

# ***TransPower***

## ***Zero-Emission Freight Transport***



**James Burns**

[Jim@transpowerusa.com](mailto:Jim@transpowerusa.com)

858-248-4359

# A Vertical Approach to ZEV Freight Transport

- TransPower solutions:

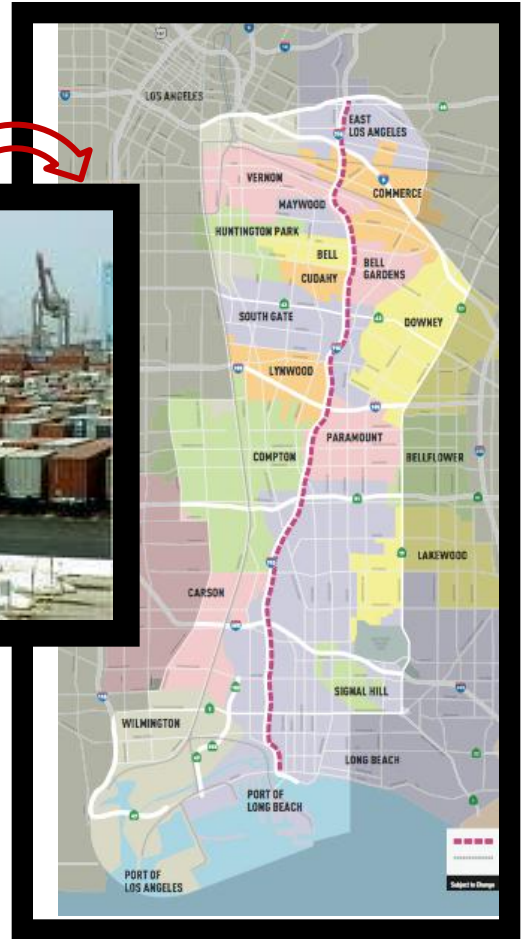
Shipboard



Drayage



Whole Corridor Solutions



Container Staging



Container Shuttling



# About TransPower

- Poway-based, privately-held Transportation and Energy Company founded in 2010
- Battery-electric and hybrid heavy-duty vehicles
- Stationary Battery Energy Storage Systems
- Related technologies and sub-systems
- Combined relevant experience on the BOD: 75yrs
- Primary work through public-private partnerships





# Process and Product Innovation at TransPower

- Systems Engineering Approaches
- Modular Battery Packaging/Management
- Onboard Inverter/Charge Unit(s)
- All-Electric Accessory Solutions
- Automated Manual Transmission
- Platform Commonality/Extensibility



# Reach Stacker Prototype Estimated Specifications

## *Features*

- Zero Emissions at Point of Use
- Lower Lifecycle Cost than a Diesel Vehicle if use hours are high
- Includes Two High-performance induction Motors
- Includes PbA battery technology
- Includes Off-board Level-II type charger

Vehicle Curb Weight:	17,500 lbs
Motor Combined Power Rating:	150 kW
Energy Stored (Usable):	100 kWh
Recharge Time Using Off-board Charger:	15 Hours
Loaded Range (Hours):	6+ Hours



# Class-8 Yard Truck Estimated Specifications

## *Features*

- Zero Emissions at Point of Use
- Lower Lifecycle Cost than a Diesel Vehicle
- Includes High-performance IPM Motor
- Includes Prismatic LiFEPO4 cell technology
- Includes Proprietary Automated Manual Transmission
- Includes High Power Onboard Charger

Vehicle Curb Weight Rev. 2:	21,500 lbs
Towing Capacity:	58,500 lbs
Motor Power Rating:	150 kW
Energy Stored (Usable):	172 kWh
Recharge Time Using Onboard Charger:	2.5 Hours
Energy Consumption Towing 22,000 lbs:	1.69 kWh/Mile*
Loaded Range (Miles):	100+ miles
Loaded Range (Hours):	12+ Hours



\* Energy consumption data is from dynamometer testing conducted at UC Riverside using industry standard drive cycle. An Electric Yard Tractor is pictured above on the dyno.

# Class-8 Drayage Truck Estimated Specifications

## *Features*

- Zero Emissions at Point of Use
- Lower Lifecycle Cost than a Diesel Vehicle
- Includes Two High-performance IPM Motors
- Includes Prismatic LiFEPO4 cell technology
- Includes Proprietary Automated Manual 10-speed Transmission
- Includes High Power Onboard Charger

Vehicle Curb Weight:	22,500 lbs
Towing Capacity:	57,500 lbs
Motor Power Rating:	300 kW
Energy Stored (Usable):	215 kWh
Recharge Time Using Two Onboard Chargers:	1.75 Hours
Energy Consumption Towing 58,000 lbs:	2.75 kWh/Mile*
Loaded Range (Miles):	100+ miles



\* Energy consumption data estimated.

# eHighway Project

## *Features*

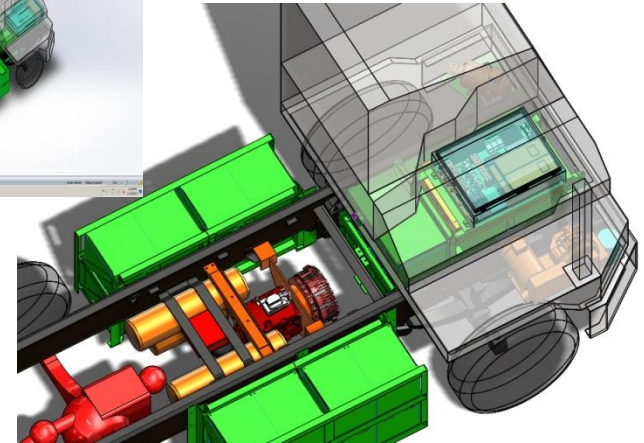
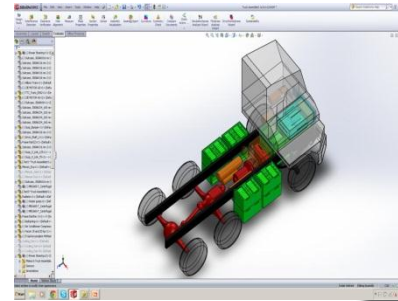
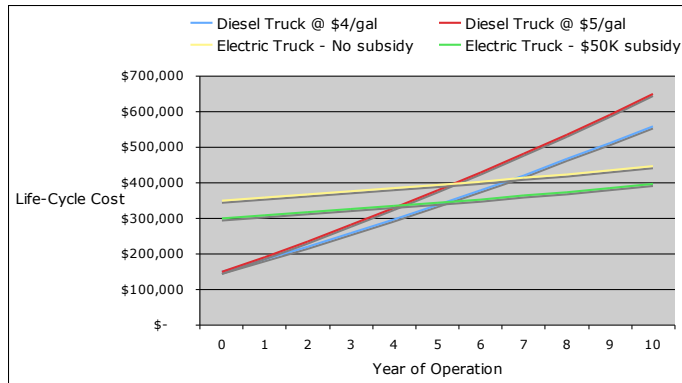
- Zero Emissions in the catenary corridor
- Two Class-8 vehicles: one a BEV and one a CNG hybrid
- 650VDC catenary for transit and charging phases
- Includes LiFePO<sub>4</sub> and/or Lithium Polymer battery technology
- Includes on-board charging as appropriate



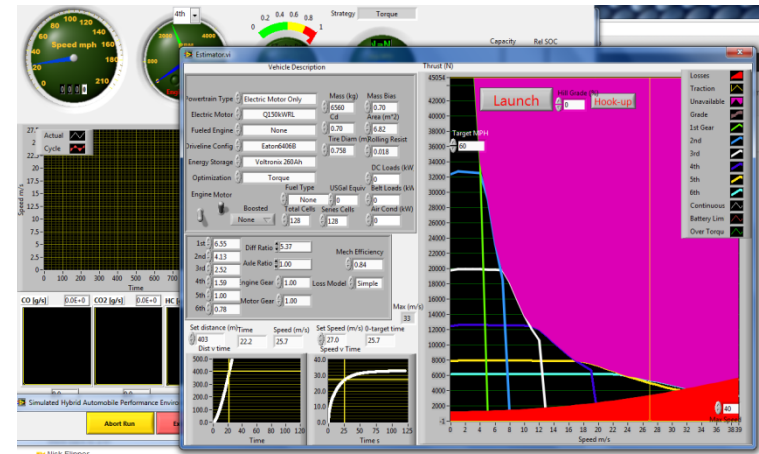
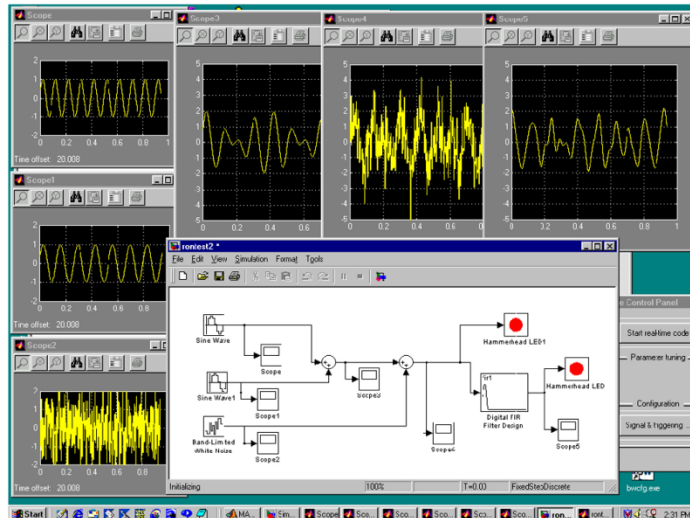


# Systems Approach to ZEV

## – Economic Analysis



## – Simulation to Verification Product Development



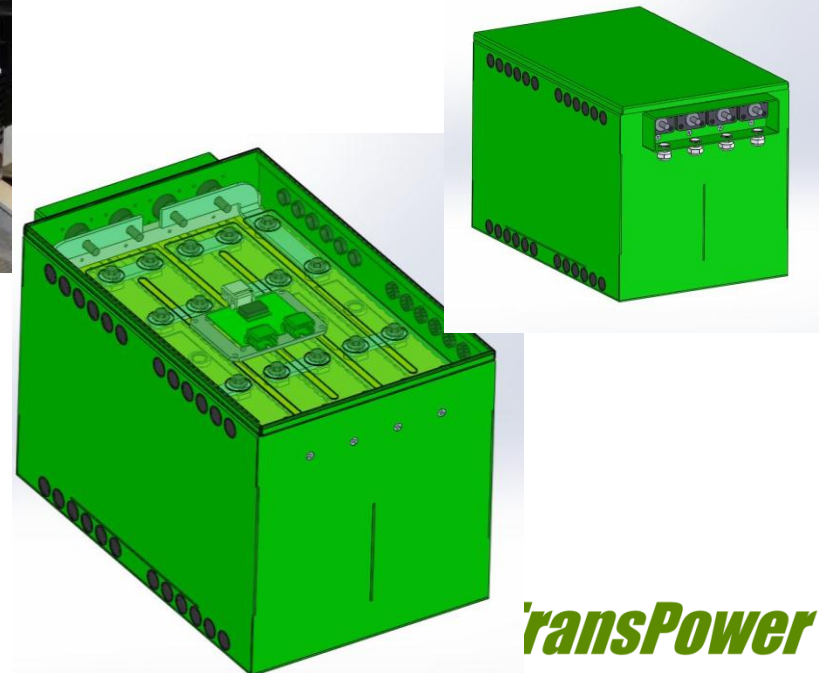
## – Rapid Prototyping Methodologies

# Inverter/Charger and Modular ESS

- 70kW 208V conductive charging on-board



- MileMax  
LiFEPO4 Modules



*ransPower*

# No-idle taken to the extreme

- No Belts, No PTO, No Radiator!
  - I'm kidding on the radiator, but it's tiny
- Efficient Electrical Accessories
  - Demand-driven software control
  - 208V, 3-phase from ESS voltage
- Automated Manual Transmission
  - 4 forward speeds, electric reverse
  - No torque converter
  - Motor-synchronized shifting
  - No Transmission Cooler or pump





# Automated Manual Transmission

- No clutch
- Motor-matched shifting
- Efficient RPMs
- Cooler running
- 50:1 final drive in low gear



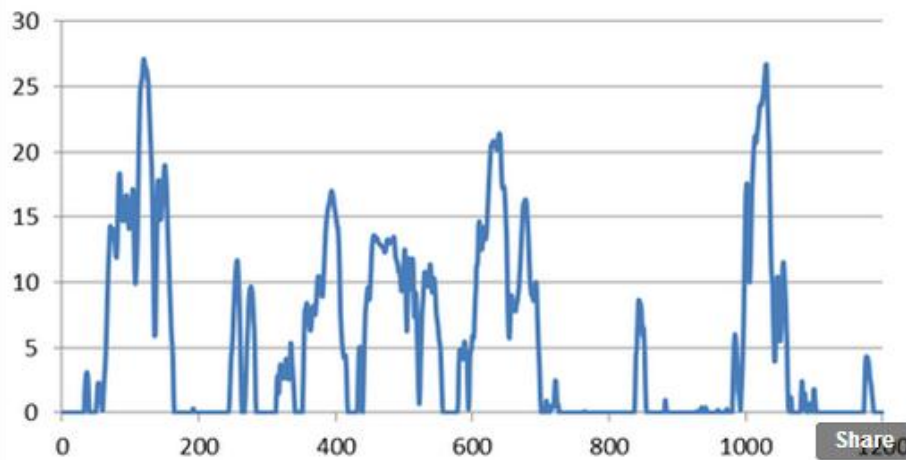


# Yard Truck Testing

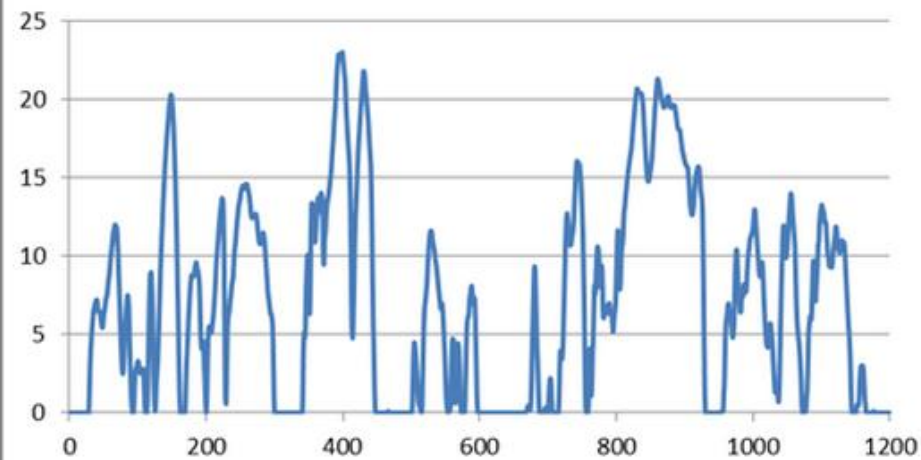
- UC Riverside Dyno
- 1.69, 2.55kWh/mile
- WV port cycles
- Triple replicates
- Thorough DAQ



YT\_trans\_23K



YT\_trans\_72K



# Points to Remember

- TransPower's vertical approach to ZEV freight transport provides opportunities for market innovation and scale economies
- Extreme idle-load reduction leads to high system efficiency and long run times
- On-board, high-rate charging supports early adoption, high utilization
- TransPower's systems-based approach and rapid controls prototyping provides flexibility and agility in early-adopter markets

[www.transpowerusa.com](http://www.transpowerusa.com)