

Alternative
Fuel
Vehicle
Project

@

Harvard University

Reasons to use Alternative Fuel Vehicles (AFV's)

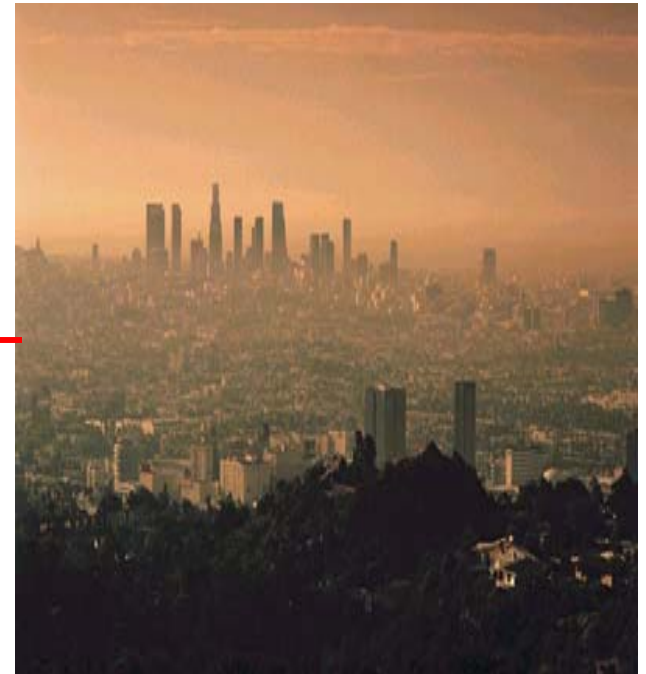


Global Warming

- Rising sea level, drought, tropical disease, extinction, famine, flooding,

Air Pollution

- Smog, asthma, bronchitis, acid rain, cancer,



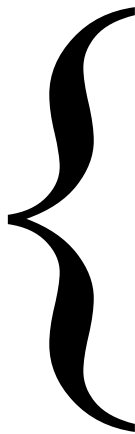
Urban Air Pollution



Vehicular emissions are a major source of air pollutants, including:

- nitrous oxides (NO_x)
- hydrocarbons (VOCs)
- particulate matter (Pm)
- carbon monoxide (CO)
- sulfur dioxide (SO_2)

Fossil Fuels



- Gasoline
- Diesel
- Compressed Natural Gas (CNG)
- Liquified Petroleum Gas (LPG)

Biomass



COURTESY APIS



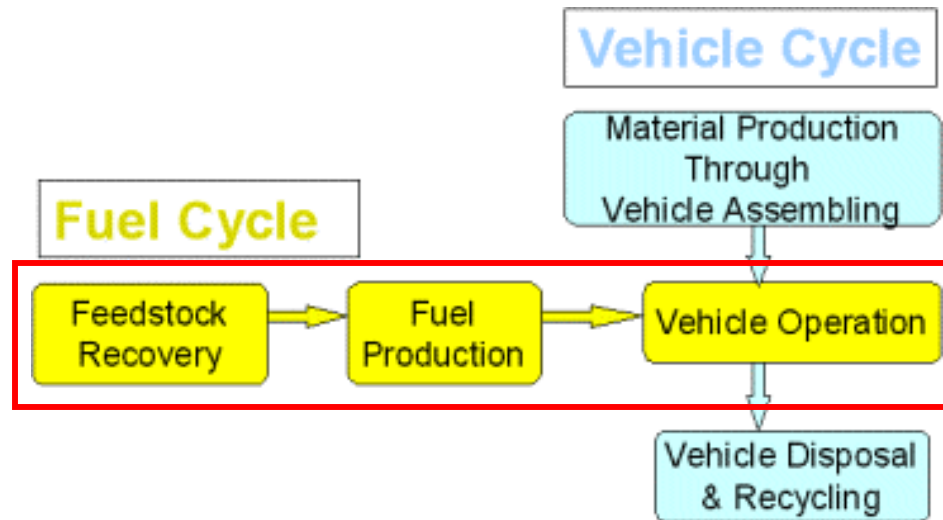
- Ethanol
- Biodiesel

Any Source



Electricity

REET Model - A fuel cycle emissions analysis (a.k.a. - Well-to-Wheel)





CNG (Compressed Natural Gas)

A **non**-renewable fossil fuel
Mined from places like Alaska

Comparison to diesel

GHG (Greenhouse Gas): **20%** more GHG

Urban Air Quality: **80%** less Pm (Particulate Matter)

45% less NO_x

30% less VOC

190% more CO

(Source: GREET Model, Argonne National Laboratory, as used by the EPA)



Hybrid (Diesel-Electric Hybrid)

Diesel engine → Batteries → Electric motor

Comparison to diesel

GHG: **30%** less GHG

Urban Air Quality: **20%** less Pm

20% less NOx

20% less VOC

20% less CO

(Source: GREET Model, Argonne National Laboratory, as used by the EPA)



Electric

(Powered by NE Electric Grid)

Powered by the power plants that make electricity

Limited range: often < 70 miles

Comparison to diesel

GHG: **45%** less GHG

Urban Air Quality: **80%** less Pm

95% less NOx

100% less VOC

100% less CO

(Source: GREET Model, Argonne National Laboratory, as used by the EPA)



BD100 (100% Biodiesel)

A **renewable** fuel made from soybeans

Fill up any diesel engine with BD100 and off you go!

Comparison to diesel

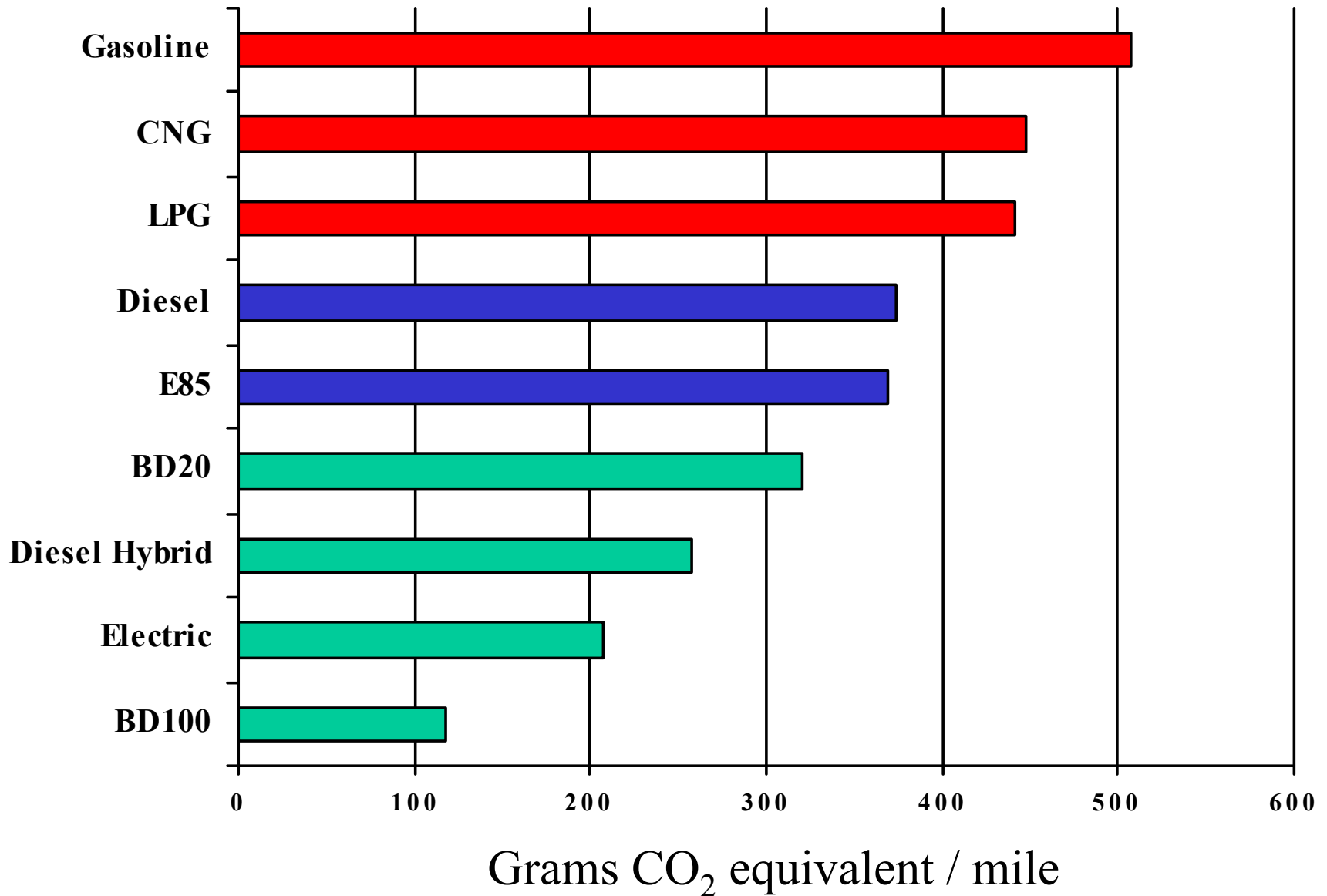
GHG: **70%** less GHG

Urban Air Quality:

- 55%** less Pm
- 5%** more NOx
- 55%** less VOC
- 45%** less CO

(Source: GREET Model, Argonne National Laboratory, as used by the EPA)

GHG Emissions / Mile for a Passenger Car



Fuel-Efficient Gasoline Vehicles



Crown Victoria, **9.5** tons GHG



Chevy Impala, **8.6** tons GHG



Ford F-150, **7.5** tons GHG



Toyota Tacoma, **5.8** tons GHG

Electric Vehicles



Chevy S-10, **7.0** tons GHG



Ford Ranger EV, **3.3** tons GHG

Biodiesel to replace Diesel



Bus on diesel, **33** tons GHG

Bus on biodiesel, **10** tons GHG

Hybrid Vehicles



Crown Victoria, **2.5** tons GHG



Toyota Prius, **1.1** tons GHG