

A Multi-Gas Approach to Climate Policy -- with and without GWPs

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Two Questions

- What are the implications of a multi-gas approach when designing policies for complying with emission constraints?
- Are there alternatives to GWPs, which provide a better welfare-based justification for action?

MERGE

- Multi-gas focus (CO₂, CH₄ & N₂O)
- When a constraint is placed on GHG emissions, the choice of technologies for the energy sector is influenced by their CO₂ and CH₄ emission characteristics
- Non-energy related emissions of CH₄ and N₂O are treated endogenously through time- and region-dependent marginal abatement cost curves
- "Second basket" of gases is not yet included
- Carbon sinks are introduced through time- and region-dependent supply curves
- Cooling effect of sulfate aerosols is introduced

EMF21_RR_3

MERGE Web Site Address

<http://www.stanford.edu/group/MERGE/>

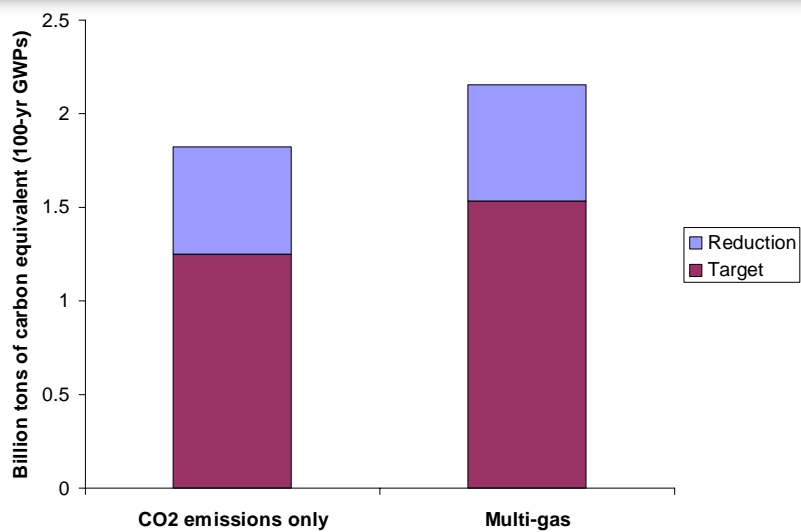
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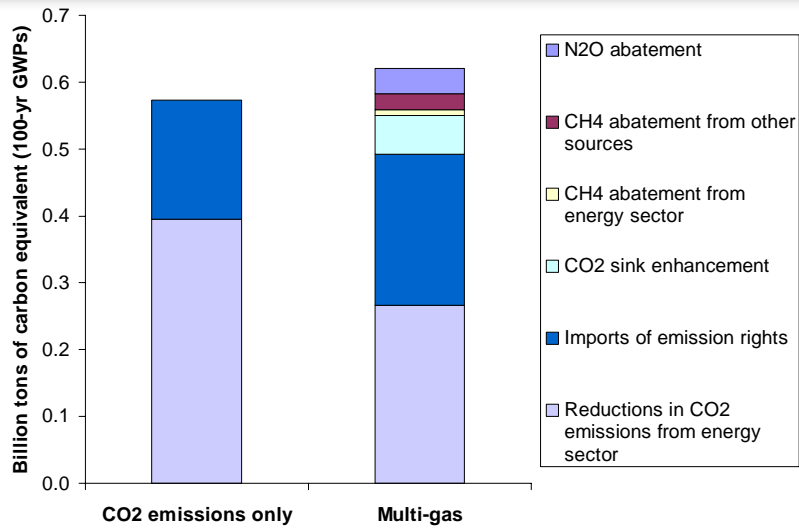
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US Emissions in 2010 under Single-gas and Multi-gas Scenarios



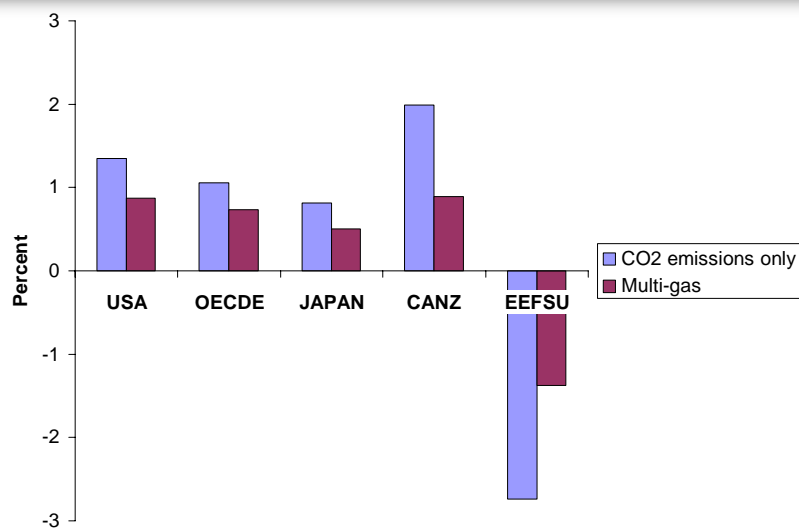
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US in 2010 -- Optimal Mix of Options for Reductions



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GDP Losses in 2010



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GWPs as a Function of Alternative Time Horizons

Species	Chemical Formula	Lifetime (years)	Global Warming Potential		
			20 years	100 years	500 years
Carbon Dioxide	CO ₂	50-200	1	1	1
Methane	CH ₄	12	56	21	6.5
Nitrous Oxide	N ₂ O	120	280	310	170

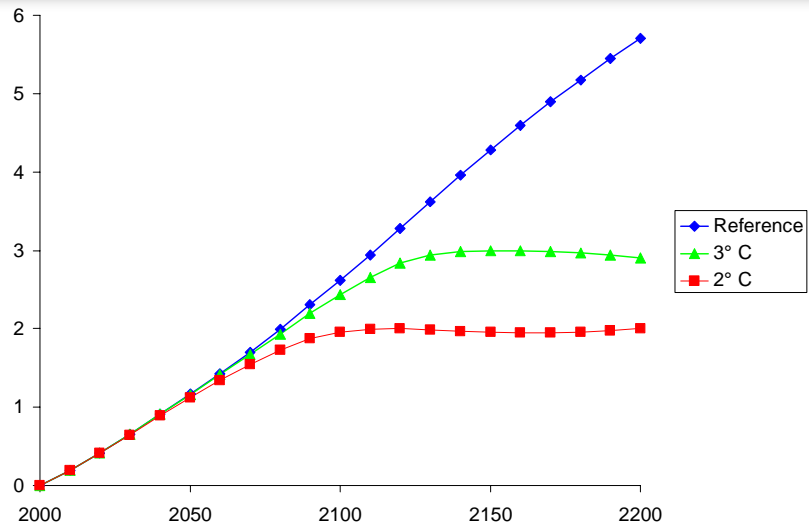
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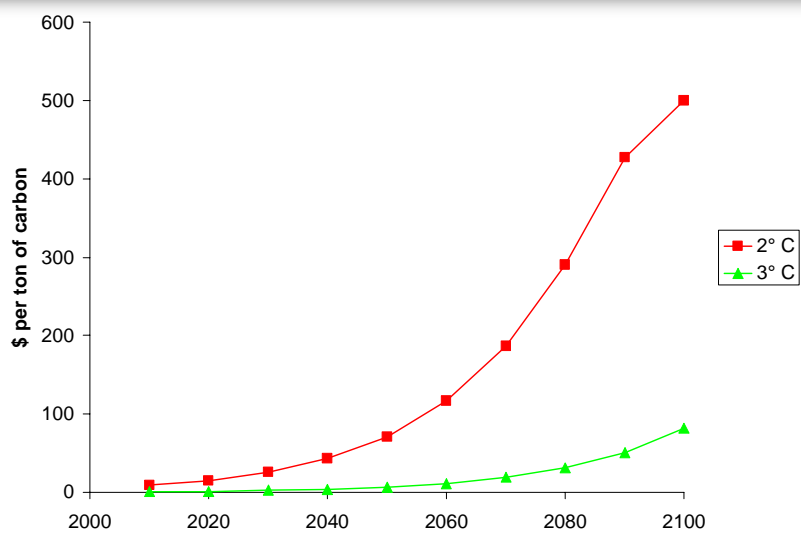
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Reference Case vs. Ceilings of 2° and 3° C (temperature increase from 2000, °C)



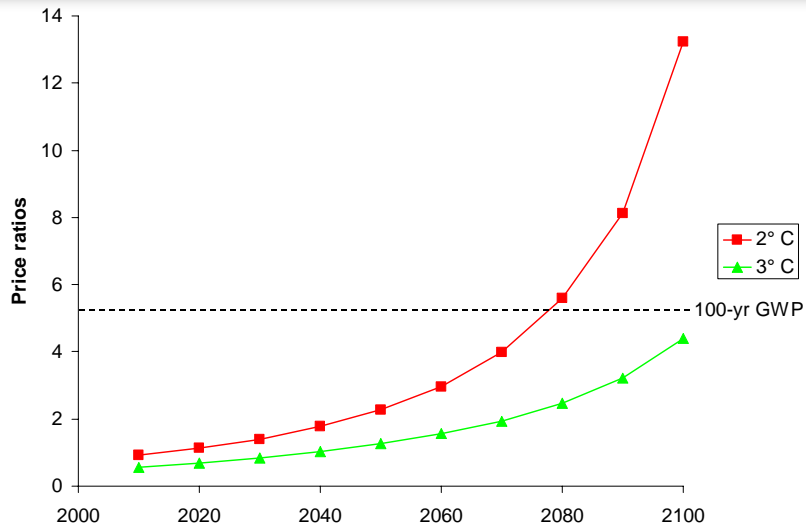
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Incremental Value of Carbon Emission Rights



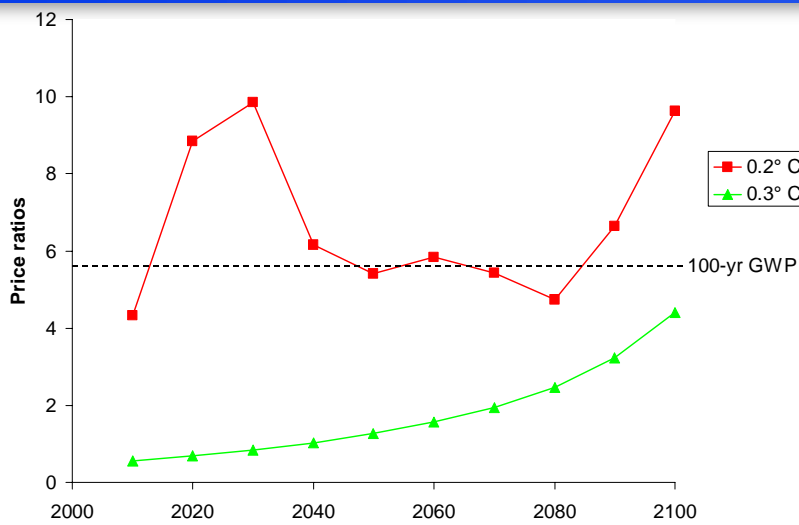
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Price of a Ton of CH4 Relative to Carbon



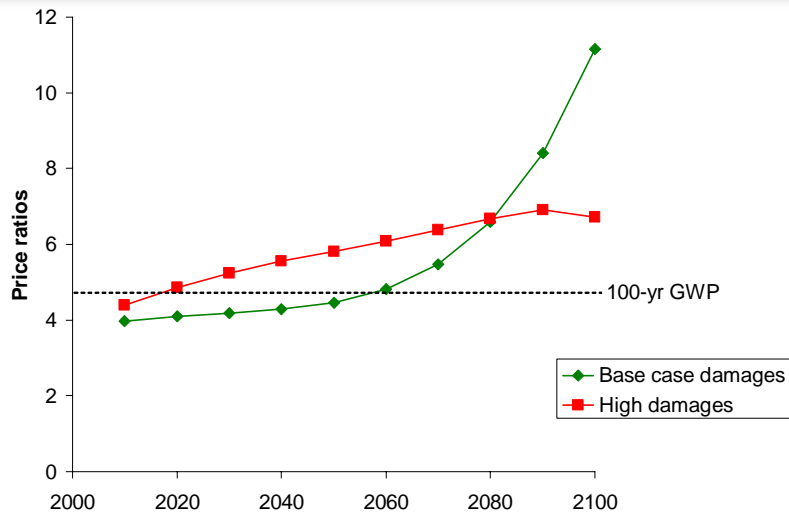
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Price of a Ton of CH4 Relative to Carbon -- Rate of Change Constraint



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Prices of a Ton of CH4 Relative to Carbon



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Final Comments

- Focusing only on CO₂ can lead to significant biases in the estimation of compliance costs
- A multi-gas approach requires some way to establish equivalence among gases
- Current approach -- the use GWPs -- has several limitations
- We examine alternative approaches based on cost-effectiveness and cost-benefit analysis
- Show that tradeoffs among gases depend both upon the target and the proximity to the target

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