

# **Overview of EMF 22 International Scenarios**

Tuesday, September 15, 2009

# Overview

- **The goal of EMF 22 is to put together, in a timely manner, a high-quality, coordinated set of transition policy scenarios using high-quality modeling to inform ongoing and upcoming climate policy discussions.**
- Moving from idealized scenarios to more realistic scenarios that don't satisfy perfect where, when, and what flexibility.
- Three focus areas:
  - **International transition scenarios:** Delayed participation and long-term concentration goals.
  - **U.S. transition scenarios:** Three cumulative emissions goals through 2050 in the U.S.
  - **E.U. transition scenarios:** Unpacking the E.U. 2020 goal.
- Modelers required to construct a common set of scenarios, but they also include their own scenarios that inform particular facets of the issues being explored.

# **This was a fast-track project, but it still has taken some time.**

- A range of meetings dating back several years, including Tsukuba, December, 2006
- Design Meeting: Dublin, February 21-22, 2008
  - Working meeting to identify key issues and discuss study design
  - Finalize study design soon after
- Preliminary Results Meeting: IIASA, September 25-26, 2008
  - Present preliminary results and obtain feedback
  - Make data and presentations available to modelers after meeting
- Final Data Due, February 2009
- Final Modelers Meeting: March, 4-5, 2009
  - Present final results and obtain feedback
  - Discuss key themes
  - Make data and presentations available to modelers immediately after meeting
- Draft Papers: April, 2009
- Communication
  - Meeting in DC: June 4, 2009
  - E.U. Rollout Activities: In Planning
- Special Issue: All papers completed and posted on Science Direct; completing overview papers

# The EMF 22 International Scenarios explore ten possible international approaches to mitigation.

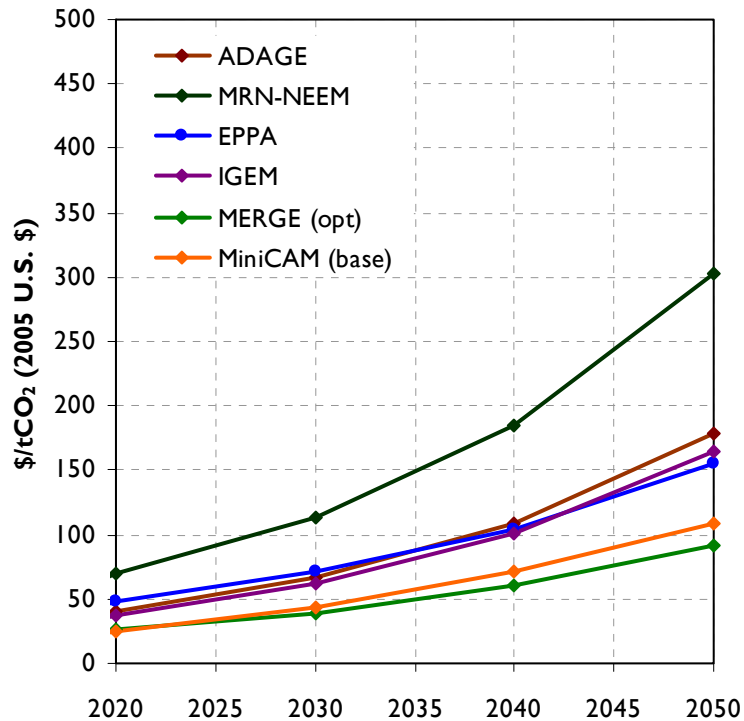
- The ten scenarios are combinations of
  - Three concentration goals based on Kyoto gases
    - (1) 450 CO<sub>2</sub>-e, (2) 550 CO<sub>2</sub>-e, and (3) 650 CO<sub>2</sub>-e
  - Two means of achieving concentration goals
    - (1) not-to-exceed this century and (2) overshoot through 2100
  - Two international policy regimes
    - (1) Full participation immediately and (2) delayed participation by non-Annex I regions and Russia

# Who Participated in the EMF 22 Scenarios

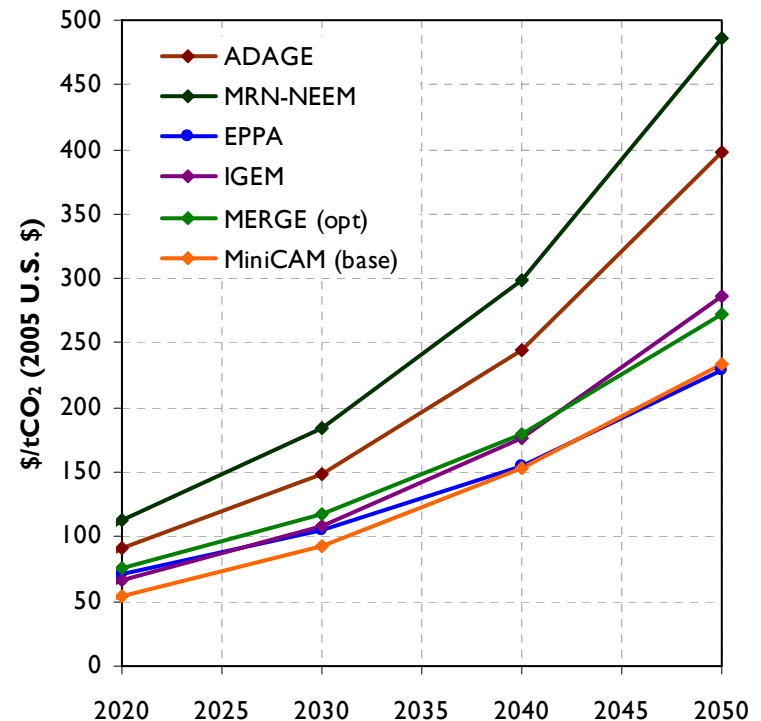
Models	International Scenarios	U.S. Scenarios	E.U. Scenarios
1 ADAGE		X	
2 EPPA		X	
3 IGEM		X	
4 MRN-NEEM		X	
5 MERGE	X	X	
6 MiniCAM	X	X	
7 ETSAP-TIAM	X		
8 FUND	X		
9 GTEM	X		
10 IMAGE	X		
11 MESSAGE	X		
12 POLES	X		
13 SGM	X		
14 WITCH	X		
15 DART			X
16 GEMINI-E3			X
17 PACE			X

# Sample Results: Allowance Prices in the U.S. Study

## “50% Reduction” by 2050



## “80% Reduction” by 2050



# Sample Result: Scenarios From the International Study


Model	650 CO <sub>2</sub> -e		550 CO <sub>2</sub> -e				450 CO <sub>2</sub> -e				
	Full Not-to- Exceed	Delay Not-to- Exceed	Full		Delay		Full		Delay		
			Not-to Exceed	Overshoot	Not-To- Exceed	Overshoot	Not-to Exceed	Overshoot	Not-To- Exceed	Overshoot	
1 ETSAP-TIAM	+	+	+	+	+	+	+	+	+	XX	+
2 FUND	+	+	+	+	+	+	+	XX	+	XX	XX
3 GTEM	+	+	+	+	XX	+	+	XX	+	XX	XX
4 IMAGE	+	+	+	+	+	+	+	XX	XX	XX	XX
4 IMAGE-BC	-N/A-	-N/A-	-N/A-	-N/A-	-N/A-	-N/A-	-N/A-	XX	+	XX	XX
5 MERGE Optimistic	+	+	+	+	XX	XX	XX	XX	XX	XX	XX
5 MERGE Pessimistic	+	+	+	+	+	+	+	XX	XX	XX	XX
6 MESSAGE	+	+	+	+	XX	+	+	XX	+	XX	XX
6 MESSAGE - NOBECS	+	-N/A-	+	+	-N/A-	-N/A-	-N/A-	XX	+	XX	XX
7 MiniCAM Base	+	+	+	+	XX	+	+	+	+	XX	+
7 MiniCAM LoTech	+	+	+	+	XX	+	+	XX	+	XX	XX
8 POLES	+	+	+	+	XX	+	+	XX	XX	XX	XX
9 SGM	+	+	+	+	+	+	+	XX	XX	XX	XX
10 WITCH	+	+	+	+	+	+	+	XX	XX	XX	XX

Some models were unable to achieve particular climate action cases under the specs of the study.

# Sample Results: The Challenges of 450 CO<sub>2</sub>-e



(From the MiniCAM Paper: Calvin et al.)


	Not-to-Exceed	Overshoot
Immediate Accession	<ul style="list-style-type: none"> <li>1) Includes immediate participation by all regions</li> <li>2) Includes 70% dramatic emissions reductions by 2020</li> <li>3) Includes substantial transformation of the energy system by 2020, including the construction of 500 new nuclear reactors, and the capture of 20 billion tons of CO<sub>2</sub></li> <li>4) Includes a carbon price of \$100/tCO<sub>2</sub> globally in 2020</li> <li>5) Includes a tax on land-use emissions beginning in 2020</li> <li>6) Includes advanced technologies</li> </ul>	<ul style="list-style-type: none"> <li>1) Includes immediate participation by all regions</li> <li>2) Includes the construction of 126 new nuclear reactors and the capture of nearly a billion tons of CO<sub>2</sub> in 2020</li> <li>3) Includes negative global emissions by the end of the century, and thus requires broad deployment of bioCCS technologies</li> <li>4) Carbon prices escalate to \$775/tCO<sub>2</sub> in 2095</li> <li>5) Possible without a tax on land-use emissions, but would result in a tripling of carbon taxes and a substantial increase in the cost of meeting the target.</li> </ul>
Delayed Accession		<ul style="list-style-type: none"> <li>1) Includes dramatic emissions reductions for Groups 2 and 3 at the time of their accession,</li> <li>2) Includes negative emissions in Group 1 by 2050 and negative global emissions by the end of the century, and thus requires broad deployment of bioCCS technologies</li> <li>3) Carbon prices begin at \$50/tCO<sub>2</sub>, and rise to \$2000/tCO<sub>2</sub></li> <li>4) Results in significant land-use leakage, where crop production is outsourced to non-participating regions resulting in a substantial increase in land-use change emissions in these regions</li> </ul>



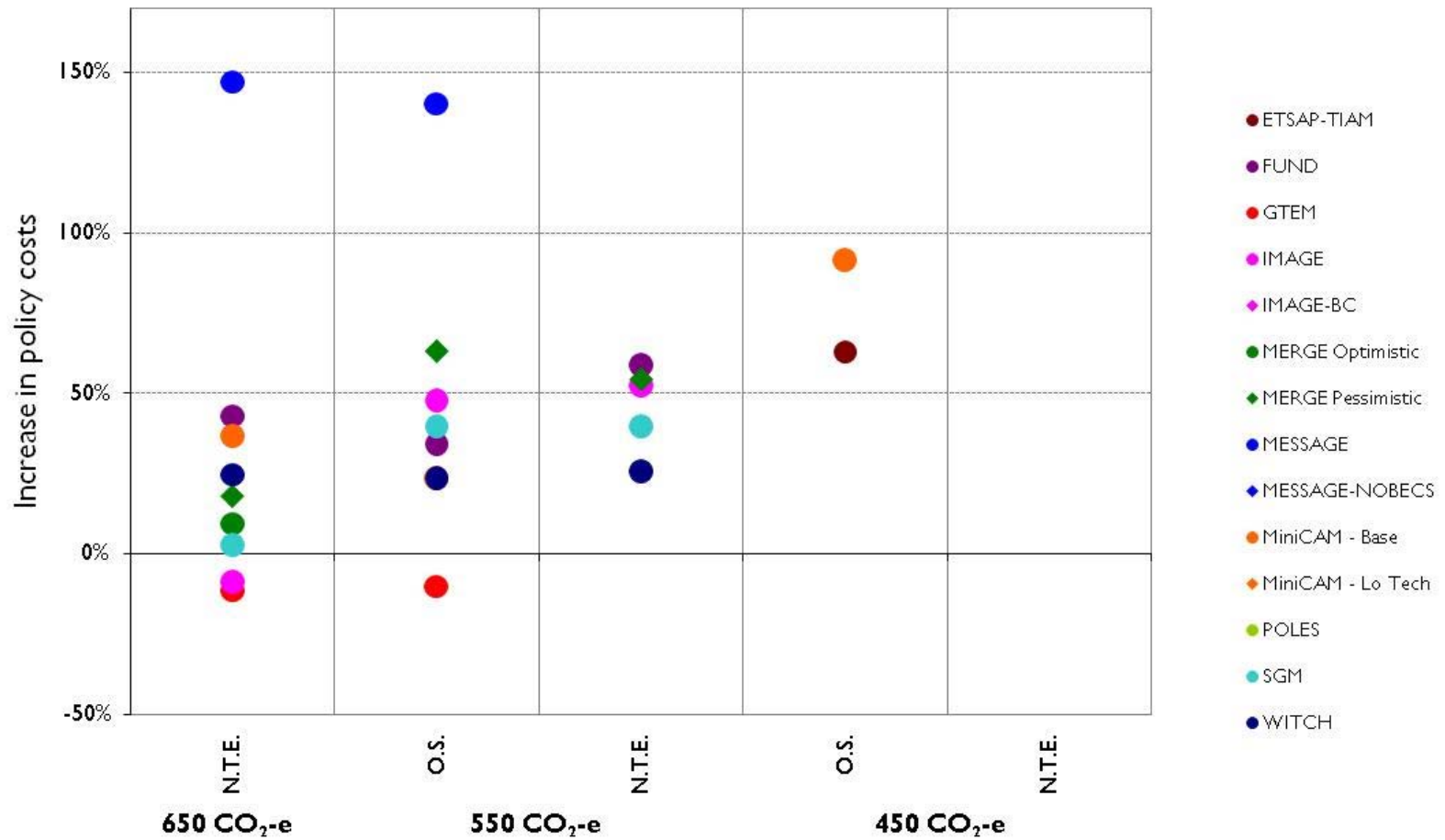
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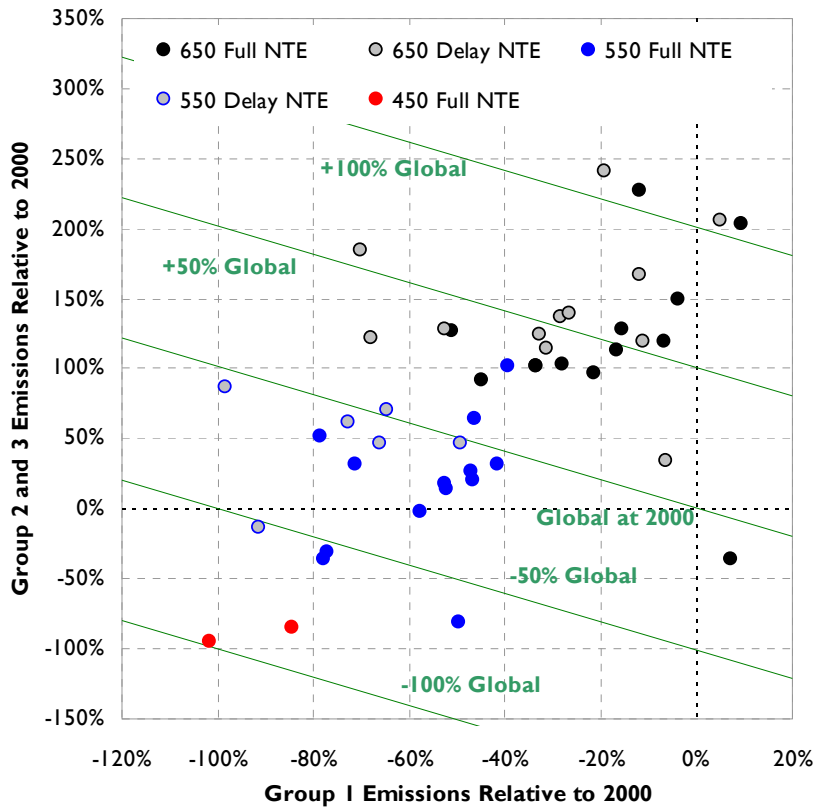
	Not-to-Exceed	Overshoot
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# Sample Results: Costs of Delay to China

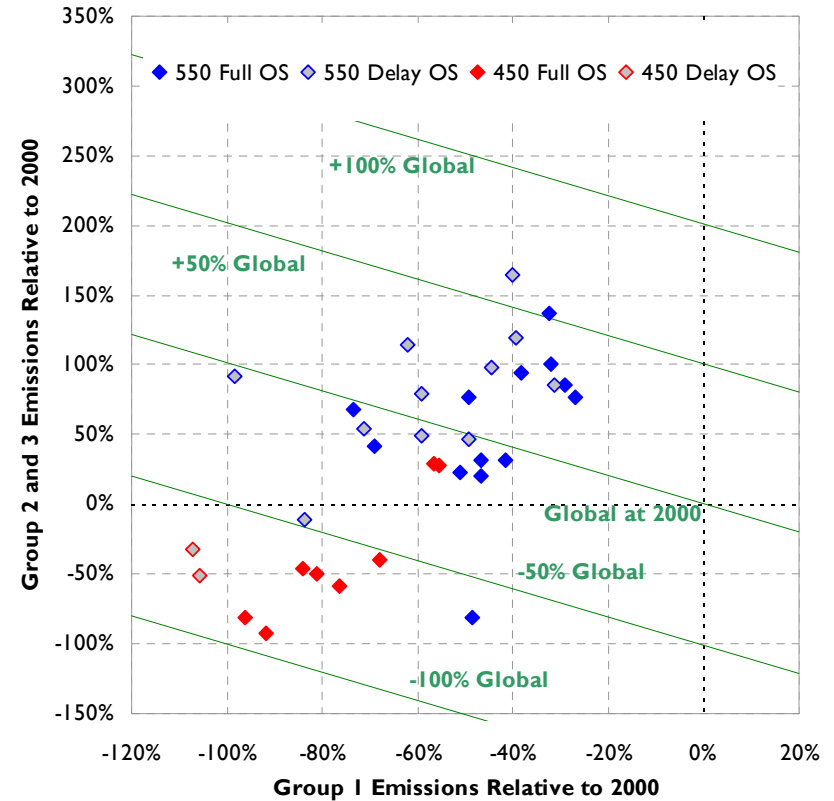


# Sample Results: Regional Reductions in 2050 across Scenarios

## Not-to-Exceed Scenarios



## Overshoot Scenarios



# Natural Extensions?

- More nuanced and “realistic” policy structures, particularly in the near-term.
  - More “Realistic” Relative Burdens
  - More “Realistic” Mechanisms for Mitigation (e.g., command and control policies)
  - Across Both: Consideration of Local Circumstances
- More exploration of technology development and deployment pathways.
- More explicit consideration of physical systems
  - For example, temperature based goals
  - Feedbacks, for example, land use and energy demand
  - The impacts of overshoots