



Balancing Climate Change, Energy Security, and Economic Sustainability

A Life Cycle Comparison of Diesel Fuel from Crude Oil and Domestic Coal & Biomass Resources

The Department of Energy, National Energy Technology Laboratory (NETL) has recently completed several studies that characterize the life cycle greenhouse gas (GHG) emissions of petroleum-based transportation fuels. The study goal and scope were aligned to meet the definition of “baseline life cycle greenhouse gas emissions” as defined in the Energy Independence and Security Act of 2007 (EISA 2007), Title II, Subtitle A, Sec. 201. Within EISA 2007, Section 526 prohibits any federal agency from entering into contract for procurement of an alternative or synthetic fuel produced from nonconventional petroleum sources unless the life cycle GHG emissions associated with the “production and combustion of the fuel” are less than or equal to the equivalent conventional petroleum fuel produced from conventional petroleum sources. Section 526 of EISA 2007, has established one of the key benchmarks by which all alternative fuels are currently measured against for environmental acceptance. NETL’s petroleum-based fuels life cycle GHG results were further modeled to estimate crude oil “source-specific” life cycle GHG profiles for the top 10 countries of imported crude oil refined in the United States in 2008.

Affordable, low carbon diesel fuel from domestic coal and biomass has also been extensively evaluated by NETL as a viable alternative transportation fuel to reduce U.S. dependence on foreign imports. The study evaluated multiple plant configurations (with and without varying amounts of non-food source biomass) and analyzed the cost effectiveness and life cycle GHG emission profile for each.

The combined results of these efforts achieve a targeted NETL goal for accomplishing parallel energy objectives. In this case, a key domestic liquid fuel alternative can be anticipated to contribute to domestic energy security, provide benefits to the U.S. economy and reduce existing GHG emissions from current crude oil import sources. Achieving the three objectives is illustrated in Exhibit 1.

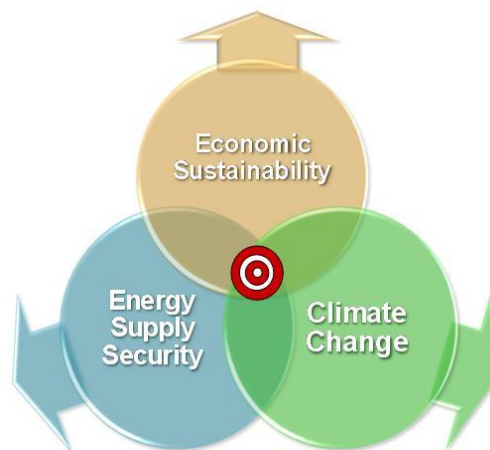


Exhibit 1. The Energy Strategy Dilemma

Key Findings

Exhibit 2 shows the life cycle GHG emissions for diesel fuel from imported and domestic crude oil sources relative to the input to U.S. refineries in 2008. The size of the spheres shows the magnitude of U.S. import expenditures in 2008 and the associated GHG emissions from the various imported crudes. The dotted line represents a proxy for EISA 2007 Section 526 baseline as determined by the NETL analysis. When the petroleum pathways analysis is combined with

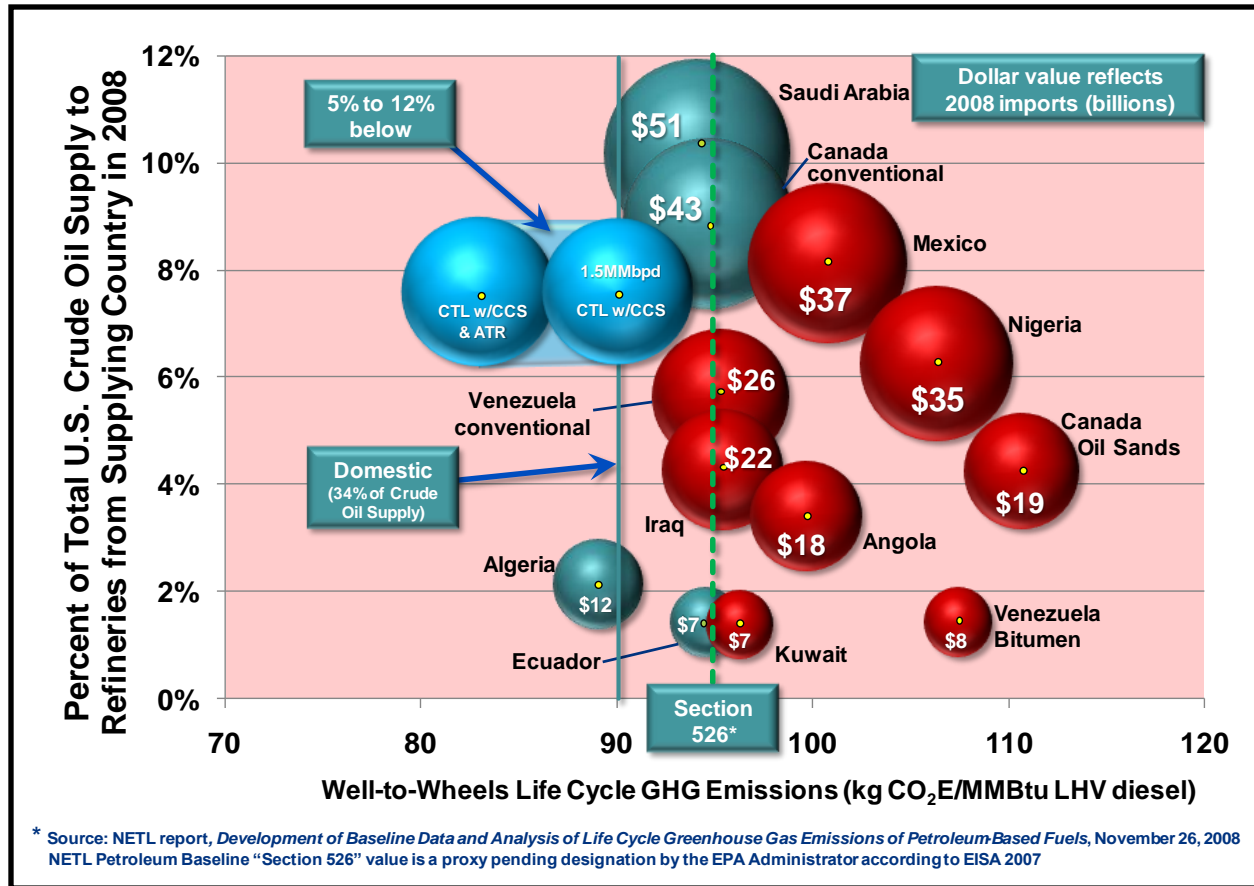


Exhibit 2. U.S. Expenditures on Crude Oil Imports (reflected by size of bubble) Relative to Their Life Cycle GHG Emissions and the 2005 Petroleum Baseline

the life cycle GHG emissions associated with coal to liquids (CTL) with carbon capture and storage (CCS), the following conclusions can be drawn:

- 52% of crude oil imports to U.S. in 2008 were above the EISA 2007, Section 526 petroleum baseline life cycle GHG emissions for diesel fuel.
- In 2008, the U.S. spent \$172 billion on crude oil imports that would not meet Section 526.
- CTL with CCS has a lower life cycle GHG emissions than 97% of all imports to the United States in 2008 with an associated foreign expenditure of \$317 billion.
- CTL with CCS produces diesel with 5 to 12% lower GHG emissions than the 2005 petroleum baseline, hence well below the Section 526 requirement.

Co-gasifying non-food source biomass with coal in a coal and biomass to liquids (CBTL) plant can provide even lower life cycle GHG emissions for diesel fuel significantly countering the GHG emissions associated with combustion of conventional petroleum diesel, Exhibit 3.

- Co-gasifying 8%, by weight, non-food source biomass with coal produces diesel fuel with life cycle GHG emissions 20% below the 2005 petroleum baseline which is:

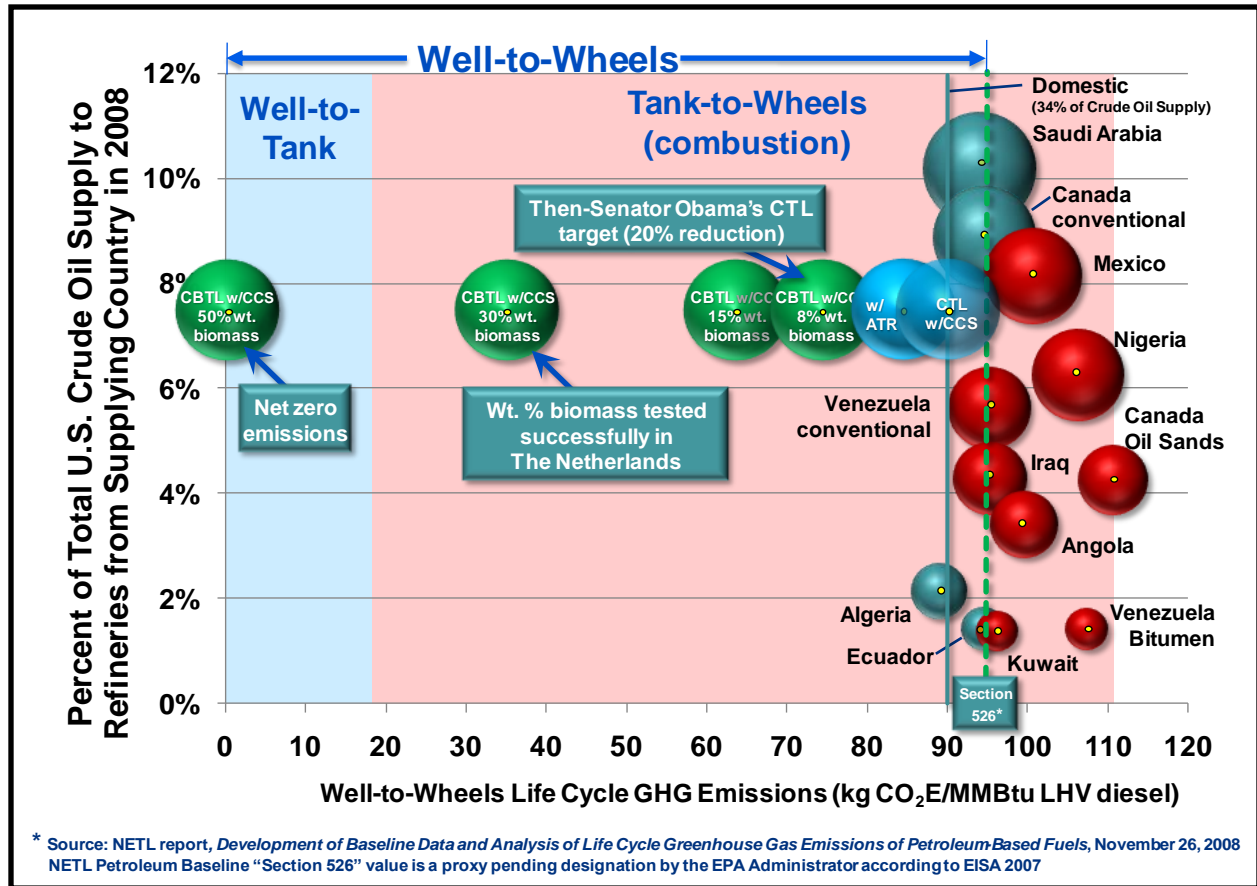


Exhibit 3. Comparison of WTW Life Cycle GHG Emissions of Top 10 Countries of Imported Crude Oil in 2005 to Near-term Domestic Coal and Biomass to Liquids (CBTL) with Carbon Capture and Storage (CCS)

- Below EISA 2007, Section 526 Requirements
- Below California's Low Carbon Fuel Standard Requirement of 10%¹
- Equivalent to EISA 2007 Requirement for Renewable Fuels², and
- Equivalent to then-Senator Obama's June 2007 Near-term Goal to Support CTL.
- Co-gasifying 30%, by weight, non-food source biomass with coal to produce diesel fuel further lowers the life cycle GHG emission to 42% below the 2005 petroleum baseline.

As the nation's most abundant fuel, coal can be part of the transportation fuel solution. In addition to contributing to domestic energy security and reducing existing GHG emissions from current crude oil import sources, a coal and biomass to liquids industry would utilize 100% domestic energy resources with domestic jobs to produce a low-carbon diesel fuel.

¹ By Executive Order by the Governor, California's statewide goal is to reduce the carbon intensity of California's transportation fuels by at least 10% by 2020 through use of a low carbon fuel standard.

² EISA 2007, Title II, Subtitle A, Sec. 202 requires that renewable fuels achieve at least a 20% reduction in life cycle greenhouse gas emissions as compared to baseline life cycle greenhouse gas emissions.



Supporting Studies

Gerdes, K., Skone, T., *Consideration of Crude Oil Source in Evaluating Transportation Fuel GHG Emissions*, DOE/NETL-1360, U.S. Department of Energy, National Energy Technology Laboratory, March 2009. www.netl.doe.gov/energy-analyses/benefit.html

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Skone, T., Gerdes, K., *Development of Baseline Data and Analysis of Life Cycle Greenhouse Gas Emissions of Petroleum-Based Fuels*, DOE/NETL-2009/1346, U.S. Department of Energy, National Energy Technology Laboratory, November 2008. www.netl.doe.gov/energy-analyses/trend.html

Tarka, T., *Affordable, Low-Carbon Diesel Fuel from Domestic Coal and Biomass*, DOE/NETL-2009/1349, U.S. Department of Energy, National Energy Technology Laboratory, January 2009. www.netl.doe.gov/energy-analyses/technology.html

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