



PHEV20 Emissions Study

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Outline

- Motivation
- Calculation Methodology
- Electric plant emissions
- Gas auto emissions
- Results
- Summary
- Future Work

Motivation

→ Determine total emissions impact of conventional gas vehicle vs plug-in hybrid vehicle



vs



Calculations

- **Electric mode emissions calculated as:**
Power plant emissions¹ x # vehicles x # miles/year
- **Gas and hybrid mode emissions calculated as:**
Tail pipe emissions x # vehicles x # miles/year

1. PHEV20 assumptions:
travel 20 miles per charge
energy consumed assumed to be 420 MWh for 50K PHEV20s (S. Letendre)
2. PHEV total emissions² = 40% electric + 60% gas
3. Assumed 12379 miles traveled per capita³

Electric Emissions



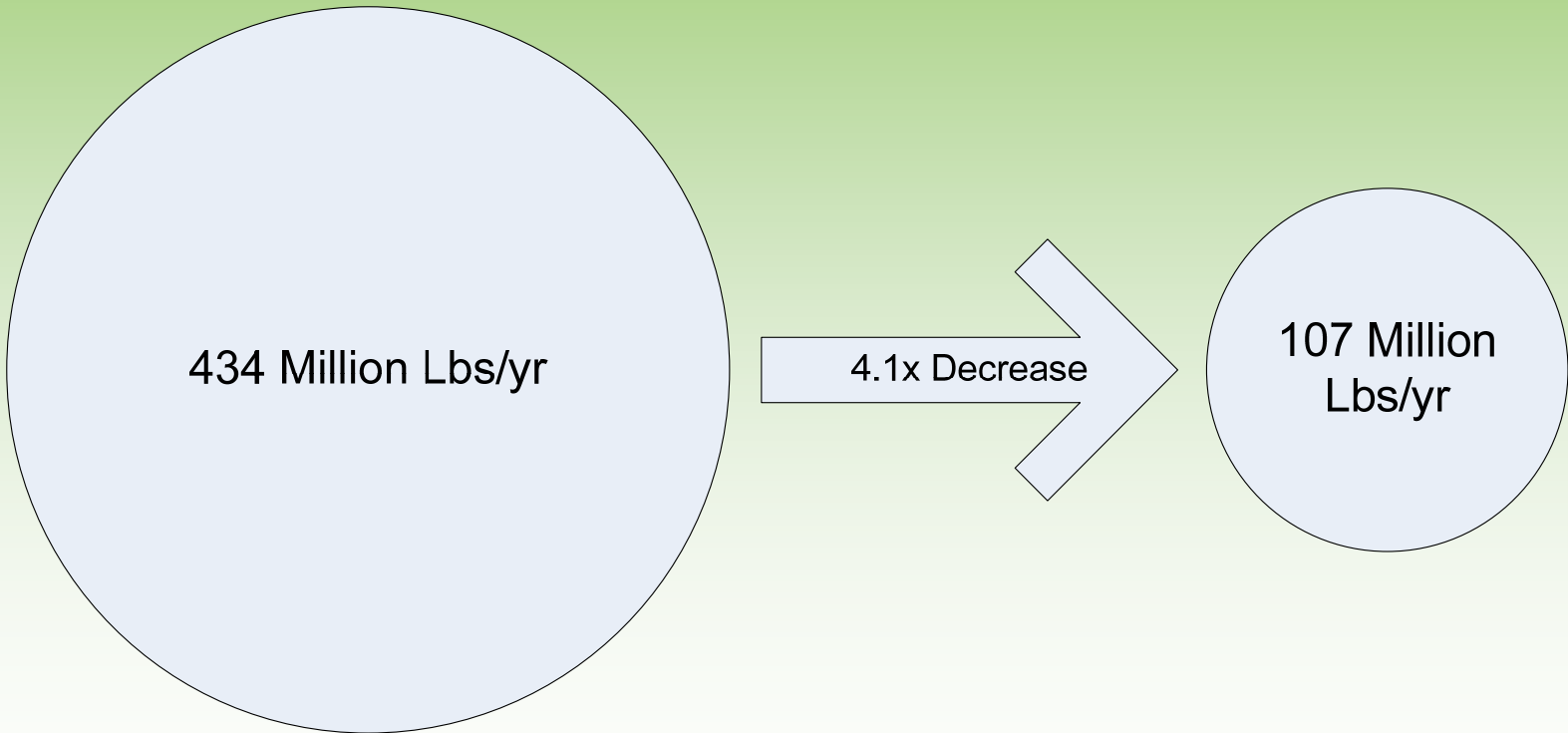
Gas Emissions

- **PHEV assumes SULEVII**
 - **Weighted average fuel economy of all hybrids sold in 2007⁴⁻⁷ = 40.4 mpg**
 - **CO₂ = 218 g/mi**
 - **NO_x = 0.02 g/mi**
- **Conventional auto assumes Ford published data⁸**
 - **Average US car fuel economy for 2006 = 27.7 mpg**
 - **CO₂ = 318 g/mile**
 - **NO_x = 0.08 g/mile**

Results-CO₂ Emissions

Conventional

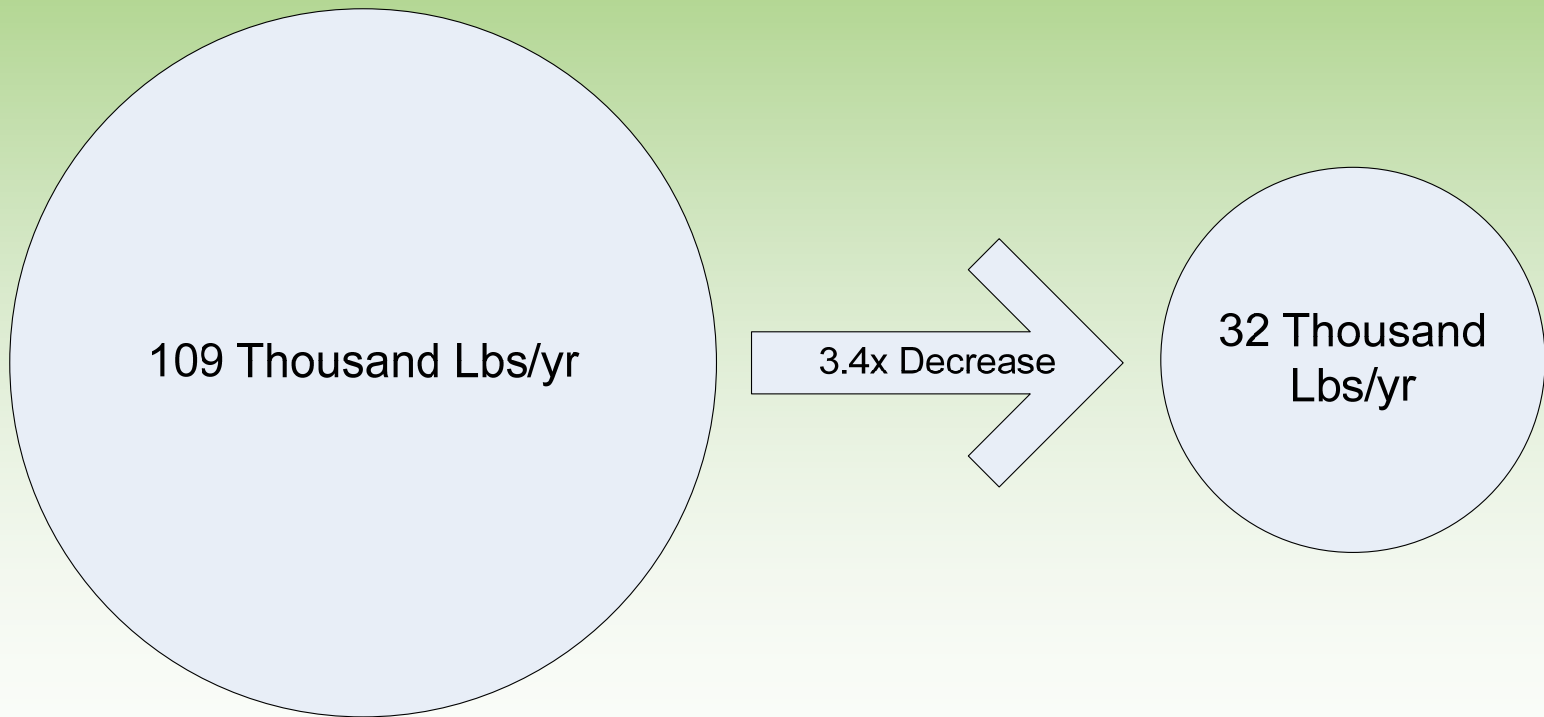
PHEV20



Results-NO_x Emissions

Conventional

PHEV20



Results-Gas Consumption

Conventional: 22.34 Million Gallons

PHEV20: 10.95 Million Gallons



Summary

- 4.1x decrease in CO₂ emissions
- 3.4x decrease in NO_x
- 11.39 Million gallons fuel saved at 50K PHEV level

Future Work

- Need to consider the fuel used to produce the electricity
- Need to more precisely understand actual VT vehicle fleet
 - Compare/contrast to Ford data used
- Need to consider actual VT driving behavior
 - County and/or town variations
- Test an actual PHEV to determine re-world performance

Acknowledgements

- UVM UTC
- Dr. Walter Varhue & Keith Pelletier-UVM SoE EE
- Steve Letendre-Green Mountain College

References

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Images from:

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2. http://www.soultek.com/images/Hymotion_Prius_plug-In.jpg
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