Economic Analysis of Non-CO2 GHG Mitigation Technologies

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Outline

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- EPA Non-CO2 Mitigation Analysis
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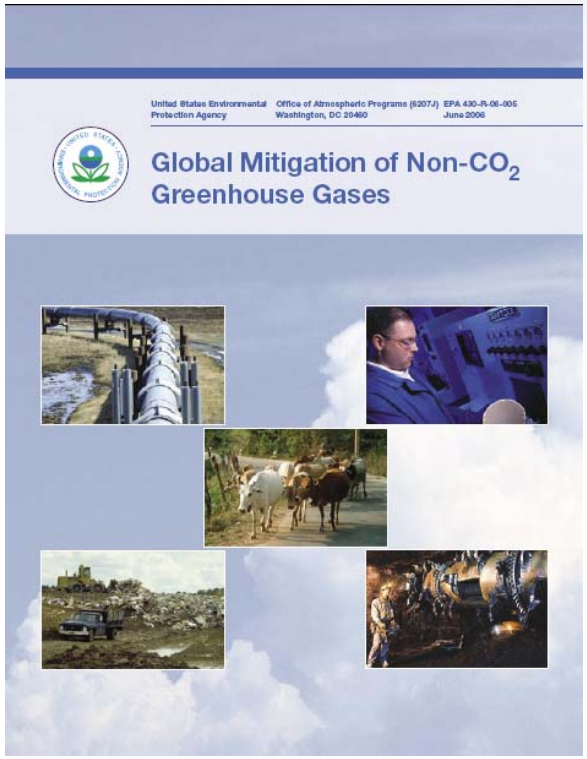
Introduction

- EPA Climate Economics Branch does economic analysis of climate bills such as Waxman-Markey
- Historically, climate modelers focused only on CO2
- EPA has led in integrating non-CO2 analysis into climate modeling
  - Methane (CH4), Nitrous Oxide (N2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulfur Hexafluoride (SF6)
  - Black carbon and ozone-depleting substances

→ Non-CO2 GHG mitigation is often very cost-effective

Global Mitigation of Non-CO_2 Greenhouse Gases



- U.S. Environmental Protection Agency's (USEPA's) comprehensive global mitigation analysis for non-CO_2 greenhouse gases
- Report has undergone an external peer review consistent with the guidelines of the USEPA Peer Review Policy
- Final report and data available on USEPA's website

http:/www.epa.gov/nonco2/econ-inv/international.html

Objective – Focus of Report

- Recent focus on multi-gas strategies calls for
  - improved understanding of mitigation potential
  - incorporation of non-CO_2 greenhouse gas mitigation estimates in climate economic analyses
- USEPA has developed a comprehensive mitigation analysis covering
  - all non-CO_2 greenhouse gases (methane, nitrous oxide, and gases with high global warming potential)
  - all emitting economic sectors (energy, waste, agriculture, and industrial processes)
  - all regions of the world

Methodology

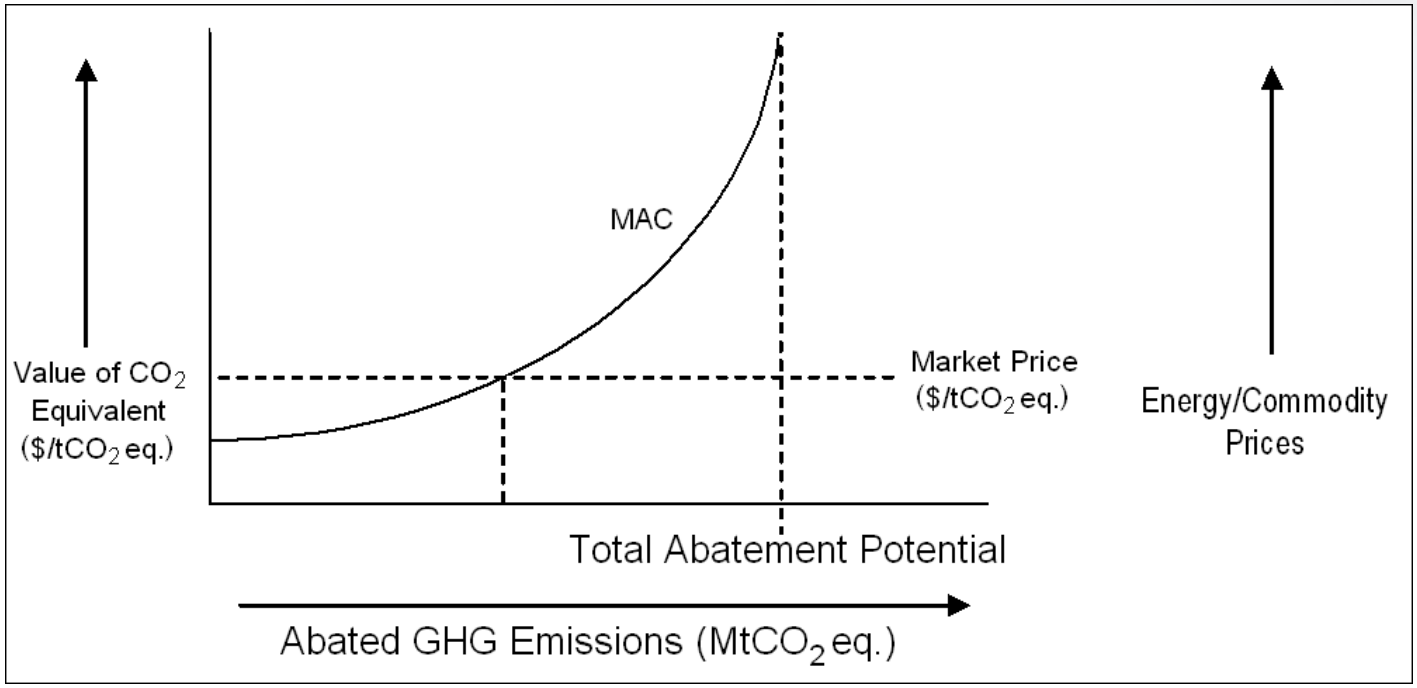
- Build on previous work
  - Stanford EMF-21
- Paired with study of non-CO2 emissions globally
  - Global Non-CO2 GHG Projections: 1990-2020
- Applies mitigation options to emissions baseline in each sector
- Cost/benefit analysis for each mitigation option (detailed on next slides)
  - Technical abatement potential calculated
  - Breakeven price calculated

Methodology – Option Abatement Potential

Technical applicability	x	Implied adoption rate	x	Reduction efficiency	=	Abatement potential
(%)		(%)		(%)		(%)
Percentage of the total baseline emissions from a parlicular emissions source to which a given option can be potentially applied.		Percentage of baseline emissions to which a given option is applied; avoids double counting among overlapping options and fixes penetration rate of options relative to each other.[a]		Percentage of technically achievable emissions abatement for an option after it is applied to a given emission stream.		Percentage of baseline emissions that can be reduced at the national or regional level by a given option. Product of technical applicability, implied adoption rate, and reduction efficiency of the option.

Methodology - MACs

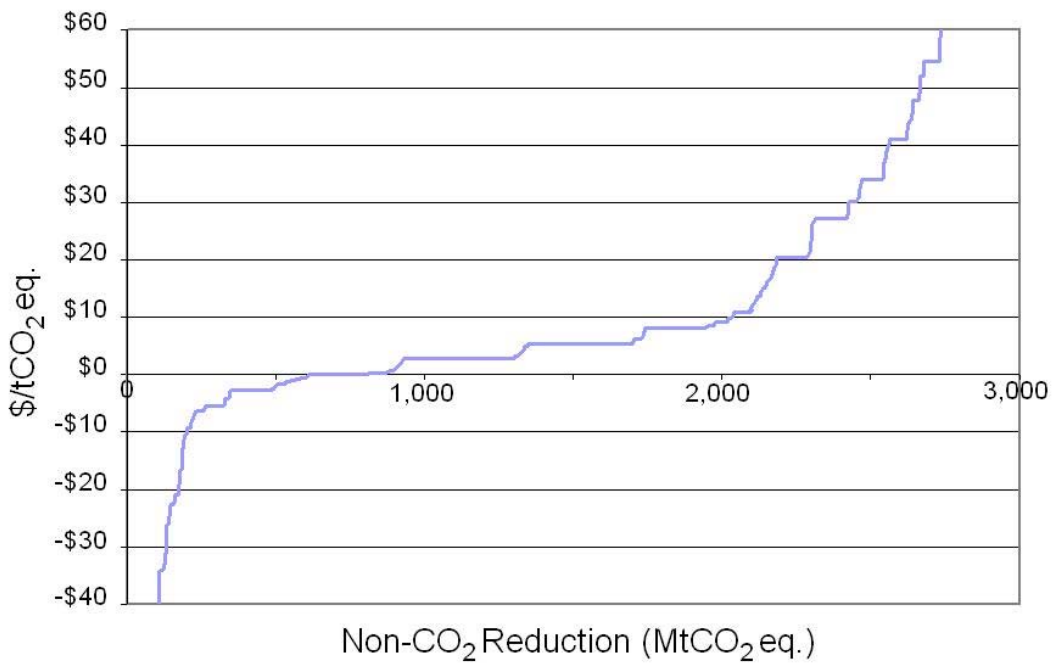
- Marginal abatement curves (MACs) are determined by the series of breakeven price calculations for the suite of available options for each sector and region.
- Each point along the curve indicates the abatement potential given the economically feasible mitigation technologies at a given carbon price.
- The result of this analysis are a series of MACs that reflect aggregated breakeven prices for implementing mitigation options in a given sector and region.



Aggregate Results – Global MAC

- **Mitigation of non-CO_2 gases can play an important role in climate strategies.**

– Worldwide, the potential for cost-effective non-CO_2 greenhouse gas abatement is significant (> 500 $MtCO_2eq$).
– As the breakeven price rises, the mitigation potential grows. The global mitigation potential at a price of $\$10/tCO_2eq$ is approximately 2,000 $MtCO_2eq$.
– In the higher range of breakeven prices, the MAC becomes steeper, and less mitigation potential exists for each additional increase in price.



NG&Oil – Baseline Emissions

- Activity driver data by country
  - Natural gas and oil production and consumption Number of wells, miles of transmission, etc
- Emissions factors
  - Estimated based on region (default factors supplied by IPCC)
  - Age and quality of infrastructure
  - Factors likely to change based on new research

→Estimated global emissions:>1,000 MMT CO2-eq or >3.5 trillion cubic feet methane

NG & Oil Systems- Overview of Technologies

Natural Gas Systems

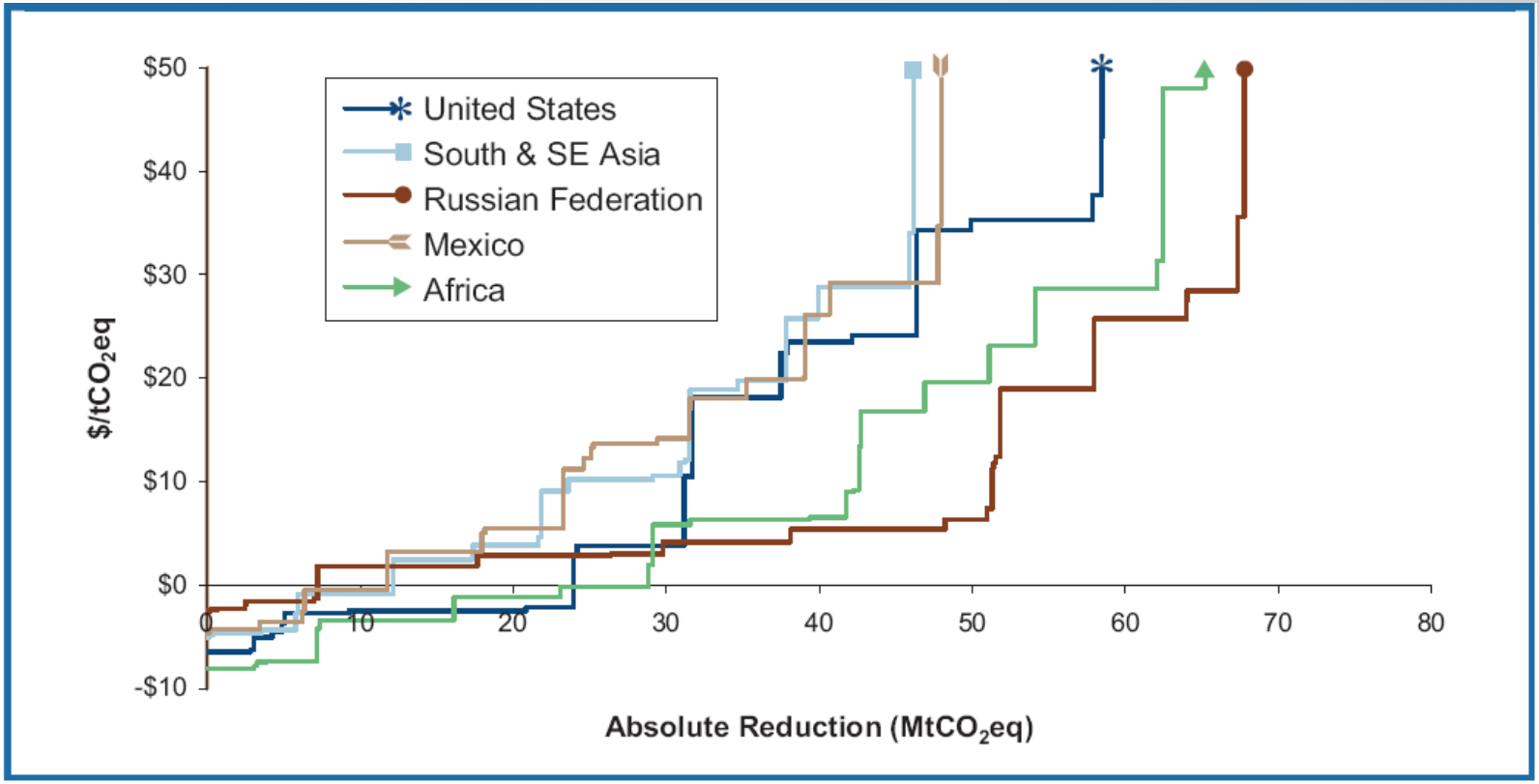
- Replacement and upgrade of equipment
  - Pneumatic devices and controls
  - Replace wet seals with dry seals
  - Flash tank separators
  - Reciprocating engines
  - Compressor rod packing systems
- Changes in practices
  - Pumpdown technique before maintenance
  - Optimization of component functioning such as glycol circulation rates
  - Electronic monitoring
- Directed Inspection and Maintenance (DI&M)

Oil Systems

- Flaring in place of venting
  - On-shore and off-shore
- Direct use of CH4
- Reinjection of CH4

NG&Oil - Results

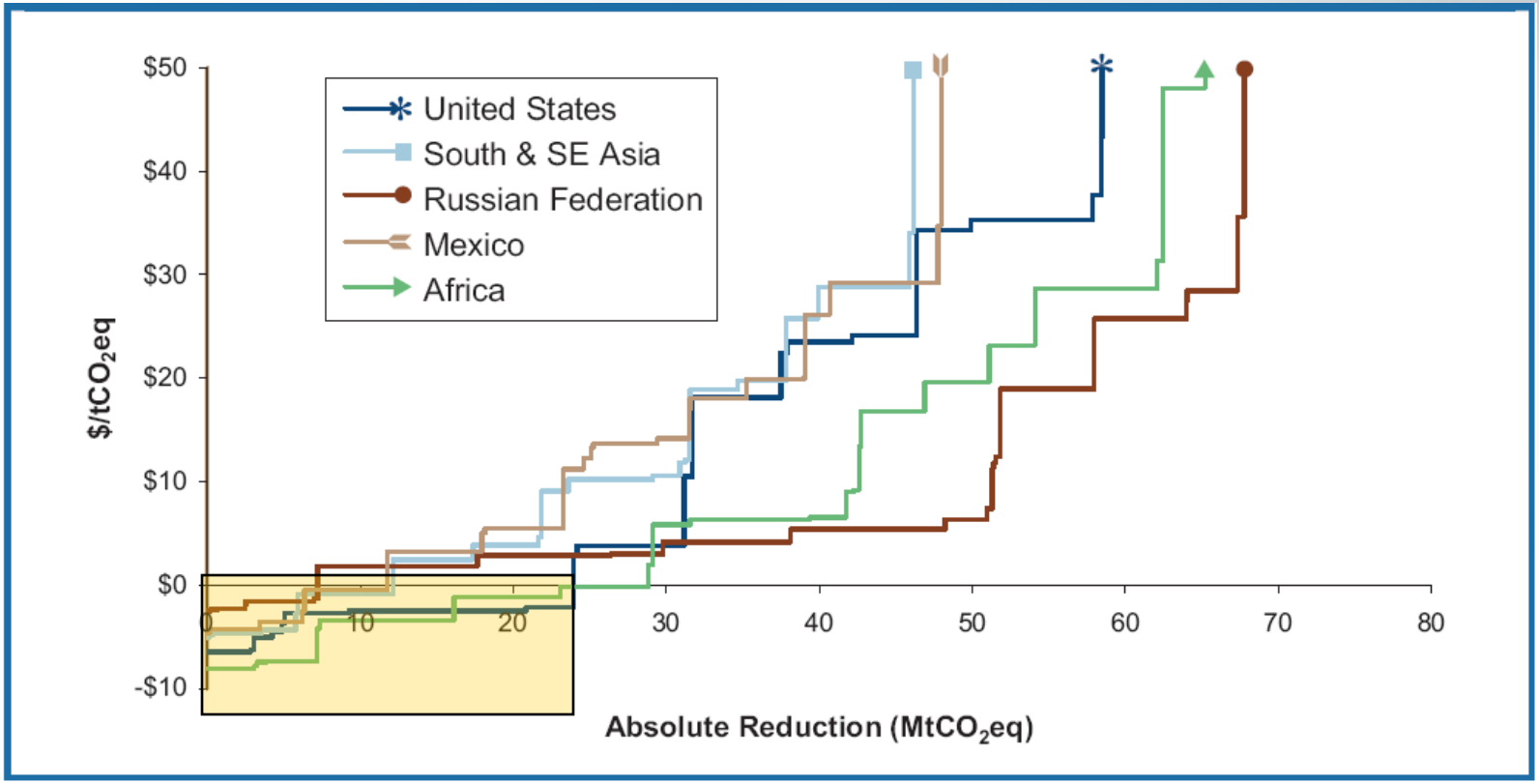
- On a global scale, approximately 30% reduction possible at a cost of about $30 per ton CO2-eq



Source: USEPA, 2003a.
Note: This table was constructed using percentage reductions from USEPA (2003), with baselines from USEPA (2005).

NG&Oil - Results

- Significant mitigation options where conserved natural gas value outweighs labor and other costs



Source: USEPA, 2003a.
Note: This table was constructed using percentage reductions from USEPA (2003), with baselines from USEPA (2005).

NG&Oil – Tech Change

- Natural gas production and consumption expanding globally, leading to more emissions if EFs constant
- Technology improvement will allow lower cost mitigation
- As low-cost mitigation opportunities are taken up, additional mitigation is more expensive
- New installations using latest technology likely to experience less leakage
- As infrastructure and equipment ages, the need to address leaks will increase

Non-CO2 in Models

- Results from EPA non-CO2 analysis have been incorporated into multiple models and datasets including:
  - MiniCAM, ADAGE, MIT-EPPA, World Energy Outlook, Global Trade Analysis Project, Energy Information Administration
- Legislative modeling of House and Senate bills
  - Understanding of non-CO2 mitigation technologies and costs is crucial to analyzing climate bills
  - In different bills, some large non-CO2 sources either covered by cap, eligible to provide offsets or could be regulated under NSPS

Further Resources

- For more information, please see the publications on our website:

  http://www.epa.gov/climatechange/economics/international.html

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