Sectoral Approaches in International and National Policy

2nd International Expert Meeting on Bottom-up Based Analysis on Mitigation Potential

Leon Clarke, Kate Calvin

October 21, 2008

Pacific Northwest
NATIONAL LABORATORY

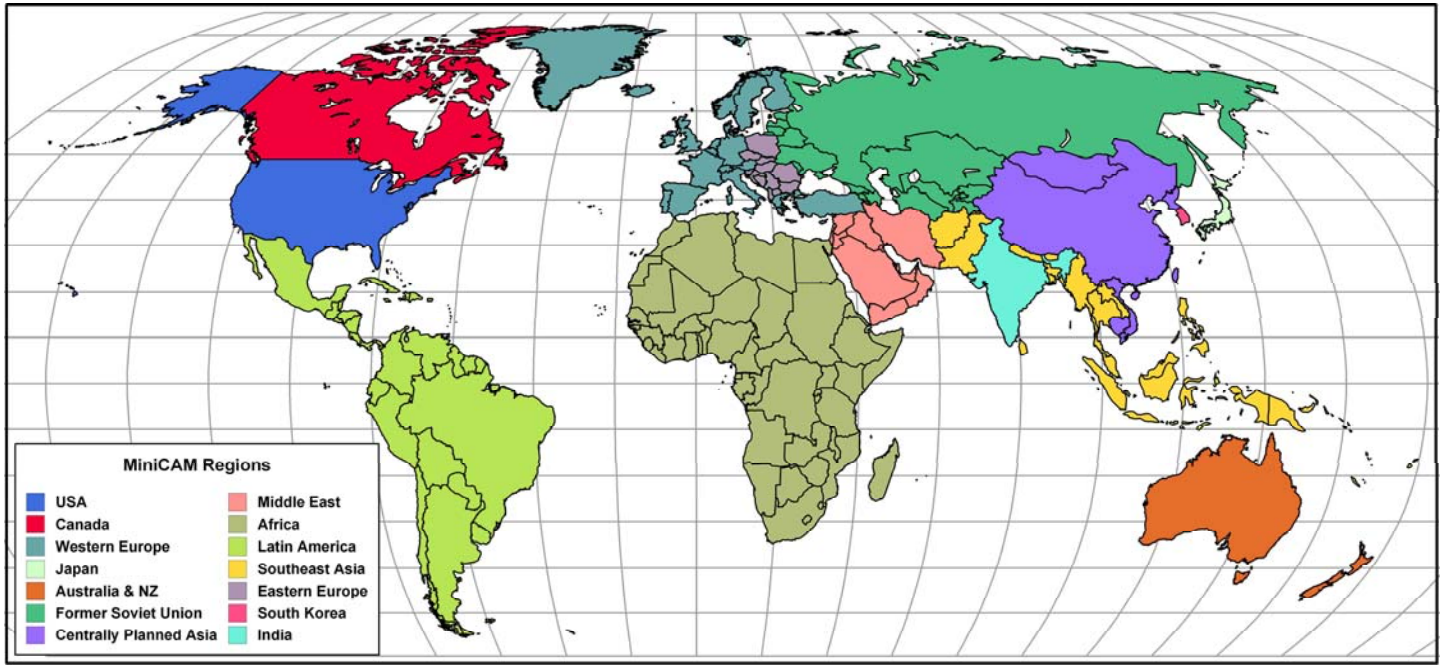
Acknowledgements

Thanks to the supporters of the

Global Technology Strategy Project

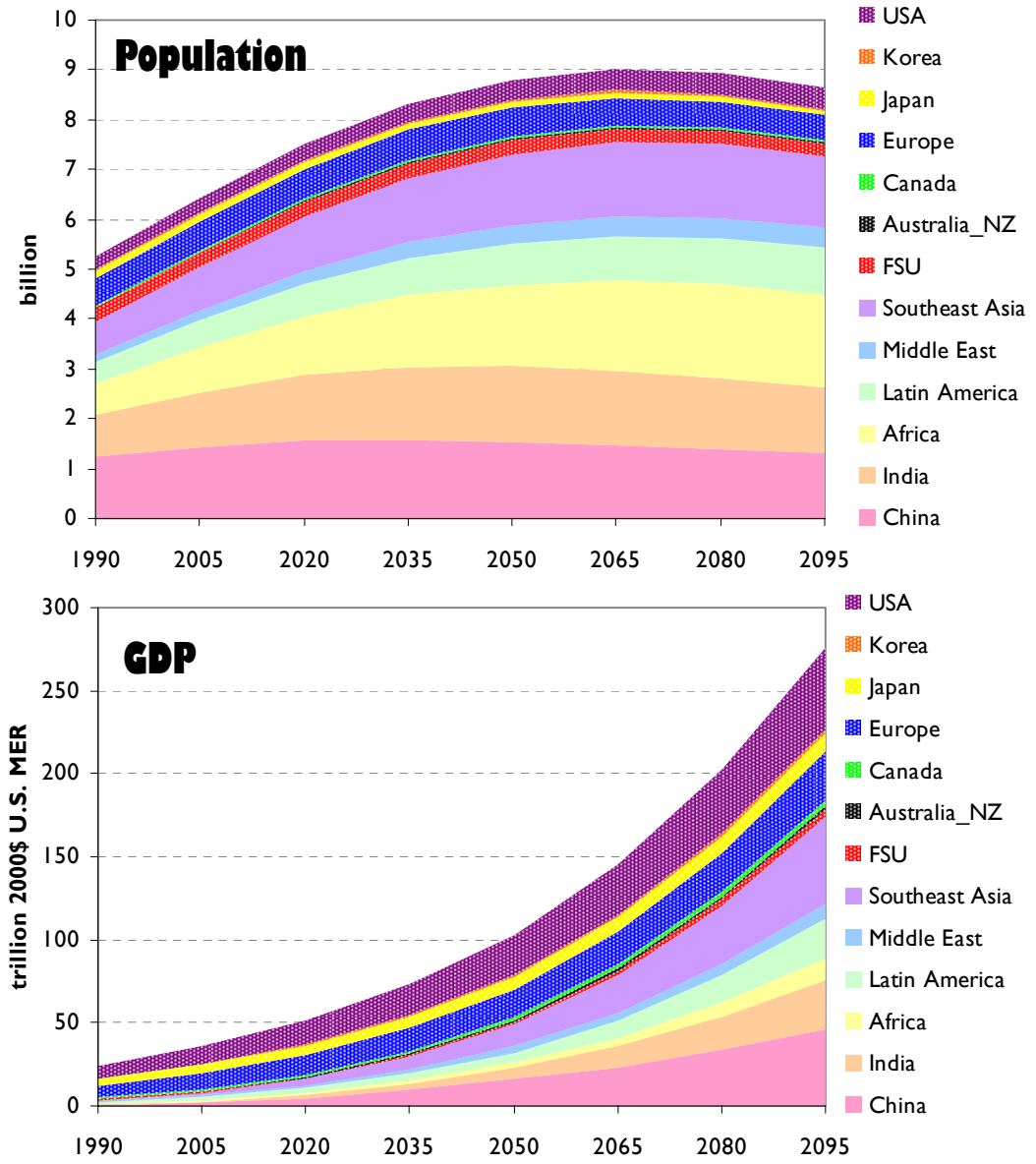
GTSP Sponsors – Phases 1,2, & 3

Overview of MiniCAM



- Integrated Assessment Model
- 14 Global Regions – Fully Integrated
- Explicit Energy Technologies – All Regions – "**Hybrid" Model**
- Economic Equilibrium Model – Dynamic Recursive
- Fully Integrated Agriculture and Land Use Model
  - Key for consistent biomass crop analysis
- Multiple Greenhouse Gases
- Runs to 2100 in 15-year time steps – **Long-Term** Integrated Perspective

The Reference Case: Population and GDP



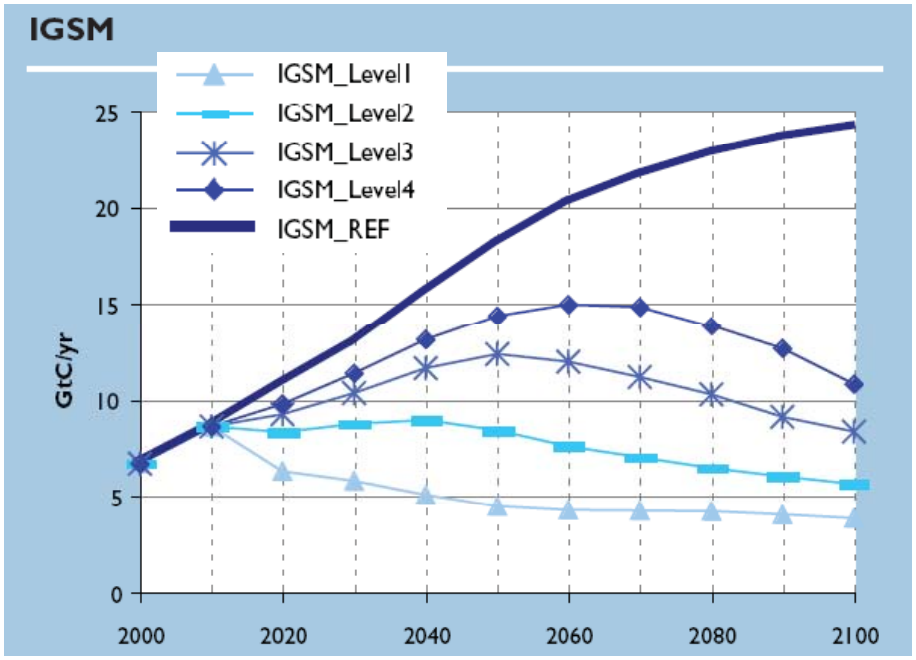
Most MiniCAM scenarios envision a growing global economy with an evolution in the distribution of economic activity.

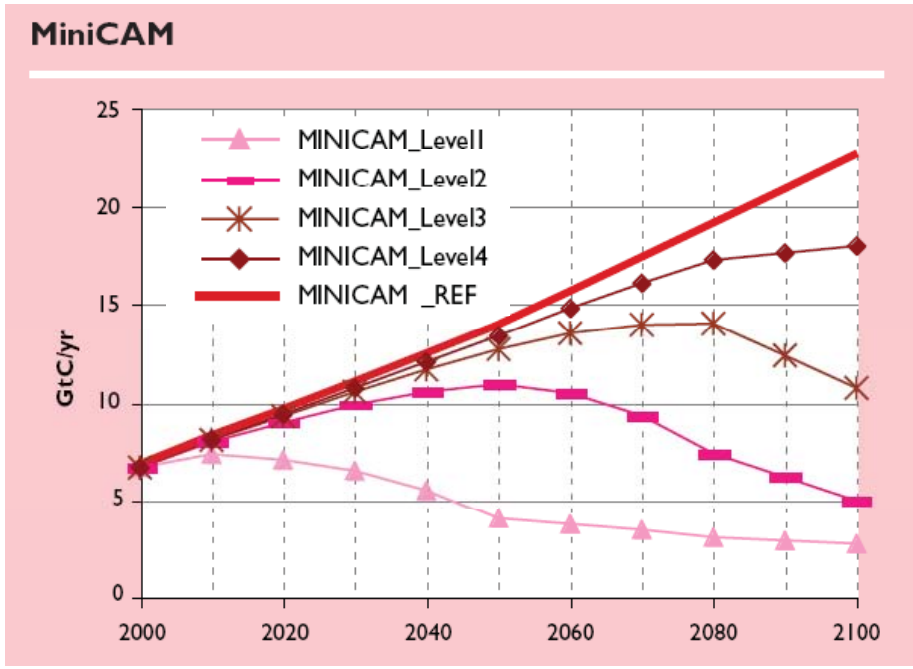
MiniCAM has 14 regions and represents population growth, labor productivity growth, and labor participation as drivers of economic activity.

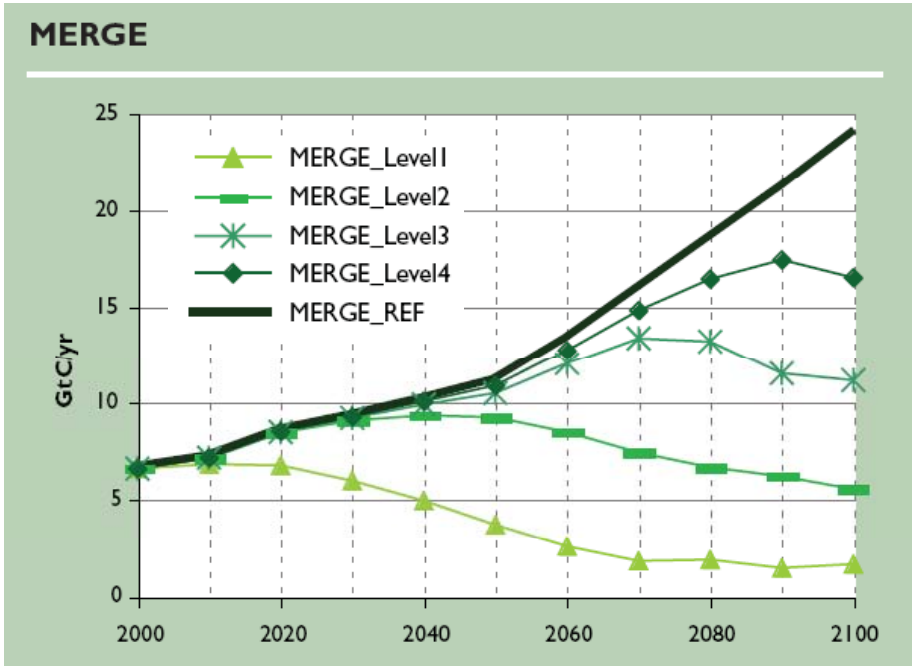
Pacific Northwest
NATIONAL LABORATORY

Background on Stabilization

Pacific Northwest
NATIONAL LABORATORY



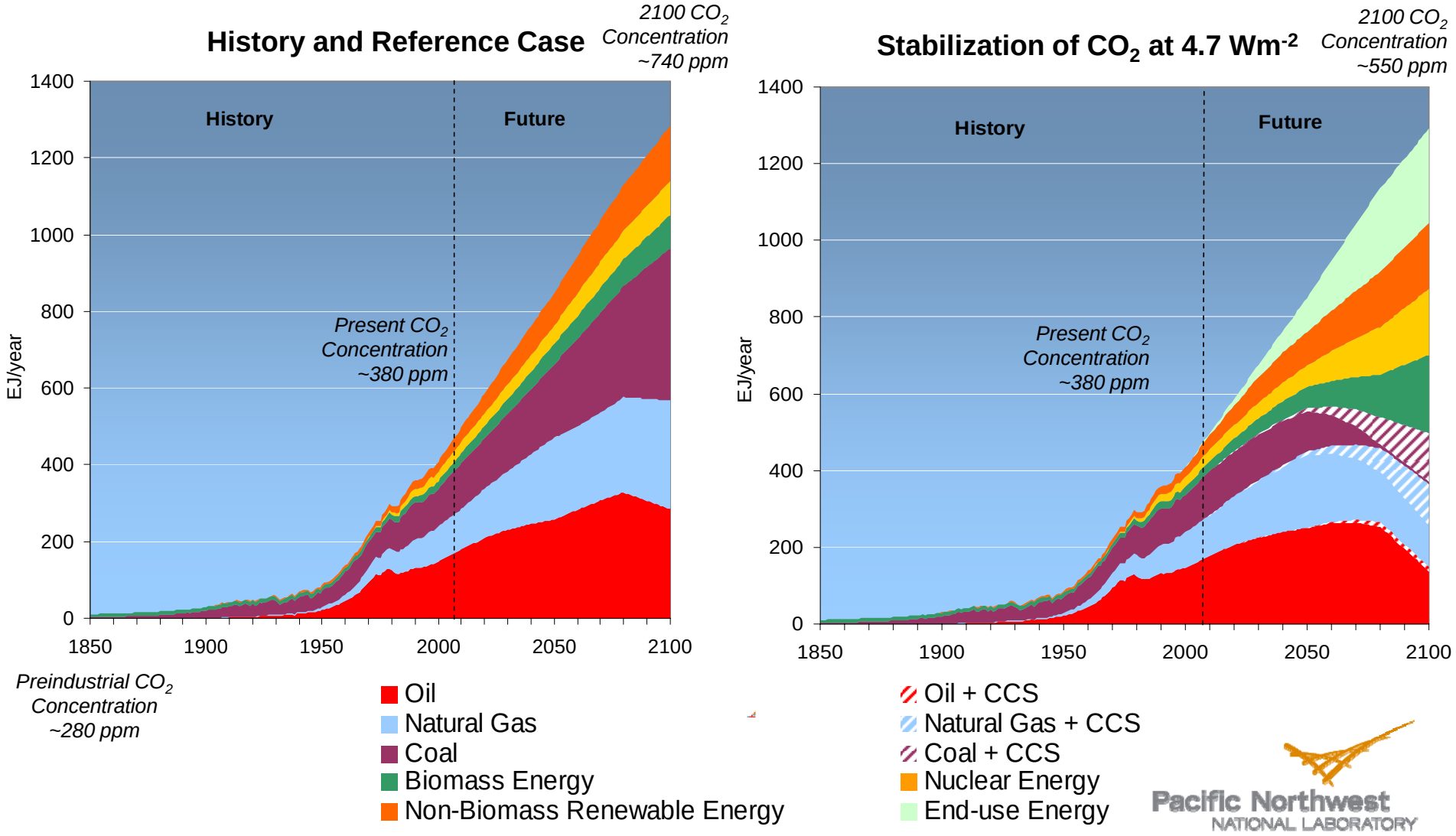




Stabilization requires that emissions ultimately decline toward the rate at which emissions are balanced by removal processes.

Pacific Northwest
NATIONAL LABORATORY

Large emissions reductions require large changes in global energy and agricultural systems.



Pacific Northwest NATIONAL LABORATORY

Stabilization implies that greenhouse gases have a price – either implicitly or explicitly.

- If carbon and other GHG's are valued at zero, both implicitly and explicitly—you get the reference scenario.
- None of the reference scenarios that we have examined stabilize GHG concentrations at low levels.

Pacific Northwest
NATIONAL LABORATORY

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.

- The Implications for sectoral policies
  - The policy needs to reach all sectors.
  - Mitigation costs will be minimized by equalizing marginal costs across sectors, regions, and gases.

- Three Examples
  - Sectoral Policies in the Energy and Industrial Sectors
  - Land use and Emissions Policies
  - International Participation

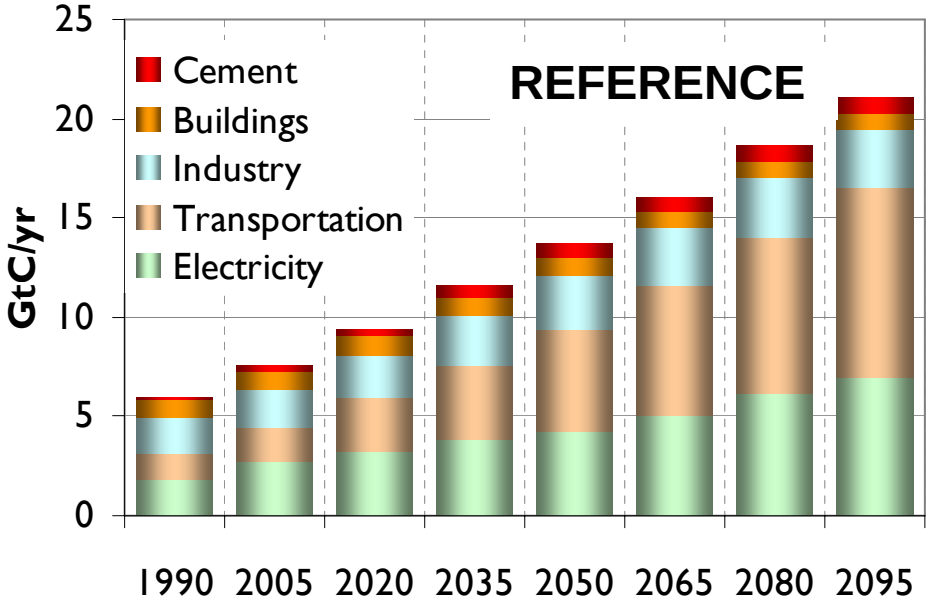
Pacific Northwest
NATIONAL LABORATORY

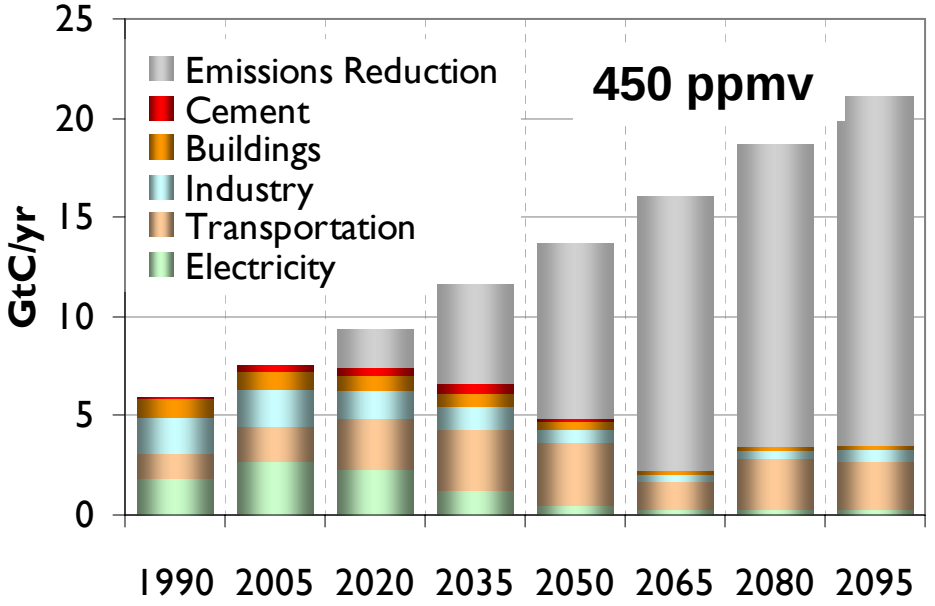
Energy And Industrial Sectoral Emissions Reductions

Pacific Northwest
NATIONAL LABORATORY

Sectoral Emissions in the Reference and Stabilization at 450 ppmv

Sectoral emissions reductions vary because of differing opportunities



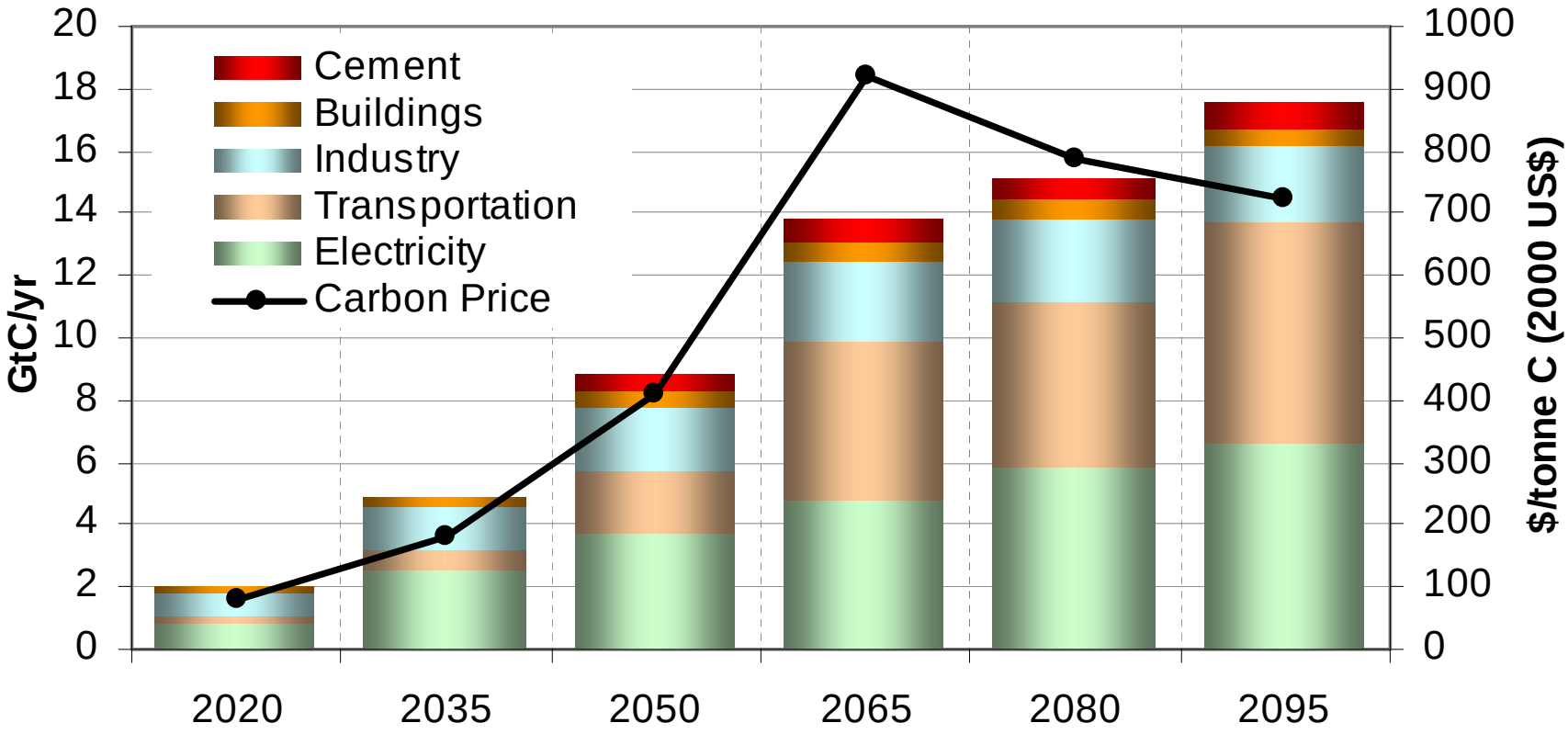


Sectors in MiniCAM

Transport*, Refining, Electricity, Cement, Other Industry*, Buildings*

Pacific Northwest
NATIONAL LABORATORY

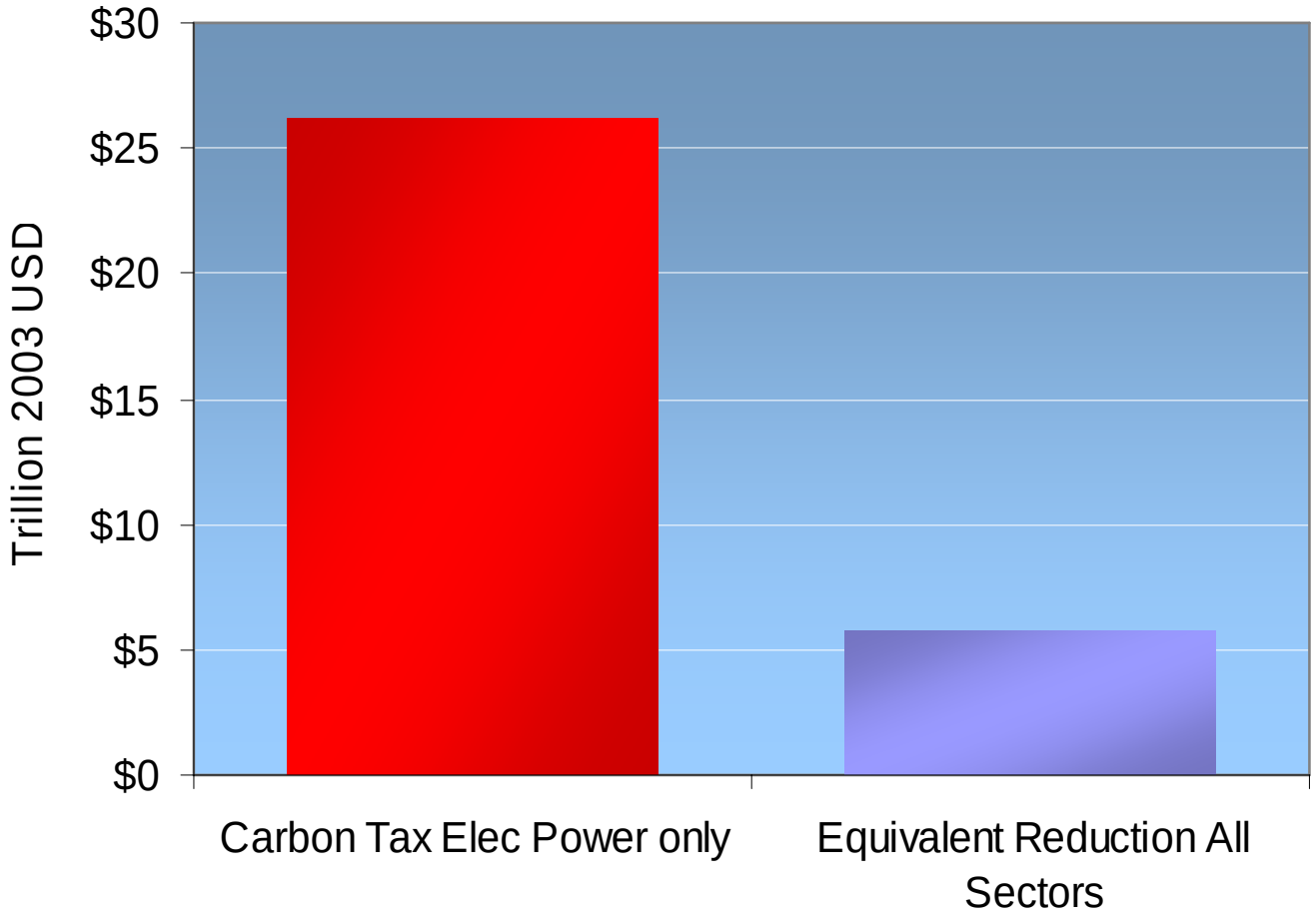
Emissions Mitigation by Sector in 450 Stabilization



Pacific Northwest
NATIONAL LABORATORY

Single Sector Reductions: A Sectoral Policy Experiment

If only one sector sees a carbon prices, then the cost of reducing a tonne of carbon emissions rises dramatically.



From Edmonds, J., T. Wilson, M. Wise, and J. Weyant. 2005. Electrification of the Economy and CO_2 Emissions Mitigation, *Journal of Environmental Economics and Policy Studies*. (2006) 7:175-203. [PNWD-3574].

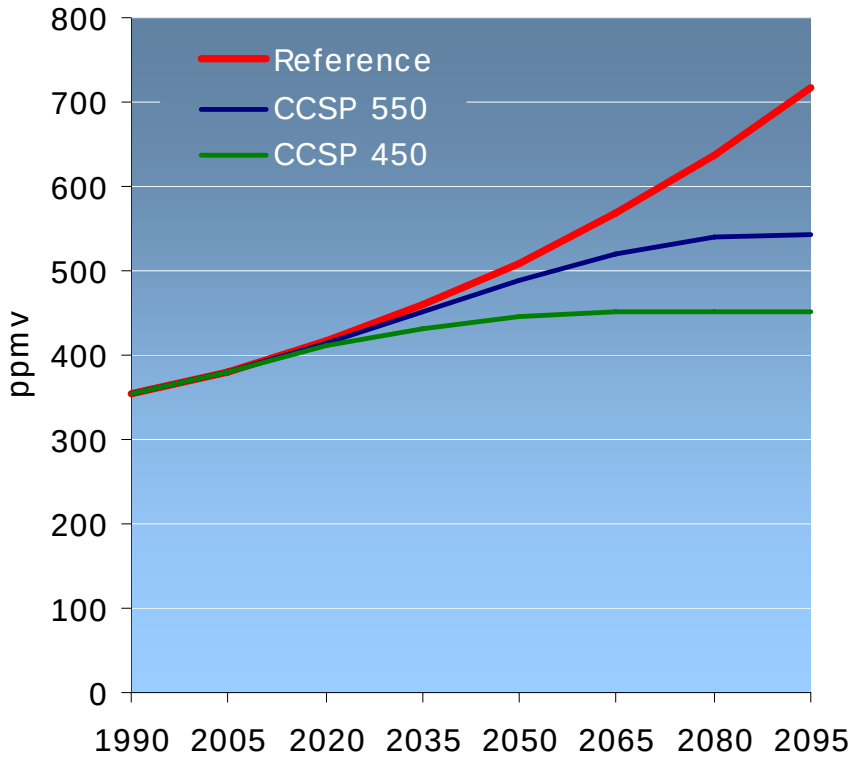
Pacific Northwest NATIONAL LABORATORY

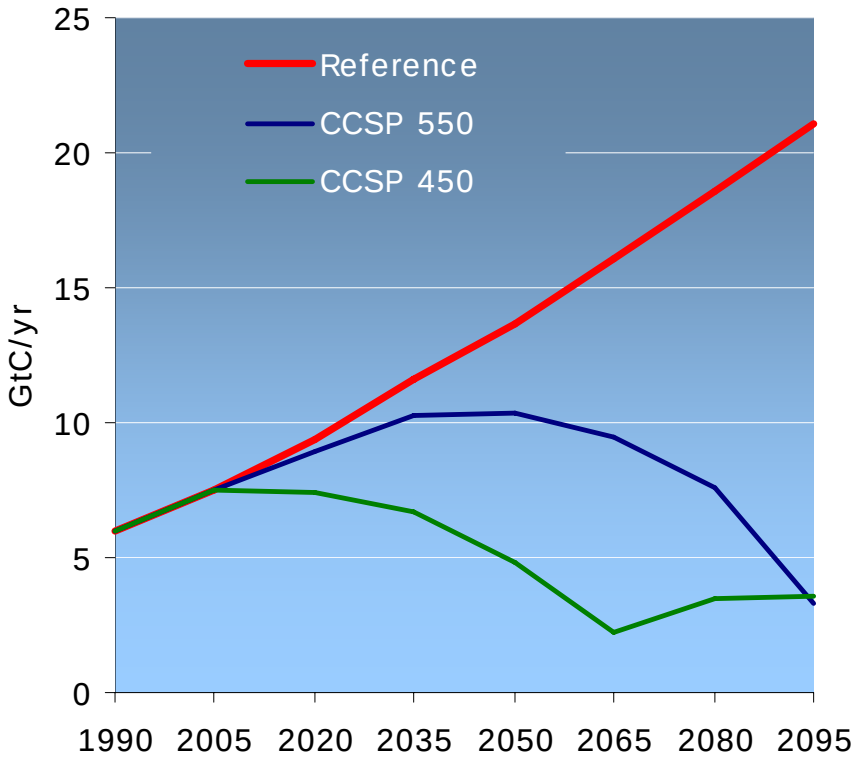
“Equal Shares”: A Sectoral Policy Experiment

- Two CO2 stabilizations scenarios
  - 450 ppm and 550 ppm
- Two Policy Regimes – Full Fossil & Industrial Coverage
  - Universal, globally common carbon tax (CCSP)
  - Each sector reduces its emissions by an equal amount relative to 2005
- Land use sector values carbon at the WRE rate in both policy regimes.

Pacific Northwest
NATIONAL LABORATORY

“Equal Shares”: Anthropogenic CO2 Emissions and Concentrations





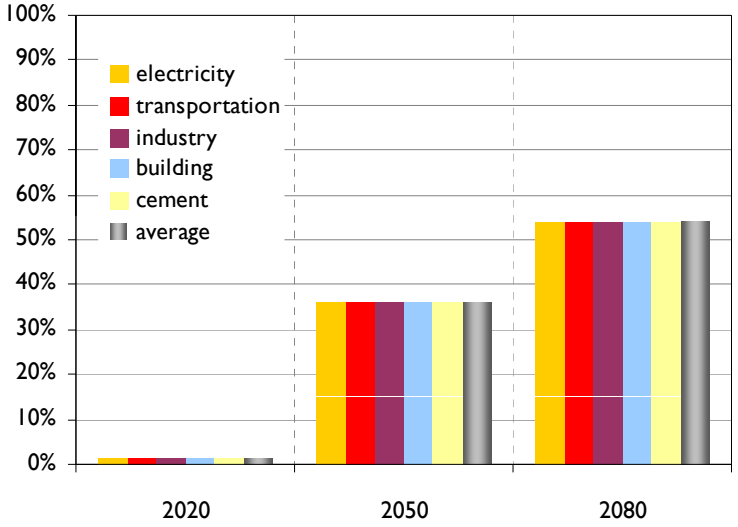
Pacific Northwest
NATIONAL LABORATORY

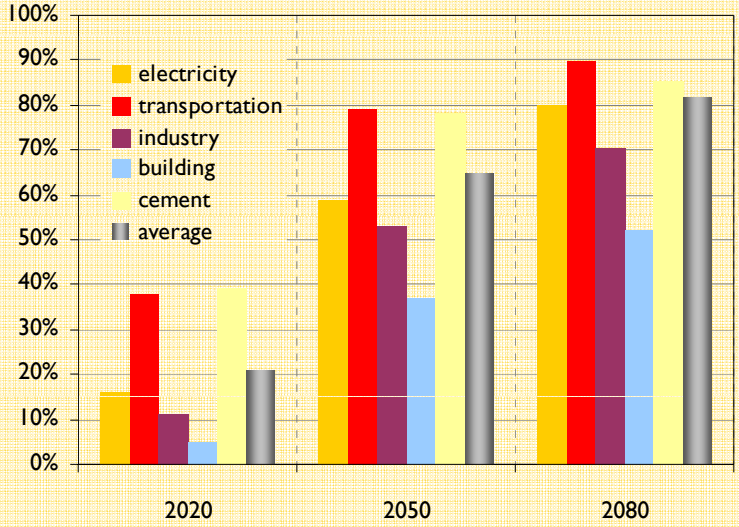
“Equal Shares”: Emissions by Sector

Reductions Relative to 2005

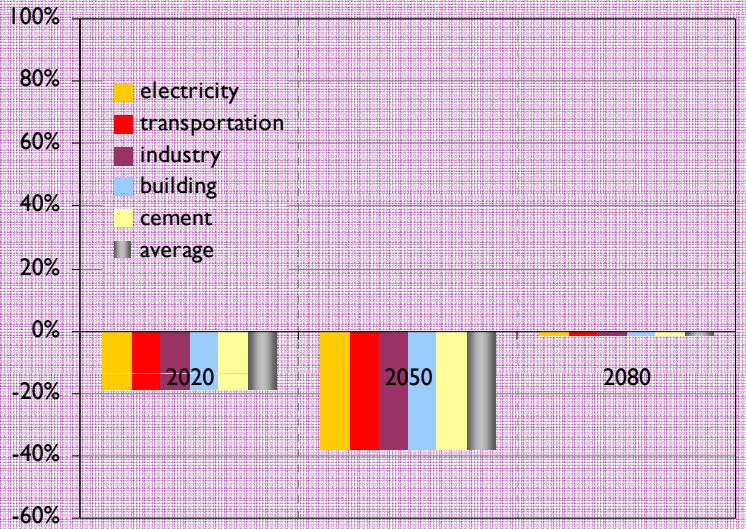
Reductions Relative to Ref

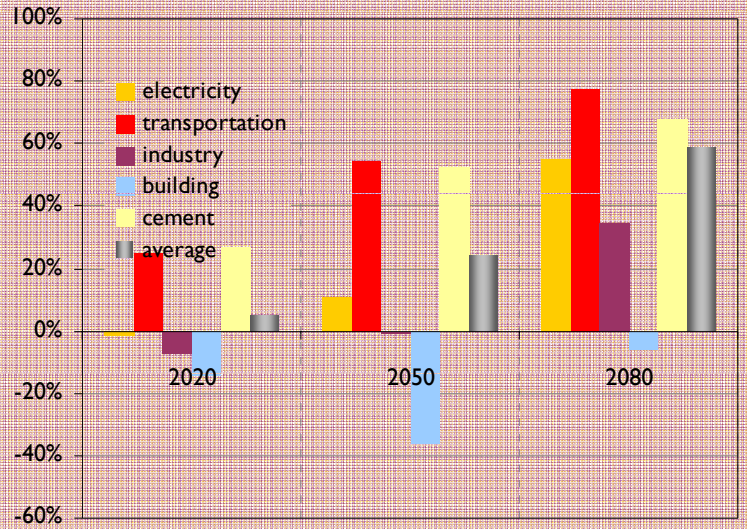
450 ppm



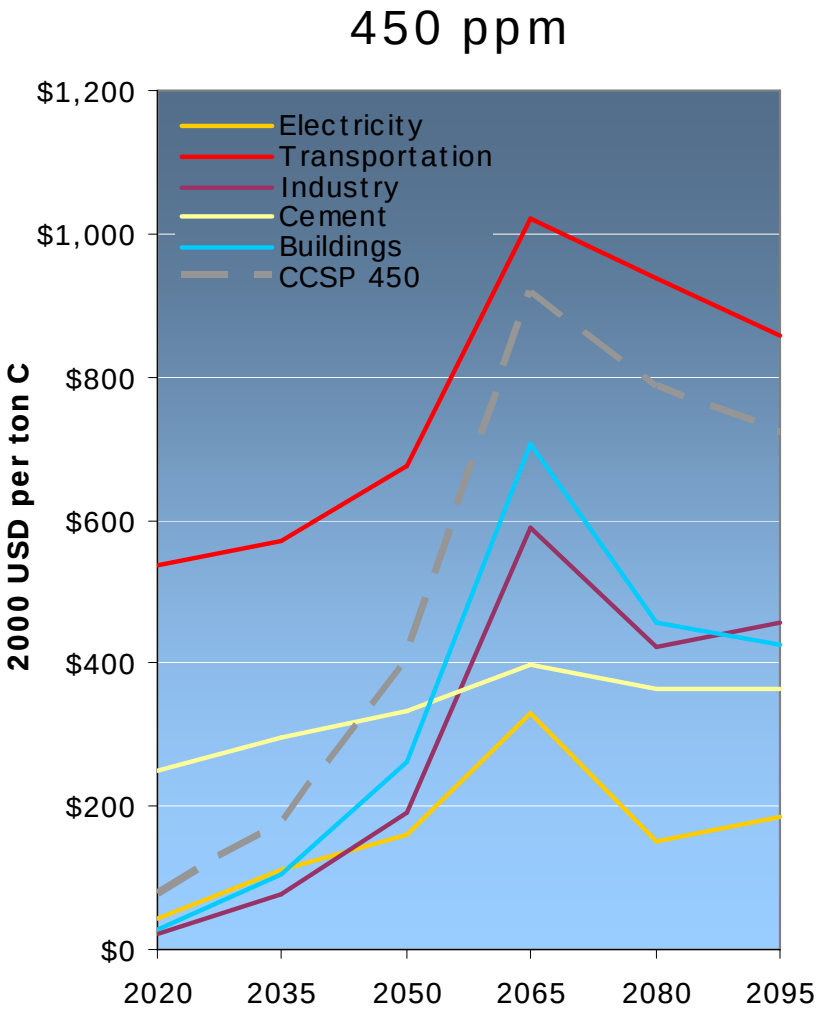


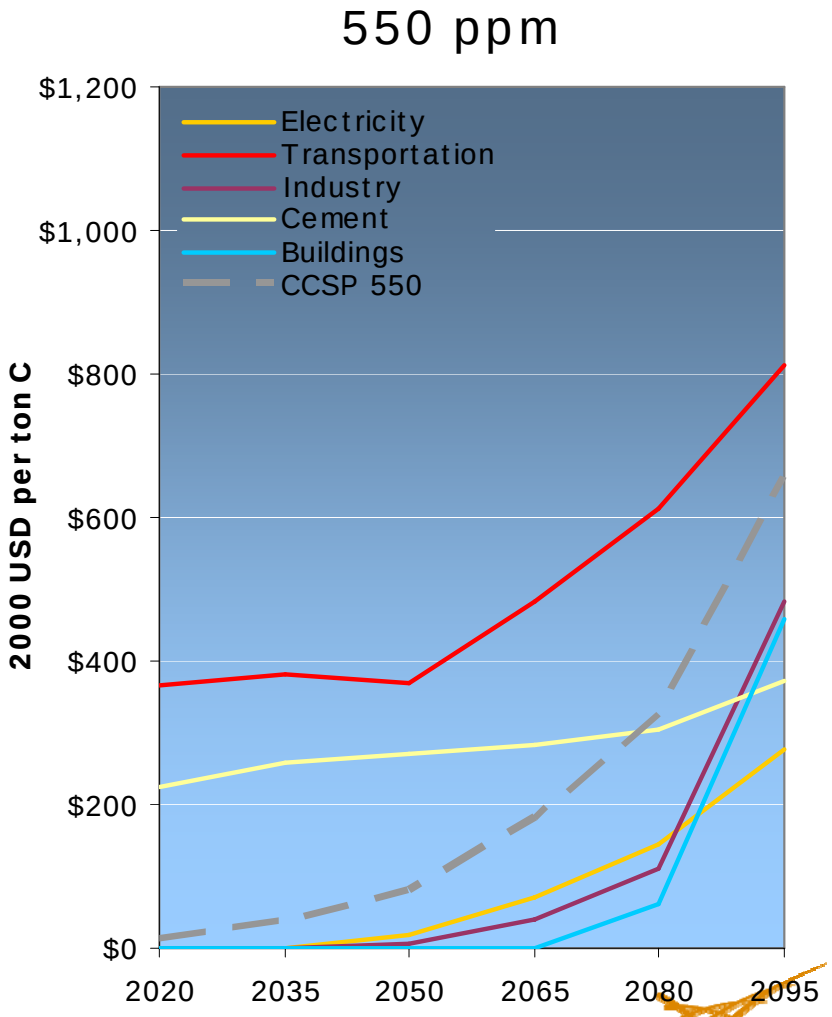
550 ppm





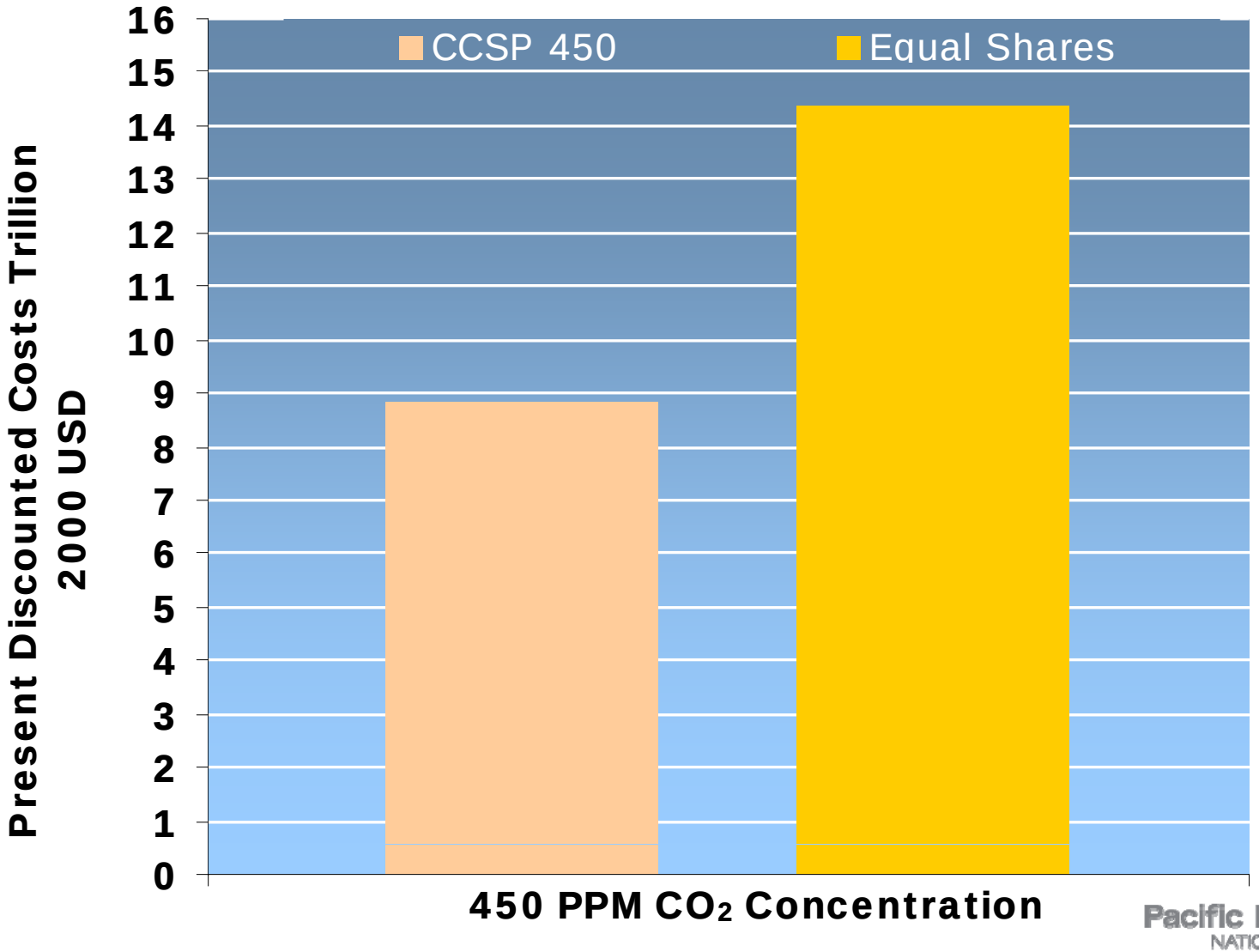
“Equal Shares” = Unequal Marginal Costs





Pacific Northwest
NATIONAL LABORATORY

“Equal Shares” = Higher Total Costs



Pacific Northwest
NATIONAL LABORATORY

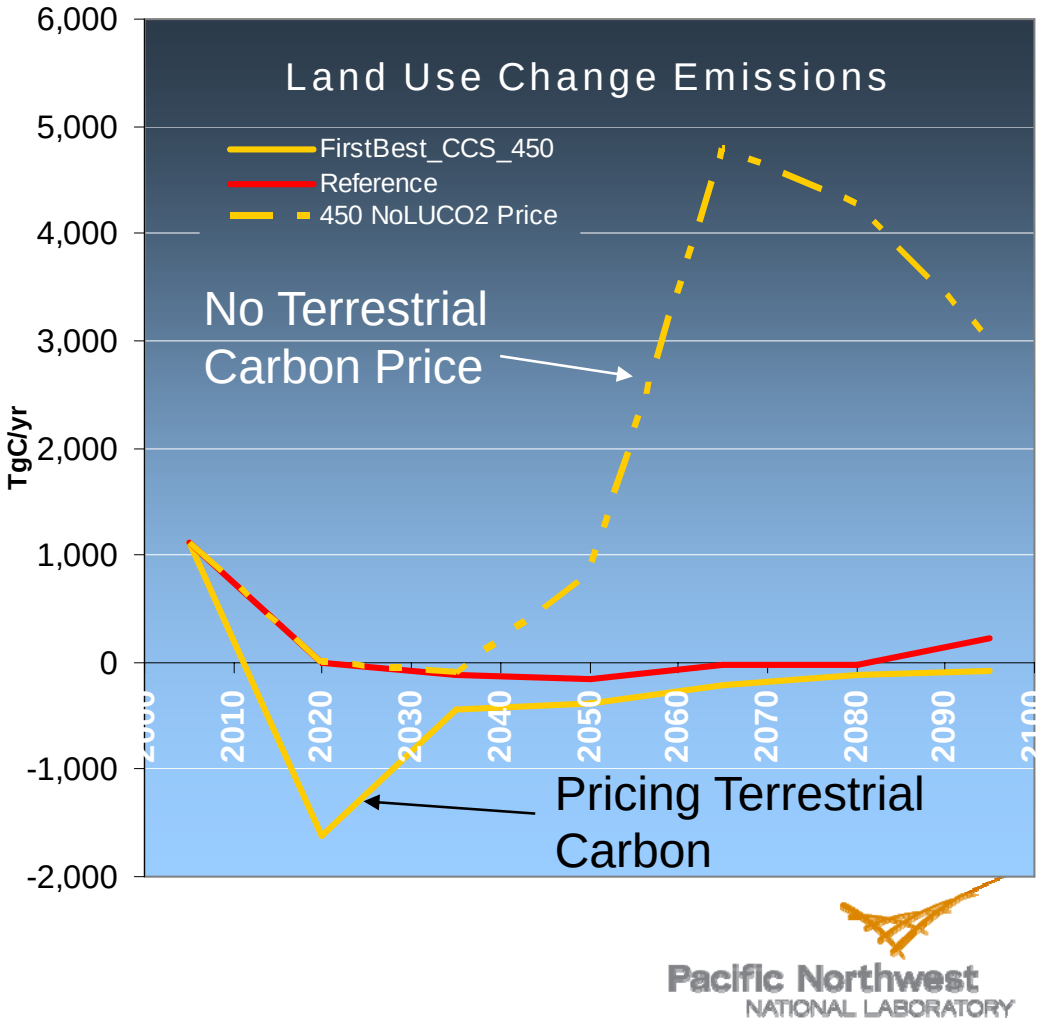
Land Use and Sectoral Policy Approaches

Pacific Northwest
NATIONAL LABORATORY

The Importance of 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

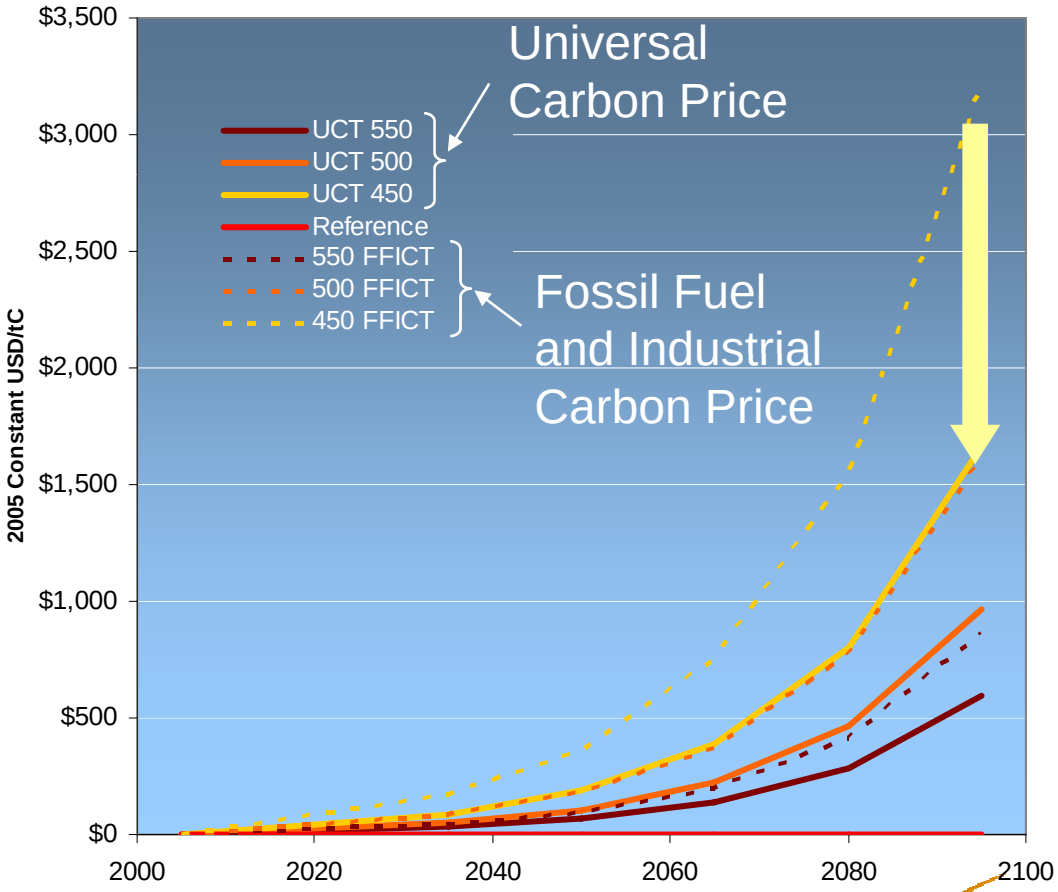


Pacific Northwest
NATIONAL LABORATORY

The Importance of Terrestrial Carbon

Valuing all carbon, including terrestrial carbon

- Dramatically reduces the price of carbon
- Reduces the long-term role of bioenergy



Pacific Northwest
NATIONAL LABORATORY

International Participation and Climate Policy

Pacific Northwest
NATIONAL LABORATORY

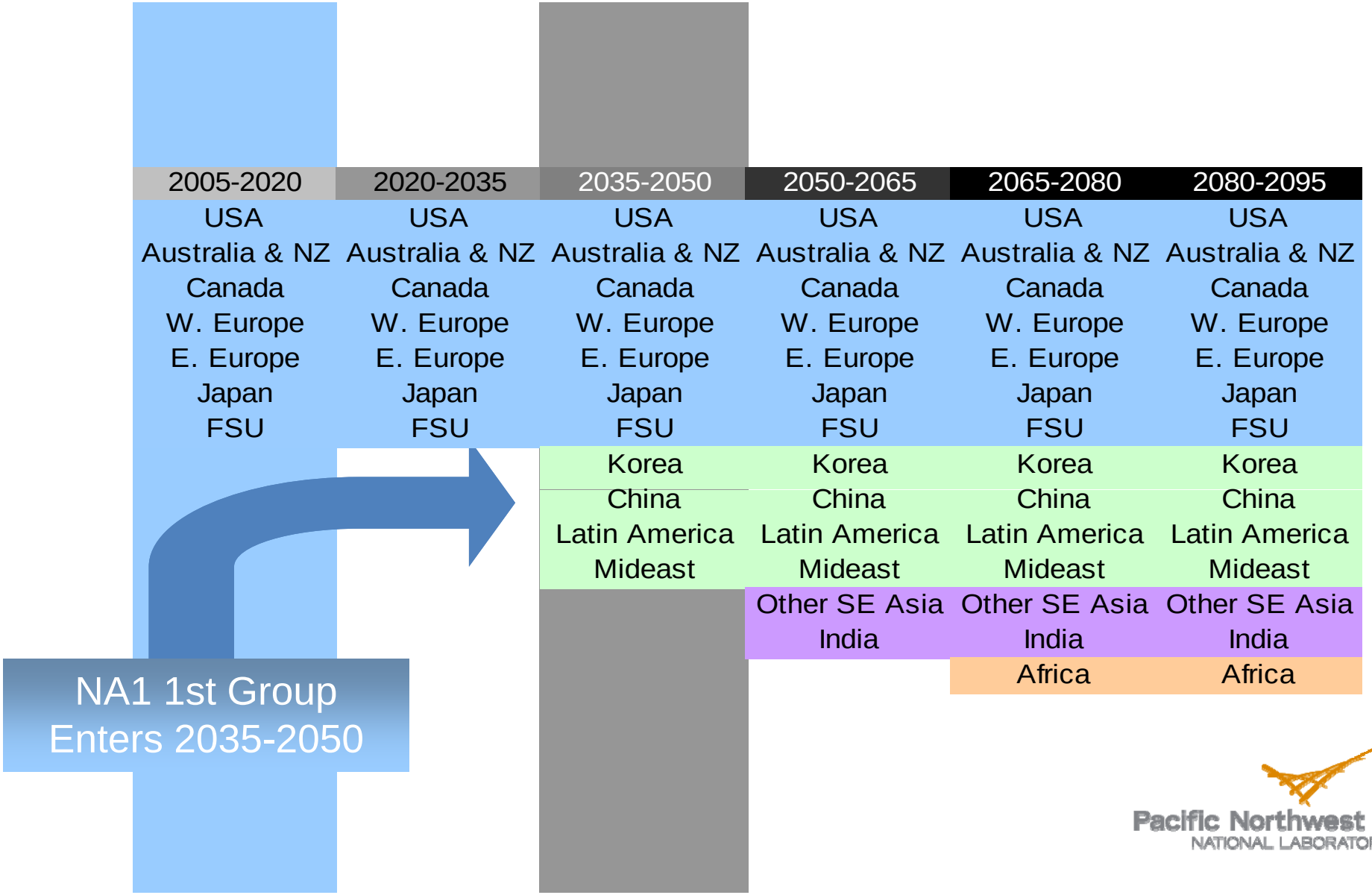
Three Scenarios of Delayed Participation

2005-2020	2020-2035	2035-2050	2050-2065	2065-2080	2080-2095
USA	USA	USA	USA	USA	USA
Australia & NZ	Australia & NZ	Australia & NZ	Australia & NZ	Australia & NZ	Australia & NZ
Canada	Canada	Canada	Canada	Canada	Canada
W. Europe	W. Europe	W. Europe	W. Europe	W. Europe	W. Europe
E. Europe	E. Europe	E. Europe	E. Europe	E. Europe	E. Europe
Japan	Japan	Japan	Japan	Japan	Japan
FSU	FSU	FSU	FSU	FSU	FSU
	Korea	Korea	Korea	Korea	Korea
	China	China	China	China	China
	Latin America	Latin America	Latin America	Latin America	Latin America
	Mideast	Mideast	Mideast	Mideast	Mideast
		Other SE Asia	Other SE Asia	Other SE Asia	Other SE Asia
		India	India	India	India
			Africa	Africa	Africa

NA1 1st Group Enters 2020-2035

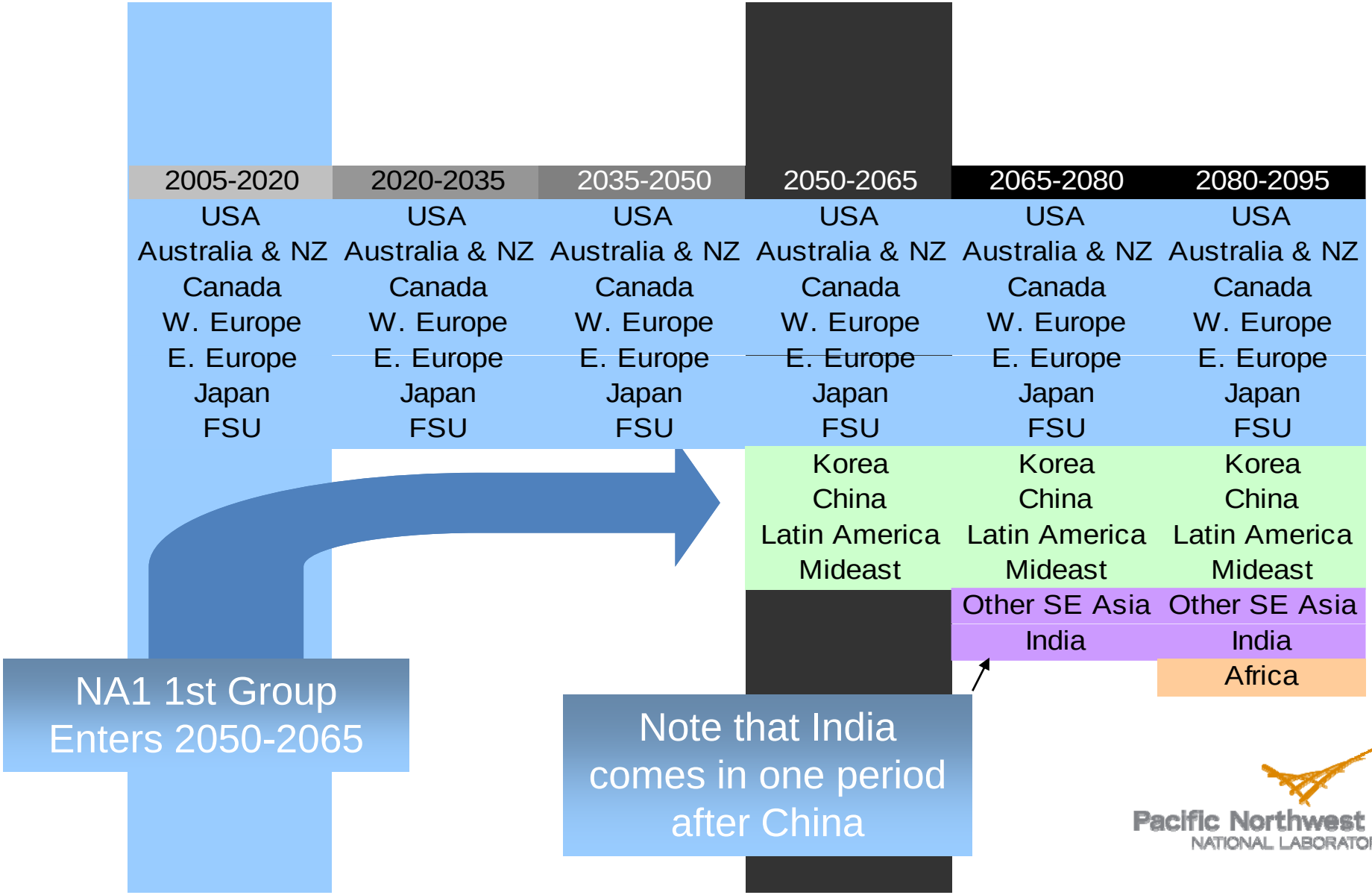
Pacific Northwest NATIONAL LABORATORY

Three Scenarios of Delayed Participation



Pacific Northwest
NATIONAL LABORATORY

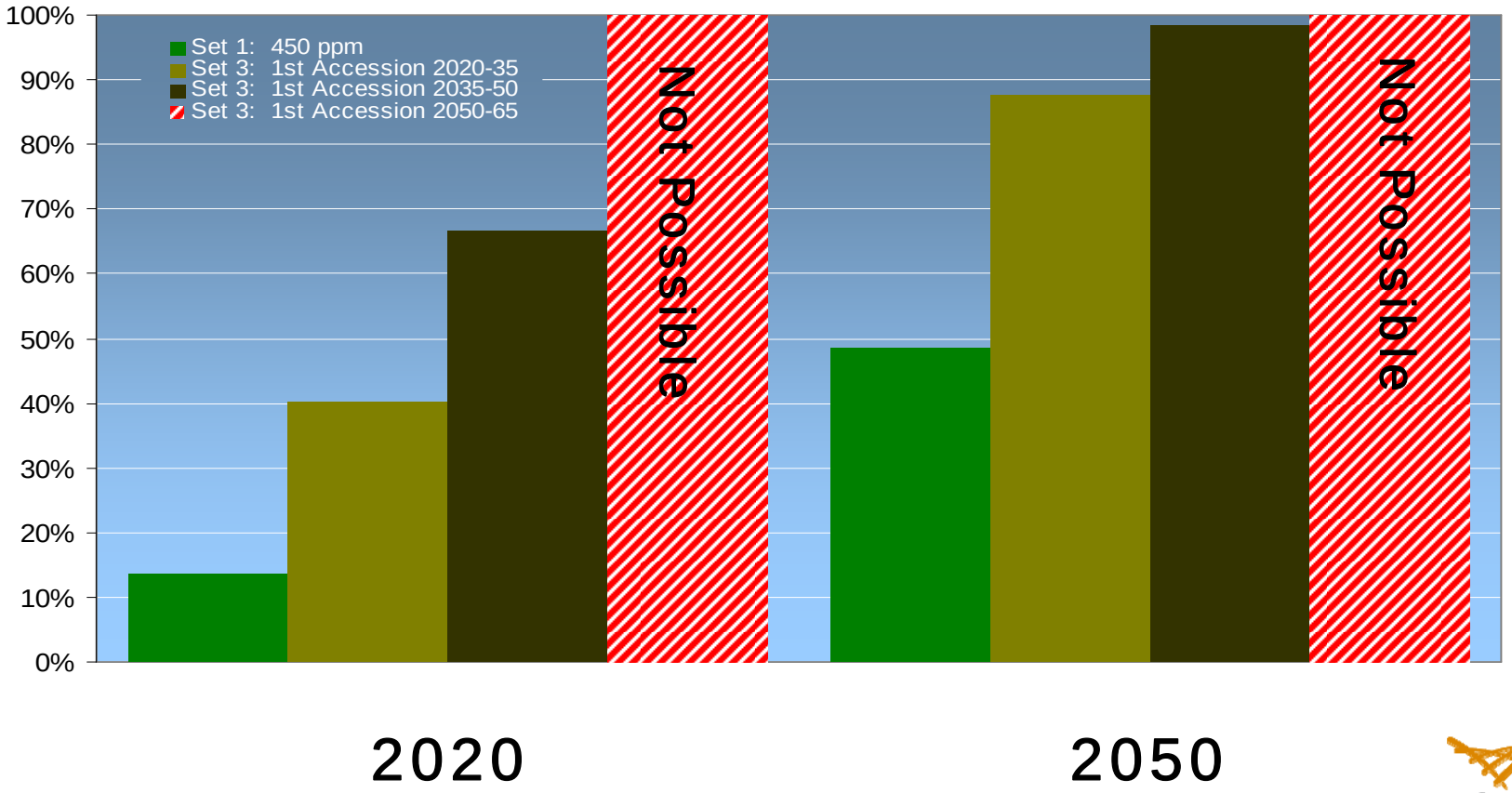
Three Scenarios of Delayed Participation



Pacific Northwest NATIONAL LABORATORY

International participation can have dramatic implications for emissions and cost.

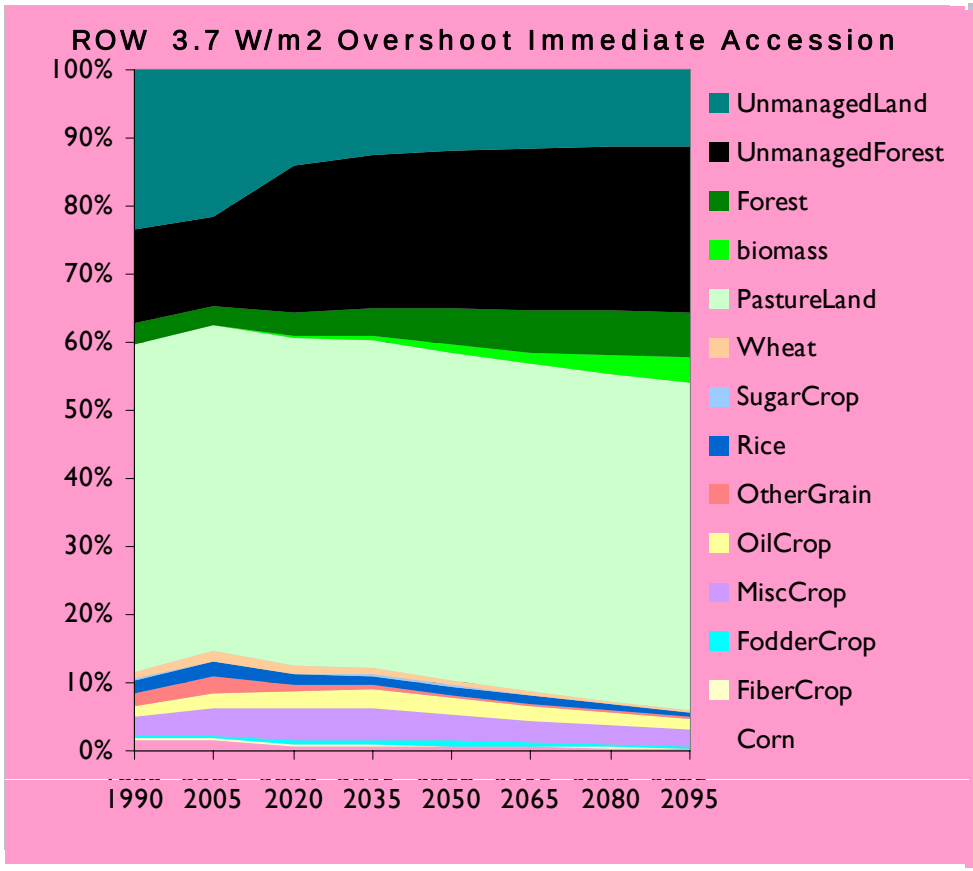
Year 2020 Annex I emissions mitigation, relative to 2005, for different accession assumptions: 450 ppm

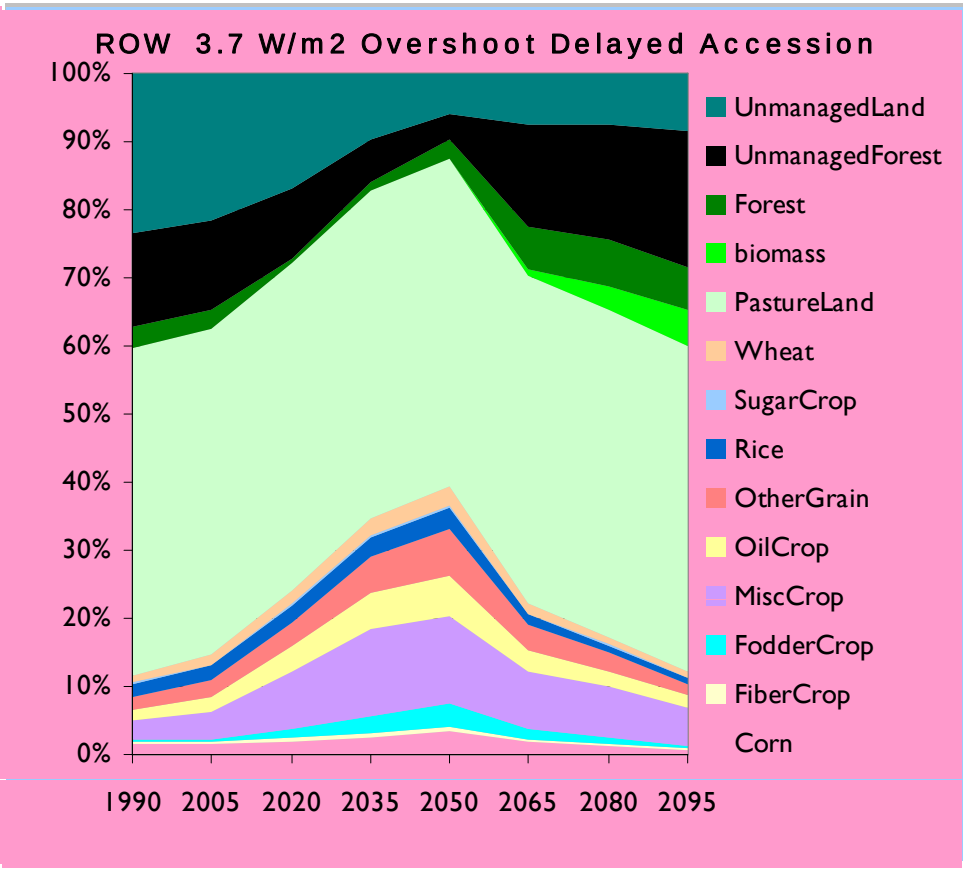


Pacific Northwest
NATIONAL LABORATORY

The Interactions between Delay and International Participation

Land Use in Three Regions: 550 CO2-e (Kyoto Gases) with Overshoot to 2100





Pricing carbon in land substantially lowers the costs of mitigation.

Limited sectoral coverage can have adverse economic and physical effects

Draft Results

Discussion

Pacific Northwest
NATIONAL LABORATORY