LAFAYETTE COLLEGE

Plug-in Hybrid Vehicle Factsheet

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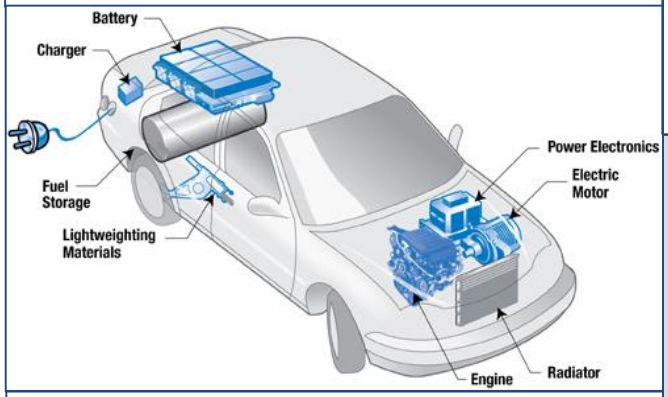
How It Works?

- Electric and gasoline motor power drivetrain
- Ability to run on only electric power for specified range
  - Range dependent on battery size
- Battery charged in two ways:
  - Regenerative Braking
  - Plugging into 120 V outlet
- Different than hybrid vehicle (HEV) because of ability to charge battery from source other than braking



Components of a PHEV

The above diagram shows the components of a PHEV, the major components that effect production emissions are the electric and gasoline motor, as well as the battery pack which is larger than those included in HEV's because of the ability to operate solely on battery power for a substantial range.

Electricity Constraints

The main constraint on emissions gains of PHEV's is the source of electrical power. This is dependent on the location, time of day, climate, and seasonal load variations. All of these factor into the graphic on the right which shows the equivalent MGP of a PHEV in the various electrical producing areas.

Why Buy a PHEV?

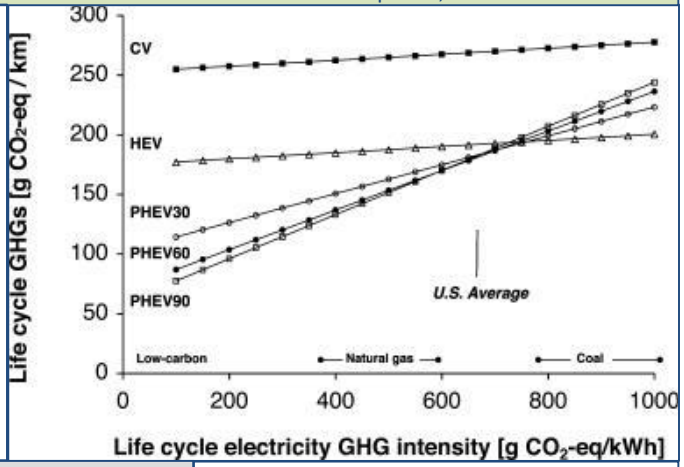
- Higher initial cost compared to HEV and ICE vehicles
- Lower initial cost than EV
  - No range issue because of tandem gas engine
- Chart on bottom right shows greater environmental impact than ownership of HEV
- Pay off period for ownership 13 years, will be reduced by;
  - Innovations in battery technology
  - Fluctuations in oil prices
  - Increases in production of PHEV's
- High initial cost offset by federal tax credit

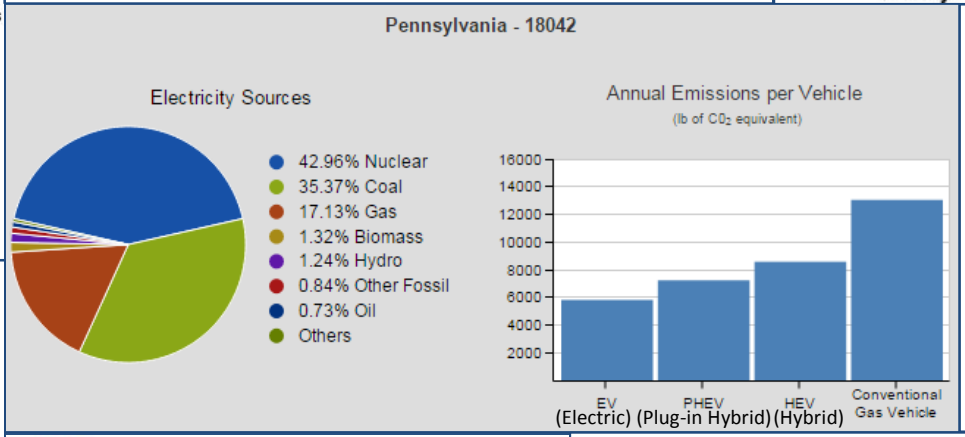
Pros

- Reduced fuel consumption
  - Save money on operation-Electric prices about $1/GGE
  - 40-60% reduction in petroleum energy consumption
  - 30-60% reduction in greenhouse gas emissions
- Reduced dependency on foreign oil

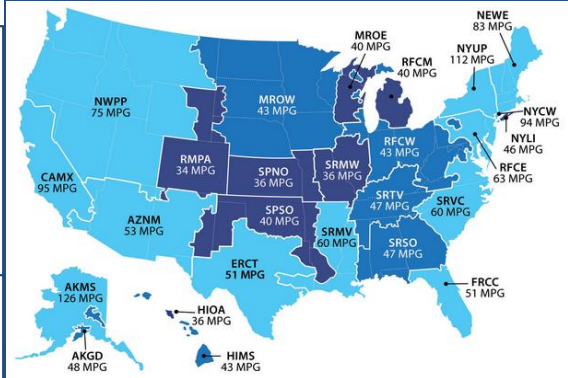
Cons

- Large charging time- 1 to 4 hours using 240 volt charger
- Emissions linked to source of power generation
  - Environmental impact strong function of carbon intensity
- Battery technology not fully evolved
  - Lithium ion batteries expensive and do not have large range
  - Batteries may need to be replaced in lifetime of vehicle
  - Increased human toxicity from battery components





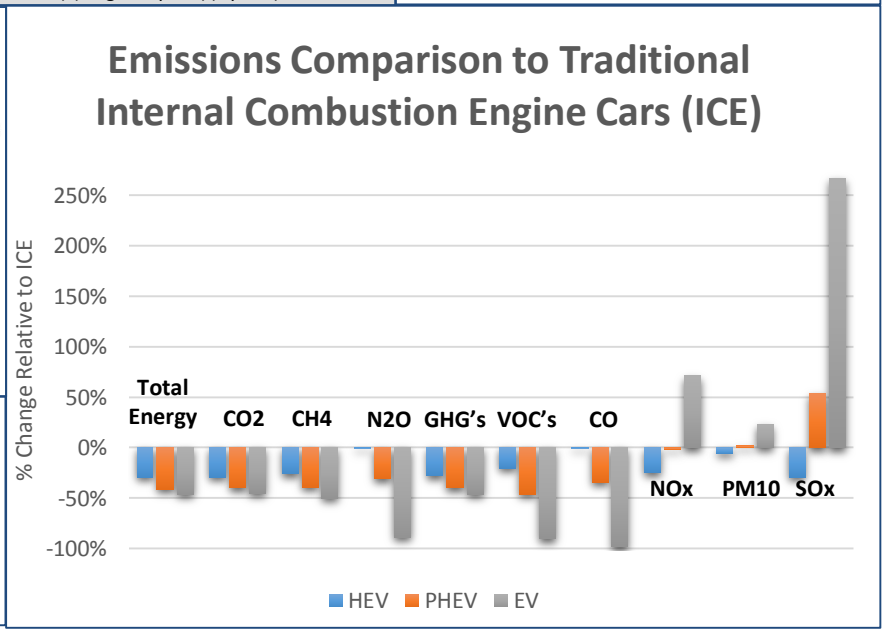
The above figure shows the lifecycle greenhouse gas (GHG) emissions of different cars as a function of the GHG intensity of the fuel used to produce that electricity. It shows that HEV has less of a lifetime emission than plug-in hybrid vehicles (PHEV). The battery range is also taken into account, which is specified in miles after PHEV.
The figure on the left uses the a model to estimate the annual emissions of different vehicles. This was done for the energy mix used in Easton, PA. Which is less GHG intensive than the national average because of the large nuclear use.



Comparative Vehicle Emissions

The figure to the right shows the percent reduction in emissions compared to ICE vehicles

- Trends show that all combustion gasses are reduced more in order of gas consumption
- PHEV's and EV's produce more PM10 and SOx because of electrical power generation



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