



## *Advancing Clean Transportation*

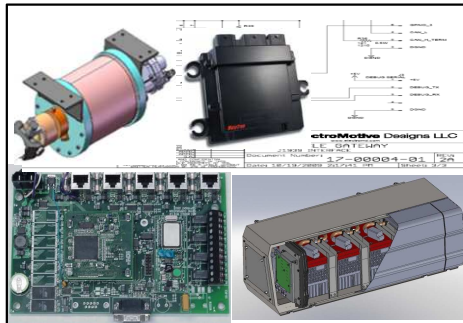
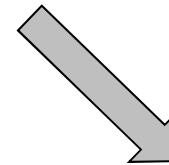
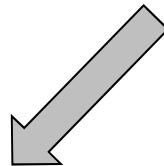
*Electric and Hybrid Electric Conversion Systems for Trucks and Buses*



AERTC 2011

# What We Do

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Engineering and  
Design Services



Propulsion Systems for  
Class 3-8 Vehicles

# Electric and Hybrid Vehicle Experience – 17 Years



## Light Duty:

- Passenger
- Utility
- Fuel Cell
- All Electric



## Medium Duty (Series Hybrid):

- Shuttle Buses
- Utility Trucks
- Recycling Collection
- Telecommunications
- Gas Service

## Heavy Duty (Parallel Hybrid):

- Refuse Collection
- Bucket Trucks
- School Bus
- Dump Body



# Hybrid Propulsion Systems

EMD has parallel hybrid conversion kit designs for Class 3 thru 8 trucks, buses and other specialty vehicles

 	 	 
<b>GVW range: 10,001-16,000lbs</b> <ul style="list-style-type: none"> <li>- pickup trucks</li> <li>- large SUV's</li> <li>- beverage &amp; parcel delivery trucks</li> <li>- shuttle buses</li> <li>- school buses</li> <li>- gas/electric utility trucks</li> </ul>	<b>GVW range: 16,001-26,000lbs</b> <ul style="list-style-type: none"> <li>- beverage &amp; parcel delivery truck</li> <li>- shuttle buses</li> <li>- gas/electric utility trucks</li> <li>- school buses</li> <li>- panel/box trucks</li> </ul>	<b>GVW range: 26,001-80,000lbs</b> <ul style="list-style-type: none"> <li>- refuse collection trucks</li> <li>- school buses</li> <li>- transit style buses</li> <li>- gas/electric utility trucks</li> <li>- panel/box trucks</li> <li>- specialty vehicles (airport, military, construction, etc)</li> </ul>

Feature	Benefit
<ul style="list-style-type: none"> <li>• Easy to install &amp; service</li> <li>• Fuel agnostic</li> <li>• Modular &amp; scalable system</li> <li>• Plug-in Capable</li> </ul>	<ul style="list-style-type: none"> <li>• Low impact – can be installed &amp; serviced by channel partners</li> <li>• Operates with gasoline, diesel, biofuels, CNG</li> <li>• Works on most types of vehicle vocations</li> <li>• Uses low cost grid power to supplement fuel</li> </ul>

# Medium and Heavy Duty Market – U.S.

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- ❏ Number of US Trucks and Buses – over 100M<sup>1</sup>

- ❏ Miles Traveled – over 1B<sup>1</sup>

- ❏ Large commercial fleets

  - ❏ Up to 50% operating costs go towards paying for fuel<sup>2</sup>

- ❏ Transportation consumes most of the oil we import<sup>4</sup>

- ❏ Military

  - ❏ Uses 175% more, per soldier than 40 years ago<sup>3</sup>

- ❏ Class 3-8 Hybrids – Thousands?

- 1- Bureau of Transportation Statistics
- 2- Wal-Mart Study
- 3- Rand/Deloitte/DOD
- 4- US DOE

# Changes In the Market

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## ❖ Fuel Costs

- ☐ Fluctuating
- ☐ Price Floor Higher
- ☐ Contract Pricing

## ❖ More Interest, Participation and Purchasing

- ☐ Fleets
- ☐ Local Government
- ☐ Public

## ❖ More Technology Available

- ☐ OEM suppliers
- ☐ Batteries, Capacitors

## ❖ Budgets Lacking

- ☐ Slower Buying
- ☐ Some Help Available (voucher programs : CA, NY, MD)



# What are Fleets Doing?

## ❏ Propulsion Systems

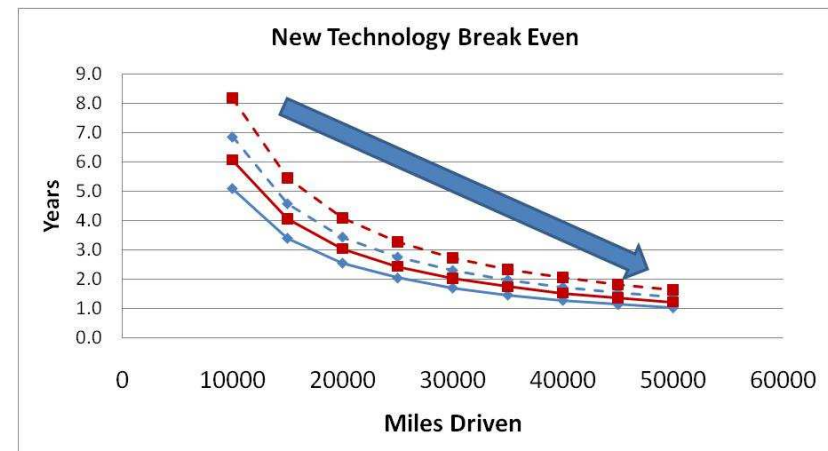
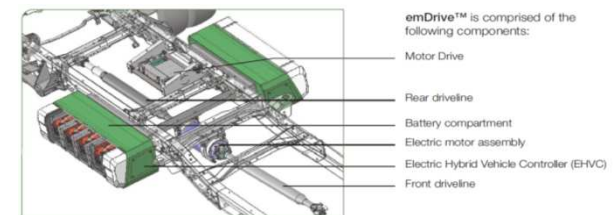
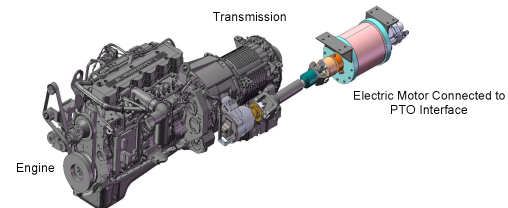
- ❑ All Electric
- ❑ Parallel Hybrid
- ❑ Series Hybrid
- ❑ Anti-Idle, Start/Stop

## ❏ Stationary Power

- ❑ Task/Feature Specific
  - ❑ HVAC
  - ❑ Hydraulics
  - ❑ Lights

## ❏ Making the Numbers Work

- ❑ All about the ROI
- ❑ Life Cycle Cost
- ❑ Financing



# Mature Industry Requirements

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## ✦ Standards

- ☐ Safety, Testing
- ☐ Packaging



## ✦ Emissions

- ☐ Vehicle Classes
- ☐ EV/HEV



## ✦ Supply Chain

- ☐ Consistency – Dozens of Recipes and Configurations
- ☐ Tested and Validated Products and Designs

## ✦ Applications

- ☐ Well understood by suppliers
- ☐ Time is needed to experience a variety of scenarios



## Closing Comments

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- ❏ Price of fuel, high operating costs and labor cut backs are creating change
- ❏ “One size does not fit all”
- ❏ Many technologies and embodiments are available to fit specific needs
- ❏ Value Proposition is everything
- ❏ Creative financial solutions are needed to get vehicles on the road

# Thank You.....

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