Half the Oil Plan
Methodology and Assumptions

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The Half the Oil plan is built on an analysis of practical oil savings solutions that are either already at work in other countries or that have been developed by industry, national laboratories, or researchers in academia. Our goal in evaluating potential oil savings was to determine how far and how fast these solutions could deliver reductions in oil use. Based on the methodology and assumptions below, we found that it is realistic to cut the United States' projected use of oil and other petroleum products in half over the course of about 20 years when compared with a baseline scenario in which no progress occurs after 2013 on efficiency or the use of low carbon alternatives to oil.

Note: for simplicity, we refer to oil use and savings, but all findings are based on use and savings of crude oil and other petroleum products.

I. Modeling Scope, Approach, Baseline and Resources

Scope

To evaluate U.S. oil use and savings, we started with the early release version of the Energy Information Administration's 2012 Annual Energy Outlook (AEO2012ER), which covers 2009 through 2035. Among other data, AEO2012ER provides estimates of future oil use for the transportation, residential, commercial, and industrial sectors based on results from the EIA's National Energy Modeling System.

The transportation sector uses oil as a fuel resource for 97 percent of its energy needs. Within transportation sector oil use, our analysis includes light-duty vehicles, medium- and heavy-duty freight trucks, air travel, freight carried by domestic ships, and freight carried by rail. These vehicles account for about 90 percent of U.S. transportation oil use. The two largest areas of transportation oil use excluded in this analysis are military transportation and international shipping, both of which are difficult to influence through more traditional policies.

Due to its low use of oil, we did not include the electricity sector in our evaluation.

Approach

To evaluate potential oil savings, we looked at the potential for realistic advances in technology and policy within each of the included sectors (details on the potential and other key data are available in the Assumptions section). Running the NEMS model was beyond the scope of this work, so instead, we applied an intensity-based approach to the vehicle or building stock under consideration.

Under our approach each vehicle or sector was assigned current and projected oil use intensities based on oil use per mile, per ton-mile, per seat-mile, per dollar of product shipped, or per square foot as appropriate. Oil use for each vehicle or sector was then determined based on this stock intensity and the associated demand in AEO2012ER, with rebound effects included as appropriate.

Baseline "Do-Nothing" Projection

Because AEO2012ER includes several policies that have been under attack and therefore cannot be guaranteed full implementation (e.g. light-duty vehicle fuel economy and greenhouse gas emissions standards and the renewable fuel standard) and because of concerns about the accuracy of the EIA's oil price projections and their modeling of consumer and business responses to those changes, we do not use AEO2012ER as our baseline.

Instead, our projected oil use baseline is a "do-nothing" case in which no improvements are made after 2013 in the efficiency of vehicle, building, and industry stocks, and no increases in the use of low-carbon biofuels or other low-carbon oil alternatives are included. As a result, our projection of oil use under a do-nothing scenario is 22 million barrels per day by 2035. AEO2012ER projects 2035 oil use at 17 million barrels per day. Therefore, even approaching the AEO2012ER projection will require maintaining and defending existing laws and planned progress in various industries. Additional reductions needed to cut our projection of oil use in half (i.e. below 11 million barrels per day) represent additional oil savings that must be achieved with policies that would be put in place in 2013 and beyond.

Resources

We relied on the following primary resources in developing our estimates of U.S. oil use and savings:

Annual Energy Outlook 2012 Early Release Overview, U.S. Energy Information Administration, January 2012. Online at *http://www.eia.gov/forecasts/aeo/er/.*

Climate 2030: A National Blueprint for a Clean Energy Economy by Rachel Cleetus, Steven Clemmer, and David Friedman. Union of Concerned Scientists, May 2009. Online at *http://www.ucsusa.org/global_warming/solutions/big_picture_solutions/climate-2030-blueprint.html*.

EPA Analysis of the Transportation Sector Greenhouse Gas and Oil Reduction Scenarios, U.S. Environmental Protection Agency, prepared at the request of Senator John Kerry, February 2010 (updated March 2010). Online at *http://www.epa.gov/oms/climate/GHGtransportation-analysis03-18-2010.pdf*.

Reducing Greenhouse Gas Emissions from U.S. Transportation by David L. Greene, Howard H. Baker, Jr. (Center for Public Policy), and Steven E. Plotkin (Argonne National Laboratory). Prepared for the Pew Center on Global Climate Change, January 2011. Online at *http://www.c2es.org/publications/reducing-ghg-emissions-from-transportation*.

UCS Light Duty Vehicle Stock Model, developed by Jim Kliesch, unpublished computer model.

II. Assumptions

Passenger Cars

Efficiency

Baseline on-road stock fuel economy: 20.4 miles per gallon (mpg) (2013 – 2035, AEO2012ER value for 2013)

Half the Oil on-road stock fuel economy: 34.6 mpg (2035, based on UCS stock model analysis of existing and proposed fuel economy and greenhouse gas standards for 2012 – 2025)

Rebound effect: 10%

Innovation

Baseline sales of electric vehicles (plug-in hybrid, battery, and fuel cell electric vehicles): 0% (rounded down from a current market share of about 0.1%)

Baseline vehicle miles traveled: 3.5 trillion miles in 2035 (rebound effect applied to AEO2012ER value of 3.6 trillion miles)

Half the Oil sales of electric vehicles (plug-in hybrid, battery, and fuel cell electric vehicles): 3% by 2020, 10% by 2025, 25% by 2030, 45% by 2035 (UCS estimates)

Half the Oil plug-in hybrid-electric vehicle energy use utility factor: 0.7 (UCS estimate)

Half the Oil improvements in stock fuel economy due to improved driver behavior, maintenance, and traffic management: 12% by 2035 (derived from Greene et al.)

Half the Oil reduction in vehicle miles traveled due to smart growth, pay-at-the-pump/pay-as-you-drive insurance, trip planning and route efficiency, and ride sharing: 9% by 2035 (derived from Greene et al.)

Commercial Vehicles (Medium and Heavy-Duty Freight Trucks)

Efficiency

Baseline on-road stock fuel economy: 6.7 mpg gasoline-equivalent. (2013 – 2035, AEO2012ER 2013 value)

Half the Oil on-road stock fuel economy: 10 mpg gasoline-equivalent. (2035, due to roughly doubling the fuel economy of freight trucks, intensity value derived from Greene et al. “high” scenario for fuel economy improvements from standards, pricing mechanisms, and improved traffic flow)

Rebound effect: 10%

Innovation

Baseline vehicle miles traveled: 337 billion miles in 2035 (rebound effect applied to AEO2012ER value of 344 billion miles)

Half the Oil reduction in vehicle miles traveled due to improved logistics, pay-at-the-pump/pay-as-you-drive insurance, and road pricing policies: 9% by 2035 (derived from Greene et al. “high” scenario)

Better Biofuels

Baseline cellulosic ethanol and other biomass liquids: 0 gallons of ethanol equivalent

Half the Oil cellulosic ethanol and other biomass liquids: 38 billion gallons of ethanol equivalent (UCS estimate)

Planes

Baseline stock fuel economy: 62.6 seat-miles per gallon (2013-2035, AEO2012ER 2013 value)

Half the Oil stock fuel economy: 98 seat-miles per gallon (2035, derived from Greene et.al. “mid” scenario for fuel economy improvements from propulsion, weight, and drag improvements and from operational improvements)

Baseline vehicle miles traveled: 1.2 trillion miles in 2035 (AEO2012ER)

Half the Oil reduction in vehicle miles traveled due to improved routing and flight paths: 10% by 2035 (derived from Greene et. al. “high” scenario)

Trains

Baseline stock fuel economy: 3.5 ton-miles per thousand Btu (2013 – 2035, AEO2012ER 2013 value)

Half the Oil stock fuel economy: 4 ton-miles per thousand Btu (2035, derived from Greene et al. “high” scenario, also consistent with five-year delayed implementation of EPA Scenario A)

Ships (Domestic Marine Freight)

Baseline stock fuel economy: 2.4 ton-miles per thousand Btu (2013-2035, AEO2012ER 2013 value)

Half the Oil stock fuel economy: 3 ton-miles per thousand Btu (2035, derived from Greene et.al. “high” scenario, also consistent with five-year delayed implementation of EPA Scenario B)

Buildings and Industry

Baseline industrial petroleum intensity: 864 Btu per dollar (2013 – 2035, AEO2012ER 2013 value), which excludes refining.

Half the Oil industrial petroleum intensity: 541 Btu per dollar (2035, derived from UCS Climate 2030, assuming a 3 year delay in implementation of the Climate 2030 policies)

Baseline commercial building petroleum intensity: 4.3 thousand Btu per square foot (2013-2035, AEO2012ER 2013 value)

Half the Oil commercial building petroleum intensity: 1.1 thousand Btu per square foot (2035, derived from UCS Climate 2030, assuming a three-year delay in implementation of the Climate 2030 policies)

Baseline residential building petroleum intensity: 2.7 trillion Btu per square foot for liquefied petroleum gases and 3 trillion Btu per square foot for distillate fuel oil (2013 – 2035, AEO2012ER 2013 value)

Half the Oil residential building petroleum intensity: 1.9 trillion Btu per square foot for liquefied petroleum gases and 0.5 trillion Btu per square foot for distillate fuel oil (2035, derived from UCS Climate 2030, assuming a three-year delay in implementation of the Climate 2030 policies)

Oil Cost Savings

The value of oil cost savings represents gross savings on oil expenditures due to the reduced consumption calculated based on the above assumptions. This is not intended to be a net savings calculation and therefore does not include the costs of the technologies and policy implementation. It is also not intended to be a consumer savings analysis as it represents only the reduction in spending on oil and does not include the other components embedded in the price of fuel such as refining, distribution, marketing, taxes, etc.[1]

[1] Union of Concerned Scientists (UCS). 2013. Where your gas money goes: How Oil Companies Profit from Your Pain at the Pump. Cambridge, MA. Online at www.ucsusa.org/assets/documents/clean_vehicles/Where-Your-Gas-Money-Goes.pdf, accessed April 25, 2013.

The above assumptions and baseline yield potential oil savings of up to 12 million barrels per day (mbpd) compared with the do nothing projected baseline of 22 mbpd. However, to be conservative the Half the Oil plan estimates a savings of 11 million barrels per day.

To determine the cost savings, the AEO2012ER was utilized to forecast the price of oil as $133 per barrel in 2035. This is the EIA weighted average price delivered to U.S. refiners for all imported oil and is likely an underestimate as the AEO2012ER predicted the 2035 cost of West Texas Intermediate (WTI) crude to be about $145 per barrel.

Under the do-nothing scenario, the United States is forecasted to use 22 mbpd at a cost of $133 per barrel, which equates to $2.926 billion per day. Multiplied by 365 to get the annual cost of oil for the year 2035, the United States is forecasted to spend $1,067,990,000,000, or $1.067 trillion, on oil and other petroleum products in 2035.

As previously mentioned, the above assumptions and baseline yield potential oil savings of up to 12 mbpd, which means in 2035 the United States would use 10 mbpd (22 mbpd forecast minus the 12 mbpd savings). Multiplying 10 mbpd by $133 equals $1.33 million per day, or $485,450,000,000 ($1.33 million x 365) for the year 2035. Compared with the do-nothing baseline of spending $1.067 trillion, the potential savings of 12 mbpd would yield a cost savings of $582 billion.

Using the same calculations, under the true Half the Oil savings of 11 mbpd, the savings would be $533 billion in 2035.

We therefore chose to qualify the gross oil cost savings from Half the Oil at more than $550 billion in 2035. We chose $550 billion to represent the range of oil savings from a true Half the Oil value of 11 mbpd ($533 billion) to the total potential oil savings analyzed of 12 mbpd ($582 billion). The mean value of these numbers is $557 billion, so $550 billion is an accurate value to depict the range between what could be accomplished and what Half the Oil reasonably predicts.

Global Warming Emissions Reductions

Reductions in carbon emissions are based on estimates of well-to-wheel emissions of carbon dioxide and other greenhouse gases on a carbon dioxide equivalent basis.

Using the GREET model[2] we assumed gasoline well-to-wheel greenhouse gas emissions are 11.1 kg CO_2-equivalent per gallon (kg/gal). This is a national value for 2010 based on a mix of 50 percent reformulated gasoline and 50 percent conventional gasoline. This value includes 8.9 kg/gal from vehicle operation, 1.5 kg/gal from producing and transporting the fuel, and 0.7 kg/gal from extracting and transporting the feedstocks. A constant value is used for all years, which may be an over or under estimate depending on increases in supply from tar sands, shale oil, heavy oil, and oxygenate volume and source. For simplicity, all other petroleum fuels were converted into a gallon gasoline equivalent on an energy basis and the greenhouse gas intensity for gasoline was applied.

To calculate the overall emissions savings from reaching the Half the Oil target in 2035, we converted the amount of oil savings from each sector discussed above (e.g., biofuels, electric vehicles, light-duty vehicle standards) into emissions avoided. For example, medium- and heavy-duty truck technology can cut oil use by 1.2 mbpd. We multiply by 365 to get the million barrels per year (547.5) and then by 42 gallons per barrel to get gallons per year (2.3 billion). We multiply again by 11.1 kg of emissions per

[2] Argonne National Laboratory. 2013. The Greenhouse gases, Regulated Emissions, and Energy use in Transportation model (GREET). Online at *http://greet.es.anl.gov/main*, accessed April 25, 2013.

gallon to get the emissions per year (25.52 billion kg) and divide by 1,000 to convert to metric tons (255 million). See Table 1 for the emissions reductions from each sector of the Half the Oil plan.

The greenhouse gas emissions savings from electricity are assumed to achieve an 80 percent reduction for every gallon of gasoline equivalent displaced. Analysis from GREET indicates that an electric vehicle delivers about a 40 percent reduction in greenhouse gas emissions based on the current U.S. electricity mix. The UCS Climate 2030 report indicates that the carbon intensity of electricity can be cut to about 25 percent of today's value over the next 20 years.[3] The combined result is about an 85 percent reduction, while a somewhat more conservative value was used for this analysis.

The greenhouse gas emissions savings from biofuels are estimated to achieve an 80 percent reduction for every gallon of gasoline equivalent displaced. Analysis by the EPA and the California Air Resources Board indicates that the full fuel-cycle greenhouse gas footprint of cellulosic biofuels and biofuels[4] from waste have the potential to be 80 percent lower than gasoline.[5]

Table 1: Emissions reductions from Half the Oil plan

Sector	**Oil Savings per Day in 2035 (mbpd)**	**Total Oil Savings in 2035 (mbpy)**	**Total Oil Savings in 2035 (gal)**	**Emissions Saved in 2035 (kg)**	**Emissions Saved in 2035 (mt rounded)**
Buildings and Industry	2.1	766.5	32,193	357,342.3	357
Commercial Vehicles	1.2	438	18,396	204,195.6	204
Passenger Cars	5.3	1,934.5	81,249	901,863.9	902
*Better Biofuels**	1.7	620.5	26,061	289,277.1	231
Planes, Trains, and Ships	0.6	219	9,198	102,097.8	102
*Electric Vehicles**	1.3	474.5	19,929	221,211.9	177
TOTAL					**1,973**

* The greenhouse gas emissions savings from electric vehicles and biofuels were estimated to achieve an 80% reduction for every gallon of gasoline equivalent displaced.

[3] Union of Concerned Scientists (UCS). 2009. Climate 2030: A national blueprint for a clean energy economy. Cambridge, MA: UCS. Online at *www.ucsusa.org/global_warming/solutions/big_picture_solutions/climate-2030-blueprint.html*, accessed April 25, 2013.

[4] Union of Concerned Scientists (UCS). 2012. *The billion gallon challenge*. Cambridge, MA. Online at *http://www.ucsusa.org/assets/documents/clean_vehicles/The-Billion-Gallon-Challenge.pdf*, accessed April 25, 2013.

[5] Environmental Protection Agency (EPA). 2010. 40 CFR, part 80. Regulation of fuels and fuel additives: Changes to Renewable Fuel Standard program; final rule. Washington, DC. Online at *http://www.gpo.gov/fdsys/pkg/FR-2010-03-26/pdf/2010-3851.pdf*, accessed April 25, 2013.

Job Creation through On-Road Vehicle Efficiency and Emissions Standards

A full evaluation of the jobs impacts of the Half the Oil plan was beyond the scope of this work, but several existing studies detailed below provide insight into the potential job creation from raising fuel efficiency standards and global warming emission standards for cars and light trucks as well as medium and heavy-duty trucks. The combination of those studies indicates that a conservative estimate would be the creation of more than 1 million net new jobs from on-road vehicle fuel efficiency and greenhouse gas emissions standards by 2035.

The current light-duty vehicle fuel economy and greenhouse gas standards are incorporated as part of the Half the Oil plan and are divided into two segments. The first reaches the equivalent of about 35.5 mpg for new vehicles by 2016. The second nearly doubles the fuel economy and cuts greenhouse gas emissions of new vehicles in half by 2025 (the greenhouse gas standards are equivalent to about 54.5 mpg if met exclusively with fuel economy).

The job creation benefits of the first round of standards have not been directly analyzed, but in 2007 the Union of Concerned Scientists and MRG & Associates evaluated the potential job growth in 2030 from raising fuel economy standards to 35 mpg by 2018. The result was a net gain of 343,600 jobs throughout the economy in 2030, including 20,000 in the motor vehicles manufacturing industry.[6]

The job creation benefits of the second round of standards were evaluated by the BlueGreen Alliance and the American Council for an Energy Efficient Economy in 2012. The result was a net gain of about 570,000 jobs throughout the economy in 2030, including about 50,000 light-duty vehicle manufacturing.[7] This analysis explicitly focused only on the 2017-2025 standards, so is additive with the previous work.

The total estimated new jobs are therefore more than 900,000 by 2030, with about 70,000 in light-duty vehicle manufacturing. These jobs are generated from a combination of increased spending on technology for cleaner cars and consumers spending net savings from reduced fuel costs throughout the economy. The latter will continue to grow as the standards are fully phased in, so we make the conservative projection that at least 900,000 new jobs will still have been created by 2035.

The current medium and heavy-duty fuel economy and greenhouse gas standards are incorporated as part of the Half the Oil plan as is the potential to go even farther, reaching about double the fuel economy by 2030. A similar scenario was analyzed as part of the UCS Climate 2030 report (reaching 9.7 mpg by 2030), and that work was the basis of jobs creation benefits evaluated in a UCS report released in 2010.

The result was a net gain of 124,000 jobs throughout the economy in 2030 due to doubling the fuel economy of medium and heavy-duty vehicles by that year.[8] As with the light duty vehicle jobs analysis, these jobs are the result of increased spending on technology for cleaner trucks and businesses and

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[6] Union of Concerned Scientists (UCS). 2012. Creating jobs, saving energy, and protecting the environment. Cambridge, MA. Online at www.ucsusa.org/assets/documents/clean_vehicles/fueleconomyjobs.pdf, accessed April 25, 2013.

[7] BlueGreen Alliance (BGA). 2012. Gearing up: Smart standards create good jobs building cleaner cars. Minneapolis, MN: BGA. Online at www.bluegreenalliance.org/news/publications/document/AutoReport_Final.pdf, accessed April 25, 2013

[8] Union of Concerned Scientists (UCS) and CALSTART. 2010a. Delivering jobs: The economic costs and benefits of improving the fuel economy of heavy-duty vehicles. Cambridge, MA: UCS. Online at www.ucsusa.org/assets/documents/clean_vehicles/The-Economic-Costs-and-Benfits-of-Improving-the-Fuel-Economy-of-Heavy-Duty-Vehicles.pdf, accessed April 25, 2013.

consumers spending net savings from reduced fuel and shipping costs throughout the economy. The latter will continue to grow as the standards are fully phased in, so we make the conservative projection that at least 124,000 new jobs will still have been created by 2035.

Therefore, adding the estimated job gain from the light duty standards (910,000) and the job gain from the medium- and heavy-duty standards (124,000) yields a total job gain of 1,034,000 jobs.