Electric School Bus Webinar Series
Webinar 2

Please mute your microphones and enter your name and organization in the chat box.

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Who and What is NCTCOG?

Regional Planning Agency

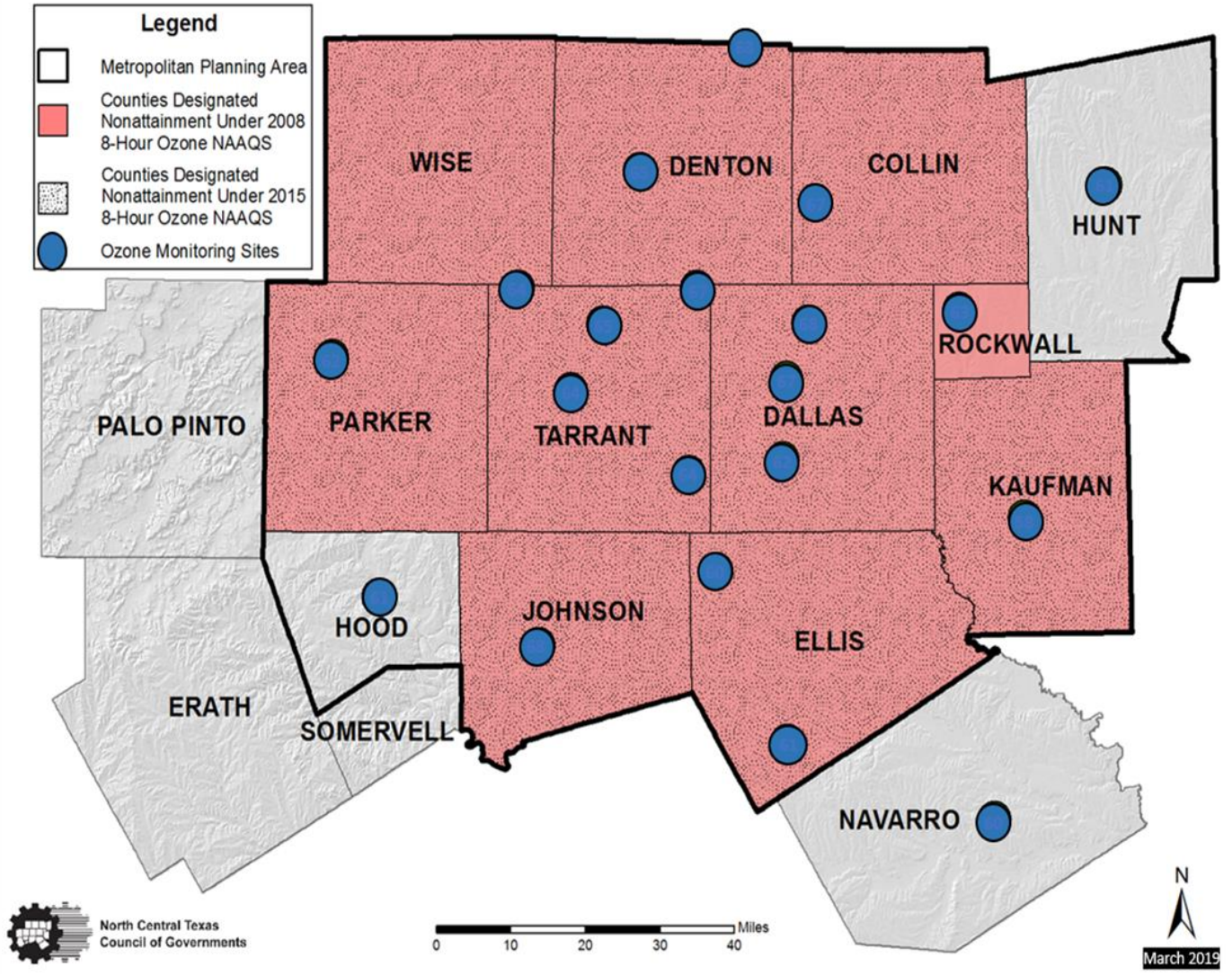
North Central Texas Council of Governments

Metropolitan Planning Organization (MPO)

RTC Regional Transportation Council

DFW Clean Cities Coalition

Dallas-Fort Worth CLEAN CITIES



Clean Cities Portfolio

Light-, Medium-, and Heavy-Duty Vehicles

Alternative and Renewable Fuels and Infrastructure

Idle Reduction Measures and Fuel Economy Improvements

New Mobility Choices and Emerging Transportation Technologies

Measuring Clean Cities Coalition Impact

Coalition projects have resulted in a cumulative impact in energy use equal to nearly **10 billion** gasoline gallon equivalents resulting from reduced fuel use and increased fuel diversity.[1]

Enough to drive the distance to the sun and back

1,175

times

Enough fuel to fill nearly

1.2 million

tanker trucks

Coalition projects have helped to put nearly **1 million alternative fuel vehicles** on the road.[2]

96 million gasoline gallon equivalents

of energy were saved through fuel economy improvement projects like telematics, driver training, and outfitting fleets with idle reduction equipment.[2]

Technology Integration Program

Provide objective/unbiased data and real-world lessons learned that inform future research needs and support local decision-making

Your Regional Resources

Austin Area

Andrew Hoekzema
Director of Regional Planning and Services
ahoekzema@capcog.org
512-916-6043

Christiane Alepuz
Regional Planning and Services Program Coordinator
calepuz@capcog
512-916-6005

Elizabeth Munger
Lone Star Clean Fuels Alliance
info@lonestarcfa.org

Dallas-Fort Worth Area

Lori Clark
Program Manager & DFW Clean Cities Coordinator
lclark@nctcog.org

Amy Hodges
Senior Air Quality Planner
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817-704-2508

Houston Area

Andrew DeCandis
Principal Planner and Clean Cities Co-coordinator
Andrew.DeCandis@h-gac.com
832-681-2589

San Antonio Area

Lyle Hufstetler
Natural Resources Project Coordinator
lhufstetler@aacog.com
210-376-9901

Today's Agenda:

Amy Hodges, DFWCC: Overview of Webinar Series

Sarah Ryan, EDF: Benefits of Electric School Buses

Chris Charlton, Collins; Andrew Bish, Motiv Power Systems: Collins All-Electric School Bus

Mark Childers, Thomas Built Buses; Eric Reynolds, Proterra: Thomas Saf-T Liner C2 Jouley-Electrification of the Yellow Bus

Jerry Dennis, DFWIA: A Step-By-Step Approach to EV Infrastructure

General Q/A

Webinar Series Overview

Webinar 1- Thursday, December 3: DFWCC, IC Bus, Blue Bird, Oncor

Webinar 2- Wednesday, December 16: EDF, Collins, Thomas Built Buses, DFWIA

Webinar 3- Wednesday, January 13: Lion Electric, grant funding, innovative financing

Need to register? www.dfwcleancities.org/dfw-clean-cities-meetings

Electrifying School Buses in Texas

Sarah Ryan
Environmental Defense Fund

EDF
ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work

Benefits of Electric School Buses

- More fuel efficient
- Less maintenance
- Higher annual savings
- Improve human health
- V2G potential

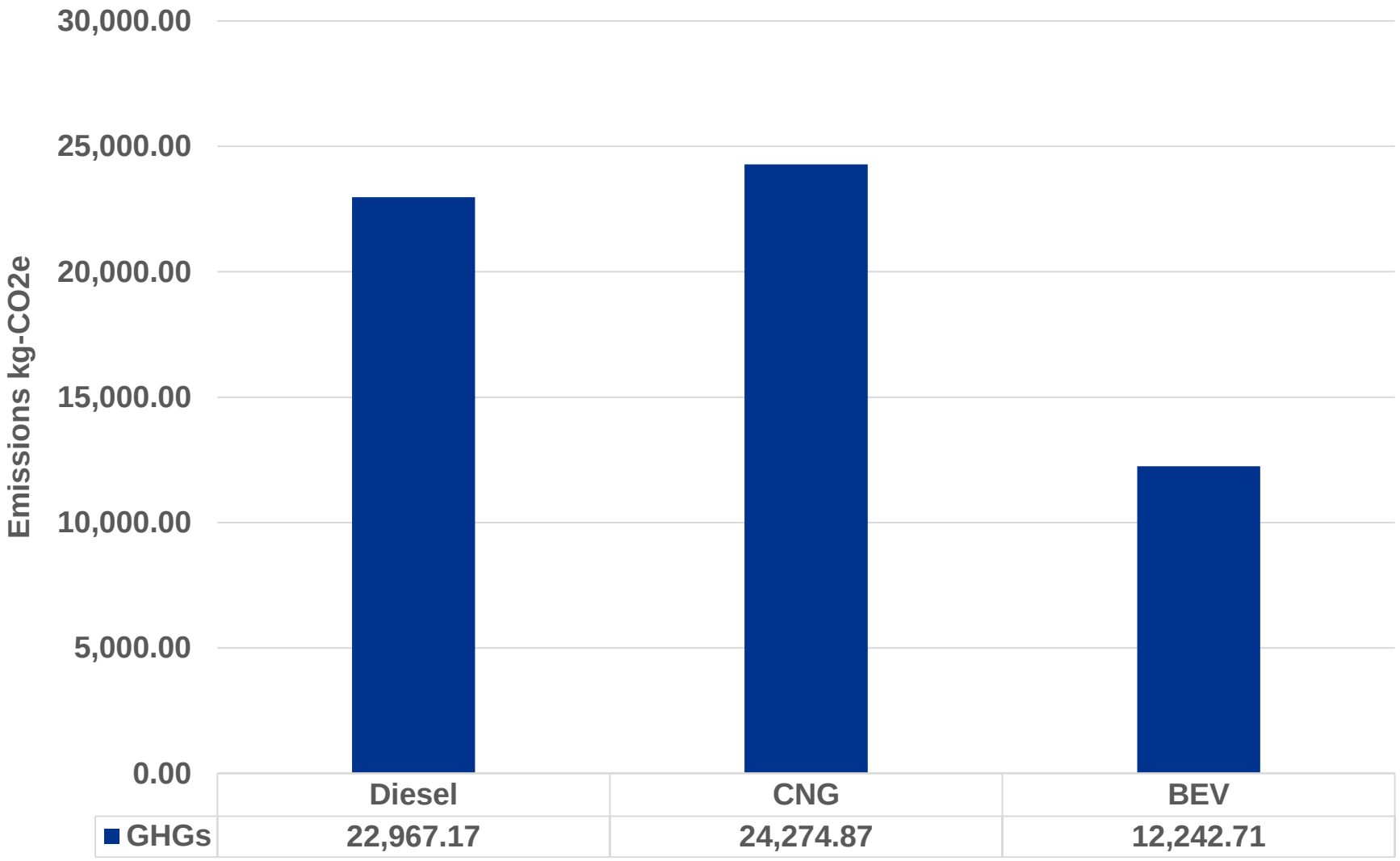
Emissions occur all along the supply chain

Pump-to-Wheels/In-Use

Well-to-Pump/Upstream

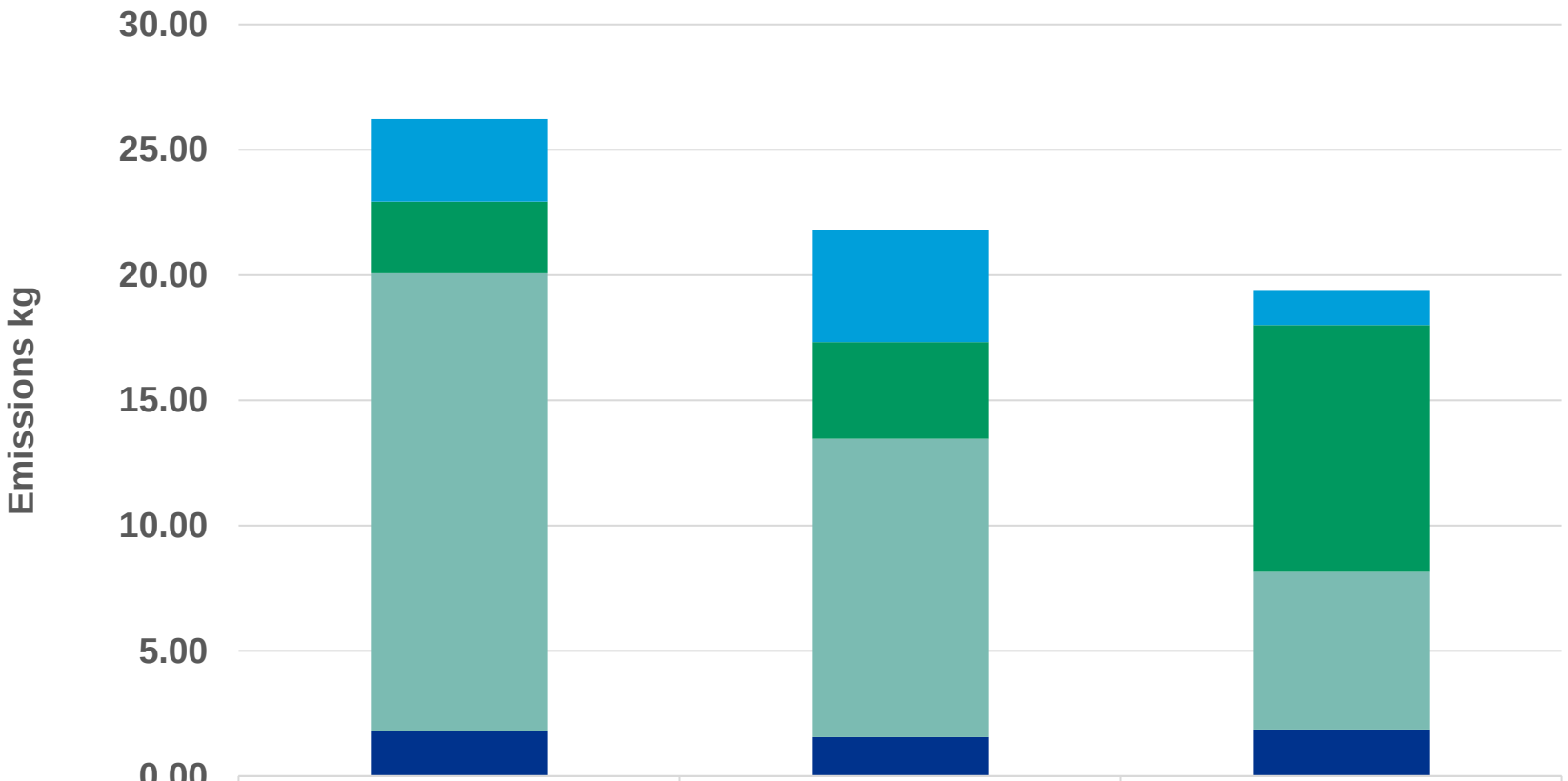
Production → Gathering & Processing → Transmission & Storage → Local Distribution → Trucks & Stations

Greenhouse Gas Emissions



* Assumptions: Class A school bus; Annual VMT of 15,000 miles; ERCOT Generation mix

Key Health-Related Emissions

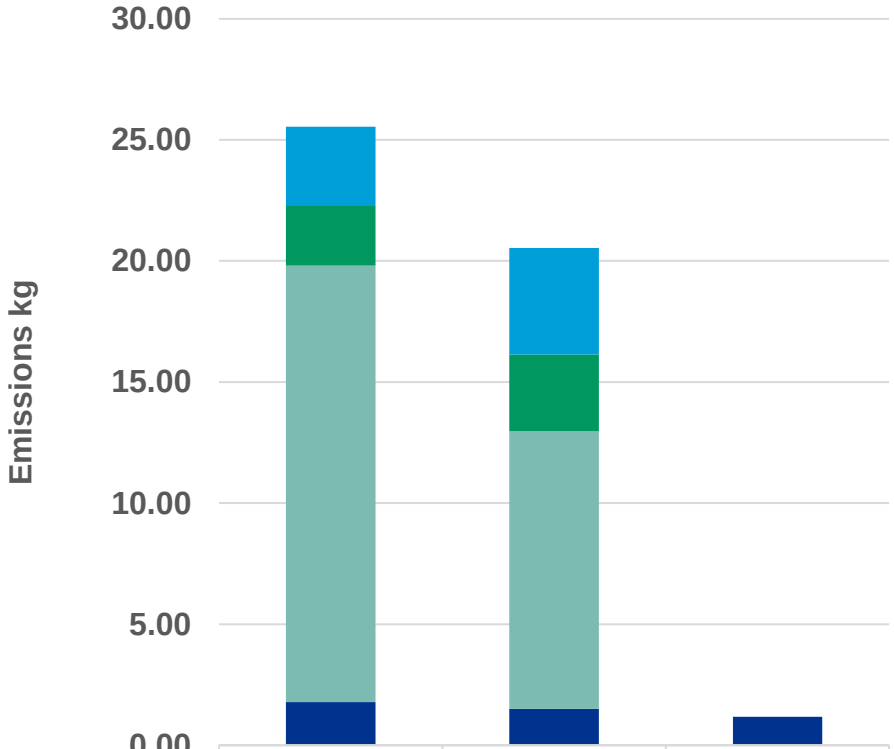


	Diesel	CNG	BEV
VOC: Total	3.29	4.49	1.36
SOx: Total	2.86	3.86	9.86
NOx: Total	18.27	11.92	6.29
PM: Total	1.81	1.55	1.86

* Assumptions: Class A school bus; Annual VMT of 15,000 miles; ERCOT Generation mix

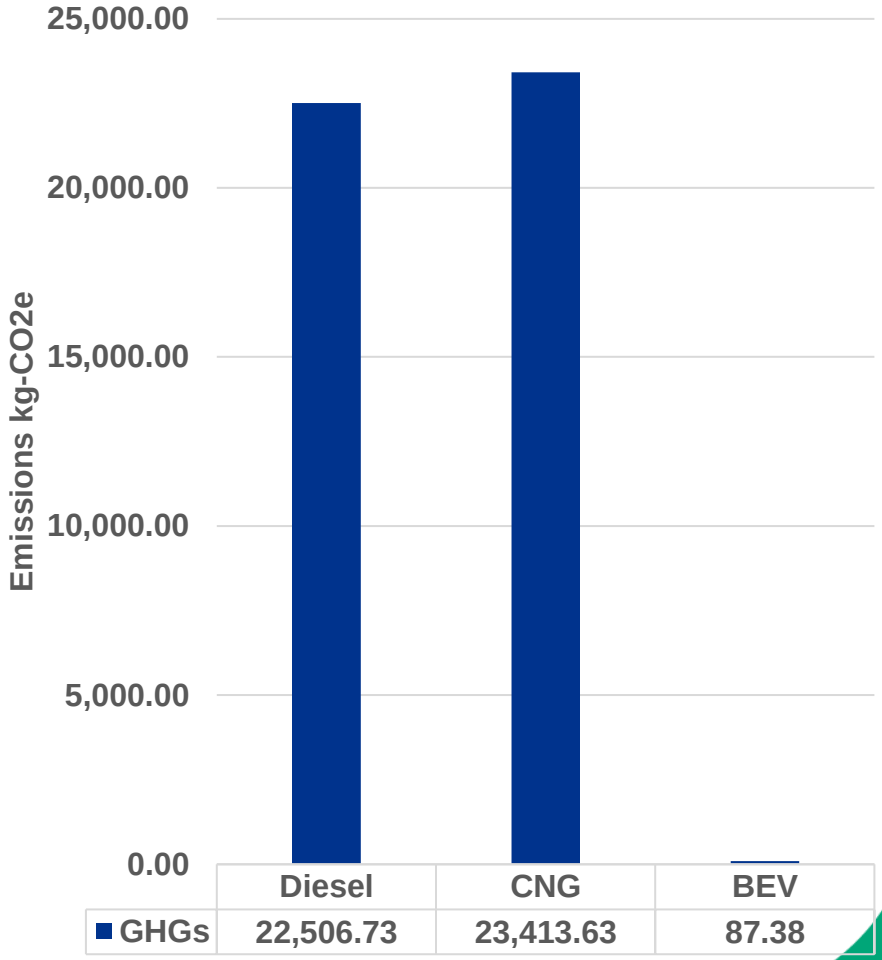
Emissions with a 100% Renewables Grid

Key Health-Related Emissions



	Diesel	CNG	BEV
VOC: Total	3.24	4.39	0.00
SOx: Total	2.48	3.16	0.00
NOx: Total	18.03	11.47	0.00
PM: Total	1.78	1.50	1.18

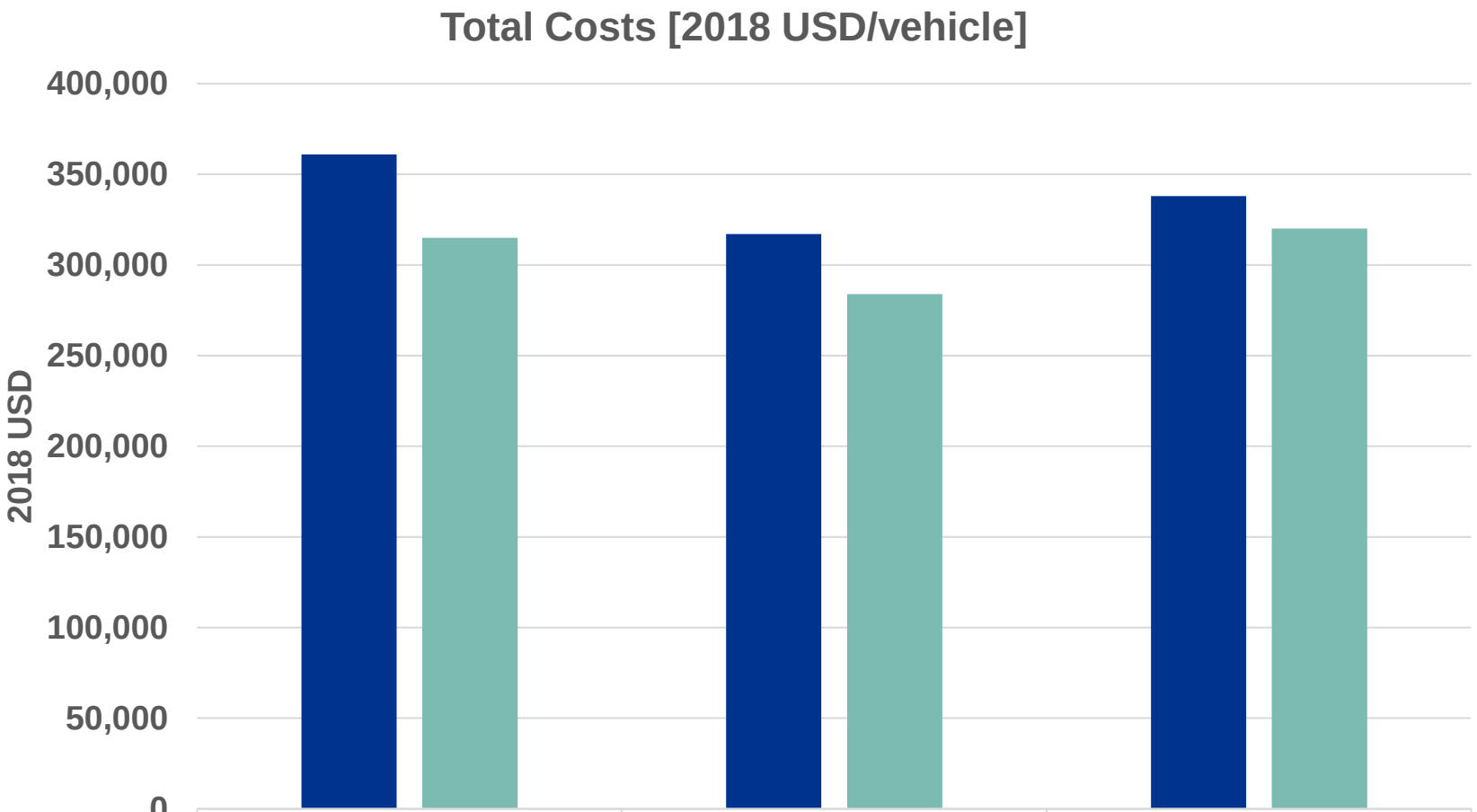
GHG Emissions Adjusted by GWP



	Diesel	CNG	BEV
GHGs	22,506.73	23,413.63	87.38

* Assumptions: Class A school bus; Annual VMT of 15,000 miles; ERCOT Generation mix

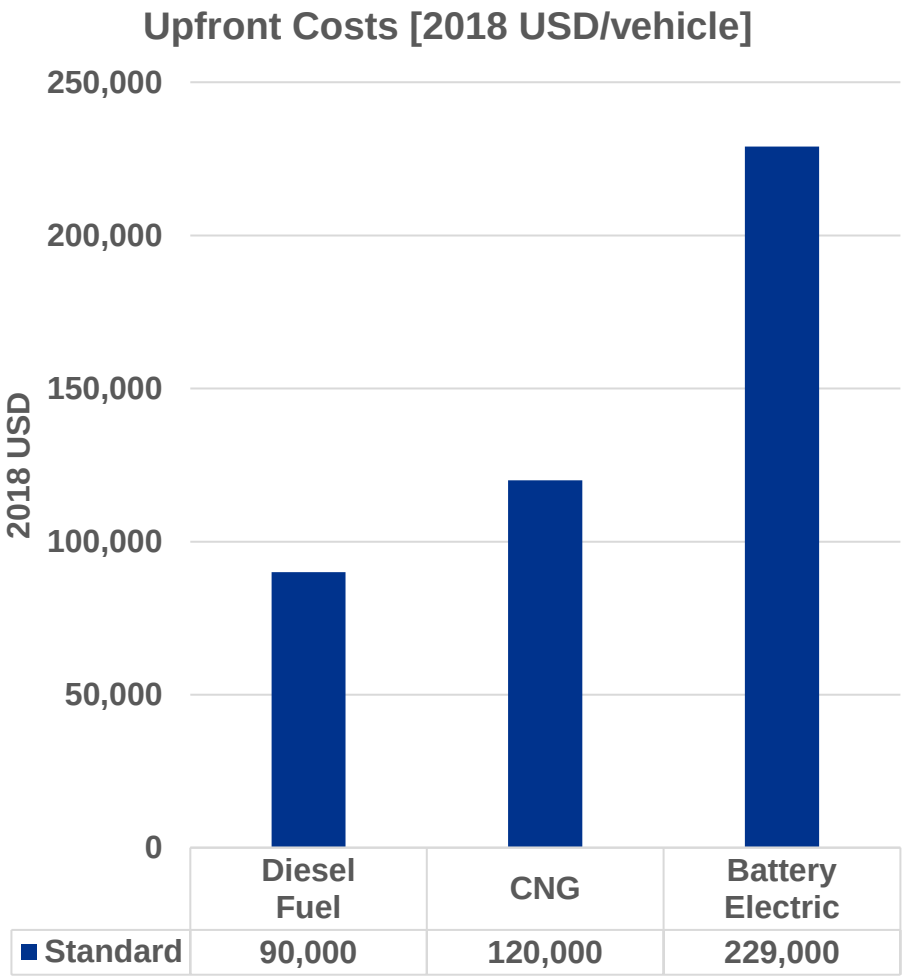
Total Cost of Ownership



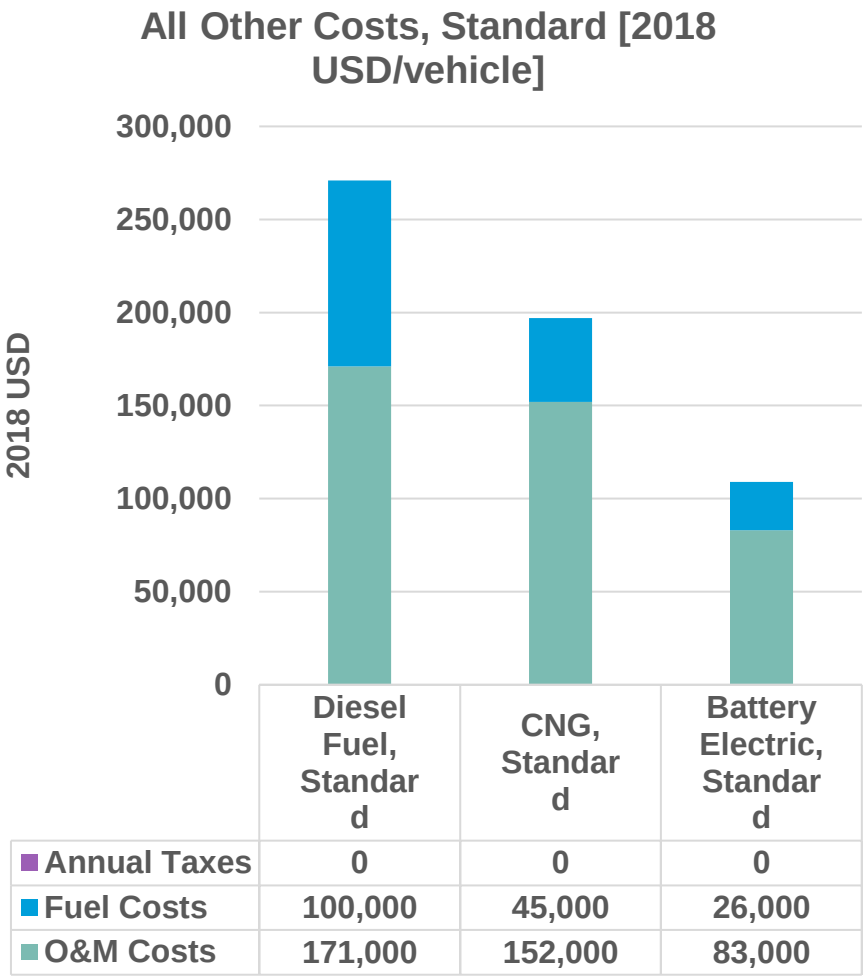
	Diesel Fuel	CNG	Battery Electric
Standard	361,000	317,000	338,000
NPV	315,000	284,000	320,000

* Assumptions: Class A school bus; Annual VMT of 15,000 miles; No infrastructure costs included; please contact sryan@edf.org if want specifics on fuel prices

Total Cost of Ownership Breakdown



	Diesel Fuel	CNG	Battery Electric
Standard	90,000	120,000	229,000



	Diesel Fuel, Standard	CNG, Standard	Battery Electric, Standard
Annual Taxes	0	0	0
Fuel Costs	100,000	45,000	26,000
O&M Costs	171,000	152,000	83,000

* Assumptions: Class A school bus; Annual VMT of 15,000 miles; No infrastructure costs included; please contact sryan@edf.org if want specifics on fuel prices

Sarah Ryan
sryan@edf.org

EDF
ENVIRONMENTAL
DEFENSE FUND®
Finding the ways that work

COLLINS ALL-ELECTRIC SCHOOL BUS

COLLINS®
REV GROUP

ELECTRIFIED BY MOTIV®

CALIFORNIA RFP WIN!

Motiv Power Systems
3,554 followers
1mo •

Congratulations to Phoenix Union High School District on their new Motiv-powered Type A School bus!

#cleanair #inEVitable #EVs

> **Collins Bus Corporation**
> 859 followers
> 1mo •
>
> Pic of the Day! Our partner RWC Group delivers the first Collins electric school bus in Arizona to Phoenix Union High School District
>
> Those pictured include: Bryan Henderson, Director of Transportation for Phoenix Union and Chuck Keane and Tom Hartman, General Manager of RWC Group
>
> Learn more about our electric school bus: https://lnkd.in/d2T2x4x

15

Motiv Power Systems
3,554 followers
3mo •

Did you know we offer both training and demos to our customers and dealer-partners? Check out our latest blog for more info about how to set up a test drive along with pics from our A-Z Bus Sales, Inc with Collins Bus Corporation demos.

#inEVitable #EVs #cleanair

https://lnkd.in/e6d8XGE

Demo & Training: A-Z Bus Sales with Collins Bus - Motiv Power Systems
motivps.com • 1 min read

41

Motiv Power Systems
3,554 followers
4mo •

Thank you to everyone who joined us at our Collins Bus Corporation demo with A-Z Bus Sales, Inc!

Upgrading your #fleet to all-electric can save you up to 85% in operating and maintenance costs, as well as provide operators and students a smoother, quieter, and healthier ride.

#cleanair #ev #inEVitable

https://lnkd.in/gNgaSSW

Motiv's All-Electric School Bus Demo
youtube.com

47 • 2 Comments

TYPE A SCHOOL BUS

- Founded in 1967, manufacturing based in South Hutchinson, KS. Employs over 200 people today
- Owned by the REV Group
- Produces approximately 3,500 Type A school buses per year
- Collins developed the first Type A school bus in 1967. Today, their buses come with tinted high-visibility passenger windows, galvanized HSLA steel body construction, and other modern features

EV FUNDING…MORE and MORE

EPA United States Environmental Protection Agency

Environmental Topics | Laws & Regulations | About EPA

Diesel Emissions Reduction Act (DERA) Funding

What's New

Make Your School Bus a Clean, Green Transportation Machine (1 pp, 206 K, EPA-420-F-20-038, About PDF)

VW Settlement & DERA

DERA News & Help

EPA United States Environmental Protection Agency

Environmental Topics | Laws & Regulations | About EPA | Search EPA.gov

CONTACT US | SHARE

Enforcement

- Enforcement Home
- Enforcement Basics
- Air Enforcement
- Water Enforcement
- Waste, Chemical and Cleanup Enforcement
- Criminal Enforcement
- Enforcement at Federal Facilities
- Data and Results
- Policy, Guidance and Publications

Volkswagen Clean Air Act Civil Settlement

(Washington, D.C.) - Through a series of three partial settlements, the EPA has resolved a civil enforcement case against Volkswagen AG, Audi AG, Dr. Ing. h.c. F. Porsche AG, Volkswagen Group of America, Inc., Volkswagen Group of America Chattanooga Operations, LLC, and Porsche Cars North America, Inc. (collectively "Volkswagen"). On October 25, 2016, the United States District Court for the District of Northern California approved the first partial settlement with certain of these Volkswagen entities addressing vehicles containing 2.0 liter diesel engines (the "2.0 liter partial settlement"). On May 17, 2017, the court approved the second partial settlement addressing vehicles containing 3.0 liter

Settlement Resources

- Complaint
- Consent Decrees
- Announcement and Statements
- Press Release
- Timeline of Events
- Other Documents and Reports

SHARE

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Clean Cities Coalition Network

Home | About | Coalitions | Partnerships & Projects | Technical Assistance | News & Events | Coordinator Toolbox

Clean Cities Coalition Network » Coalitions

- Locations
- Starting Coalitions
- Contacts

A National Network of Local Coalitions

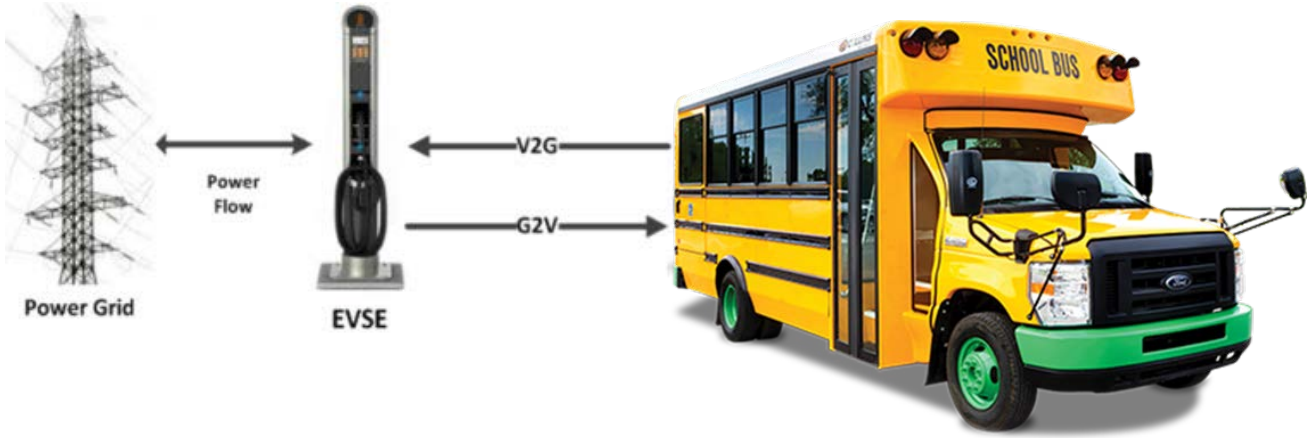
Clean Cities coalitions support the nation's energy and economic security by building partnerships to advance affordable domestic transportation fuels, energy efficient mobility systems, and other fuel-saving technologies and practices.

At the national level, the U.S. Department of Energy's Vehicle Technologies Office provides unbiased and objective resources and information to help transportation stakeholders evaluate options and achieve goals around alternative fuels, advanced vehicles, mobility solutions, and other fuel-saving strategies. At the local level, nearly 100 coalitions leverage these resources to create networks of local stakeholders that advance transportation projects.

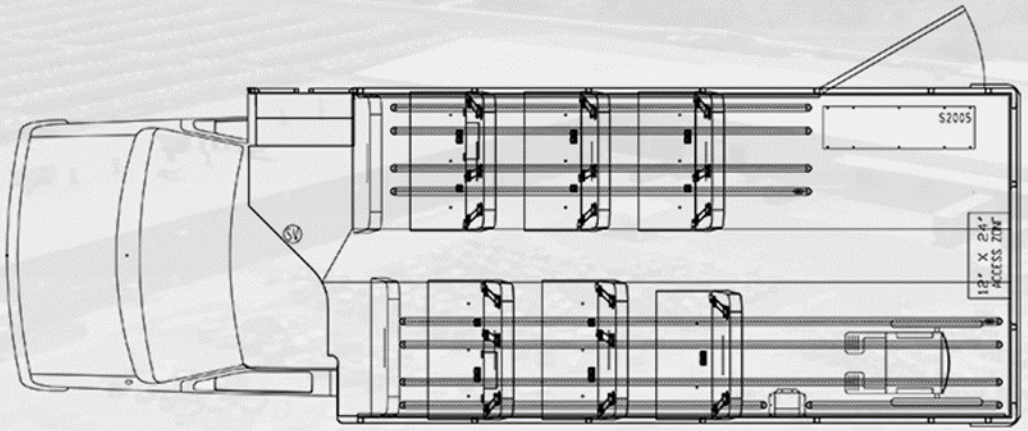
Learn how coalitions are creating significant and lasting change in communities large and small, one project, one local decision, and one fleet at a time.

Find My Local Coalition

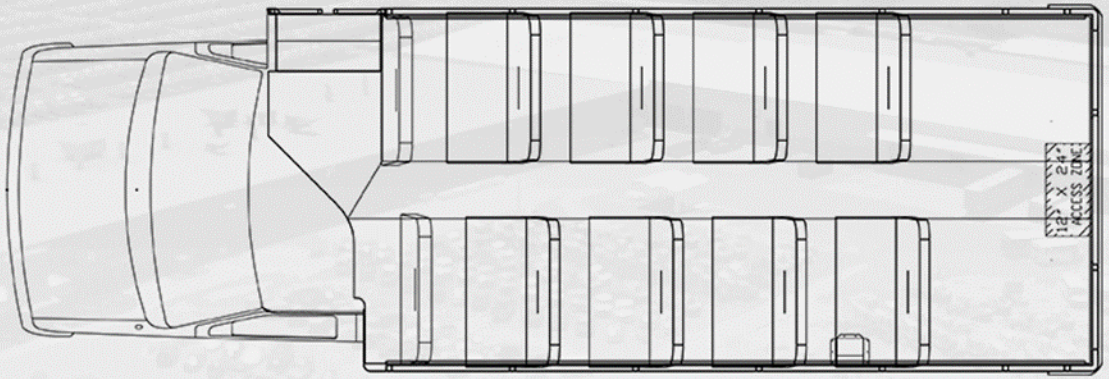
enter ZIP code or city and state



COLLINS – ELECTRIC BUS FLOOR PLANS



DE516WF – Passengers (16 + 1 wheelchair)

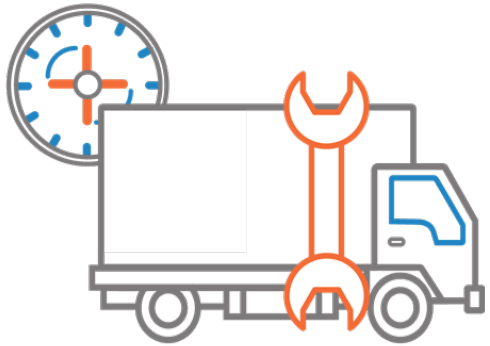


DE516 – Passengers (24 + 0 wheelchairs)

YOUR PATHWAY TO ELECTRIFICATION

Project Planning

- Review routes: range, route profile, and HVAC usage
- Check for eligible funding programs
- Review charging infrastructure needs
- Total Cost of Ownership analysis
- Evaluate vehicle options – focus on technology maturity, local presence and customer support infrastructure



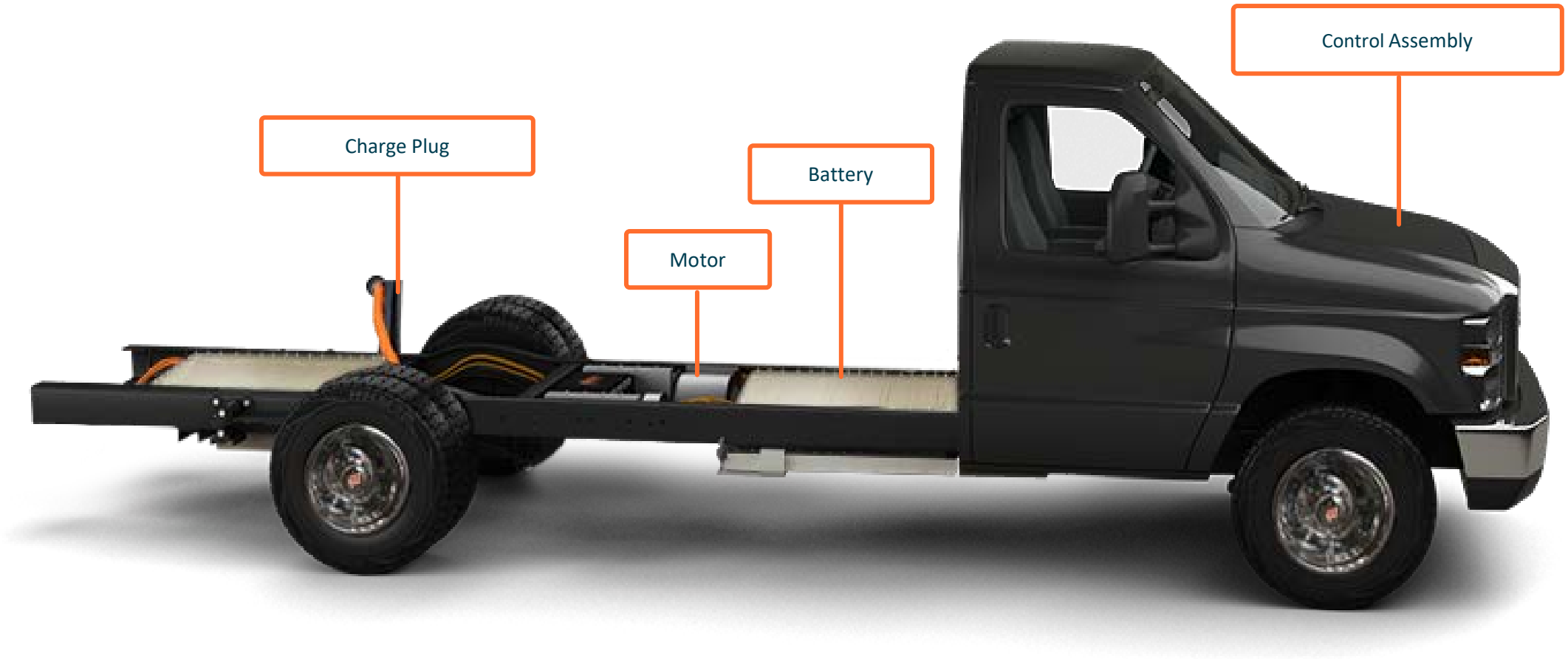
Project Execution

- Ensure charging infrastructure is installed and powered before vehicle deliveries
- Formal driver and mechanic training
- High touch Customer Service to ensure a seamless deployment
- Usage reports detailing uptime, utilization and daily mileage/range
- Driver training refreshers as needed

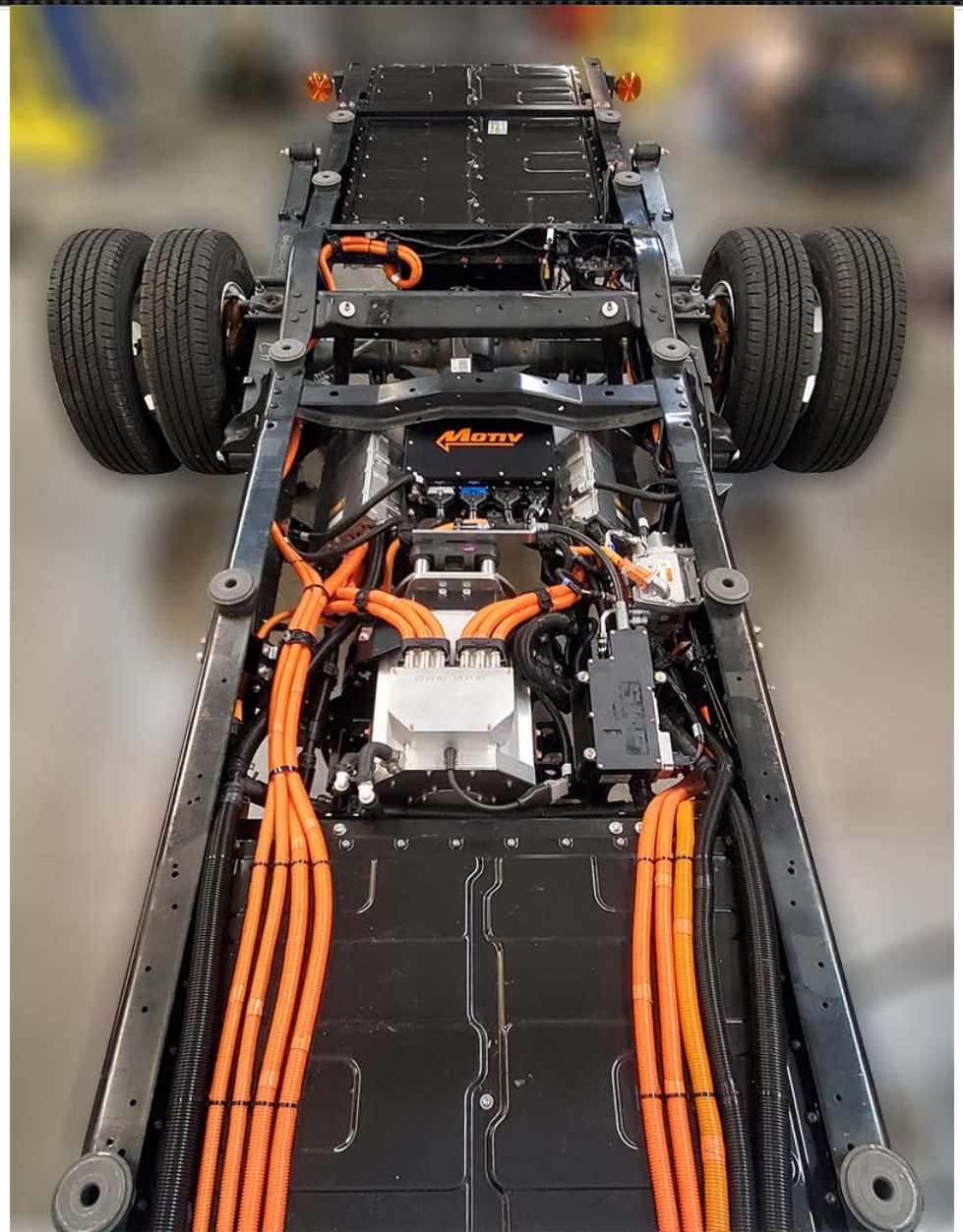
Customer Support

- One of our Core Values: **Customer Support** extends all the way from pre sales to after sales
- Dedicated team of highly trained field technicians at your service to ensure post-deployment success

MOTIV – E-450 EPIC CHASSIS SPECIFICATIONS



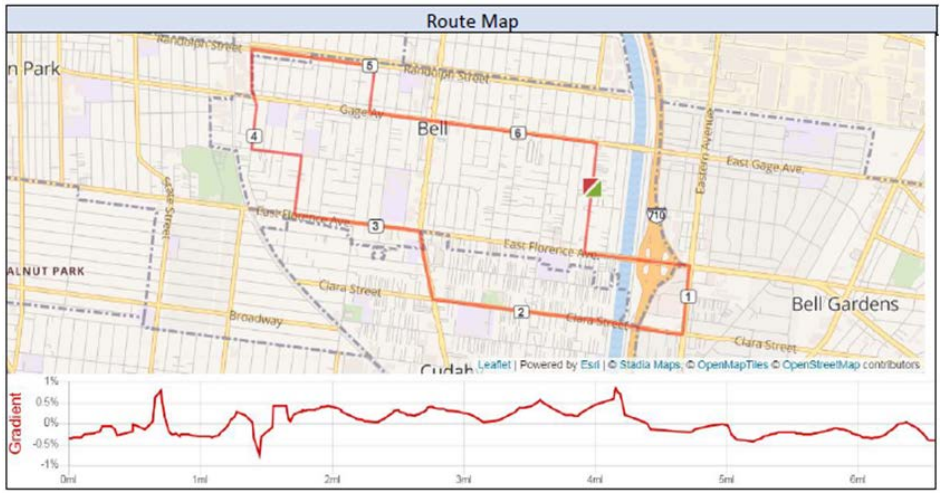
MOTIV – E-450 EPIC CHASSIS SPECIFICATIONS



Chassis	EPIC E-450
Battery Technology	BMW i3 Lithium-Ion
Battery Capacity	127 kWh (3 BMW packs)
Real World Range	105 miles
Level 2 Charging	19.2 kW / J1772
Level 3 Charging	60 kW / CCS
Regenerative Braking	Multiple levels, driver selectable based on preference/comfort
Hill Hold	Yes
Wheelbase Options	158” to 190”

RANGE: ROUTE ANALYSIS AVAILABLE

- Real world range varies based on driver behavior, route profile, and HVAC usage
- Collins / Motiv offers complimentary review of your exact routes and usage to confirm if EVs are suitable for your routes
- Collins / Motiv provides driver training and support after deployment to ensure driver and operator satisfaction



Shift Time		45 Mile Trip			
Start	09:00	Miles Travelled	45	Available Range	60
End	12:00	Time Charged (min)		State of Charge	58%

Shift Time		90 Minute Charge			
Start	12:00	Miles Travelled		Available Range	82
End	13:30	Time Charged (min)	90	State of Charge	78%

Shift Time		45 Mile Trip			
Start	13:30	Miles Travelled	45	Available Range	37
End	16:30	Time Charged (min)		State of Charge	35%

Shift Time		360 Minute Charge			
Start	16:30	Miles Travelled		Available Range	105
End	22:30	Time Charged (min)	360	State of Charge	100%

EXPERIENCE

Describe experience working with utilities in past projects. Include information related to equipment, infrastructure upgrades, charging rates, rate structures, etc.

- Collins Bus / Motiv has facilitated numerous infrastructure projects for fleets, several of which involve different power utilities. Current projects include the power utility as an active participant and funding provider, where our California fleets are directly receiving infrastructure incentives as part of PG&E's EV Fleet Program and SMUD's Commercial Fleet program, among others. Under these programs, To The Meter (TTM) infrastructure is entirely funded by the power utility, and EVSE hardware and/or installation is also partially funded. Further incentives include specialized electric vehicle charging rates for separately-metered charging station installations, which have drastically increased the ROI of our customer's electric vehicles. Motiv's role as part of these programs has been to serve as the coordinator and project manager for our customers, assisting them throughout the entire process to ensure successful EVs deployments.

MAINTENANCE & SERVICE SUPPORT

Describe maintenance/service support available to fleet customers in Texas, including facility names and contact information. If support is not currently available in Texas, describe any plans for doing so.

- Network of field technicians who provide service at user's locations available to be dispatched from three strategic locations (California, New York, and Indiana) to efficiently, and expeditiously respond to service needs limiting service disruptions. Most service calls can be addressed within 24 hours.

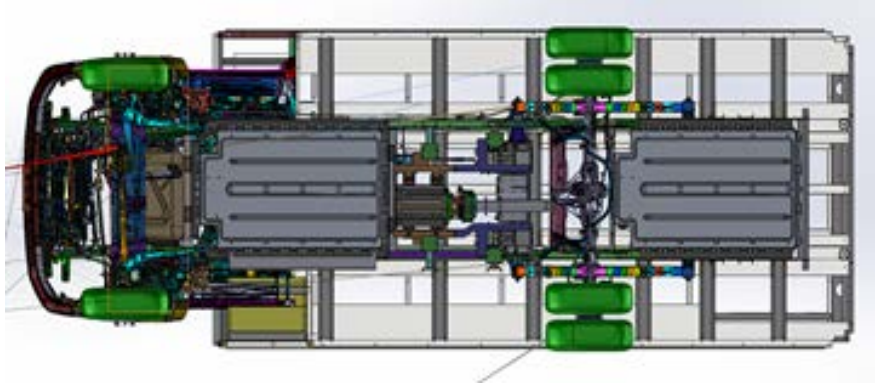
- Available turn-key solution. We have a program where the cost of EVs is cost neutral or better to the school district and we handle everything from vehicle ownership to installing the infrastructure and handling the maintenance and support on site, 24 /7.

CHARGING INFRASTRUCTURE

Describe recommended charging infrastructure and protocols, including any recommended charging manufacturers, specific EVSE makes/models, charging speeds, etc. Describe any systems for "managed" charging that are integrated into the bus.

- We recommend CS-100 charging station provided by ClipperCreek. This is a robust plug-and-play unit that provides the highest Level 2 (19.2 kW), allowing vehicles to charge from 0-100% in about 8 hours. For fleets needing networked (smart) charging solutions, we work with a variety of station networking partners to provide customized turnkey data reporting, Level 3 DC Fast Charging and load management services, and other smart station features.

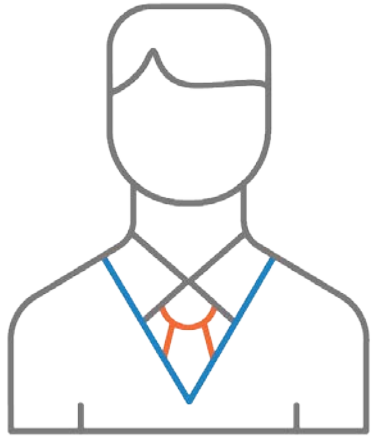
- All Motiv-powered all-electric vehicles have an on-board charger that manages charging and utilize a standard J1772 connection. For fleets seeking managed/scheduled charging, Motiv can facilitate a networked charging station solution. We assess customer's current charging installation, make recommendations, and assist with implementation as needed.



APPENDIX

- Why Go Electric
- Contact Information – EVSE Manufacturers
- Why Motiv
- Motiv – Freeing Fleets from Fossil Fuels
- Advertisement
- Point of Contact

WHY GO ELECTRIC?

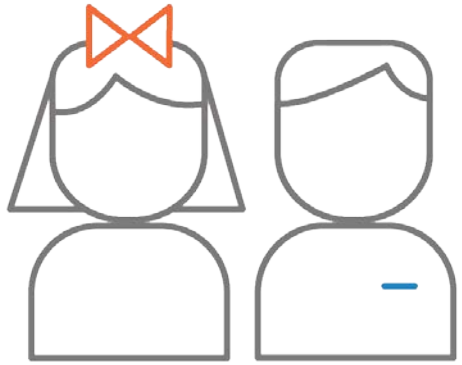


For Fleet Managers

- Up to 85% O&M savings
- Local customer support
- Compliant with new regulations
- Real time data tracking

For Drivers

- Free driver training
- Comfortable and responsive
- No more fuel stops or idling
- Configurable regenerative braking

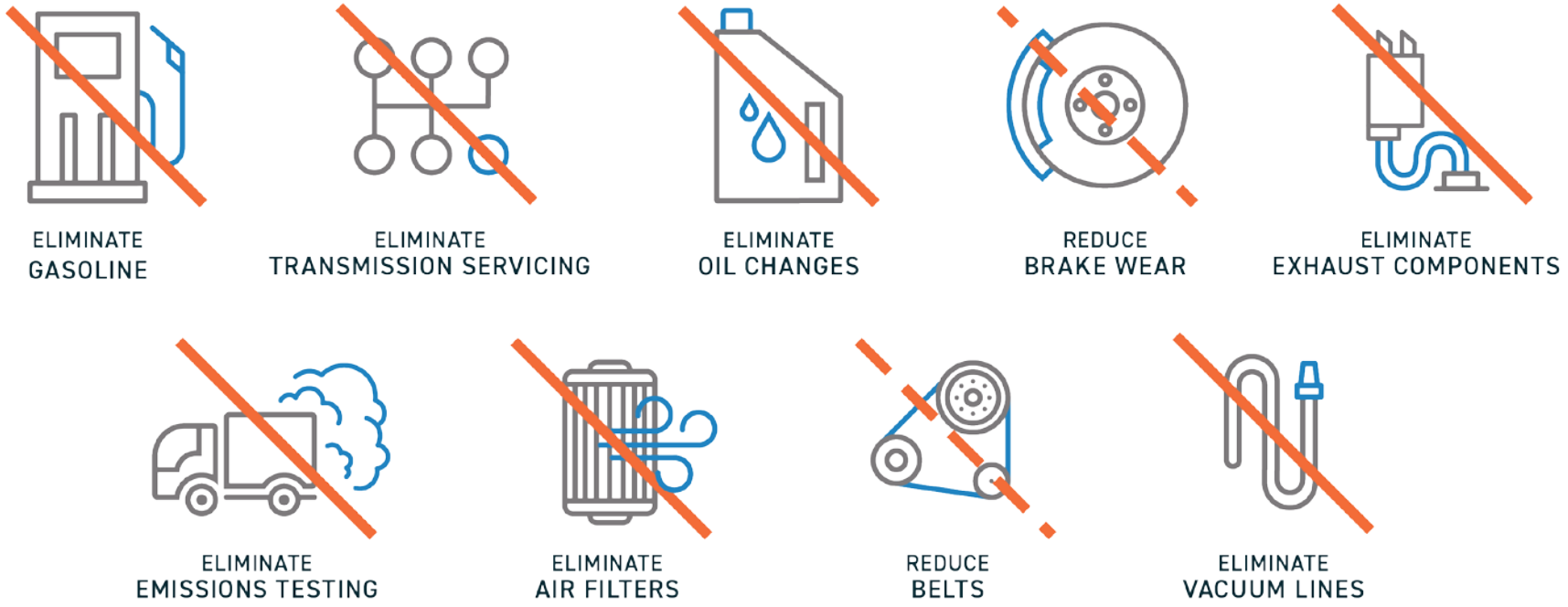


For Riders

- Healthier for communities
- Cleaner for the environment
- Comfortable, no vibrations
- No noise for quieter rides

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.



CONTACT INFORMATION – EVSE MANUFACTURERS

Provide contact information for any recommended EVSE manufacturers. These manufacturers may be contacted to request their participation in the series of webinars.

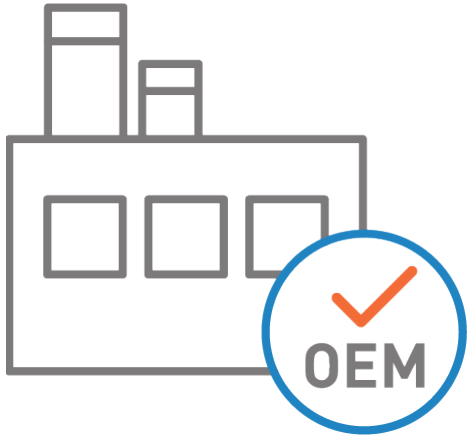
Will Barrett
Director of Sales
ClipperCreek
Will@clippercreek.net
530.887.1674 x 303

Dexter Turner
Founder & CEO
OpConnect EV Charging Solutions
dturner@opconnect.com
(503) 553-9106

Kevin Kostiner
Head of Business Development & Partnerships
EverCharge, Inc
kevink@evercharge.net
(415)-942-1092

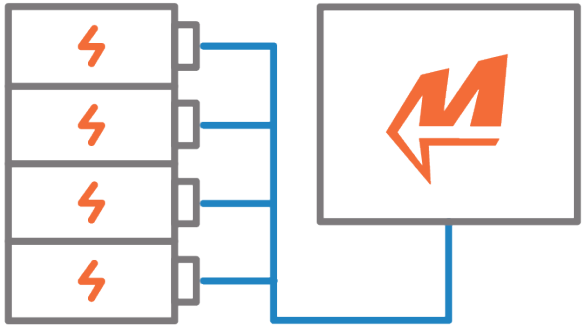
Customer references available upon request

WHY MOTIV



OEM Approved

- Ford eQVM approved electric chassis to ensure robust design, reliability, and warranty coverage
- Final stage vehicle built by industry leading bus and truck builders in high-volume production plants



Proven Batteries

- Commercially proven battery packs with significant R&D behind them to ensure quality and reliability, and built in high-volume automated production facilities
- Current partners BMW has billion of real world miles of experience with over 100,000 vehicles on the road using the same batteries

Customer Support

- Strong pre-sales project planning support – incentives, charging infrastructure and more
- Dedicated team of highly trained field technicians at your service to ensure post-deployment success

MOTIV – FREEING FLEETS FROM FOSSIL FUELS

- Ford eQVM approved all-electric F-59, F-53 & E-450 chassis built with commercially-proven batteries and components and industry leading truck and bus body partners
- Corporate HQ plus 2 locations in California, with chassis electrification in Indiana and Michigan
- Software and power electronics specialists for medium duty EVs with >10 awarded patents and >10 pending
- Proven 5th generation technology: >100 vehicles, >1 million miles, 100+ in order backlog with >50% repeat orders
- Customers: Aramark / AmeriPride, Bimbo Bakeries, Mountain View, USPS, Winnebago, CRP, Town of Estes Park, various school bus districts and contractors across CA, AZ, NY, CT and IL
- >900+ metric tons of GHG eliminated

ADVERTISEMENT: SCHOOL BUS FLEET

POINT OF CONTACT

Chris Charlton

Brand Director

chris.charlton@collinsbus.com

Mobile: 620-931-0763

https://www.collinsbus.com/electric-school-bus

Electrification of the Yellow Bus

ELECTRIFICATION:

North Central Texas Council of Governments

December 16, 2020

Thomas Dealer

THOMAS BUS
TEXAS
AN STR COMPANY

Thomas Bus Texas
8806 Mississippi St.
Houston, TX 77029
Toll Free: (800) 481-6564
www.thomasbustexas.com

Richard Shively
General Manager
Thomas Bus Texas
8806 Mississippi Street
Houston, TX 77029
(713) 580-8601 Direct
(281) 745-5477 Cell

Daimler Trucks Electric Portfolio

DAIMLER

Mercedes-Benz

Thomas BUILT BUSES

eMobility Global Footprint

DAIMLER

Daimler Trucks N.A.


Mercedes-Benz

Research & Development

Thomas Built Buses

Freightliner Custom Chassis

ACCUMOTIVE

Our own American Gigafactory

StoreDot

One example of our investments

Others: PROTERRA chargepoint+

Mercedes-Benz

MB Passenger Car


MB Trucks/EvoBus


MB Van (Sprinter/Metris)

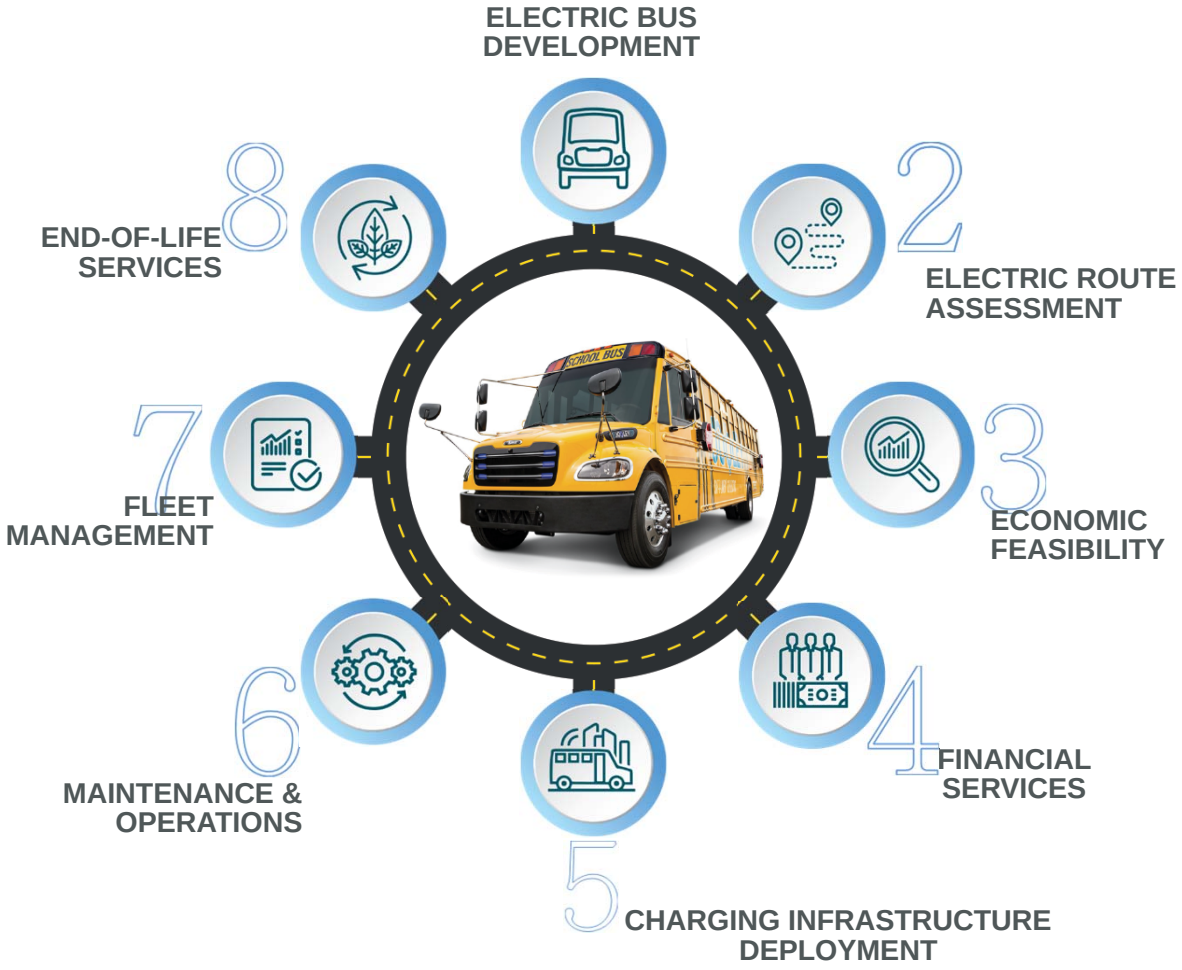
ACCUMOTIVE

Our own Gigafactory

FUSO

Mitsubishi Fuso Bus & Trucks

Ecosystem Support for School Buses



Day in the Life of a BEV School Bus

JOULEY

Day Operation with Overnight Charging and Mid-day Re-charge

Example: School bus operates morning route with a return to bus yard for charging. After period of charging, school bus operates afternoon route with return to bus yard. After afternoon route, school bus is charged overnight.

Detailed EV Release Criteria

Safety Testing

- **High Voltage Safety**
  Battery Safety - MBN LV 123, SAE J2929, UN 38.3
- **Functional Safety (ISO 26262) Due Diligence**
  Hazard Analysis and Risk Assessment (HARA)
  Fu-Sa concept & Testing
- **Crash Testing, Colorado Rack & Kentucky Pole Test**

Compliance Testing

- **EPA & ARB Certifications**
- **FMVSS/ CMVSS Regulatory Testing**
- **State & Provincial Specific Testing**

Functional Testing

- **HV & LV Functionality**
  Steering, Braking, Cooling, HVAC
  Battery Thermal Mgmt, Motor Torque
  Drivability & Range
- **Hot & Cold Weather Testing**

Reliability Testing

- **Reliability Growth -** 15 Yr school bus duty-cycle
  Mixed use-case route designs (highway, stop/start, city)
  100k miles coverage
- **Durability Testing**
  Rough Road structural durability
  Compressed test profile correlated to typical NA school bus life and duty cycle.

Specifications Overview

UP TO 135
MILES RANGE

220
kWh TOTAL BATTERY CAPACITY

295
PEAK HORSEPOWER

2
SPEED TRANSMISSION

100
% CHARGE <3.3 HOURS DC 60kw CHARGER

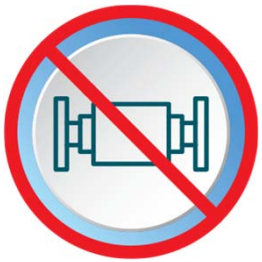
DC FAST CHARGE
J1772-CCS1 PLUG

Reduced Maintenance Costs

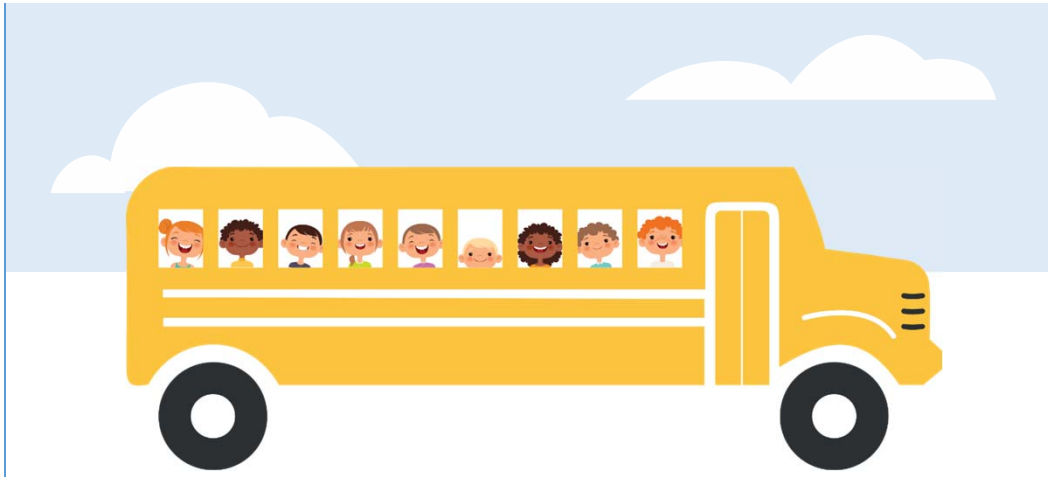
FUEL

OILS/FILTERS/
LUBRICANTS

BELTS



AFTER TREATMENT
COMPONENTS



IMPROVED
RIDE FOR STUDENTS

NO ENVIRONMENTAL EMISSIONS

HEALTH BENEFITS
FOR RIDERS

Response to COVID-19

Social Distancing & Seating: Addressing social distancing with STARS based seating configurations and alternative seating arrangements

Rider Personal Protection: Supporting riders with on board based personal protection systems to reduce potential known virus transmission modes

Driver Personal Protection: Supporting the driver with on board protective barriers

Sanitizing & Disinfecting: Interior friendly surfaces and solutions to support a sanitized and disinfected environment

PROTERRA ELECTRIC VEHICLE TECHNOLOGY

Leading provider of commercial electric vehicles and technology for fleets

Proterra city bus

Powered by Proterra

Thomas school bus

Van Hool coach bus

Commercial electric fleet technology

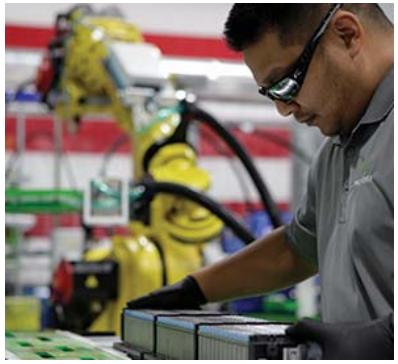
High power charging

Energy-dense battery pack

High efficiency drivetrain

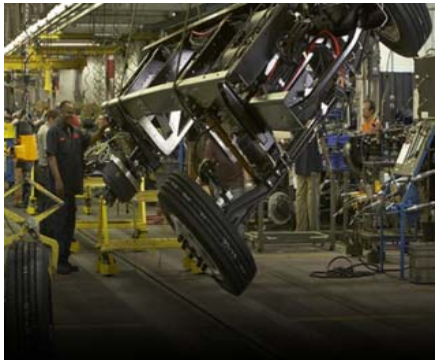
Connected vehicle platform

PARTNERSHIP FOR ELECTRIC SCHOOL BUSES



Proterra

- EV Bus Deployment know how
- Battery Technology & Charging Infrastructure
- Design and Manufacturing
- Burlingame, CA and Greenville, SC



Freightliner Custom Chassis Company (FCCC)

- C2 Chassis Manufacturing
- Service expertise
- Gaffney, SC

Thomas Built Buses

- Dealer sales and service network throughout the U.S.
- School Bus Design and Manufacturing
- High Point, NC

Close proximity of design and manufacturing facilities enables close collaboration and efficient production.

Charging, Battery & Infrastructure

DC FAST CHARGING WITH 60 kW POWER

Open source communications protocol

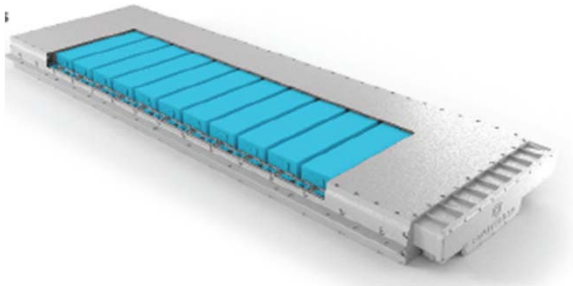
V2G Bi-directional V2G capability

Smart grid ready

EXPERIENCED EV INFRASTRUCTURE EXPERTS

PROTERRA ENERGY™
FLEET SOLUTIONS

Proterra Battery
Smart, Safe, Efficient, Proven



SMARTER CHARGING FOR ELECTRIC SCHOOL BUSES

POWER CONTROL SYSTEM PAIR WITH UP TO 4 CHARGING DISPENSERS

Open source communications protocol

V2G Bi-directional V2G capability

Smart grid ready

- **STANDARDIZED TECHNOLOGY**

  Industry-standard charging technology seamlessly connects with your electric buses and other EVs.

- **FAST CHARGING**

  DC charging enables a full charge in less than 3 hours. With additional dispensers, up to 4 buses can be charged in automated sequence in less than 12 hours.

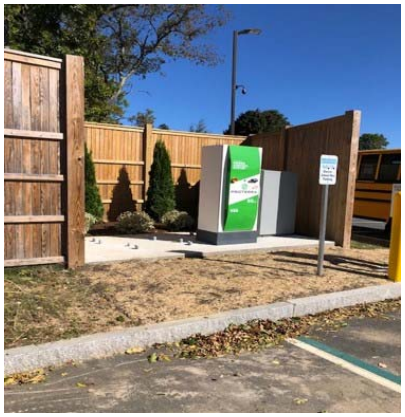
- **VEHICLE TO GRID (V2G) CAPABLE**

  Proterra's utility-preferred DC charging solution is optimized for bi-directional power flow, with inverters integrated into the charger rather than on the bus.

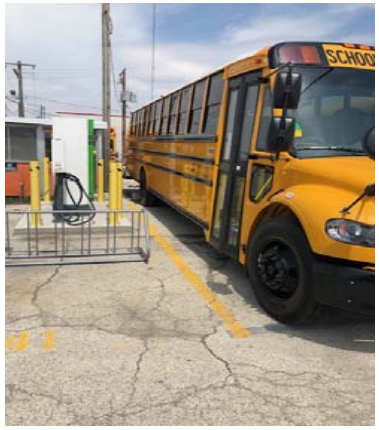
- **TURNKEY INFRASTRUCTURE**

  Proterra offers turnkey installation of your charging infrastructure to simplify your transition to an electric fleet.

Proterra Charger & Infrastructure




Beverly, Massachusetts

Maywood, Illinois


C2 Facility, Thomas Bus

Wilsonville, OR

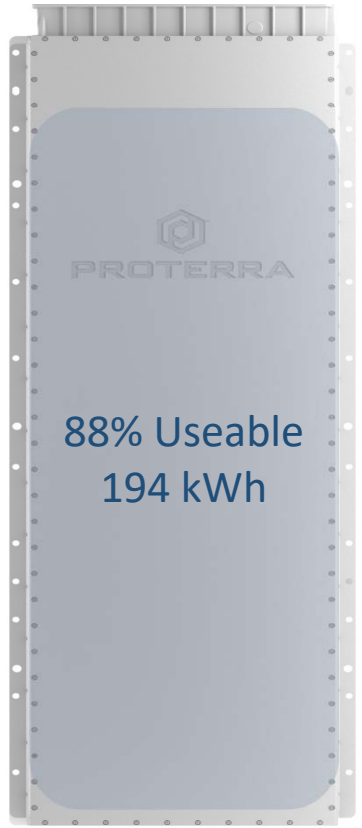
WHAT IS BATTERY CAPACITY?

TOTAL BATTERY CAPACITY

- Electric School buses on the market have battery capacities that range from very low to the highest which is 220 kWh.
- The Saf-T-Liner C2 Jouley powered by Proterra technology has a total battery capacity of 220 kWh.

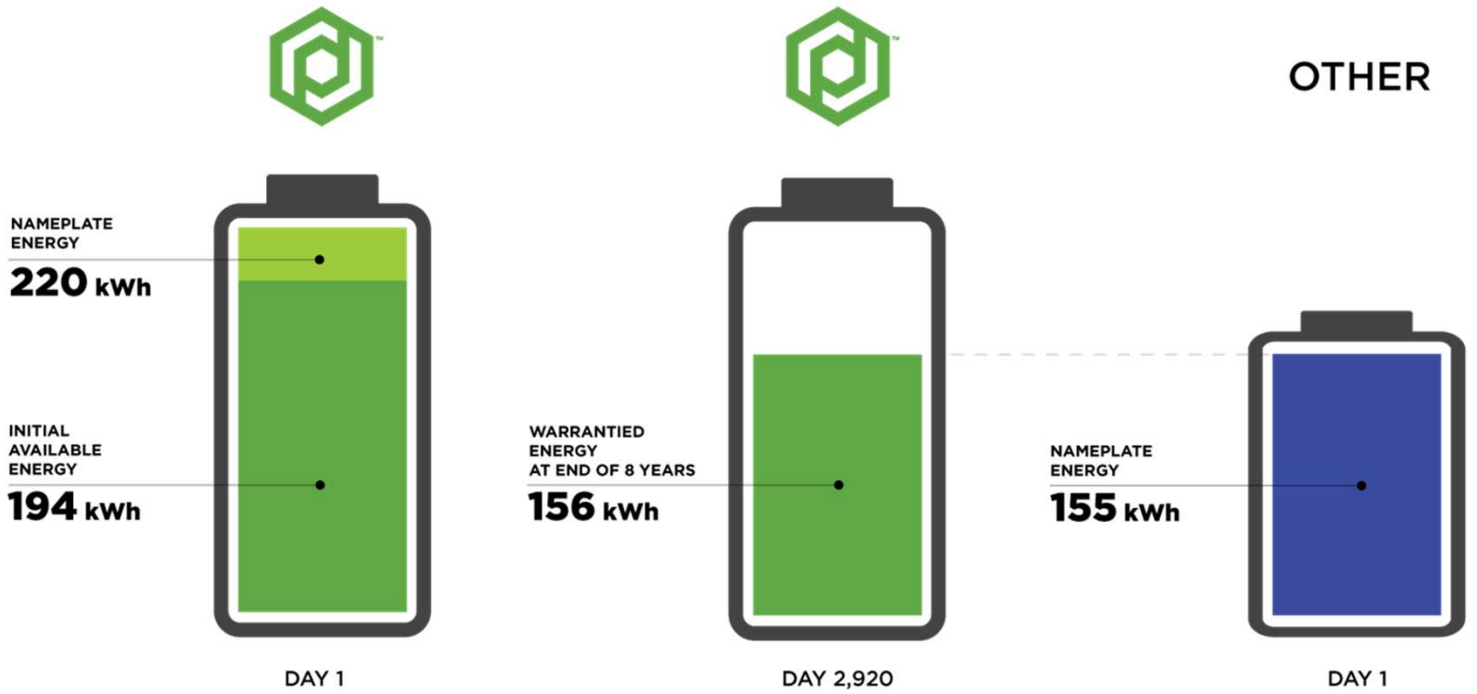
USABLE BATTERY CAPACITY

- The amount of energy that can actually be used **must be limited** to reduce battery degradation and increase longevity
- The actual amount of energy that can be used in a battery pack is called the **usable energy**
- The current Usable energy in the Jouley powered by Proterra is 198 kWh.

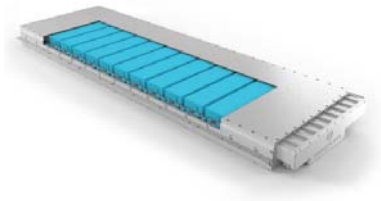


PROTERRA BATTERIES PROVIDE MAXIMUM ENERGY

PROTERRA BATTERIES PROVIDE MORE ENERGY AT THE END OF 8 YEARS THAN SOME OTHERS PROVIDE ON DAY 1



Battery Range



Total battery capacity

220kWh

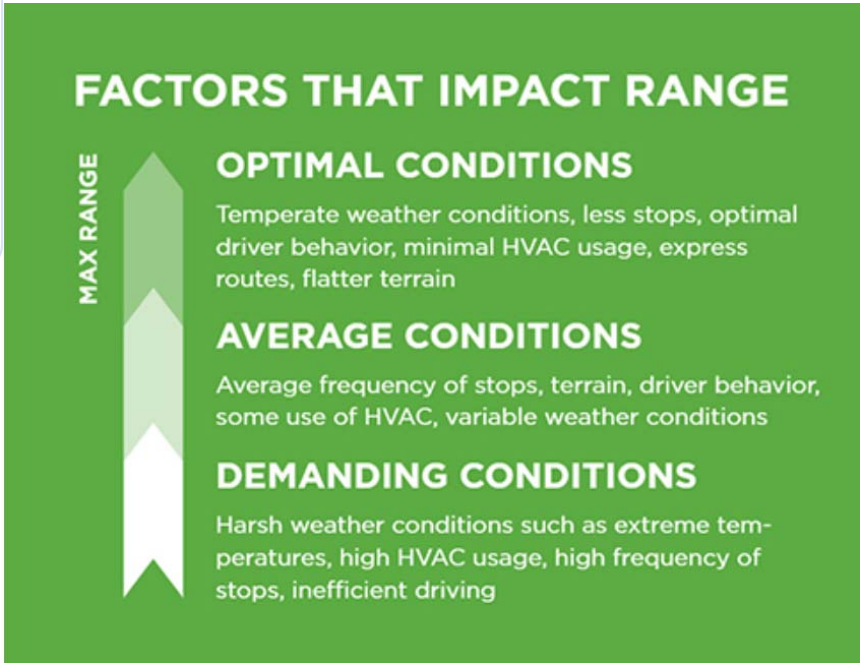
Vehicle efficiency
1.474 kWh/mile

Nominal range = 149 miles = $\frac{220\text{kWh}}{1.474\ \text{kWh/mile}}$

Useable range = 131 miles = 149 miles x 88% useable battery capacity

*Operating range is simulated based on usable battery capacity which is limited to maintain longevity of the battery pack.

Operating range can vary depending on route conditions, driver behavior, temperature and frequency of stops. The Proterra Route Simulation tool is in development and will provide specific operating ranges for individual school bus routes.



S.T.A.R.S MOUNTING SYSTEM

- **Saf-T-Anchor Removable Seat Mounting System**
  - Allows seats to be removed completely from inside the vehicle
  - Uses standard wall mount seat frames
  - Seats can only be re-installed from where they were removed

- **Available with 'S.T.A.R.S. Compliant' options for Wheelchair tie downs**
  - Slide 'N Click
  - Track Segments
  - Continuous 4 piece track

- **Available for SynTec S3C, S3B & IMMI seats**
  - 30", 36", 39" & 45" width

- **Meets all Federal (US & Canada) and State Regulations**
- **More Cost Effective Configurations**
  - No longer have to buy continuous track
  - No upcharge for track mounted seat frames
  - Allows the use of pockets, Slide 'N Click or track segments for wheelchair positions
- **Quicker and Easier for Customers to Re-Configure their buses to meet their ever-changing route needs**
  - No guess work as to where seats must be installed to meet FMVSS (Poka-Yoke)
  - Fewer fasteners

ELECTRIC VEHICLE TRAINING

Throughout DTNA, High Voltage Safety training falls into three categories
- High Voltage HV1, HV2, and HV3.

Each category has specific task and roles the employee is allowed to perform. Reading and understanding this guide is the equivalent of HV1 Training.

The Jouley-101 (HV1) training is <u>required</u> for drivers, technicians, and any other personnel that will interact with a pre-production Jouley Electric Bus.

Employee's task	without training	HV1 training	HV2 training	**HV3 training**
Driving a production eVehicle	X	X	X	X
Driving a pre-production vehicle containing a HV system		X	X	X
Perform any 'non HV work' on any vehicle containing a HV System (Decommissioning required if potential to damage HV System)			X	X
Perform work on HV Components while the vehicle is decommissioned			X	X
Decommissioning of HV-System/ Commissioning of HV-System				X
Perform any work on an automotive HV system				X
HV-System modifications / troubleshooting energized HV eVehicle				

Employee Job Classification	No Training Needed	HV1 training	HV2 training	**HV3 training**
Driver production HV Vehicle	X			
Driver of pre-production HV Vehicle		X		
Fleet/ Customer Technician(working HV eVehicle but non-HV Components)			X	
Fleet/ Customer Technician (working HV eVehicle and working on HV Components)				X
Fleet/ Customer Maintenance Employees not working on eVehicles (Awareness)		X		
Dealer Technician (working HV eVehicle but non-HV Components)			X	
Dealer Technician (working HV eVehicle and working on HV Components)				X
Dealership Technicians not working on eVehicles (Awareness)		X		
Anyone moving in and around (inside physical safety barriers) a HV eVehicle while maintenance is being performed. Anyone that must go beneath a HV eVehicle for any reason, inspections or other purposes.			X	

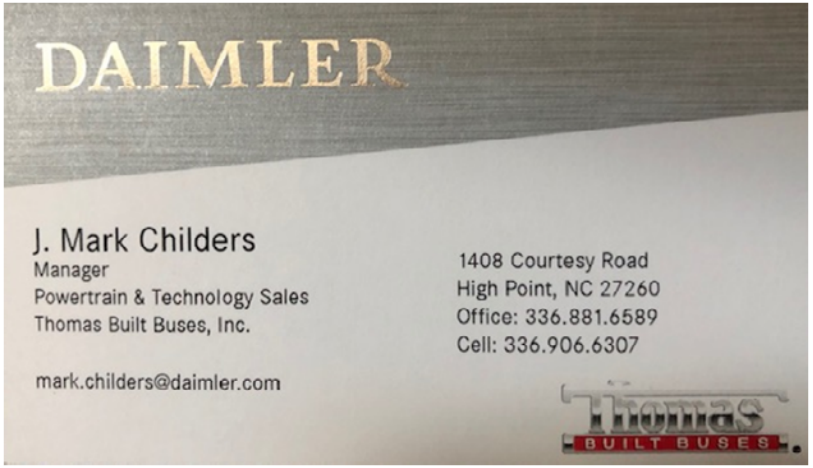
Thomas C2 Jouley Warranty Summary

Coverage Type	Coverage Terms
Standard Bus Body	3 years/50,000 miles
Standard Chassis	3 years/50,000 miles
Proterra Battery	8 years/175,000 miles/200,000 kwh throughput per battery pack(total of 2 packs per vehicle)
Proterra Powerdrive	5 years/100,000 miles (traction motor, transmission, inverter)
Extended Warranty Available	Up to 10, 12 & 15 years

Thank You!

VISIT US AT

https://thomasbuiltbuses.com/school-buses/saf-t-liner-c2-jouley/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Resources

Thomas Built Buses	https://thomasbuiltbuses.com/school-buses/saf-t-liner-c2-jouley/
Thomas C2 Jouley Video	Thomas C2 Jouley Video
National Renewable Energy Lab	https://www.nrel.gov/
US Department of Energy	https://afdc.energy.gov/tools
Argonne National Laboratory (AFLeet)	https://afleet-web.es.anl.gov/home/
EPA VW Settlement	https://www.epa.gov/enforcement/volkswagen-clean-air-act-civil-settlement
Proterra	https://www.proterra.com/
Proterra Battery Video	Proterra Battery Video

A Step-By-Step Approach to EV Infrastructure

Jerry R. Dennis, CEM, CEP

AVP, Energy & Infrastructure

Agenda

- Build a Business Case for EV’s
- Identify Charging Requirements
- Engage Local Utility (TDSP)
- Engage Retail Electric Provider (REP)

Build a Business Case for EV

What is your motivation?

- Operational
- Budget
- Environmental
- Efficiency

airport carbon accredited
NEUTRALITY

Carbon neutral accredited since 2016

DFW

Identify Charging Requirements

- What level of charging
  - Level 1
  - Level 2
  - Level 3 (Fast Charge)
- Distributed Charging (Opportunity Charging)
- Centralized Charging

Engage Local Utility (TDSP)

- Identify Service Location(s)
- Provide Power Requirements
  - Voltage
  - Phase
  - Demand (kW)
- Provide Charging Unit(s) Details

Engage Retail Electric Provider (REP)

- Can the load be served under an existing contract?
- Will the load be added to an existing account?
- Will the load represent a “material change” to the contract?
- Is it in the organization's best interest to execute a new electric service contract?

Questions

Thank You