



Medium-Duty Vehicle Projects



Jeff Cox – Air Quality Specialist

South Coast Air Quality Management District

AQMD Sponsored MD Vehicle Projects

- Gasoline Hybrid Electric Delivery Truck - FedEx
- Gasoline Plug-in Hybrid Service Vehicle – UHaul
- 378 Vehicle Fleet of PHEV's – Utility Industry

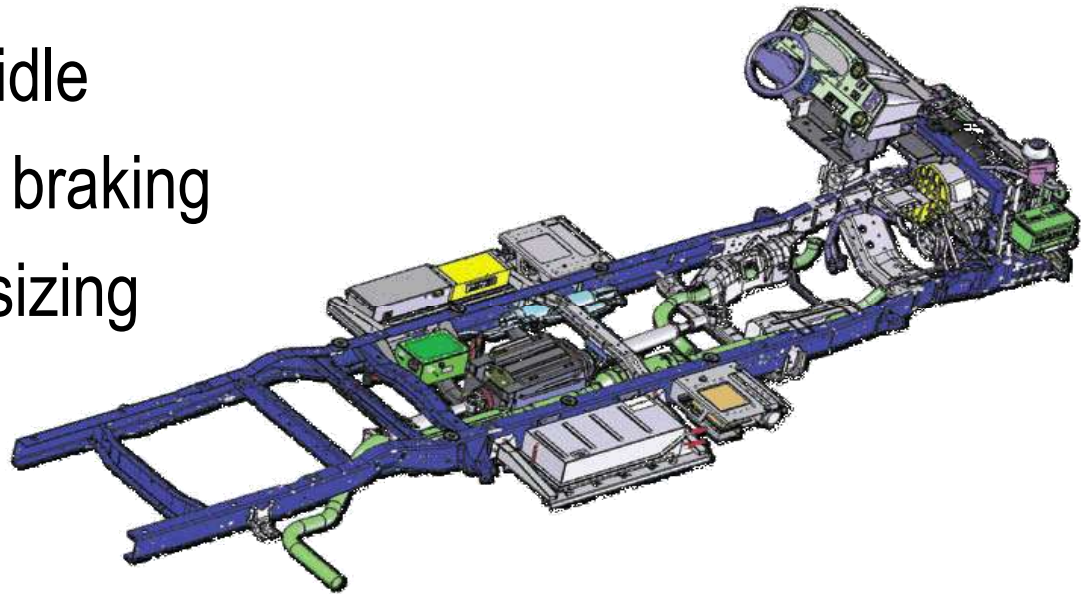


FedEx Hybrid Delivery Vehicle

- Program Overview
 - Deployment of four hybrid electric delivery vehicles with FedEx
 - Driving route characterization
 - Chassis dyno emissions testing
 - In-use fuel economy evaluation
 - Modeling to determine PHEV suitability
- Program Costs
 - \$325,000 AQMD
 - \$270,000 FedEx

FedEx Hybrid Delivery Vehicle

- Vehicle Technology
 - Ford E450 chassis
 - Azure Dynamics parallel hybrid drive system
 - Electric launch assist
 - Engine-off at idle
 - Regenerative braking
 - Engine downsizing

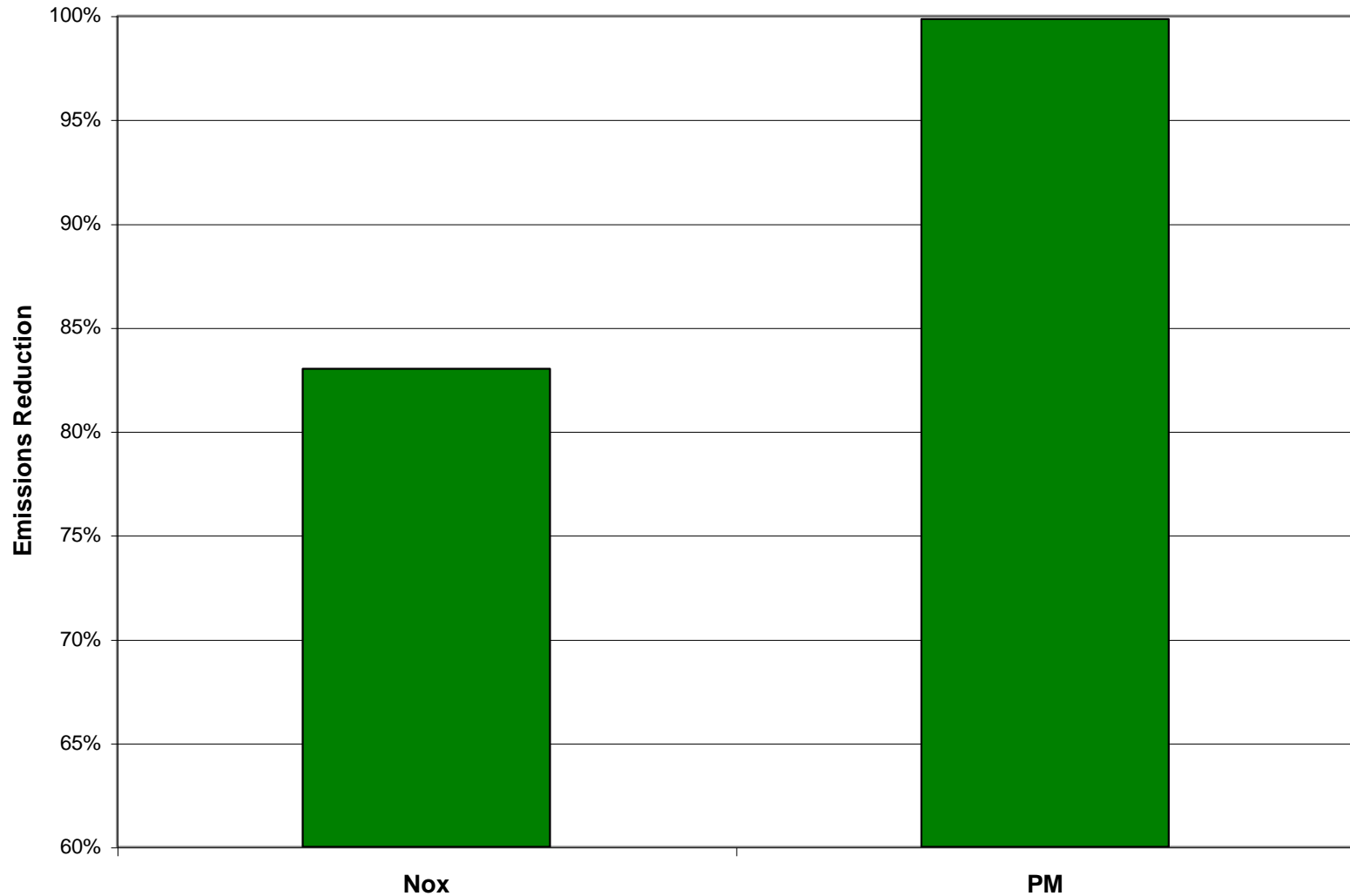


FedEx Emissions Testing

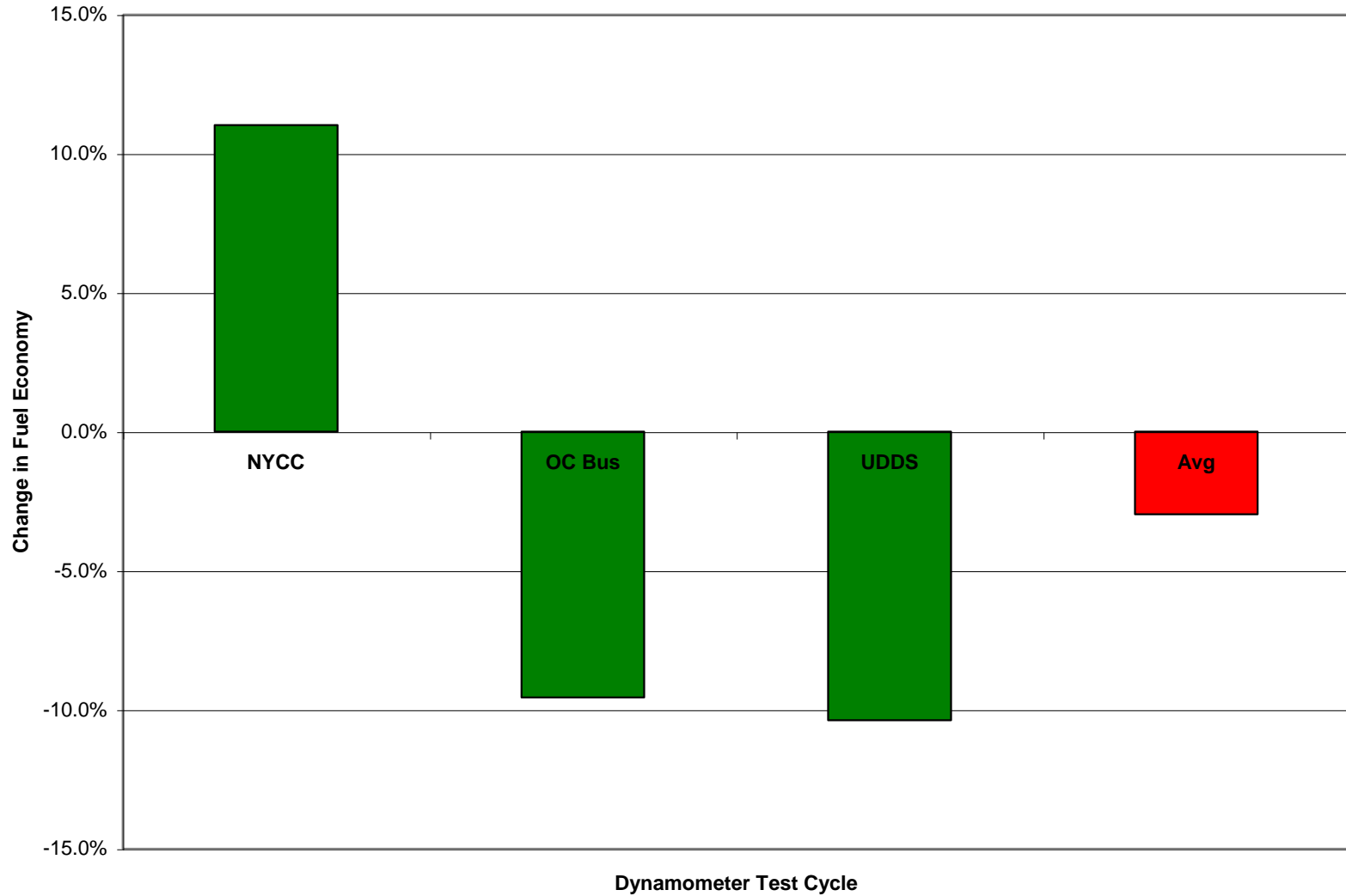
- Three dynamometer drive cycles were selected to match the kinetic intensity of the vehicles used in Fed Ex's Fleet
 - NYCC
 - OC Bus
 - UDDS



PM and NOx Emissions Results



Fuel Economy



Potential Follow-up Work

- Comparative chassis dyno testing with:
 - CNG
 - 2010 compliant diesel
 - 2010 compliant hybrid electric diesel

U-Haul Gasoline PHEV Service Vehicle

- Program Overview
 - Development of a medium-duty gasoline PHEV
 - Demonstration of one vehicle with U-Haul
 - Comparative emissions testing
 - In-use fuel economy evaluation
- Program Costs
 - \$984,000 AQMD (through a DOE Grant)
 - \$1,200,000 CARB
 - \$3,795,000 Leveraged funding from utility industry for PHEV bucket truck development

U-Haul Service Vehicle

- Vehicle Technology
 - Ford F550 Chassis
 - Eaton PHEV drive system
 - 16 kWh Li-ion battery pack
 - 45 kW electric motor
 - Engine downsizing (5.4L gasoline)
 - Regenerative braking
 - Engine-off at idle
 - All-electric low speed operation

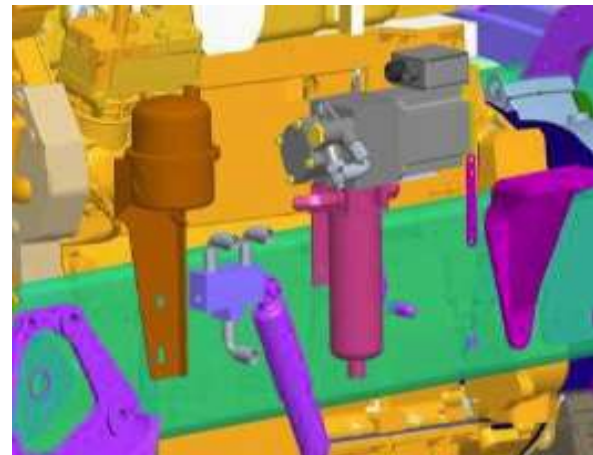
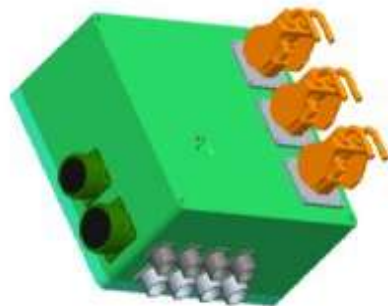
Phase 1 - Program Status

- Phase 1 is complete
 - Development of a diesel PHEV without engine-off capability
 - Five Phase 1 vehicles being deployed for “shake-out” testing

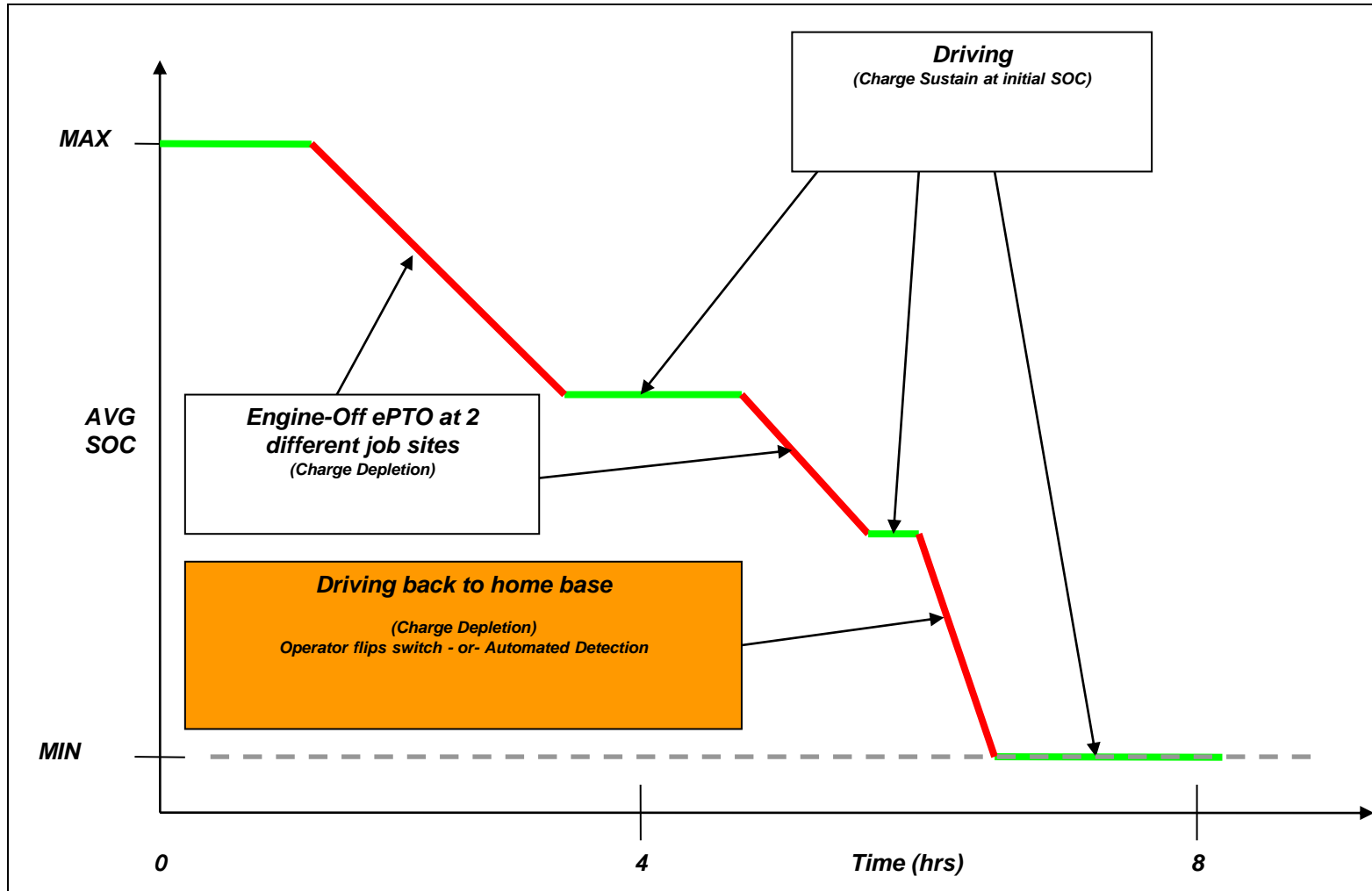


Phase 2 - Program Status

- Phase 2 is expected to be completed by the end of '09
 - Enable engine-off vehicle operation
 - Electrification of a/c
 - Electrification of power brakes
 - Electrification of power steering
 - Electric heater



PHEV Utility Truck Operation



Phase 3 - Program Status

- Phase 3 is expected to start early 2010
 - Development of a high-speed hybrid drive transmission compatible with a gasoline engine
 - First gasoline demonstration vehicle expected in Q4 2010

Recovery Act – Transportation Electrification Award

- Expand Trouble Truck program to 378 vehicles
 - 50+ fleets nationwide
 - Ford 550 Trouble Trucks, pickups, shuttle vans
- \$45.4M award from DOE
 - \$5M CEC cost share
 - \$30M+ utility cost share
- Set-up production facilities
 - Key suppliers are US companies with Midwest facilities
- Fleet build and delivery by Q2 2011

