The Impacts of Quantitative and Qualitative Limits of Offsets Use on Compliance Costs and Technology

EPRI Greenhouse Gas Offset Policy Dialogue Workshop 2

Jae Edmonds & Kate Calvin

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Background: Why offsets?

- For climate it is cumulative, not annual emissions, by everyone, everywhere, over all time that matter.

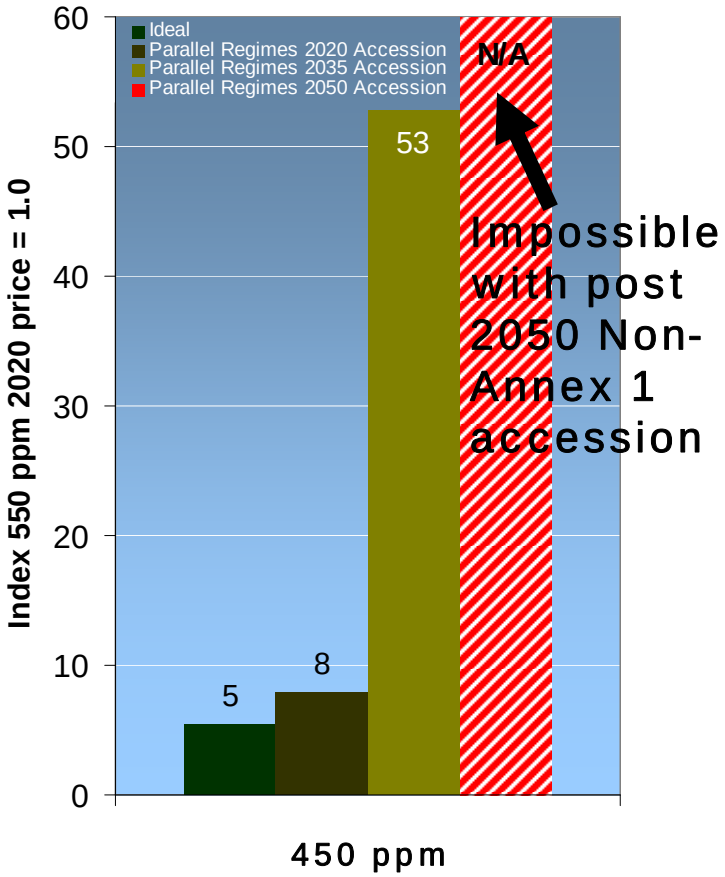
- Society's costs of meeting any climate stabilization goal are minimized when emissions are mitigated "where," "when," "what," and "how" they are cheapest.
  - Where—regional participation
  - When—timing of emissions mitigation
  - What—GHG's included
  - How—sectoral inclusion

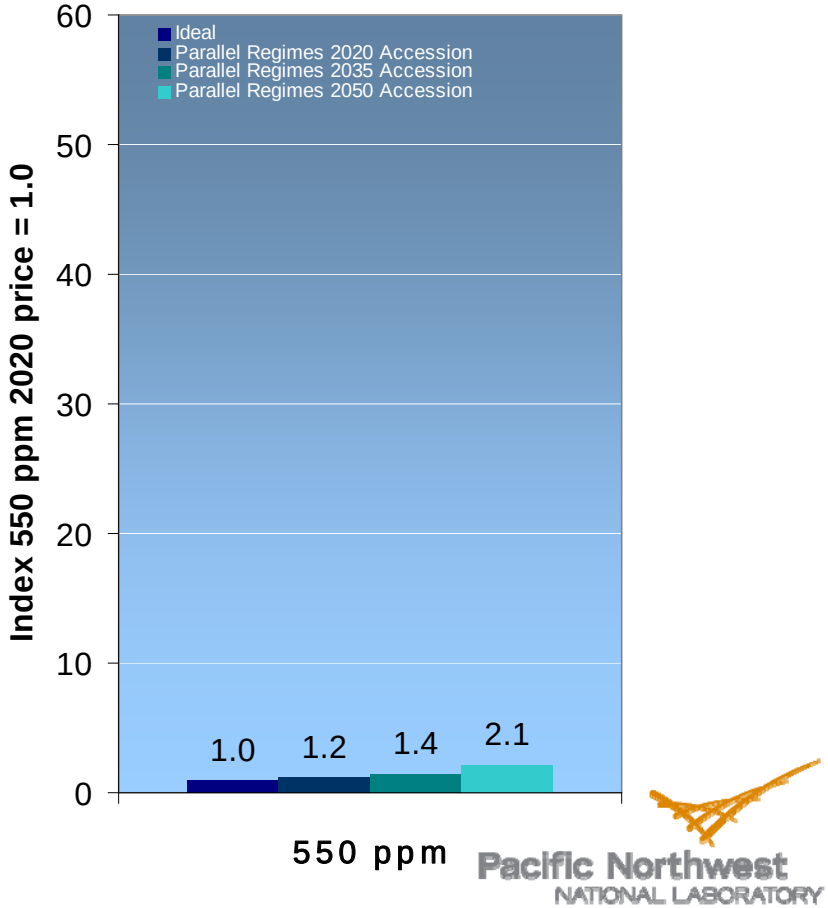
All Net Carbon Emissions Affect the Atmosphere.

- To the extent that marginal costs are similar across all emissions sources, costs will be minimized.
- To the extent that large marginal cost differences are created, then the total cost of carbon emissions mitigation will rise, and potentially by large amounts.
- Three Examples
  - International Participation
  - Timing of Emissions Mitigation
  - Electrification
  - Land use

"Where" Flexibility—International Participation in Emissions Mitigation

Year 2020 USA carbon prices for different international regimes: 450 and 550 ppm





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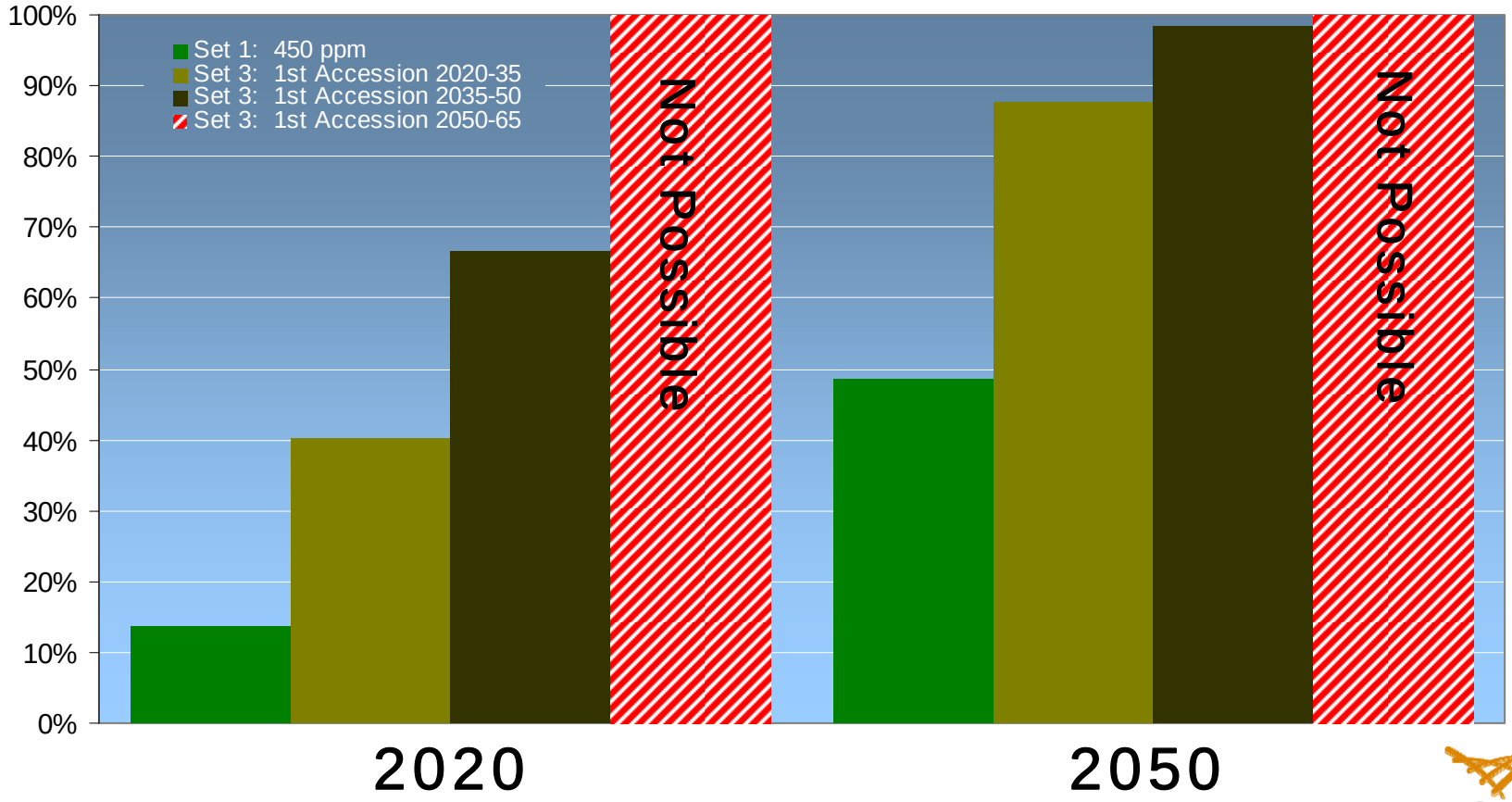
"Where" Flexibility—International Participation in Emissions Mitigation

- Offsets become increasingly important as the emissions limitation becomes more stringent.
- Absent the ability to reduce emissions outside of Annex I, some CO_2 concentrations limitations are not only vastly more expensive…
- …they are infeasible

"Where" Flexibility—International Participation in Emissions Mitigation

Years 2020 and 2050 Annex I emissions mitigation, relative to 2005, for different accession assumptions: 450 ppm



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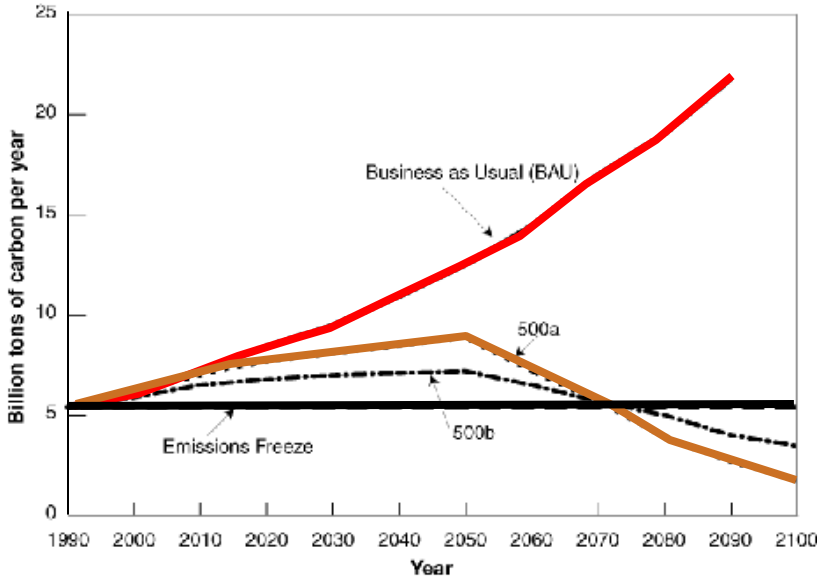
"When" Flexibility

- The ability to shift emissions over time allows more efficient allocation of resources.
- Edmonds and Richels (1995). "The Economics of Stabilizing Atmospheric CO_2 Concentrations." Energy Policy 23(4/5):373-378.



- Showed that stabilizing emissions, which implied a CO_2 concentration of 500 ppm, cost twice as much as a stabilization trajectory using "when" flexibility.

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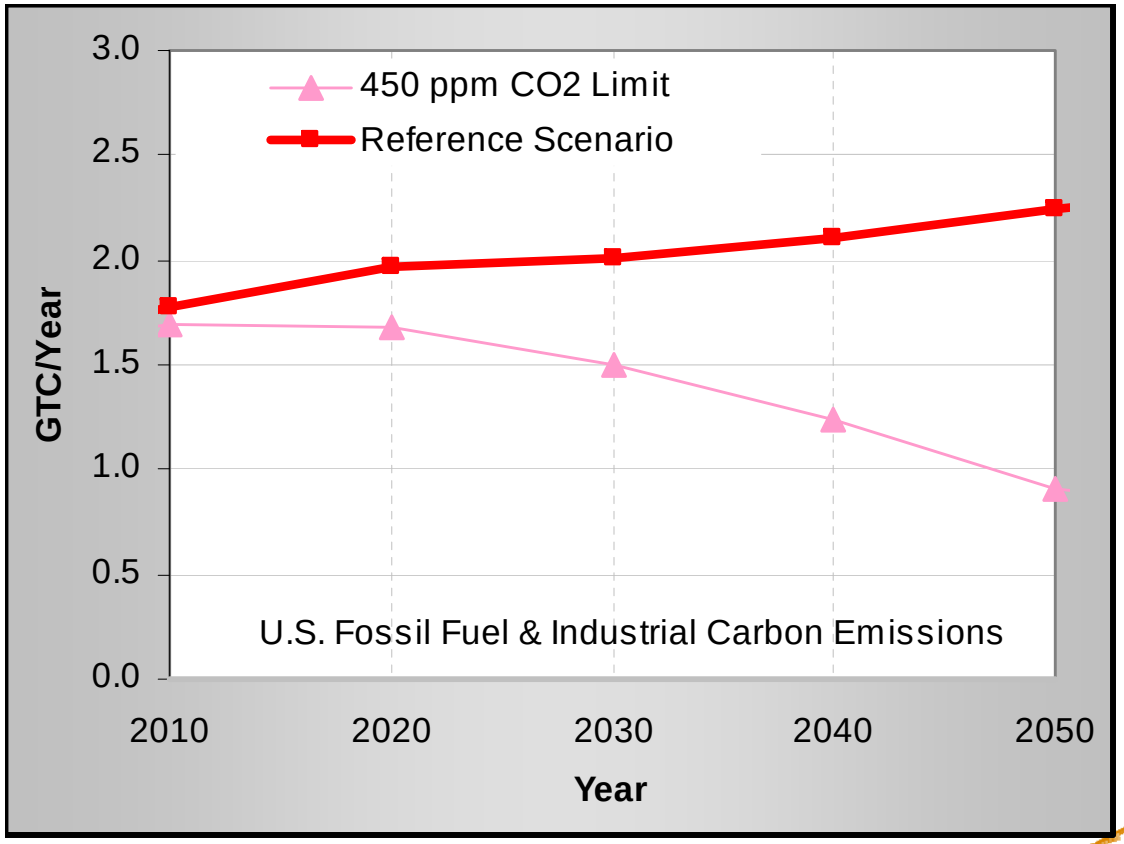
Mechanisms

- How to get the benefits of when flexibility and maintain compliance?
- Linked compliance periods with early over-subscription?

U.S. Emissions Along a 450 ppm Stabilization Trajectory



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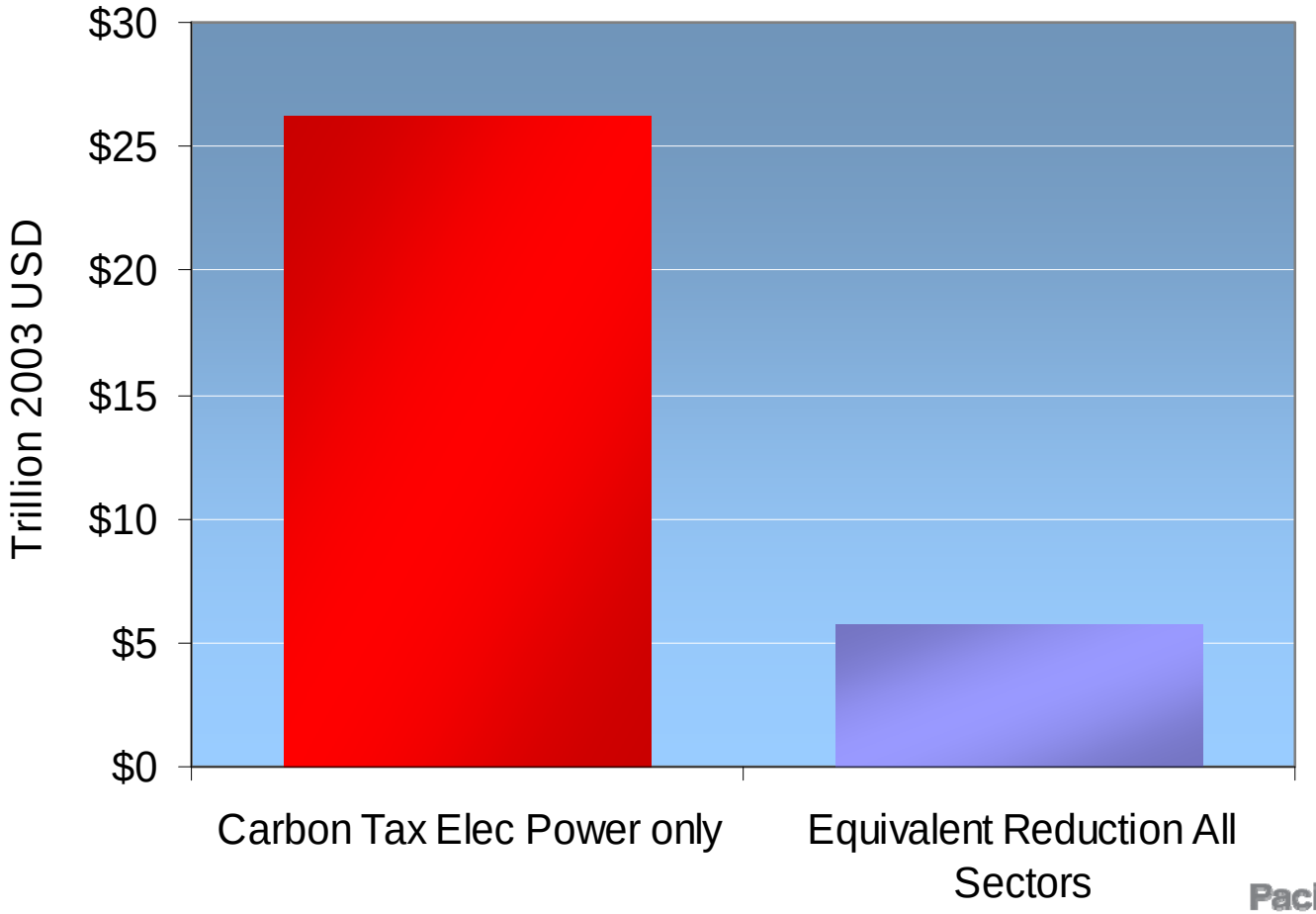
"How" Flexibility—Utilities

If only electric power generators see carbon prices, then the cost of reducing a tonne of carbon emissions rises by a factor of FIVE.



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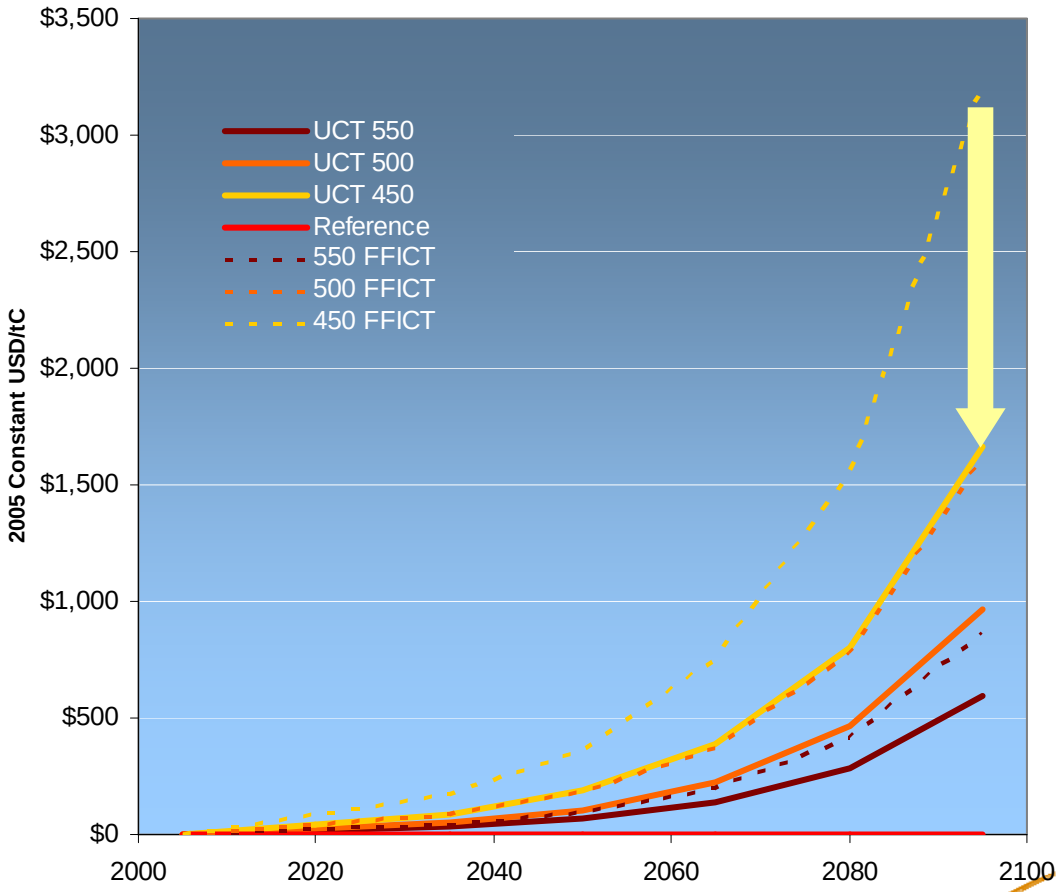
"How" Flexibility—Terrestrial Systems Carbon Price

Valuing all carbon, including terrestrial carbon

- Dramatically reduces the price of carbon.
- Cuts the price at 450 ppm in half!
- Reduces the amount of bioenergy production in the long term, but increases near-term bioenergy supply, relative to the case in which terrestrial carbon was not valued.



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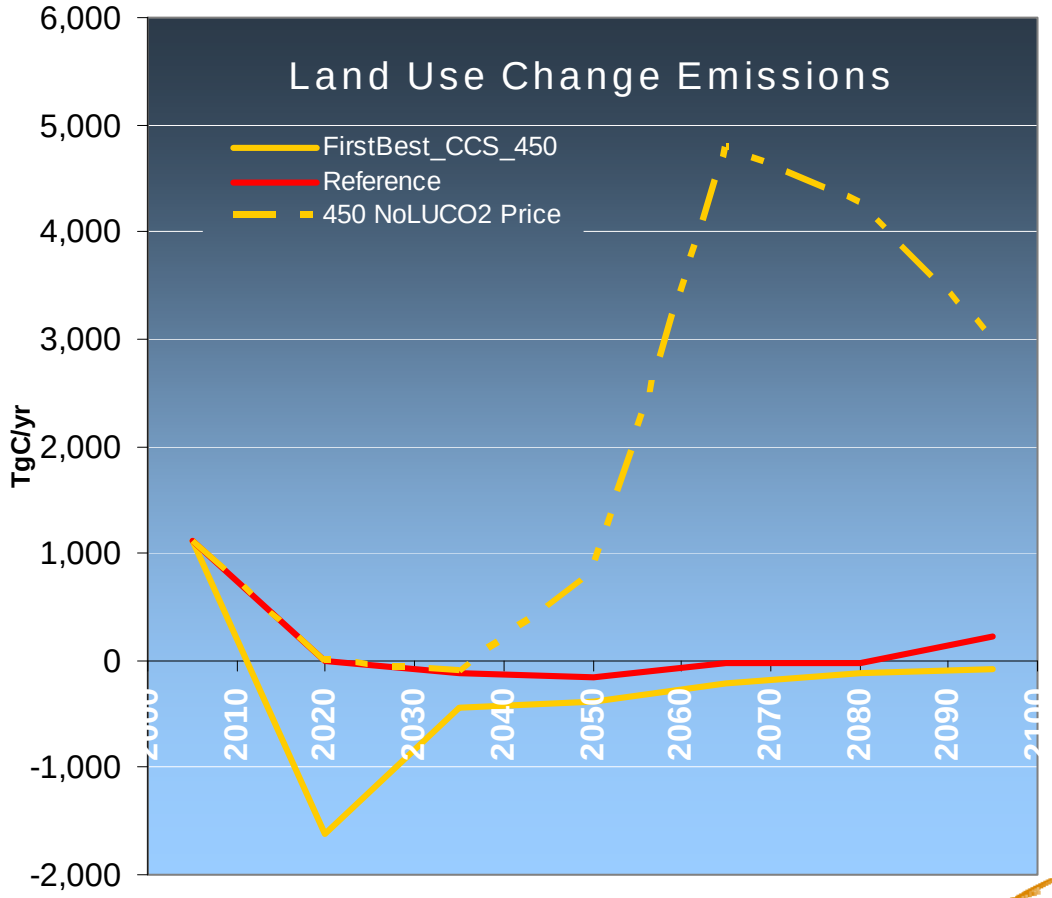
"How" Flexibility—Terrestrial Systems
Terrestrial Carbon

- Land use emissions reduction by valuing terrestrial carbon (cumulative 2005 to 2095)
  - 550 ppm 125 PgC
  - 500 ppm 170 PgC
  - 450 ppm 210 PgC



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Terrestrial Carbon

- Terrestrial carbon systems can potentially dramatically reduce the cost of stabilizing the concentration of CO_2.
- What about their role in regimes where not all countries are participating?
- Consider a scenario in which there is a flat tax of $50/tC in Annex I countries.

Land-use emissions

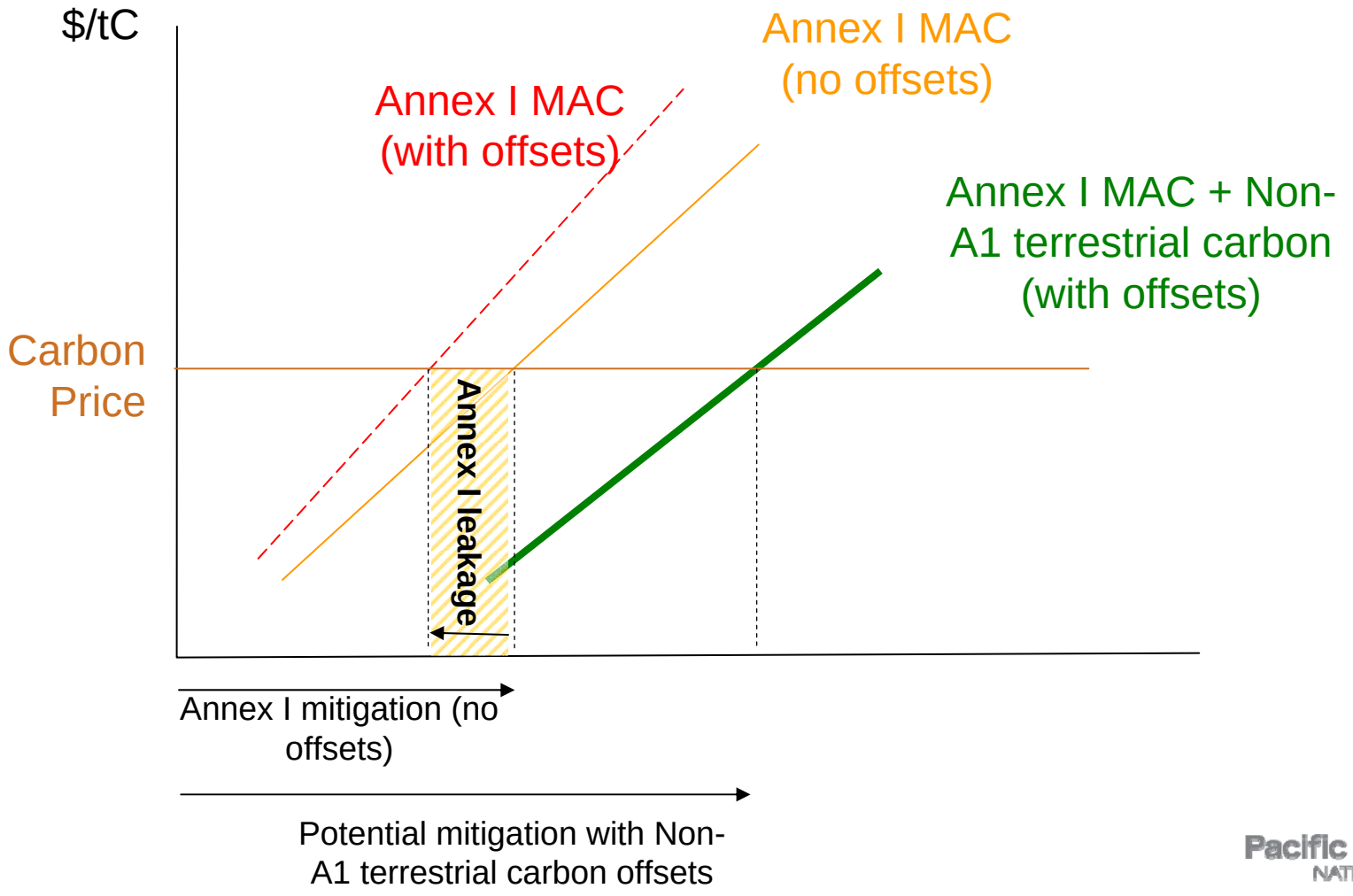
CASE 1

- Annex I emissions are mitigated within Annex I.
- All carbon is counted in emissions mitigation:
  - Fossil fuel & industrial emissions, &
  - Land-use change emissions.

Case 2

- Fossil fuel and industrial emissions are mitigation within Annex I only.
- Land-use change emissions can be mitigated anywhere.

How much more mitigation at a given price?



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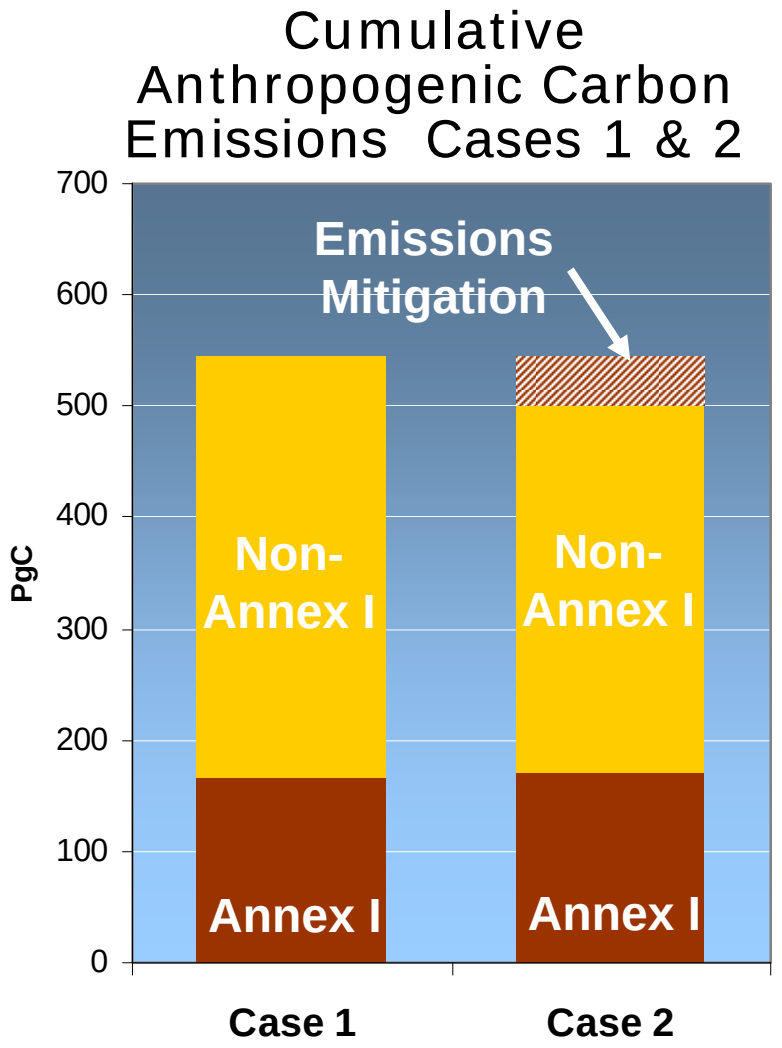
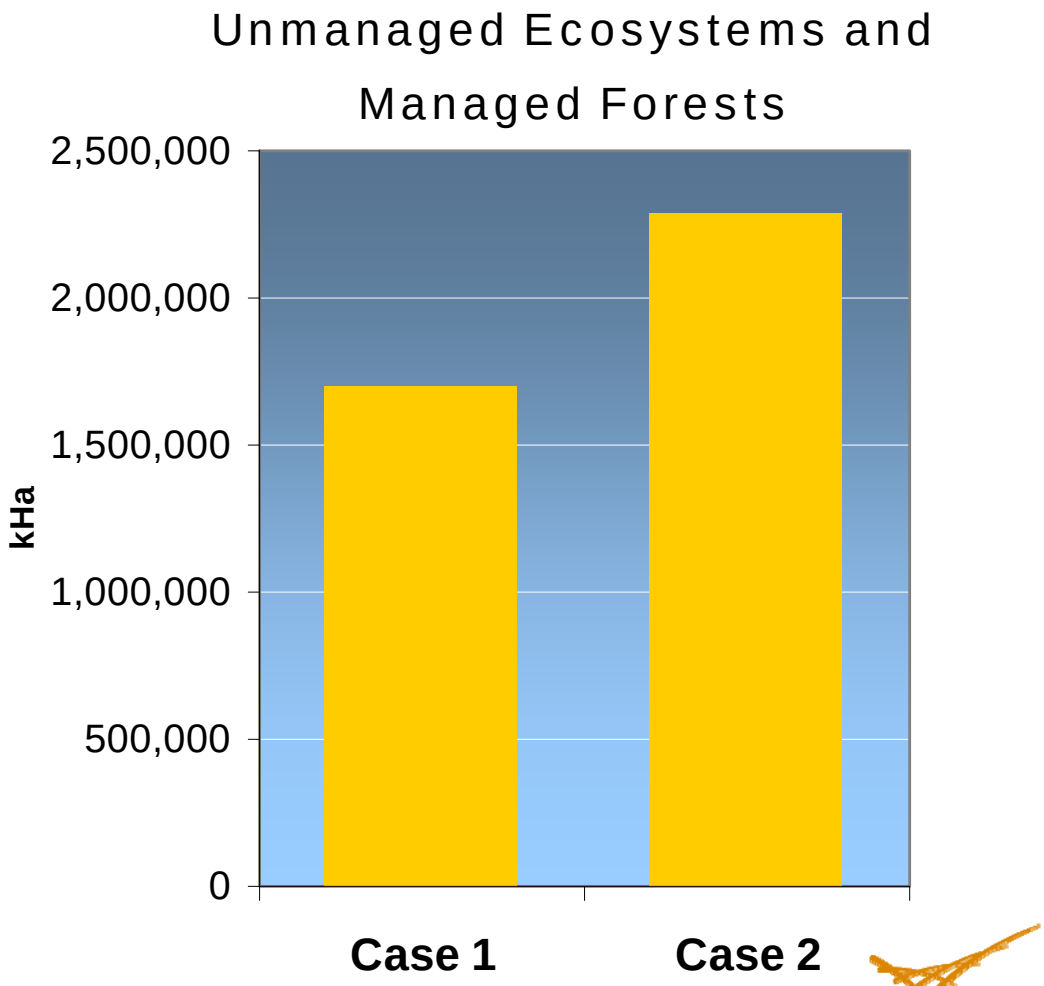
Emissions Mitigation

- Cumulative global anthropogenic emissions are reduced by 42 PgC (2005 to 2050).
  - Annex I cumulative emissions 2005-2050 rise by 4 PgC.
  - Non-Annex I cumulative emissions decline because of reduced land-use change emissions by 46 PgC.
- Leakage—back to Annex I—is less than 10%.



Land use change emissions

- Unmanaged ecosystems and managed forests expand in Non-Annex I regions
- Of course, one could always hold emissions fixed and reduce the cost of meeting the emissions mitigation target



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Discussion