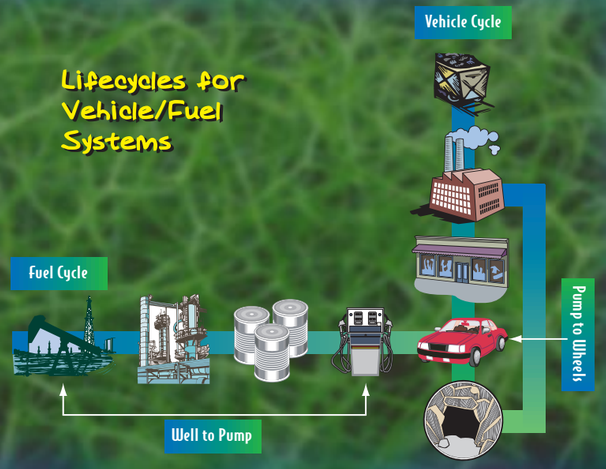
Argonne's Standard-Setting GREET Tool Models Fuel-Cycle Energy and Emissions Performance

Sponsored by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy, Argonne has developed a fuel-cycle model called GREET (Greenhouse Gases, Regulated Emissions, and Energy use in Transportation). This industry-standard-setting tool allows researchers to evaluate various vehicle and fuel combinations on a consistent fuel-cycle basis.

Lifecycles for Vehicle/Fuel Systems



For a given vehicle and fuel system, GREET separately calculates the following:

- Consumption of total energy (energy in non-renewable and renewable sources), fossil fuels (petroleum, natural gas, and coal), and petroleum
- Emissions of CO_2-equivalent greenhouse gases—primarily carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O)
- Emissions of criteria pollutants: volatile organic compounds (VOCs), carbon monoxide (CO), nitrogen oxide (NO_x), particulate matter with size smaller than 10 micron (PM10), and sulfur oxides (SO_x).

GREET includes more than 30 fuel-cycle pathways. It also includes the following vehicle technologies:

- Conventional spark-ignition engines
- Direct-injection, spark-ignition engines
- Direct-injection, compression ignition engines
- Grid-independent hybrid electric vehicles
- Grid-connected hybrid electric vehicles
- Fuel cell vehicles
- Battery-powered electric vehicles

GREET Has Over 30 Fuel Pathways

Petroleum	Conventional & Reformulated Gasoline	Crude Naphtha
	Conventional & Low Sulfur Diesel	Liquefied Petroleum Gas
Natural Gas	Compressed Natural Gas	Liquefied Petroleum Gas
	Liquefied Natural Gas	Dimethyl Ether
	Fischer-Tropsch Diesel and Naphtha	Methanol
	Gaseous and Liquid H_2	
Flared Gas	Liquefied Natural Gas	Dimethyl Ether
	Fischer-Tropsch Diesel and Naphtha	Methanol
	Gaseous and Liquid H_2	
Landfill Gas	Methanol	
Corn	Ethanol	
Cellulosic Biomass	Ethanol	
Soybeans	Biodiesel	
Various Sources	Electricity	
Electricity	Gaseous and Liquid H_2	

To address technology improvements over time, GREET separates fuels and vehicle technologies into near- and long-term options. The latter are assumed to have improved energy and emissions performance compared with the former.

GREET Includes More Than 50 Long-Term Vehicle/Fuel Systems

Conventional Spark-Ignition Vehicles
- Conventional gasoline, federal reformulated gasoline, California reformulated gasoline
- Compressed natural gas, liquefied natural gas, and liquefied petroleum gas
- Methanol and ethanol

Compression-Ignition Direct-Injection Hybrid Electric Vehicles: Grid-Independent and Connected
- Conventional diesel, low sulfur diesel, dimethyl ether, Fischer-Tropsch diesel, and biodiesel

Spark-Ignition Hybrid Electric Vehicles: Grid-Independent and Connected
- Conventional gasoline, federal reformulated gasoline, California reformulated gasoline, methanol, and ethanol
- Compressed natural gas, liquefied natural gas, and liquefied petroleum gas

Battery-Powered Electric Vehicles
- U.S. generation mix
- California generation mix
- Northeast U.S. generation mix

Fuel Cell Vehicles
- Gaseous hydrogen, liquid hydrogen, methanol, federal reformulated gasoline, California reformulated gasoline, low sulfur diesel, ethanol, compressed natural gas, liquefied natural gas, liquefied petroleum gas, and naphtha

Compression-Ignition Direct-Injection Vehicles
- Conventional diesel, low sulfur diesel, dimethyl ether, Fischer-Tropsch diesel, and biodiesel

Spark-Ignition Direct-Injection Vehicles
- Conventional gasoline, federal reformulated gasoline, and California reformulated gasoline
- Methanol and ethanol

GREET was developed as a multidimensional spreadsheet model in Microsoft® Excel and was recently enhanced with a graphical user interface program. This public domain model is available free of charge for anyone to use. The first version of GREET was released in 1996. Since then, Argonne has continued to update and expand the model. The model is designed to readily allow researchers to input their own assumptions and generate fuel-cycle energy and emission results for specific vehicle/fuel systems.

Argonne has used GREET to evaluate various vehicle and fuel systems for DOE, other government agencies, and industry. Currently, there are more than 640 registered GREET users in North America, Europe, and Asia, representing government agencies, the auto industry, the energy industry, research institutes, universities, and public interest groups.

For more information:
http://www.transportation.anl.gov

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