Creating a Sustainable Climate Policy in Energy and Land Use for a Low Carbon Society

February 19-21, 2011

The 16th AIM International Workshop

National Institutes for Environmental Studies

Tsukuba, Japan

Office of Science
U.S. DEPARTMENT OF ENERGY

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ACKNOWLEDGEMENTS

- Thanks to my hosts:
  - NIES
  - Mikiko Kainuma

- Thanks to the DOE Office of Science, Integrated Assessment Research Program for long-term model development support .

Motivation

- Wise et al. (2009) showed the importance of terrestrial carbon cycle interactions with human land-use decision making.
  - Valuing all carbon equally in an **idealized** global emissions mitigation program results in the following:
    - Reduced cost of stabilization,
    - Net afforestation,
    - Expanded bioenergy production,
    - Changed global diet toward less land-intensive food,
    - Higher crop prices.
- What happens when the world is less than ideal?
  - EMF 22 delayed participation and land-use change emissions
  - EMF 22 delayed participation and terrestrial system offsets programs
  - Use of Reducing Emissions from Deforestation and Forest Degradation (REDD) programs

LAND-USE LEAKAGE

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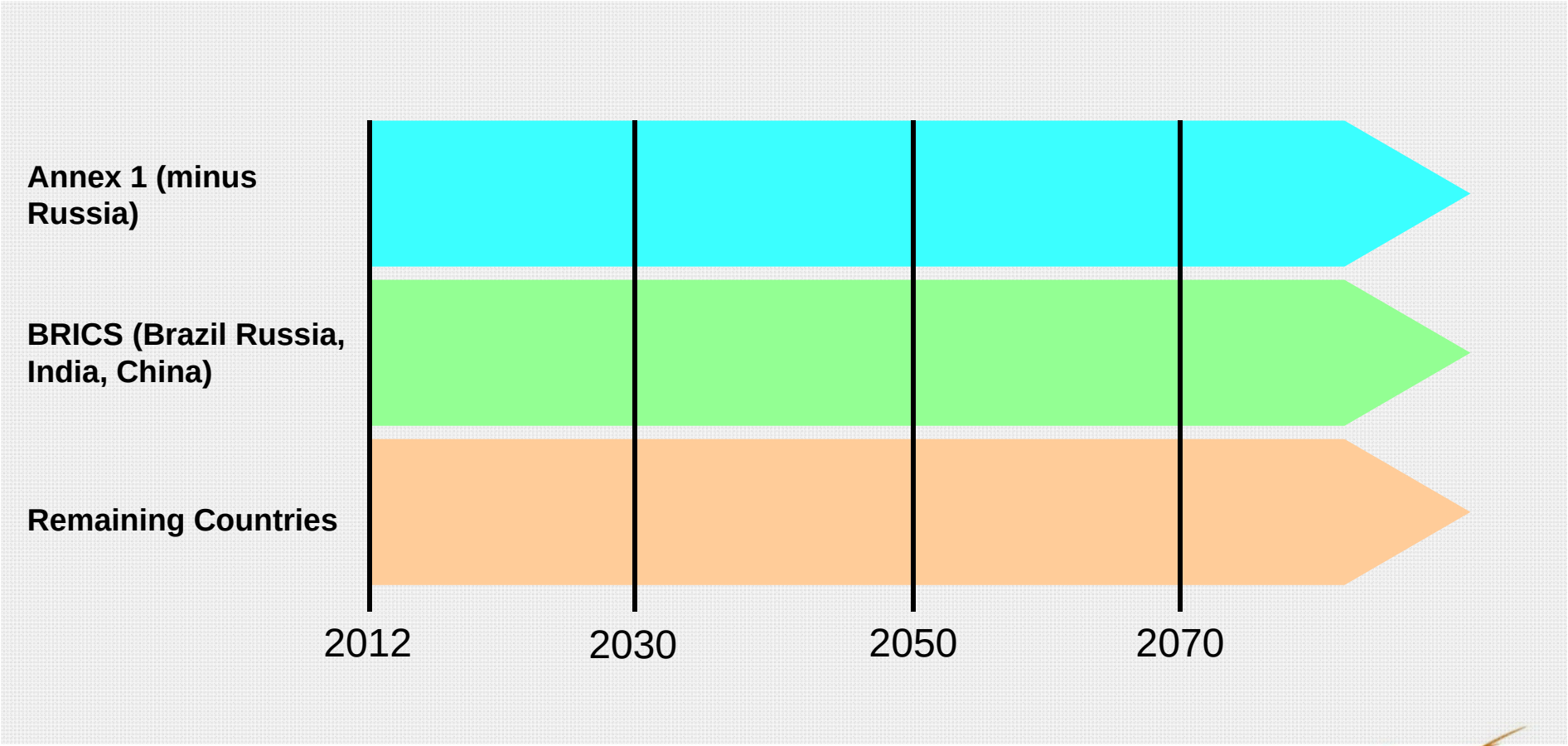
Full Participation: All Begin Reductions Immediately



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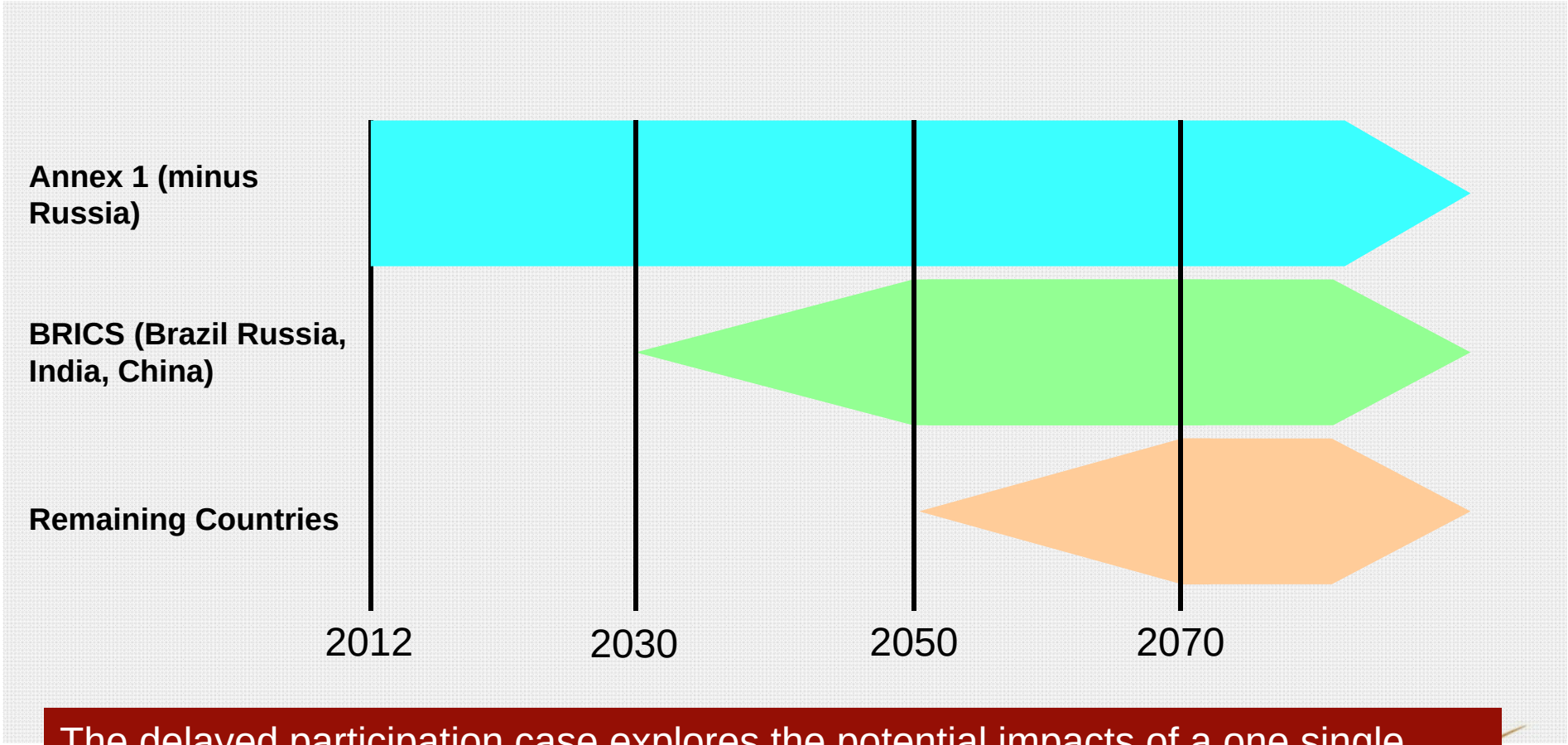
Delayed Participation: Regions Enter the Global Coalition over Time



The delayed participation case explores the potential impacts of a one single possibility for delay in non-Annex I participation – it does not represent any real policy proposal. Mechanisms such as offsets may lead to policy structures that lie between the two cases explored in this study.

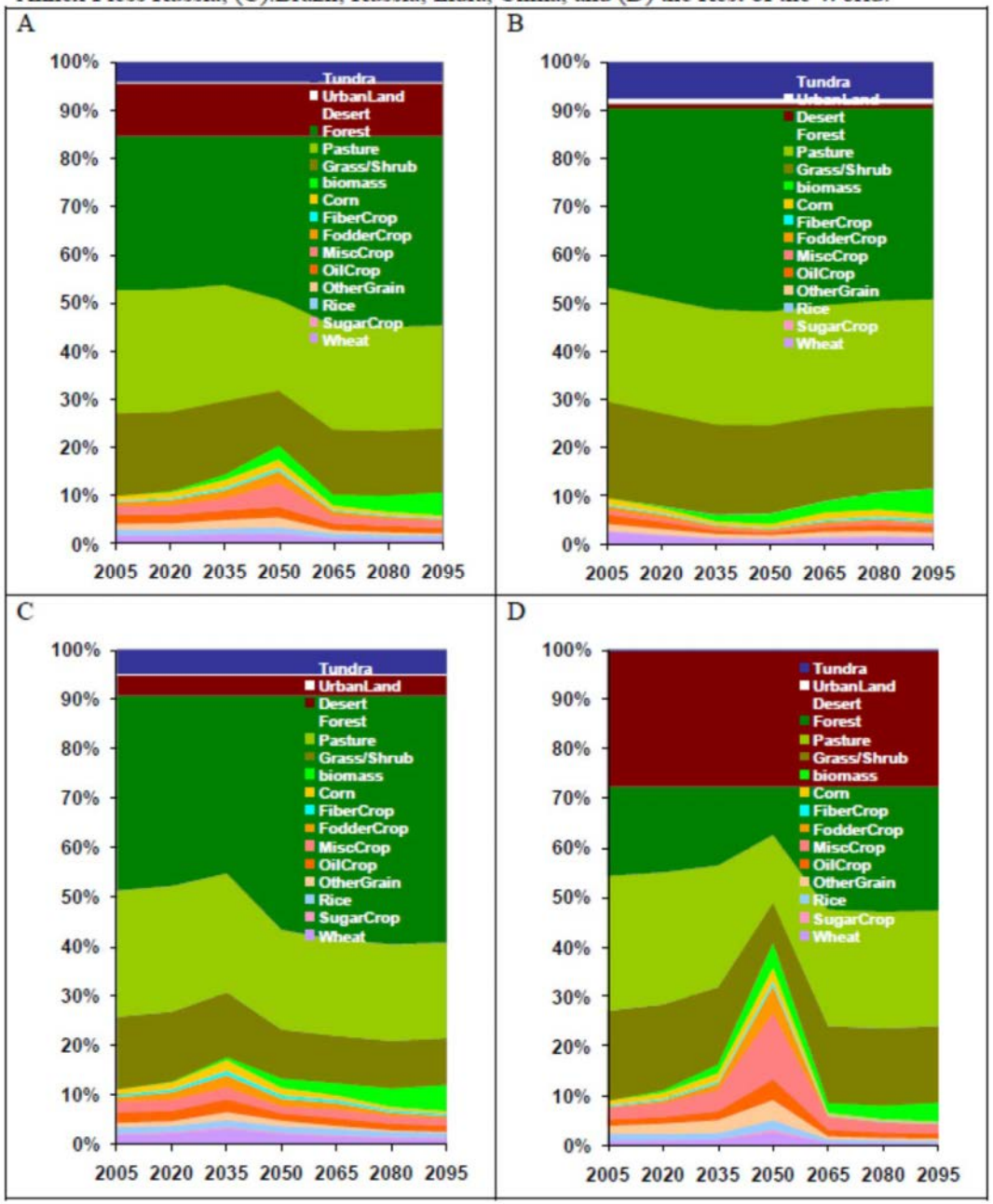
Policy Assumptions

- Mitigating regions value ALL carbon (fossil fuel, industrial and land-use change) equally.

- Non-participating regions have no value on carbon.
  - i.e. No offsets programs.

- **NO BIOENERGY PRODUCTION**
  - **We make this assumption to isolate the effect of carbon valuation from the bioenergy effects.**

Figure 2: Land Allocation by Region in the Delayed Accession Scenario. for (A) the World, (B
Annex I less Russia, (C).Brazil, Russia, India, China, and (D) the Rest of the World.



Land Use Changes

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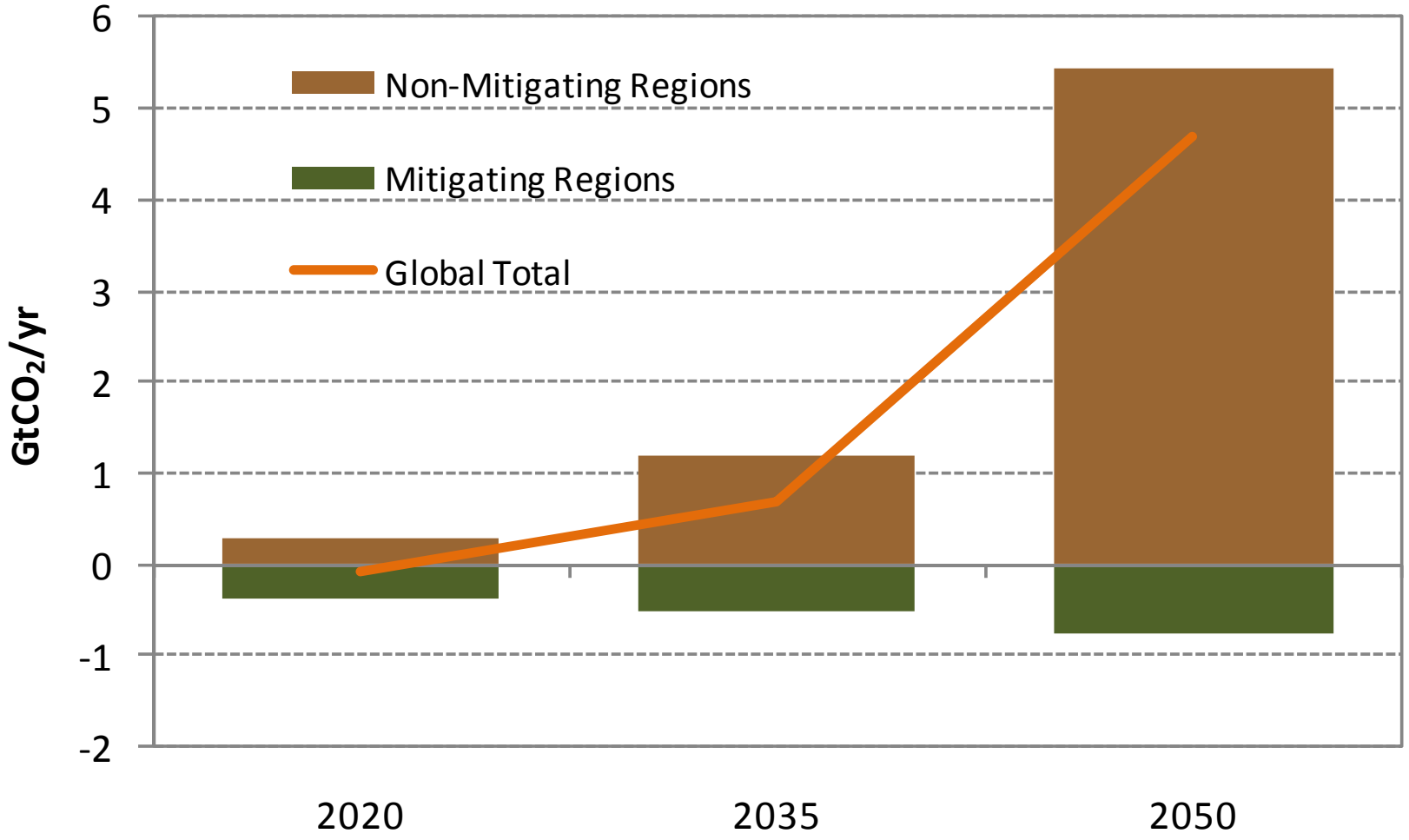
Impact of terrestrial carbon emissions leakage—EMF 22 assumptions (550-e)



TERRESTRIAL OFFSETS

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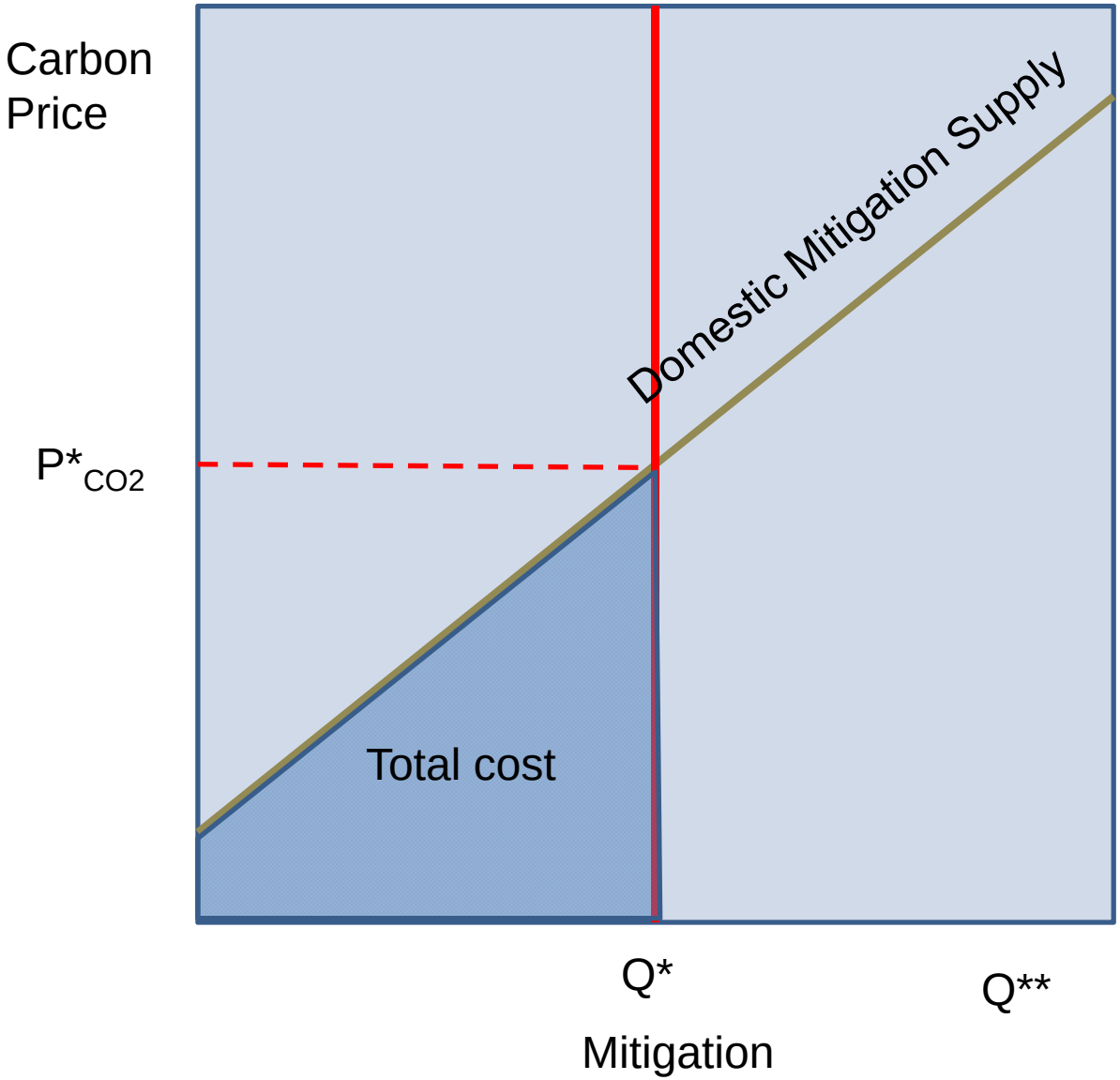
OFFSETS AND EARLY ACTORS

- Introducing offsets in the context of a global regime with delayed participation always makes the world better off.
- Emissions reductions costs in the early years are reduced for the world.
- Wealth is transferred from the early actors to the delayed actors to compensate them for undertaking some actions early.

- But, if we compare two programs that stabilize CO_2 concentrations at the same level, are the early actors better or worse off with the offsets program?

The offsets problem for early mitigators in the context of stabilization



- Without offsets, the total cost of emissions mitigation depends on domestic opportunities alone.
- Total cost is the area under the MAC schedule.

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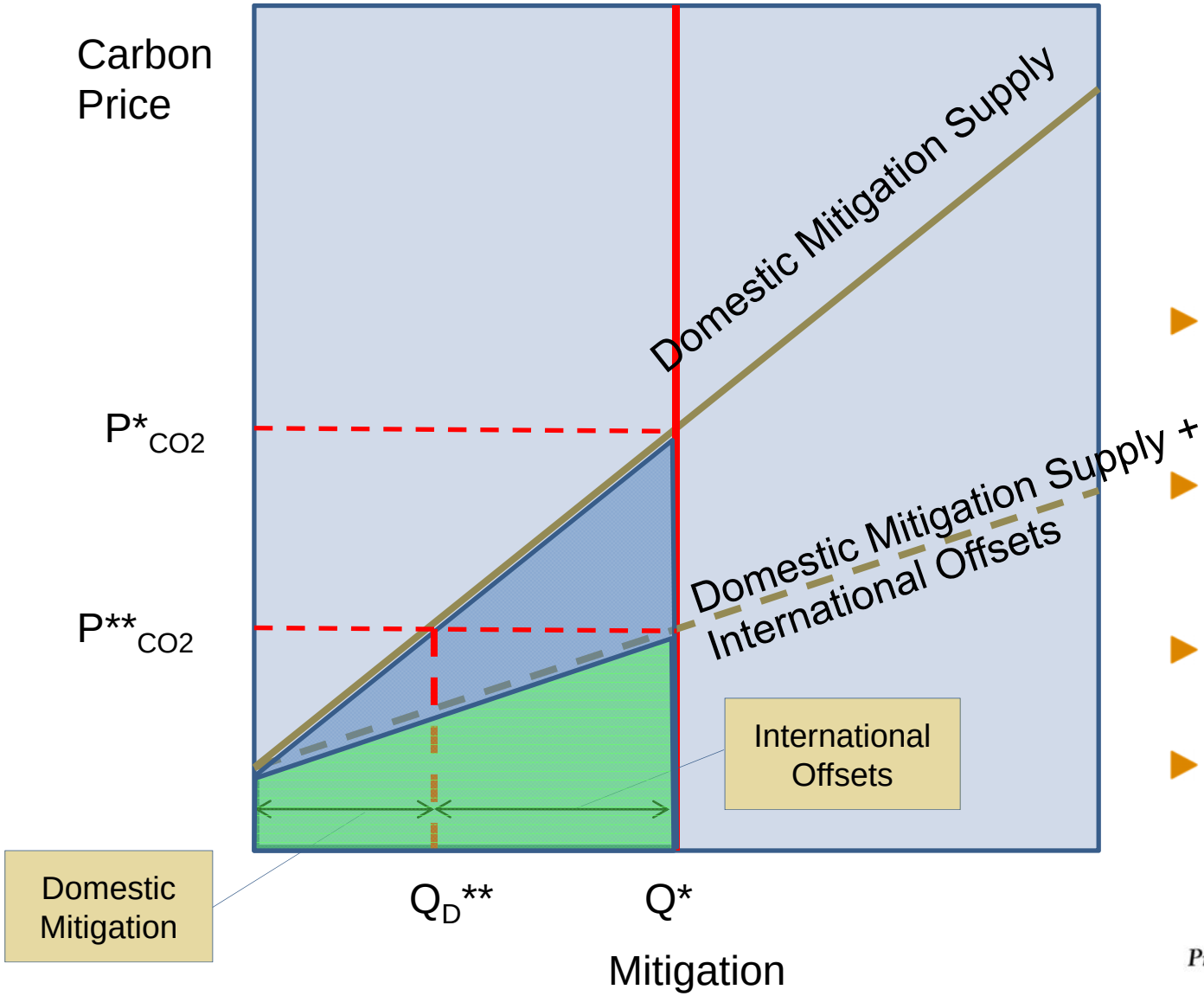

- Adding an international offsets option expands the emissions mitigation opportunities.
- Lowers the domestic carbon price.
- Reduces domestic emissions mitigation.
- Replaces it with offsets, and
- Lowers total cost.

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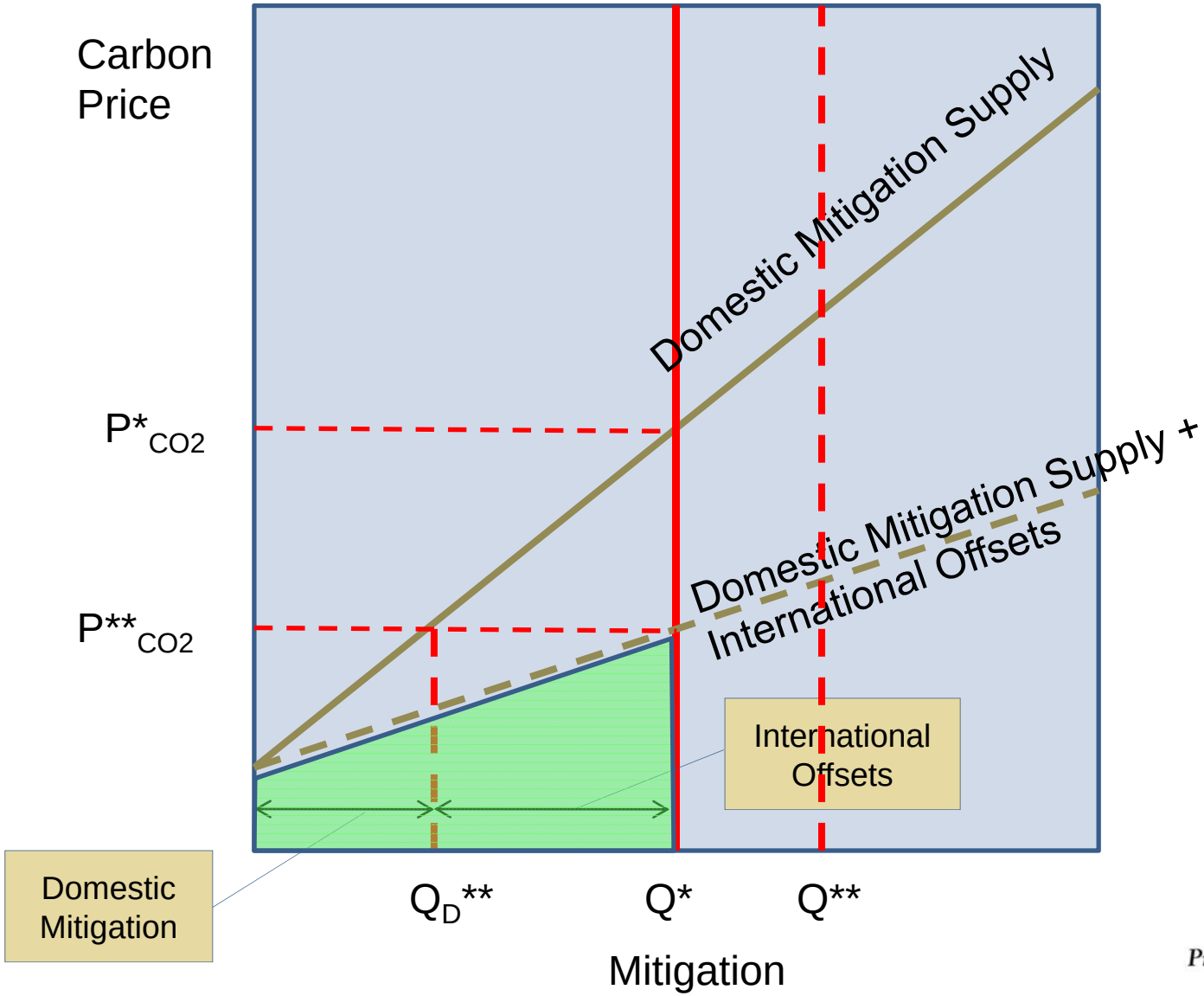

- But, in the context of stabilizing CO_2 concentrations, lower near-term emissions mitigation costs shift emissions mitigation from the future toward the present, increasing the required emissions mitigation on the part of early actors.

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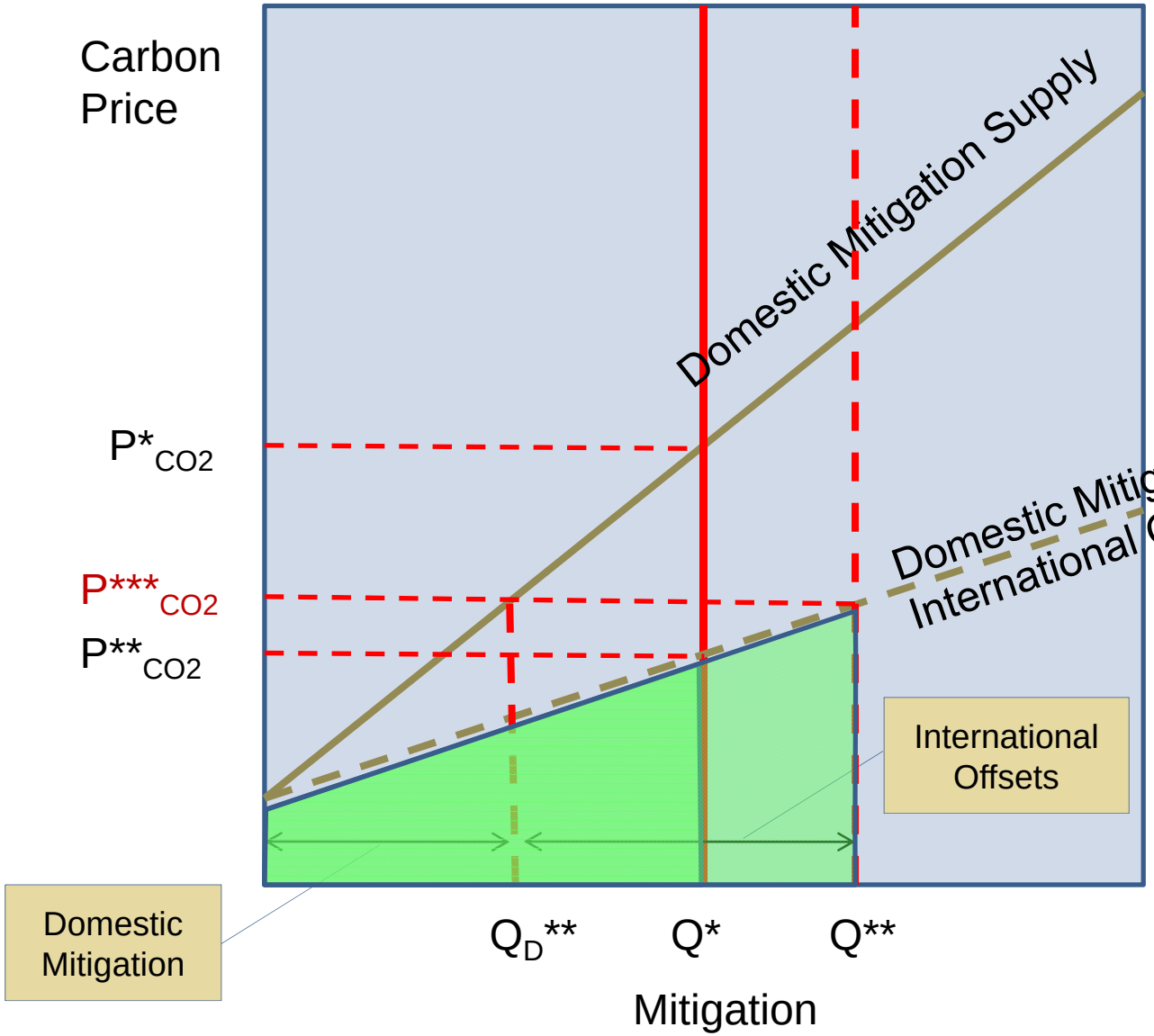
The offsets problem for early mitigators in the context of stabilization



- This raises the domestic price relative to the simple offset calculation, as well as increasing required, and
- Increases total domestic cost (though the world is always better off)

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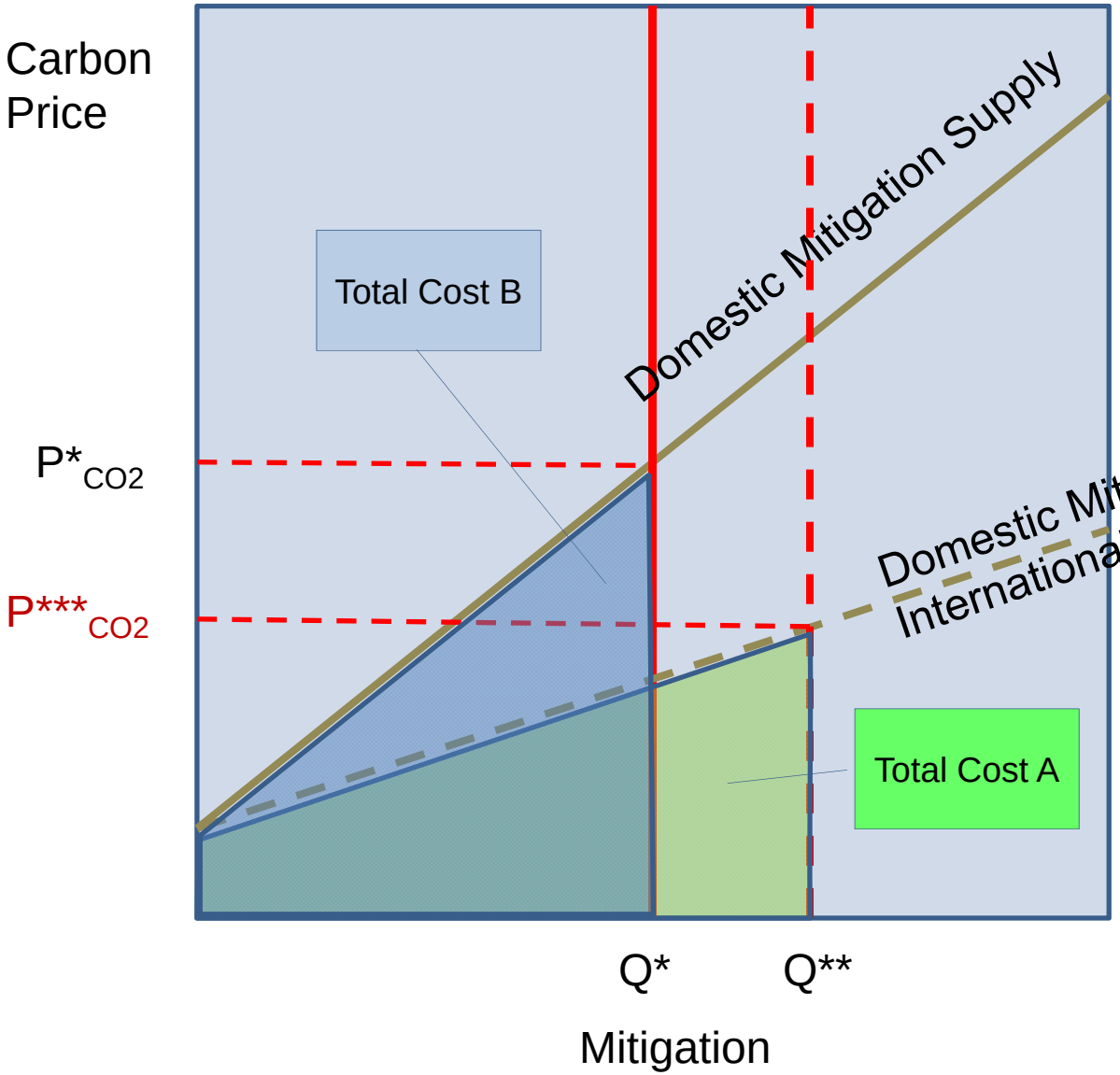

- So, the question becomes: Is the early actor better off with the offsets program, or not?
- In other words, is Total Cost A or
- Total Cost B larger?

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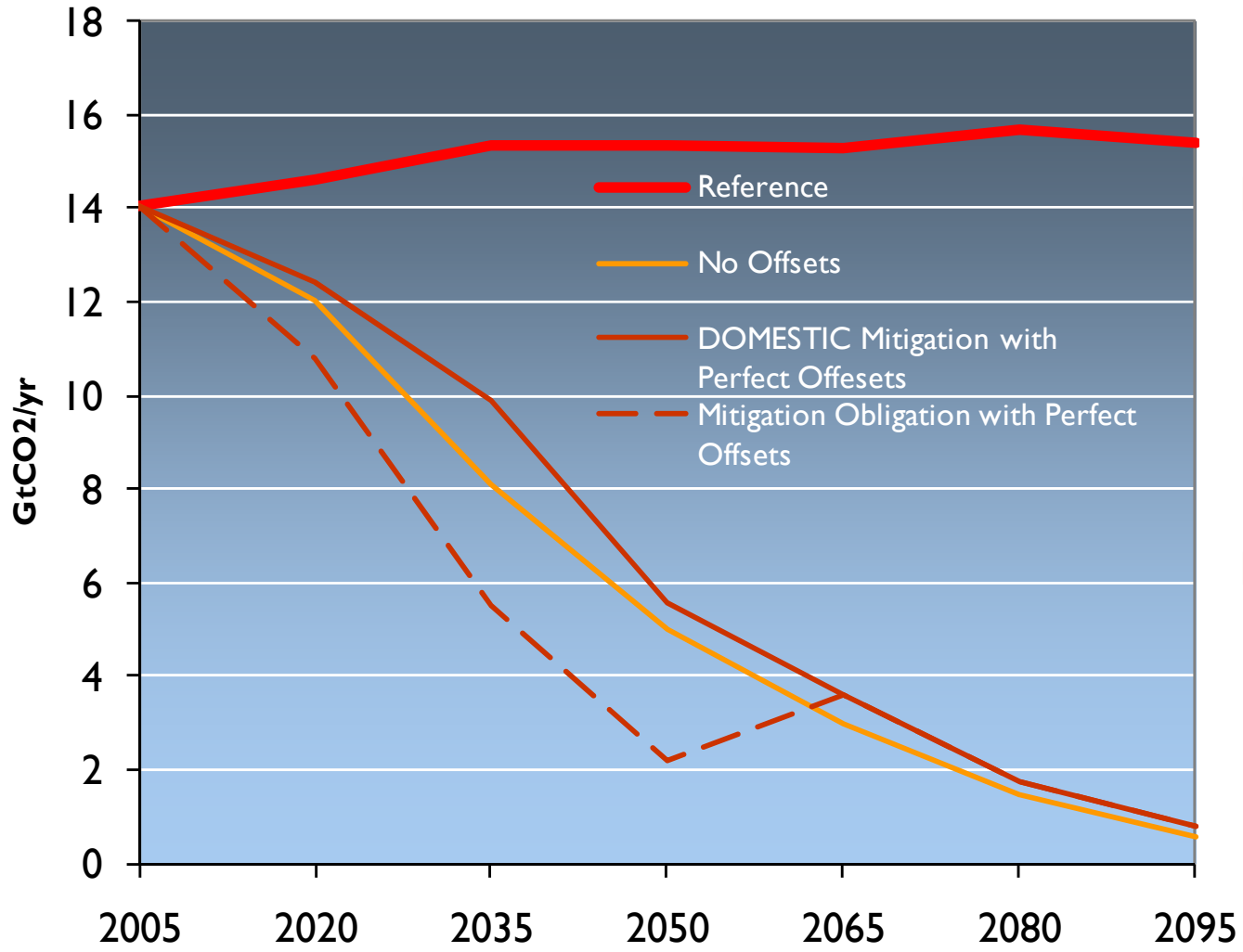
A numerical experiment with GCAM



Microsoft Office Excel Chart

- We fix the climate limit at 550 ppm co2-e.
- Allowing offsets reduces domestic mitigation; BUT,
- Implies a more stringent mitigation obligation.

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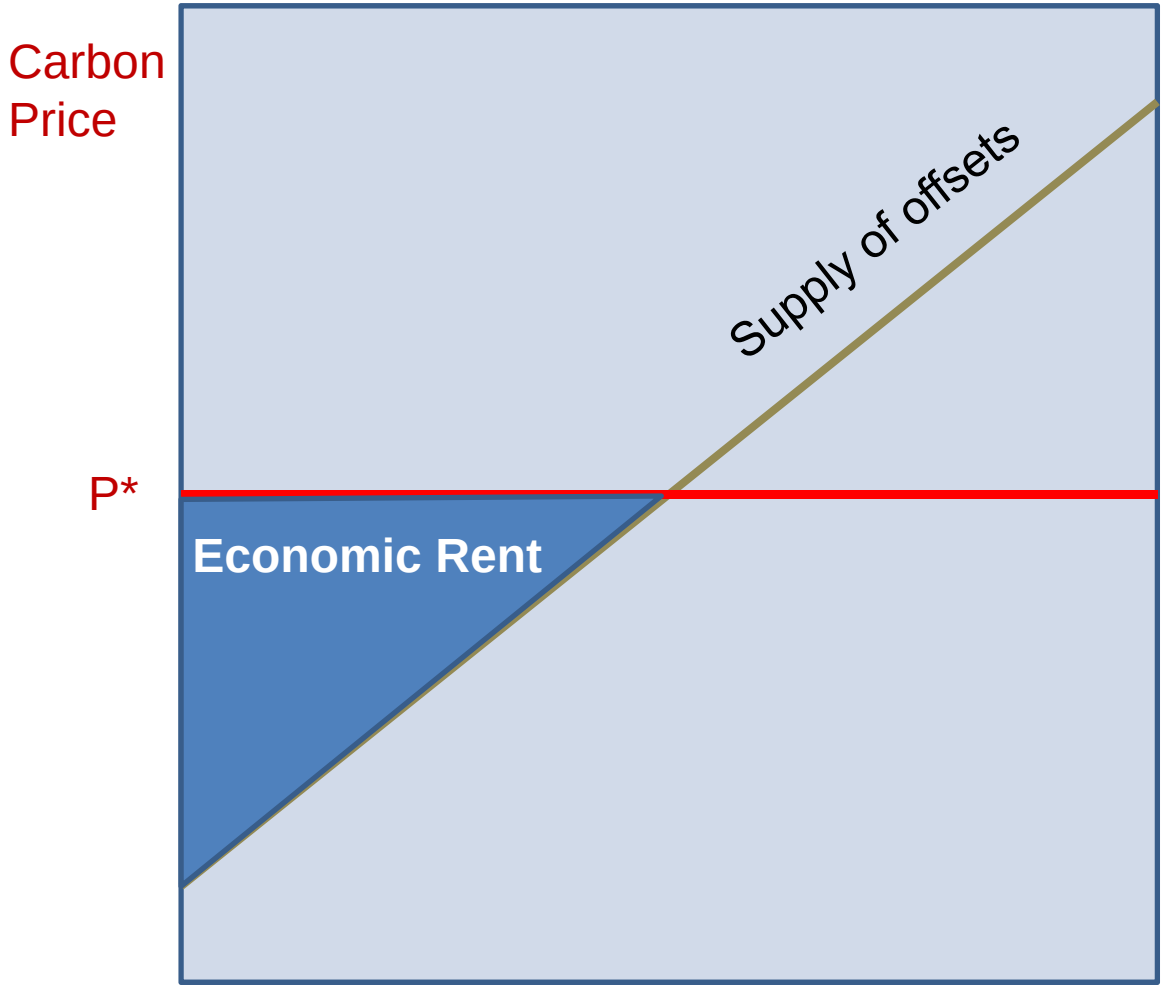
The offsets market

- Whether or not the early actors are better off with an offsets program compared with an alternative world in which the same stabilization goal is reached but without offsets
- Depends in part on the nature of the offsets market.

Market Power

- Whether or not early actors are better off will depend in part on who gets the economic rent from emissions the supply of offsets.
- When the buyers get to buy each project at cost, then the buyers get the rent.
- But, if offsets are sold in a global market at a global price, the sellers get the rents.



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Do International Terrestrial Offsets Make Early Actors Better Off?

- Total Economic Cost of Emissions Mitigation Group 1 (Annex 1 ex. Russian Federation)
- Billion 2005 USD
- EMF 22: 3.7 Wm^{-2} (550 ppm CO_2-e) limit in 2100.

Scenario	2020	2035	2050
NO offsets	$23	$169	$1124
Perfect Offsets—Economic Rent to Buyers	$31	$81	$857
Perfect Offsets—Economic Rent to Sellers	$46	$146	$1004
Imperfect Offsets (only 50% available)—Economic Rent to Sellers	$34	$163	$1,142

REDD

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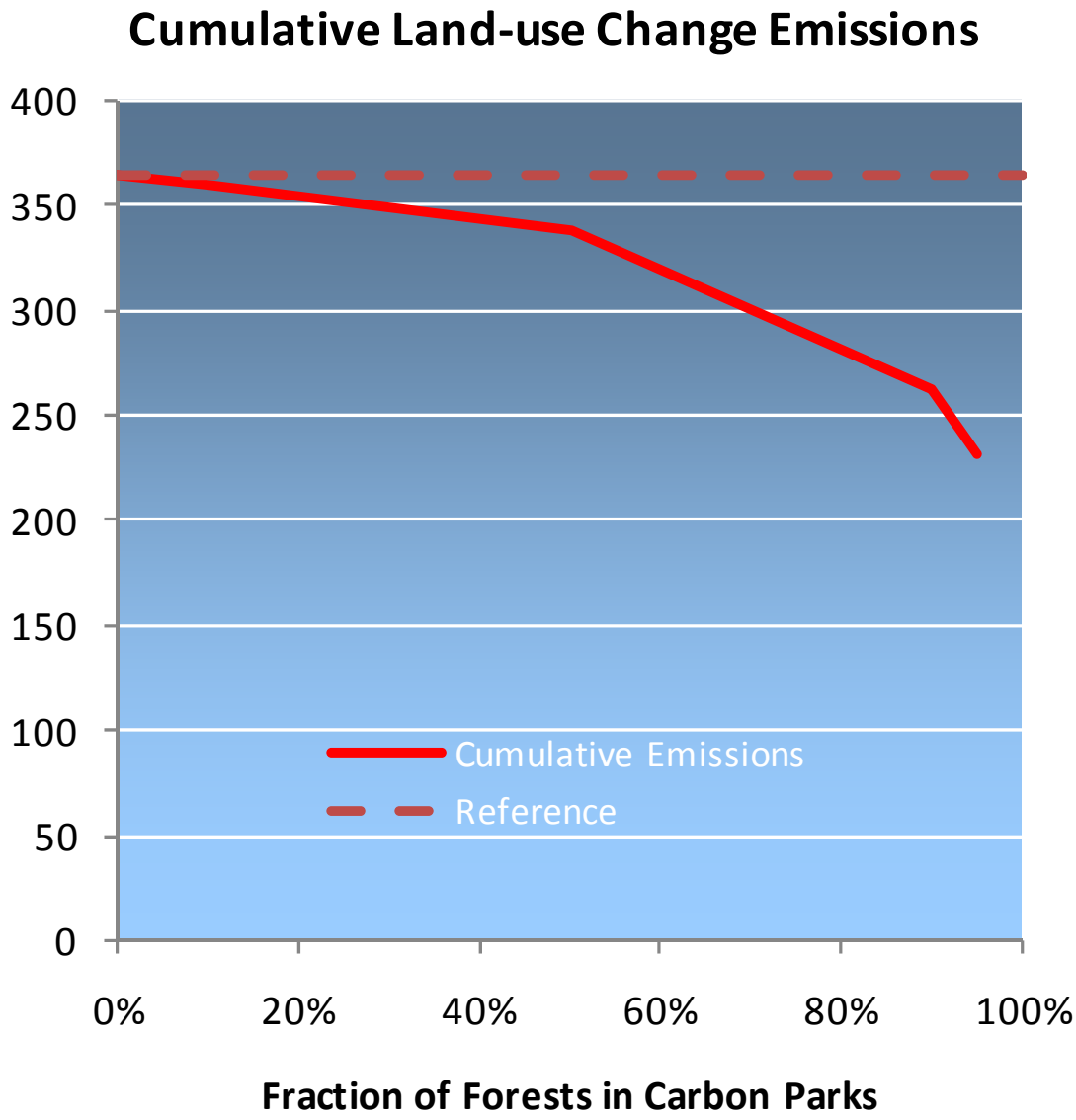
REDD in a reference scenario

ASSUMPTIONS

- There is no price on carbon anywhere.
- We assume that some fraction of unmanaged forests are banked in carbon parks.
- Carbon parks cannot be converted to managed ecosystems.
- Carbon parks do not prevent land-use change emissions due to changes in carbon density of managed systems.

REDD in a reference scenario

- Carbon parks have almost no effect on bioenergy production.
- Carbon parks reduce cumulative land-use change emissions the more extensively they are deployed.



How much does a REDD program help?

Fraction of Forest Included in the Program	Reduction in Land-Use Emissions 2005-2095 (PgC)	Marginal Rate of Emissions Mitigation for the Next 1% Added to the REDD System
0-10%	4	-0.4 PgC
10-50%	27	-0.6 PgC
50-90%	101	-1.9 PgC
90-95%	132	-6.2 PgC

Reference Case Cumulative Land-use Change Emissions ~ 350 PgC

Summing up

- In an ideal world valuing all carbon in an emissions mitigation program leads to lower costs of stabilization, afforestation, changed diets and higher food prices.
- In a world with delayed participation and non-mitigating regions, deforestation and land-use change emissions could be accelerated if all carbon is valued equally in the mitigating regions.
- Terrestrial offsets programs could help correct this problem, however, the early actors may or may not find it in their interests to engage in such programs.
- REDD programs could also reduce land-use change emissions, but their effectiveness is limited by the fungibility of land resources and the global connectedness of commodity markets.

DISCUSSION