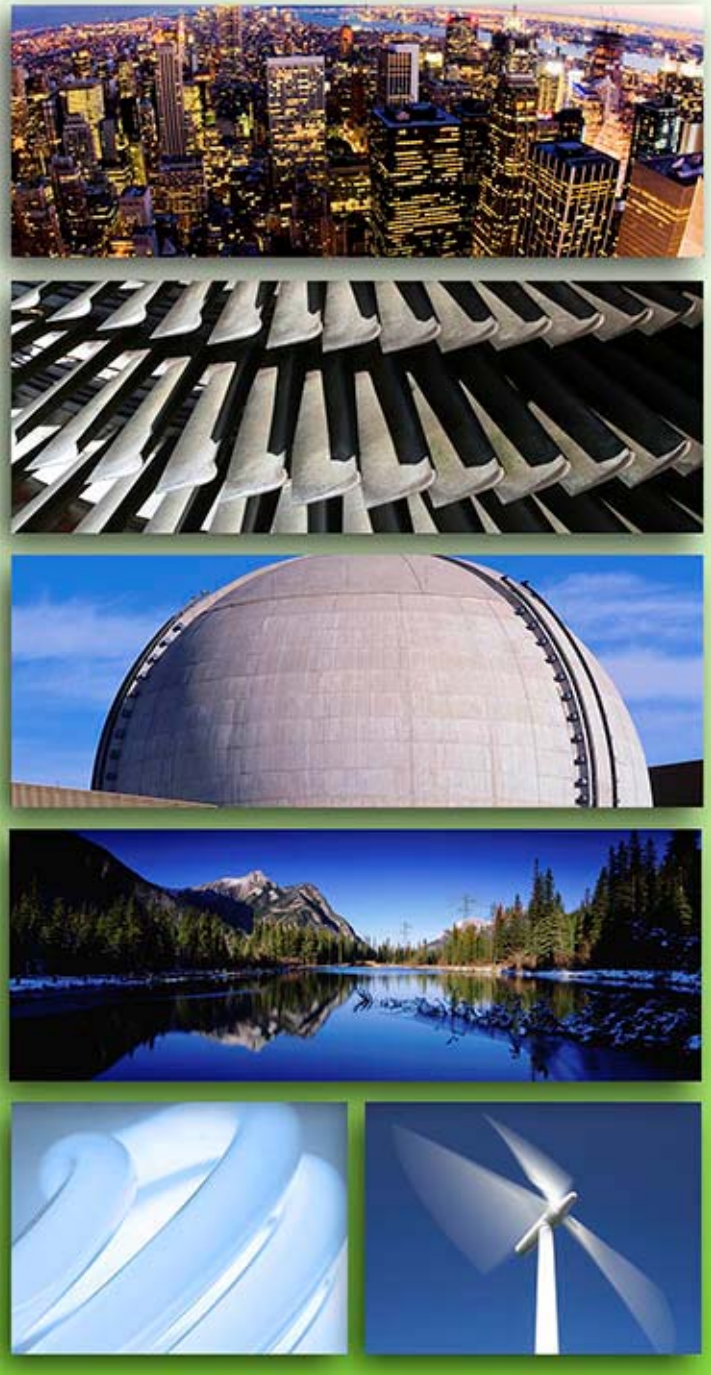

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The Key Role of Greenhouse Gas Emissions Offsets in Evolving GHG Cap-and-Trade Programs

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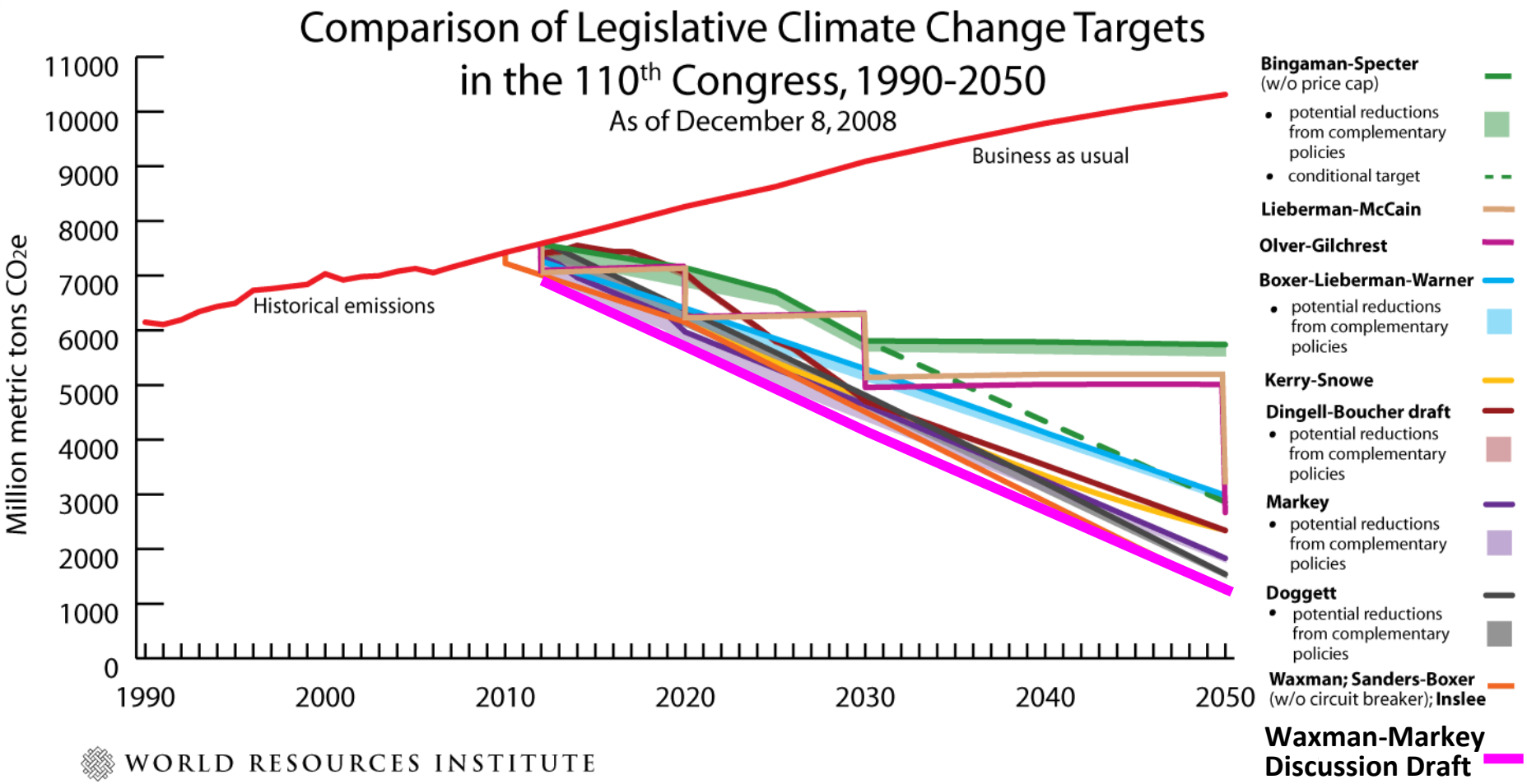
EPRI Global Climate Change Research Seminar
May 21, 2009

Today's Discussion

1. The GHG emissions reduction challenge and the benefits of offsets
2. Interaction of GHG offsets with GHG cap-and-trade emission reduction programs
3. Key offset elements and issues
4. Offsets and Waxman-Markey (HR 2454)

The GHG Emissions Reduction Challenge

All Major Policy Proposals in the U.S. Require Rapid and Dramatic Cuts in CO_2 Emissions



All Proposals Use Cap-and-Trade!

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Cap and Trade Compliance Options

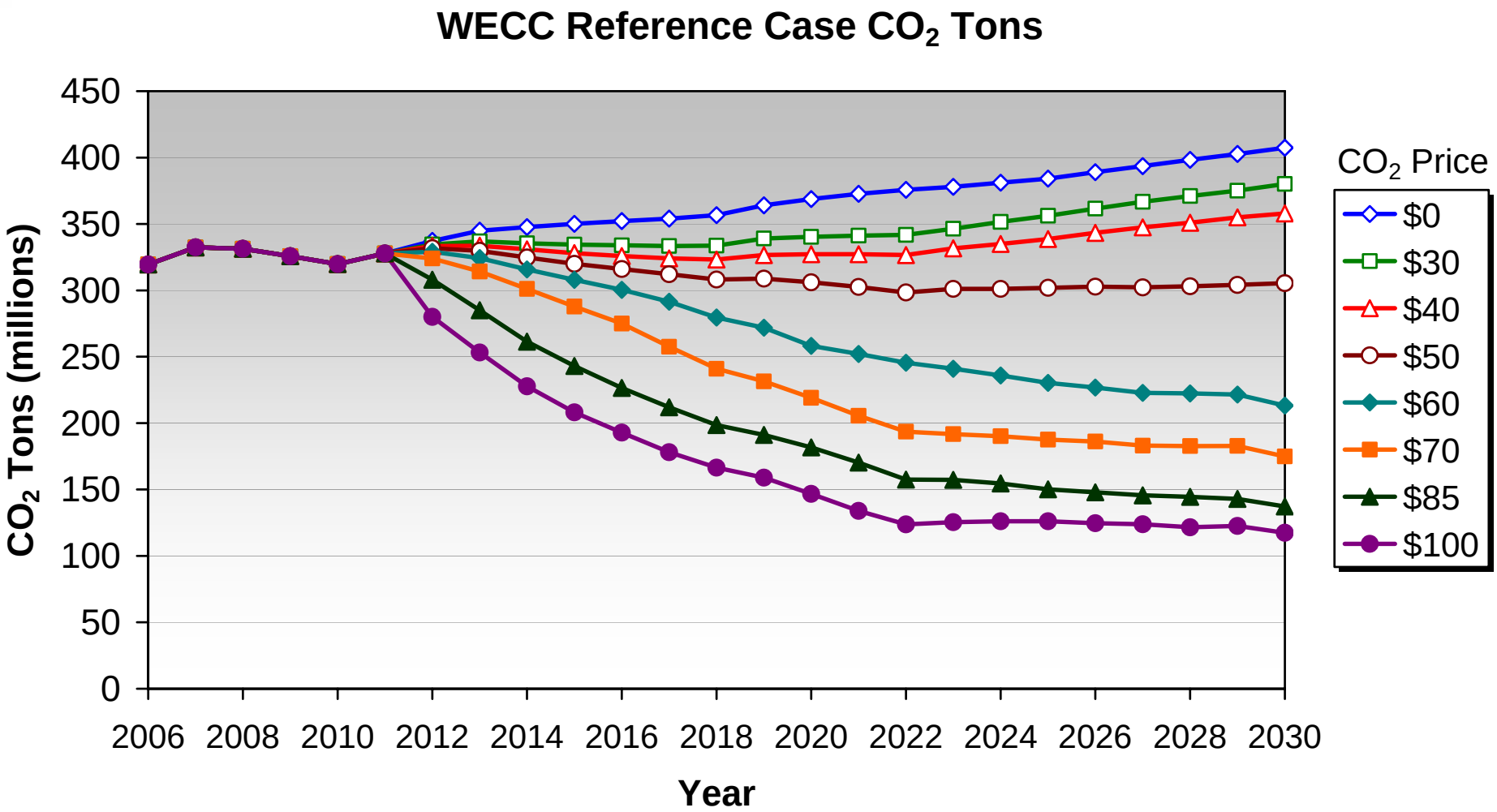
IF an electric company is allocated fewer allowances than its expected GHG emissions, **THEN** the company can achieve compliance by optimizing the least-cost option of:

- Internal GHG abatement
- Buy GHG allowances in the market
- **Buy or develop GHG offsets**
- Suffer non-compliance penalties (not really on option *per se*)

Near-Term Implications of Rapid and Steep GHG Reduction Targets and Timetables

- No large-scale, low-cost GHG abatement options are available in the electric sector in the near term (5-10 years)
- CO_2 prices will rise to a level that forces changes in regional power dispatch so natural gas plants displace coal-based generation
  - ~\$50/tonCO_2e prices to maintain emissions at 2005 levels
  - >\$50/tCO_2 to reduce GHG emissions
- GHG allowance prices will be very high, ***unless…***
  - **Abundant offsets available from unregulated sources**
  - Safety valve or other price-control mechanism(s)
  - Massive GHG reductions by other regulated sectors (unlikely)

CO_2 Emissions by CO_2 Price ($/t$CO_2$)



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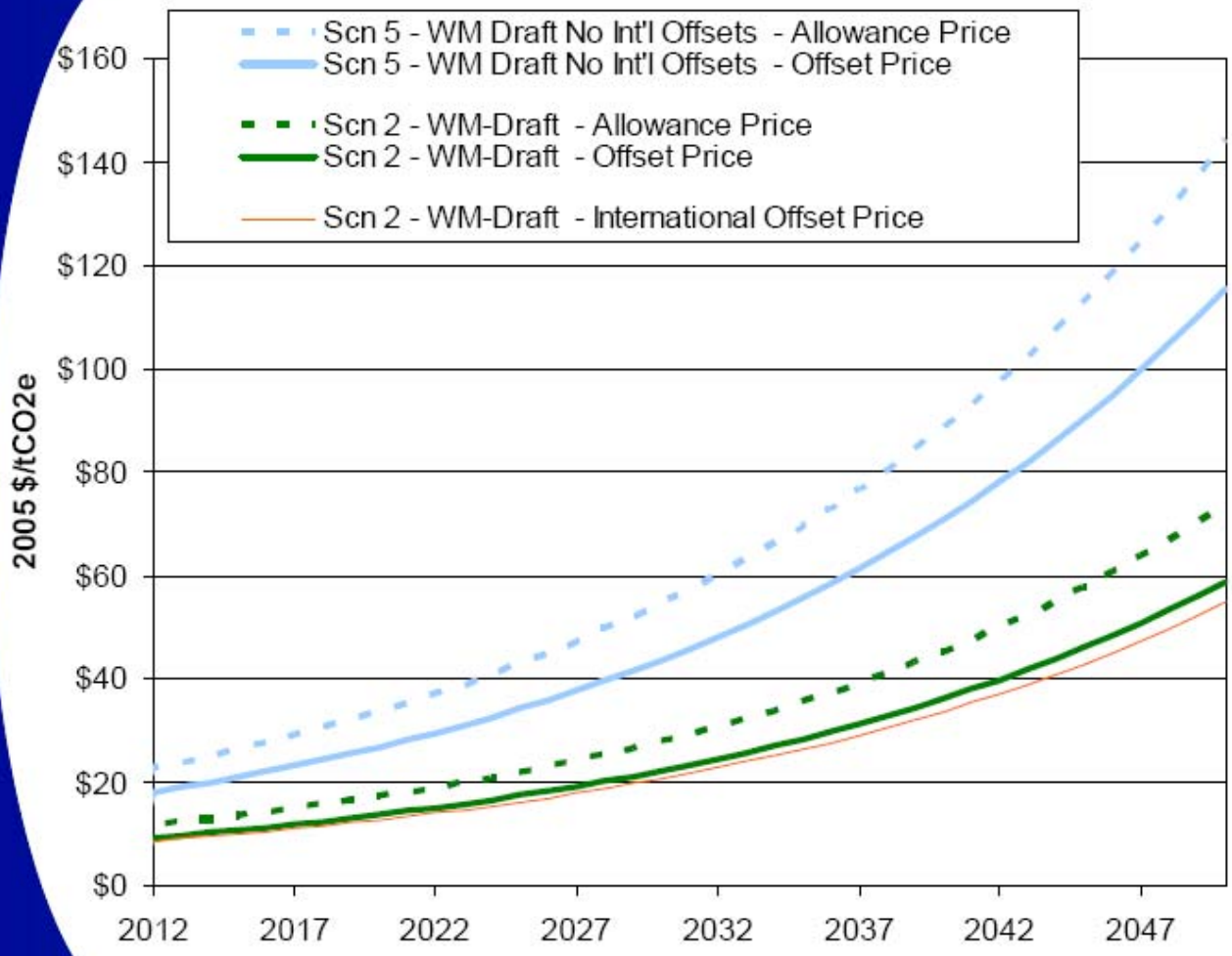
The Potential Benefits of GHG Offsets

- Reduce the cost of compliance for regulated entities and society
- Reduce GHG emissions in uncovered economic sectors and regions
- Provide an incentive to develop new GHG abatement approaches and technologies
- A mechanism to "link" global carbon markets
- A "bridge to the future" that allows time for new technology development and a broader array of sectors and nations to participate in GHG mitigation efforts.

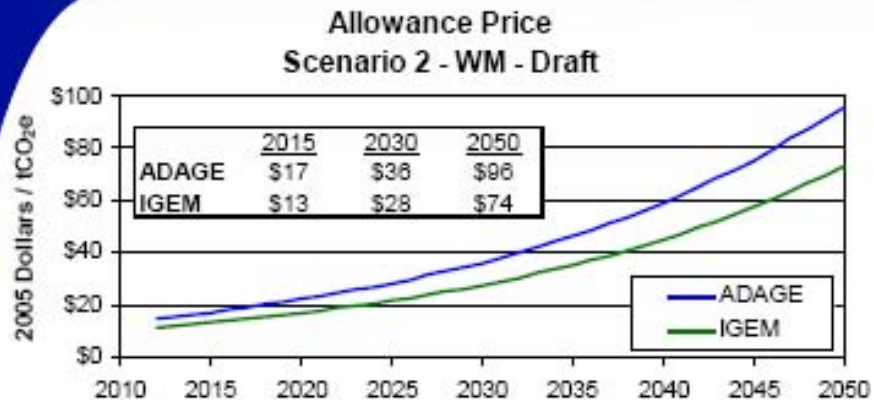
Offset and Allowance Prices

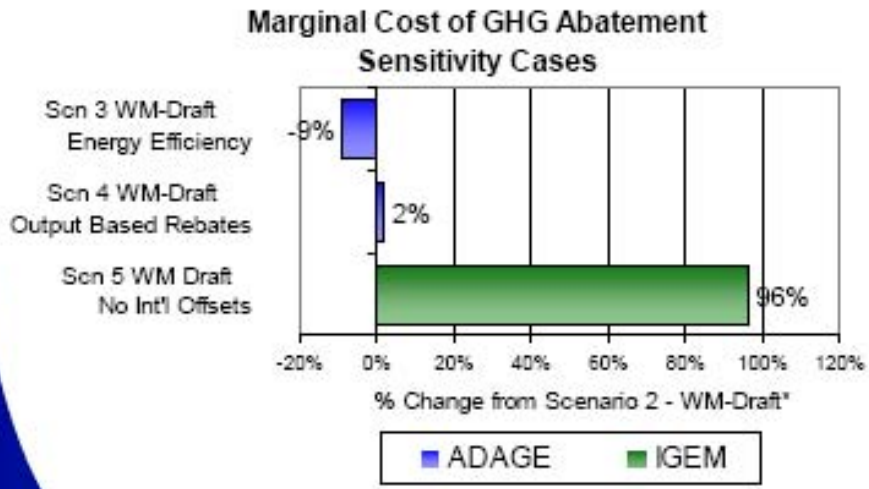
WM-Draft Scenario Comparison (IGEM)



- WM-Draft limits the use of domestic and international offsets each to 1 billion ton CO_2e per year.
- The limit on the use of domestic offsets is non-binding in all years.
- All offsets are discounted so that 5 tons of offsets must be turned in for every 4 offsets credits received.
- Since the limit on offsets is non-binding, demanders are willing to pay a price equal to the allowance price for each ton of offsets *after* discounting.
- Suppliers of offsets thus receive a price equal to 80% of the allowance price for each ton of offsets supplied *before* discounting
- The international offset price is driven by the international demand and supply of GHG abatement, the price shown here is the price *before* discounting.

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%.

GHG Offsets in Emissions Cap and Trade Schemes & Potential Offset Benefits

Two Distinct Types of Carbon "Markets"

- Allowance markets – "*Cap and trade*" programs that allocate GHG emissions which are traded to achieve compliance goals.
  - AAU trading between nations under the Kyoto Protocol
  - EU Emissions Trading Scheme (EU-ETS)
  - Northeast Regional GHG Initiative (RGGI)
- GHG offset / credit markets – "*Baseline and credit*" schemes that award GHG offsets for specific projects that reduce GHG emissions against a project-specific baseline and are traded and used for compliance purposes.
  - U.N. Clean Development Mechanism (CDM) & Joint Implementation (JI) programs
  - Australia NSW Greenhouse Gas Abatement Scheme (NSW-GGAS)
  - Chicago Climate Exchange (CCX)
  - RGGI offsets market

What are GHG Offsets?

Project-based GHG reductions that are *real, additional, permanent, measurable and verifiable* generated in **sectors and regions *outside of the boundaries*** of a GHG emissions cap and trade program.

Emissions *Offset* (aka ”Credits”)

Project-based GHG or CO_2 emission reductions compared to ”business-as-usual” emissions
(e.g. 1 offset = 1 ton of CO_2e GHG *emissions reduction*)

Accessing Offsets for Compliance

- "Build" option (i.e., develop "in house")
  - May be able to acquire "low-hanging fruit," but…
  - Requires dedicated staff and resources and specialized expertise
  - Willingness to take on project and other related risks
  - Non-core business for electric companies
- "Buy" option
  - Similar to SO_2, NO_x, and fuels purchases
  - Flexible approach to respond to changing circumstances
  - Diversify and reduce corporate risk
  - Offset suppliers include:
    - "Project developers" (e.g., CAMCO, EcoSecurities, MGM and others)
    - Carbon funds (e.g., Natsource GG-CAP)
    - Financial Institutions / Brokers (e.g., Morgan Stanley, Fortis Bank, Evolution markets, etc…)

Key GHG Offset Policy Issues

1. Should GHG offsets be incorporated in evolving international and domestic climate policies?
   - Proposed US federal GHG legislation
   - US regional schemes (e.g., CA (AB-32) / RGGI / WCI)
   - Post-2012 international agreement

   If so…then…

2. What kind of offsets should be allowed?
   - Eligible categories / types?
   - Eligible quantities?
   - Approved methodologies / protocols?
   - "Source" regions (domestic v. international)?
   - How should key technical issues be addressed?
   - **How can we achieve the necessary scale?**

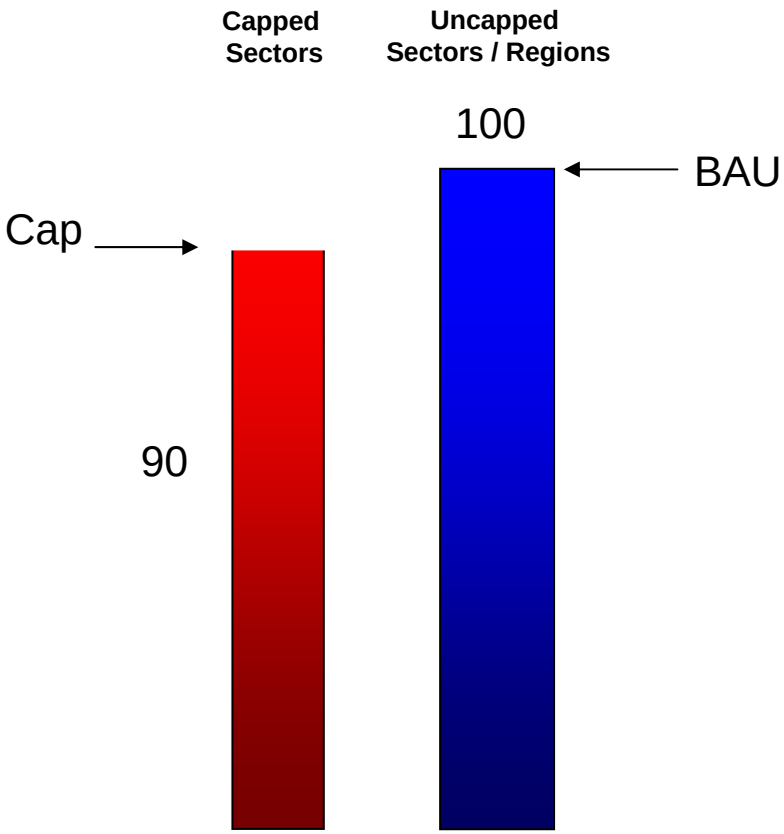
Key Offset Elements and Issues

Key Offset Challenges

- Offset projects may turn out *not* to be **additional** so credits may be issued for projects that would have been implemented under "business-as-usual."
- Project **baselines** may be incorrect so an offset project may yield *more* or *less* GHG emissions reductions than expected.
- Offsets may not to be **permanent** so emissions reductions in one period may be re-emitted later intentionally or unintentionally.
- Offset projects may cause **leakage** leading to credits being issued for "phantom" reductions.
- Some claim the *cost containment* provided by offsets may reduce compliance costs, but also may reduce the incentive to invest in low-carbon technologies in the near term.

GHG Offsets Can Substitute Emissions Reductions in Uncapped Sectors & Regions for "Internal" Reductions

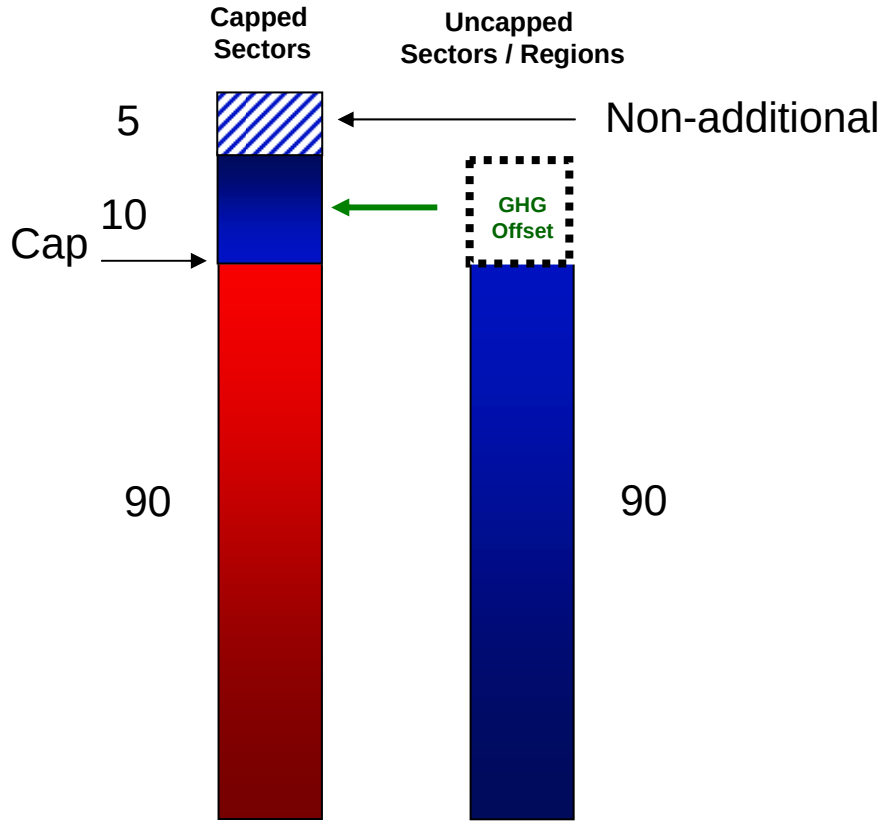
No Offsets



Total BAU = 200 Units (100+100)

Total GHG with Cap = 190 (90 +100)

Offset Included



Total BAU = 200 Units (100+100)

Total GHG with Cap = 190 (100 +90)

Total GHG with Cap = 195 (100+90+5)

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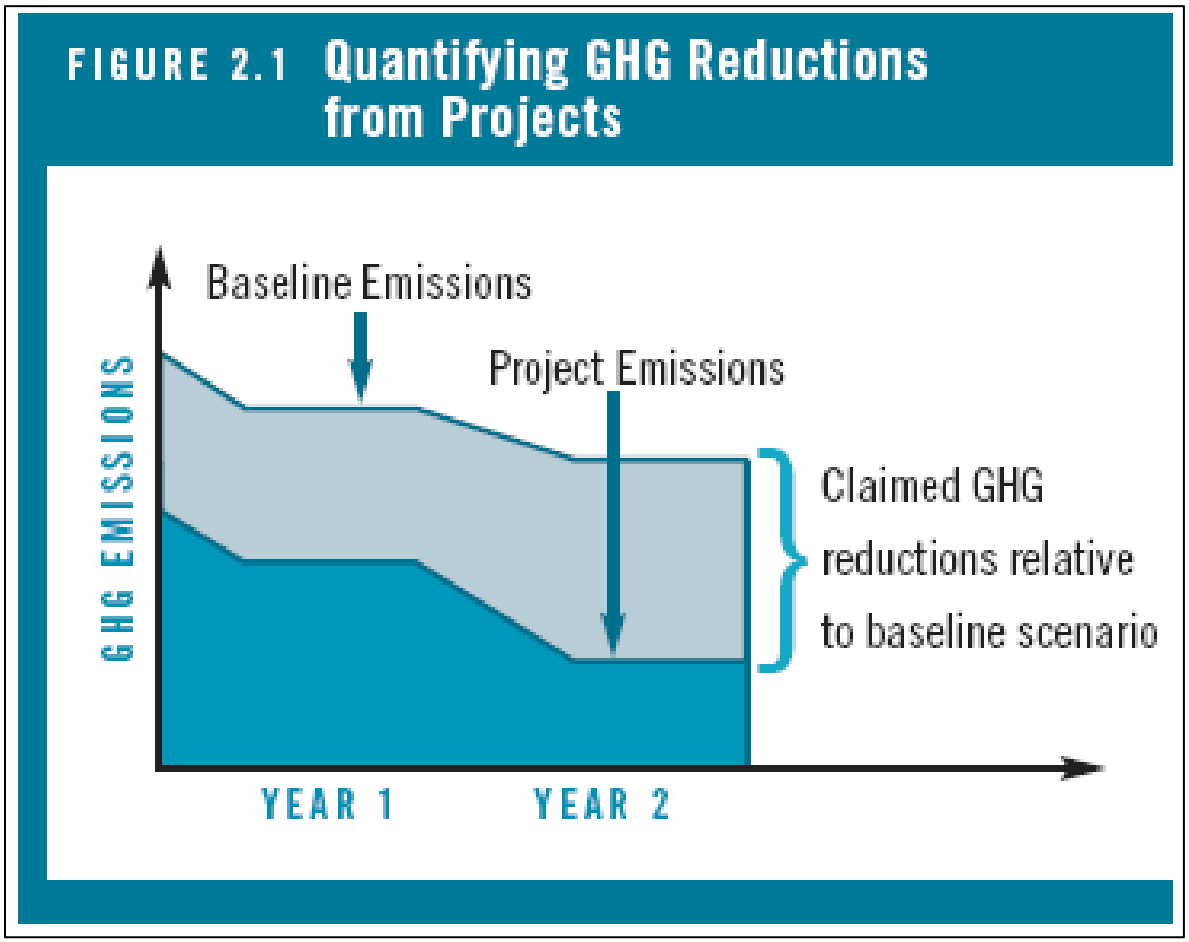
Additionality & Baselines

Additionality – What Are We Really Asking?

- **Additionality:** Would a proposed GHG emissions reduction (i.e., offset) project have happened ***in the absence of the offset market***?
  - Yes or No?
  - No perfect tests or empirically correct answers
- **Baseline:** What would have happened ***in the absence of the offset market***?
  - The proposed offset project?
  - Another alternative project?
  - Continuation of current BAU activities?

Adapted from presentation by Derik Broekoff, CA Climate Action Registry, at 2nd EPRI GHG Offsets Workshop, 9/10/2008.

GHG Project Baselines Cont. (2 of 2)



- Schedule of GHG emissions related to a project that are expected to occur in the absence of the project.
  - "Business-as-usual" (BAU) emissions; or
  - Alternative baseline
- An abatement project may generate GHG "offsets" to the extent it reduces GHG emissions below a baseline.

Source: *The Greenhouse Gas Protocol: Guidelines for Quantifying GHG Reductions from Grid-Connected Electricity Projects*, World Resources Institute (WRI) and World Business Council for Sustainable Development (WBSCD), 2007.

Additionality – *Project-Based Assessments*

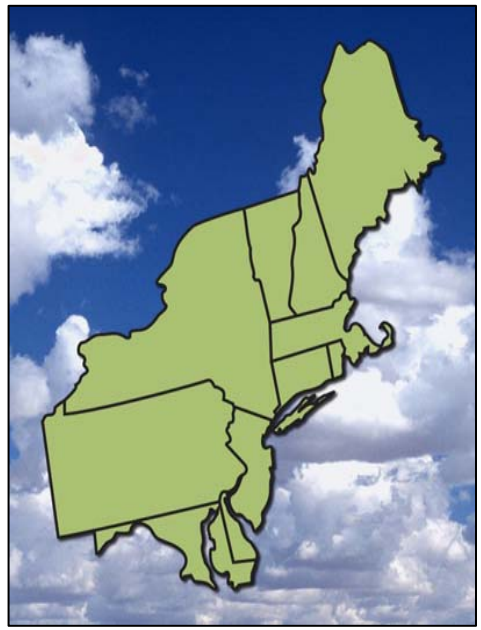
- Project-based methodology development
  - Offset project proponents submit project-specific methodologies for review, evaluation and approval.
  - GHG offsets are awarded based on the application of a specific methodology
  - Potentially more flexible than a simple "positive list," but can require very substantial efforts by both regulators and project proponents.
  - Adopted by the UN's CDM and JI programs.
- Barriers tests (e.g. institutional barriers)
- Investment tests (i.e., "financial" additionality)
- Other tests

Additionality – A *"Positive List" Approach*

- Pre-approval of specific GHG offset types
- *A priori* choice of types of offsets affirmatively to be allowed for compliance purposes.
- Typically involves development of approved "project protocols"
- GHG offsets awarded based on application of protocols
- Examples
  - NSW-GGAS
  - RGGI

Northeast Regional GHG Initiative (RGGI) Adopted a "Positive List" of Offset Types

1. Landfill gas capture (LFG)
2. CH_4 capture from animal waste
3. SF_6 reduction in T&D systems
4. End-use efficiency*
5. Afforestation



*Note: "End-use" efficiency here refers to items such as boiler upgrades in apartment buildings; not end-use electric efficiency items, such as CFLs or variable-speed drives etc….

Additionality – *Standardized Tests*
Screen Projects Based on Objective Criteria

- Involves a predefined technology/practice
- Does not involve predefined "common practice" technologies and/or practices
- Is not mandated by law
- Started after date X
- Has lower emissions than a predefined benchmark (i.e., a "performance standard")
- Is below/above a certain size
- Is not a (pre-specified) "least-cost" option
- Other….

Adapted from presentation by Derik Broekoff, CA Climate Action Registry, 2nd EPRI GHG Offsets Workshop, 9/10/2008.

Proportional Additionality

- Proportional additionality is based on the idea that the amount an offsets project is "additional" should reflect the actual market-penetration of a technology / application proposed to be used in an offset project:
  - If 10% of livestock producers are engaged actively in manure methane destruction projects, than an offset project proposing to engage in livestock methane destruction would be considered to be 90% additional.
  - Offsets would be granted based on the % of market penetration of the proposed technology / program
  - The level of project additionality would shift over time as technologies and practices come into more common usage.
  - Eventually current offset project types would no longer be additional.

Note: Based on ideas originally presented by Dr. Gordon Smith, EcoFor.

Permanence

Permanence

- ***Permanence*** refers to the potential to reverse GHG emissions reductions
  - Unintentional (e.g., fire, disease…)
  - Intentional (e.g., timber harvests)
- Of particular concern for terrestrial sequestration projects
  - Sequestered forest carbon may be re-emitted due to timber harvesting, forest fire & disease.
  - Sequestered soil carbon may be re-emitted when farmers revert from no-till to standard tillage

Source: Courtesy of Sam Sandburg, USDA Forest Service

- In contrast, some GHG abatement activities are permanent because they avoid or destroy GHG emissions
  - CH_4 destruction projects (LFG, digesters, CMM)
  - N_2O reductions in agricultural crop production

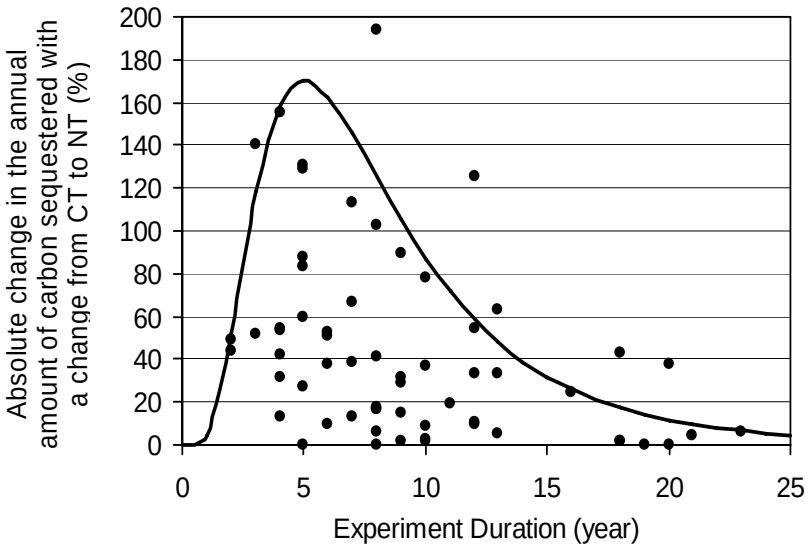
Why is Permanence an Issue?

- Volatility of sequestered carbon - sequestered carbon can be rapidly released back to the atmosphere on reversal of practices, fire etc...
- Saturation / New Equilibrium - differential rates of accumulation over time and a long run decline to a near zero rate of net sequestration
- Sustainability of Practices – crop rotations and herbicide resistance plus land diversion
- Contract Duration & Liability Terms - project payment terms, liability and duration influence offset value including leasing
- Uncertainty – how much carbon is sequestered and retained (not entirely a permanence issue, but closely related)

Source: Bruce McCarl, Ph.D., Texas A&M University

Saturation / New Equilibrium of Sequestration in Agricultural Soils and Forests

Soil C sequestration over time with change from conventional to no-till operations

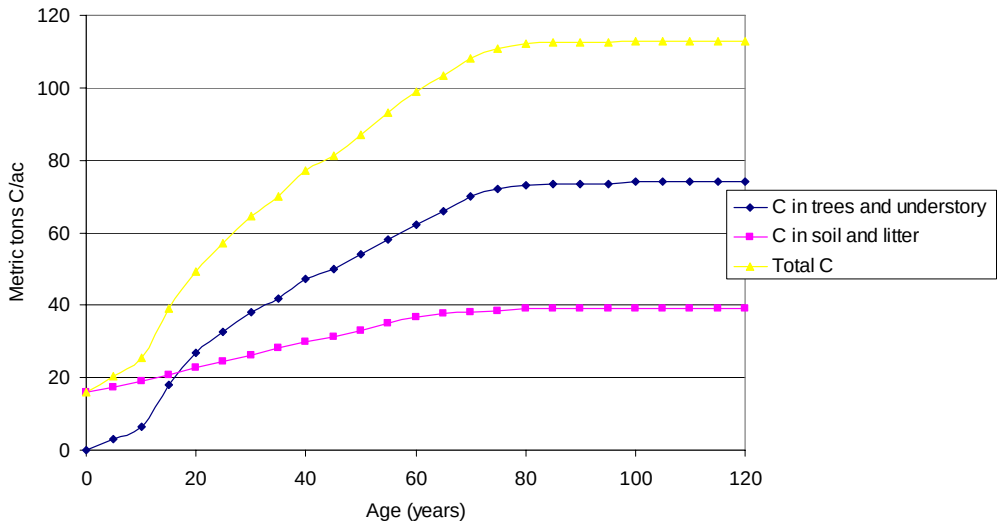


West and Post 2002 Soil Organic Carbon Sequestration by Tillage and Crop Rotation: A Global Data Analysis Soil Science Society of America Journal 66:1930-1946 (2002)

Note saturation by year 20

Forest C sequestration over time based on afforestation

Figure 2. Cumulative Carbon sequestration in a Southeastern U.S. pine plantation
Source: Data Drawn form Birdsey (1996)



Birdsey et al, USFS, FORCARB

Note saturation by year 80

Source: Adapted from Bruce McCarl, Ph.D., Texas A&M University, EPRI GHG Offsets Workshop, 2/19/09.

Possible Ways to Address Permanence

- Market price differentiation
- Risk-based discounting of offsets
- Operational & legal liability
  - Buyer / seller / negotiated liability
  - System-wide liability
- Insurance requirements / maintenance fees
- Regulatory differentiation (e.g., tCERs and lCERs)
- Creation of "buffer reserves"
  - Withhold a portion of each project's offsets based on an assessment of the project's permanence risk and place retained offsets in a "buffer reserve"
  - Project-specific or community-wide?

Allowance Set Asides

- Set aside an amount of *emission allowances* under the overall emissions cap to be issued to qualifying projects
  - Could solve both permanence and leakage
  - Incorporated into S.1766 (Bingaman-Specter)
  - If projects "succeed" in reducing emissions, than actual GHG emissions will be below the cap
  - If projects "fail" the emissions cap would still be maintained
- But….Implementing a set-aside is highly contentious
  - If the overall emissions cap is reduced to create a "set-side," this will force regulated emitters to reduce their emissions even further, increasing costs for them and society at large
  - If the overall cap is increased to create the set aside, this may lead to the concern that GHG emissions are not being reduced enough to contribute to climate change mitigation

Another Option – Put the Agriculture and Forestry Sectors Under the GHG Cap

- Help to create an economy-wide CO_2 price signal to force GHG emissions reductions to take place in sectors and regions where it would be most cost effective
- Need to incorporate both GHG emissions as well as GHG sequestration
- Difficult to implement given the challenges in measuring and monitoring GHG emissions and sinks across the agriculture and forestry sectors and the large number of potentially covered entities
- The New Zealand ETS has adopted this approach
  - The first covered sector in the NZ ETS is forestry
  - Livestock-related emissions will be covered in future years as part of the phased expansion of the NZ ETS

CCAR's Approach to Permanence: *Insurance Buffer Pool*

- Each project must undergo a risk assessment to determine the risk of reversal
  - Natural disturbances (wildfire, disease, insects, etc...)
  - Social (changing policies, political instability, etc...)
  - Management (overharvesting, illegal logging, conversion, etc…)
- Projects must contribute verified GHG emissions reductions into a CCAR-administered buffer pool.
  - Pool will be used to compensate system for any "unintentional" reversals to ensure overall program integrity.
  - Intentional reversals must be remedied by landowner / developer through financial restitution including possible penalties.
- CCAR will be re-insured and may seek 3rd party insurer to administer the pool.

Source: Adapted from John Nickerson, CA Climate Action Reserve, EPRI GHG Offsets Workshop 2/19/09.

Leakage

Emissions “Leakage”

- ***Leakage*** refers to a shift of GHG emissions to a location or sector outside of a GHG abatement project’s boundary where *they remain uncontrolled or uncounted*.
  - Leakage has been a contentious issue in the design of RGGI and CA climate policies
  - CA experimented with adoption of a “load-serving entity” approach rather than a “source-based” approach to reduce leakage.
- Examples:
  - Forest preservation may be offset by timber harvesting elsewhere
  - Reduced crop yields resulting from no-till farming may be offset by conversion of farmland elsewhere to make up for the lost yields.

Leakage: An Example

Afforestation project on agricultural land

Increased deforestation elsewhere to clear land For agriculture

Source: Adapted from Brian Murray, Duke University, EPRI GHG Offset Workshop 4, 2/19/09.

Why Do We Care About leakage?

- Erodes the GHG benefits/offset value of a project
- Impacts can be difficult to measure
- Difficult to enforce against leakage due to incomplete contracts
- Has the potential to undermine a project-based offset system

Source: Adapted from Brian Murray, Duke University, EPRI GHG Offset Workshop 4, 2/19/09.

Some Approaches to Handling Leakage

- Discounting – Reduce issuance of offsets for projects based on quantification of expected leakage
- Project Design – Address leakage directly in project design
  - e.g., grow a new forest plantation associated with a forest preservation-based offset project to "make up" the expected amount of "lost" timber supply
- Land – Do activity where displaced land use is declining.
  - Conversion of pastureland to forest where total pasture use regionally already is declining
  - Afforestation projects done on marginal farmland that is falling out of production

Source: Adapted from Brian Murray, Duke University, EPRI GHG Offset Workshop 4, 2/19/09.

Leakage Myths

- Leakage is the same as “activity shifting”
  - This is only the case if the “activity shifting” causes GHG emissions to shift outside of the accounting/policy boundaries
- All leakage is bad
  - You can get positive spillover effects (but they appear to be rarer)
- Leakage does not occur if projects are too small to affect the market price
  - This is incorrect. Work to date suggests comparatively more leakage occurs on smaller projects than larger ones
  - Small projects don’t affect market prices because of leakage, and lots of other market participants exist who can replace the project’s contribution to the market without disruption

Source: Adapted from Brian Murray, Duke University, EPRI GHG Offset Workshop 4, 2/19/09.

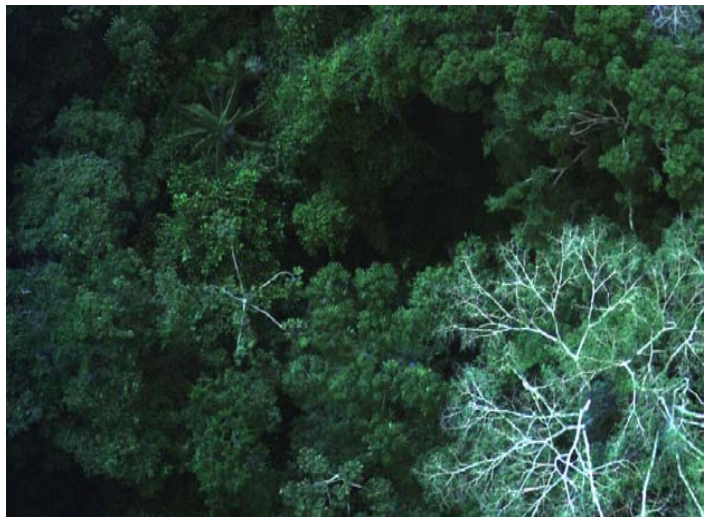
What Can We Do About Leakage?

- Ignore it!
- Adjust the overall cap to account for leakage
- Make the emissions cap comprehensive
  - All emissions get counted
  - Nothing leaks
- Minimize leakage through project design
  - Focus offsets on activities with low leakage potential
  - Minimize local leakage through contracts (is this possible?)
- Discount all offset credits
  - Estimate leakage (e.g., econometrically) and hold back offset credits accordingly
  - Option: true-up *ex-post* with system-wide accounting

Source: Adapted from Brian Murray, Duke University, EPRI GHG Offset Workshop 4, 2/19/09.

Measurement, Monitoring & Verification (MMV)

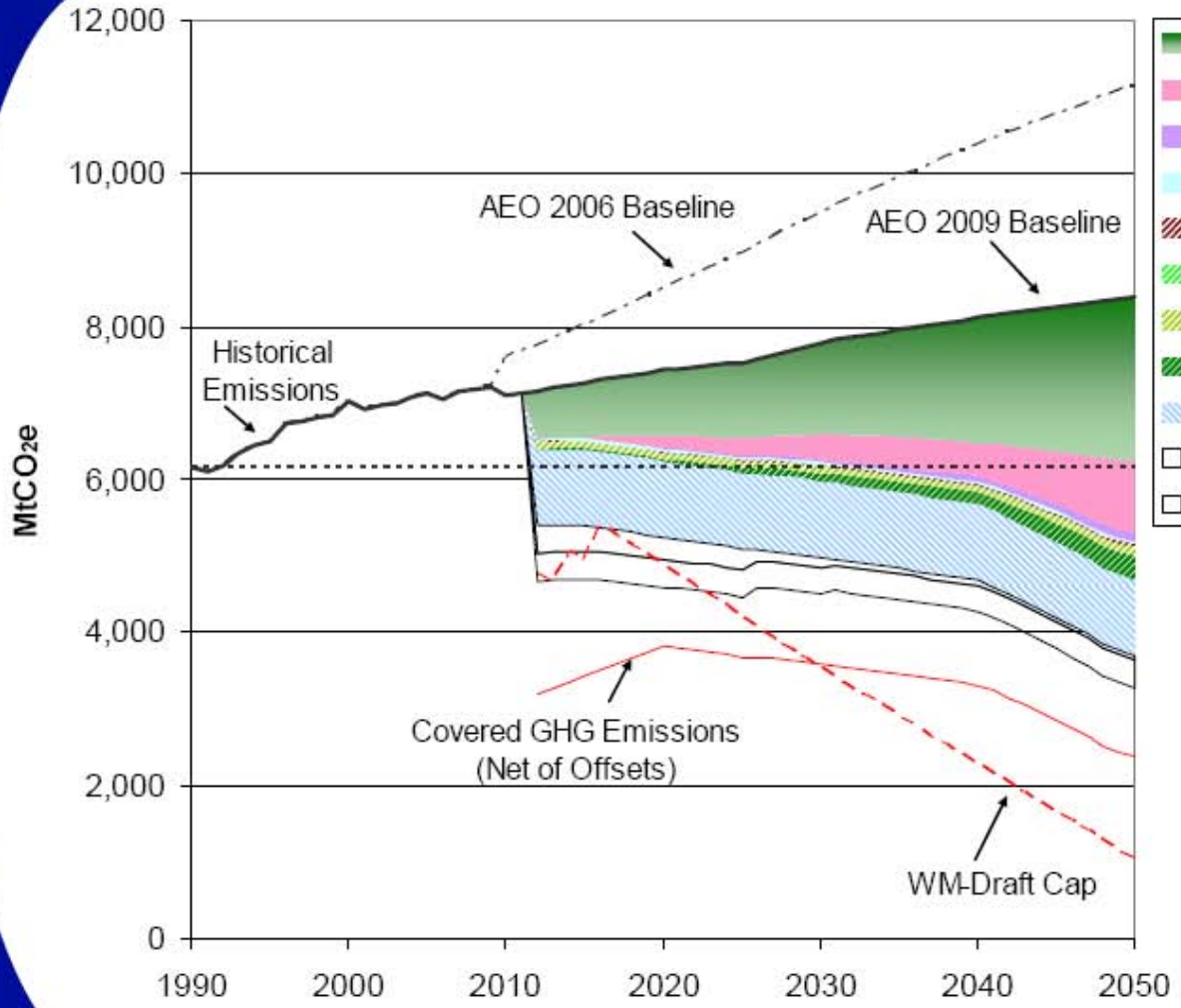
- Critically to creating GHG offsets
- Typically done by 3rd-party
- GHG offsets issued for GHG reductions that have been measured and verified.
- Projects need to be monitored to ensure they are implemented as designed.
- Verification assures that reported GHG emissions reductions have been accounted for in a manner consistent with the underlying project methodology or protocol.
- Key issue – How do we handle measurement uncertainty?



Offset in the Waxman-Markey Discussion Draft

Total US GHG Emissions & Sources of Abatement

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



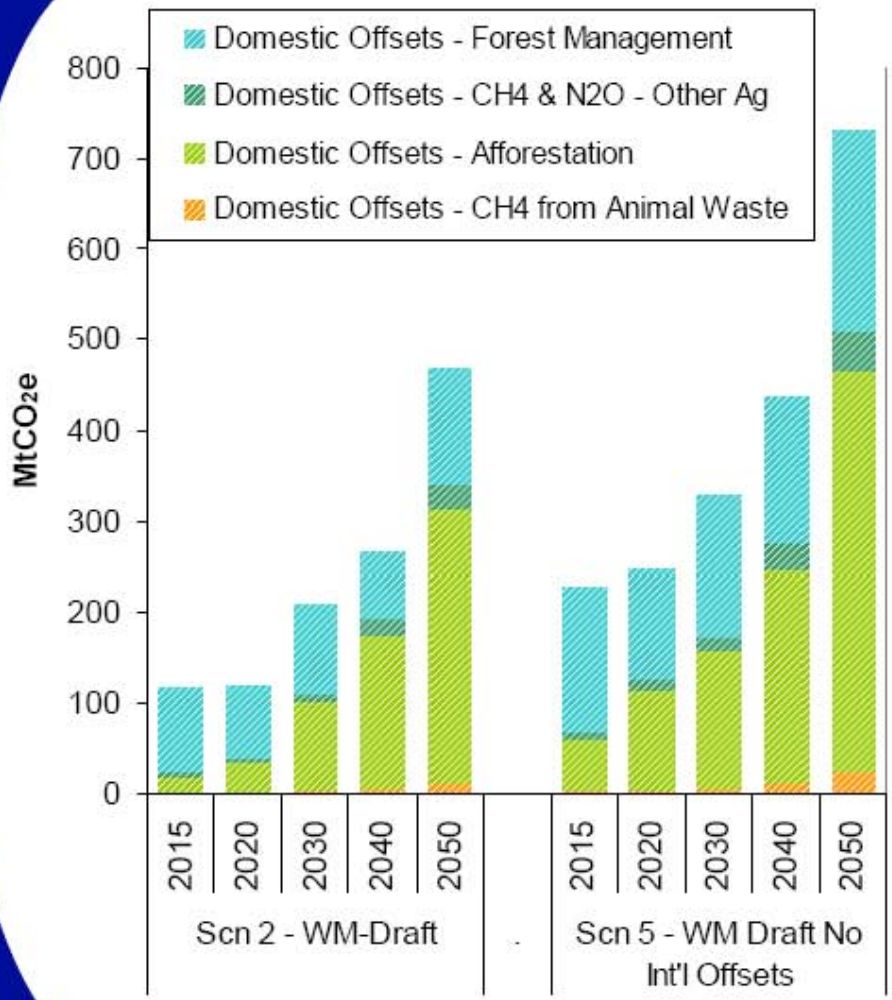
- The updated reference case for this analysis is based on AEO 2009, and the old reference case from EPA's S. 2191 analysis was based on AEO 2006.
- Cumulative 2012-2050 GHG emissions are 18% (67 bmt) lower in the AEO 09 baseline compared to the AEO 06 baseline in IGEM.
- The main reason for the lower emissions is 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 tons CO_2e of offsets each year split evenly between domestic and international. The domestic limit is non-binding in this analysis.

Offsets in Waxman-Markey HR 2454

- Domestic offsets
  - Agriculture & Forestry
  - Methane not available as offsets due to new NSPS (CMM & LFG)
- International Offsets
  - "Sectoral" offsets
  - Issued by an "international body" (e.g., CDM)
  - Reduced Emissions from Deforestation and Degradation (REDD)
- 2 billion ton CO_2 limit annually in *aggregate*
- Supplemental emissions reductions from reduced deforestation
  - Set-aside" of 5% of the U.S. CO_2 cap in 2012-25…)
  - 720 million tons CO_2 by 2020, which is equal to 10% of U.S. emissions in 2005, and 6 billion tons cumulatively by the end of 2025

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.
- Offsets discounting provisions in WM-Draft require that 5 tons of offsets be turned in for every 4 offsets used.
  - 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%.*
- Restricting the use of international offsets, as in "*scenario 5 – WM Draft No Int'l Offsets*" has a large impact on allowance prices (91% increase).
  - Without the use of international offsets, covered sectors are forced to find an additional 39 billion metric tons of abatement.

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

Key Insights

1. Offsets are an important “bridge” to a low-carbon future.
2. The availability of large-scale domestic and international offsets can help to reduce compliance costs, achieve GHG reductions in uncovered sectors and regions, and encourage innovation and entrepreneurship.
3. Need new designs / approaches to scale-up offsets to a meaningful level in a future carbon-constrained world.
4. Offsets can help to provide a mechanism to “link” existing and evolving carbon markets around the world.
5. GHG offsets face a variety of real and potentially serious challenges including additionality, baselines, permanence and leakage that need to be addressed if offsets are going to play a key role in near-term climate mitigation.
6. WM bill (HR 2454) includes significant provisions to create both domestic and international offsets.

Thank You

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