

Analysis of Greenhouse Gas Reductions from an Energy Bill

September 24, 2007

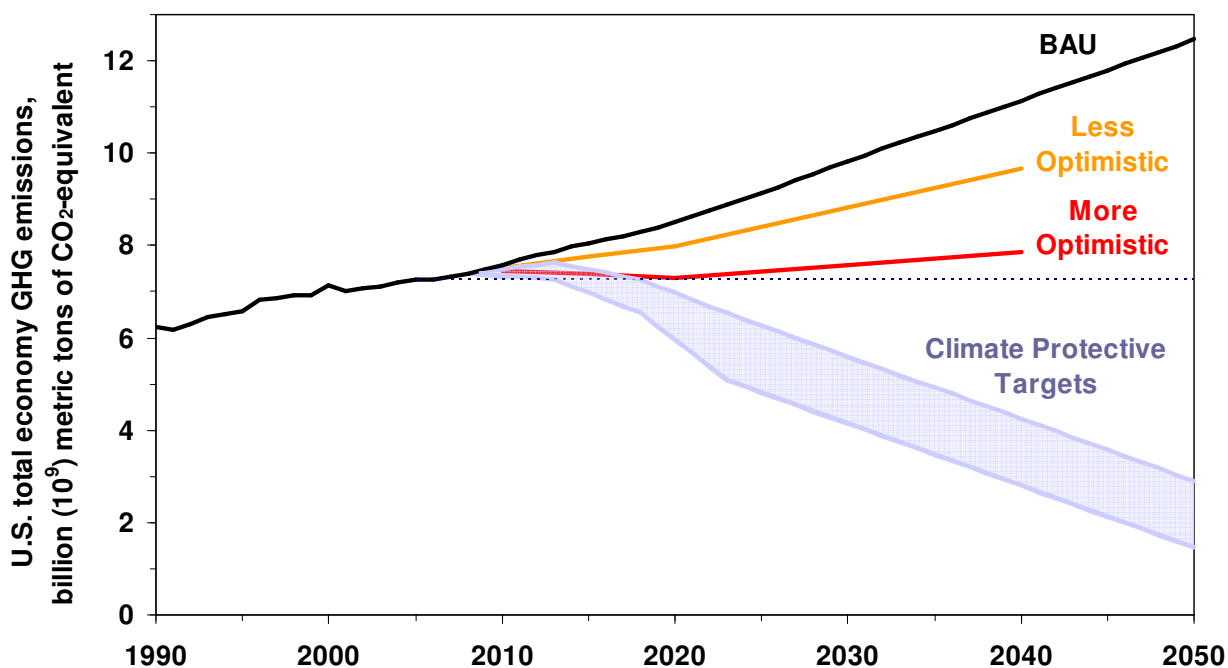
As the energy bills passed in the Senate and House this summer head for possible reconciliation in conference, it is crucial to evaluate how well new energy legislation will protect the climate. Both bills have provisions that can reduce greenhouse gases (GHG) emissions, although there is little overlap in terms of how the reductions would be achieved.

Figure 1 shows the range of reductions we estimate for an energy bill. Because some policies contain “off ramps” or other weakening language and some measures are voluntary, we show two scenarios, *less optimistic* (orange line) and *more optimistic* (red line), beneath a business-as-usual (BAU) projection (black line).¹ The dashed line shows current levels and the blue shaded zone shows emissions targets similar to those recommended by the U.S. Climate Action Partnership (USCAP) based on scientific assessments of what is needed to protect the climate.²

The more optimistic energy bill scenario meets near-term targets (before 2018), illustrating that policies are within reach to put the country on a path toward climate protection. Even so, this better case outcome fails to reduce emissions below current levels. In the less optimistic scenario, an energy bill falls far short of making any significant progress on climate protection.

Through 2030, which is a reasonable horizon for evaluating the effect of the proposed measures, an energy bill under the more optimistic assumptions achieves 44% of the cumulative reductions needed to hold emissions down to the more stringent climate protective targets. Under a less optimistic scenario, an energy bill achieves only 19% of the reductions needed.

Figure 1. Scenarios of U.S. GHG emissions under pending energy legislation



MAJOR ENERGY BILL PROVISIONS

The major provisions in the Senate energy bill (H.R. 6) include: prescribed Corporate Average Fuel Economy (CAFE) standards for light duty vehicles (LDVs); authorized fuel efficiency (FE) standards for medium- and heavy-duty trucks (M&HDTs); national oil savings requirements; a renewable fuel standard (RFS) for motor fuels and home heating oil; and energy efficiency measures including higher efficiency standards for lighting, appliances and buildings as well as establishing state and local government energy efficiency initiatives.

Key provisions in the House energy bill (H.R. 3221) include a renewable portfolio standard (RPS) and energy efficiency measures including efficiency standards for lighting, buildings, and a more expansive list of industrial and home appliances, plus state and local government and industrial energy efficiency initiatives.

A further description of the provisions for both bills is provided starting on page 4.

KEY ASSUMPTIONS FOR SCENARIO ANALYSIS

In the more optimistic scenario, we combine the stronger provisions from both bills and assume that these provisions are all well implemented. Assumptions include: the Senate bill's overall LDV CAFE target of 35 mpg is met by 2020 (an average of 3.4% per year from 2011-2020); FE standards for M&HDTs increase 2% per year starting in 2016; the House bill's RPS is fully implemented with no retail electric supplier using the alternative compliance mechanism; all energy efficiency measures are fully funded; and the oil savings requirements yield GHG reductions equal to about half of the oil savings beyond those achieved through LDV CAFE and M&HDTs FE standards.

In the less optimistic scenario, we assume that LDV CAFE standards increase by 2.1% per year from 2011-20 (the same rate of improvement required by the MY2008-11 light truck CAFE standard); M&HDTs FE standards are either not implemented or merely "rubber stamp" levels equivalent to BAU; energy efficiency measures are only partially funded; and the oil savings targets are met to some extent through the renewable fuel standard but no additional measures are implemented. Additionally, we assume that retail electricity suppliers expand renewable generation to a financially attractive level but then rely on the alternative compliance mechanism (paying a fee in lieu of renewable electricity production) to fulfill the RPS obligation.

Additional details on our analytic assumptions are given later in this document.

ANALYTIC RESULTS

Table 1 summarizes our numerical results. Because the energy bills were not designed to provide long-term reductions, we highlight results through 2030, by when the effects of most measures would be largely manifest. The figure and table also give scenario results through 2040 because the RPS provisions extend through 2039. We estimate that a reconciled energy bill would achieve reductions of 1,001 – 2,245 million metric tons of CO₂-equivalent (MMTCO₂e) in 2030, amounting to 10%–23% of the 9,825 MMTCO₂e BAU projection for that year.

In the more optimistic scenario, an energy bill slows emissions growth significantly in the near term, holding U.S. GHG emissions to within the climate protective target range through roughly 2015. But emissions never get below the current (2005) level and they are 4% above it in 2030, compared to 35% higher under BAU. Climate protection is not just a matter of hitting a

Table 1. Projected U.S. GHG emissions under more and less optimistic energy bill assumptions

Year	BAU emissions (MMTCO ₂ e/yr)	Emissions reductions (MMTCO ₂ e/yr)		Projected emissions (MMTCO ₂ e/yr)		Projected reductions as % of BAU		Emissions as percentage of current (2005) levels		
		More optimistic	Less optimistic	More optimistic	Less optimistic	More optimistic	Less optimistic	BAU	More optimistic	Less optimistic
2005	7,260	0	0	7,260	7,260	0%	0%	100%	100%	100%
2010	7,585	129	57	7,456	7,528	2%	1%	104%	103%	104%
2020	8,509	1,218	514	7,291	7,995	14%	6%	117%	100%	110%
2030	9,825	2,245	1,001	7,580	8,824	23%	10%	135%	104%	122%
2040	11,141	3,084	1,371	8,057	9,770	28%	12%	153%	111%	135%
2050	12,457	-	-	-	-	-	-	-	-	-

BAU = business as usual; MMTCO₂e = million metric tons of carbon dioxide equivalent.

long-term target, however, because it is the cumulative emissions that matter for limiting the buildup of GHG emissions in the atmosphere. Using this yardstick and the more optimistic assumptions, a reconciled energy bill will achieve 44% of the cumulative reductions necessary to be on track with the more stringent climate protection targets by 2030.

In the less optimistic scenario, U.S. GHG emissions are only weakly controlled and would increase to 22% above current levels by 2030. In this case, an energy bill's GHG reductions amount to only 19% of the cumulative reductions needed for being on track with the more stringent climate protection pathway by 2030.

Table 2 shows a breakdown of emissions reductions by major provision, listing estimates for both scenarios in the year 2030. Buildings and industrial sector energy efficiency measures dominate the reductions, followed by light duty vehicle CAFE standards.

Table 2. Summary of GHG reductions for major energy bill provisions in 2030

Provision	Reductions in 2030, MMTCO ₂ e/yr	
	More optimistic	Less optimistic
LDV CAFE standards	517	316
M&HDTs FE standards	70	0
RPS	357	87
Oil savings plan or RFS	388	55
Energy efficiency measures	913	543
Total	2,245	1,001

OVERVIEW OF MAJOR ENERGY BILL PROVISIONS AND HOW WE ANALYZED THEM

Here we provide more detail on the provisions from both the Senate and House bills along with our interpretations of how they might be reconciled and implemented under more and less optimistic assumptions. These assumptions are summarized in Table 3 and discussed below. Because neither bill provides uniform enforceability mechanisms as would be needed for an effective climate protection program, they leave significant discretion to the agencies that will implement their provisions. Such implementation uncertainty is in addition to the uncertainty about which measures will be included, and how they will be included, if and when the two bills are reconciled in conference.

1. Fuel Economy Standards (Title V, Sec. 502 of the Senate bill)

Light duty vehicle CAFE standards

The LDV CAFE provision in the Senate energy bill sets the combined car and light truck CAFE target at 35 mpg by 2020, and requires increases to the "maximum feasible" levels from 2021 to 2030. However, the legislation expressly allows the agency to prescribe a standard lower than the 35 mpg target in 2020 or the ratable-increase requirement for years between 2011 and 2020 if it is determined that standards consistent with the target are not cost effective. On the scope of the standard, the LDV CAFE provision extends the regulated fleet to cover medium duty passenger vehicles (MDPVs) but not class 2b pickups (pickup trucks over 8,500 lbs and less than 10,000 lbs gross vehicle weight); class 2b pickups are covered under the provision of medium- and heavy-duty trucks fuel economy standards.

For the more optimistic scenario, we assume that the combined car and light truck fleet reaches 35 mpg by 2020 and remains fixed thereafter.³ In the less optimistic scenario, we assume the LDV CAFE standards increase by 2.1%/yr from 2011-20 (the same rate of improvement required by the MY2008-11 light truck CAFE standard) and see no increase thereafter.

Medium- and heavy-duty truck fuel economy standards

The Senate energy bill authorizes the Department of Transportation to study and set fuel economy standards for medium- and heavy-duty vehicles (including class 2b pickups and trucks over 10,000 lbs GVW), but does not specify any fuel economy targets.

In the more optimistic scenario, we adopted the estimates of emissions reductions from the American Council for an Energy-Efficient Economy (ACEEE).⁴ ACEEE assumes that fuel economy of heavy duty vehicles increases 2% per year, starting in 2016, but it does not provide estimates of GHG reductions from medium duty vehicles. With fewer vehicles in operation, it is assumed that reductions from medium duty vehicles would be much smaller than those from heavy duty vehicles. The 2% annual increase in M&HDTs FE standard is half of the 4% annual improvement for M&HDTs FE standards proposed in the "Ten in Ten" bill that was reported out of the Senate Commerce Committee. In the less optimistic scenario, we assume the M&HDTs FE standards are either not implemented or implemented in a way that merely codifies business-as-usual efficiency levels.

2. Renewable Portfolio Standard (Subtitle H of the House energy bill)

The Renewable Portfolio Standard (RPS) provision in the House energy bill calls for the percentage of electricity generated through renewable sources to increase from 2.75% in 2010 to 15% in 2020 and to remain at 15% through 2039. The requirement applies to all retail electric suppliers producing more than 1,000,000 megawatt-hours of electricity per year, excluding those in Hawaii, all municipalities, and rural electric cooperatives.

In order to fulfill the RPS requirement, each retail electric supplier must submit renewable energy credits reflecting the amount of renewable electricity generated. Department of Energy (DOE) issues one renewable energy credit for each kilowatt hour (kWh) of electricity generated by a facility; some facilities, such as those on Indian lands, can be issued two or more credits for each kWh generated. The RPS allows for trading, banking and borrowing of credits, and 27% of annual RPS requirements may be met through approved energy efficiency measures. A company may also meet the requirements through the alternative compliance mechanism, in which case

Table 3. Assumptions for the more optimistic and less optimistic scenarios

Provision	More optimistic	Less optimistic
Light duty vehicle (LDV) CAFE	Combined LDV CAFE standard reaches 35 mpg by 2020 and remains at 35 mpg thereafter.	LDV CAFE standards increase by 2.1% per year (same rate of increase as the MY2008-11 light truck CAFE standard).
Medium duty/heavy duty truck fuel efficiency	FE standard of HDTs increases 2% per year, starting in 2016.	M&HDTs FE standard not implemented.
Renewable Portfolio Standard (RPS)	27% of the RPS requirement fulfilled by energy efficiency measures, and the rest met by displacing 78% coal, 14% natural gas and 7% nuclear generation capacity; no retail electric supplier use the alternative compliance mechanism.	Renewable production capacity reaches 95,000 MW by 2020 (i.e., the level of announced renewable projects through 2020) and remains the same average rate of development through 2030; suppliers use alternative compliance mechanism to meet the shortfall in renewable energy production.
Carbon reduction from Oil savings requirement (Renewable Fuel Standard (RFS) in the less optimistic scenario)	GHG reductions equivalent to fulfilling half of the remaining oil savings requirements beyond the LDV CAFE and M&HDTs FE standards.	Assumes no additional measure for meeting the oil savings requirements beyond RFS, LDV CAFE and M&HDTs FE standards; carbon content of ethanol produced from existing facilities the same as gasoline, the rest of the RFS met by fuels with carbon content 20% less than gasoline on a lifecycle basis.
Appliances, building and lighting energy efficiency requirement	All energy efficiency measures proposed in the House bill are implemented; the commercial building initiative and the Block Grant program receive full funding.	All energy efficiency measures proposed in the House bill are implemented; annual funding for the commercial building initiative limited to \$40 million and the funding for the Block Grant program limited to \$100 million per year from 2008-2012.

the company could pay \$30 per MWh of renewable generation shortfall or two times the cost of credits needed to fulfill the requirement.

The RPS provision could result in significantly different emission reduction scenarios depending on the degree of compliance and the kind of generation displaced. For this analysis, we assume that energy efficiency measures contribute to 27% of the RPS requirement. GHG reductions from energy efficiency measures for meeting RPS requirements are based on estimates by ACEEE and included in the reductions from energy efficiency provisions, as discussed below.

In the more optimistic scenario, we assume that all facilities meet the remaining 73% of the RPS requirement through expanding renewable electricity generation, and renewable energy displaces a mix of electricity production comprising 78% coal, 14% natural gas and 7% nuclear. Such a mix is consistent with EIA's projection for the mix of new generation through 2030.

In the less optimistic scenario, we assume that it will be financially more attractive to comply with the requirement through the alternative compliance mechanism than expanding renewable electricity generation capacity beyond the rate of development demonstrated by renewable projects announced to date. We therefore assume that the renewable electricity generation capacity reaches 95,000 MW by 2020 (i.e., the level of announced renewable projects through

2020) and remains at the same average rate of development through 2030. The increased renewable generation is assumed to displace 100% natural gas rather than a mix of generation.

3. Oil savings requirements (Subtitle D, Sec. 251 of the Senate energy bill)

Section 251 of the Senate bill requires the Office of Management and Budget to publish an action plan consisting of a list of requirements that would be sufficient to reduce oil consumption by 2.5 million barrels per day (Mbd) in 2016 from business-as-usual projection, by 7 Mbd in 2027 and by 10 Mbd in 2031. However, the bill provides no specifics regarding how reductions beyond those achieved by the specific standards in the bill would be met. Because of a lack of carbon requirement for attaining the stated oil savings goal, it is possible that the goals are met by displacing oil with fuels of higher carbon intensity.

In the more optimistic scenario, we assume that beyond the oil savings (and GHG reductions) achieved by the LDV CAFE and M&HDT's FE standards, the oil savings provision will result in additional GHG reductions equivalent to emissions from half of the oil savings requirements remaining after the vehicle efficiency standards. Estimates of GHG reductions of this provision came from ACEEE.

In the less optimistic scenario, we assume that aside from the LDV CAFE and M&HDT's FE standards, additional oil savings (and GHG reductions) could be achieved through the RFS specified in Section 111 of the Senate energy bill (see the following section), but no additional measures are implemented to meet the oil savings targets.

4. Renewable Fuel Standard (Title I, Subtitle A, Sec. 111 of the Senate bill)

The bill imposes an increasing renewable fuel volume requirement that reaches 36 billion gallons in 2022. The advanced biofuels requirement (any renewable fuels not derived from corn starch) will reach 21 billion gallons in 2022. Title I additionally requires that at least 60 percent of biofuels must be advanced biofuels starting in 2023 and the percentage of renewable fuels in the regulated fuel pool from 2023 onwards shall be at least the same as its share in 2022. Fuels that are subject to the RFS requirement include motor vehicle fuel and home heating oil.

Title I provides no requirements on carbon content of fuels, but stipulates all renewable fuels produced from facilities that commence operation after the bill enactment must achieve 20% reduction in lifecycle GHG emissions relative to gasoline.

In the more optimistic scenario, we assume that the RFS contributed to fulfilling the oil savings requirements, so we do not include a separate estimate for the GHG emissions reductions from the RFS.

In the less optimistic scenario, we assume that ethanol production capacity reaches 10 billion gallons per year by 2008⁵ and that the fuel lifecycle GHG emissions of ethanol produced from these existing facilities are the same as gasoline. We assume that the rest of the renewable fuels for meeting the volumetric RFS requirements achieve 20% reduction in lifecycle GHG emissions compared to gasoline. Projected volume of fuel use is based on EIA's AEO 2007.

5. Energy efficiency measures in the House bill (Title IX, Subtitle A, Parts 1- 6 and 9)

Both the Senate and the House energy bills set higher energy efficiency standards for appliances, lighting and buildings. The bills also establish an Energy and Environment Block Grant program to assist state and local governments in implementing initiatives to reduce fossil fuel emissions and improve energy efficiency in the transportation, building and other sectors. Since the House energy bill includes a more extensive list of energy efficiency measures, this analysis assumes the final energy bill will include all the energy efficiency measures in the House bill.

Our projected GHG reductions from the energy efficiency measures are based on estimates from ACEEE.⁶ In the more optimistic scenario, we assume that the two initiatives that require annual funding from Congressional appropriations (the commercial building efficiency initiative and the Block Grant program) will receive full funding. In the less optimistic scenario, we assume that the commercial building initiative receives annual funding of \$40 million and the Block Grant program receives annual funding of \$100 million from 2008-2012.

Please contact Tony Kreindler at 202-572-3378 with any questions.

¹ Historical U.S. GHG emissions based on EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005* (<http://www.epa.gov/climatechange/emissions/usinventoryreport.html>, accessed Aug 2, 2007); projections from 2006-2030 based on DOE's report titled *Energy Market and Economic Impacts of S. 280, the Climate Stewardship and Innovation Act of 2007* (<http://www.eia.doe.gov/oiaf/servicerpt/csia/index.html>, accessed Aug 20, 2007). Projection of emissions from 2031-2050 extrapolated from the trend from 2020 through 2030.

² For purposes of this analysis, we take 2005 emissions as indicative of current levels and assume enactment of legislation in 2008. USCAP near-term targets are based on years from enactment (*Call for Action*, www.us-cap.org). As shown in the blue shaded zone of Figure 1, we use climate protective targets of 100%-105% of current levels in 2013, 90%-100% of current levels in 2018, 70%-90% of current levels in 2023, and then a long-term range of 20%-40% of current levels in 2050.

³ We also examined a sensitivity case in which CAFE standards continued the 3.4% annual rate of increase through 2030; although savings increase over that decade, the result is still not sufficient to push overall GHG emissions below the current level.

⁴ ACEEE's assessment of the potential energy and carbon savings for H.R. 6 as passed by the Senate (<http://www.aceee.org/energy/national/SenateBillSavings.pdf>, accessed September 18, 2007).

⁵ Based on U.S. Department of Agriculture's 2007 report titled *Ethanol Expansion in the United States – How will the Agricultural Sector Adjust?*, U.S. ethanol production capacity is expected to exceed 10 billion gallons per year by 2009. The assumption of 10 billion gallons per year of ethanol production capacity is consistent with the Renewable Fuels Association's estimate of over 12.6 billion gallons by 2009 (RFA's May 31, 2007 press release, Ethanol Production, Demand Remains Strong, www.ethanolrfa.org/media/press/rfa/2007/, accessed Aug 28, 2007) and Houston BioFuels Consultants' estimates of 8 to 10 billion gallons per year by the end of 2008 (Dec 20, 2006 press release, The Need for Increased Ethanol Blending to Balance New Production Capacity, www.ethanolmarket.com, accessed Aug 28, 2007).

⁶ ACEEE's estimates of the House energy bill energy efficiency requirements (<http://aceee.org/energy/national/nrgleg.htm>, accessed September 18, 2007).