The US imports 5 million barrels of oil per day. Transportation accounts for 70%.

Motivations for vehicle electrification

**Energy Security:** Reduce our dependency on foreign oil.

**Air Quality:** Reduce air pollution and its effects on human health and the environment.

**Climate Change:** Reduce greenhouse gas emissions to slow climate change.

**Economics:** Reduce cost of driving, use local energy sources, and lead new technology innovation.

Electrification helps achieve these goals sometimes, but not always.

Benefits vary based on...

**Vehicle Type**

A typical gasoline vehicle may generate around $4,000 of costs to society over its life, in the form of human health costs, environmental damages, and other air pollution costs.

A hybrid electric (HEV) or plug-in hybrid electric (PHEV) vehicle could lower these costs by 15-30%, depending on the electricity source.

A pure battery electric vehicle (BEV) could either cut these costs in half or double them, depending on the electricity source.

HEVs and PHEVs tend to offer more air emissions and oil displacement benefits per dollar spent than pure BEVs with comparable range.¹
Benefits vary based on...

How you drive

In stop-and-go city driving, HEVs and PEVs could cut greenhouse gas emissions in half while lowering lifetime costs. But for highway cruising, the same vehicles can cost more with marginal environmental benefit.\(^2\),\(^7\)

How your electricity is generated

Charging in the northern Midwest can produce two to three times as much carbon dioxide as the same vehicle charged on the West Coast.

While an electric Nissan Leaf produces fewer greenhouse gas emissions than the gasoline Toyota Prius in the western U.S., the opposite is true in the coal-heavy northern Midwest.\(^4\),\(^7\),\(^8\)

Fuel economy policy

Federal fuel economy standards allow automakers that sell PEVs to meet less-stringent fleet fuel efficiency standards through 2025. So, when one consumer opts for a PEV it allows other consumers to purchase higher-emitting vehicles, and net U.S. emissions and gasoline consumption increase.

Each time a PEV is sold in the United States, net vehicle fleet greenhouse gas emissions increase by up to 60 metric tons of CO\(_2\), and U.S. gasoline consumption increases by up to 6,700 gallons.\(^6\)

Implications

To achieve the best outcomes today, PEV adoption should typically be focused on HEVs and PHEVs by city drivers in mild-climate regions with a clean electricity grid, such as San Francisco or Los Angeles. And drivers should not be encouraged to charge at night in coal-heavy regions. However, because of federal fuel economy policy, even in the best scenario U.S. PEV adoption may result in increased emissions and gasoline consumption – at least through 2025.

The hope is that in the long run – as the electric power grid becomes cleaner, as electric vehicles become cheaper and faster to recharge with longer range, and as policies adjust – that electrification will offer benefits across the board. Electric vehicle technology is one of the few options capable of providing personal transportation with near-zero emission energy sources.

To achieve energy security, air quality, climate change and economic goals, policies that target these goals directly, rather favoring specific technologies, have the potential to be more efficient in managing the types of variations described here, while avoiding unintended consequences.

For more information: Professor Jeremy Michalek • (412) 268-3765 • jmichalek@cmu.edu • www.cmu.edu/cit/veg

---