



**SUSTAINABLE
FLEET
WEBINARS**

SCHOOL BUS ELECTRIFICATION



Sustainable Fleet Webinars: School Bus Electrification

June 12, 2019

- 2:00-2:02 **Rick Sapienza, NC Clean Energy Tech Center**—Welcome
- 2:02-2:10 **Chuck Woodruff, American Association of School Administrators (AASA)**--Introduction
- 2:10-2:20 **Margo Sidener, Breathe California**—Zero Emissions Squared: Solar Assisted School Buses Background
- 2:20-2:23 **Bob Garzee, Green Fleets Group**—Zero Emission Squared Pilot Demonstration Project
- 2:23-2:32 **Edward Monfort, DIYeV**—School Bus Electric Repower Solution
- 2:32-2:35 **Mark Roest, Sustainable Energy Inc.**—Solar Refueling
- 2:35-2:45 **Mark Childers, Thomas Built**—Electric Eco-System
- 2:45-2:55 **Tim Shannon, Twin Rivers Unified School District**—Real World School Bus Deployment Experience
- 2:55-3:05 **Cassie Powers, National Association of State Energy Officers (NASEO)**—VW Fund Opportunity Update
- 3:05-3:10 **Rick Sapienza, NC Clean Energy Technology Center & Tom Johnson, The 100 Best Fleets**—Wrap-Up
- 3:10-3:?? **Q&A**



Format

- Q & A at end
- Submit questions to “Panelists”
- Scheduled for 2:00p-3:15p
- Can go beyond, if interest remains
- Slide handout
- Recording





Chuck Woodruff
Chief Operating Officer
AASA, The School
Superintendents Association

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Contact Information

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Clean Cities Coalitions > Technical Assistance>

Find Data and Information



BREATHE
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Zero Emissions Squared

Solar-Assisted Electric School Buses



BREATHE
CALIFORNIA



Disruptive Innovation Project funded by
The Health Trust

Getting Kids to School in a dramatically
better way!

WHY- My Perspective

- **CEO, Breathe California**—Century-old Clean Air and Healthy Lungs Local Leader (environment & health) in San Jose, CA
- **Coordinator for Silicon Valley Clean Cities Coalition**, program supported by US DOE
- **Decades working in/with schools, former teacher**

Multi-Disciplinary Team Partners

- 1) **Breathe CA**
- 2) **Green Fleets Group (formerly ETDC)**
- 3) **Edward Monfort, inventor**
- 4) **Gilroy Unified School District**
- 5) **Silicon Valley Clean Cities Coalition**
- 6) **Green Transportation Workforce Development**
- 7) **CH Reynolds Solar**
- 8) **American Bus Video**
- 9) **Ralph Knight of Napa Valley Unified School District**
- 8) **100 Best Fleets**
- 9) **A-Z Buses**
- 10) **The Health Trust**

Overview -1st Project

Major Deliverables

- **1st full-size, class D solar-assisted, electric school bus, converted from diesel;**
- **Placed in service in a lower-SES school in Gilroy, CA together with solar-fueling station & integrated security system installed in the bus and school;**
- **Full training & support services**

Accomplished

**Completed,
launched May 27,
2014**



Diesel to Electric Bus

- **Converted bus**
- **Installed fuel station and security components (on bus and at school)**
- **Passed regulatory requirements**
- **Tested bus (on “real” routes); adjusted as appropriate**
- **Developed trainings and provided training to drivers, mechanics, fleet managers, school stakeholders, parents**
- **Put into regular service**

WHY RENEW PROJECT NOW?

Challenges

New, Alarming
Data on School Bus
Pollution

AND

- **55% of school buses are still regular diesel**

Source: Diesel
Technology Forum

Opportunities

- 1. More, Better EV Buses and Re-powers**
- 2. Better Recognition of Benefits of Conversion beyond cutting pollution**
- 3. Money, Money, \$\$\$\$\$**

Why: Scope of Need

School
Transportation
is a BIG Issue—

Nation's largest
transit
program

- **480,000** school buses in America and
- **26 million students ride daily**
- **346.6 million** Total daily mileage saved by students riding school buses

WHY- Busing is Good

School Busing
Saves
Miles Driven
and Fuel over
Parent
Transport

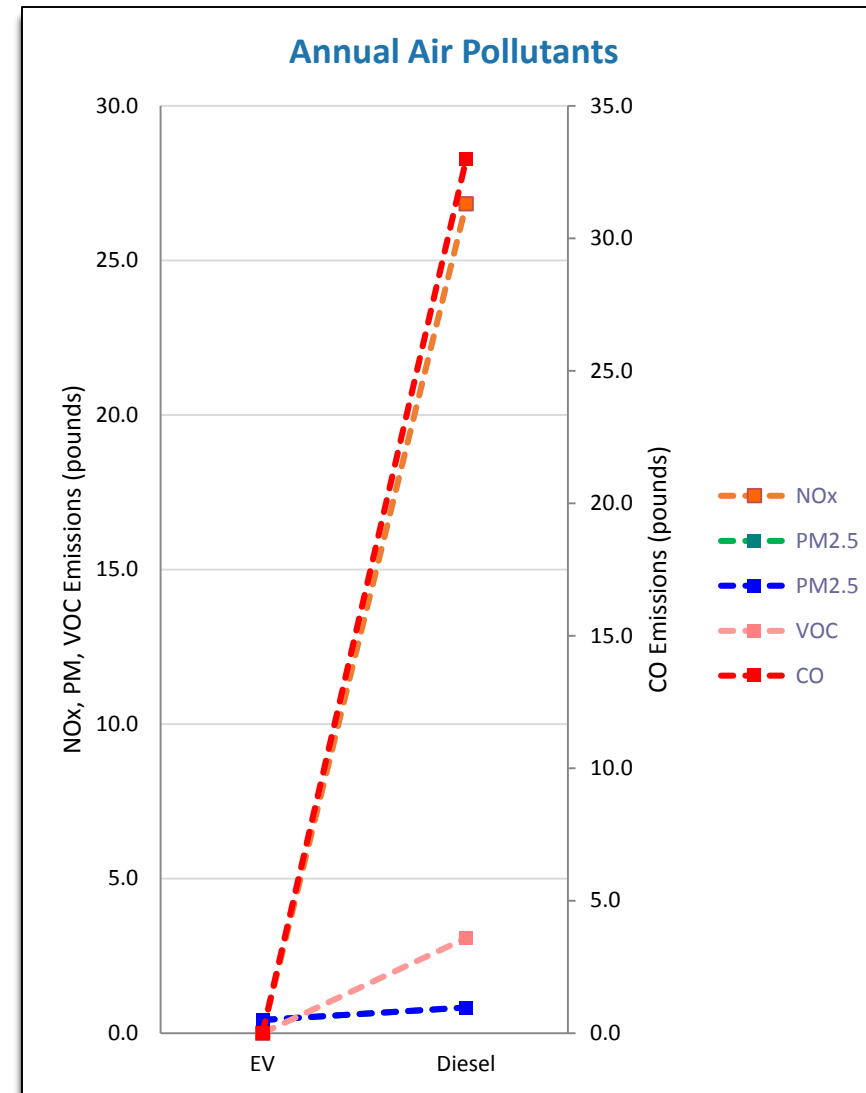
- **36**= # cars needed for students on one school bus
- **17.3 million**= # of private vehicles that would be needed to transport students that now ride school buses

Source: American School Bus Council

- free bus transportation to school really important for **lower-income** households

School bus diesel exposures to children pose as much as 23 to 46 times the cancer risk considered significant under US federal law.

“no known safe level of exposure to diesel or gasoline exhaust for children.” US EPA



Well-to-Wheels Petroleum Use and GHGs & Vehicle Operation Air Pollutants

WHY- Need Cleaner Buses

Fuel	CO	NOx	PM2.5	VOC
EV	0.0	0.0	0.4	0.0
Diesel	33.0 Pounds	26.8 Per	0.8 Year	3.1

WHY NOT: Myth--Too hard to find

NO- Many models EV school buses available

3 Type A, 4 Type C, 1 Type D

Many old diesels available to convert:

40% “clean” diesel

1 % percent natural gas CNG

2 % gasoline

>1 percent are electric,

WHY NOT—Myths: Too Much \$\$\$

Fuel Type	Price
Diesel	\$90,000
Electric	\$290,000
Propane	\$98,000
Compressed Natural Gas (CNG)	\$120,000

Source: <https://afleet-web.es.anl.gov/afleet/>

WHY NOT---Myth: Too Much \$\$\$

More grants available than ever before to subsidize purchase of electric buses

- **Volkswagen Environmental Mitigation Funds**
- **up to \$200 million in federal grants per year to retrofit or replace engines (Diesel Emission Reduction Act-DEIRA)**
- **State Funds**
- **Air Districts**

Check with your local Clean Cities Coordinator

<https://cleancities.energy.gov/coalitions/>

WHY NOT—Myth: Too Much \$\$\$

NO- Electric buses save dramatic amount of fuel, averaging over \$20,000 per bus per year

Fuel	Fuel Unit	\$/Fuel Unit
Gasoline	Gallon	\$2.80
Diesel	Gallon	\$3.06
Electricity	kWh	\$0.13
Gaseous H ₂	kg	\$0.00
E85	Gallon	\$2.39
CNG	GGE	\$2.37

WHY NOT—Myth: Too Much \$\$\$

NO- EVs save money on **maintenance**, requiring less lubricant, less frequent replacement of brakes, and more.

Solar Fueling , Vehicle to Grid Use of Energy Save even More (60% of CA school districts already have solar

WHY NOT----Myth: Drivers and
Mechanics will have to adjust to new bus

NO

**You can keep the same bus,
known and loved by all, and
convert it to electric.**

“We also find that retrofitting districts see significant test score gains in English, and smaller gains in math. Results suggest that engine retrofits can have meaningful and cost-effective impacts on health and cognitive functioning.”

School Bus Emissions, Student Health, and Academic Performance; Georgia State University

Dec. 2018

Pollution and School Performance

Does Pollution Drive Achievement? The Effect of Traffic Pollution on Academic Performance

Jennifer Heissel, Claudia Persico, David Simon

NBER Working Paper No. 25489 National Bureau of Economic Research

“downwind” middle/high school in the same zip code experience **decreases in test scores, more behavioral incidents, and more absences...**”

Long-lasting Results

250,000 old diesel school buses still on the road that were manufactured before stringent emissions regulations took effect in 2007. Using the E.P.A.'s [diesel emissions quantifier](#), we calculated that replacing 1 in 10 (25,000) would save about 5,000 tons of pollution in the 1st year, & the **benefits would continue as long as the buses were on the road.**

Dirty School Buses, Sick Kids; Joshua M. Sharfstein & Frances Phillips, Jan. 8, 2016

Contact Information

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Find Data and Information



BREATHE
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The Green Team and Green Fleets Group



Bob Garzee, Team Leader

ETDC Founder & CEO

greenfleetsgroup.com

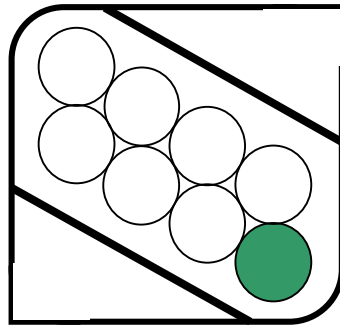
Email: bob@greenfleetsgroup.com

Phone: 408-221-3367




Zero Emissions Squared

Solar-Assisted Electric School Buses

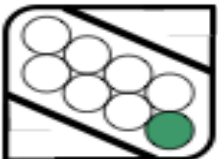
The Green Team and Green Fleets Group



THE GREEN TEAM & GREEN FLEETS GROUP COALITION



BREATHE
CALIFORNIA



GREEN TEAM
Green Transportation Team
Of Silicon Valley

VEHICLES	TECH	INFRA	FINANCING	TRAINING	SUPPORT
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TURNKEY SUPPORT FOR YOU

The Green Team and Green Fleets Group



- Acknowledged for years of work in electronic transportation
- Recognized for disruptive innovation
- Motor Week video captures the significance of the electric school bus project
- [Motor Week video](#)

The Green Team and Green Fleets Group

MotorWeek

Television's Original Automotive Magazine

<https://youtu.be/XEq7yQAJfEY>

The Green Team and Green Fleets Group



Bob Garzee, Team Leader

ETDC Founder & CEO

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Edward Monfort
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www.DIYev.com



Electric School Buses

[DIYev.com](https://www.diyev.com)

A Winning Combination



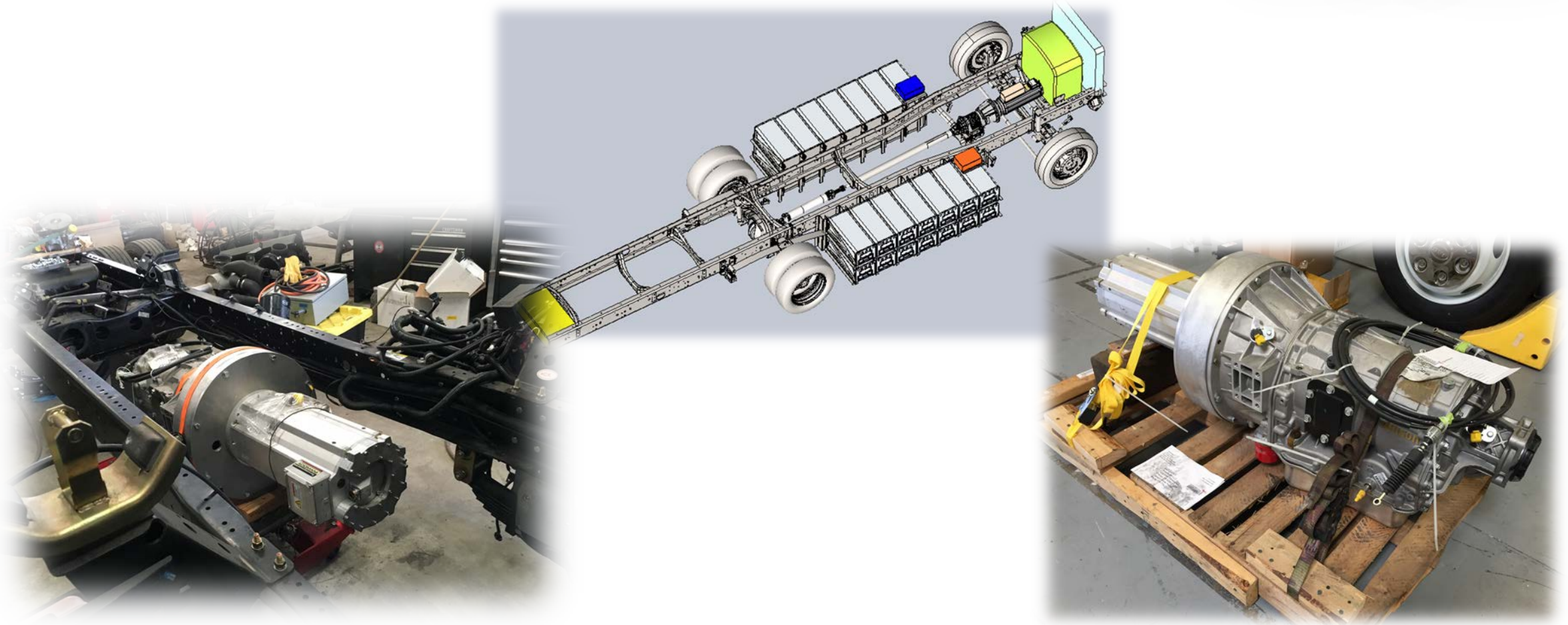
“What makes us different”

DIYEV.COM

- Drivetrain
- Battery Pack
- Maintenance and parts
- Don't throw your used bus away. Cut cost for EV electric bus in half by using DIYev.

The DIYev.com clear difference

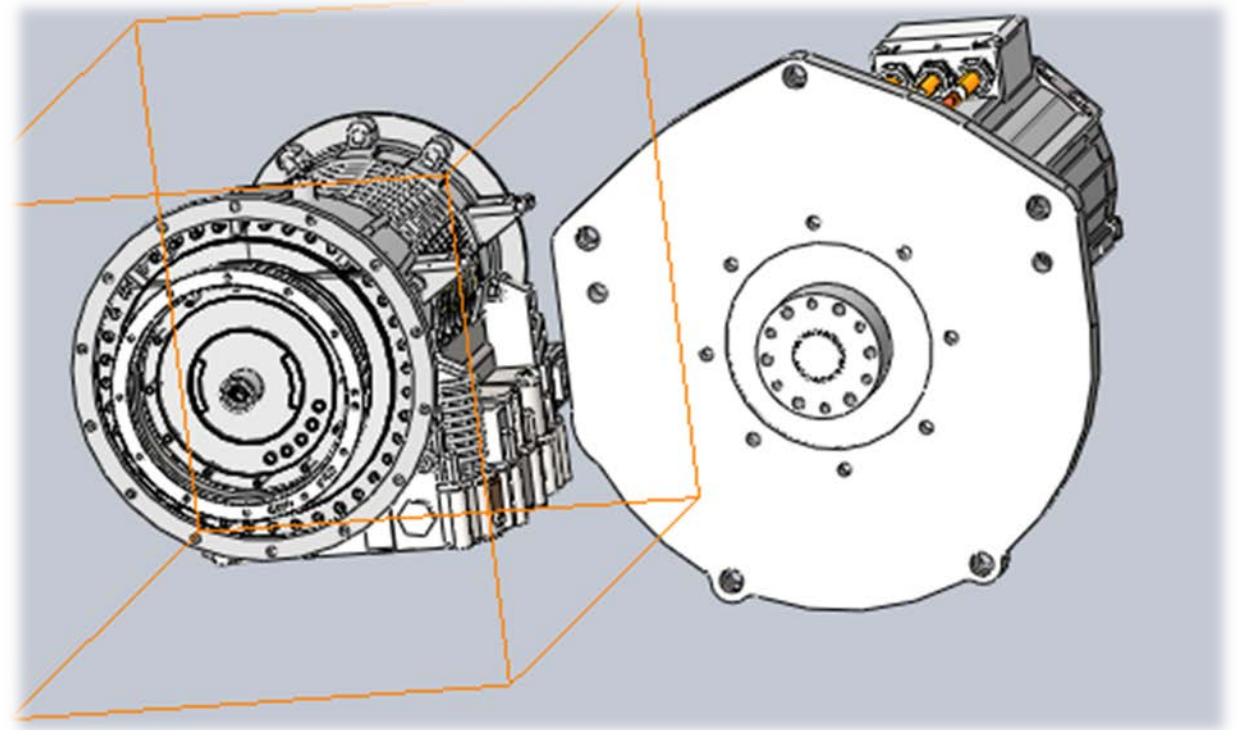
DIYEV.COM



“Drivetrain difference”

We are a Repower Drivetrain company:

1. Almost all OEM parts remain in the vehicle
 2. Remove ICE Internal Combustion Engine
 - 3. Replace with EMA (Electric Motor Assembly)**
 - 4. Can last 25 years with zero maintenance, saving over \$100K over lifetime**
-
1. Remove Fuel system
 - 2. Replace with Battery pack**
 3. Remove Exhaust system



DIYev.com powertrains provide the same excellent performance as its diesel-powered chassis counterpart.

Powertrain specs: up to 625HP and 1,200 ft lbs of torque. All programmed to match previous ICE OEM specs.

“Power Pack difference”

We are an Electric Vehicle Battery company:

1. Modular design
2. Add modules at anytime
3. Add more modules for more power
4. Add more modules for more distance
5. **Last 3,000 cycles before replacement needed.
Saving over \$88K in fuel cost**



DIYev Battery Modules can be upgraded or maintained direct from your existing facility using your staff.

Battery Module info: Stack modules up to 850VDC, each module is 9.2KWH, and 38.4VDC.

“Maintenance difference”

We use your existing maintenance and parts infrastructure:

1. Repower EMA (Electric Motor Assembly) attaches to existing OEM engine mounts
2. Plug and play. No training required. One simple wiring harness.

1. Battery modules placed on side of vehicle for **EASY ACCESS**.
2. Plug and play. No training required.
3. 2 keyed high voltage plugs and 2 keyed low voltage plugs
4. **Save over \$100K in maintenance over lifetime**



33,000 GVWR Type D school bus Video

DIYEV.COM

New 2019 Drivetrain available now:

- Fits up to GVW to 33,000GVW
- Our entire system is an easy design drop in for **assembly lines and/or Repower**

Repower EV school bus is half the cost of new EV school bus

Click below or copy and paste for youtube video

<https://youtu.be/v2JfDYuKr1s>

Our Team experience

DIYEV.COM

- Our CTO was with Lockheed Martin autonomous and optics design division
- Awarded 4 patents in the EV industry for our clients
- Thousands of miles of testing EV school buses & trucks
- First to acquire CHP approval for type D school bus



Team past experience builds

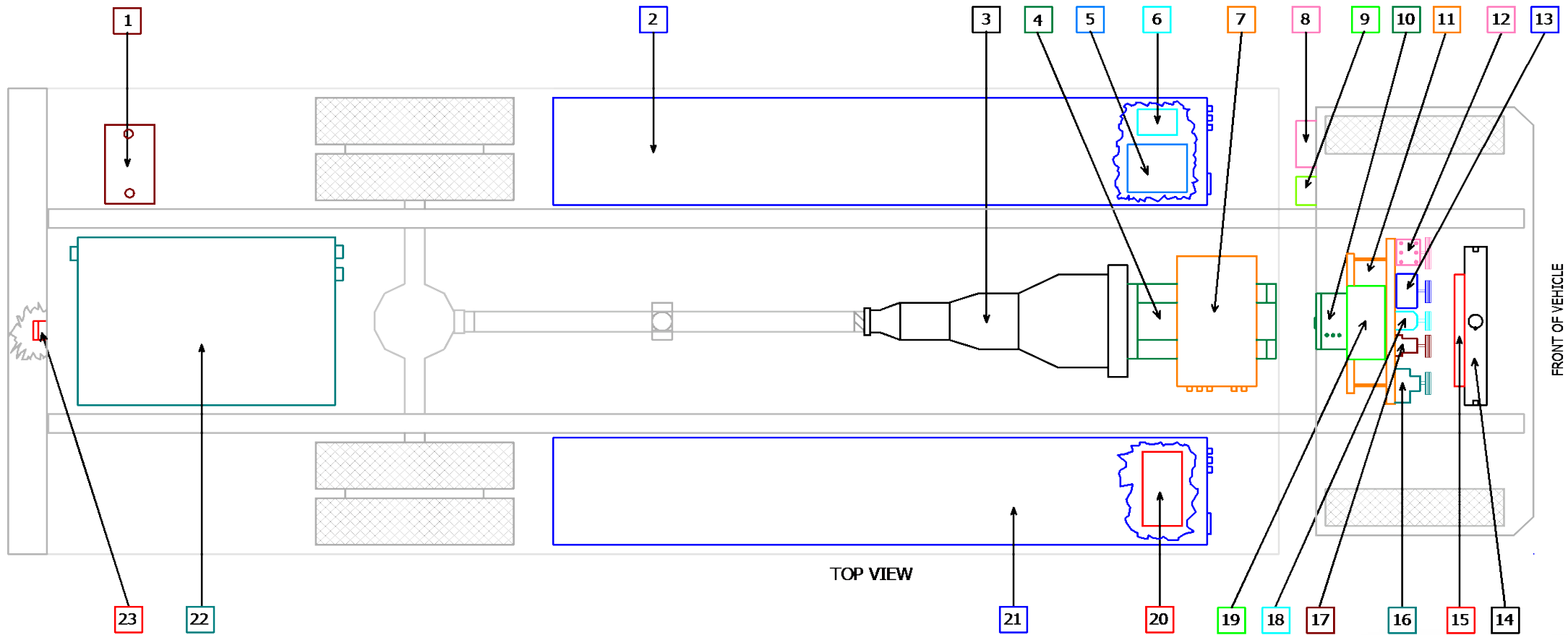
DIYEV.COM



100% all electric vehicle builds

- Two 40 foot type D bus (100 mile distance)- repower vehicle
- Ford F150 (120 mile distance)- repower vehicle
- Ford Ranger (80 mile distance)- repower vehicle
- 19,500 GVWR cab over truck (100 mile distance)- **New Truck**

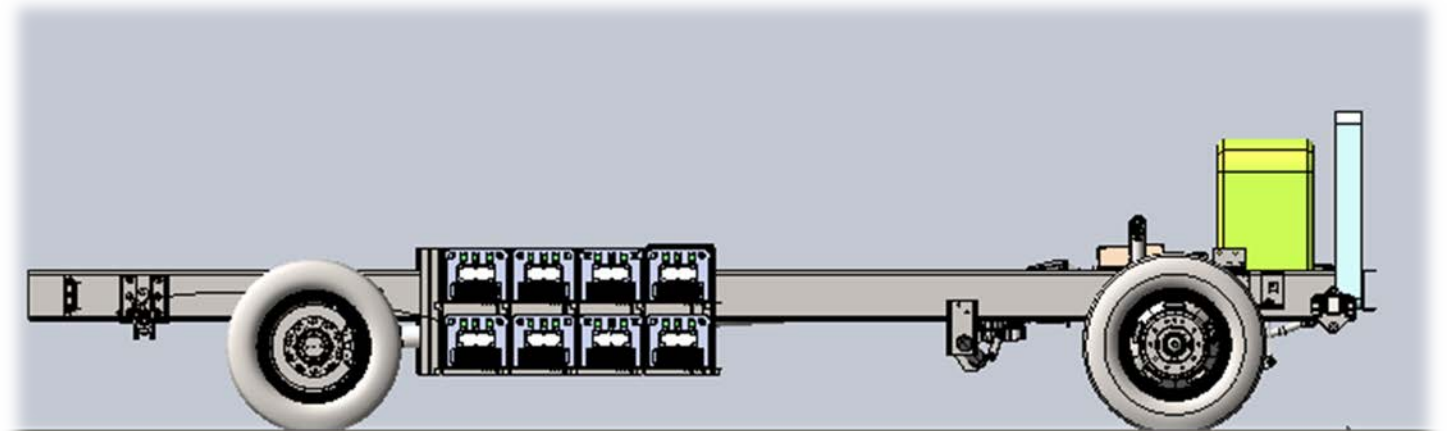
Powertrain Configuration



100% 33,000 GVW Type D.

DIYEV.COM

- Over 100 mile distance
- 17% grade
- 33,000GVWR
- 65mph
- Regen
- AC PM motor
- 180 KWH battery pack
- OEM Brakes



The System:

DIYEV.COM

- UP TO 420KW ELECTRIC MOTOR
- UP TO 850 VDC VOLTAGE
- UP TO 1,280 FT LBS TORQUE
- UP TO 230KWH BATTERY PACKS
- UP TO 21KW FAST CHARGER

- ALL LIQUID COOLED



DIYev.com California manufacturing facility

DIYEV.COM

STOCKTON, CALIFORNIA

MANUFACTURING PLANT

55,000 SQUARE FEET WITH AN ADDITIONAL 50,000 SQUARE FEET AVAILABLE FOR EXPANSION. MULTI-FACILITIES ACROSS THE COUNTRY NOW IN PROGRESS.

CAN PRODUCE 10 POWERTRAINS PER DAY (IN HOUSE)

- BUILD POWER TRAINS AND REPOWER BUSES FOR YOU FULL TURN-KEY IN AMERICA
- BUILD BATTERY MODULES AND DRIVETRAIN
- FULL MAINTENANCE AND TRAINING INCLUDED IN AMERICA
- 100% ASSEMBLED IN AMERICA



Questions and Answers...

Thank you for your time. We look forward to building a long and lasting relationship together.

www.DIYev.com

Edward Monfort

727-434-0007



Sustainable Energy, Inc.



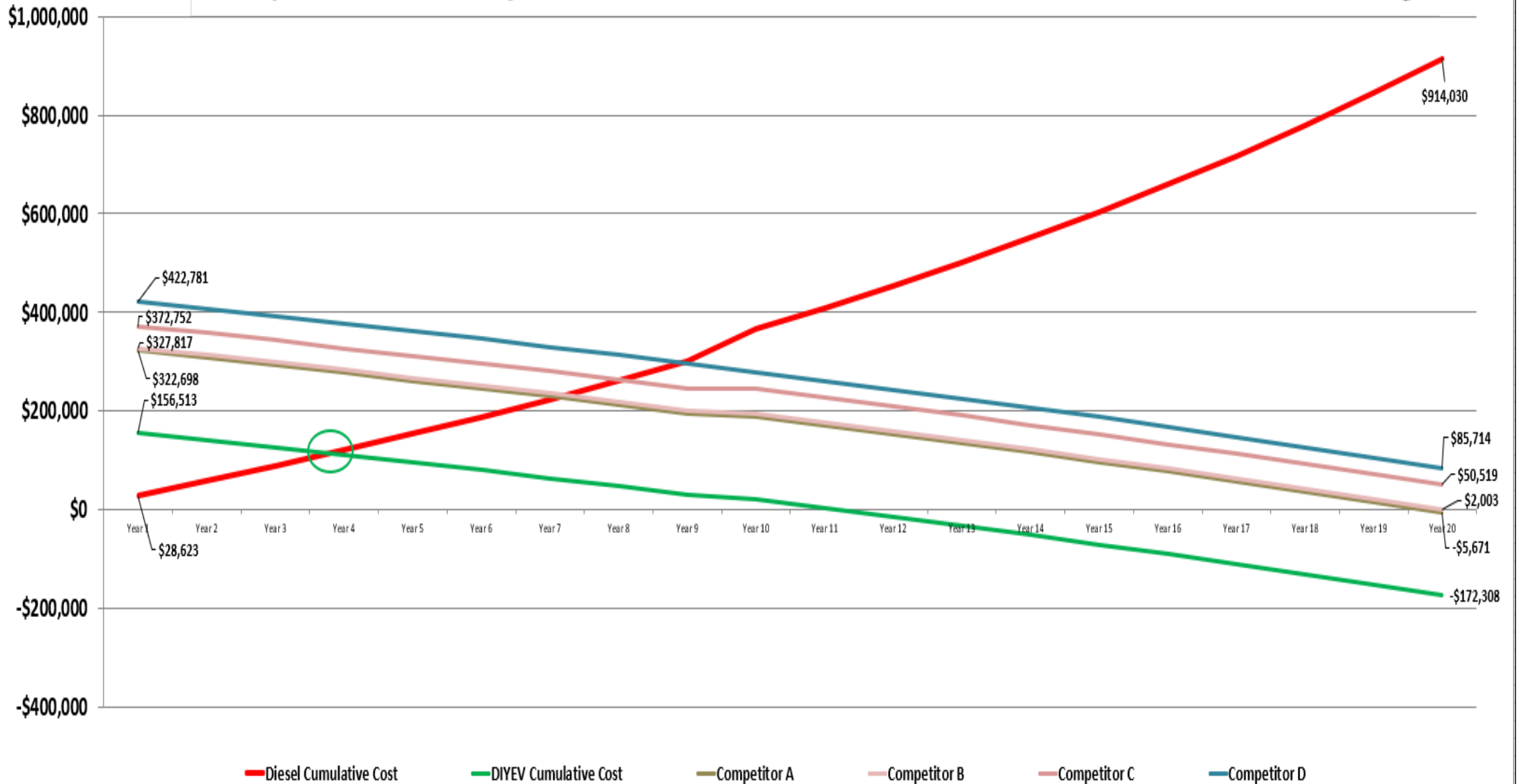
Mark Roest – Director of Marketing & International Development

- **Graduate studies and B.A. San Jose State University.**
- **44 years related technical and business experience.**
- **Board Member, Green Fleets Group.**
- **MarkLRoest@gmail.com**
- **650-888-3665**

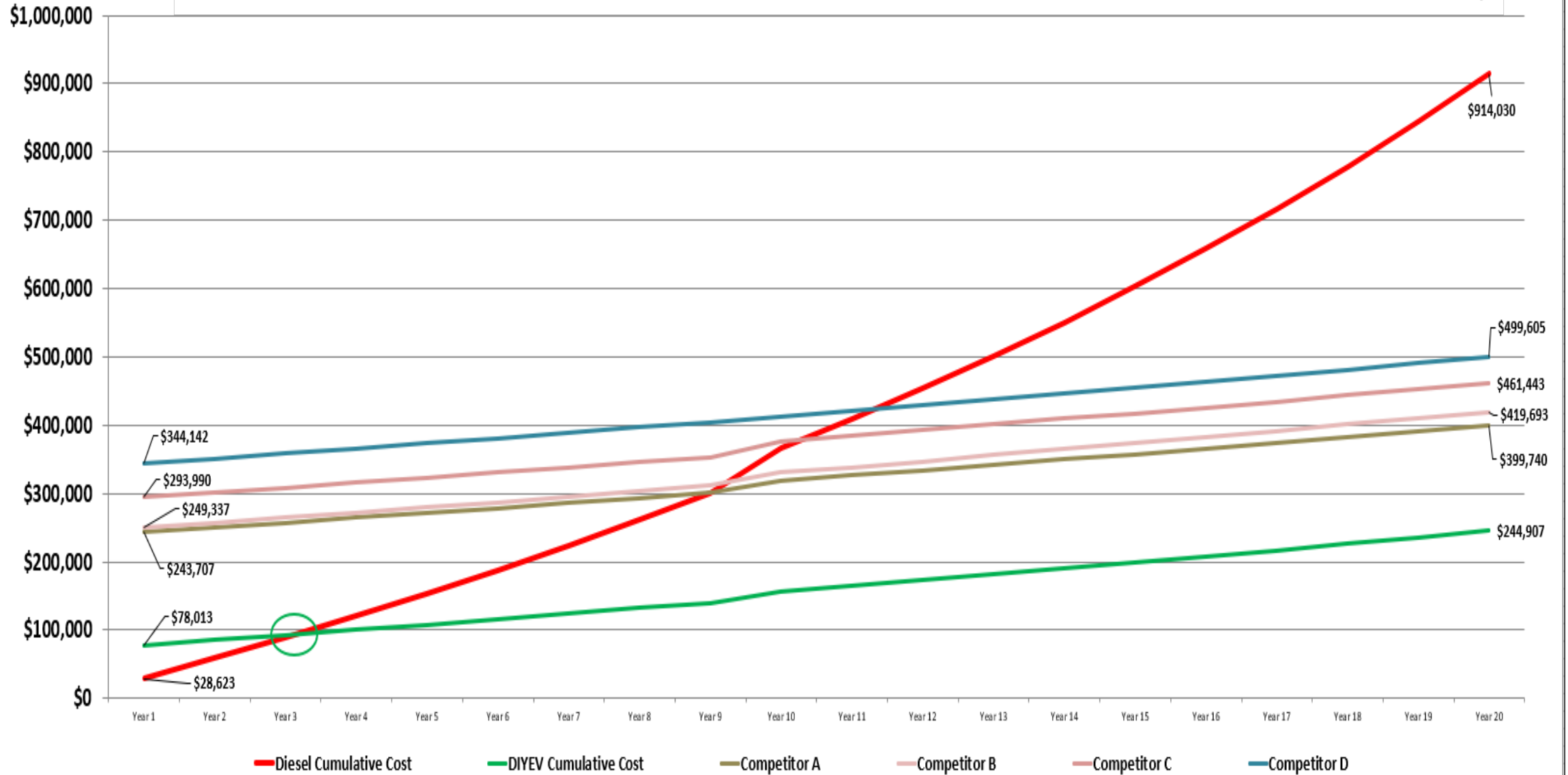
Mark Roest, Green Fleets Group Board Member

- Charge your fleet with solar fuel!
- Green Fleets Group has all you need:
 - SunPower elite installer Freedom Solar
 - DIY-ev school bus conversions
 - Charging systems
 - Training for mechanics & drivers
 - Route by route ROI estimates
- **We *know*** fueling with the sun!

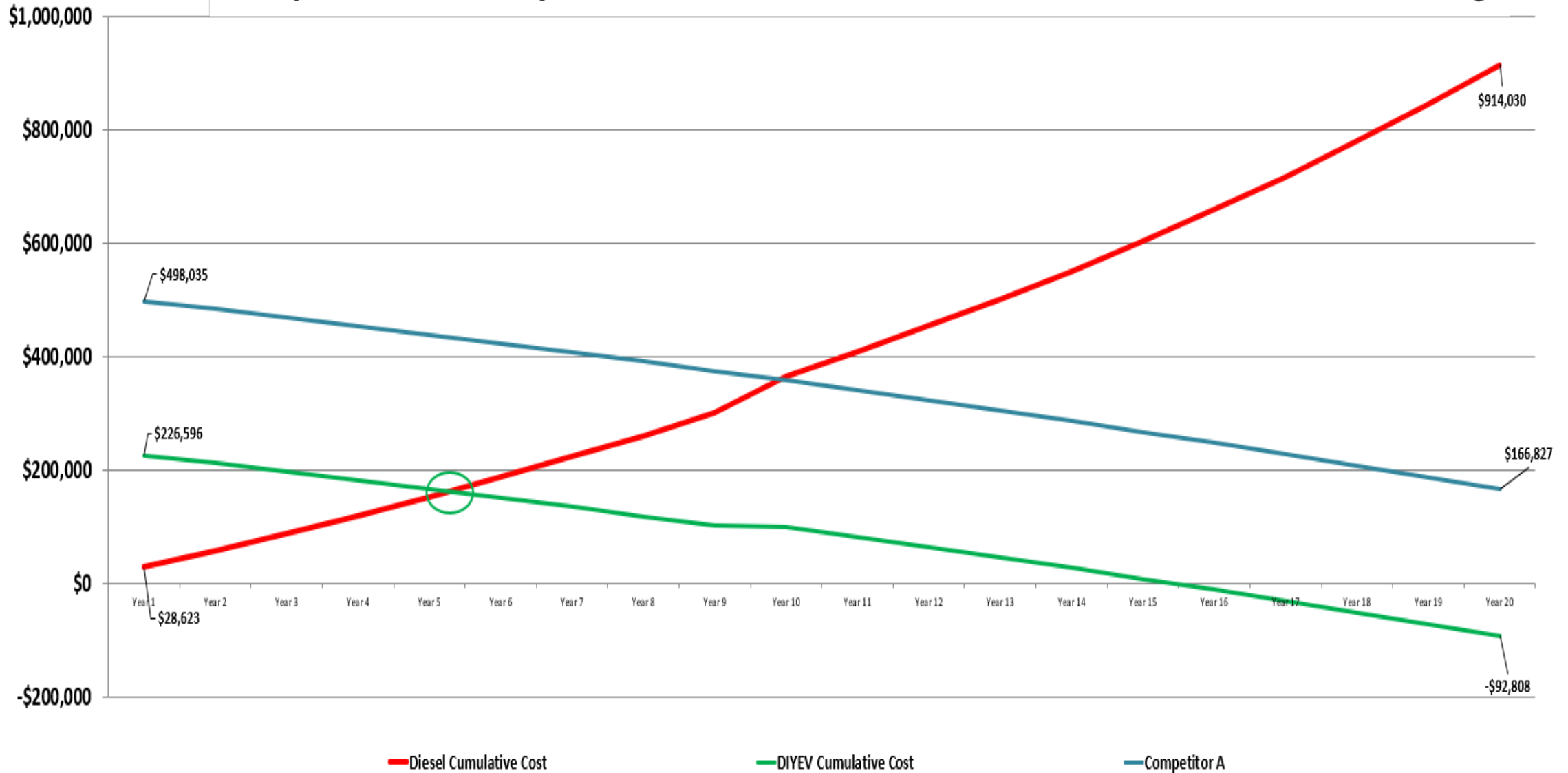
Comparison of Life Cycle cost of Re-Power vs. New Class C Buses With Solar Fueling



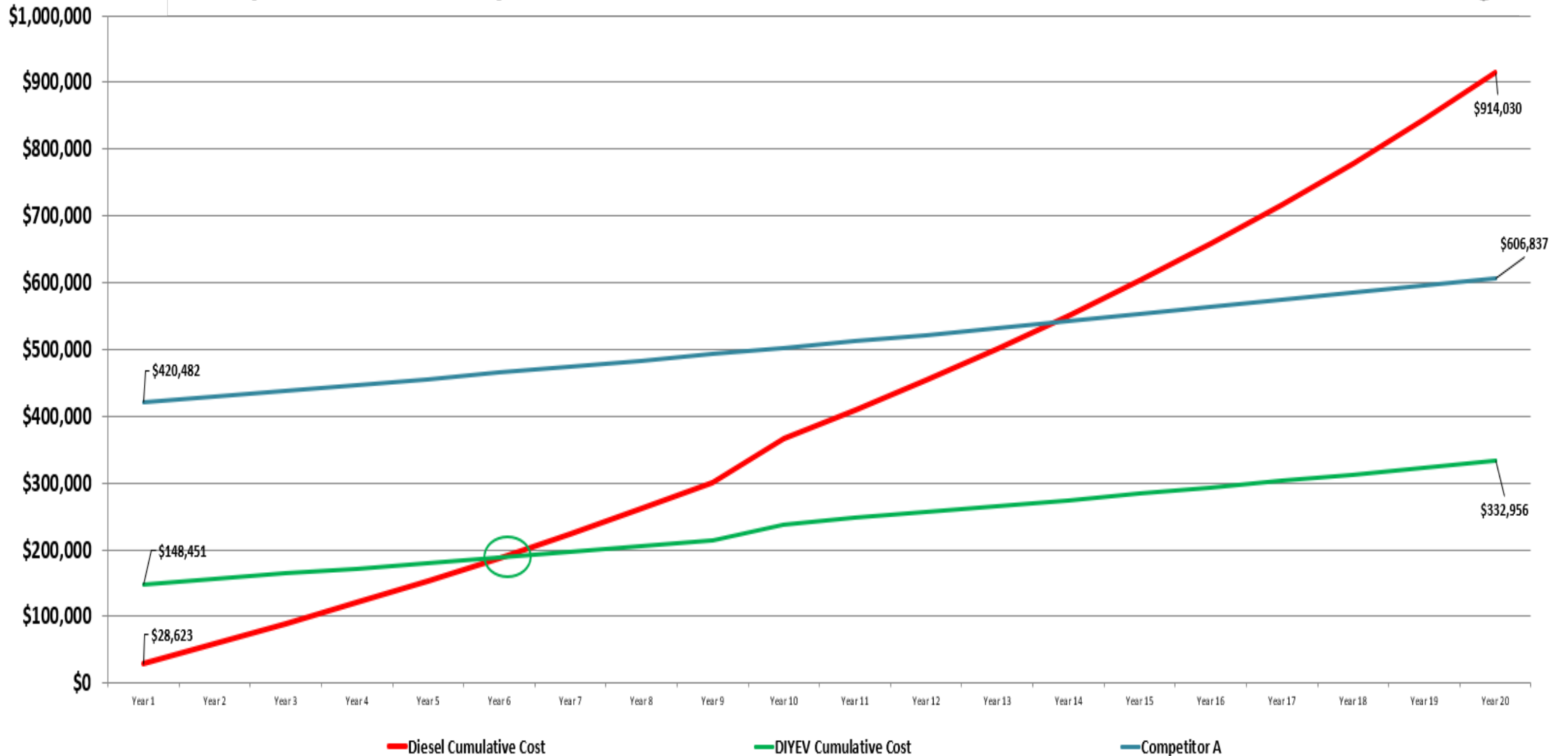
Comparison of Life Cycle cost of Re-Power vs. New Class C Buses Without Solar Fueling



Comparison of Life Cycle cost of Re-Power vs. New Class D Buses With Solar Fueling



Comparison of Life Cycle cost of Re-Power vs. New Class D Buses Without Solar Fueling



Solar charging adds AMAZING VALUE!

- School Buses are Top Priority for Solar Fueling
- Use solar for both vehicles *and* building!
- Put solar on roofs, and on canopies over parking.
- No net negative cash flow financing helps *all* schools!
- Government incentives boost the ROI.
- My slides use California's HVIP funding.
- Please contact us for follow-up and questions.

Sustainable Energy, Inc.

- Battery developer in Iowa & Northern California.
- William Todorof – CTO, Founder & Chairman
 - Master's Degree Alfred University.
 - 50 years related technical experience.
 - Multiple patents and innovation awards.
- Mark Roest – Director of Marketing & Internat'l Development
 - Graduate studies & B.A., San Jose State University.
 - 44 years related technical & business experience.
 - **Board Member, Green Fleets Group.**
 - MarkLRoest@gmail.com +1-650-888-3665

DAIMLER



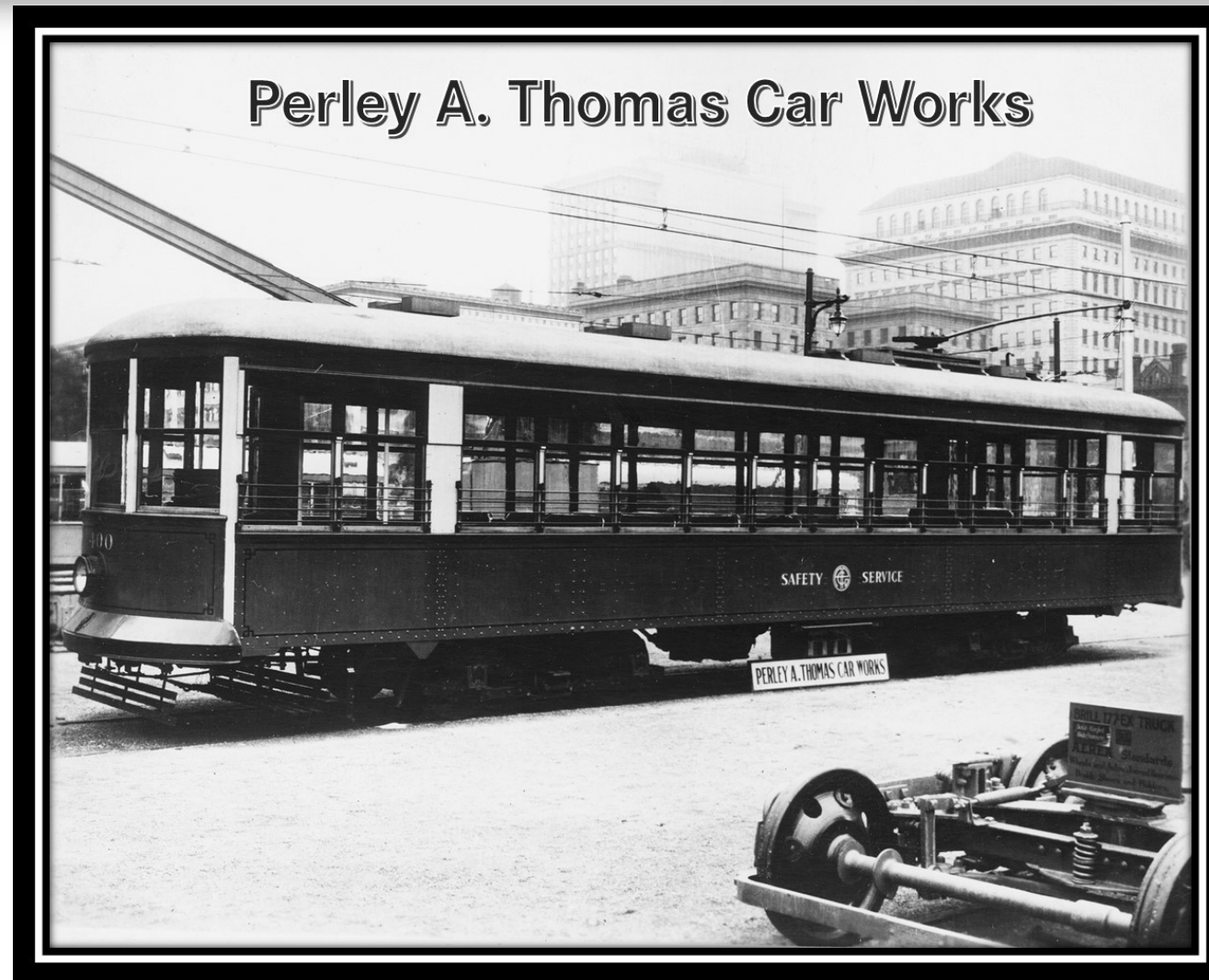
Sustainable Fleet Webinars: School Bus Electrification and VW Settlement Update

June 2019

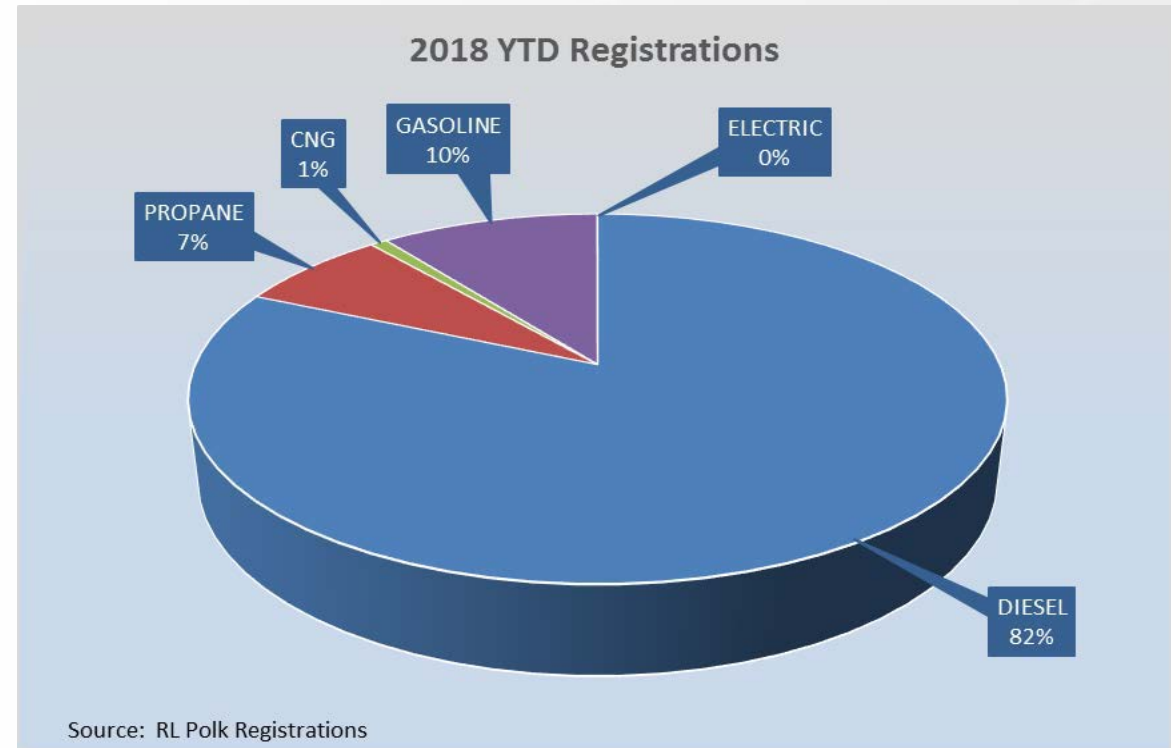
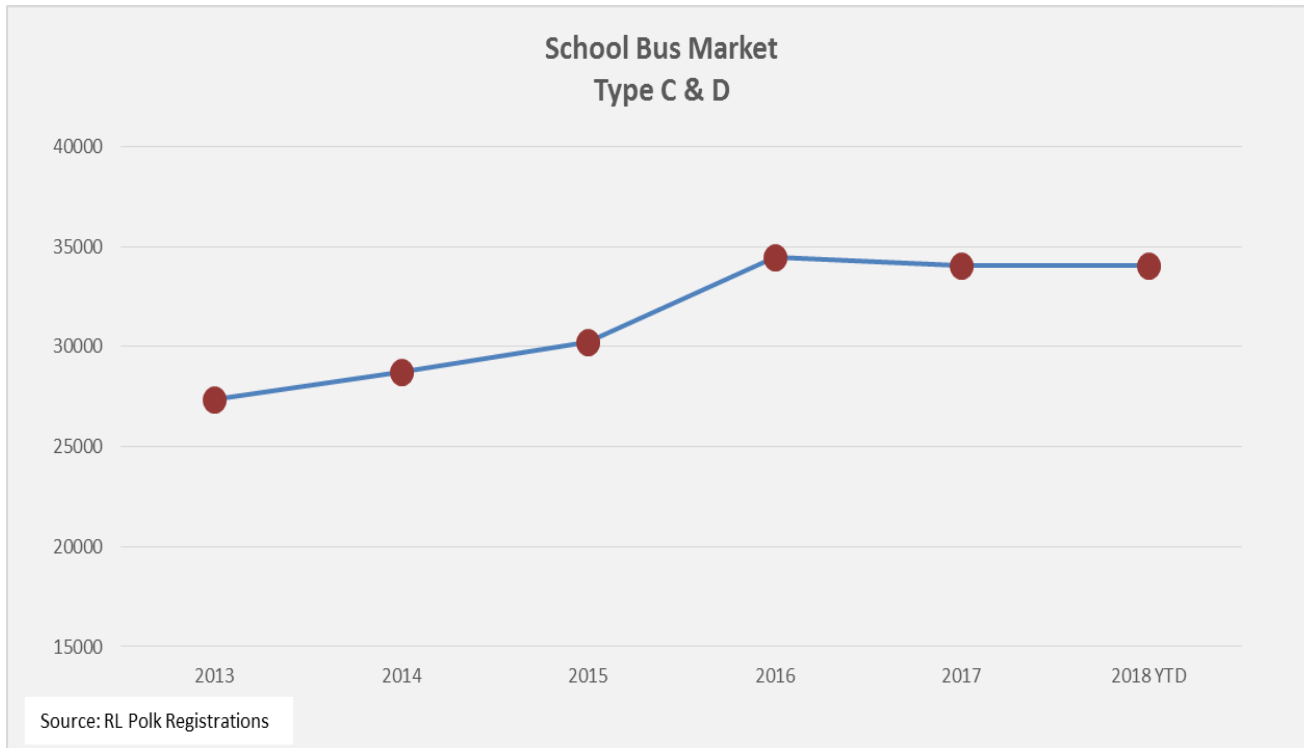
J. Mark Childers – Powertrain & Technology Sales Manager



Thomas Built Buses History



School Bus Market



Leading the Charge, Gaining Knowledge and Global Production Network to “Electrify” the Future



LEADING THE CHARGE!

Proof of Concept

1x eCascadia & 1x eM2
4x Thomas Saf-T Liner C2

June 2018



Strategically align regional/global Daimler brands from design to production



GAINING KNOWLEDGE

Co-creation of Innovation Fleet

Testing 30 eTrucks with our customers and learn together

Q3 2018 – Q2 2019

ELECTRIC
**INNOVATION
FLEET**



20 eCascadia



10 eM2

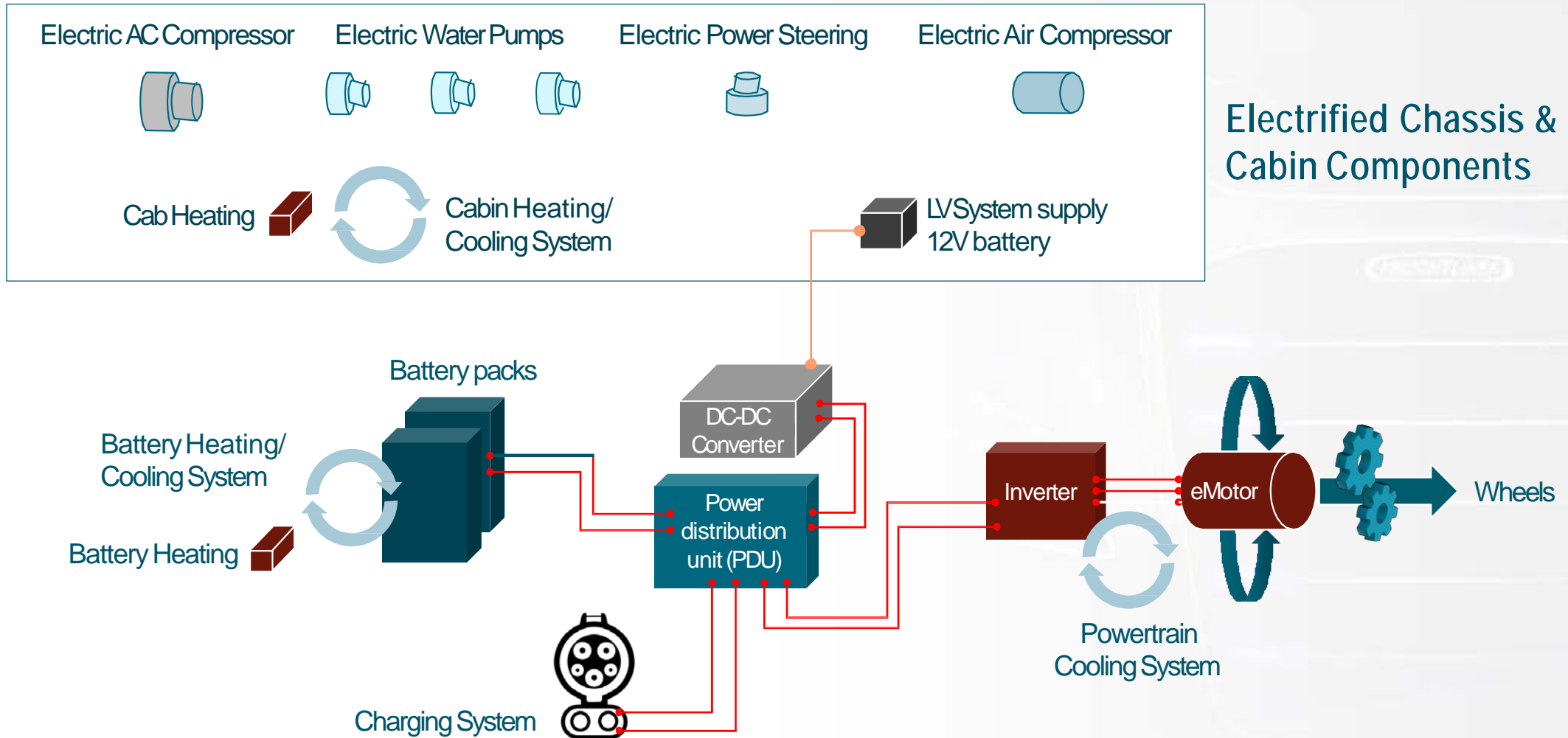
GAINING KNOWLEDGE

Co-creation of Innovation Fleet/Limited Production begins 2020

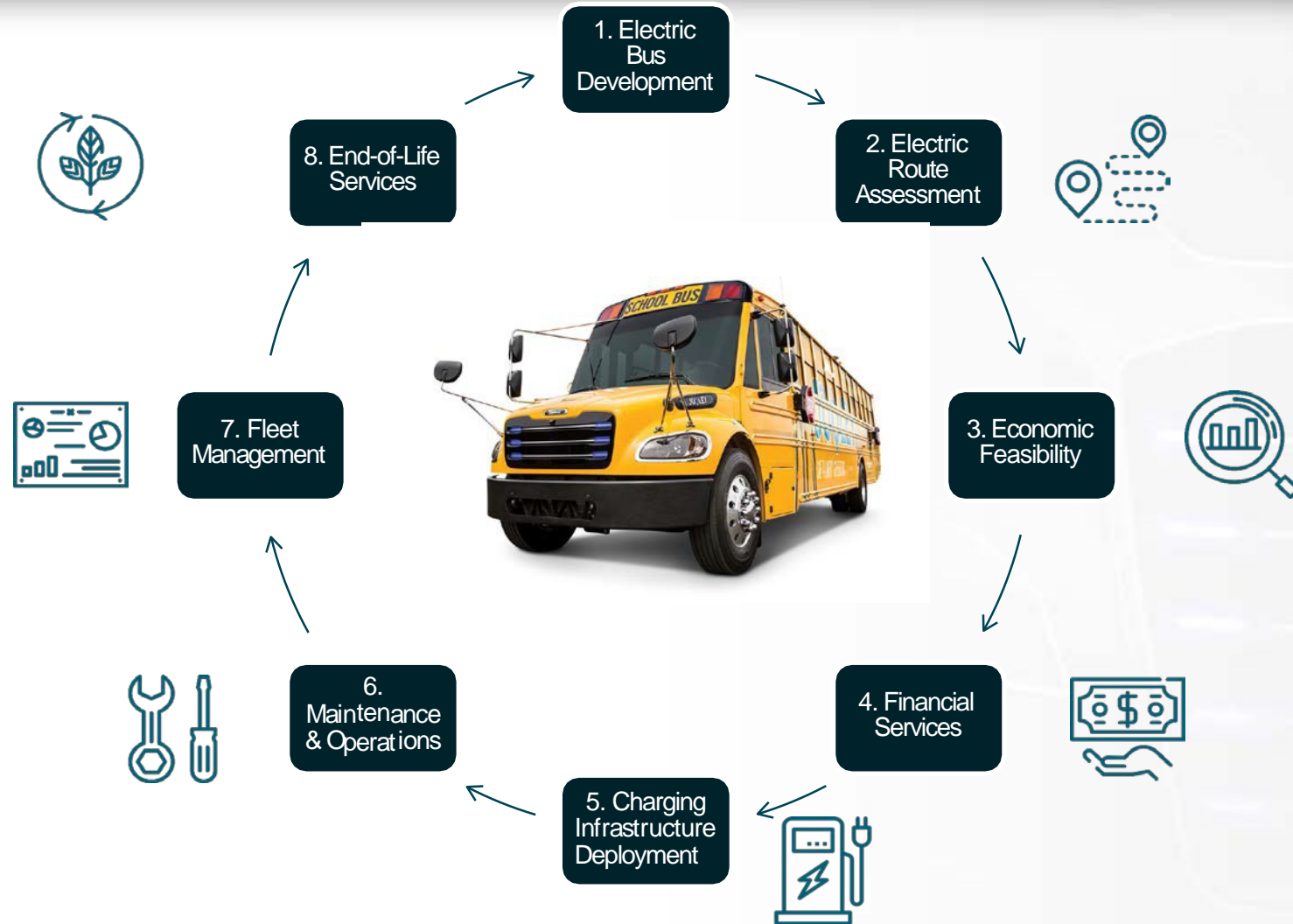
2019-2020...



Electric Powertrains are less complex.



Battery electric Vehicle EcoSystem

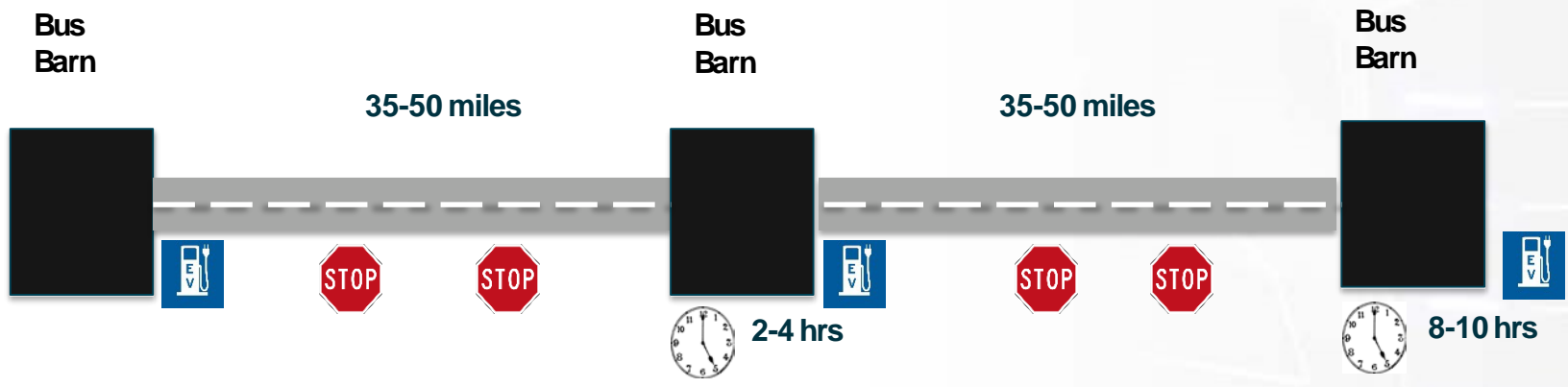


Day in the life of a BEV school bus



School Bus

Day Operation with Overnight Charging & Mid-day Recharge



Example: School bus operates morning route with a return to Bus Barn for charging. After period of charging, school bus operates afternoon route with return to Bus Barn. After afternoon route, school bus is charged over night.

Thomas Built Buses Saf-T Liner C2 Jouley



- ▶ **Showing 2019 at ACTexpo**
- ▶ **Innovative** - All-electric bus powered by Proterra battery technology and drivetrain with 220kWh of battery storage energy
- ▶ **CARB certified and HVIP approved**
- ▶ **DC fast charge system**
- ▶ **Wheelbases 259" & 279"**
- ▶ **Special Needs Equipped in both wheelbases**
- ▶ **State-of-the-Art Solutions**
 - Proterra – battery management system and control software
 - Proterra telematics and diagnostics system - tracks bus location and real-time monitoring of potential issues
 - Exportable power option



INNOVATION IN ACTION



J. Mark Childers
Mark.Childers@Daimler.com
336-881-6589

Thank you!



Visit Us at:
<https://thomasbuiltbuses.com/school-buses/saf-t-liner-c2-jouley/>





TwinRivers

UNIFIED SCHOOL DISTRICT

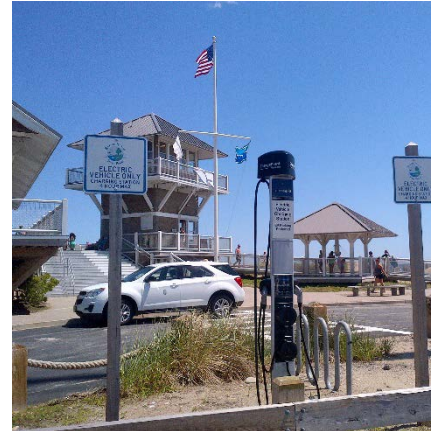


Tim Shannon
Director of Transportation
Twin Rivers Unified School District
Email: Timothy.Shannon@twinriversusd.org
Phone: 916-566-1600 X37001





NASEO
National Association of
State Energy Officials



Volkswagen Settlement Environmental Mitigation Trust: Updates and Info on School Bus Programs

Cassie Powers
NASEO
June 12, 2019



About NASEO

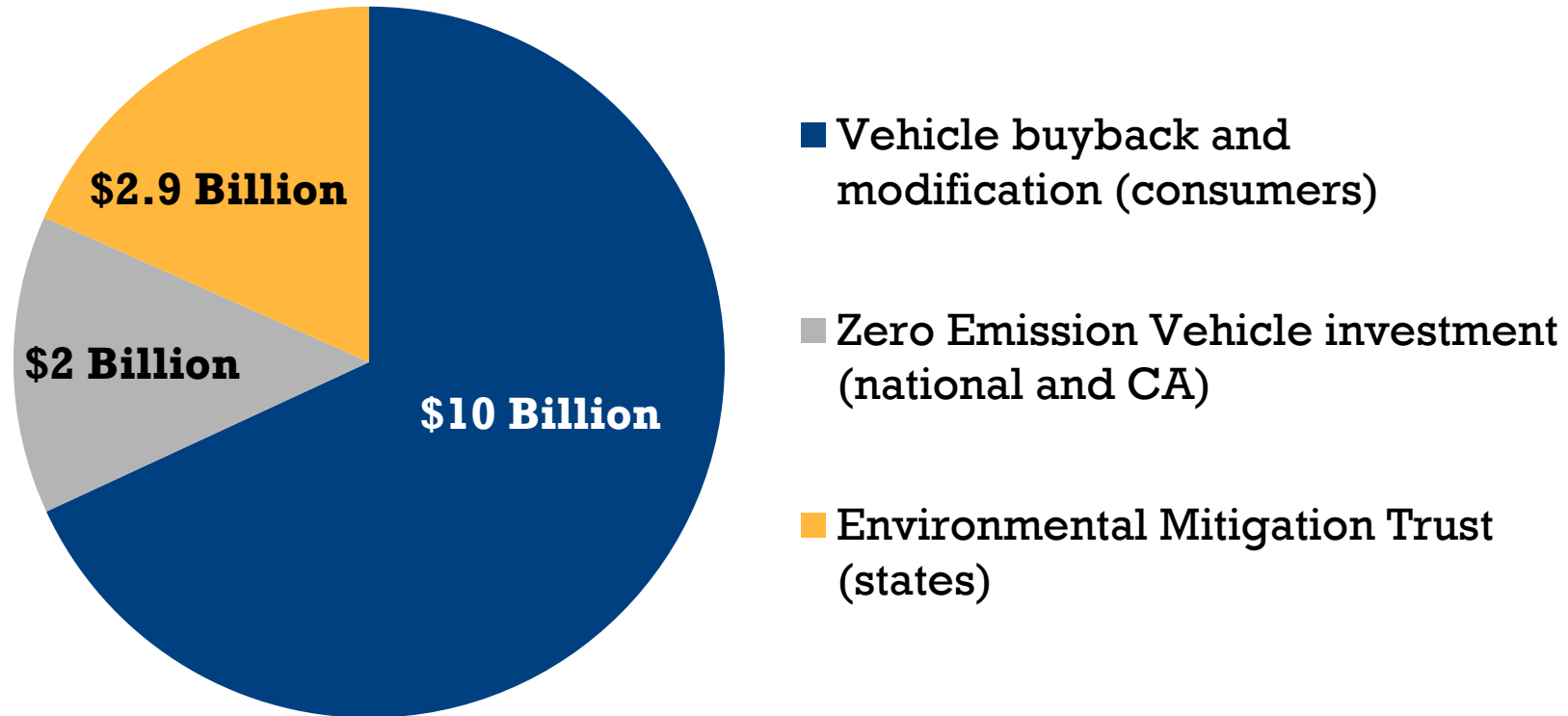
- Formed by the states in 1986
- Membership includes the 56 Governor-designated energy policy officials from each state and territory, as well as private sector affiliates
- Facilitates peer learning across states to improve the effectiveness of energy programs and policies
- Serves as a resource for and about State and Territory Energy Offices
- Advocates on behalf of the State Energy Offices with Congress, federal agencies, and private-sector organizations
- Works through topical committees to facilitate peer learning across states to improve the effectiveness of energy policies and programs
- Visit www.naseo.org for more information



Settlement Overview

- Volkswagen agreed to spend up to \$14.9 billion to settle allegations of cheating emissions. Settlement funds will be used to buyback and/or modify vehicles, and to support national- and state-level projects to reduce NOx emissions.

Settlement Breakdown





Environmental Mitigation Trust (EMT): Update

- Environmental Mitigation Trust has been established
 - Wilmington Trust administers EMT
- All funds currently available
 - Beneficiaries have 10 years to spend 80% of their funding; and 15 years to spend 100% of their funding
- Beneficiaries are submitting funding requests to Wilmington Trust to draw-down their funds
 - Beneficiaries trouble-shoot via the NASEO & NACAA VW Settlement Working Group
 - Information on the settlement available at www.vwclearinghouse.org



VW Clearinghouse

(www.vwclearinghouse.org)

NASEO & NACAA VW Settlement Clearinghouse



The Volkswagen Settlement Clearinghouse is a resource for state and local government offices and agencies as they develop plans and implement projects under the settlement's Environmental Mitigation Trust, and coordinate with Volkswagen subsidiary Electrify America on zero-emission vehicle infrastructure investments. View a timeline for the settlement [here](#) or read more about the settlement [here](#).



Resource Library

Explore curated resources we assembled related to the settlement. Find reports, official documents, websites, and tools.



Settlement-Related Progress and State Contacts

Figure out what's happening in the states. Who's the lead agency? What's a state done so far related to the settlement?



Mobile Source NOx Emissions by State, County, and Sector

Use our interactive dashboard to explore emissions by state and county.



EMT – First Disbursements

- Wilmington Trust filed its first semi-annual report including fund disbursements (Feb. 15, 2019)

- Nine states had approved actions: AZ, GA, ME, MN, NE, NV, OK, OR, RI

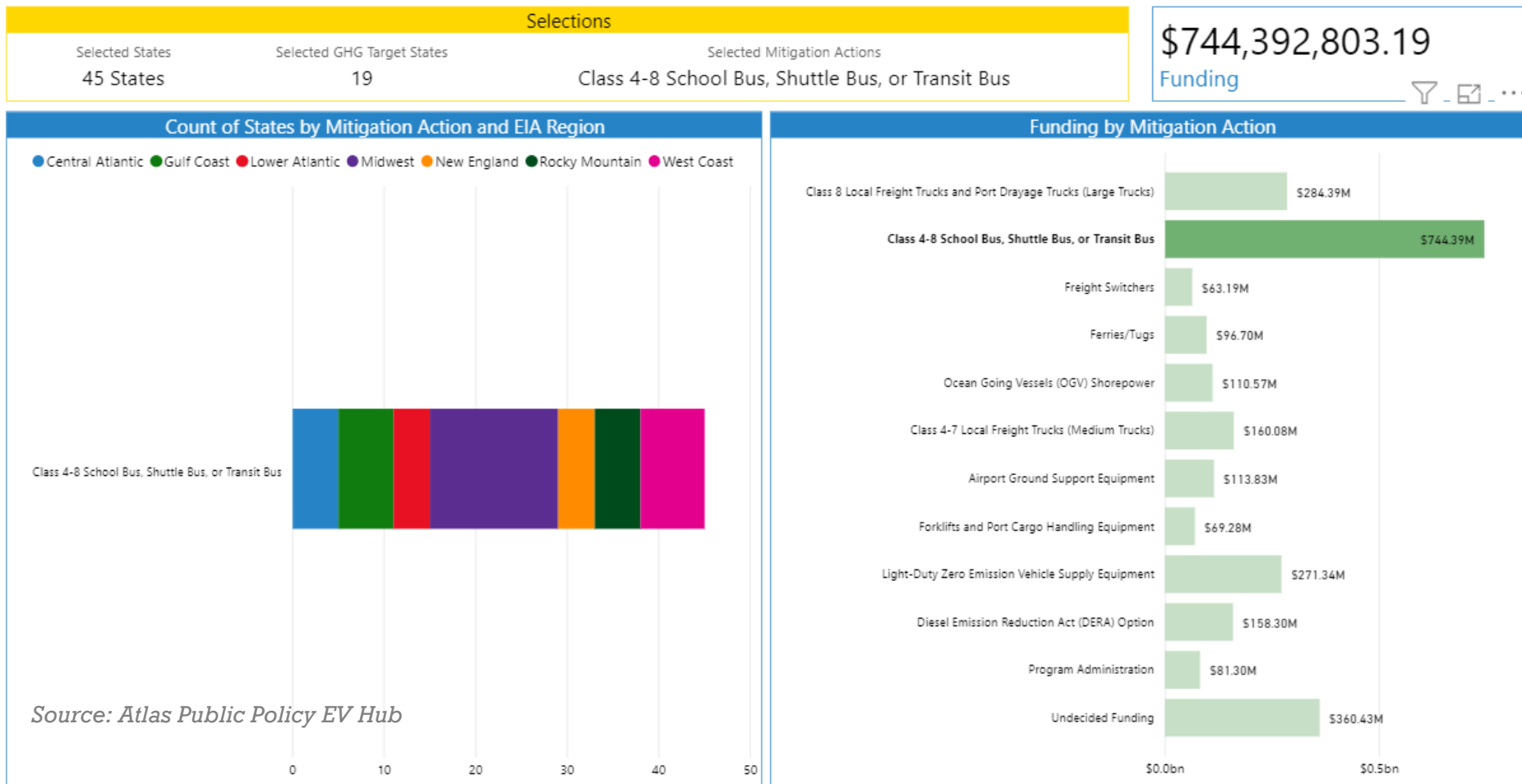
- 18 total approved actions
 - 9 bus replacements (Category 2): \$84.55m
 - 5 EVSE developments (Category 9): \$1.46m
 - 4 DERA options (Category 10): \$1.02m

- These numbers dominated by bus replacement projects in AZ and GA, over \$36m each. Both used more than half of their EMT funds.



EMT Beneficiary Mitigation Plans: School-Bus Heavy

- 45 states plan to spend \$744.39M, collectively, on class 4-8 school bus, shuttle bus, or transit bus





Contact Information



Thank You

Cassie Powers

cpowers@naseo.org



Rick Sapienza

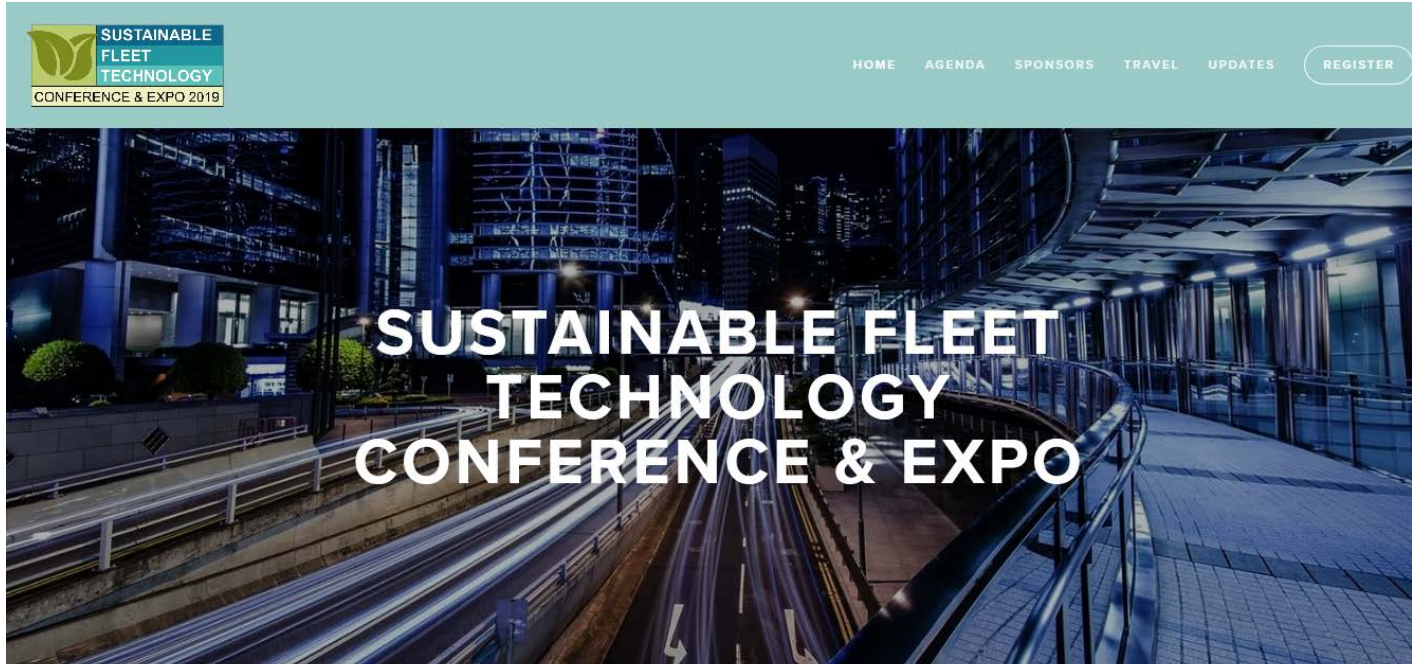
resapienza@ncsu.edu

Phone: 919-515-2788

Rick Sapienza

- Clean Transportation Program Director NC Clean Energy Technology Center at NC State University
- 7.5 years with NC State
- 30 years experience including General Motors, Draper Lab and Great Lakes Pulp & Fibre in both engineering and business management roles





SAVE THE DATE: August 6-8, 2019
Durham Convention Center, Durham NC
SUSTAINABLEFLEETEXPO.COM



The 100 Best Fleets in the Americas



Tom C. Johnson,
author of *Green Fleet Awards™*
and *100 Best Fleets in the Americas™*

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http://www.the100bestfleets.com/gf_application.htm





**SUSTAINABLE
FLEET
WEBINARS**

SCHOOL BUS ELECTRIFICATION

