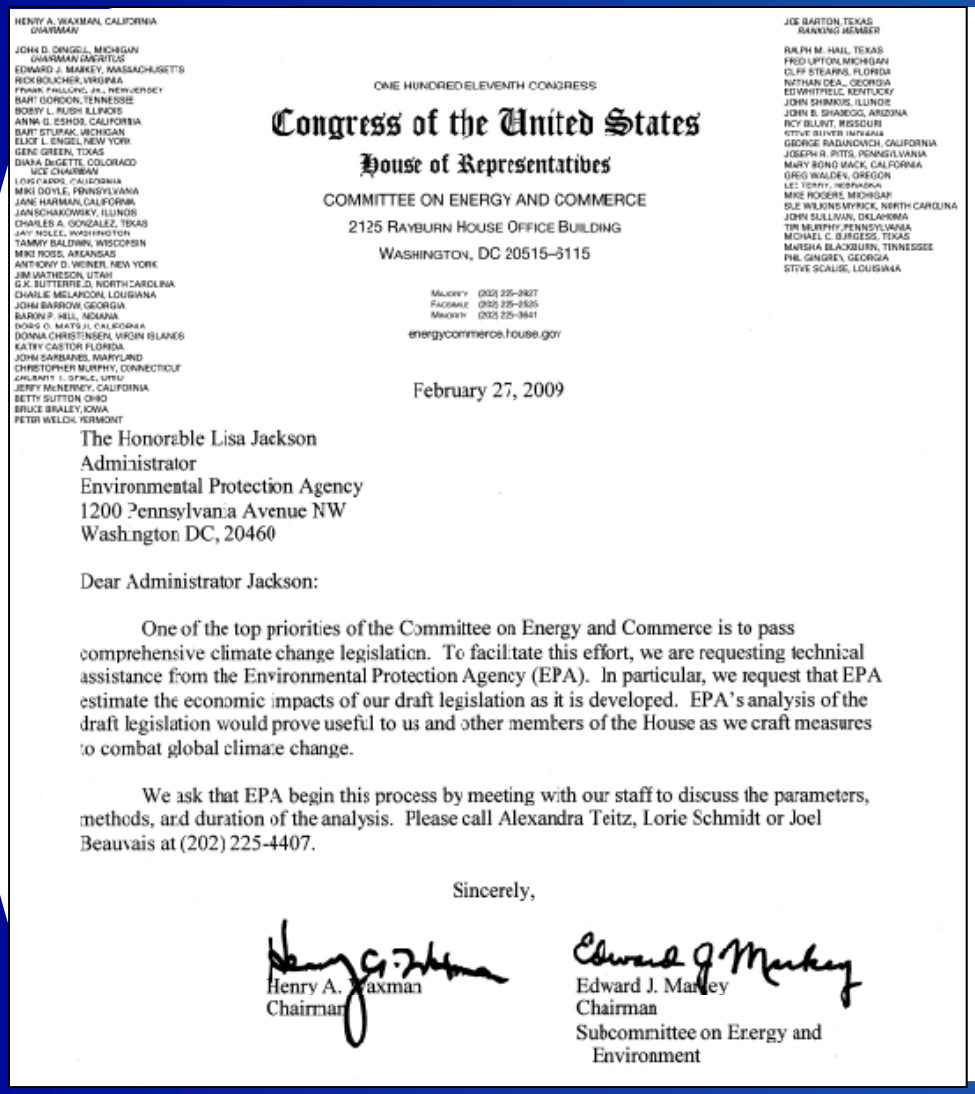
EPA Preliminary Analysis of the Waxman-Markey Discussion Draft

The American Clean Energy and Security Act of 2009 in the *111th Congress*

Summary Presentation

Request for Analysis



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Congress of the United States

House of Representatives

COMMITTEE ON ENERGY AND COMMERCE

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energycommerce.house.gov

February 27, 2009

The Honorable Lisa Jackson
Administrator
Environmental Protection Agency
1200 Pennsylvania Avenue NW
Washington DC, 20460

Dear Administrator Jackson:

One of the top priorities of the Committee on Energy and Commerce is to pass comprehensive climate change legislation. To facilitate this effort, we are requesting technical assistance from the Environmental Protection Agency (EPA). In particular, we request that EPA estimate the economic impacts of our draft legislation as it is developed. EPA's analysis of the draft legislation would prove useful to us and other members of the House as we craft measures to combat global climate change.

We ask that EPA begin this process by meeting with our staff to discuss the parameters, methods, and duration of the analysis. Please call Alexandra Teitz, Lorie Schmidt or Joel Beauvais at (202) 225-4407.

Sincerely,

Henry A. Waxman
Chairman

Edward J. Markey
Chairman
Subcommittee on Energy and Environment

- On February 27, 2009 the House Energy and Commerce Committee Chairman Waxman and Energy and Environment Subcommittee Chairman Markey requested that EPA estimate the economic impacts of the comprehensive climate legislation being developed by the committee.
- The committee released the Waxman-Markey Discussion Draft of the American Clean Energy and Security Act of 2009 on March 31, 2009.
- This document, released on April 20, 2009, represents EPA's preliminary analysis of the Waxman-Markey Discussion Draft.

The analysis was conducted by EPA's Office of Atmospheric Programs.

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This analysis is available online at:
www.epa.gov/climatechange/economics/economicanalyses.html

Waxman-Markey Discussion Draft

Bill Summary

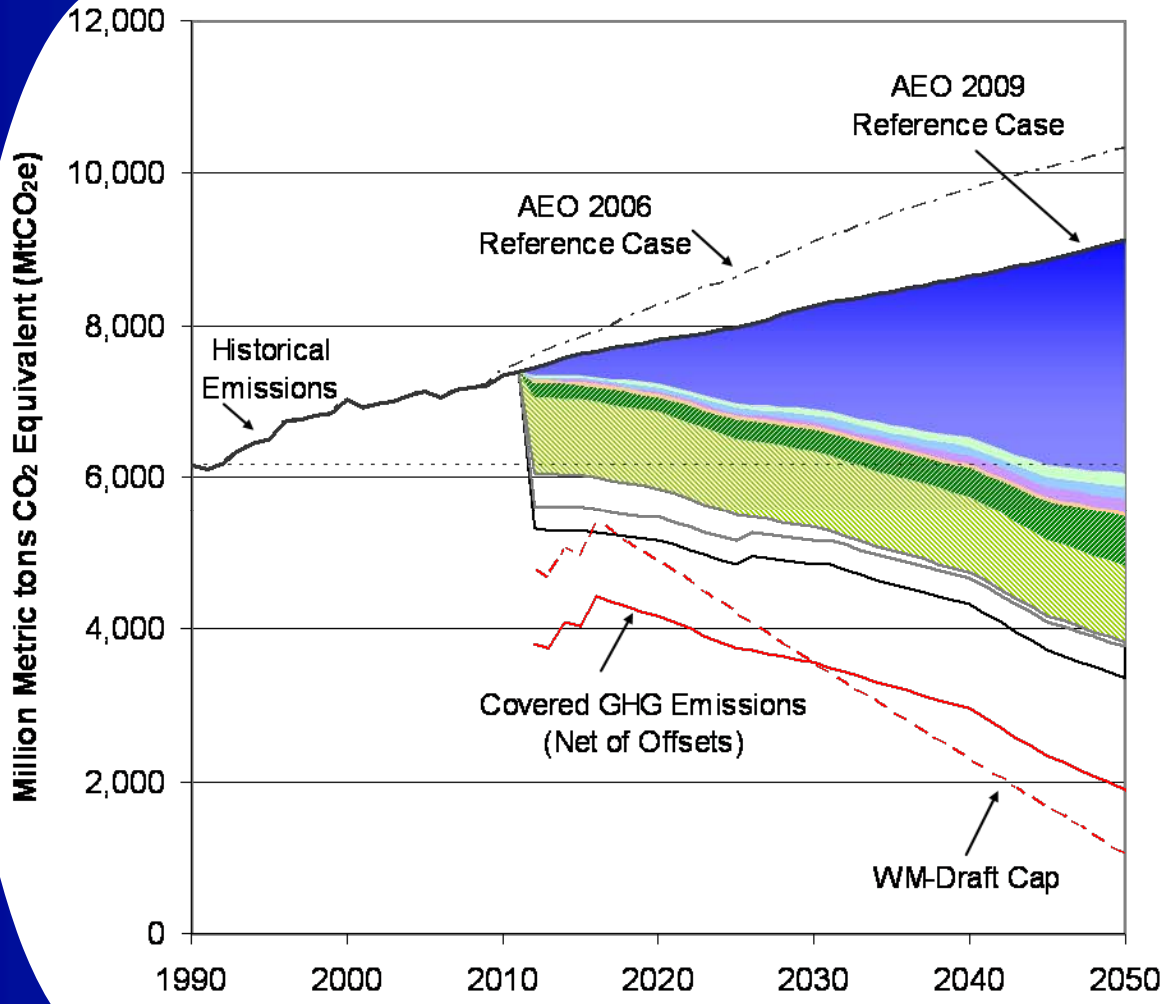
- Title III of the Waxman-Markey Discussion Draft (WM-Draft) establishes a cap & trade system for greenhouse gas emissions.
  - The cap gradually reduces covered greenhouse gas emissions from 3 percent below 2005 levels in 2012, to 20 percent below 2005 levels by 2020, 42% below 2005 levels in 2030, and 83 percent below 2005 levels by 2050.
  - Banking of allowances is unlimited, a two year compliance period allows borrowing from one year ahead without penalty, limited borrowing from two to five years ahead.
  - Offsets are limited to 2,000 million metric tons CO_2 equivalent ($MtCO_2e$) per year split evenly between domestic and international.
  - Offsets turn-in-ratio requires entities using offsets to submit 1.25 tons of offsets credits for each ton of emissions being offset.
  - Supplemental emissions reductions from reduced deforestation through allowance set-asides.
- Titles I & II of WM-Draft deal with clean energy and energy efficiency, and among other things establish a renewable electricity standard, a low carbon fuel standard, and energy efficiency programs and standards for buildings, lighting, appliances, and vehicles and engines.
  - Titles I & II are not explicitly modeled within the cap & trade analysis.
- Title IV addresses competitiveness issues and the transition to a clean energy economy.
  - Creates an output-based allowance allocation mechanism based on H.R. 7146 (Inslee-Doyle bill).
  - Allows for the implementation of an international reserve allowance requirement.
  - The output-based allowance allocation mechanism is included in this analysis, but not in all scenarios. The rest of Title IV is not included in this analysis.

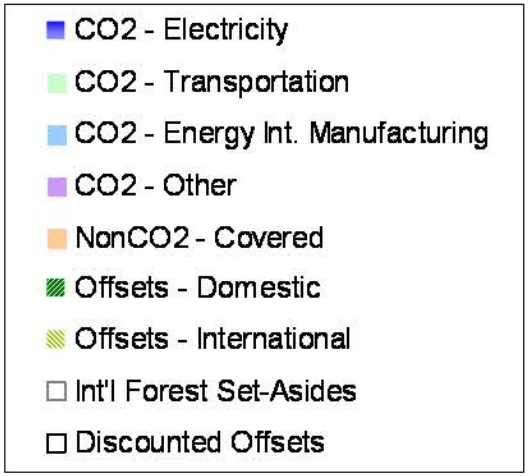
Waxman Markey Discussion-Draft – Bill Summary
Additional Assumptions from Committee Staff

- The bill is silent on how allowances will be allocated or auctioned.
- In order to model the bill, we need to make assumptions about how allowances will be allocated and how auction revenue will be used.
- House Energy and Commerce Committee Staff directed EPA to use the following assumptions:
  - CCS Bonus Allowances: 2% 2012-2016; 5% 2017-2050
    - Included in all scenarios.
  - International Forest Carbon: 5% through 2025, 3% through 2030, 2% through 2050.
    - Included in all scenarios.
  - Energy Efficiency: 12.5%
    - Included in scenario 3.
  - Output-Based Rebate: 15% through 2020, should decline at 10% per year after that.
    - Included in scenario 4.
  - Necessary allowances for deficit neutrality
    - Included in all scenarios.
  - Remaining allowance value is recycled to households lump sum.
    - Included in all scenarios
- The following assumptions about the CCS bonus allowance provisions were also given:
  - CCS bonus allowance provisions should be modeled as specified in the Dingell-Boucher discussion draft.
  - No set bonus allowance rate. The number of bonus allowances given for each ton sequestered is determined so that the value of the bonus allowances is equal to $90 for the first 3 GW of CCS, $70 for the second 3 GW of CCS, and $50 for the rest (values are in 2005 dollars).
  - If the program is oversubscribed, then you can borrow from future period allocations until the total pool of bonus allowances is used.

Total US GHG Emissions & Sources of Abatement

Scenario 1 - Reference & Scenario 2 – WM-Draft (ADAGE)

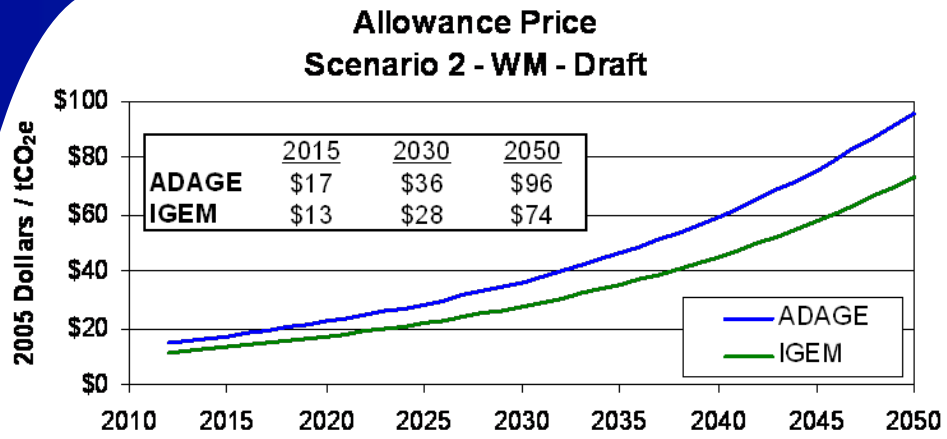


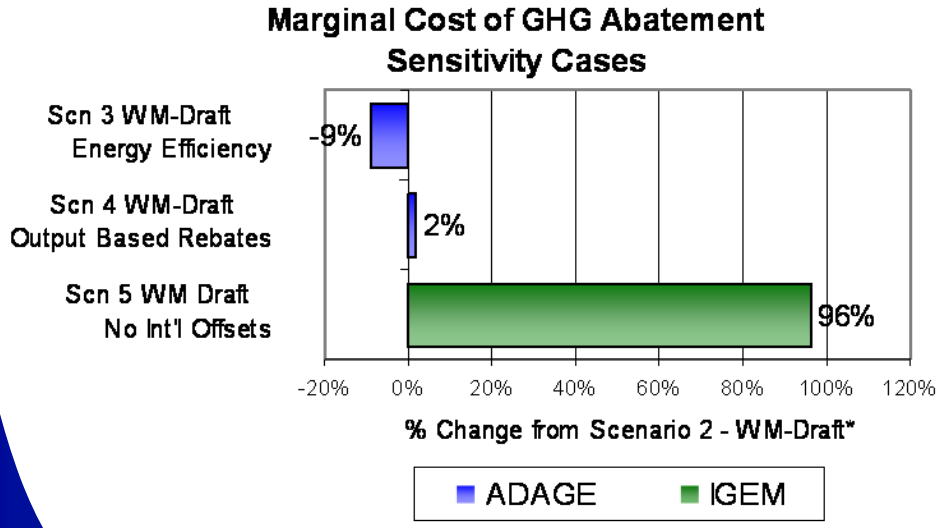


- The updated reference case for this analysis is based on AEO 2009, and the old reference case from EPA's S. 2191 analysis was based on AEO 2006.
- Cumulative 2012-2050 GHG emissions are 14% (51 bmt) lower in the AEO 09 baseline compared to the AEO 06 baseline in ADAGE due to the inclusion of EISA, lower initial (2010) GDP ($13.2 trillion in AEO 09 vs $14.6 trillion in AEO 06), and a lower projected GDP growth rate (2.5% in AEO 09 vs 3.0% in AEO 06).
- WM-Draft allows a quantity of 2 billion metric tons CO_2e of offsets each year split evenly between domestic and international. The domestic limit is non-binding in this analysis.

GHG Allowance Prices & Sensitivities

WM-Draft Scenario Comparison



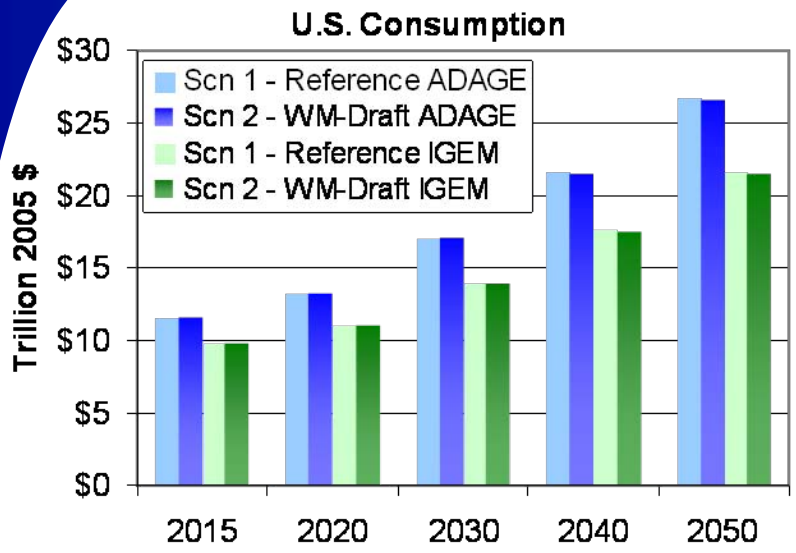


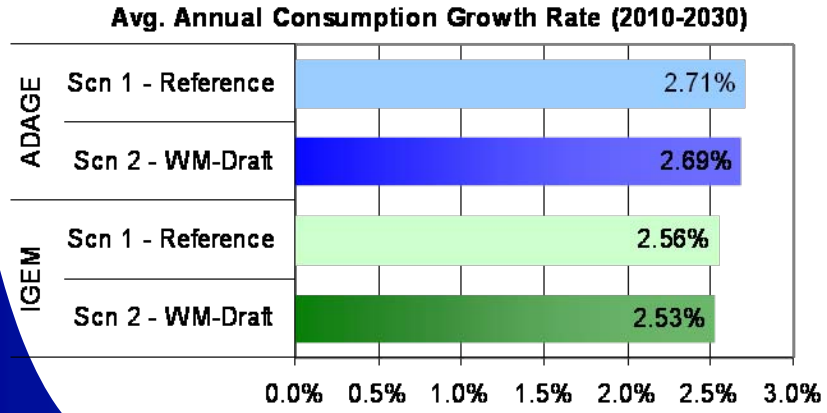
* Note that these percentage changes apply in all years.

- The marginal cost of GHG abatement is equal to the allowance price.
- Range of 2030 allowance price in *"scenario 2 – WM-Draft"* across models is: $28 - $36. This range only reflects differences in the models and does not reflect other scenarios or additional uncertainties discussed elsewhere.
- Range of 2030 allowance prices across all scenarios is: $28 - $54.
- The EE scenario results in lower allowance prices because of significant projected energy demand reductions. See Appendix 3 for a discussion of the limitations and caveats associated with the methodology used in this scenario.
- The availability of offsets under WM-Draft significantly influences the allowance price.
- While limited technology runs are not included in this analysis, previous EPA analyses have shown that the availability of nuclear and carbon capture and sequestration (CCS) technologies have a significant impact on allowance prices.
- In EPA's S. 2191 analysis, restricting nuclear and biomass electricity to reference case levels increased allowance prices by ~30% and additionally not allowing CCS until after 2030 increased allowance prices by ~80%.

Consumption

Scenario 1 – Reference & Scenario 2 – WM-Draft





ADAGE	2015	2020	2030	2040	2050
Ref. Consumption per Household	$92,202	$99,888	$117,973	$140,233	$164,348
% Change (Scn. 2)	-0.11%	-0.19%	-0.37%	-0.67%	-0.78%
Consumption Loss per Household	-$100	-$192	-$441	-$936	-$1,288
NPV Cost per HH ($)	-$75	-$112	-$158	-$206	-$174

Average Annual NPV cost per Household	-$140

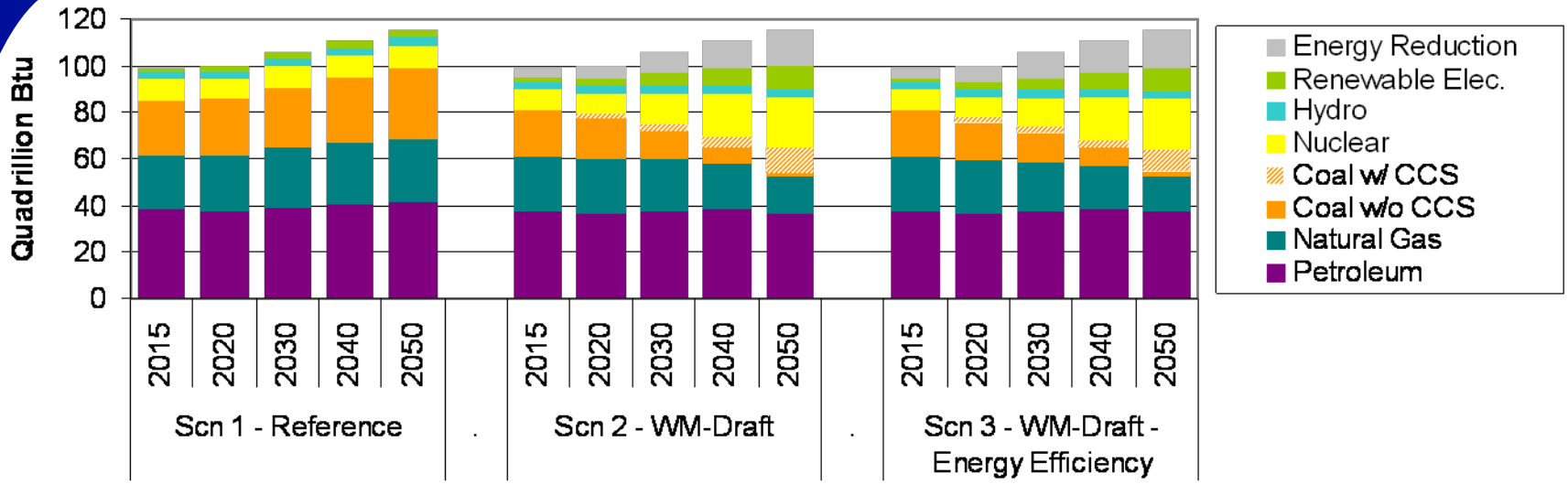
IGEM	2015	2020	2030	2040	2050
Ref. Consumption per Household	$77,310	$83,367	$96,443	$113,760	$132,956
% Change (Scn. 2)	-0.02%	-0.17%	-0.39%	-0.62%	-0.85%
Consumption Loss per Household	-$19	-$137	-$358	-$647	-$1,018
NPV Cost per HH	-$14	-$80	-$128	-$143	-$138

Average Annual NPV cost per Household	-$98

- The average annual cost per household is the 2010 through 2050 average of the net present value of the per household consumption loss in "*scenario 2 – WM-Draft*."
- The costs above include the effects of higher energy prices, price changes for other goods and services, impacts on wages and returns to capital, and importantly, the above cost estimates reflect the value of emissions allowances returned lump sum to households which offsets much of the cap-and-trade program's effect on household consumption. The cost does not include the impacts on leisure.
- This analysis is a cost-effectiveness analysis, not a cost-benefit analysis. As such, the benefits of reducing GHG emissions were not determined in this analysis.
- The $98 - $140 average annual cost per household is the annual cost of achieving the climate benefits that would result from this bill.
- See Appendix 1 for a discussion of consumption accounting differences between ADAGE and IGEM and of composition of GDP.
- See Appendix 5 for a more detailed discussion of the average annual NPV cost per household calculation, and additional consumption cost metrics.

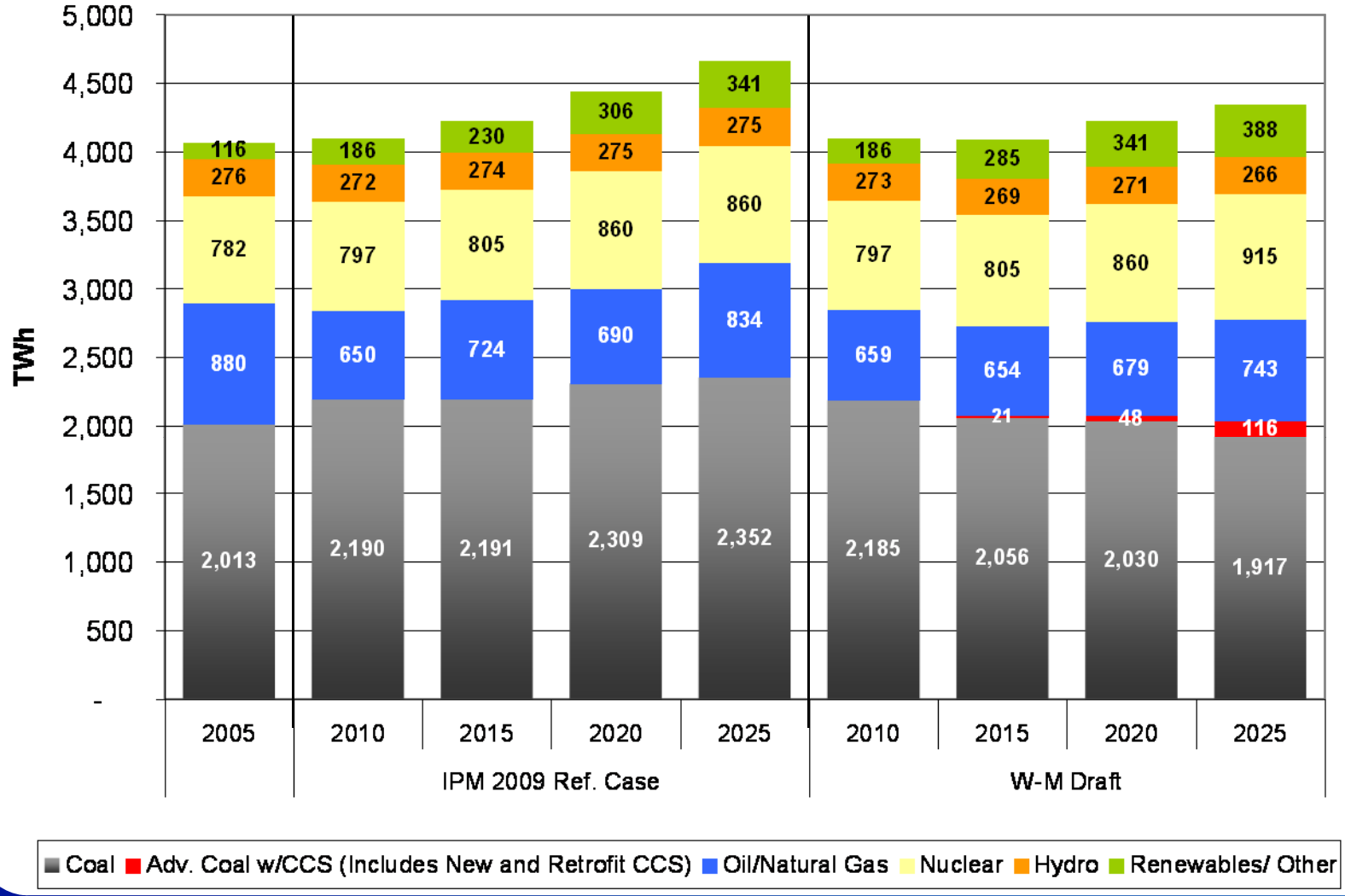
Primary Energy

WM-Draft Scenario Comparison (ADAGE)

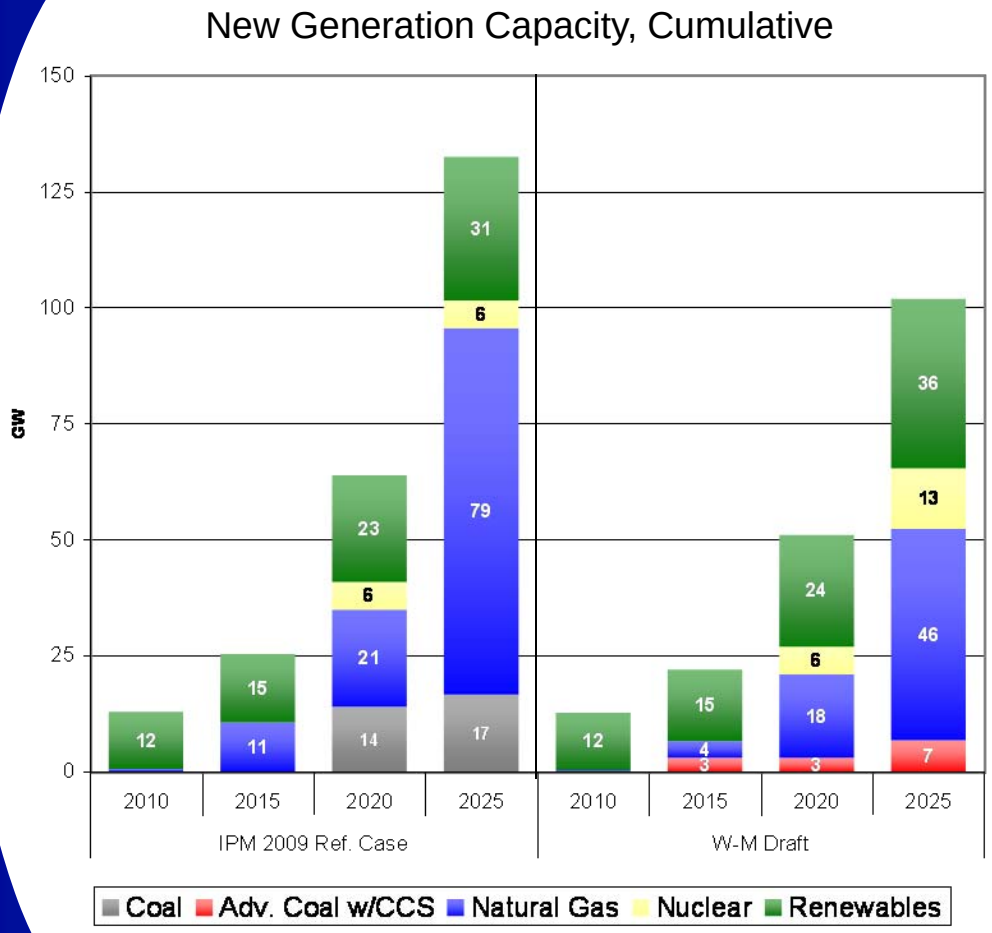


- The Waxman-Markey Discussion Draft transforms the structure of energy production and consumption, moving the U.S. to a clean energy economy.
  - Increased energy efficiency and reduced demand for energy resulting from the policy mean that energy consumption levels that would be reached in 2015 without the policy are not reached until the middle of the century with the policy.
  - The share of low- or zero-carbon primary energy (including nuclear, renewables, and CCS) rises substantially under the policy to 18% of primary energy by 2020, 26% by 2030, and to 46% by 2050, whereas without the policy the share would remain steady at 14%. Increased energy efficiency and reduced energy demand simultaneously reduces primary energy needs by 6% in 2020, 9% in 2030, and 13% in 2050.
  - Electric power supply and use represents the largest source of emissions abatement.

Electricity Generation Mix (IPM)



New Generation Capacity (IPM)

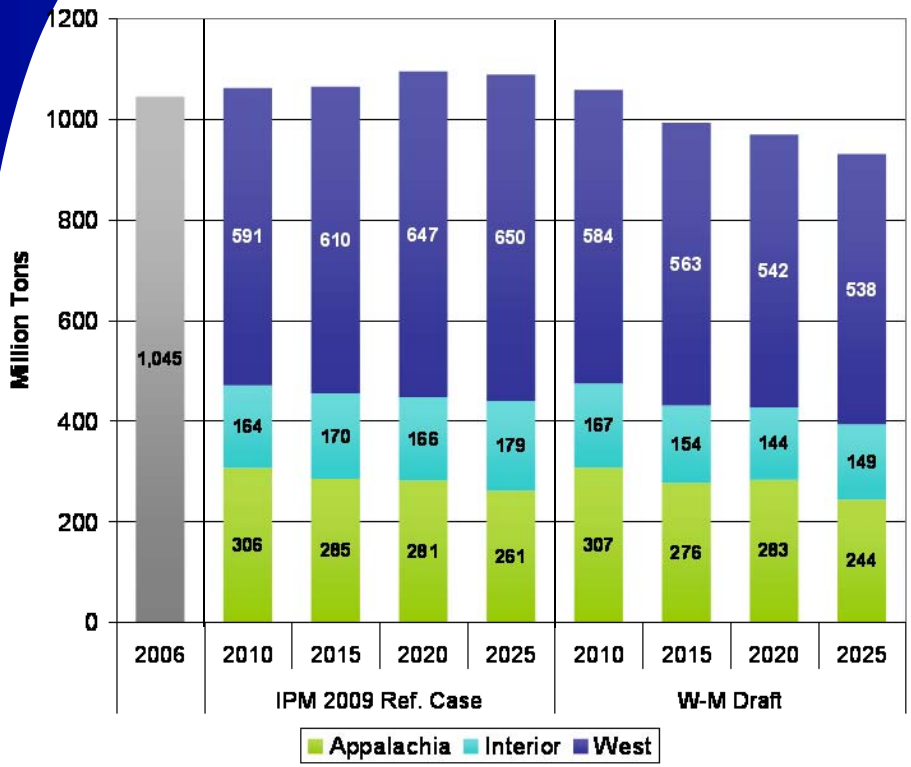


Note: New capacity additions less that 1 GW of capacity are not indicated.
* See appendix for more detail on EPA's technology penetration limits applied in IPM.

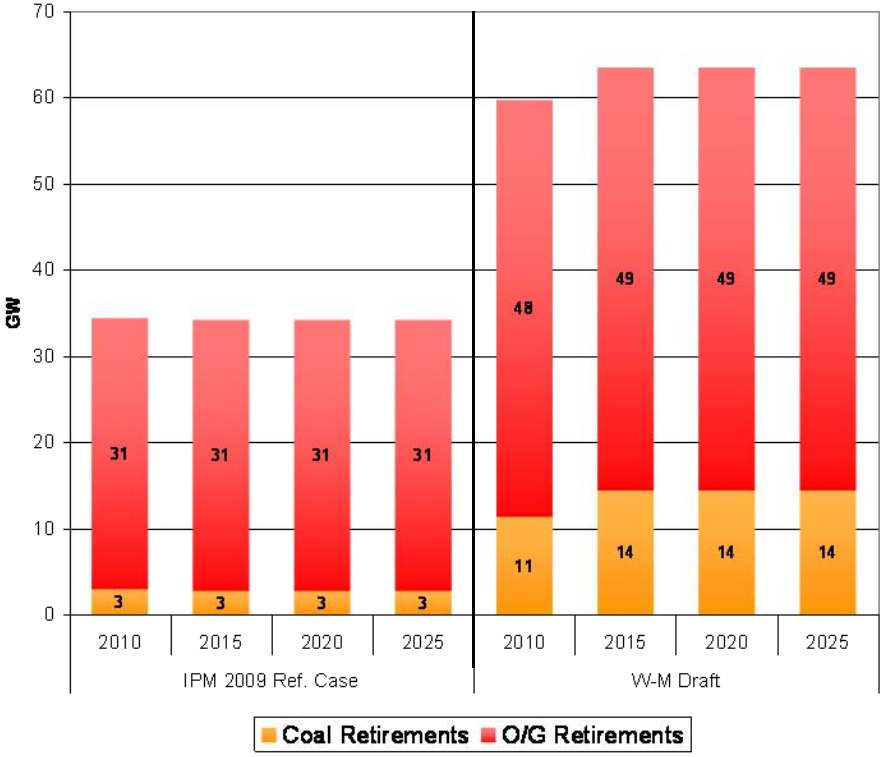
- Lower electricity demand, along with lower allowance prices and higher costs for new technologies, results in fewer new power plants needing to be built.
- Waxman-Markey contains a bonus allowance provision for CO_2 emissions that are captured and sequestered, but the bonus does not result in significant penetration of *new* coal capacity with CCS technology
  - 3 GW if new coal with CCS is forced in IPM in 2015 to reflect the early deployment provisions of the Bill. An additional 4 GW of new coal with CCS is built by 2025 due to the CCS bonus.
  - CCS retrofits to the *existing* coal fleet are economic, facilitated by the bonus (retrofits to existing facilities are not reflected in the graphic).
    - There are roughly 4 GW in 2020 and 9 GW (cumulative) in 2025 of post-retrofit capacity. The *retrofit capacity limitations* are reached in IPM.
- The technology penetration limits placed on *new capacity* are not reached in this analysis.*

Coal Production for Electricity Generation & Retirements of Existing Capacity (IPM)

Coal Production for Electricity Generation



Retirements of Existing Capacity (Cumulative)

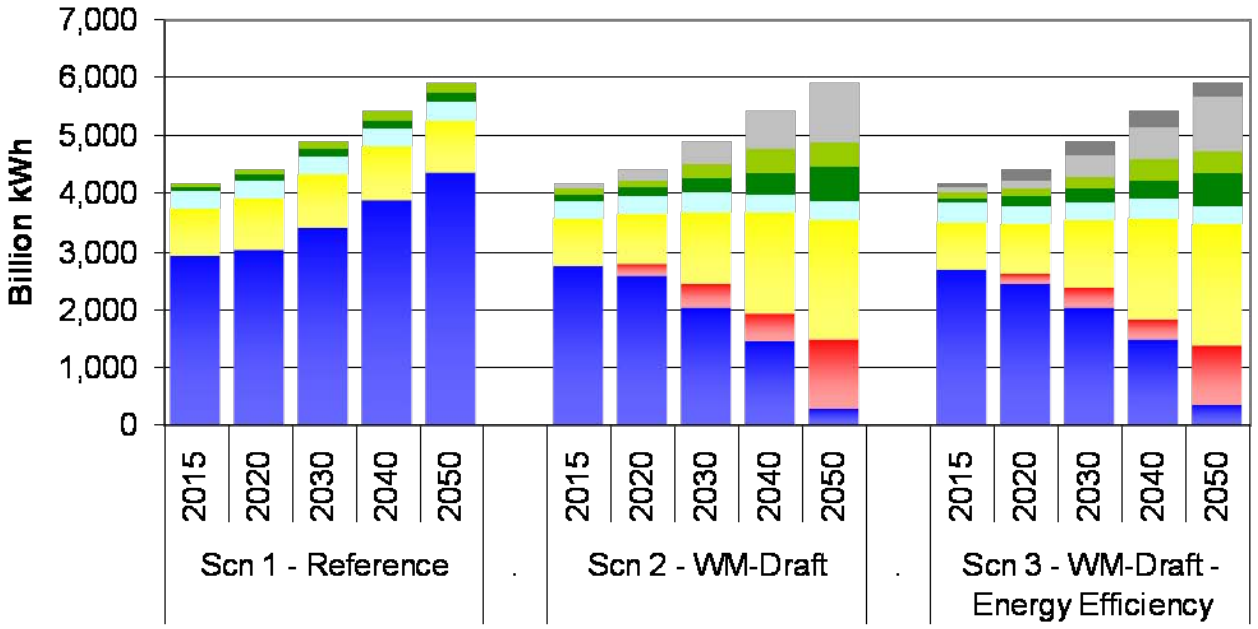


- There are fewer coal retirements under Waxman-Markey than in past IPM modeling because of lower allowance prices and higher costs to build new technology, making existing coal more cost competitive than before.
- In reality, uneconomic units may be “mothballed,” retired, or kept running to ensure generation reliability. The model is unable to distinguish among these potential outcomes.
- Most uneconomic units are part of larger plants that are expected to continue generating. Currently, there are roughly 120 GW of oil/gas steam capacity and 320 GW of coal capacity.

Note: Regional coal production data includes coal production for power generation only. Historical data is from EIA’s AEO 2008.

U.S. Electricity Generation

WM-Draft Scenario Comparison (ADAGE)



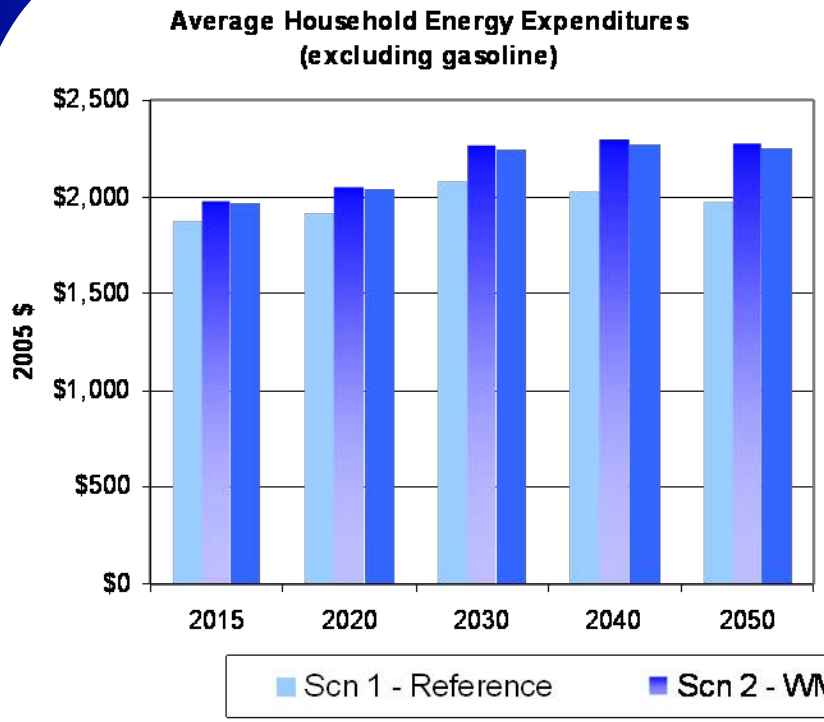
* *Efficiency / Reduced Demand* represents the energy savings from the consumer response to increased electricity prices (e.g. conservation, substitution to other goods/services from energy, etc.).

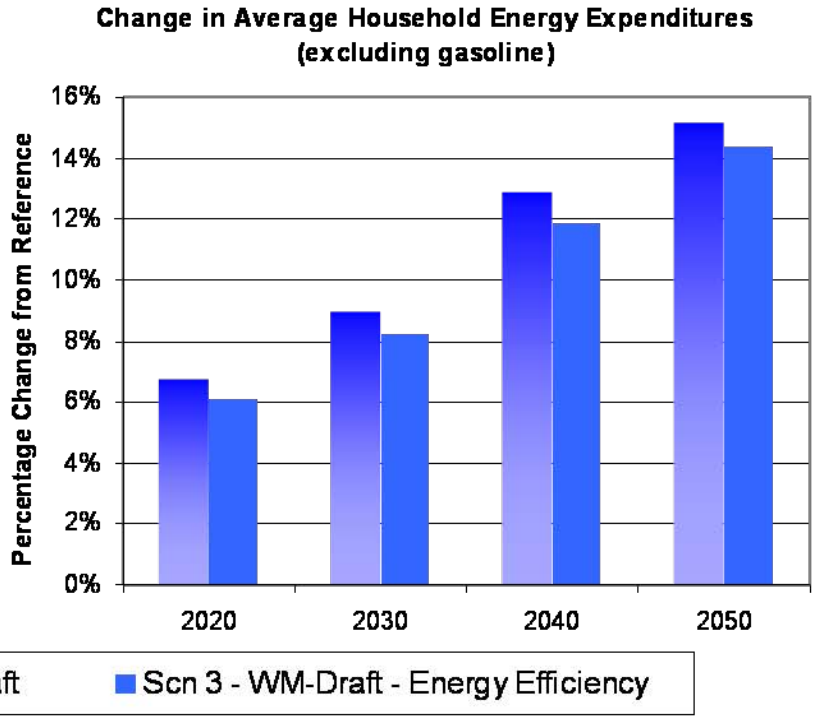
** *Energy Efficiency Programs* represents the energy savings achieved by the energy efficiency programs funded by allowance allocations or auction revenues.

- Under the policy scenarios, both nuclear and renewable electricity generation expands above the reference levels.
- Constraints on nuclear power growth are exogenous to the model (nuclear power generation is allowed to increase by ~150%
- Renewable electricity (including incremental hydro) approximately double under the policy scenario, and increase further with energy efficiency programs.
- CCS deployment on fossil-fuel generation begins in 2020. Without a subsidy for CCS, the technology would not deploy until 2040, and allowance prices would be 13% higher.
- By 2050, over 80 percent of fossil electricity generation is capturing and storing CO_2 emissions.

Household Energy Expenditures

WM-Draft Scenario Comparison (ADAGE)



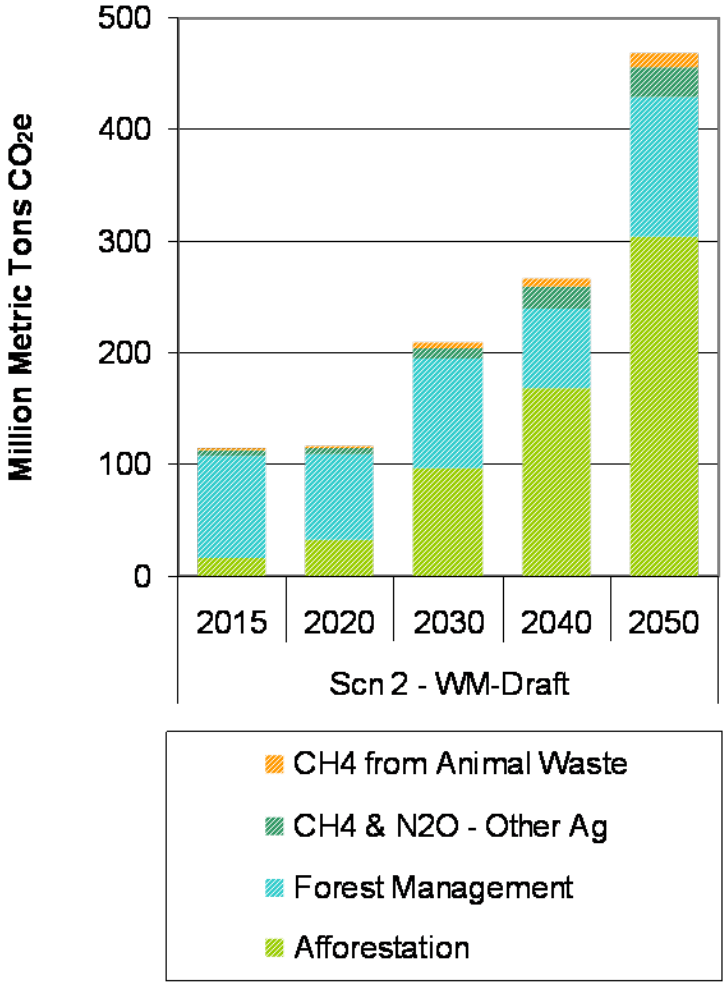


Scn 1 - Reference | Scn 2 - WM-Draft | Scn 3 - WM-Draft - Energy Efficiency

- In 2030 electricity prices increase by 22% in "*scenario 2 – WM-Draft*" and natural gas prices increase by 17%. In "*scenario 3 – WM-Draft Energy Efficiency*" electricity prices increase by 20% and natural gas prices (including allowance costs) increase by 13%.
- Actual household energy expenditures increase by a lesser amount due to reduced demand for energy. In 2030 the average household's energy expenditures (excluding motor gasoline) increase by 9% in *scenario 2 – WM-Draft*" and by 8% in "*scenario 3 – WM-Draft Energy Efficiency.*"
- In ADAGE, energy expenditures represent approximately 2% of total consumption in 2020 falling to 1% by 2050 in all scenarios.
- The energy expenditures presented here do not include any potential increase in capital or maintenance cost associated with more energy efficient technologies.

Offsets by Source

WM-Draft Scenario Comparison (IGEM)

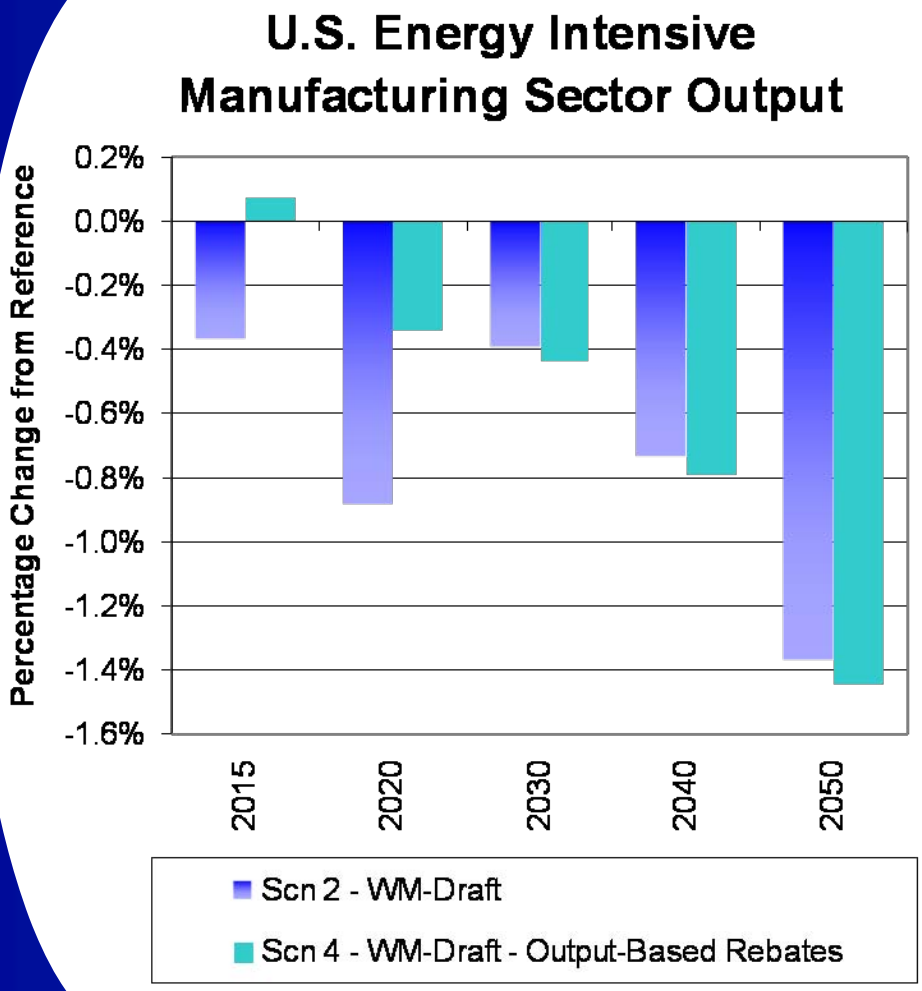


- The 1 billion ton CO_2e annual limit on the usage of domestic offsets is non-binding.
- The turn-in-ratio for offsets in WM-Draft require that 5 tons of offsets be turned in for every 4 tons of emissions being offset.
  - Eliminating this requirement would decrease allowance prices by 7%, increase the price received by offsets suppliers by 16%.*
  - Domestic offsets supply would increase by 11% and domestic offsets usage would increase by 39%.*
- In our analysis, we assume that landfill and coal mine CH_4 are covered under new source performance standards (NSPS) and are thus not available for offsets.
  - Allowing landfill and coal mine CH_4 as offset projects instead of covering them under NSPS would increase cumulative domestic offsets usage by 45%, and decrease allowance prices by 9%.*

* Allowance price and offsets usage impacts for these cases were determined in sensitivities run using a reduced form version of IGEM.

Summary of Trade Impacts, Emissions Leakage, and Output-Based Rebate Scenario

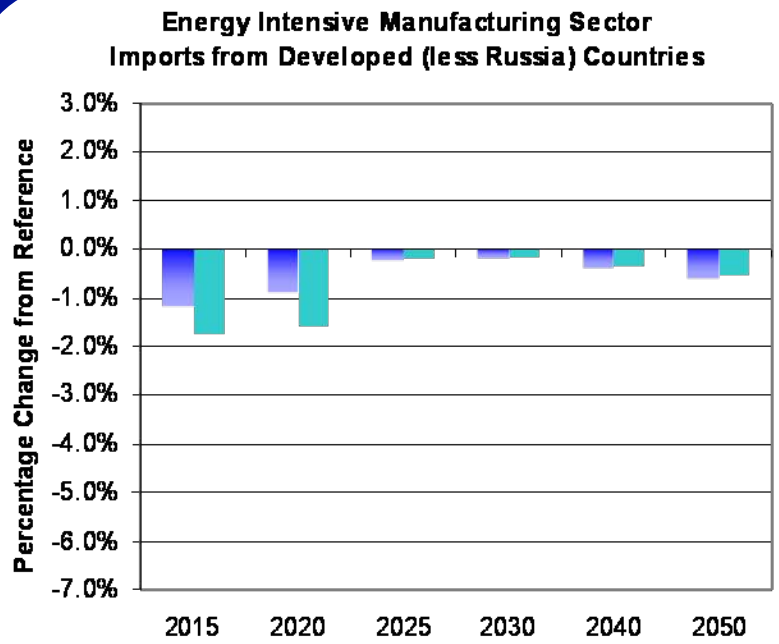
(ADAGE)

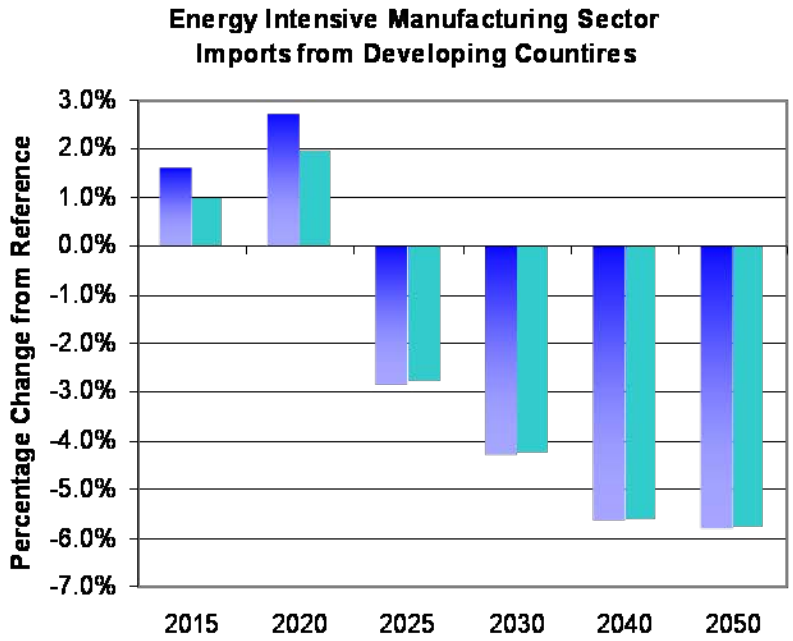


- The output-based rebate provision specified in Title IV of WM-Draft is similar to H.R. 7146 (Inslee - Doyle).
  - Applies to energy- or GHG-intensive industries that are also trade-intensive.
  - Rebates on average 85 percent of the direct and indirect cost of allowances, based on an individual firm's output and the average GHG and energy intensity for the industry.
  - Gradually phases out between 2021 and 2030, or when other countries take comparable action on climate change.
- Without output-based rebate provision, energy intensive manufacturing output decreases by 0.4% in 2015 and by 0.9% in 2020. With the output-based rebates, energy intensive manufacturing output *increases* by 0.1% in 2015 and only falls by 0.3% in 2020.
- The output-based rebate provisions increase allowance prices by 2%, and thus, in later years after the rebates are phased out, the energy intensive manufacturing sector output losses are slightly higher than in scenarios without the rebates.
- More detailed results are presented in Appendix 5.

Summary of Trade Impacts, Emissions Leakage, and Output-Based Rebate Scenario

(ADAGE)





- Imports of energy intensive manufacturing goods from developing countries increase in 2015 and 2020, then decrease in 2025 and after as the developing countries are assumed to adopt climate policies.
- In 2015 and 2020, the output-based rebate provisions decrease imports from both developed and developing countries.
- More detailed results are presented in Appendix 5.

Key Differences Between WM-Draft and HR. 2454

- **On May 15, 2009 Congressmen Waxman and Markey introduced a revised version of their discussion draft as H.R. 2454.**

- ***Cap Levels***
  - In H.R. 2454, the year-2020 cap is changed from 20% to 17% below the year-2005 level, while the 2012, 2030, and 2050 targets remain the same.
    - That relaxation of the cap, by itself, will lower allowance prices by 3%.

- ***Offsets Provisions***
  - Domestic offsets in HR. 2454 have a one-to-one turn in ration instead of the four-to-five turn in ration from the discussion draft.
    - This change alone increases the total purchase and use of domestic offsets by 11% and increases the average price paid for domestic offsets by 16%. Allowance prices are lowered by 7% in each year. The 1,000 $MtCO_2e$ annual limit on the usage of domestic offsets is still not met in any year.
  - Domestic and international offsets are each limited to 1,000 $MtCO_2e$ each year. If the limit on domestic offsets is not met, the limit on international offsets increases up to 1,500 $MtCO_2e$ each year, while the limit on domestic and international offsets combined remains 2,000 $MtCO_2e$ annually.
    - Allowing those additional international offsets into the system has the potential to lower allowance prices significantly further than the 7% reduction described above.

Key Differences Between WM-Draft and HR. 2454 (Continued)

- ***Allowance Allocations for Protection from Electricity Price Increases***
  - The largest allowance allocation specified in H.R. 2454 gives 30% of allowances to local electric distribution companies for the purpose of protecting consumers from increases in electricity bills.
    - If this provision lessens the impact on electricity prices, it will place slight upward pressure on allowance prices, because it will lessen somewhat the incentive for consumers to conserve electricity.
    - That slight upward pressure on allowance prices will likely be overpowered, however, by the substantial downward pressure caused by the relaxation in the year-2020 cap level and the increased use of domestic and international offsets.

- ***Incentives for Carbon Capture and Storage***
  - H.R. 2454 allocates 2% of allowances 2014-2015, and 5% off allowances thereafter to subsidize CCS. The first 6 GWs of CCS may receive a subsidy of $90/ton captured for 10 years. Beyond the first 6 GWs, additional bonus allowances are made available through a reverse auction.
    - The reverse auction ensures that CCS projects are not over- or under-subsidized, and that the bonus allowances will be distributed in a way that maximizes the amount of CCS deployed in response to the bonus allowances.
    - These changes are likely to result in greater penetration of CCS in 2020 and 2025 than EPA saw in its analysis of the draft bill. That will likely result in somewhat higher use of coal in 2020 and 2025 than EPA saw in its analysis of the draft. Beyond 2025, the use of the reverse auction has the potential to extend the use of CCS bonus allowances to a greater number of projects than shown in EPA's preliminary modeling of the draft.

Thank you and Additional Information

The analysis was conducted by EPA's Office of Atmospheric Programs.

This analysis is available online at:

www.epa.gov/climatechange/economics/economicanalyses.html

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