Alternative Transportation



Rocky Mountain Institute Mike Simpson MOVE Team Analyst

Rocky Mountain Institute: 25 Years of Business-Led Environmental Solutions





Over 100 Staff in Two Offices





Entrepreneurial Research and Consulting Focused on Energy Efficiency

RMI's wide array of Recent Clients in Transportation and Industry Demonstrates Experience





US Fuel Consumption by Sector





Source: EIA. *Annual Energy Outlook 2007 with Projections to 2030*. Tables 2 and 7. Report #:DOE/EIA-0383(2007). Retrieved on 6 August 2007 from <u>http://www.eia.doe.gov</u>.

Many alternative fuels and fuel efficiency measures exist... which path should we choose?



Source: RMI, Brookings Institution analysis

Today's common yield just a few times the energy returned over energy invested (EROEI).



While most biofuels maintain positive yields, this representation does not portray other inputs to sustainability.

Source: RMI analysis

Bio-fuels emit fewer GHG than petroleum-based fuels, but are NOT CLEAN



Vehicle technologies differ in source fuel and efficiency.



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Powertrain	Abbreviation	Energy Flow	Resource-to- Wheels Efficiency	Benefits	Drawbacks
Electrified Vehicle Hybrid Electric Vehicle (10–40 mi AER)	PHEV	Oil 85% Gas Hengine 31% 95% 95% 90% 90% 90% 90% 90% 90% 95% Batteries Motor	~25.0% [oil path] to ~38.5% [electricity path]	Can run on electricity only	Needs petroleum fuel for long range, expensive battery
Extended- Range Electric Vehicle (10–40 mi AER)	EREV	Coal, 50% 95% 95% Motor 90% Trans 95%	~22.2% [oil path] to ~38.6% [electricity path]	Can run on electricity only	Needs petroleum for long range, expensive battery
Battery Electric Vehicle	BEV	Coal, 50% 95% 95% 95% 90% Trans 95% Gas, + Batteries Motor + Trans +	~38.6%	No petroleum fuel required, smaller transmission	More expensive, heavier battery pack, limited driving range
Fuel-Cell Electric Vehicle	FCEV	Coal, 50% C Coll Gas, Coal, 50% C Coll Etc. Hydrogen	~14.2%	No petroleum fuel required, smaller transmission	Expensive and heavy H ₂ storage, requires new infrastructure

RMI Focuses on end use, yielding higher [fuel] savings upstream



ONLY 0.5% OF THE GASOLINE MOVES THE DRIVER

Source: RMI analysis

Electrified Vehicle Space Getting Crowded with Concepts, But Scale is Critical and Uncertain Issue





Source: RMI analysis

Retrofit

A New Energy Paradigm Driven by Multiple Industry Trends



Smart Garage represents the synergistic relationship between Buildings, Transportation, and Energy Generation.

Domestically, Demos are Sprouting Up In All Regions of the country



International Development Will Influence Domestic Development







Questions?