



U.S. Environmental Protection Agency
Office of Atmospheric Programs

Potential Supply of Offset Emissions

From the EPA Analysis of the
American Clean Energy and Security Act of 2009
H.R. 2454 in the 111th Congress

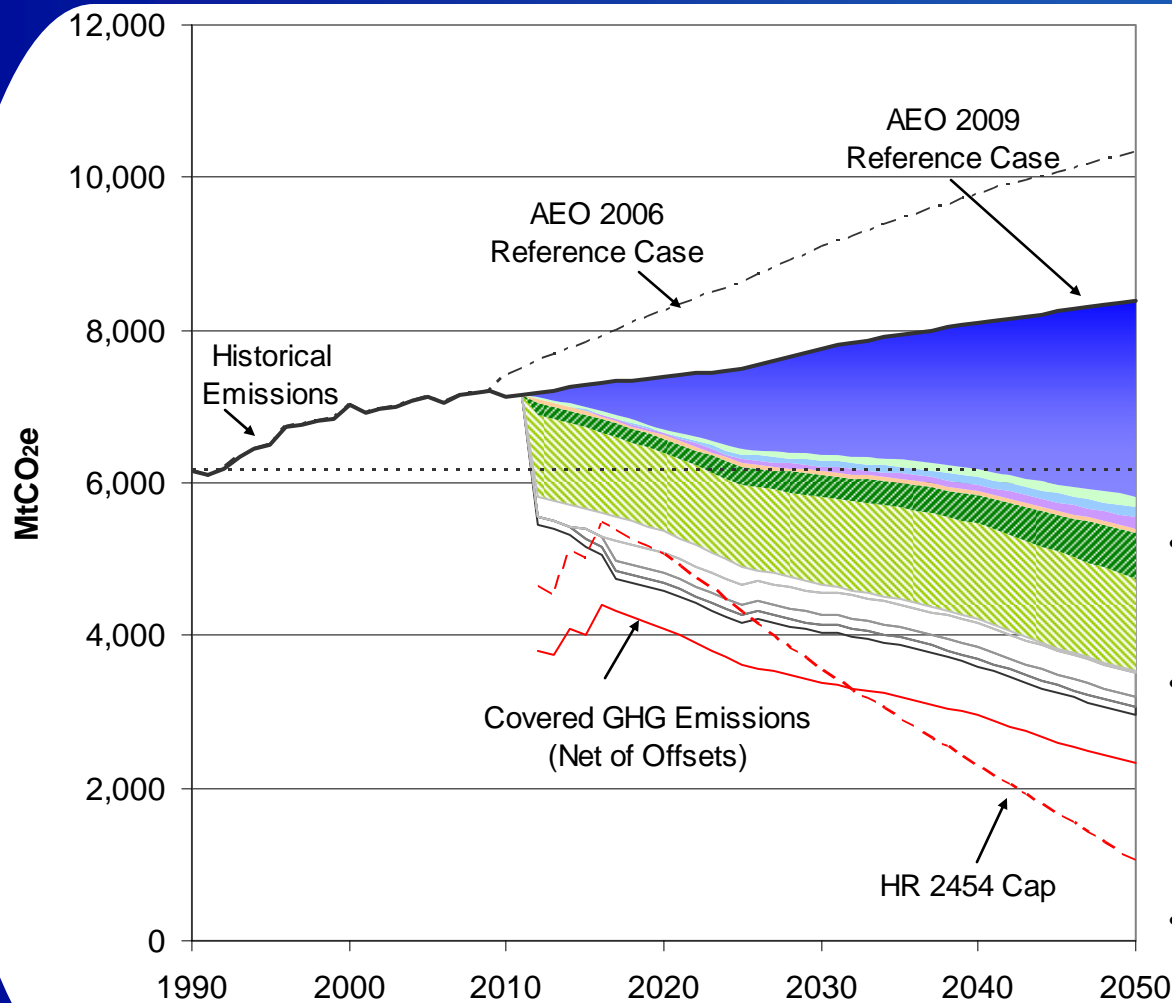
EPRi Greenhouse Gas Emissions Offset Policy Dialogue

7/30/09



Total US GHG Emissions & Sources of Abatement

Scenario 1 - Reference & Scenario 2 – H.R. 2454 (ADAGE)



- CO₂ - Electricity
- CO₂ - Transportation
- CO₂ - Energy Int. Manufacturing
- CO₂ - Other
- NonCO₂ - Covered
- Offsets - Domestic
- Offsets - International
- Int'l Forest Set-Asides
- Discounted Offsets
- NSPS - CH₄
- HFCs (separate cap)

- 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).
- International forest set-asides, discounted offsets, NSPS provisions for landfill and coal mine methane, and the HFC cap all provide additional abatement that does not help to meet the main cap.



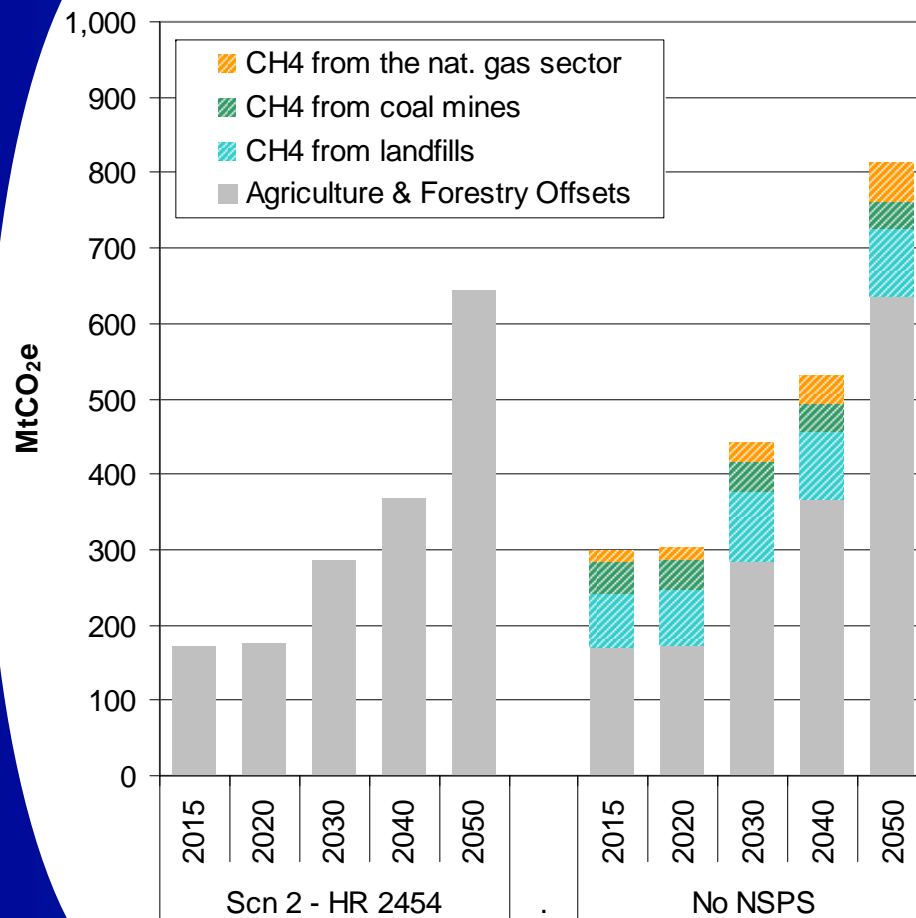
Stationary Source Standards

- H.R. 2454 requires standards of performance be established for uncapped stationary sources.
 - Any individual sources with uncapped emissions > 10,000 tons CO₂e
 - Any source category responsible for at least 20% of uncapped stationary GHG emissions.
 - Source categories to be identified by EPA shall include each source category that is responsible for at least 10% of uncapped **methane** emissions.
 - Sources potentially covered by this provision include at a minimum:
 - Landfills
 - Coal Mines
 - Natural Gas Systems
- EPA may also regulate uncapped emissions from capped sources (e.g., certain fugitive emissions) and uncapped emissions from other sources
- Emissions reductions from performance standards for the three methane source categories listed above in 2020 could be approximately 130 million tons CO₂e.
- Cumulative emissions reductions from performance standards for these sources by 2050 could be approximately 5 billion metric tons CO₂e.
- EPA's previous analysis of the Waxman-Markey discussion draft showed that allowing landfill and coal mine methane as offset projects instead of covering them under NSPS would increase cumulative domestic offsets usage by 45%.



Domestic Offsets Usage

H.R. 2454 Scenario Comparison (IGEM)



- The annual limit on the usage of domestic offsets is non-binding.
- In our analysis, we assume that landfill, coal mine, and natural gas system CH₄ are covered under new source performance standards (NSPS) and are thus not available for offsets.
- Allowing landfill, coal mine, and natural gas system methane as offset projects instead of covering them under NSPS would:
 - Decrease allowance prices by 2%.
 - Increase 2012 – 2050 cumulative domestic offsets usage by 46% (6 GtCO₂e).
 - Decrease 2012 – 2050 cumulative international offset usage by 12% (5 GtCO₂e).
 - Increase 2012 – 2050 cumulative U.S. GHG emissions by 6 GtCO₂e).



H.R. 2454 Offsets Provisions

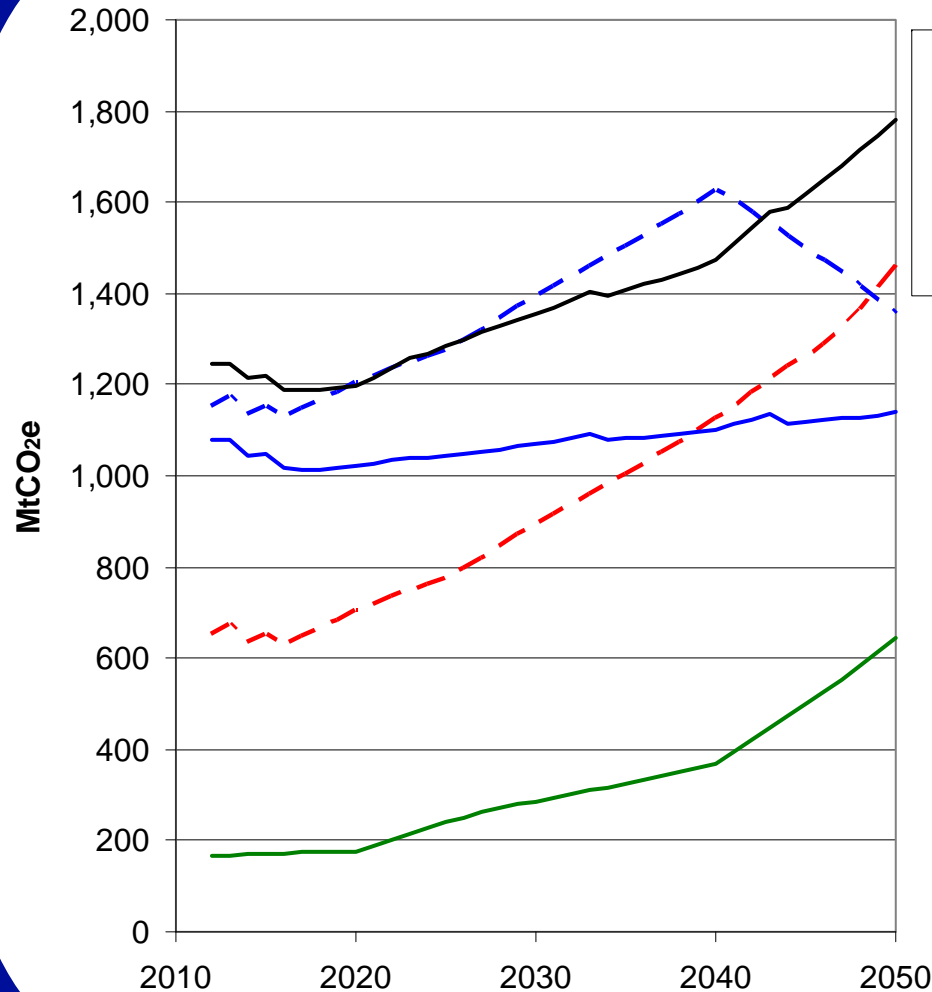
Sec. 722 (d) (1)

- H.R. 2454 Sec 722 (d) (1) (A) allows covered entities to collectively use offset credits to demonstrate compliance for up to a maximum of 2 billion tons of GHG emissions annually.
- This section also attempts to share the 2 billion tons of offsets allowed pro rata among covered entities. However, the formula specified for pro rata sharing among covered entities does not result in 2 billion tons of offsets in total.
 - Covered entities are allowed to satisfy a specified percentage of the number of allowances required to be held for compliance with offsets credits.
 - H.R. 2454 Sec 722 (d) (1) (B) shows that for each year, the specified percentage is calculated by dividing two billion by the sum of two billion and the annual tonnage limit for that year. For example, in 2012, when the cap level is 4.627 GtCO₂e, the percentage would be 30.20%; and in 2050, when the cap level is 1.035 GtCO₂e the percentage would be 65.90%.
 - The number of allowances required to be held for compliance is equal to the amount of covered emissions, so for any given firm the amount of offsets they are allowed to use is equal to the product of their covered emissions and the percentage specified above.
 - The total amount of offsets allowed is equal to the product of the total amount of covered emissions and the specified percentage. In order for this to be equal to the 2 billion ton limit on offsets specified above, total covered GHG emissions would have to be equal to the cap level plus 2 billion tons. There are several reasons why this is unlikely to be the case.
 - First, even if covered emissions remain at reference levels, in the early years of the policy they will not be 2 billion tons over the cap level.
 - Second, if firms bank allowances, their covered GHG emissions will be reduced, which will reduce the amount of offsets they are allowed to use.
 - Third, in the later years when firms are drawing down their bank of allowances, it is possible for covered GHG emissions to be more than 2 billion tons above the cap, which means that the pro rata sharing formula can be in conflict with the overall 2 GtCO₂e limit on offsets usage. However, if the domestic limit is non-binding, then the pro-rata sharing would allow for the international limit to exceed 1 GtCO₂e, so long as the sum of domestic and international offsets were still below 2 GtCO₂e.
- H.R. 2454 Sec 722 (d) (1) (C) modifies the pro rata sharing to allow more international offsets if fewer than 0.9 GtCO₂e are expected to be used.
 - In years when this provision triggers, an additional amount of international offsets are allowed equal to the lesser of: 1 GtCO₂e less the actual amount of domestic offsets used; or 0.5 GtCO₂e.
 - This has the potential in later years to allow more than 2 GtCO₂e of offsets into the system, so our interpretation is that the actual amount of extra international offsets allowed would be equal to the lesser of the amount calculated above, or 2 GtCO₂e less the sum of the international offsets limit and the actual usage of domestic offsets.
 - Because the pro-rata sharing limits domestic offsets in the early years to well below 0.9 GtCO₂e, this provision will automatically trigger, even if the actual limit on domestic offsets were binding.



Domestic & International Offsets Usage & Limits

Scenario 2 – H.R. 2454 (IGEM)



- “1/2 Total Offsets Limit” represents the limits on domestic and international offsets based on H.R. 2454 Sec. 722 (d) (1) (A) & (B)
- “Int'l Offsets Adjusted Limit” represents the limit on international offsets after adding in the extra international offsets allowed under H.R. 2454 Sec. 722 (d) (1) (C) when the usage of domestic offsets is below 1,000 MtCO₂e.
- Actual usage of both domestic and international offsets are each below their respective limits, and the total use of offsets is below 2,000 MtCO₂e in all years.



International Offsets Sensitivities

Side Scenarios (IGEM)

Because of the importance of international offset, several side scenarios are included here to further explore the relationship between the availability of international offsets and the price of domestic allowances. A reduced form version of the IGEM model was used for these side scenarios.

Scenario 2 – H.R. 2454

- One of the main scenarios.

Scenario 7 – H.R. 2454 with No International Offsets

- One of the main scenarios.

Scenario 7a – H.R. 2454 with Delayed International Offsets

- Side scenario.
- No international offsets are allowed in the first 10 years.

Scenario 7b – H.R. 2454 with No Extra International Offsets

- Side scenario
- No extra international offsets from H.R. 2454 Sec 722 (d) (1) (C) when domestic offset usage is below 900 MtCO₂e.

Scenario 7c – H.R. 2454 with Delayed International Offsets & No Extra International Offsets

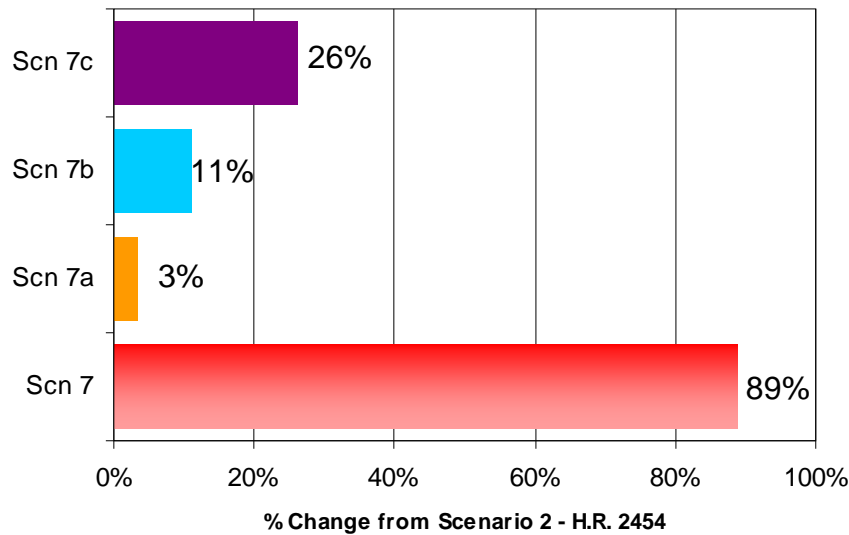
- Side scenario
- No international offsets are allowed in the first 10 years.
- No extra international offsets from H.R. 2454 Sec 722 (d) (1) (C) when domestic offset usage is below 900 MtCO₂e.



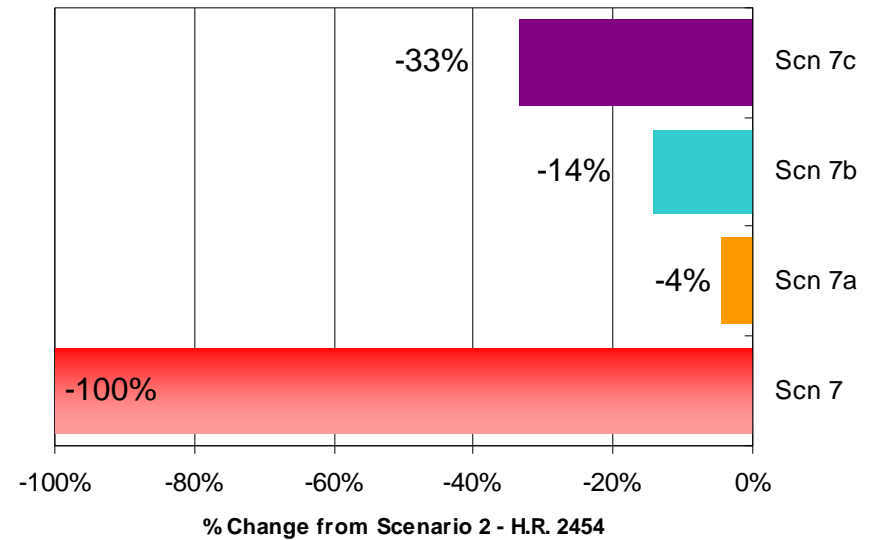
International Offsets Sensitivities

Allowance Prices & Cumulative International Offsets (IGEM)

Marginal Cost of GHG Abatement Sensitivities



Cumulative Int'l Offsets Usage (2012-2050)



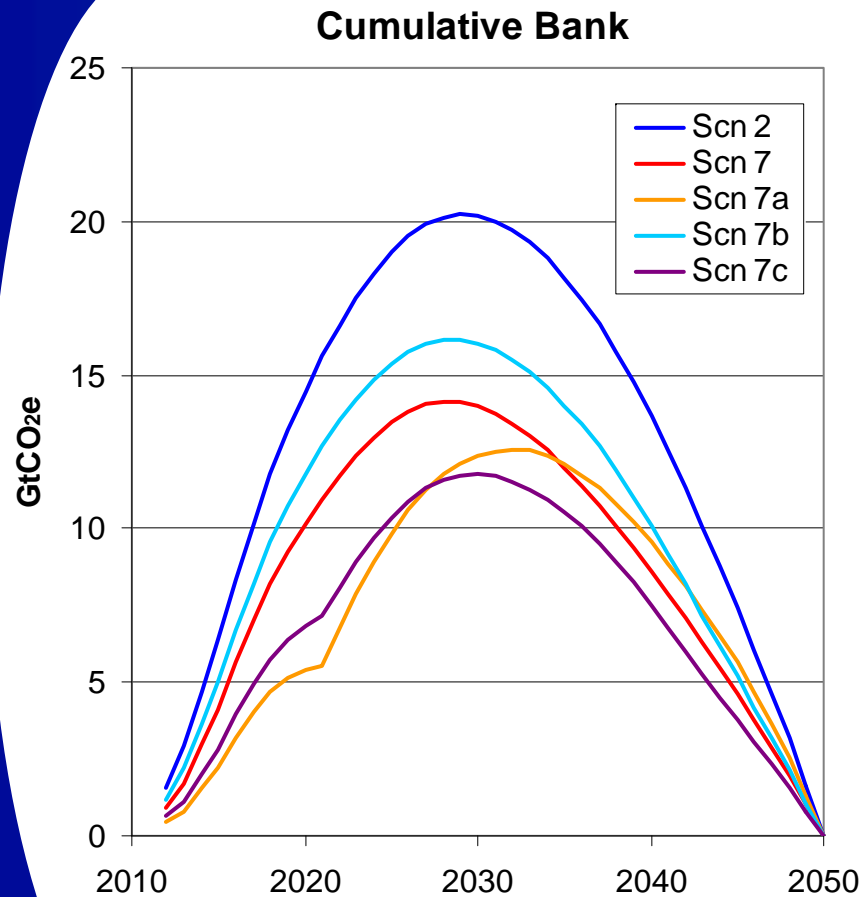
Cumulative International Offsets Usage (GtCO₂e)

Scn 2 - H.R. 2454	42
Scn 7 - H.R. 2454 - No Int'l Offsets	0
Scn 7a - H.R. 2454 - Delayed Int'l Offsets	40
Scn 7b - H.R. 2454 - No Extra Int'l Offsets	36
Scn 7c - H.R. 2454 - Delayed & No Extra Int'l Offsets	28



Cumulative GHG Allowance Bank

Scenario Comparison (IGEM)



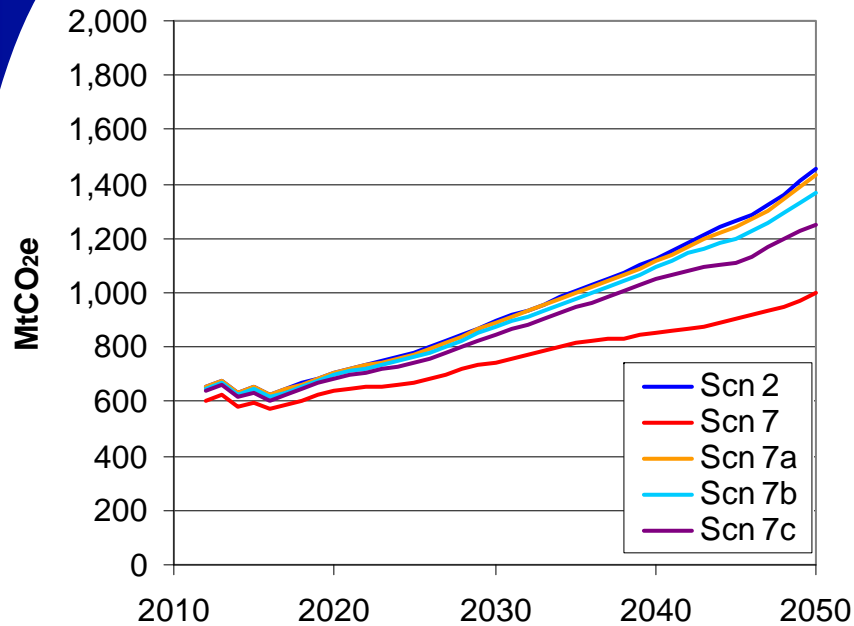
- H.R. 2454 allows for unlimited banking of allowances, as a result the allowance prices in both models grow at the exogenously set 5% interest rate.
 - If instead the allowance price were rising faster than the interest rate, firms would have an incentive to increase abatement in order to hold onto their allowances, which would be earning a return better than the market interest rate. This would have the effect of increasing allowance prices in the present, and decreasing allowance prices in the future. Conversely, if the allowance price were rising slower than the interest rate, firms would have an incentive to draw down their bank of allowances, and use the money that would have been spent on abatement for alternative investments that earn the market rate of return. This behavior would decrease prices in the present and increase prices in the future. Because of these arbitrage opportunities, the allowance price is expected to rise at the interest rate.
- In all modeled scenarios, a bank of allowances is built up in early years, and drawn down in later years so that the cumulative covered emissions (net of offsets) over the 2012 – 2050 period is equal to cumulative emissions allowed under the cap.
- The IGEM model builds up a larger bank of allowances than the ADAGE model. The reason for this is mobility of capital in the two models. ADAGE has a putty-clay capital structure with quadratic capital adjustment costs, while IGEM has perfectly mobile capital. The capital adjustment costs in ADAGE slow down the movement of capital, and make it harder to build up a large bank of allowances in early years.
- As modeled, the allowance bank goes to zero in 2050, however unlike previous bills analyzed by EPA, H.R. 2454 specifies a cap past 2050. The banking behavior predicted by the models is dependent on the complete credibility of the caps. Firms bank allowances beginning in 2012 in anticipation of rising allowance prices that are driven in part by the out year caps. If firms believe that Congress may revise the caps, then the incentive for banking is diminished, as an upwardly revised cap would reduce the value of banked allowances. If the caps past 2050 are credible, then a positive bank would still be held in 2050 at the end of the model run, and allowance prices would accordingly increase.



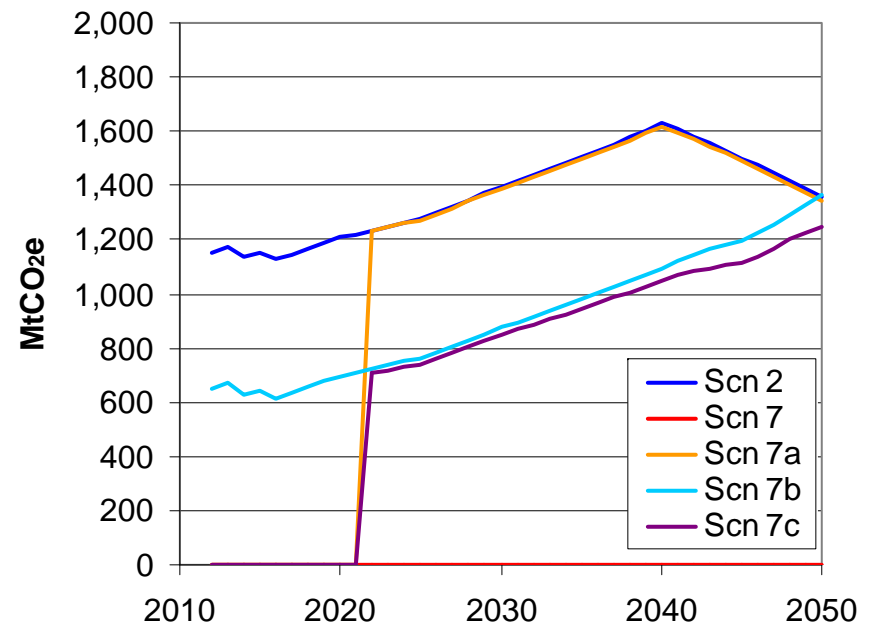
International Offsets Sensitivities

International Offsets Limits (IGEM)

1/2 of Total Offsets Limit



Adjusted Int'l Offsets Limit

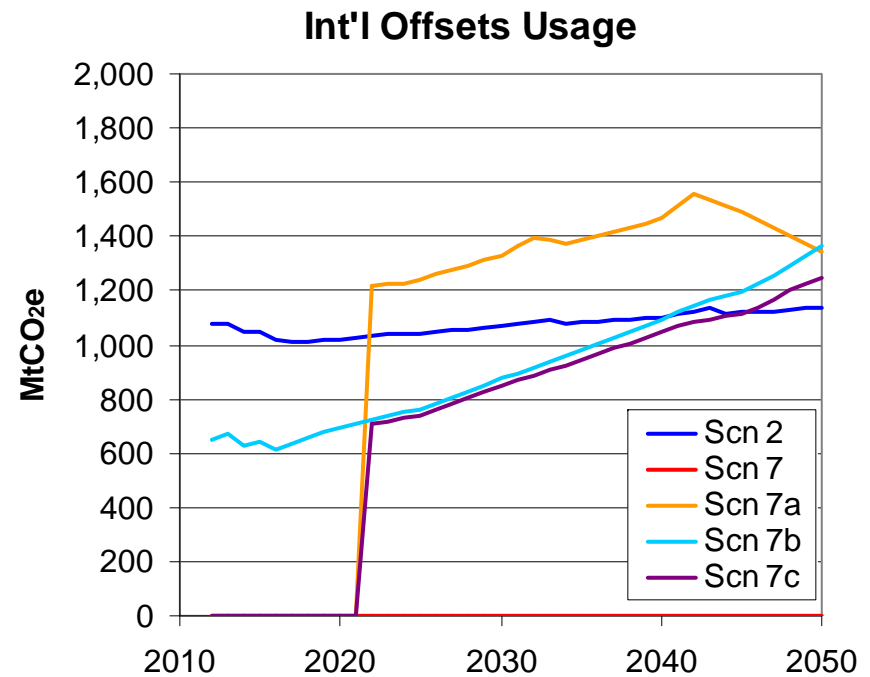
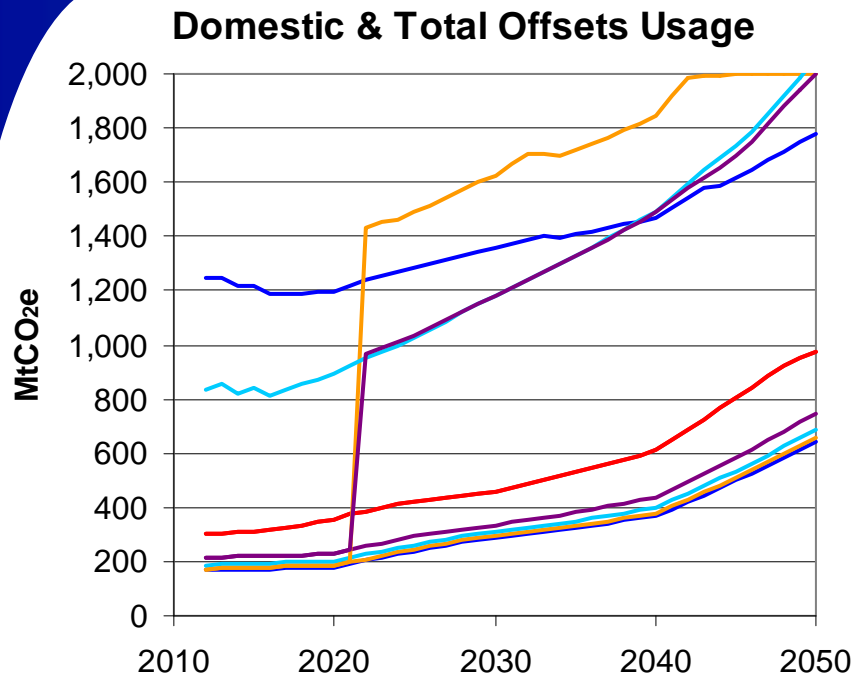


- “1/2 Total Offsets Limit” represents the limits on domestic and international offsets from H.R. 2454 Sec. 722 (d) (1) (A) & (B)
- “Int'l Offsets Adjusted Limit” represents the limit on international offsets after adding in the extra international offsets allowed under H.R. 2454 Sec. 722 (d) (1) (C) when the usage of domestic offsets is below 1,000 MtCO₂e.
 - Scenario 7a sets the limit on international offsets to zero for the first ten year.
 - Scenario 7b does not allow any extra international offsets from Sec. 722 (d) (1) (C).
 - Scenario 7c sets the limit on international offsets to zero for the first ten year, and does not allow any extra international offsets from Sec. 722 (d) (1) (C).



International Offsets Sensitivities

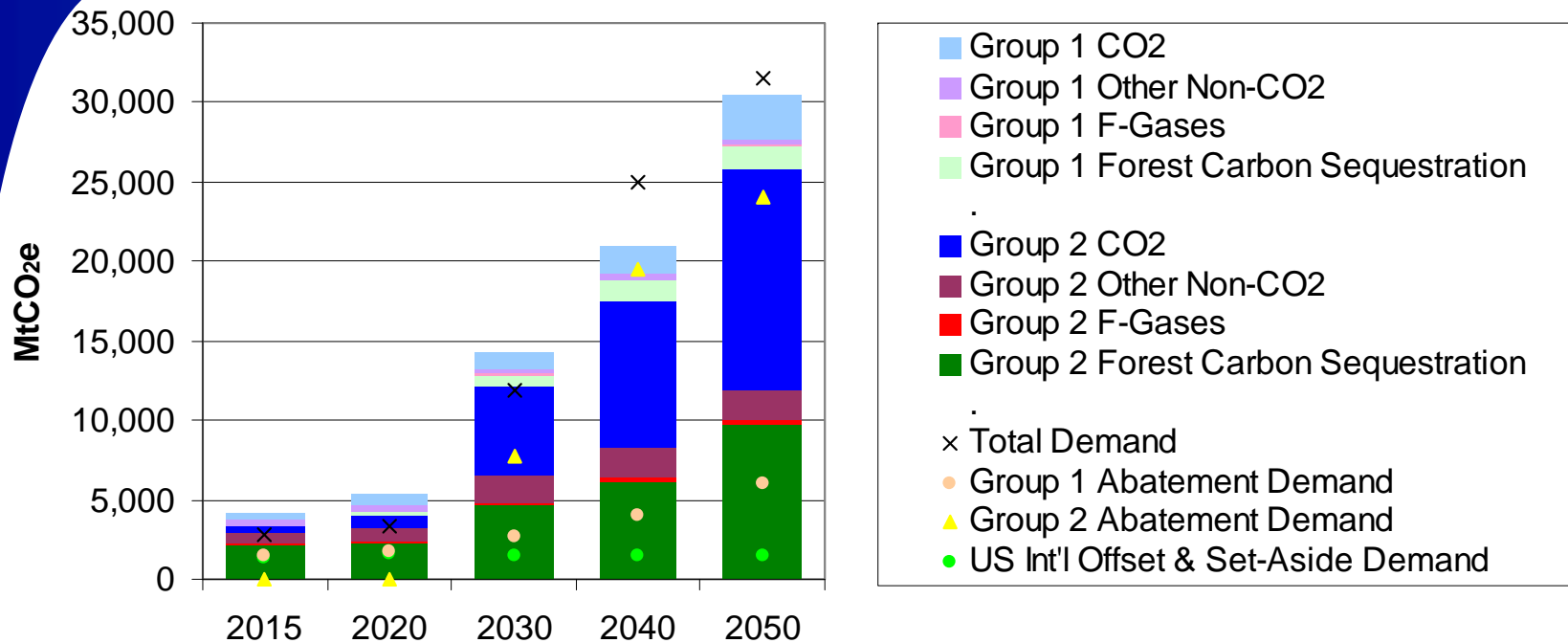
Offsets Usage (IGEM)



- Scenario 7a sets the limit on international offsets to zero for the first ten year.
- Scenario 7b does not allow any extra international offsets from Sec. 722 (d) (1) (C).
- Scenario 7c sets the limit on international offsets to zero for the first ten year, and does not allow any extra international offsets from Sec. 722 (d) (1) (C).



International GHG Abatement Supply & Demand



- International policy assumptions are based on those used in the 2007 MIT report, “Assessment of U.S. Cap-and-Trade Proposals.”
 - Group 1 countries (Kyoto group less Russia) follow an allowance path that is falling gradually from the simulated Kyoto emissions levels in 2012 to 50% below 1990 in 2050.
 - Group 2 countries (rest of world) adopt a policy beginning in 2025 that returns and holds them at year 2015 emissions levels through 2034, and then returns and maintains them at 2000 emissions levels from 2035 to 2050.



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This presentation is based on EPA's analysis of H.R. 2454, available online at:

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