

# MOTIV POWER SYSTEMS

*Proven All-Electric Solutions*



# Intro to Motiv Power Systems

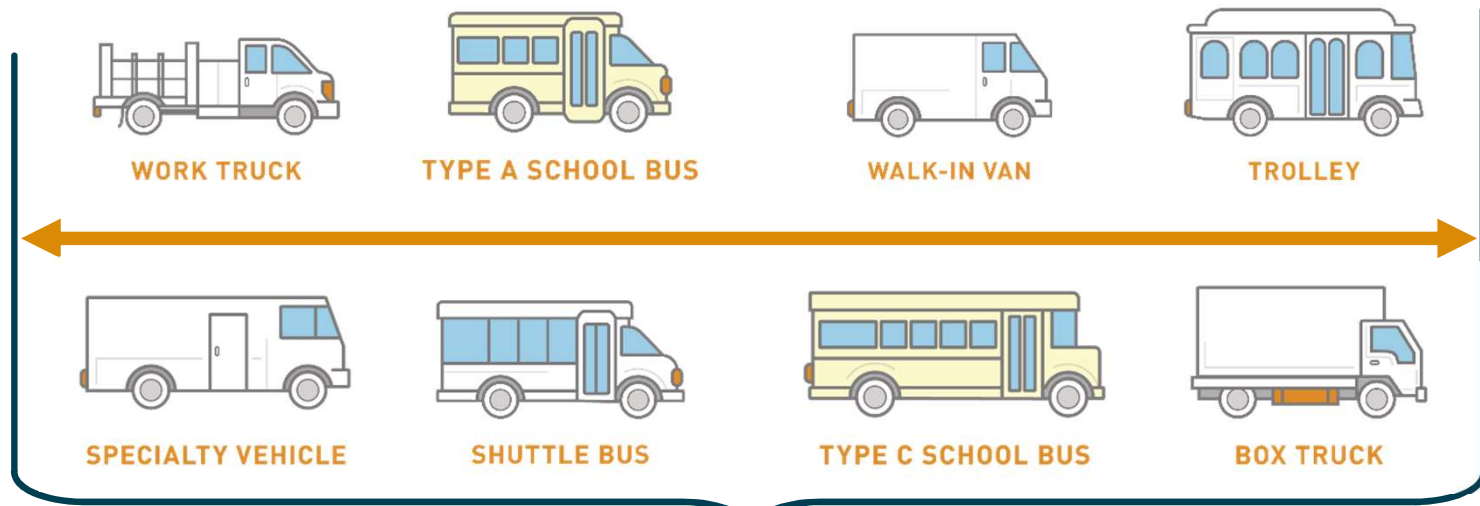
- Ford eQVM approved all-electric chassis built with commercially proven components
- Industry leading truck and bus body partners
- HQ in San Francisco Bay Area, chassis electrification in Indiana and Michigan



*Motiv-powered All-Electric Trucks and Buses*



# Our Focus – Medium Duty Trucks and Buses



**Passenger Cars**

High volume/model  
Low Configurability



**Class 8 Trucks**

Medium  
volume/model  
Low Configurability



# History



**2009**  
Founded



**2013**  
1<sup>st</sup> E-450 Type A Electric School Bus deployed in California (industry first)

**2016**  
- Increased Deployments / Repeat Orders  
- CARB Approval for powertrain



**2012**  
Launched Prototype All-Electric powertrain at NTEA Work Truck Show



**2015**  
- E-450 Google shuttle buses deployment  
- F-59 AmeriPride step vans deployment



**2017**  
- Ford eQVM approval (industry first)  
- F-59 Type C with Creative Bus Sales & Starcraft





### 2018

- CARB Certified for electric chassis
- New Partnerships



DETROIT CHASSIS LLC

### 2019

- All-Electric USPS step van deployed
- BMW Lithium Ion battery packs
- New customers and partners
- F-550 Prototype with Dana



# Vehicle Applications and Body Partners

**EPIC E-450**  
Class 4



**EPIC F-59**  
Class 5/6



**EPIC F-53**  
Class 6



## Case Study: AmeriPride Delivery Vans

- Built on EPIC F-59 with 127kWh
- 10 vehicles deployed in 2017
- 20 Additional vehicles deployed in 2018 at 4 new locations
- 13 hour work days with 50 - 85 mile routes
- > 100,000 miles and counting



## Case Study: USPS Pilot Program (E-450)

- Built on EPIC E-450 with 106kWh
- Vehicle #1 passed rigorous acceptance tests, deployed in real world routes shortly after
- Range test #1 Unloaded without HVAC usage: 102 miles
- Range test #2 Loaded 3730 lbs with some HVAC usage: 86 miles
- Hill hold, start and stop tested successfully at 3%, 7% and 20% grades
- **Positive feedback on vehicle #1 in the field resulted in Go-Ahead for 6 more vehicles**



# Build Process



**Body  
Builder**



**Fleet**

## Motiv/Ford All-Electric Chassis

*The same process as ICE  
chassis procurement and build.*

*OEM chassis parts, battery  
packs, and motors.*



**Dealer**



# Sample Electric Chassis Overview

## Adaptive Power Converters:

DC-DC converters convert voltages between battery, DC link, inverter for optimal performance. 1 per battery + 1 for accessories power supply

## Charger:

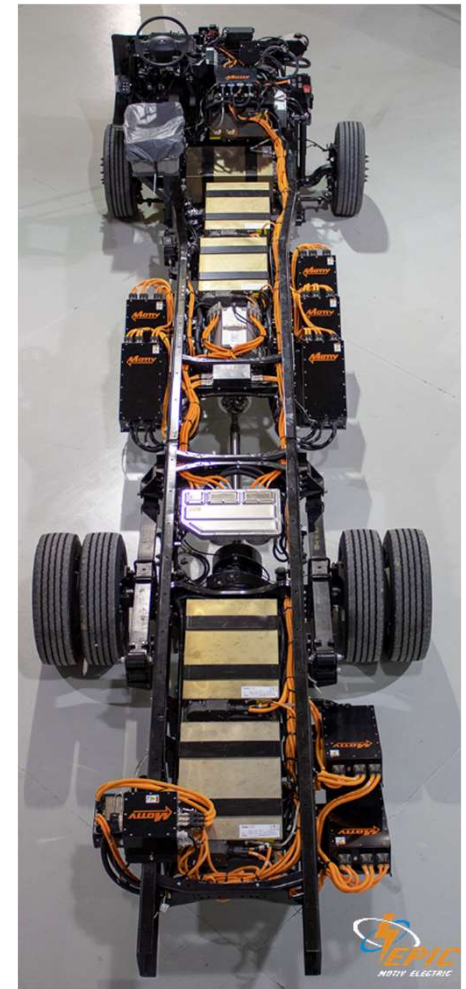
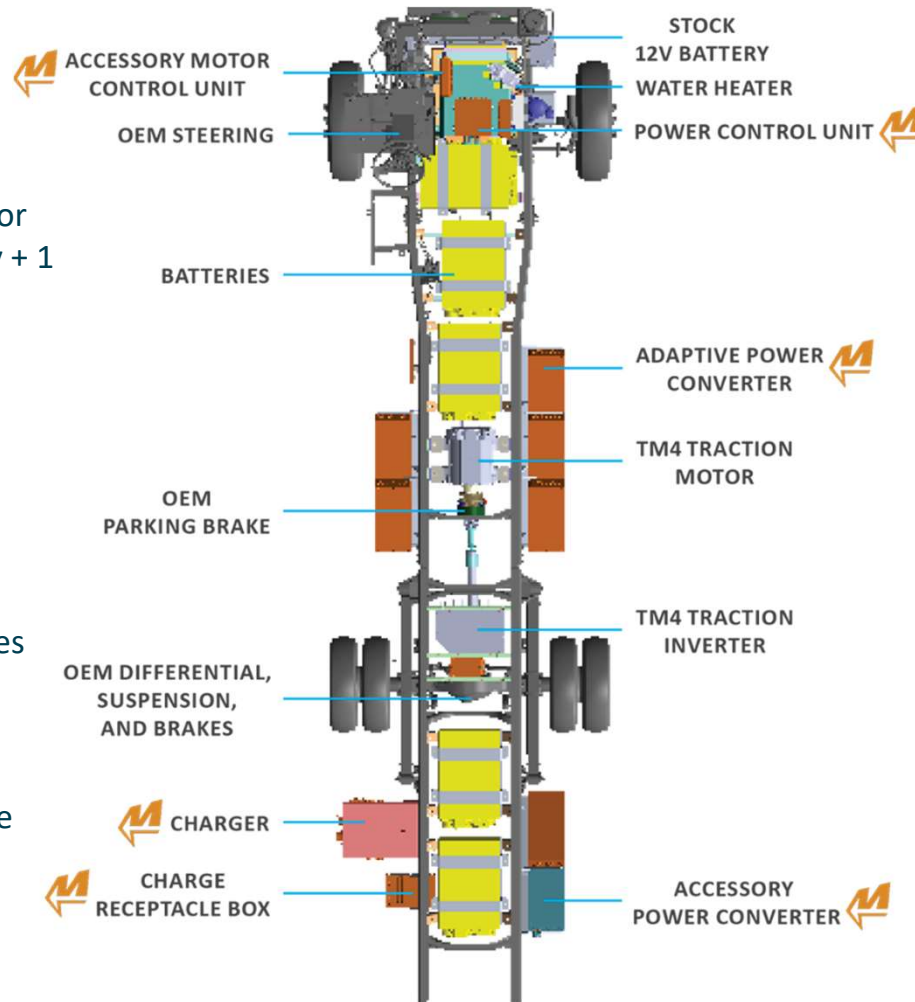
Currently utilizing 16.8 kW charging station

## Power Control Unit:

Intelligently manages all other power electronics including batteries and controllers

## Traction Motor:

240HP. No transmission, direct drive



# Battery Options



Lithium Ion



- BMW's passenger car battery
- 42 kWh per pack
- On the road today on more than 100,000 i3 EVs!
- **Available on: EPIC F-59**



Sodium Nickel



- Manufactured in Italy
- 21.2 kWh per pack
- No flammable electrolyte and fully recyclable
- Other customers include IVECO (DHL trucks), ENEL (Italian Power Company), EDF (French Utility), Bombardier etc
- **Available on: EPIC E-450 and EPIC F-59**

# Motiv-Powered Delivery Trucks

## Ford F-59 Based Step Van

- Various wheelbases & body lengths
- Body built by: Utilimaster, IN, USA
- Assembled in USA
- No major components from China



## Ford E-450 Based Box Truck

- Various wheelbases & body lengths
- Body built by: Utilimaster, IN, USA  
Rockport Commercial Vehicles, IN, USA
- Assembled in USA
- No major components from China



# Motiv-Powered Shuttle Buses

## Champion Challenger EV

- Based on Ford E-450
- Various seating configurations
- Body built by: Champion, MI, USA
- Assembled in USA
- No major components from China



## Starcraft eQuest XL

- Based on Ford F-59
- Various seating configurations
- Body built by: Starcraft Bus, IN, USA
- Assembled in USA
- No major components from China



# Motiv-Powered Mobile Outreach Vehicles

## J33S & J38S

- Based on Ford F-53
- Body built by: Winnebago, IA, USA
- Assembled in USA
- No major components from China
- Applications include: mobile medical clinics, mobile dental offices, bloodmobiles, bookmobiles, mobile offices, mobile retail, mobile classrooms, and more



**WINNEBAGO**



# Motiv-Powered Work Trucks

## Work Trucks, Stake Bed Trucks, Utility Trucks

- Based on Ford E-450
- Body built by: CTEC in CA, USA
- Assembled in USA
- No major components from China



# Why Motiv powered EVs?

## For Fleet Managers

- Lower operating cost
- Easier maintenance
- Over-the-air-updates add new features











## For Drivers

- No more fueling stops
- Easy one pedal driving
- Fewer driver checks

## For Riders

- Smooth ride (no jerky transmission)
- Quiet (easy to talk)
- No noxious fumes

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

 ELIMINATE GASOLINE	 ELIMINATE TRANSMISSION SERVICING	 ELIMINATE OIL CHANGES	 REDUCE BRAKE WEAR	 ELIMINATE EXHAUST COMPONENTS
 ELIMINATE EMISSIONS TESTING	 REDUCE BELTS	 ELIMINATE IGNITION COMPONENTS	 ELIMINATE AIR FILTERS	 ELIMINATE VACUUM LINES



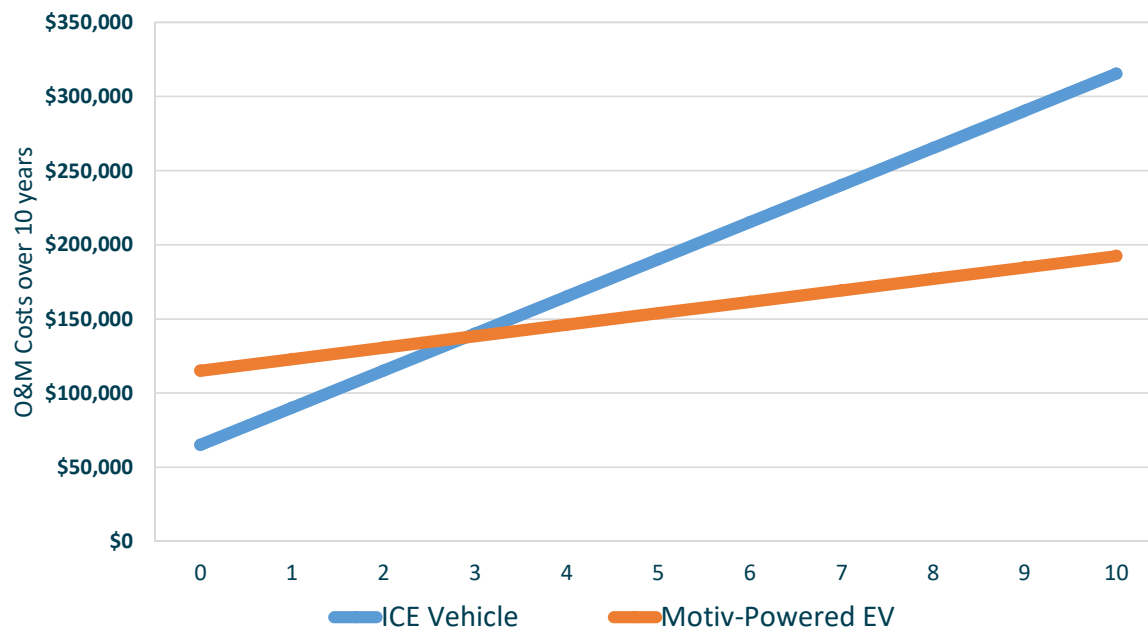


# Total Cost of Ownership: F-59 Step Van Example

Payback occurs in **1.22 years** with **over \$107,000** in savings over a 10 year period!

## Significantly Lower TCO

- Up to 85% savings in Operating Costs
- Up to 66% savings in Maintenance Costs
- 30+ tons of emitted pollutants eliminated

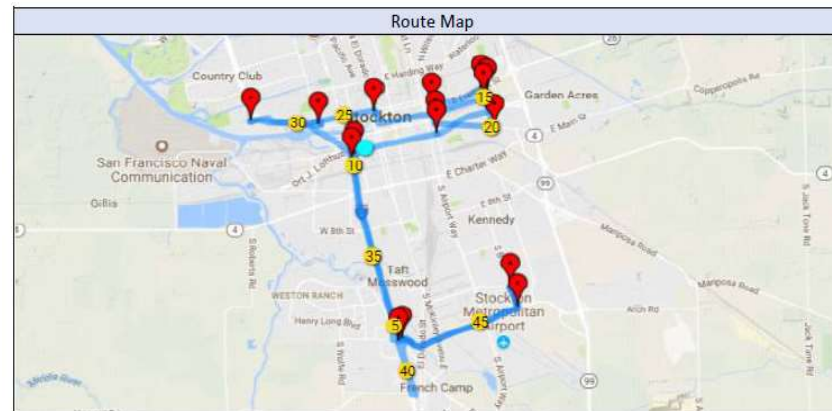


ASSUMPTIONS			
Comparable ICE Vehicle Price	\$55,000	EV Purchase Price - Before Incentives	\$170,000
ICE Efficiency (mpg)	6	EV Incentives	\$100,000
ICE Fuel Price (\$/gal)	\$3.70	EV Price - After Incentives	\$70,000
Electricity Price (\$/kWh)	\$0.15	Miles per Day	80
Lifetime (years)	10	In-Use Days per Year	260



# Range | Route Analysis Available

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



Shift Time		50 Mile Trip			
Start	07:00	Miles Travelled	50	Available Range	40
End	11:00	Time Charged (min)		State of Charge	44%

Shift Time		120 Minute Charge			
Start	11:00	Miles Travelled		Available Range	63.9
End	13:00	Time Charged (min)	120	State of Charge	71%

Shift Time		50 Mile Trip			
Start	13:00	Miles Travelled	50	Available Range	13.9
End	17:00	Time Charged (min)		State of Charge	15%

Shift Time		450 Minute Charge			
Start	17:00	Miles Travelled		Available Range	90
End	00:30	Time Charged (min)	450	State of Charge	100%



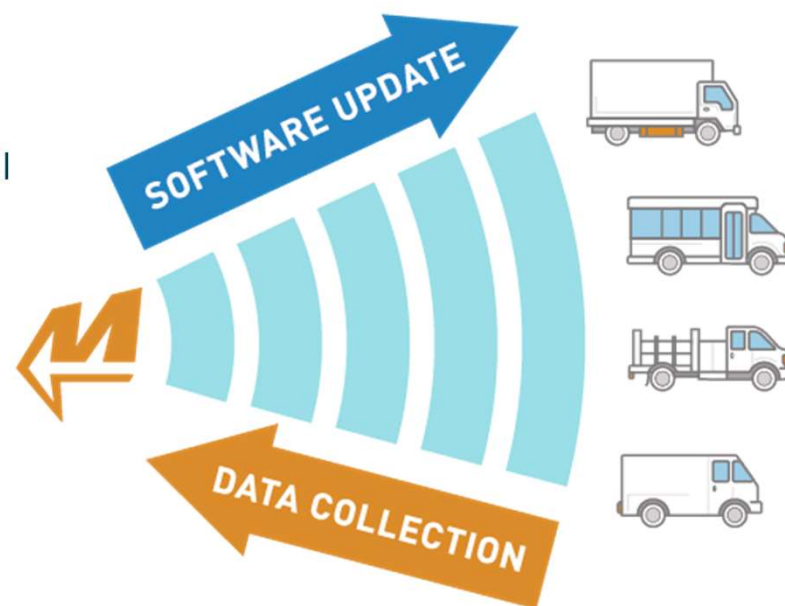
# Telematics Capabilities

## Data Push to Vehicle

- Advanced Diagnostics to “deep dive” into vehicle performance
- Fleet Configuration Management to change vehicle settings:
  - Top speed, regenerative braking, etc.
  - Charge, pre-heat scheduling
- Over-the-air updates send software with new features and fixes to all Motiv-powered vehicles
  - Vehicle OEM does not need to manage software maintenance
  - Subscription-based
  - Paid feature, 3rd party, and application-level software delivery

## Data Collection from Vehicle

- Able to integrate with and provide data to any data collection platform the fleet is already using
- White-label data collection platform available
- Regardless of how it is collected, data is actionable for fleet users and parts suppliers (battery pack providers, etc.)



# MOTIV POWERED

EPIC All-Electric Chassis for Class 4 - 6 Applications

