

# Truck Transition Scenarios Model

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STEPS Presentation

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# Introduction

- Details of Truck Transition Scenarios model (Yang talk Wednesday)
- Model CA based (plan to start US model next year)
- Model uses Fuel Infrastructure model (Yang talk)
- Model uses much of fuel economy results presented (Burke talk)

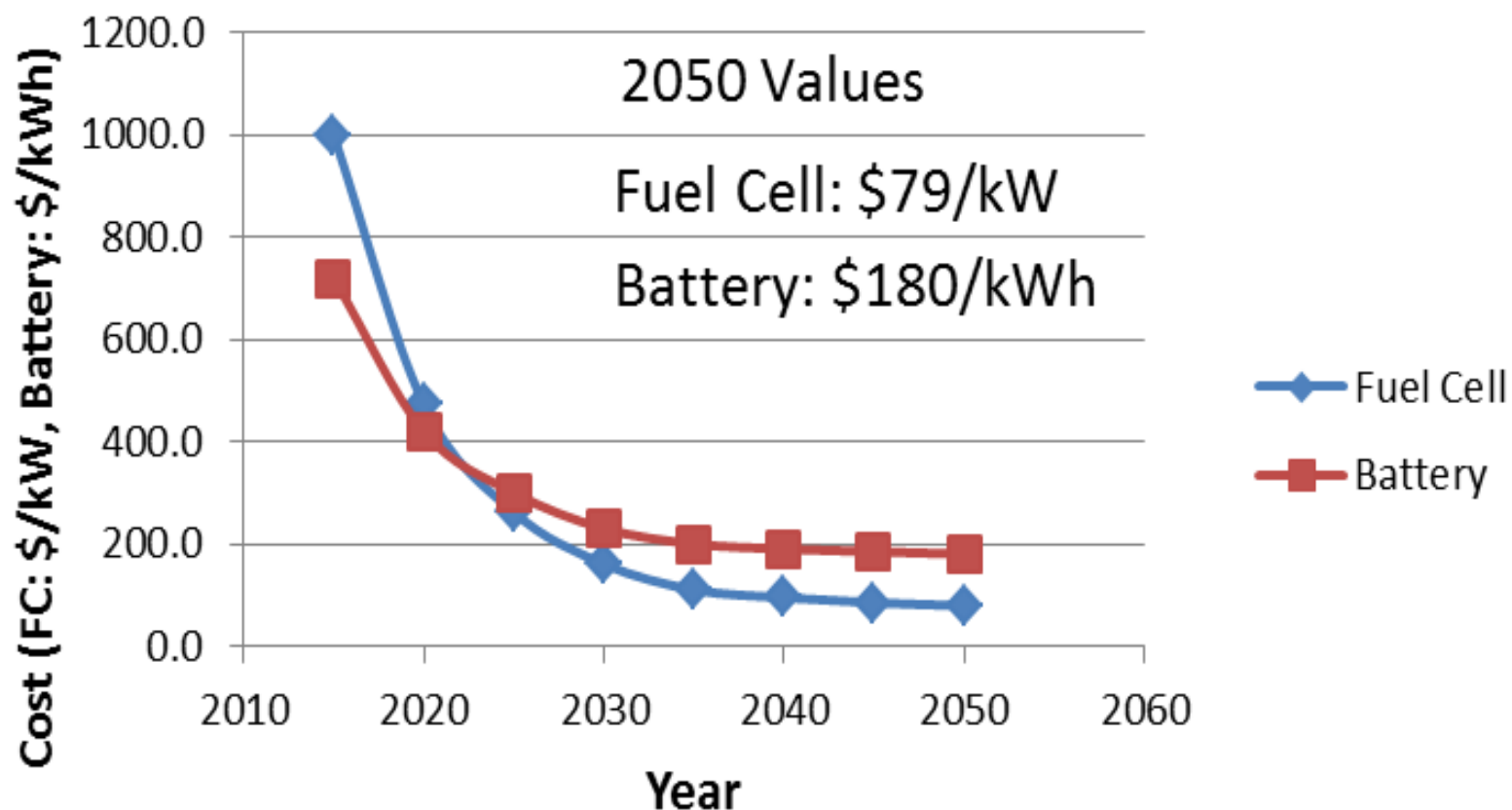
## Updates to June Work

- Expanded trucks to 8 truck types (Burke talk) - incorporated all of EMFAC/Vision truck categories
- Cost model that includes major cost components
- Fuel infrastructure model (Yang talk)
- Decision Choice model
  - 8 truck types (up from 3)
  - Includes 3 choice algorithms for each truck type
  - Setup to link directly to HDV workbook sales percentages

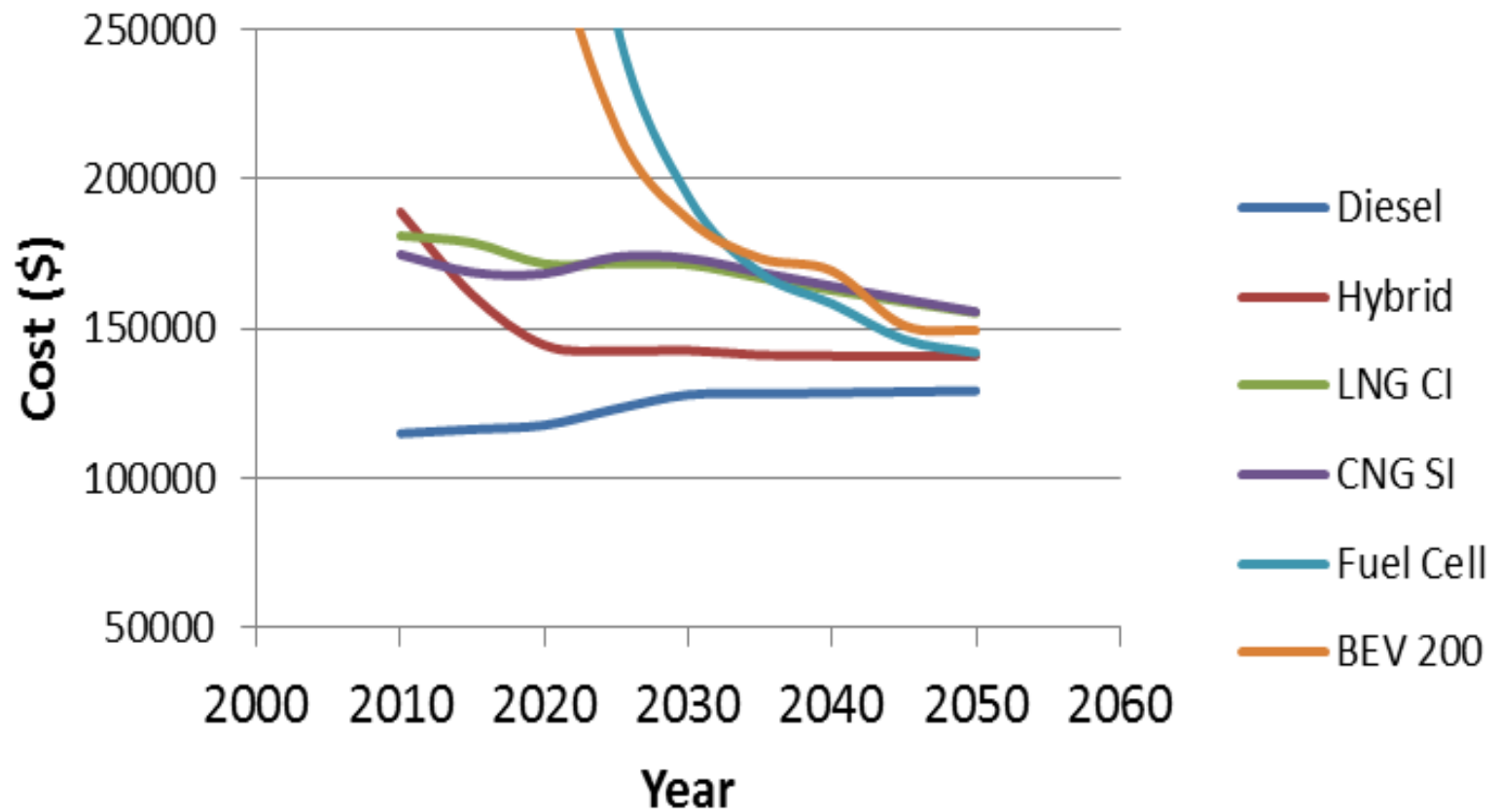
# Vehicle Cost

- Cost model sums costs for major components
- Present cost data, literature on future costs
- Estimate emissions controls cost increase to meet future standards
- Battery (\$/kWh), Fuel cell (\$/kW), motor (\$/kW), hydrogen fuel storage (\$/kg): Use cost parameterizations as function of year
  - Includes OEM markup
  - Multiplier for high power batteries

## Fuel Cell and Battery Cost



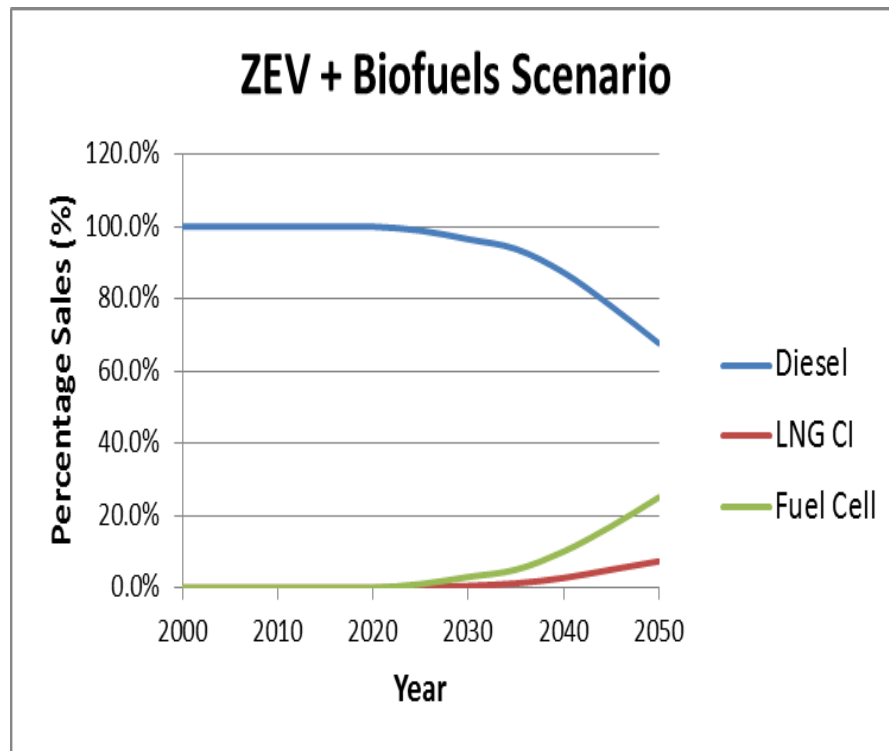
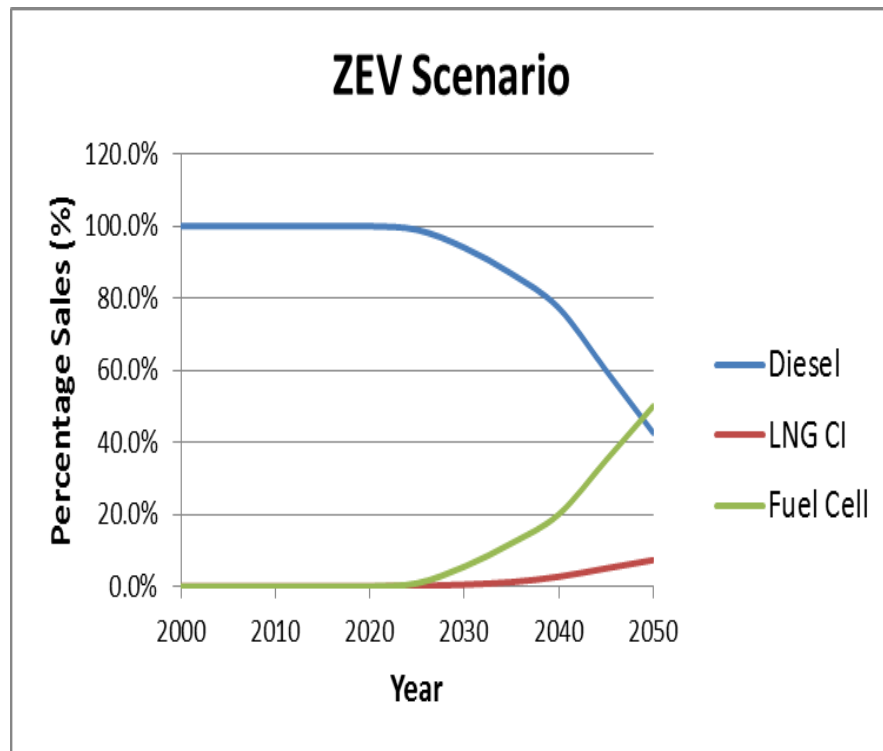
## HD Short Haul Vehicle Cost



# Scenarios

- Scenarios specify the percentage of new vehicle sales for each truck type and technology for each year through 2050
- BAU (business as usual)
  - Meet phase I and phase II standards for fuel economy
  - No advanced technologies (BEV, fuel cell)
- ZEV
  - Aggressive fleet penetration for fuel cell and BEVs
- ZEV + biofuels
  - Fleet penetration roughly half of ZEV scenario for fuel cell and BEVs
  - Biodiesel contribution grows to 50% by 2050

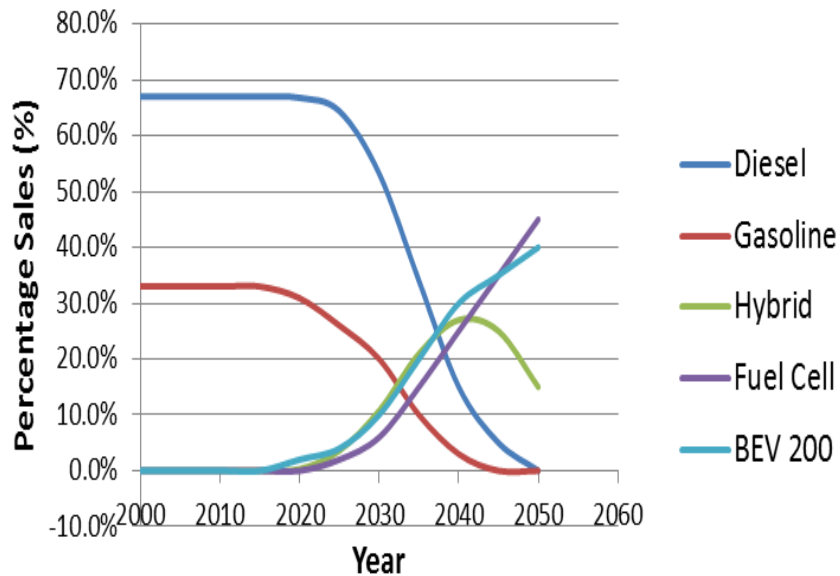
# Long Haul Scenarios



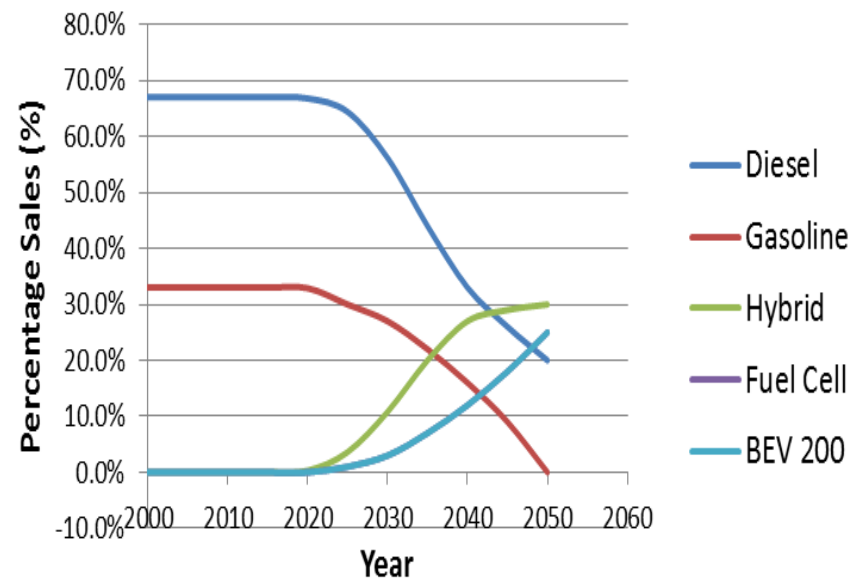


# HD Pickups Scenarios

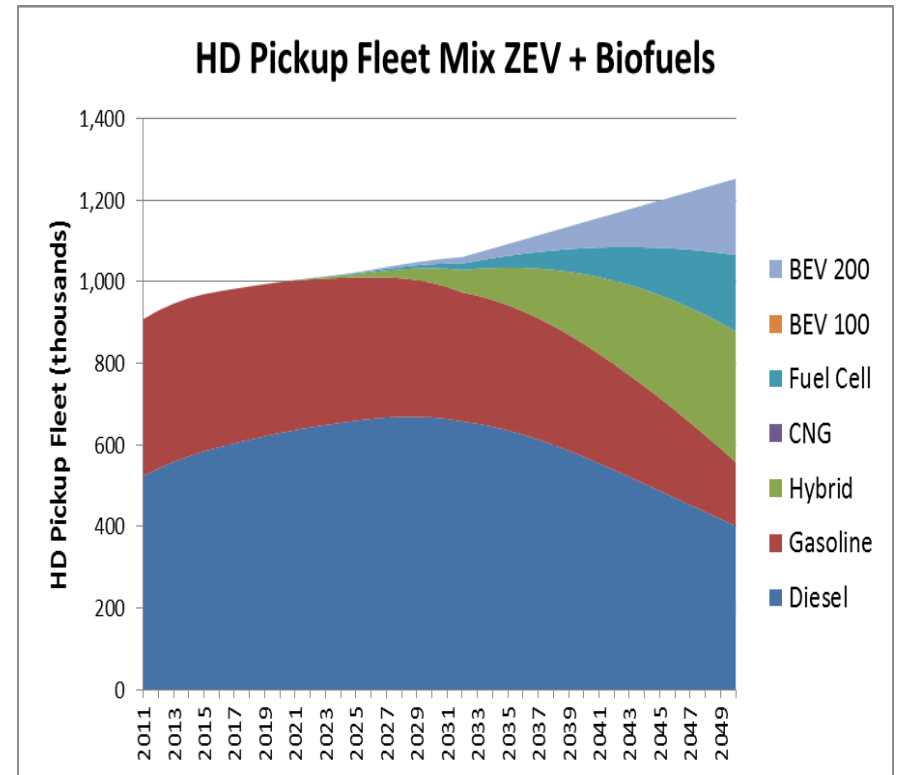
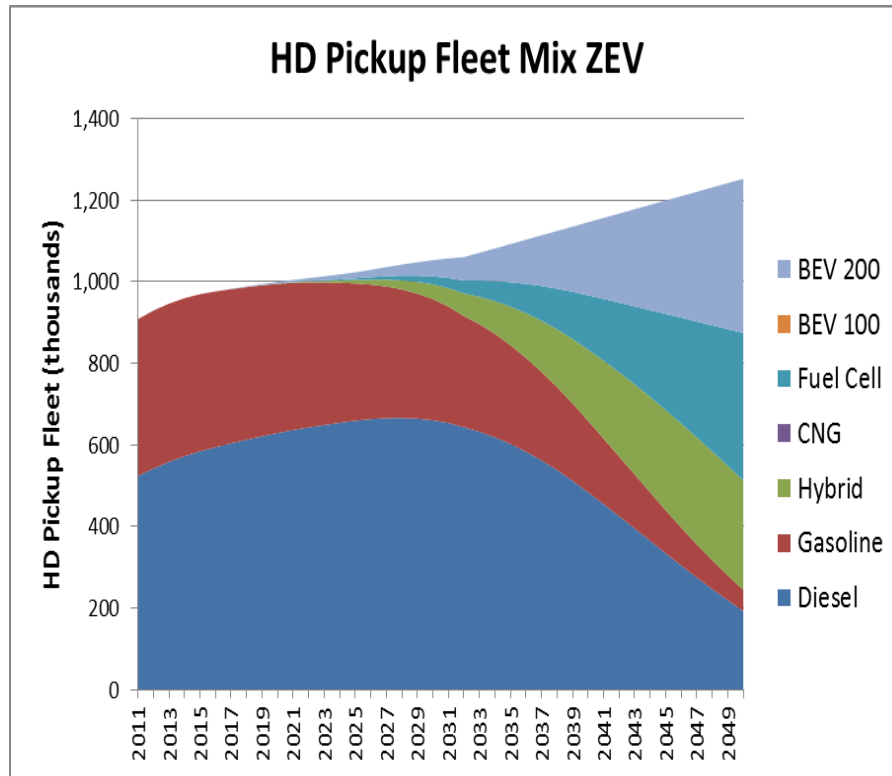
## ZEV Scenario



## ZEV + Biofuels Scenario

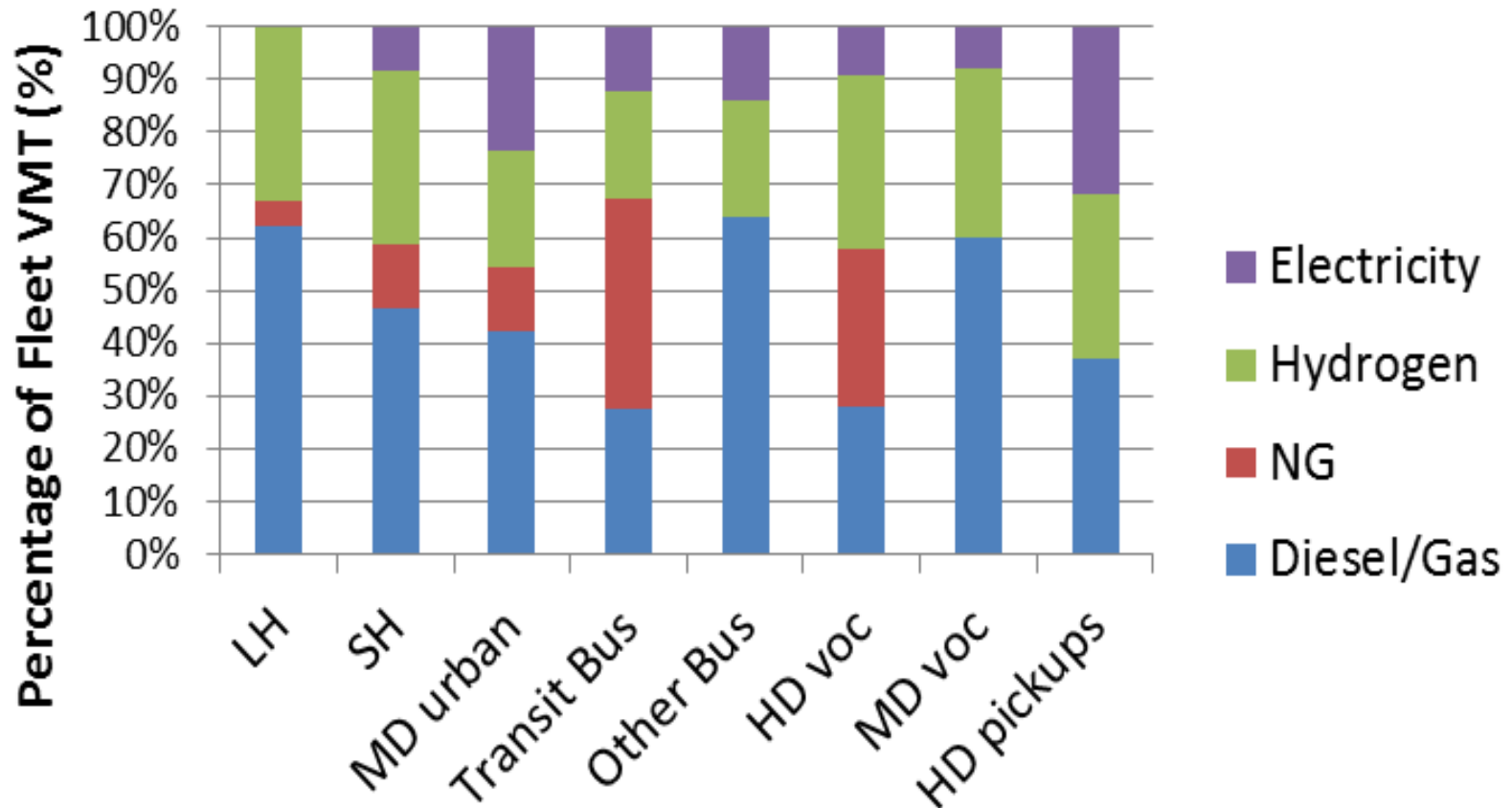


# HD Pickups Fleet Stock

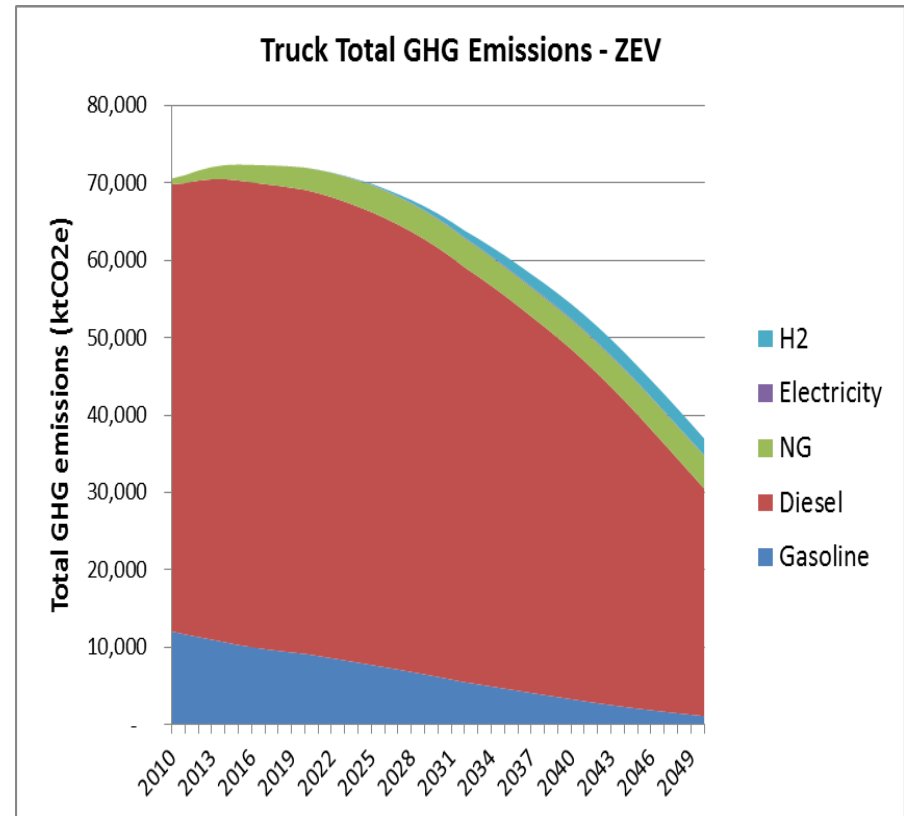
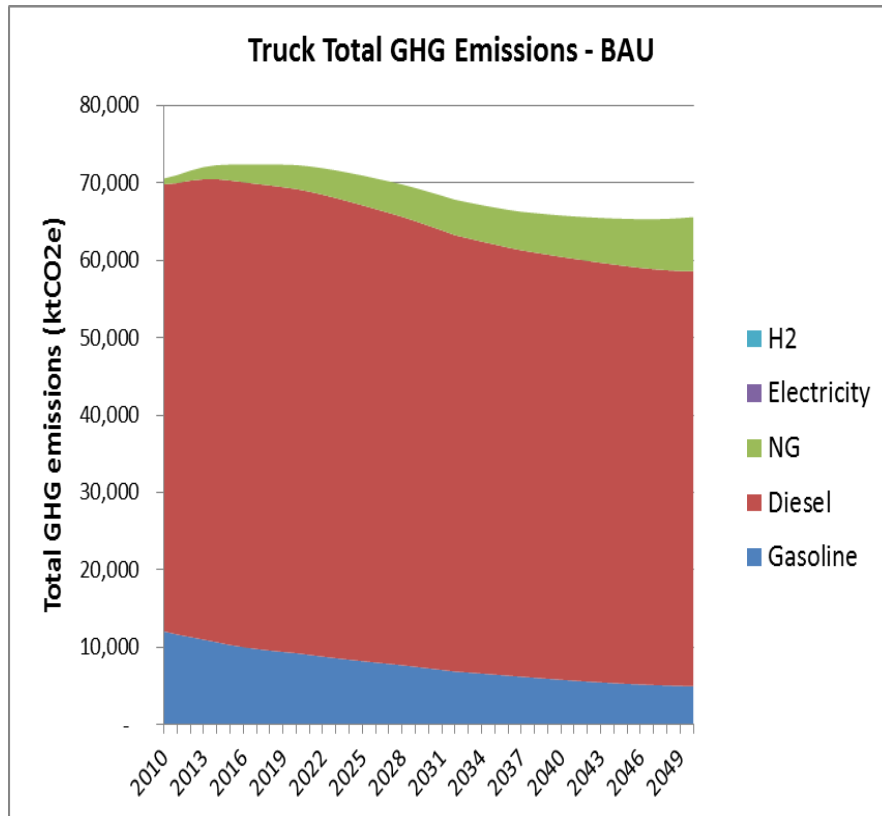


ZEV Scenario: ZEVs ~60% of fleet, ZEV + Biofuels Scenario: ZEVs ~30%

## 2050 VMT by Fuel Type ZEV Scenario



# Total Truck GHG Emissions



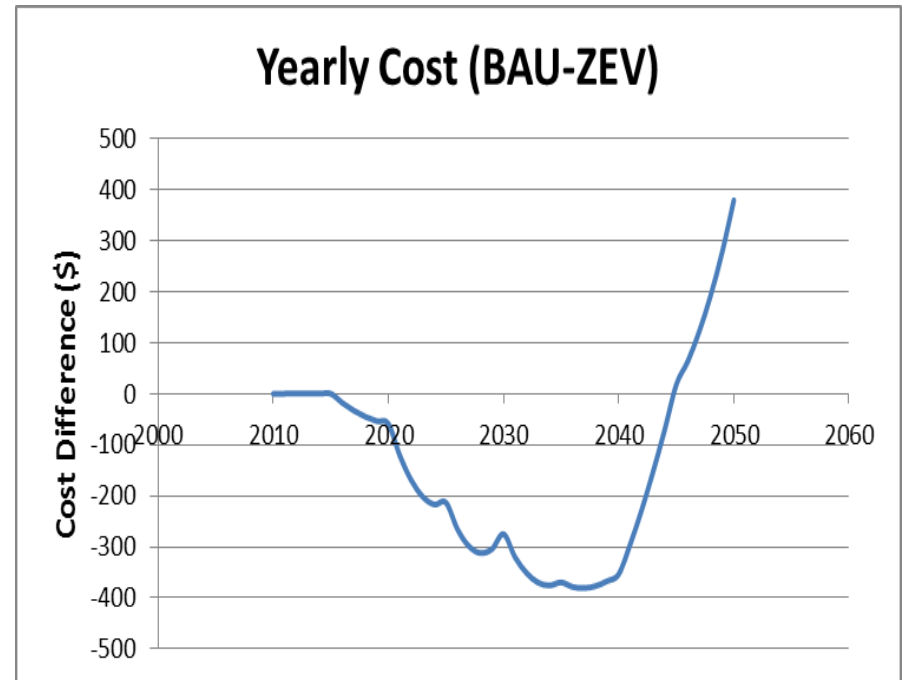
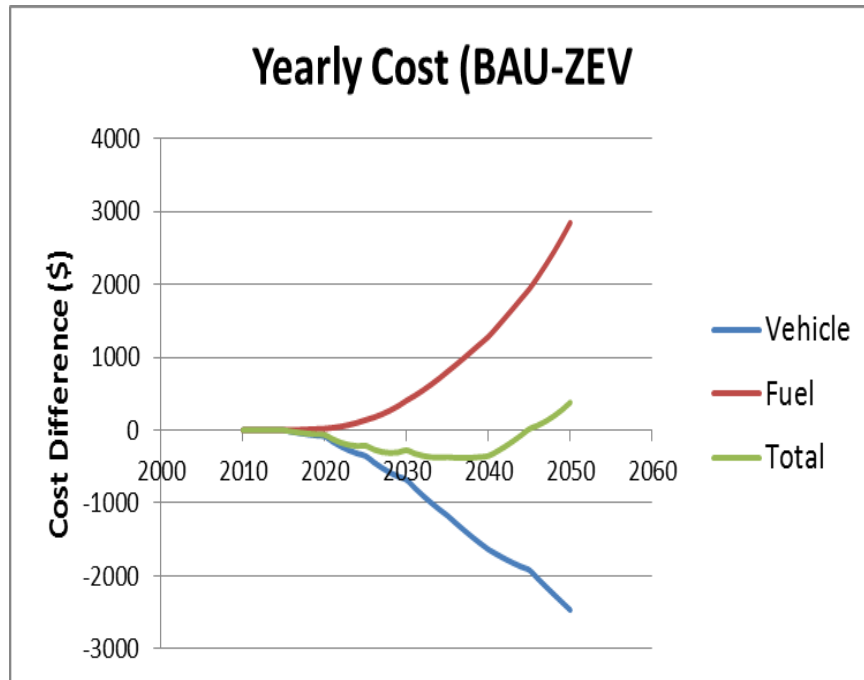
ZEV: Low CI values, 5% diesel biofuels

2050 ZEV gCO<sub>2</sub>e/gge: Diesel ~ 14,000, H<sub>2</sub> ~ 2,000, elec ~150-500

## GHG Emissions Reductions by Scenario

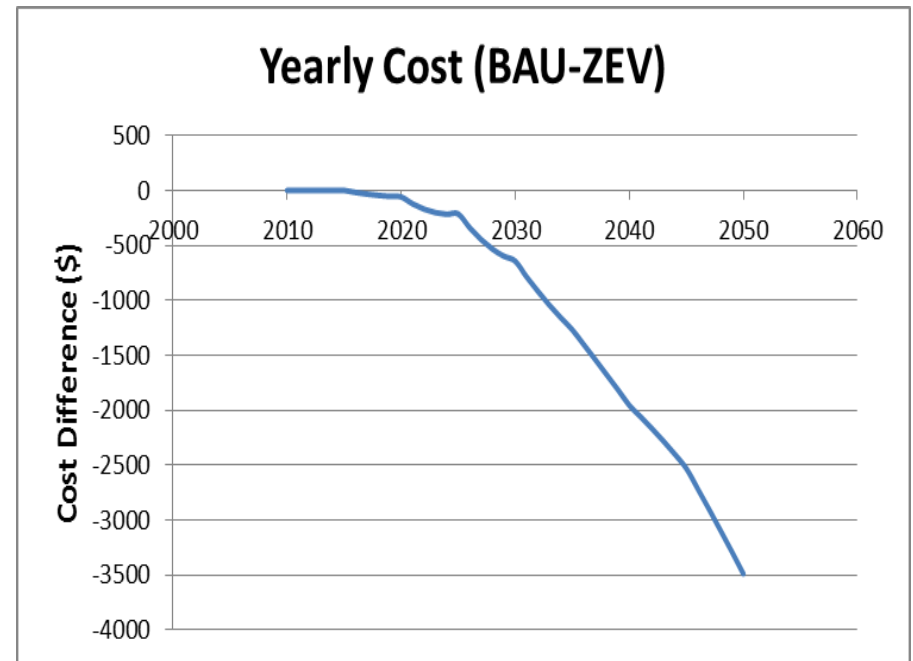
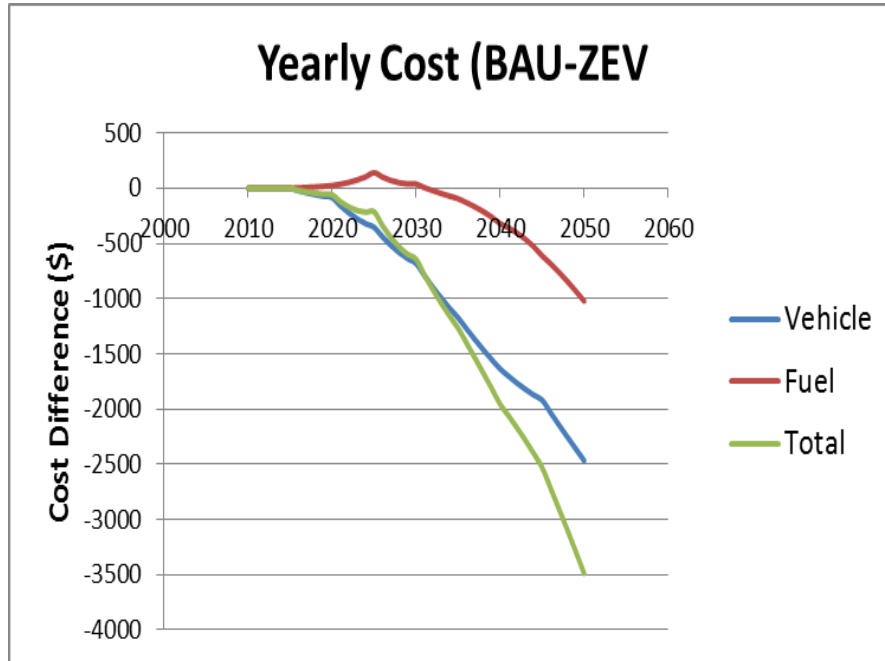
Scenario	GHG Reduction in 2050 from 2010 (%)
BAU (frozen efficiency and CI)	32
BAU	-8
ZEV	-48 (-7 in 2030)
ZEV + Biofuels	-47

# Yearly Total Cost Difference (BAU – ZEV)



2050: Diesel = \$5.37, H2 = \$6.23 (truck stop)  
\$7.74 (fleet)

# Yearly Total Cost Difference (BAU – ZEV)



2050: Diesel = \$3.50, H2 = \$6.23 (truck stop)  
\$7.74 (fleet)

## Summary

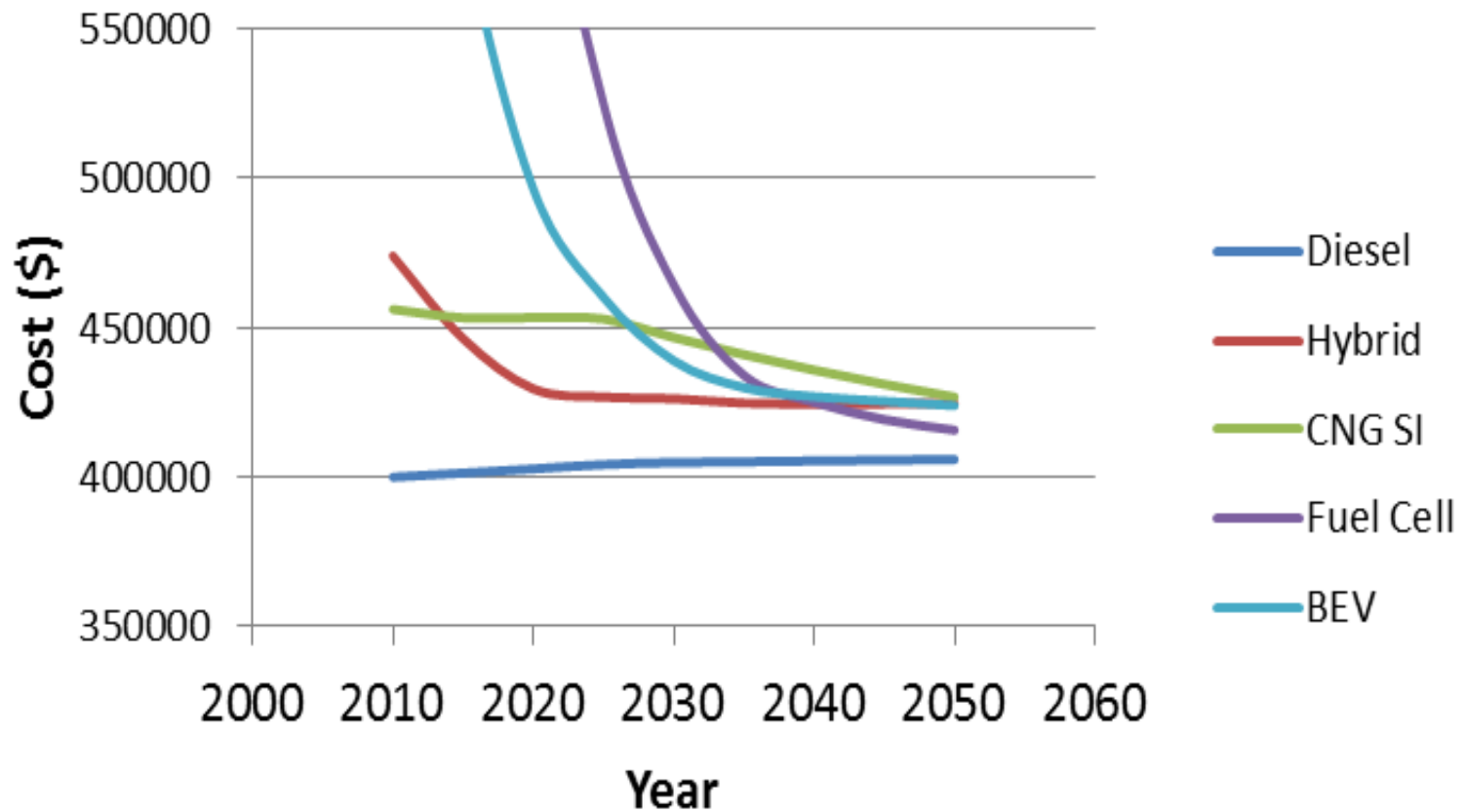
- VMT growth roughly equals BAU efficiency gains
- Difficult to get significant ZEV penetration in truck fleet by 2050
- BEVs make up modest fraction of fleet. ZEV scenarios depend heavily on fuel cells.
- ZEV and ZEV + Biofuels scenarios achieve ~48% GHG reductions in 2050 from 2010 values
- Total Cost (BAU-ZEV scenarios) heavily dependent on diesel cost



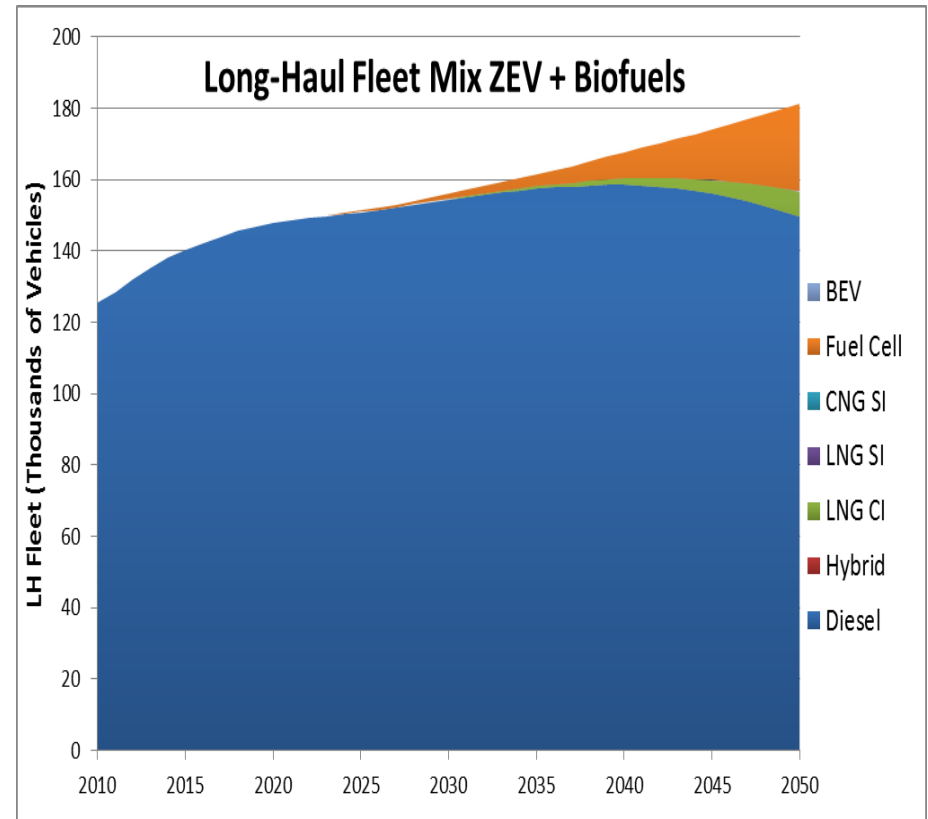
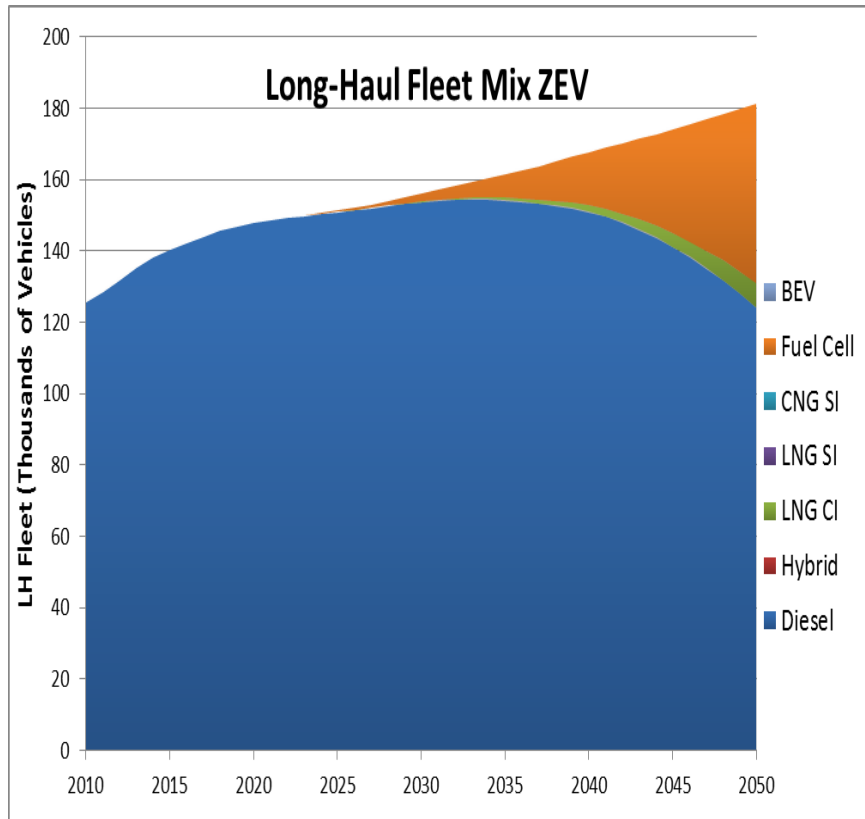


# Thank You

## Transit Bus Vehicle Cost



# Long Haul Fleet Stock



# Truck Vehicle Types

Truck Type	Technologies	Description / Example	Miles/day Operating days/yr	MPDGE (2015 MY) EMFAC
Long Haul	Diesel, hybrid, CNG SI LNG SI LNG CI, FC(500)	Class 8 sleeper cab	287 miles/day 312 days/yr	6.6
Short haul	Diesel, hybrid, CNG, FC, BEV	Class 8 non sleeper cab	140 miles/day 312 days/yr	6.5
MD urban	Diesel, Gas, diesel hybrid, CNG, FC, BEV	Delivery truck (UPS)	80 312	8.6
Transit Bus	Diesel, hybrid, CNG, FC, BEV	Transit Bus	150 327	4.6
Other Bus	Diesel, hybrid, CNG, FC, BEV	Coach Greyhound	90 292	8.6
HD pickup	Diesel, Gas, CNG, Hybrid, FC, BEV, PHEV	Ford F250	70 327	18
MD vocational	Diesel, PHEV, BEV, FC		20 312	8.4
HD vocational	Diesel, CNG, BEV, FC		145 312	6.7