electric-vehicle-batteries-already-cheaper-than-2020-projections/
Stepping Stones to Expanding Markets for Zero Emissions
Almost Twenty ZEB Products Across Nine Bus Makers and Up-fitters
Buses Available

BYD 40 foot e-buses
E-Lion School Bus
Proterra 35, 40 foot e-buses
New Flyer 35, 40, 60 foot e-buses
Zenith Shuttle bus
Trans Tech SSTe
Stepping Stones to Expanding Markets for Zero Emissions

- BEACHHEAD
  - BEV Transit Bus
  - FCEV Transit Bus
  - BEV Delivery
  - BEV Hostlers
  - Electrification at Terminals, Facilities
  - EV & EV XO** CHE
  - EV GSE

- BEACHHEAD
  - BEV & FC Forklifts
  - FC Range Extenders
  - BEV Shuttle, School Bus

- BEV & BEV XR* M/HD Delivery
- Series Drive Engine and FC Range Extender Tech Demos
- EV, PHEV & EV XR* Regional HD
- EV, PHEV & EV XR* Drayage

**XR = Extended Range with FC or engine
**XO = Extended Operations with FC or engine
ZE, PHEV Delivery Trucks

Motiv

Zenith

Workhorse

EDI

BYD
Orange EV

» All electric yard tractor – now an on-road version, too

» Up to 80,000 pound loads, up to 20 hour work days

» Available for Chicago incentive program
Daimler – E-Trucks in 5 Years

» Testing HD models now
» Aimed at urban drive cycles and center city restrictions – 10% of truck use
» 120 miles range?
» Battery costs 60% less and energy tripled by 2025 compared to 1997 (Wolfgang Bernard, Daimler Trucks chief)

From Transport Topics
Efficiencies
Beachheads and Pathways
Hybrids “Back” – New Players, Prices

» New conversion, retrofit options showing more attractive price points

» Hino Class 5 Cab-over highly competitive for price and selling well
XL Hybrids

» New and existing vehicle conversion to cost-effective hybrid electric on Class 2-6 chassis

» Solid payback in high mileage applications

» Fast conversion uses known QVM approach
Lightning Hybrids

» Retrofit or conversion
» Hydraulic hybrid system
» Benefits for reduced brake wear, improved stopping, fuel savings
» Currently Class 2-5
EDI (Efficient Drivetrains Inc) Export Power PHEV

» California hybrid drivetrain developer, supplier
» Architecture allows high power export from vehicle
» Of interest to commercial, military markets
» Powered relief centers during Lake Fire

“The EDI trucks will allow new operational efficiencies for both maintenance with no service interruption, and disaster relief. We can power about 100 homes at the same time off of that vehicle.”

Dave Meisel, Senior Director, Transportation, PG&E
NYT-VIP E-trucks and E-buses

For non-attainment counties in NY State

Zero-Emission Trucks and Buses
Voucher = 80% of incremental cost with caps based on GVWR

<table>
<thead>
<tr>
<th>GVWR (lbs.)</th>
<th>All-Electric Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,001 - 14,000</td>
<td>$60,000 Cap</td>
</tr>
<tr>
<td>14,001 - 19,500</td>
<td>$90,000 Cap</td>
</tr>
<tr>
<td>19,501 - 26,000</td>
<td>$100,000 Cap</td>
</tr>
<tr>
<td>26,001 - 33,000</td>
<td>$110,000 Cap</td>
</tr>
<tr>
<td>33,001 - 38,000</td>
<td>$120,000 Cap</td>
</tr>
<tr>
<td>&gt; 38,000</td>
<td>$150,000 Cap</td>
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</tbody>
</table>
Stepping Stones to Expanding Markets for Zero Emissions

BEACHHEAD
BEV Transit Bus
BEV Delivery
BEV Shuttle, School Bus
FCEV Transit Bus

BEV Hostlers
Series Drive Engine and FC Range Extender Tech Demos
BEV & BEV XR* M/HD Delivery

**XR = Extended Range with FC or engine

EV, PHEV & EV XR* Regional HD

FC Range Extenders

Electrification at Terminals, Facilities

EV & EV XO** CHE

**XO = Extended Operations with FC or engine

BEACHHEAD
BEV & FC Forklifts
EV GSE
43 Truck ZE Drayage Demo
California ARB/Air Districts – 4 OEMs – 5 Ports

Kenworth
NG-REEV

BYD
BEV

Volvo
PHEV

Peterbilt
BEV; NG-REEV
Electric, Hybrid Trucks-Buses

» Not the future – it is already upon us!
» Choice of vehicles never been better and it’s accelerating
» Expanding market moving through clear market expansion stages, towards larger vehicles, longer distances over time
» Faster growth would come from additional **voucher incentive projects** in other regions of Northeast
  » State funds, CMAQ, VW funds all possible funding sources

» **How will YOU lead this change?**
Leading the Industry with Activities in Technology Commercialization / Policy / Technical Analysis / Market Acceleration
Notes: Bill Van Amburg – E-Trucks & Buses, Hybrid Vehicles

- Capability is developing around nodes, but should be expanding into corridors before long.
- Toyota truck pictured is a dray truck, using 2 passenger vehicle batteries.
- Technology moving rapidly towards market-ready.
- What are the first, second, third markets, based on business case? First: transit bus. More than 9 makers, 20 models. Next: delivery vehicles & yard hostlers / terminal tractors. Payback getting plausible. Regional trucks; available, but only affordable through incentive programs. Last: extended range provided by fuel cell or engine, for versatile port drayage truck.
- Hydraulic hybrid in the running too.
- Operational costs are competitive, but upfront costs need incentives. Sold out on incentives in NYC, but some coupons still available in NYS.
- Focus now on return-to-base delivery vehicles.
- Faster growth would come from creating voucher incentive programs elsewhere on corridors that lead out from NYC, Chicago, etc.
- How can we lead this charge to move vehicles through commercialization?
Northeast Diesel Collaborative
Freight Corridors Webinar
Patrick Bolton

July 27, 2017
Planning

**NYS Canal and Great Lakes Marine Transport**

Alternative transportation modes and routes provide farmers with more options to get their produce to market during natural disasters, economic disruption, and transportation system oversaturation.

Inland marine transportation is a cost-effective and environmentally friendly option to transport bulk agricultural commodities from areas of surplus within the Great Lakes region using the Great Lakes and New York State (NYS) Canal system. A canal barge must meet certain specifications to operate on a restricted waterway, while a load line certificate is required to operate on the Great Lakes. It is too expensive and cumbersome for a canal barge to obtain a load line certificate which applies to all waterways outside the U.S. Boundary Line in any possible conditions. Therefore, New York State Marine Highway Transportation Company is preparing to apply for a load line route exemption from the U.S. Coast Guard (USCG) to streamline the use of canal barges on the Great Lakes. The New York State Energy Research and Development Authority and the New York State Department of Transportation has funded an investigation of the economic, environmental, safety, and other aspects that support the establishment of this load line route exemption.

A Load Line indicates the legal limit to which a vessel may be loaded for specific ocean areas and seasons of the year. A Load Certificate has determined, among other aspects of seaworthiness, that a vessel has enough volume of ship (reserve buoyancy) below the waterline (load line) so that it will not be in danger of foundering or plugging when under way in heavy seas. Single Voyage Load Line Exemptions are regularly issued by the USCG for special deliveries across the Great Lakes using canal barges, but the application process and inspection procedure is too burdensome for operating a regular cargo route. The most effective licensing process for cross-border, lake-to-canal transport routes is a Load Line Route Exemption (not requiring a load line for certain vessels, carrying specified cargo on a particular route). The Canadian Coast Guard has issued route exemptions for Canadian-flagged barges to transport grain across Lake Ontario and into the NYS canal, but Canadian barges cannot transport any cargo from U.S. port to U.S. port because of Jones Act provisions. Route exemptions for U.S.-flagged barges have been issued for transporting cargo between the Mississippi river and two ports on Lake Michigan.

**NYS Marine Highway Transportation Co., LLC**

**www.nysmarineway.com**
Electric Tender
Education and Technology Transfer

Save the Date

LAST MILE FREIGHT DELIVERY
USE OF CLEANER MOBILITY VEHICLES

PRESENTED BY
UNIVERSITY TRANSPORTATION RESEARCH CENTER - REGION II

In collaboration with:
- IDMEC – Instituto Superior Técnico, Lisbon
- New York State Energy Research and Development Authority (NYSERDA)
- New York State Department of Transportation (NYSDOT)

Date: Friday, October 4, 2013
Time: 8:30am - 4:30pm
Location: Baruch College/CUNY William and Anita Newman Conference Center
151 East 25th Street, 7th Floor,
New York, NY 10010.

RSVP at:
www.utrc2.org/events/lastmilefreightdelivery.com
Policy Research and Feasibility Studies

Green Loading Zones to Support Cost-Effective Zero-Emission Commercial Vehicle Operations in New York City

Paul Salama and Adam Lubinsky
RMIT architecture + urban design

Bryan Roy and Ziga Ivanič
Energise Incorporated

Paul Lipson and Luis Torres
Barbados Bay Strategies

Joseph Tario
NYSDOT

Robert Ancar
NYSDOT


Abstract
The emergence of electric vehicle (EV) delivery trucks is resulting in health and environmental benefits, less noise, reduction of foreign energy dependency, and economic development opportunities. Green Loading Zones (GLZs) are dedicated units spaces for commercial delivery EVs, meant to incentivize and accelerate market adoption. This study examined the impact and potential benefits of this strategy for New York City. Discussions with fleets revealed that while they are realizing operational savings and other benefits from the use of EVs, their incremental costs over diesel vehicles are taking a very long time to recover; even with existing subsidy programs. Complementary incentives like GLZs can provide further justification for the investment in cleaner technology. Most fleets interviewed would place a high monetary value on guaranteed delivery locations and reduced parking violation expenses. Inclusion of GLZ electrical infrastructure to charge the EV battery could extend the usage and operational capacity or permit the fleet to purchase vehicles with smaller battery packs, both of which would increase the cost-effectiveness of this technology. Three specific New York City sites were selected to determine the feasibility of implementing GLZs. GLZs represent a difficult implementation, butting up against many of the city’s current policy approaches such as reducing congestion, monetizing curbside space, preserving existing parking spaces, and avoiding confusing and hard to enforce curbside restrictions. While these are barriers to overcome, the benefits of enabling further EV use were found to be too significant to not pursue concepts like GLZs.

Introduction
Trucks, as a key component of the freight network, are essential to the prosperity of our region, but bring with them a host of issues such as congestion, emissions, and noise. New York City receives over 130,000 freight deliveries daily, predominantly going to wholesale, retail, and food enterprises. To make these deliveries, trucks and van operators are required to navigate congestion, traffic, and parking challenges that force drivers to circle, single and double park, resulting in economic loss and increases in the amount of pollution emitted into the air. Frequent stops often cause untold costs to complete deliveries, disrupting traffic flow on vehicle and bicycle lanes, while accessing parking fees for their employees. Some larger fleets accrue millions of dollars in parking surcharges each year.

Freight trucks, primarily diesel fueled at present, generate high volumes of emissions that negatively impacts health and quality of life in local communities and contribute to global climate change, taxing the city and region. New York City is
Product Development and demonstration

- Short range urban electric delivery truck
- Anti-idling electric power for ambulances
- Battery systems for reducing demand charges for DCFC
- High efficiency switched reluctance motor for electric trucks
- Anti-idling for locomotives
Vehicle Deployment

www.truck-vip.ny.gov

$19 million dollars
Potential Activities for VW Settlement Funding

- EV Charging Stations Level 2 and Fast Charge
- Electric and Other Alternative Fuel Trucks and Buses
- New Diesel Truck and Bus Replacements
- Clean Port Equipment
- Airport Electric Ground Support Equipment
- Electric Railroad Freight Switchers
Infrastructure

- NYSERDA selected 11 CNG station projects across the state for up to $500K in funding
- Stations will be installed by 2018
- Stations will help more fleets buy more CNG vehicles for interstate and intrastate routes
Infrastructure

• Installed over 700 charging stations to date
  – Collecting usage data, published on ChargeNY website
• New York State Tax Credit
  – 50% up to $5,000 per installation (public and workplace charging)
• Cleaner, Greener Communities projects – over 200 add’l stations
• Upcoming program to establish purchasing collaborative for charging stations, including targeted additional incentives
Thank you!

Patrick Bolton
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Notes: Patrick Bolton - Demonstrations & Funding

- NYSERDA is the DOE for NYS.
- Patrick is in Clean Transportation Program; its transportation efficiency program includes freight.
- How to move more freight, using canal & marine system, to reduce reliance on truck?
- Demo’d an electric tender, which maintains canal and helps tugs; also looking to develop an electric tug.
- Green loading zones are parking/charging spots for electric trucks; at study phase.
- Working with a major fleet and tech companies to develop a short-distance electric delivery truck.
- Also developing an anti-idling technology with shore power for ambulances, where they park on the street, to provide AC and hoteling.
- Fast charging: hard to make $ if have to pay normal demand charges. Necessary to expand electric to more types of trucks.
- Also looking at motor changes that reduce electric draw.
- Working on anti-idling for regional RRs, mainly for winter during long periods of no work.
- Truck VIP: Price of truck is reduced at POS by incentive amount. 600 vouchers distributed, including all electric, hybrid, CNG, and filters.
- 50% up to $5000 can apply to truck charging.
The EV Opportunity: A Perspective

July 27, 2017
Agenda

• Current EV landscape
• What others have done
• The impact of NWA on the scenario
• Recent REV demonstration activities
• The way forward
• Test and learn
Current EV landscape
Current EV landscape

![Graph showing the current EV landscape with various manufacturers and their vehicle numbers and average BEV electric ranges from 2010 to 2021.](image)

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EV Opportunity - 74
What others have done

- 12 utilities with total investment of $259.5M in progress
- 11 utilities with total potential investment of $1,531.4M pending
- 2 utilities with proposed investment of $18.8M withdrawn

- Utility ownership
- Utility “make-ready” and rebates
- Hybrid approaches
The REV and NWA

- New York State Reforming the Energy Vision
- Non-Wires Alternatives

- Balancing objectives required
- Focus on managing the load while driving adoption
- SmartCharge New York
- Assess options for demand mitigation
REV Demonstrations

- $25M allocated out of $130M for EV demonstration projects
- Focus on portfolio approach in six areas:
  - Smart home charging
  - Curbside
  - Transit bus
  - School bus
  - Fast charge hubs
  - Proactive system planning and design
The way forward

- $25M allocated out of $130M for EV demonstration projects
- Focus on portfolio approach in six areas:
  - Smart home charging – 80% of charging requires effective load management
  - Curbside – establish efficacy and franchise rules through demonstration
  - Transit bus – in-depot and on-route charging with potential for network load diversity
  - School bus – idle summer assets align well with v2g from batteries
  - Fast charge hubs – dense vertical MUDs and scarcity of land
  - Proactive system planning and design – DER hosting capacity aligns with EV load
Test and learn

- Nobody has all the answers
- Ability to test models
- Expand stakeholder engagement
- Learn from demonstrations
- Modify and adjust as we go
- Utilize learnings to inform future offerings and business models
Thank You!

John Shipman
ConEdison
shipmanj@coned.com
Notes: John Shipman & Electric Vehicle Infrastructure

- NWA = non wire alternatives.
- A lot of product available, at least in light-duty space, but also in all product categories. Still question remains: how fast will uptake happen?
- Range is expanding steadily.
- Only 2 utilities have withdrawn their support. Utilities want to get into this space.
- Utility approaches include owning chargers, to address peak use. Some have taken “make-ready” approach, paying for infrastructure up to property line, then facility would do rest.
- Hybrid approaches include sharing costs for chargers, and rebates.
- Concerned about need to reduce load, and find ways to generate back into grid.
- NWA not best for reducing GHGs, but is needed to advance whole trend.
- Good kwhs: EVs. Bad: buildings. Want to prioritize supplying good over bad.
- ConEd piloting multi-funder models. Recently put out RFP with portfolio of approaches. Home charging important because 60% of LDV charging will take place at home. Curbside charging important because it’s where people park in dense cities like NYC. Transit buses consume lots of energy, so another priority. (Best EV: the subway!) Demo’ing transit charging in depots as well as enroute, in Manhattan and Brooklyn. Next: school buses, which sit idle a lot; could be a way to have them send energy back into grid in summer, as well as shut down while waiting. Install fast charging hubs in places where lots of users live/work.
- Need to expand stakeholder engagement to diversify involvement.
Workgroup Discussion
Q&A from Presentations

Question #1 – How many of the high-utilization TSE sites are in states that have adequate enforcement of idle reduction laws.

Linda Gaines – Not much other than CA. There is significant high utilization in Texas. Unfortunately, with the federal mandate for truck rests, it is difficult to enforce idle reduction laws as well as the costs of state labor to enforce idle-reduction.

Question #2 – Concern expressed on diesel auxiliaries not meeting strong emission standards and can possibly contribute more emissions than if the main truck engine were to be left on.

Linda Gaines – Released a TRB report recently on this topic. Today, the new truck standards are much more stringent for NOx and PM. Small auxiliary diesel engines do have emission standards but can be more than a new diesel truck. Diesel-fired heaters have less emissions than APUs.
Question #3 – What are some specific technologies that need to be developed in the near term to reach business model objectives? What is inhibiting technology transitions?

Bill Van Amburg – There are a variety of technologies depending on duty cycles. We need to build out the supply chain base to get more competitive in this space. That is what is happening with the bus, MD/HD school bus, delivery truck and now heavy duty electric truck space. The battery diversity/capacity has a lot to do with the growth of these emerging MD/HD technologies.

Range extenders can play an important role in this space and can use fuel cells to provide that additional power need to make the electric vehicle go farther. We are starting to see this with industrial fork lifts which has been a real good beach head for smaller fuel cell techs. Fuel cells can provide a small amount of electricity to extend the range of an electric vehicle. We are also excited about the Low NOx natural gas engine as an engine generator for range extension of an electric drive, another interesting breakthrough area.
Q&A from Presentations

Question #4 – Is NYSERDA implementing the use of certified Green Transportation bonds for low carbon projects?
Patrick Bolton – Not currently but something that is being looked at.

Question #5 – Will the planned PANYNJ bus depot upgrade on 42nd street be e-bus friendly?
John Shipman – We are looking at updating the Michael Quill depot on 42nd street to have depot chargers.

Question #6 – What idle-reduction technologies did NYSERDA use for locomotives (i.e. start-stop, electric engine heaters, etc.)? Which railroads were involved?
Patrick Bolton – NYSERDA worked with the smaller/regional railroads that are responsible for a couple 100 miles of track, typically for last mile rail delivery. We worked with fuel fired heaters to heat the coolant while engines were turned off. The regional railroads do not have access to nearby electrical grid so had to explore use of fuel fired heaters.
Discussion Questions – Part 1

Charging facilities for electric and hybrid trucks:

- What open-access facilities are needed in the Northeast to enable longer routes? Best locations? Funding?

- Are incentives necessary to expand private or limited-access truck charging facilities? What sorts?

- Northeast freight-intensive locations (ports, intermodal yards, industrial parks, & DC clusters): what fleets & charging would work best, where?
Part 1 Responses:

Bill Van Amburg – Yard Trucks/Hostlers are great examples of vehicle techs that work great in electric charging/return to base operation. This could also be a good node for delivery vehicles. We are starting to see this in the transit space with route charging. One approach is this idea of inside and outside the fence charging. Yard Trucks charging/operating within the terminal/warehouse and delivery trucks being use to provide local delivery from the same terminal/warehouse. Overnight charging could be an option for extended range delivery.

We are looking at building a network of opportunities around route charging within an urban environment/region that could support corridors and this network of charging could build out the fast chargers for light duty. One could be designated in key areas and garages of distribution trucks, this region could use 5 fast chargers for the distribution trucks.

We need to start looking at this, may be early, but is the right time. Really pleased to see what ConEd is doing with planning and protecting the grid and locating chargers at the right places.
Part 1 Responses:

John Shipman – Echo Bill’s comments. When you are around major highways, you can put in a fast charge hub that can act as a location where regional/long haul trucks can pull in as well as possible passenger vehicles.

Bill Van Amburg – This is happening in real time. Light duty access for medium duty vehicles.

Need to space charging so that bigger, more heavy duty vehicles can access and charge at these locations.
Discussion Questions – Part 2

**No-idle** spaces for trucks and TRUs:

- How can states & MPOs incentivize creation of no-idle **truck parking**, AND exclusive and full utilization? Is regulation & enforcement the only way??

- What locations & partners can demonstrate the AQ & cost savings of eTRUs, including no-idle docking, layovers & storage for reefers?
Discussion Questions – Part 3

Vehicles, infrastructure and energy:

- What **incentive programs** hold the most promise for making these trucks, TRUs, & onboard idle reduction equipment affordable?

- What models of **collaboration** between providers, fleets, & host facilities should we emulate?
Discussion Questions – Part 4

General:

- How to capitalize on strong interest in charging for personal electric vehicles to expand potential for trucks?

- Are warehouses & ports the best locations for multi-modal charging (trucks & CHE)? How about intermodal (rail-truck) yards?
NEDC Partners Meeting

Growing the Market for Clean Technologies, Improving Communities and Advancing the Economy

Join NEDC Partners in Newark, NJ to learn and exchange strategies for advancing the future of clean transportation and goods movement in the Northeast.

September 25 & 26, 2017

New Jersey Institute of Technology
The Atrium at Campus Center
150 Bleeker Street
Newark, NJ 07102

Register for the NEDC Partners Meeting [here](#).
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