Sustainable Forestry Management Americas
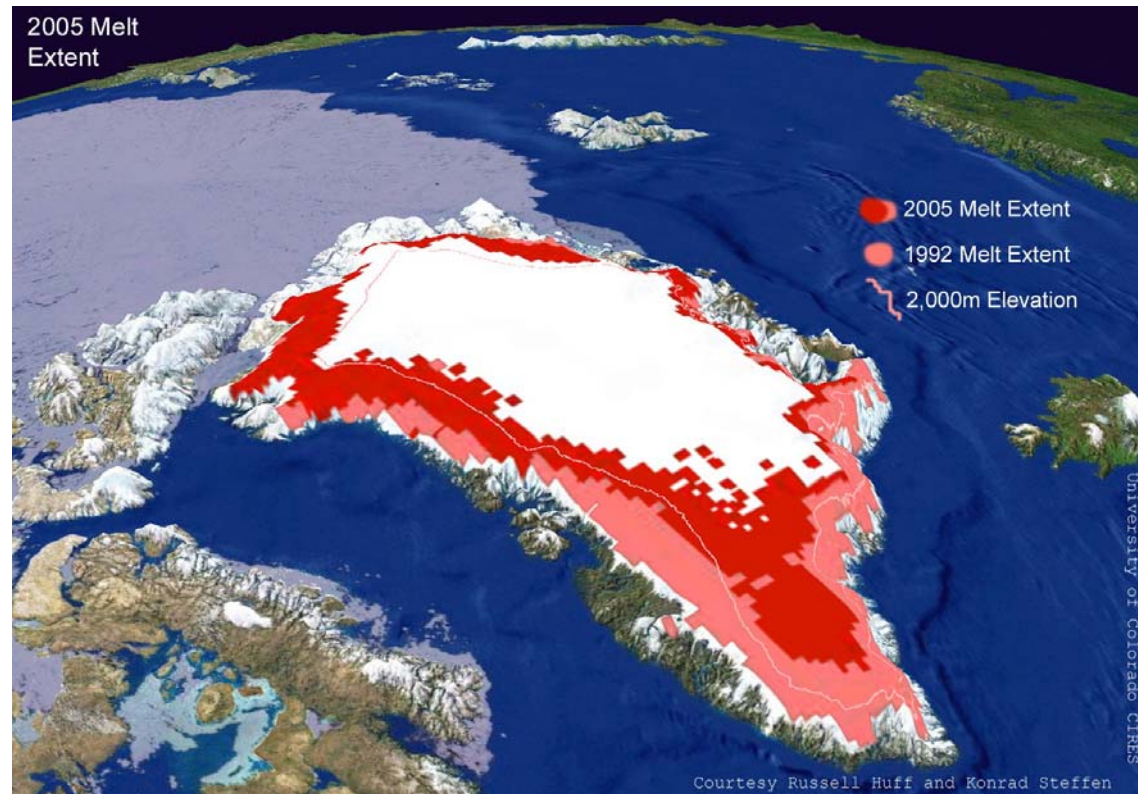
Temperature Records
(Deviation from 1951- 1980 mean)

(a) Global-Mean Surface Temperature Anomaly (°C)
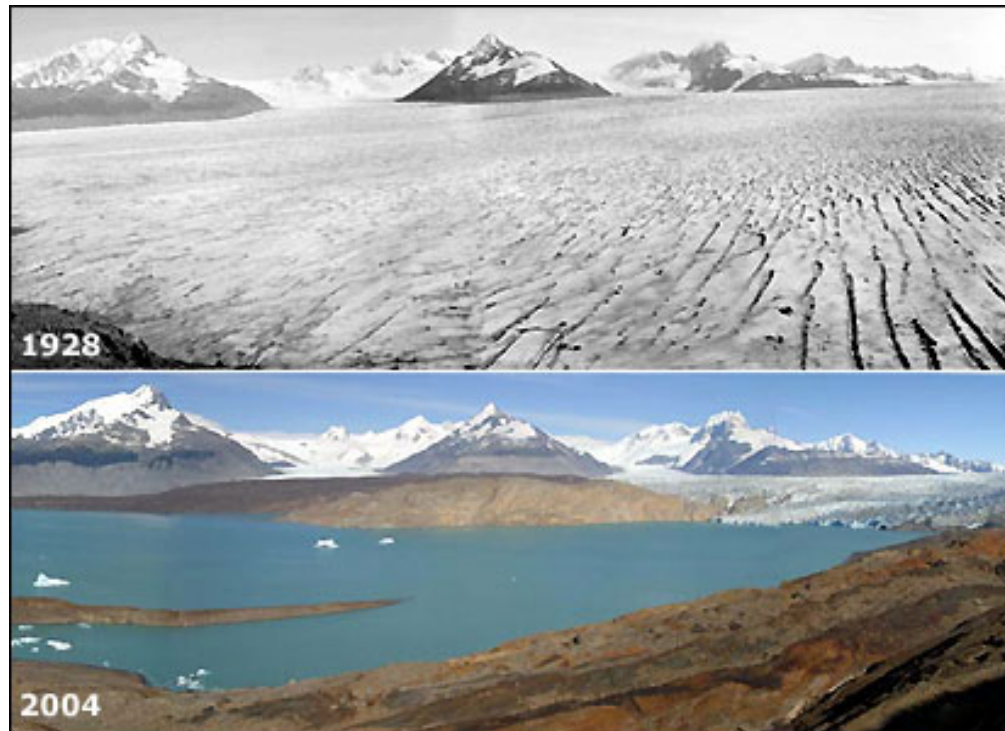
(b) 2005 Surface Temperature Anomaly (°C)
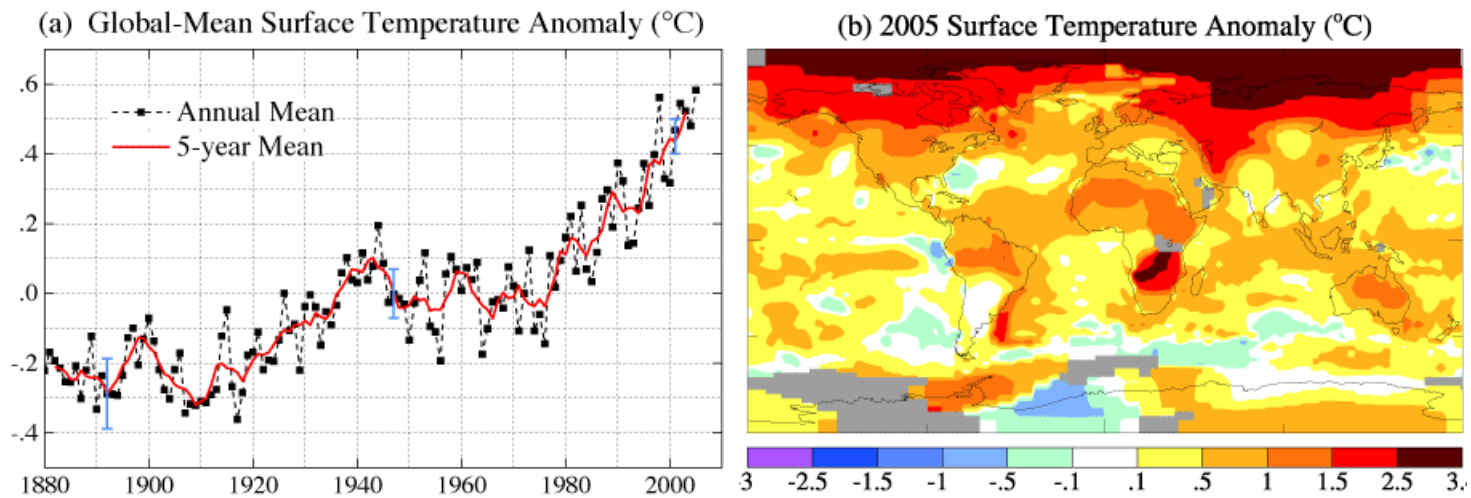
Source: NASA Goddard Institute for Space Studies Surface Temperature Analysis
at data.giss.nasa.gov/gistemp/

Ice Melt in Greenland

Source: http://cires.colorado.edu/science/groups/steffen/greenland/melt2005/
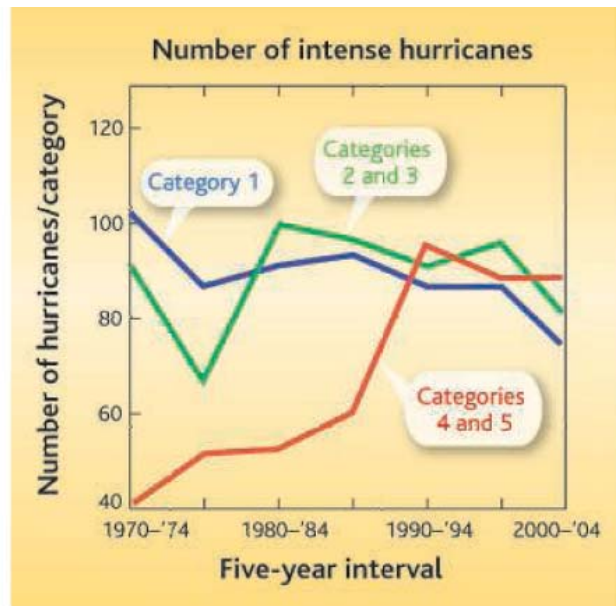
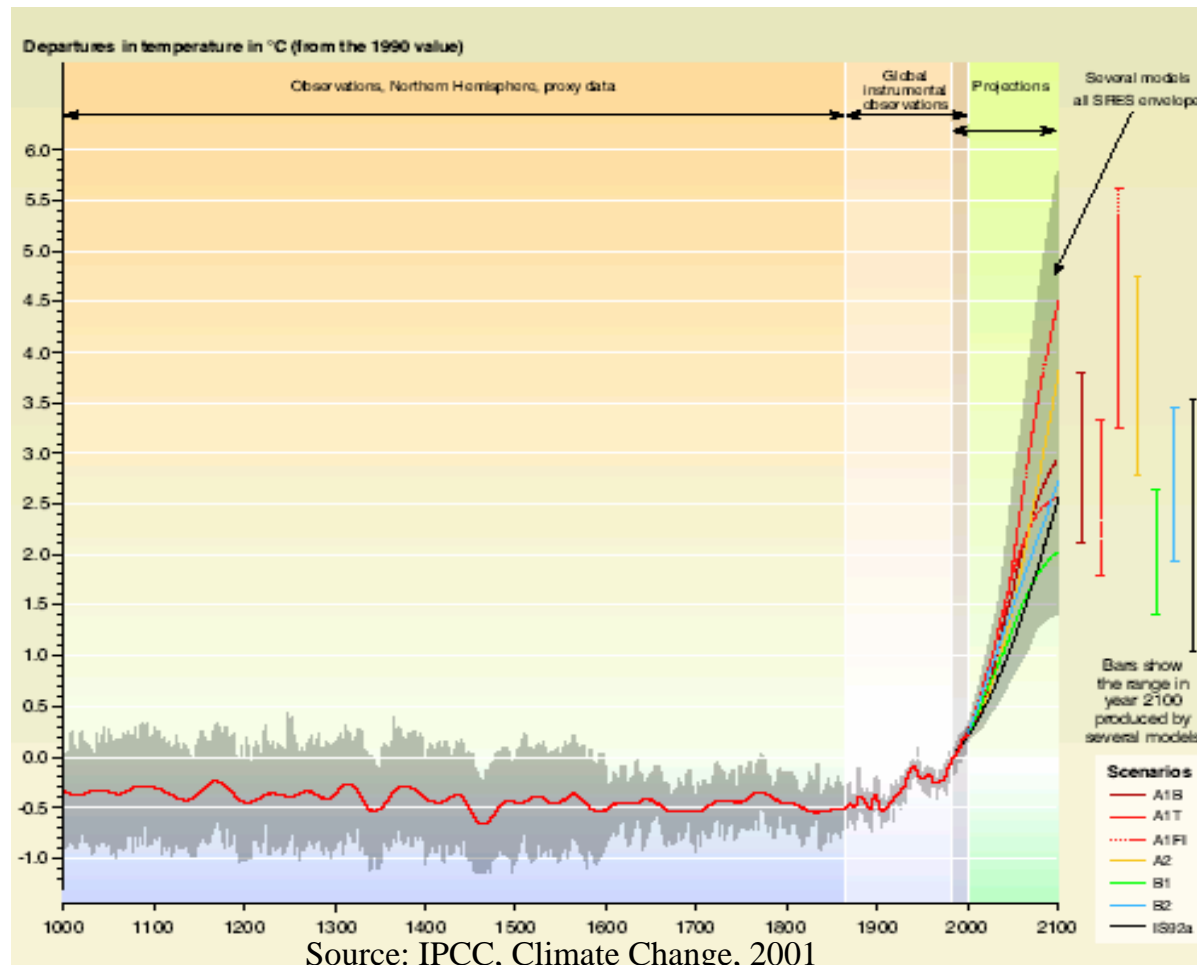# Andean Glaciers

1928

2004

Source: http://news.bbc.co.uk/1/shared/spl/hi/picture_gallery/05/sci_nat_how_the_world_is_changing/html/1.stm

Hurricane Trends

Source: Webster et al, *SCIENCE* 16 September 2005

...and temperature

Source: IPCC, Climate Change, 2001

Climate Sensitivity

- IPCC 2001 TAR: temperature increase from doubling of CO2 concentrations: 1.5 – 4.5°C
- New study (2006), to be included in AR4: 1.5 – 6.2°C.
  - 5–95 per cent range
  - Combines large ensemble energy balance modeling and simulations of the temperature response to past solar, volcanic and greenhouse gas forcing to determine which climate sensitivities yield simulations that are in agreement with proxy reconstructions.

Climate sensitivity constrained by temperature reconstructions over the past seven centuries, Gabriele C. Hegerl, Thomas J. Crowley, William T. Hyde and David J. Frame, *Nature*, 20 April 2006

The primary culprit is energy and CO_2

- Land use change and agriculture are a close second

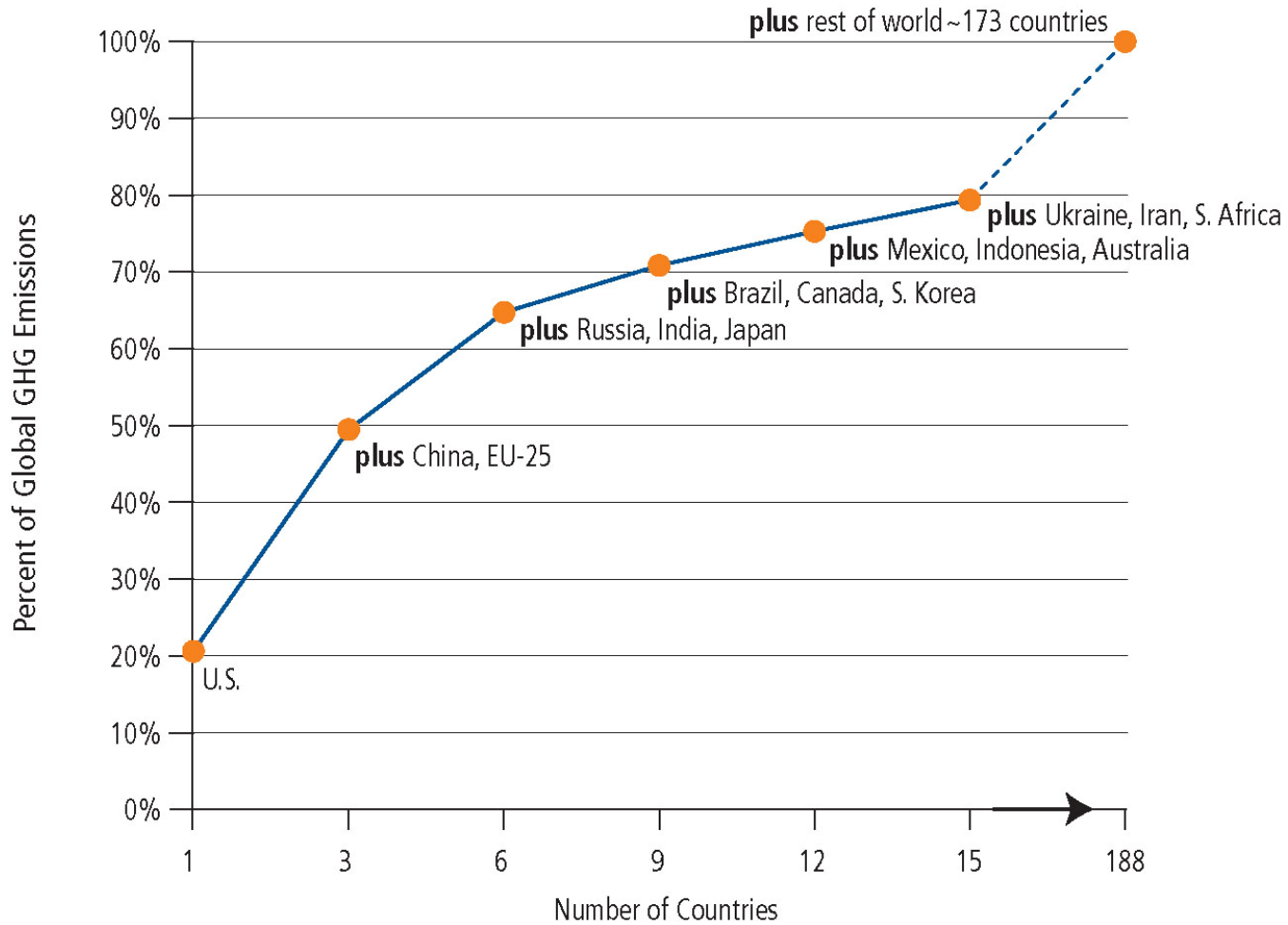- Only a few countries account for almost all emissions; it is not a "global" problem

GHG Flow Diagram: Global Emissions

Sector		End Use/Activity		Gas	
Transportation	13.5%	Road	9.9%		
		Air	1.6%		
		Rail, Ship, & Other Transport	2.3%		
Electricity & Heat	24.6%	Residential Buildings	9.9%		
		Commercial Buildings	5.4%		
		Unallocated Fuel Combustion	3.5%		
		Iron & Steel	3.2%	Carbon Dioxide (CO₂) 77%	
		Aluminum/Non-Ferrous Metals	1.4%		
		Machinery	1.0%		
		Pulp, Paper & Printing	1.0%		
		Food & Tobacco	1.0%		
Other Fuel Combustion	9.0%	Chemicals	4.8%		
		Cement	3.8%		
Industry	10.4%	Other Industry	5.0%		
		T&D Losses	1.9%		
		Coal Mining	1.4%		
Fugitive Emissions	3.9%	Oil/Gas Extraction, Refining & Processing	6.3%		
Industrial Processes	3.4%				
Land Use Change	18.2%	Deforestation	18.3%		
		Afforestation	-1.5%		
		Reforestation	-0.5%		
		Harvest/Management	2.5%		
		Other	-0.6%		
				HFCs, PFCs, SF₆ 1%	
		Agricultural Energy Use	1.4%		
Agriculture	13.5%	Agriculture Soils	6.0%	Methane (CH₄) 14%	
		Livestock & Manure	5.1%		
		Rice Cultivation	1.5%		
		Other Agriculture	0.9%		
Waste	3.6%	Landfills	2.0%	Nitrous Oxide (N₂O) 8%	
		Wastewater, Other Waste	1.6%		

Source: WRI, Baumert et al, 2005

Largest Emitters: *Developed & Developing*

Percent of Global GHG Emissions (y-axis: 0% to 100%)

Number of Countries (x-axis: 1, 3, 6, 9, 12, 15, 188)

U.S.

plus China, EU-25

plus Russia, India, Japan

plus Brazil, Canada, S. Korea

plus Mexico, Indonesia, Australia

plus Ukraine, Iran, S. Africa

plus rest of world ~173 countries

The emissions space for stabilising CO_2 concentrations

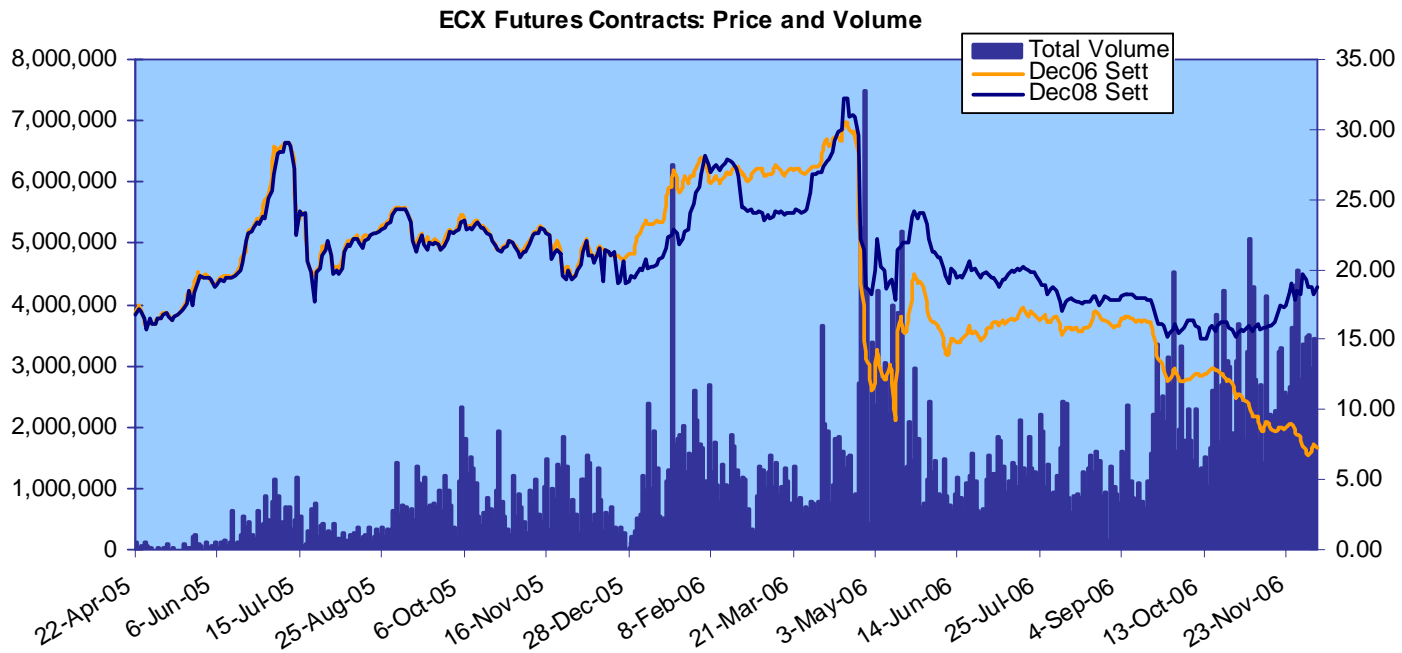| WRE CO_2 Stabilisation profiles	Year in which global emissions peak
450	2005 – 2015
550	2020 – 2030
650	2030 – 2045
750	2040 – 2060
1000	2065 – 2090

Source: IPCC-TAR Synthesis Report

CO$_2$ Emissions Trends 2005 - 2030
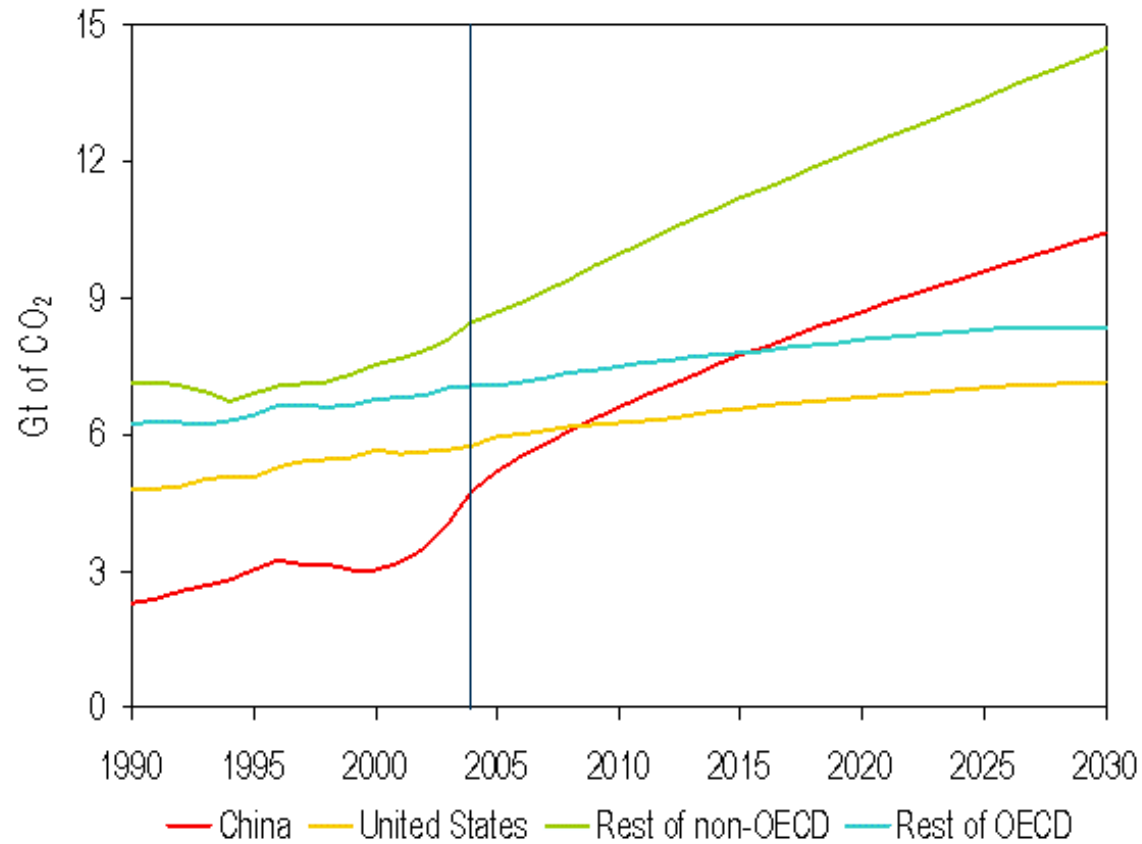
Source: IEA WEO, 2006
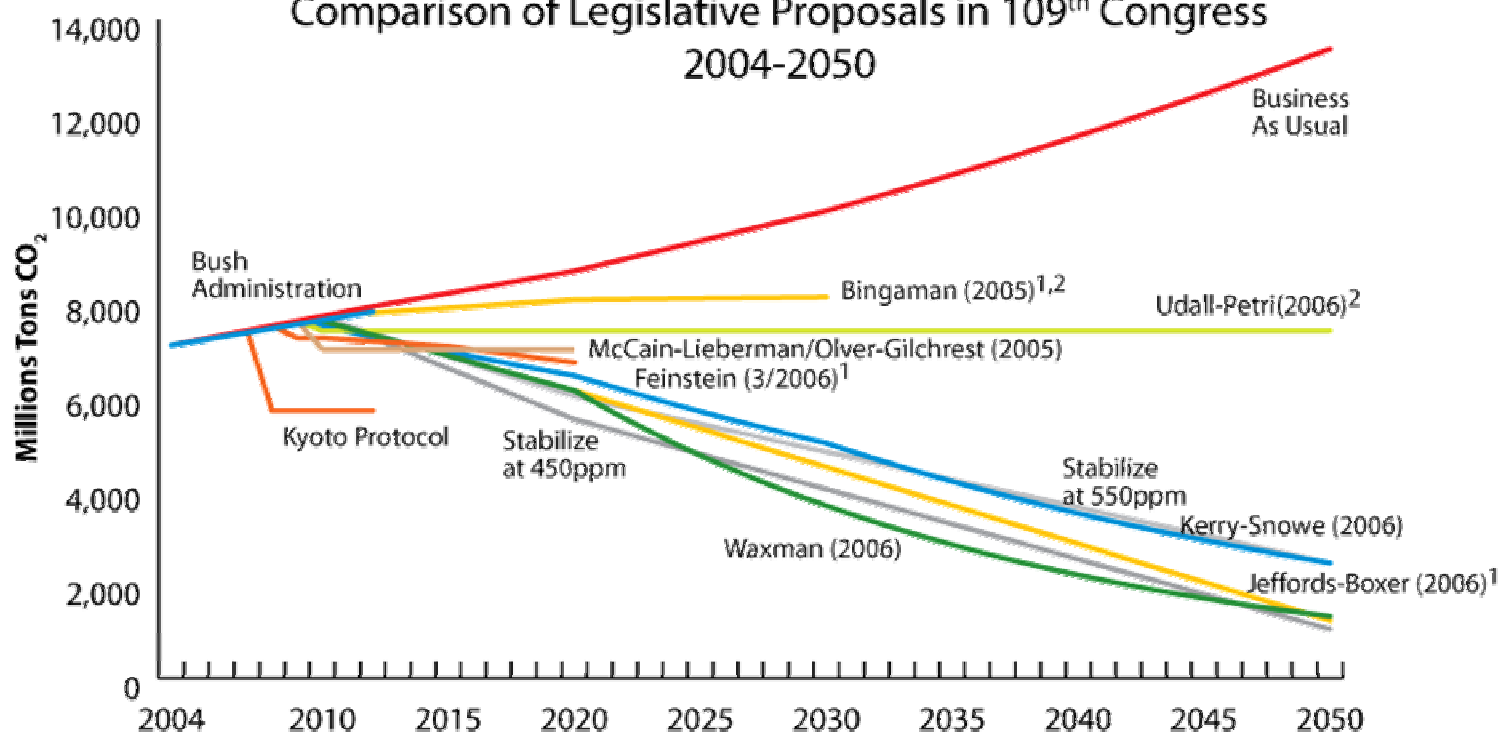
Dealing with Climate Change

- Policies cover all gases and all sectors-- but emissions are not evenly divided among these
  - Energy and CO_2 are key
- Policy Choices:
  - Emit less (be more efficient)
  - Emit differently (switch fuels or processes)
  - Sequester
  - Do without (change behavior)
  - Adapt (learn to live with it)
- Policy actions include:
  - Market approaches (taxes, subsidies, cap-and-trade)
  - Regulations
  - R&D
  - Processes/outreach

EU emission market trends

ECX Futures Contracts: Price and Volume

Comparison of Legislative Proposals in 109th Congress
2004-2050

Business As Usual

Bingaman (2005)[1,2]

Udall-Petri (2006)[2]

McCain-Lieberman/Olver-Gilchrest (2005)
Feinstein (3/2006)[1]

Bush Administration

Kyoto Protocol

Stabilize at 450ppm

Stabilize at 550ppm

Kerry-Snowe (2006)

Waxman (2006)

Jeffords-Boxer (2006)[1]

Millions Tons CO_2

Year

© 2006, World Resources Institute
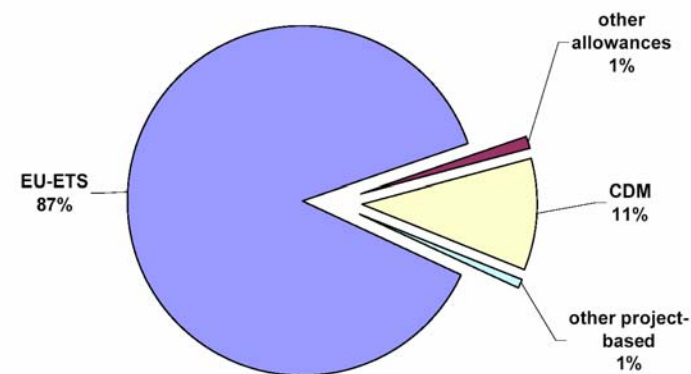
[1] Discussion draft
[2] Projections do not include emissions that may exceed the cap due to a price "safety valve."

Shares Transacted
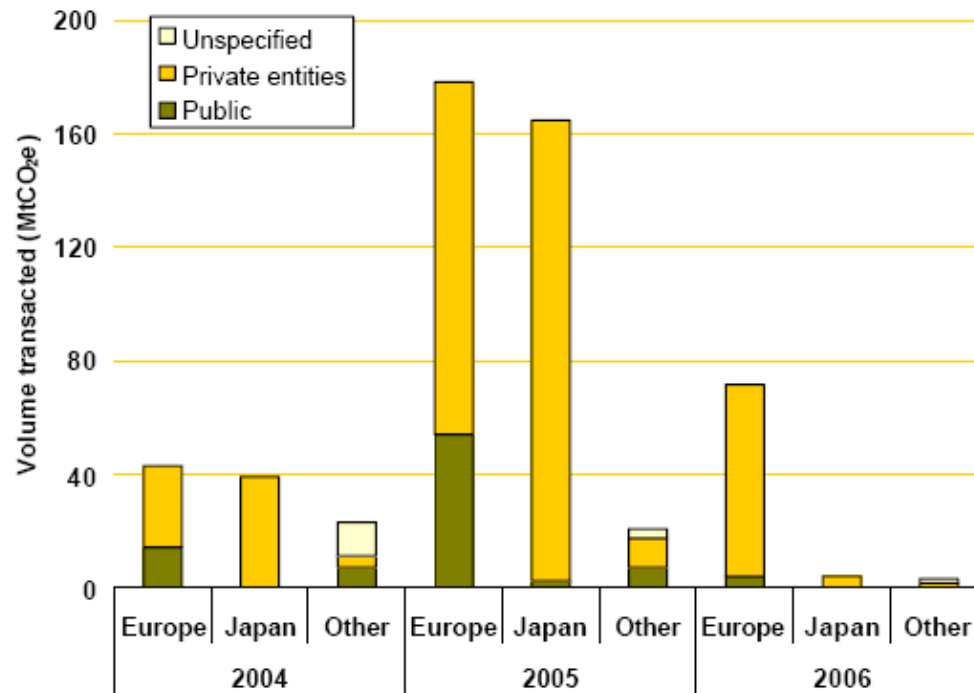# in the Carbon Market

(1/2005 – 9/2006)
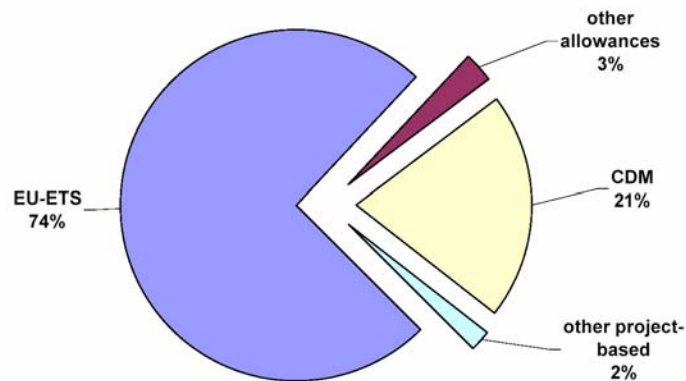
Volume
~716 MMTCE

Value
~$21.5 billion

Increasingly prominent private sector role

Source: IETA/World Bank 2006

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