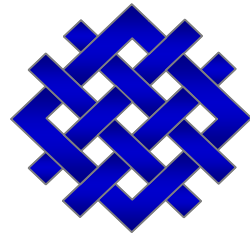


# Energy and Environment: A Global Outlook

**Jonathan Pershing**  
**World Resources Institute**



ENERGY, ENVIRONMENT AND ECONOMICS IN A NEW ERA  
24th Annual North American Conference of the USAEE/IAEE  
July 8, 2004 • Washington, DC, USA

# Overview

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- Tour de horizon: energy and environmental issues
- Focusing on climate (policies, markets and corporate impacts)
- Comments and conclusions

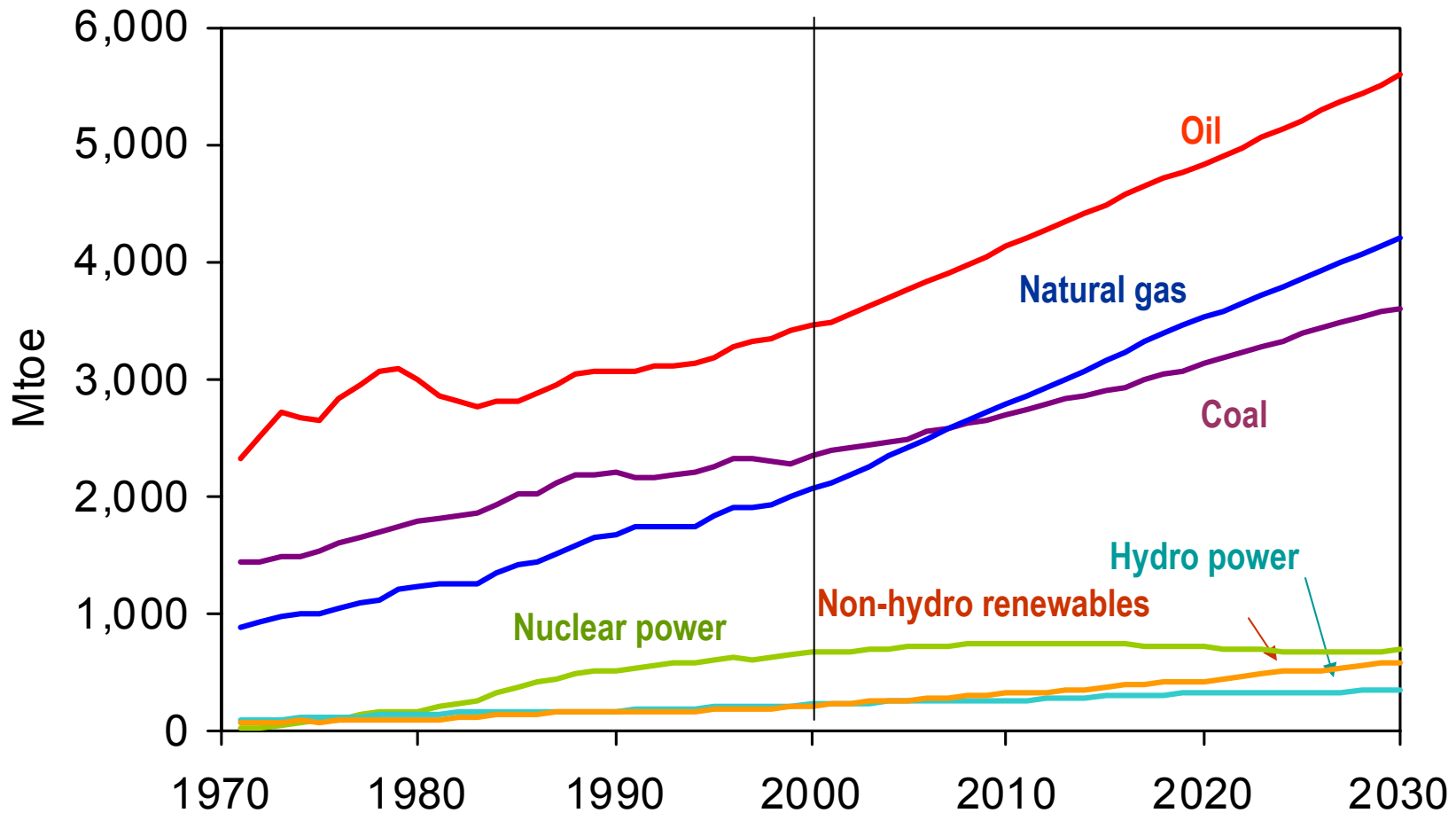


# Tour de Horizon : Energy and Environment Issues

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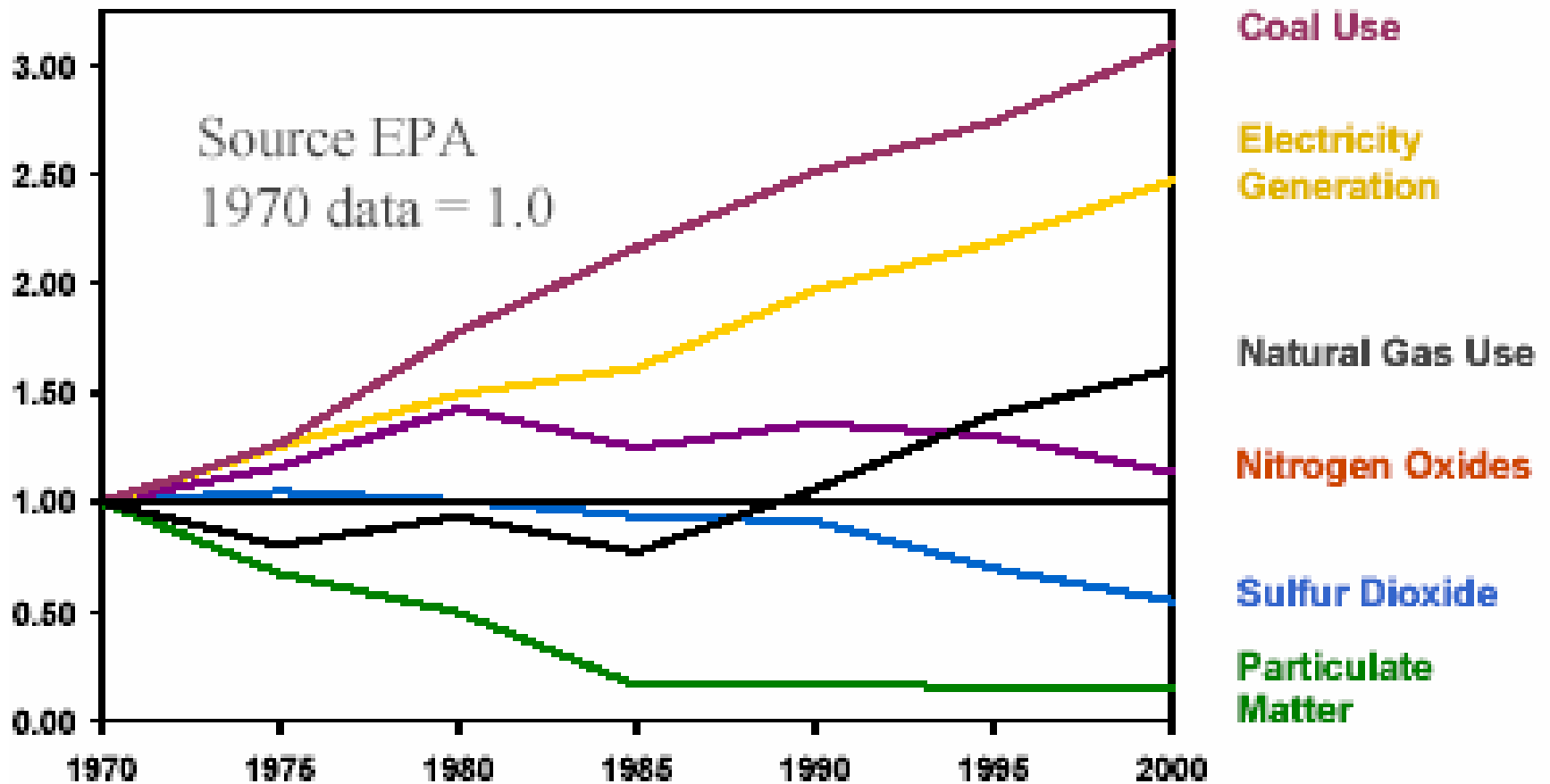
# Energy Demand: Driving Environmental Impacts



Source: IEA WEO 2002



# Emissions Trends and Energy Use



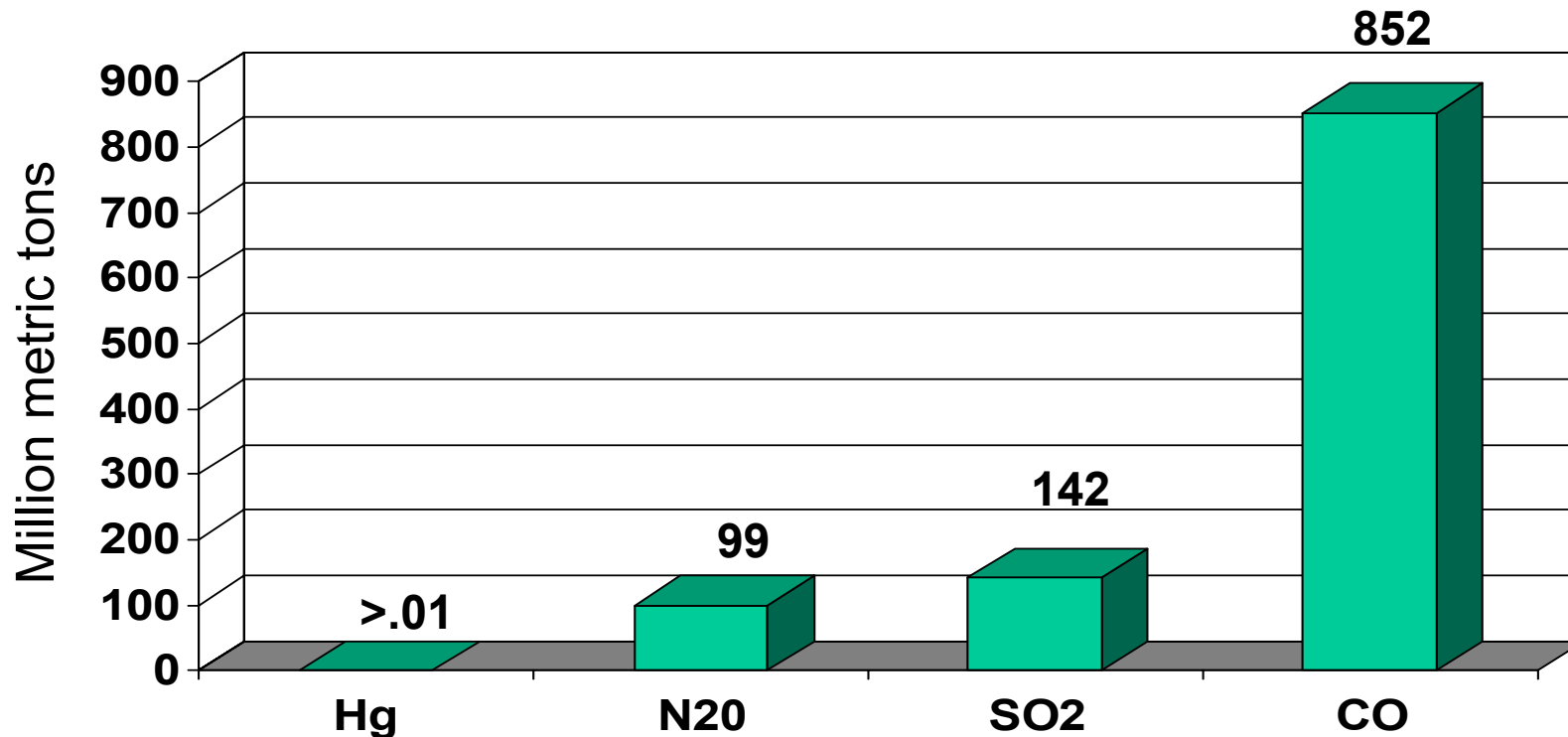
SOURCE: EPA, National Air Quality and Emissions Trends Report, 1999 (March 2001)



WRI

Presenting WRI, May 4, 2004

# Atmospheric Pollutants (Global energy-related emissions, 1995)



Source: UNEP, WRI Earth Trends



# US SO<sub>2</sub> and NO<sub>x</sub> Markets (\$/ton)

## Platts Weekly Broker Emissions Index

As of week's end, June 28

	Bid	Offer	Index
SO <sub>2</sub> - Spot	407.50	420.50	414.00

NO<sub>x</sub>

2004	2300	2394	2347
2005	3367	3550	3458
2006	3069	3200	3134

Source: [www.platts.com](http://www.platts.com)



# Restricted access to sensitive areas

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- As traditional oil sources are depleted, industry going into more remote areas and closer to human populations.
  - By 2007, 80% of new E&P will be in the humid tropics.
- Opposition to oil and gas development is increasing.
  - NGO networks, communications technology, public sentiments in industrial countries.
- Examples of this issue include:
  - ANWR, Shell in Nigeria, West of Shetland Isles, Offshore CA and FL, Occidental in Colombia, Texaco in Ecuador.

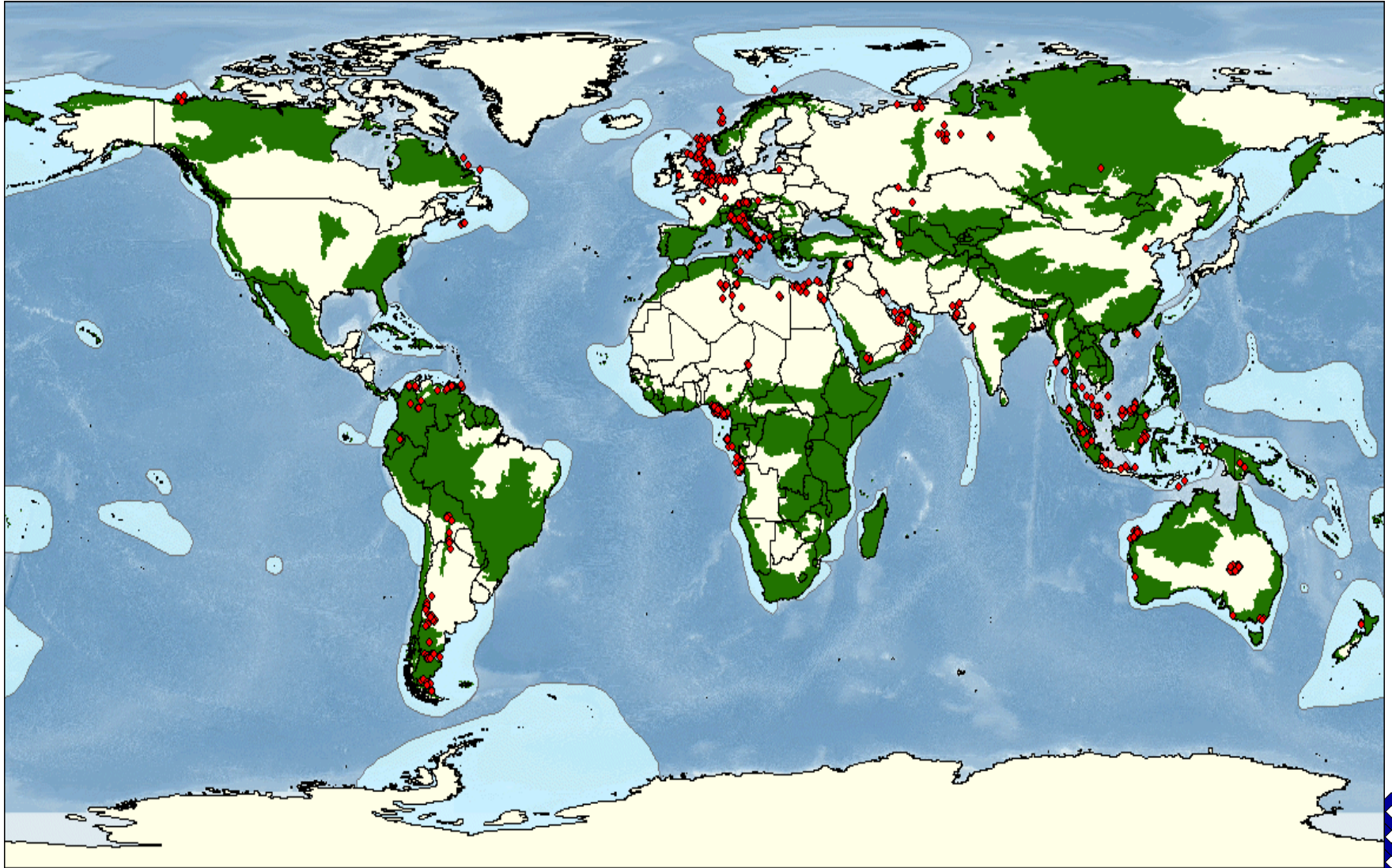




Global 200 - Terrestrial Ecoregion

Global 200 - Marine Ecoregion

Chevron-Texaco



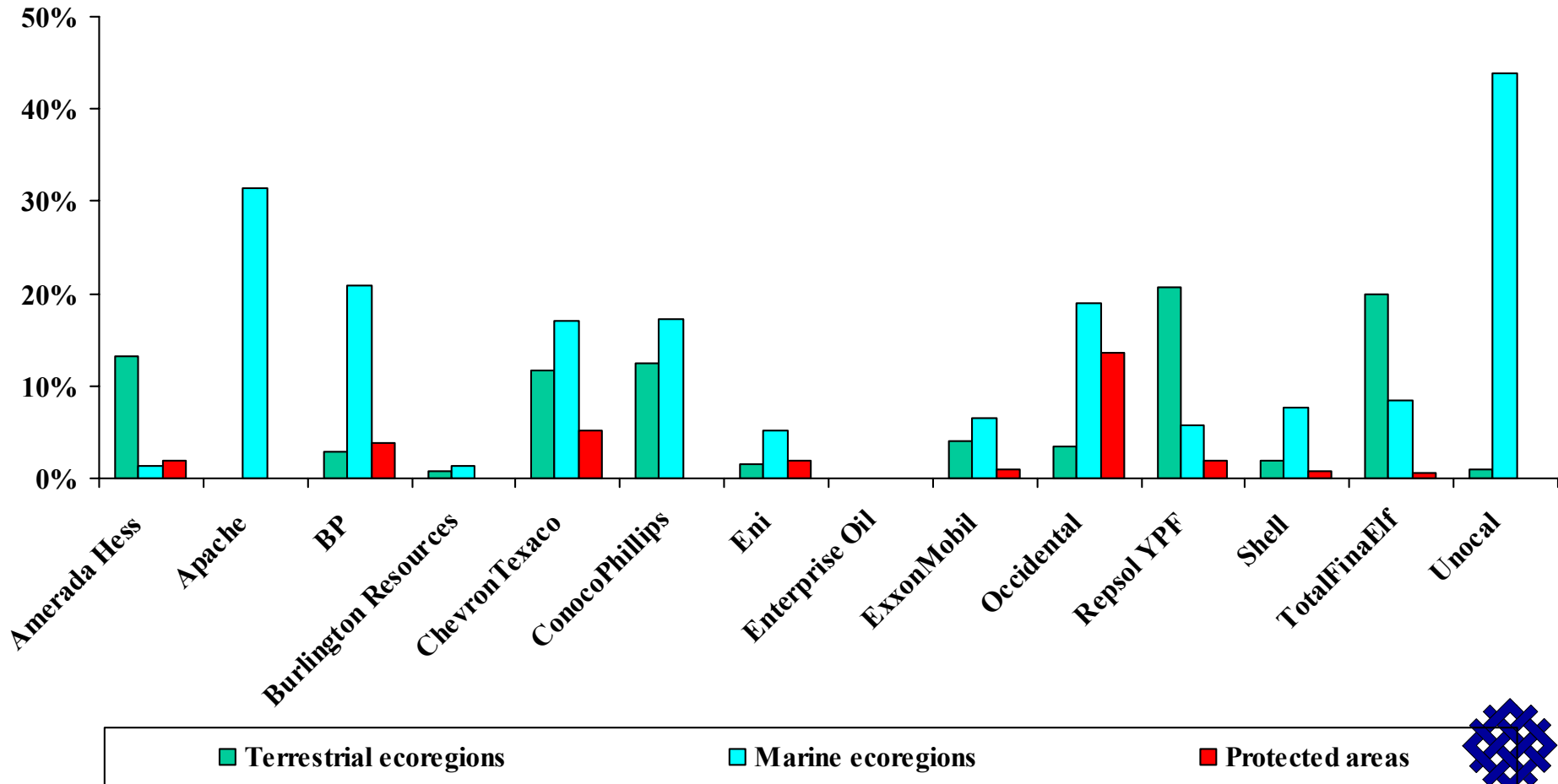
Source: WRI, *Changing Oil*; 2002



J. Pershing, EMA, May 4, 2004

# Which companies are exposed to access issues?

Percent of total reserves outside the U.S.

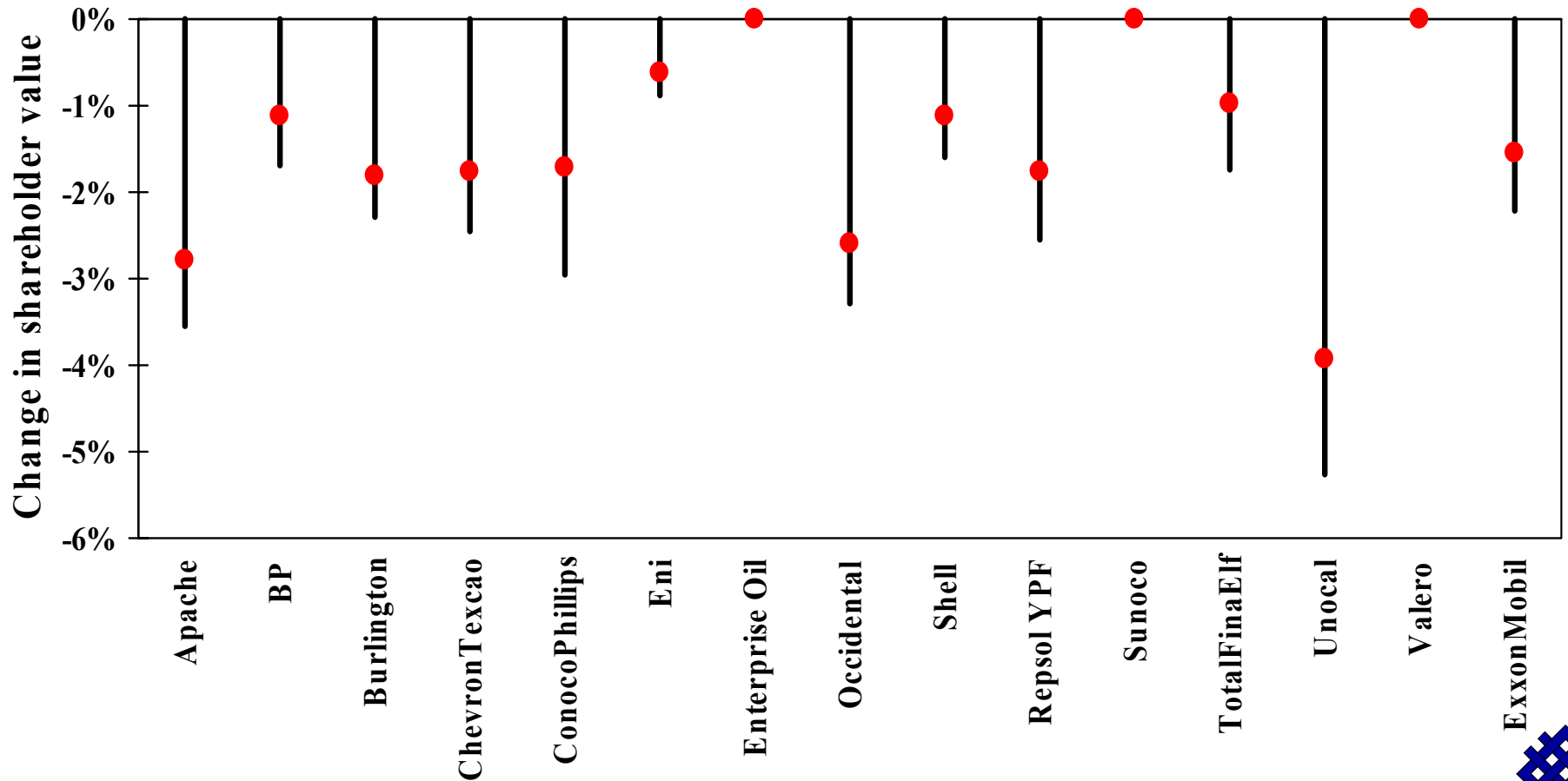


Source: WRI, *Changing Oil*; 2002



WRI

# Aggregate access results (Range and mostly likely impact)



Source: WRI, *Changing Oil*; 2002



# A focus on climate

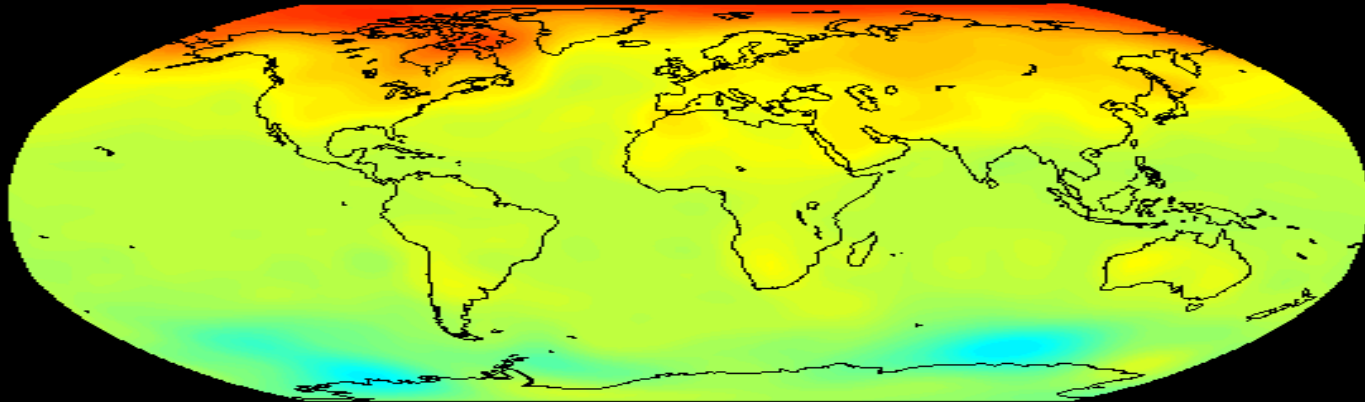
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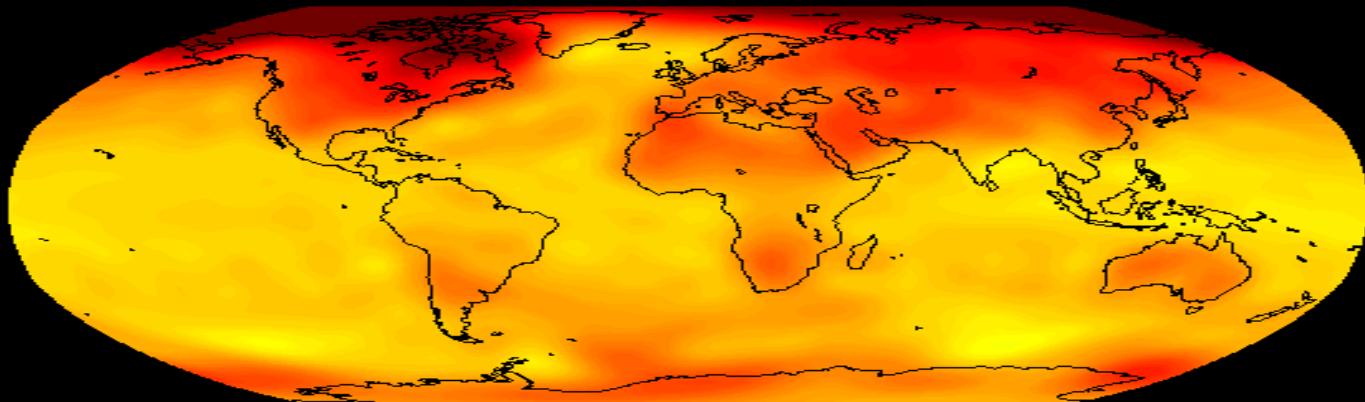
# The Climate Change Problem

Surface Air Warming (°F)

2xCO<sub>2</sub>

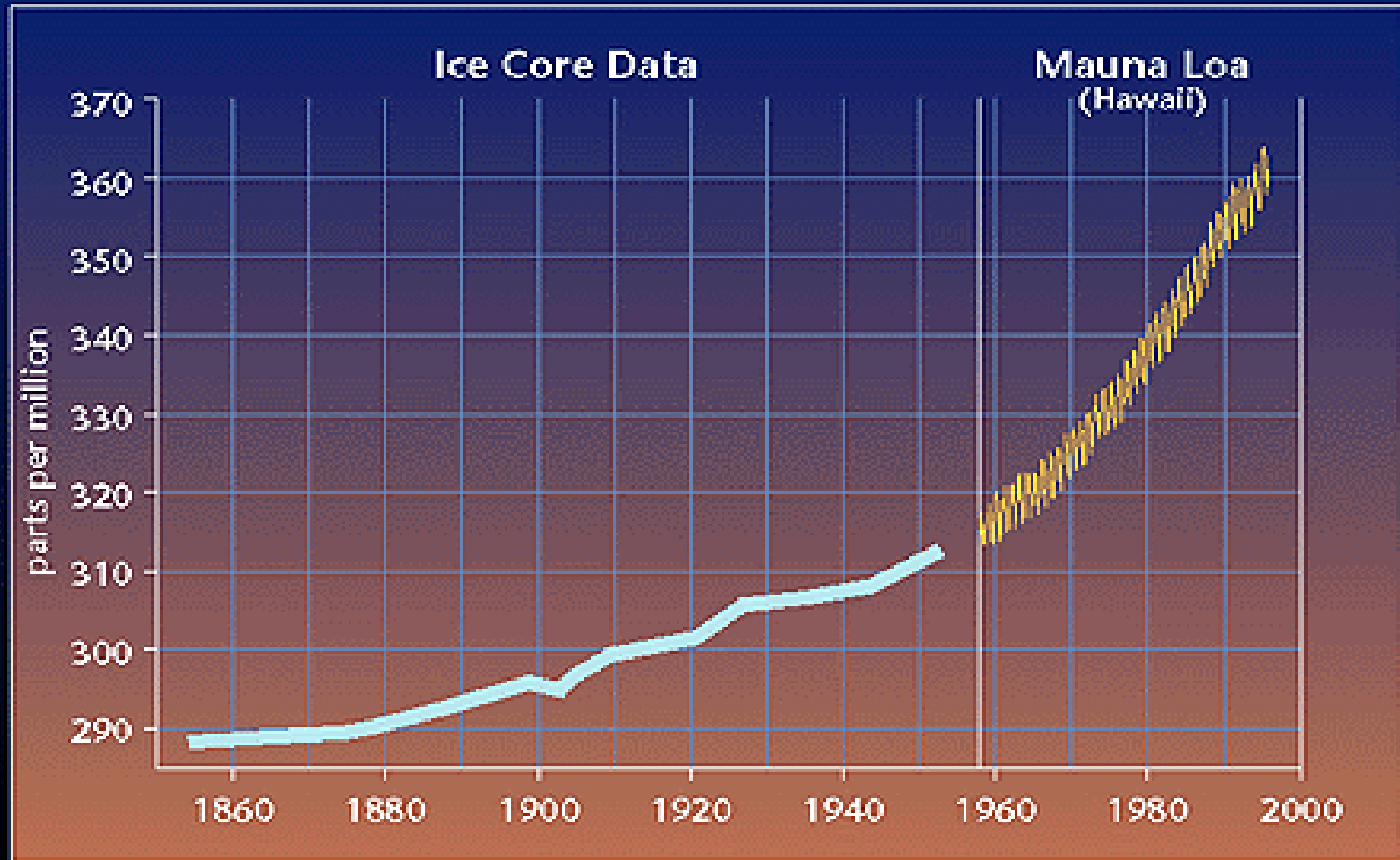


4xCO<sub>2</sub>



Source: CFDL R15 Climate Model; CO<sub>2</sub> transient experiments, years 401–500.

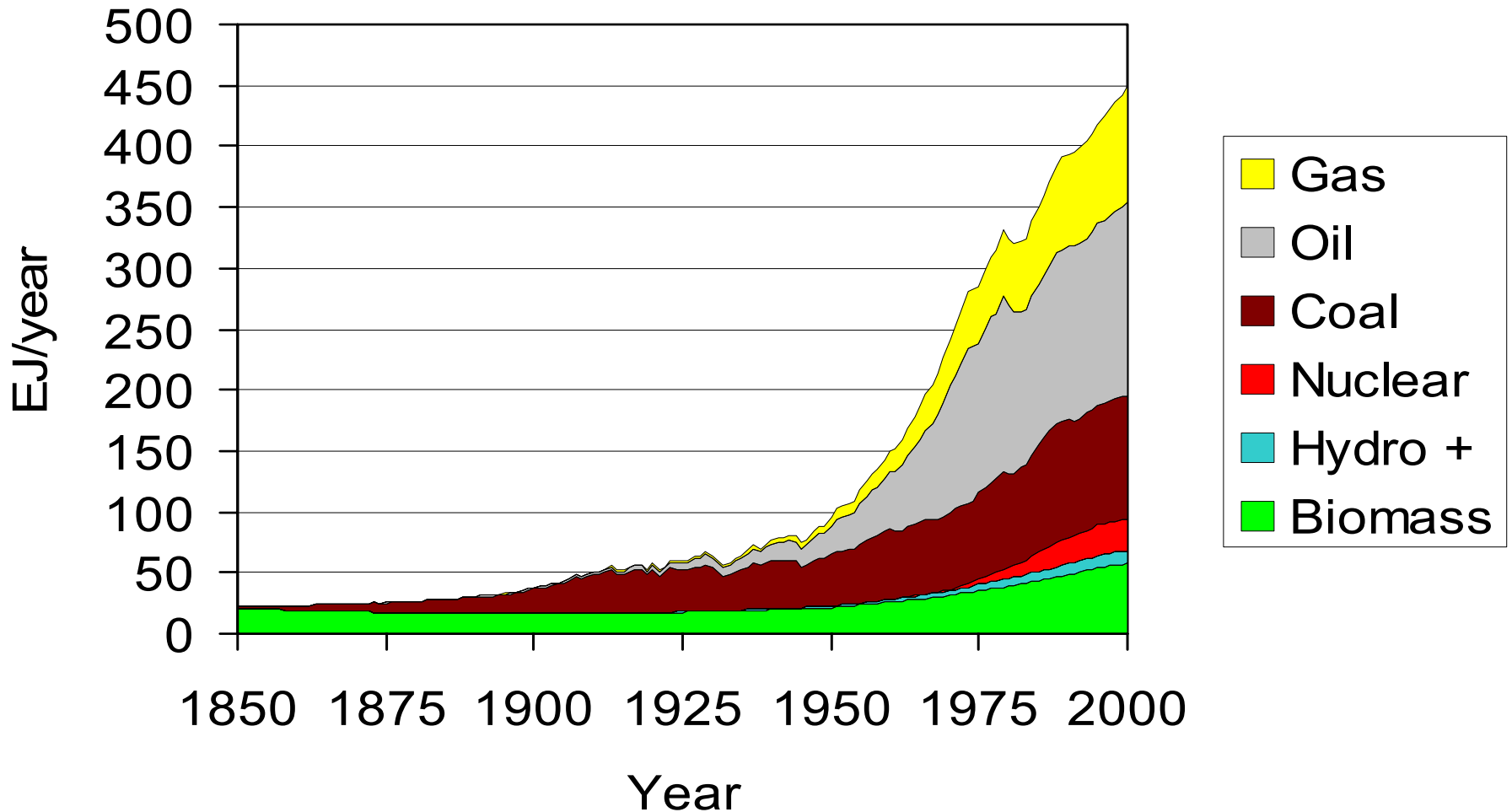
# Carbon Dioxide Concentrations



Combining the ice-core data and the direct measurements from Mauna Loa yields a curve strikingly similar to the curve that describes...



# World Energy 1850-2000



...the increase in worldwide fossil-fuel combustion in the past 150 years.

# Emissions space for stabilising CO<sub>2</sub> concentrations

<b>WRE CO<sub>2</sub> Stabilisation profiles</b>	<b>Year in which global emissions peak</b>	<b>Year in which global emissions fall below 1990 level</b>
450	2005 – 2015	<2000 – 2040
550	2020 – 2030	2030 – 2100
650	2030 – 2045	2055 – 2145
750	2040 – 2060	2080 – 2180
1000	2065 – 2090	2135 – 2270

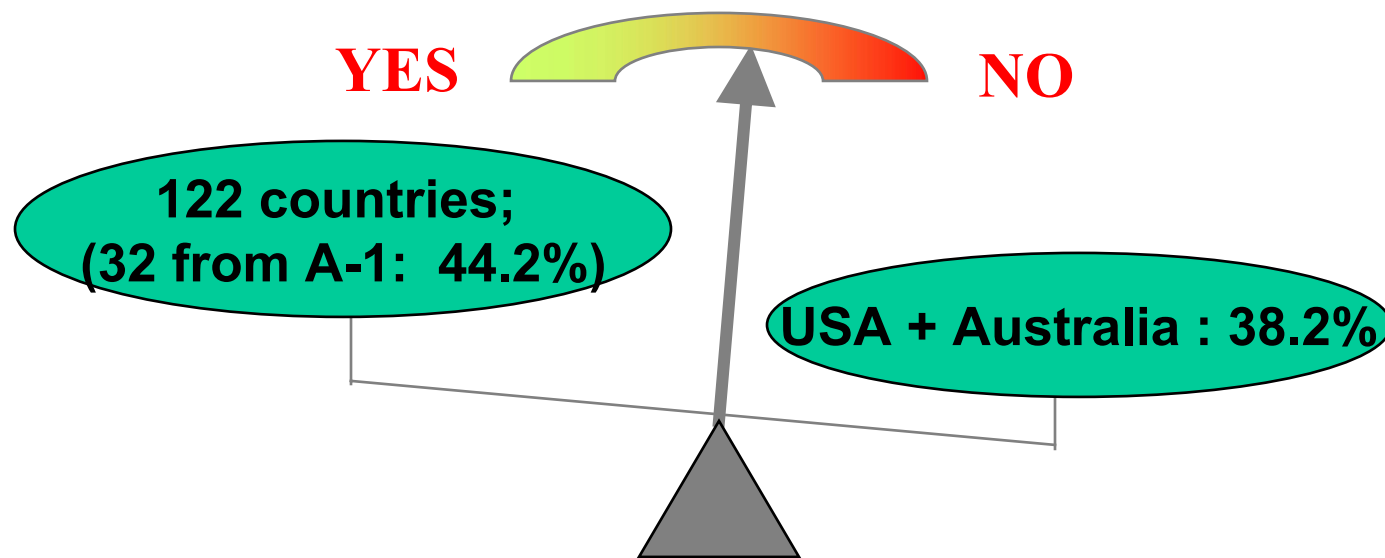
**Source: IPCC-TAR Synthesis Report**





# The proposed solution (Kyoto Protocol) has yet to be ratified

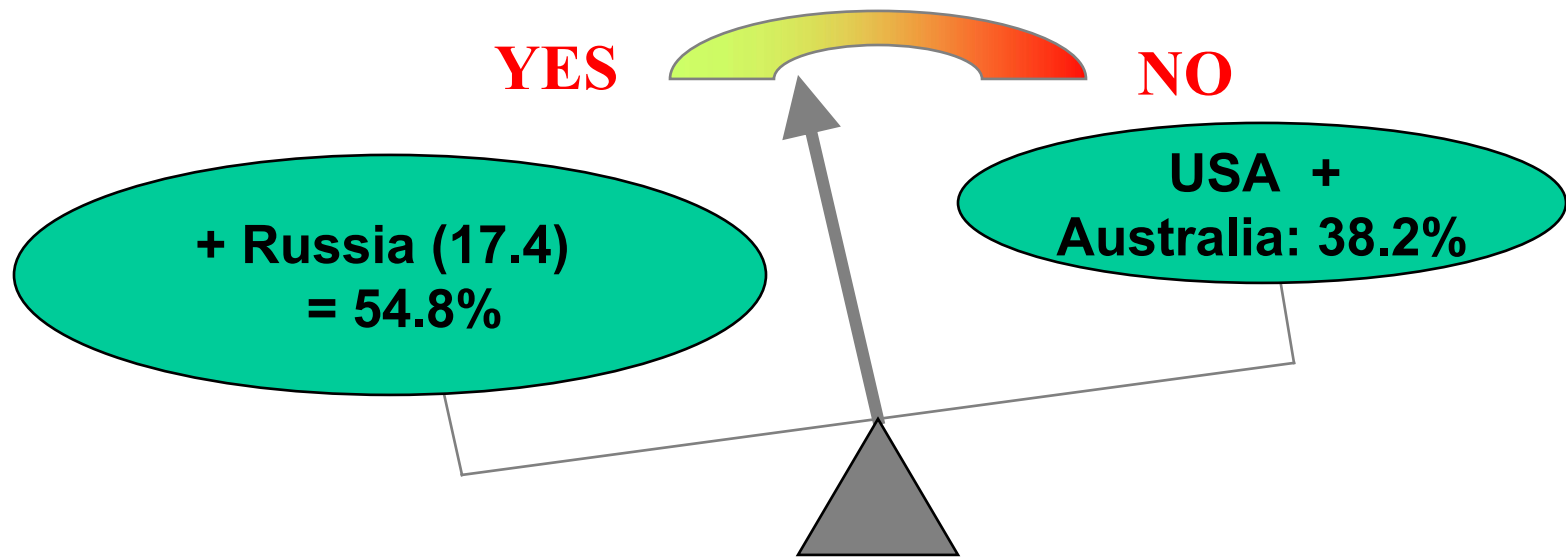
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**Current status**  
(as of April 15, 2004)

**Required: 55 Countries representing at least 55% of Annex I CO<sub>2</sub> Emissions**

# ...but Russia could tip the balance



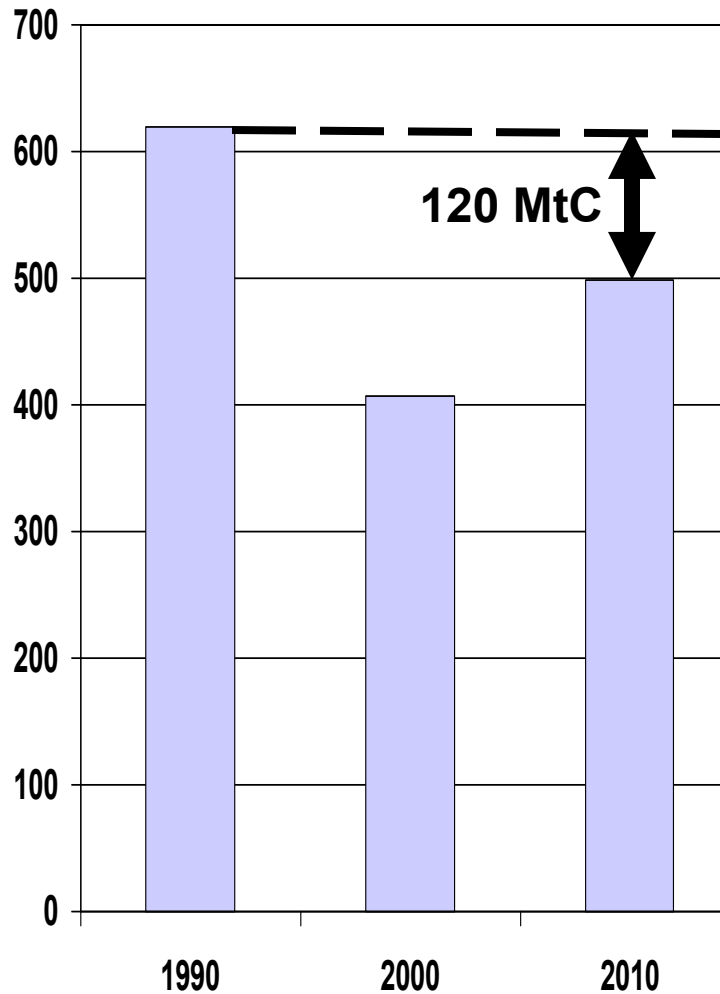
**Required: 55 Countries representing at  
least 55% of Annex I CO<sub>2</sub> Emissions**

# Elements of a Russian Ratification Bargain

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- Russia and the EU agree on Russian WTO accession
  - Function of successful outcome removing restrictions to EU access to Russian gas pipeline and reducing gas subsidies in Russia
  - “Agreed” at Russia/EU summit, May 21, 2004
- Russia, the EU, Canada and Japan agree on purchasing Russian tons (either/both AAUs and ERUs)

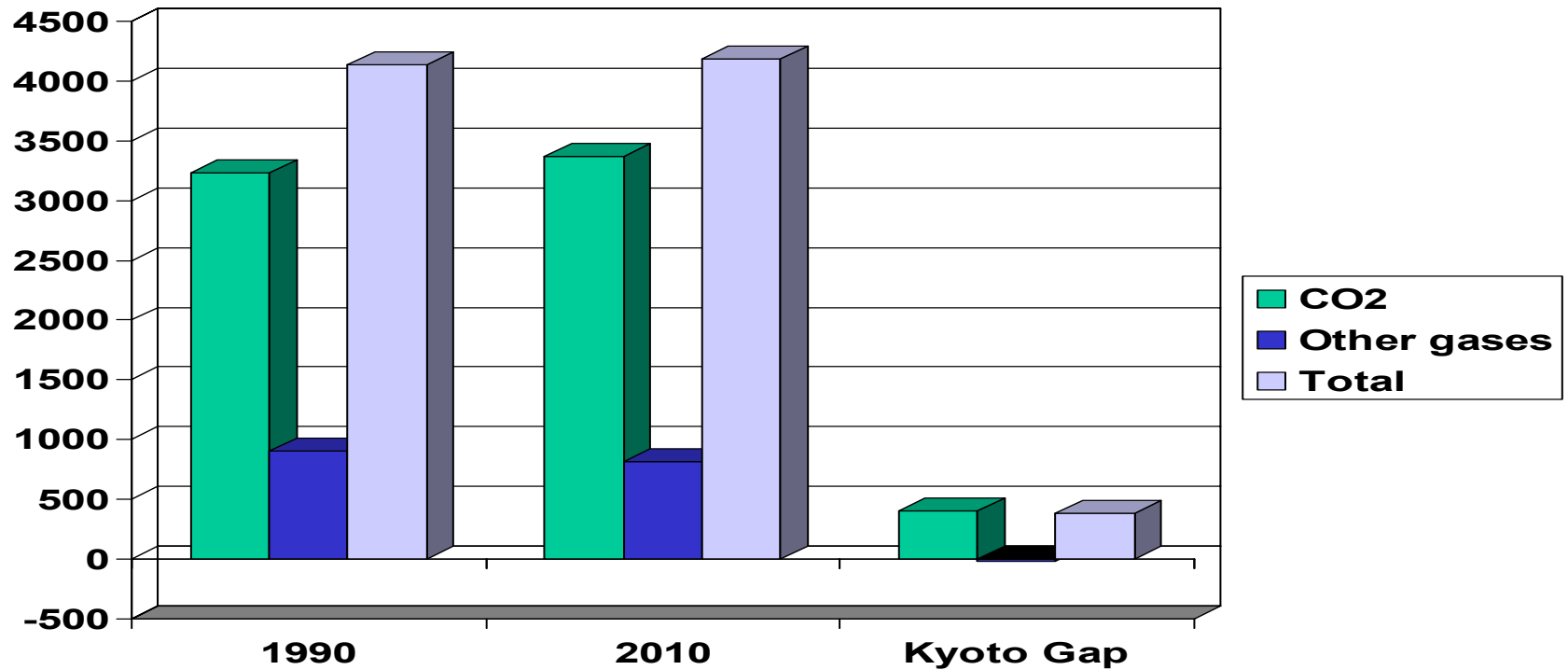
# Russian GHG Market Potential



Source: WRI, CAIT

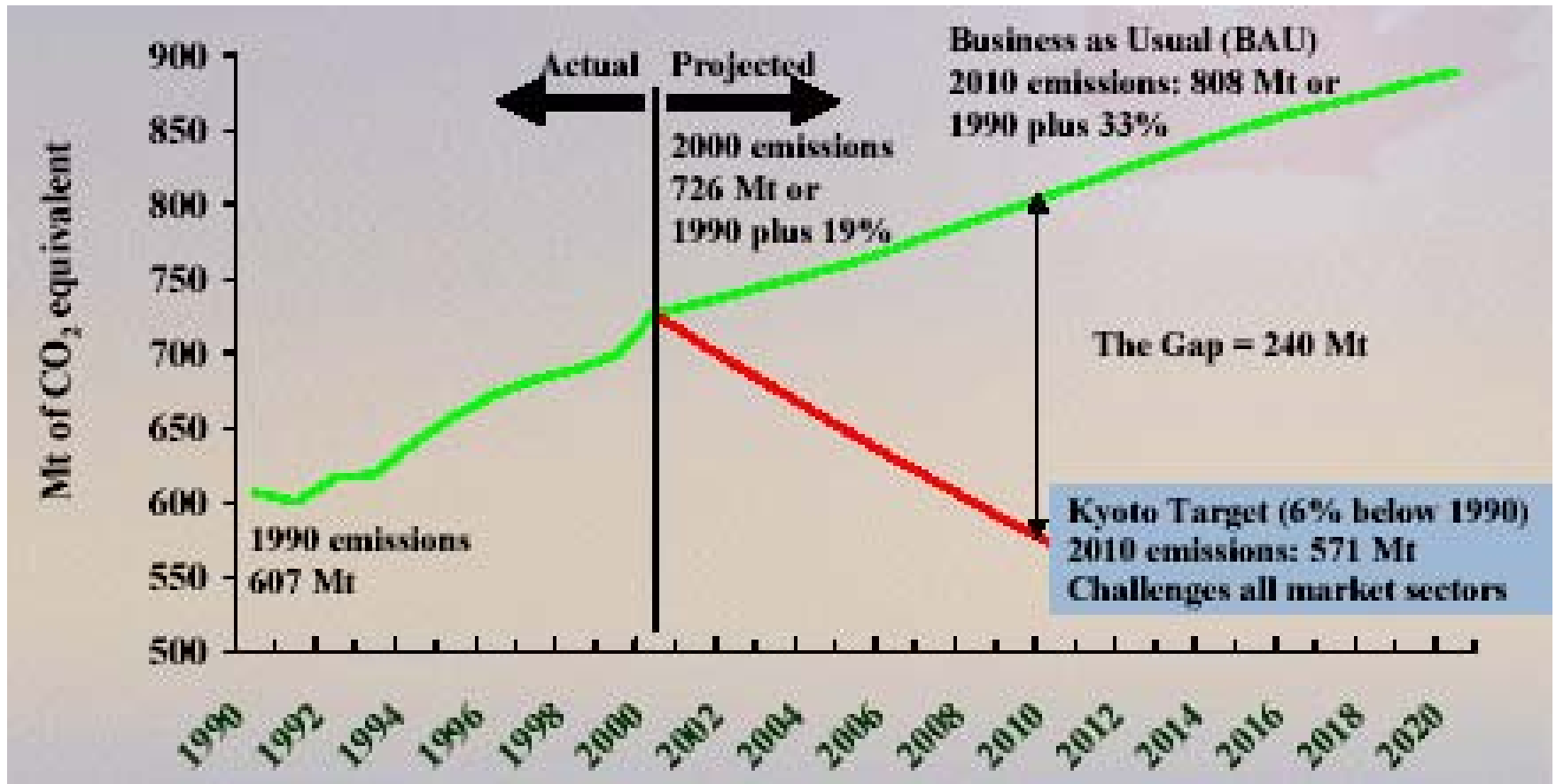
<b>National Emissions</b> (6 gases, MtC <sub>eq</sub> , 2000)	<b>520</b>
<b>Emissions per Capita</b> (2000, tons C/person)	<b>3.6</b>
<b>Carbon Intensity</b> (t C/million \$, 2000)	<b>427.3</b>

# The EU Gap: 383 MtC



Source: EU 3<sup>rd</sup> UNFCCC National Communication, 2001

# The Canadian Picture



Source: [http://www.nrcan.gc.ca/es/etb/cetc/combustion/cctrm/pdfs/bpearson\\_cctrm\\_issues\\_paper.pdf](http://www.nrcan.gc.ca/es/etb/cetc/combustion/cctrm/pdfs/bpearson_cctrm_issues_paper.pdf)



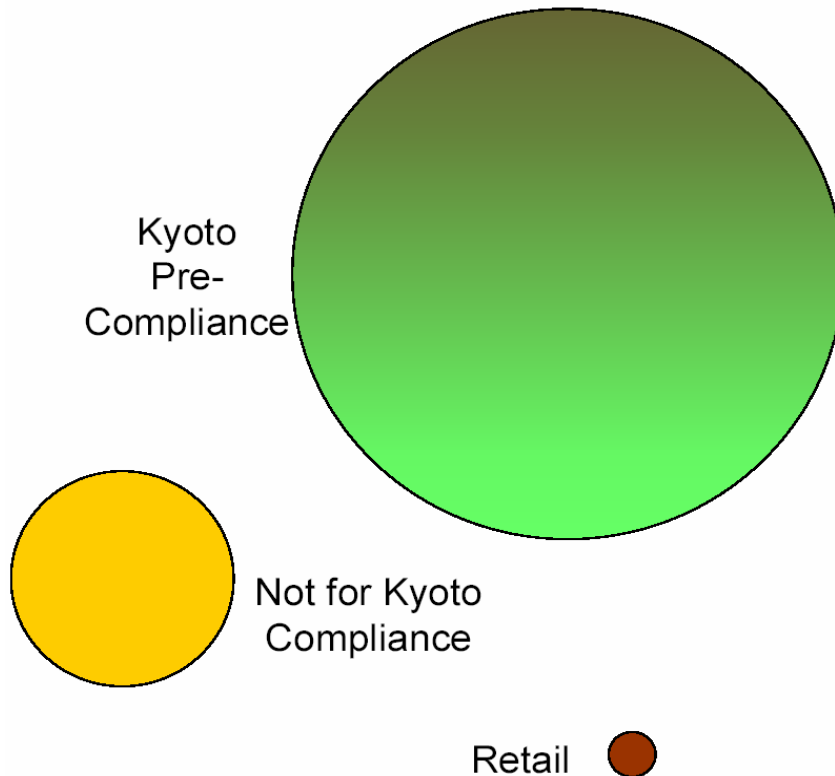
# Today's Market in GHGs

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- Typical transaction size : around 2 million tCO<sub>2</sub>eq
  - Purchases of up to 10 million tCO<sub>2</sub>eq have transacted
  - Smaller purchases from 50,000 tCO<sub>2</sub>eq upwards
- Significant trading activity has taken place to date; international pre-compliance market approximately 250 million tCO<sub>2</sub>eq.
- Certified Emission Reductions (CERs) market developing rapidly
  - Early movers took VERs
  - Commercial buyers today almost exclusively contracting to take delivery of CERs; prices for CERs for delivery in 2010 are around \$4.50 - \$5.50 per CER.
  - Expect emergence of a secondary market in CERs

# Overview of the Carbon Market

## Project-Based Transactions (96%)

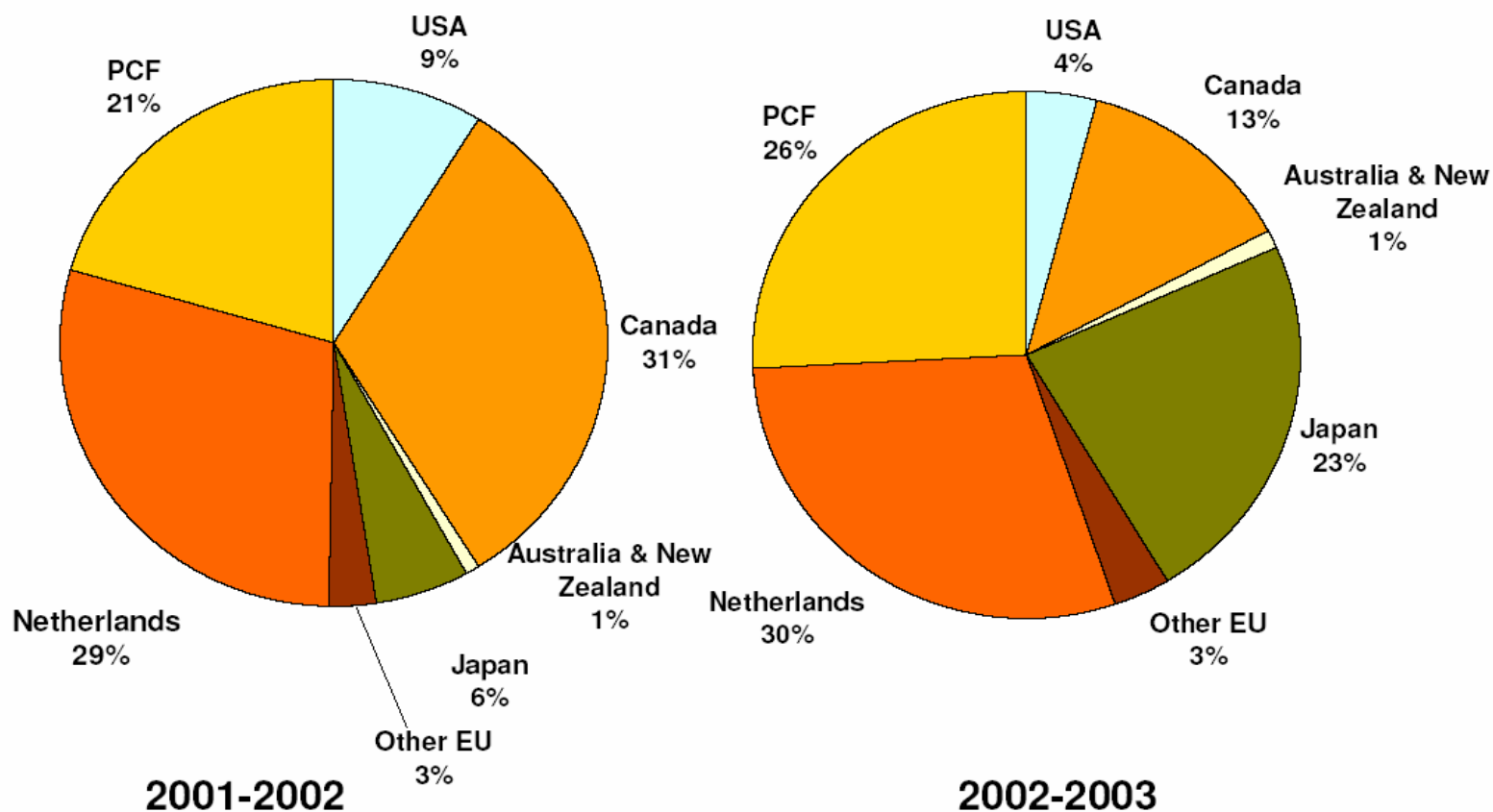


## Allowance Markets (4%)

- UK Emission Trading Scheme
- EU Emission Trading Scheme
- Chicago Climate Exchange
- New South Wales Certificates



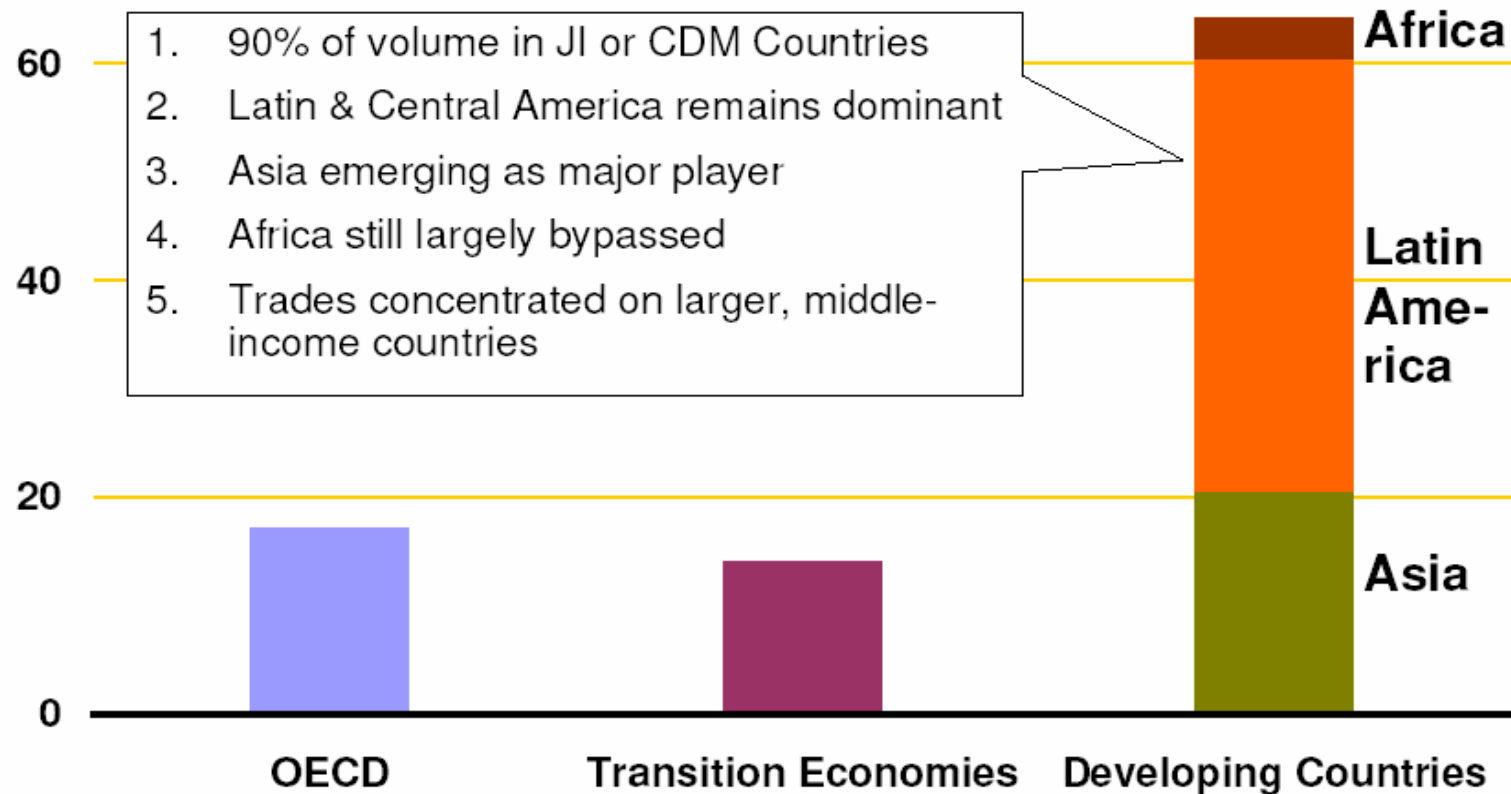
# The Carbon Market: Who's Buying



SOURCE: World Bank: State and Trends of the Carbon Market, 2003



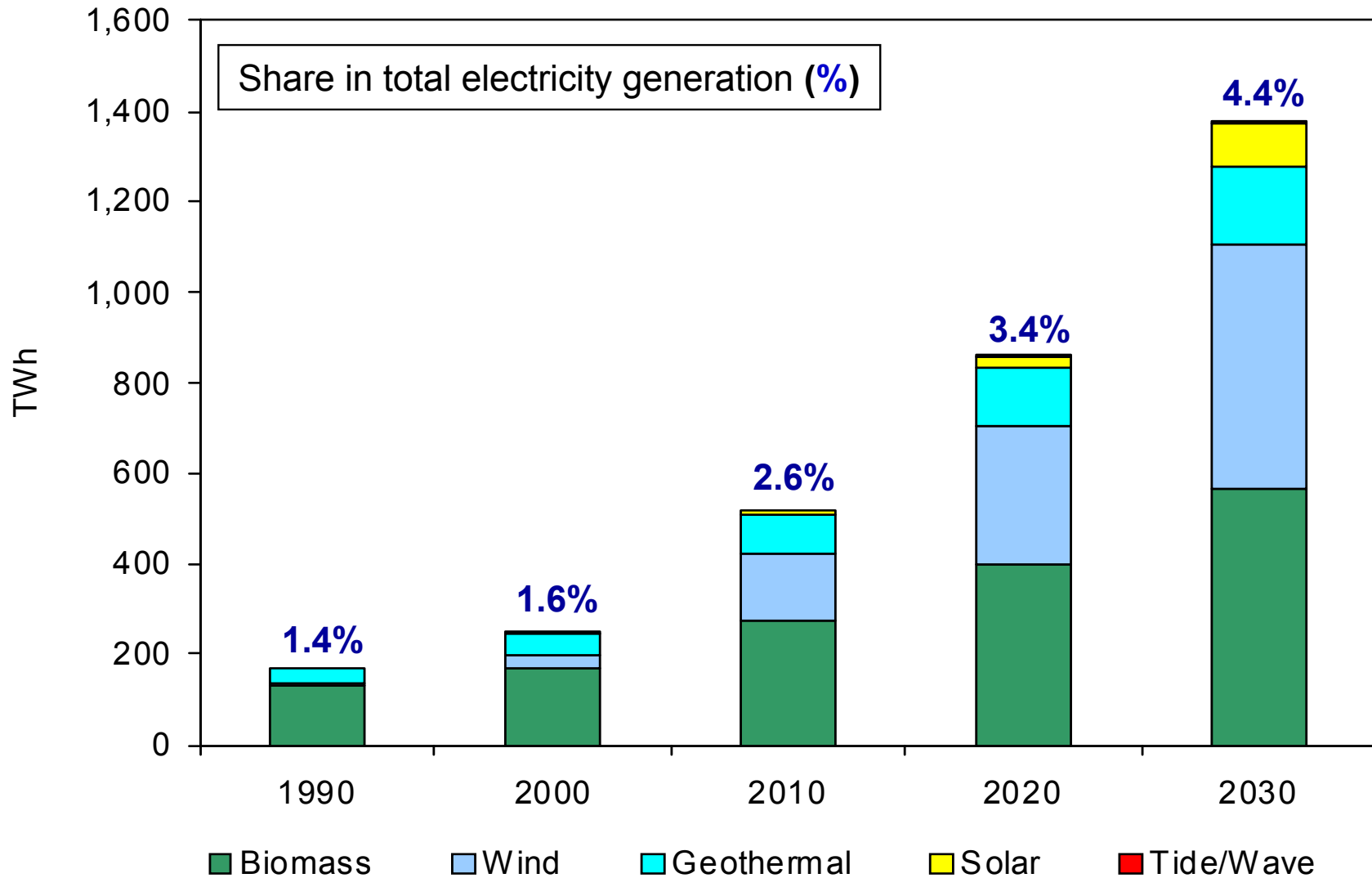
# Emerging Markets



SOURCE: World Bank: State and Trends of the Carbon Market, 2003



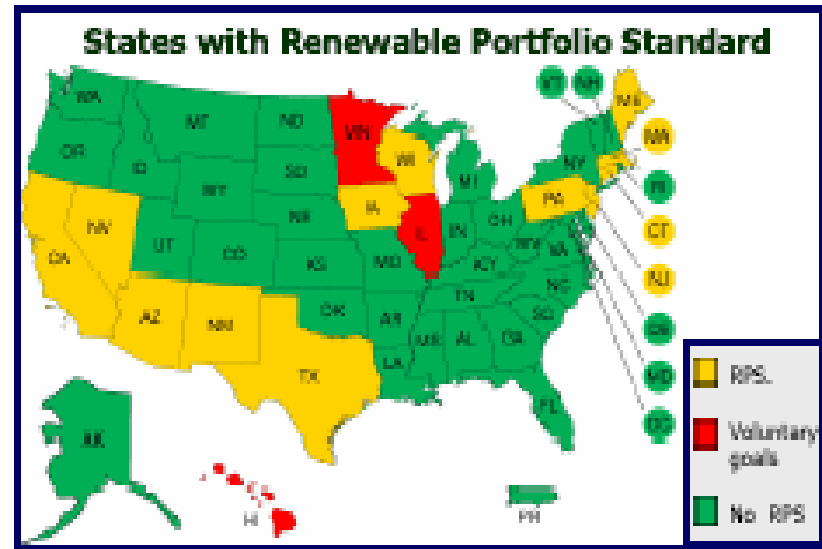
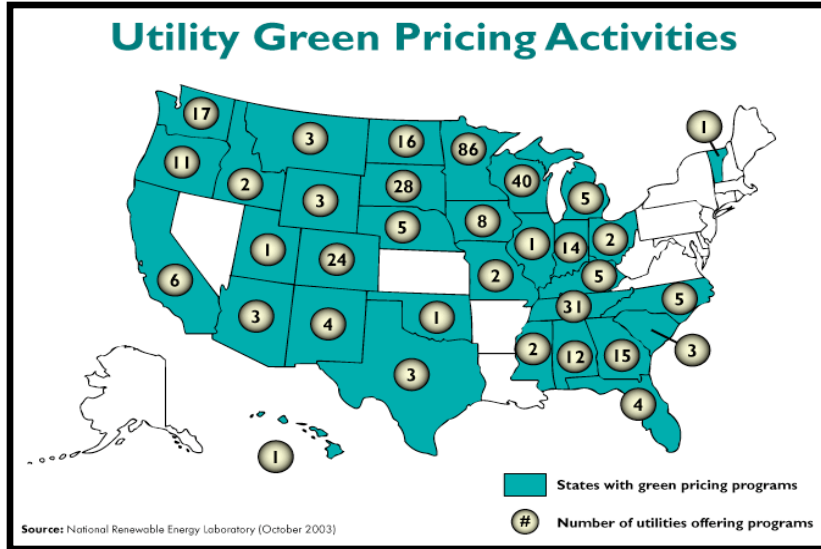
# World Non-Hydro Renewables-Based Power Generation



Source: IEA WEO 2002



# Renewable Energy: A Market in Environmental Protection



Source: Evolution Markets, 2003

# US RECs Prices (per MWh)

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## **Voluntary Markets: Price discretion based on resource type**

- Solar: → \$250
- Wind: \$6 - \$20;  
depending on location
- Biomass, hydro:  
\$3 - \$5

## **Compliance Markets: Little price discretion among resource types**

- Texas: low \$3, high \$17  
(now in 11<sup>th</sup> month at  
\$11-\$13 range)
- New Jersey: Class I:  
~\$6, Class II: ~\$3
- Massachusetts
  - 2002: \$25
  - 2003: \$30+
  - 2004: \$40+

# Oil companies are exposed to climate risk:

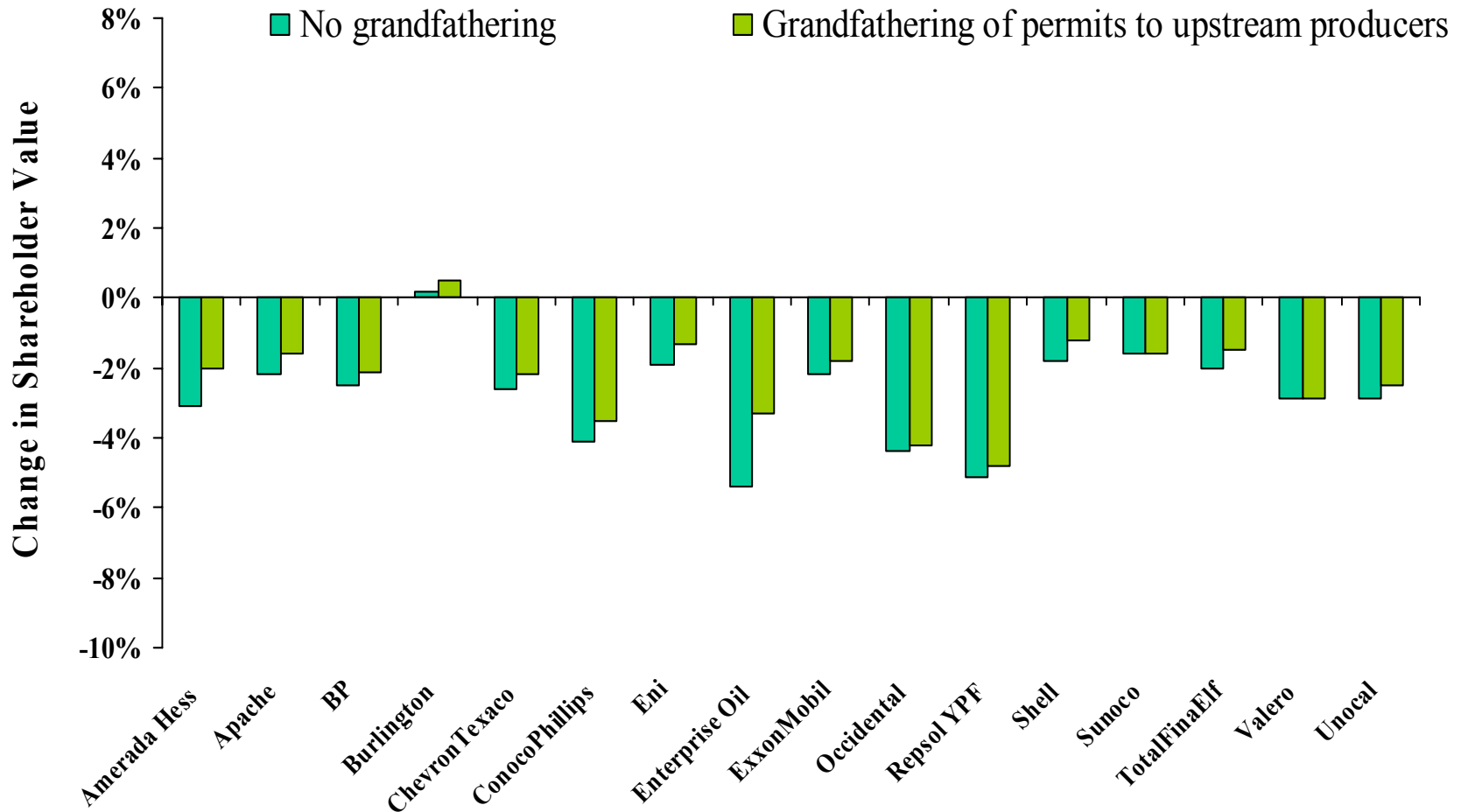
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- Companies will be exposed to climate pressures depending mainly on:
  - Oil-gas mix
  - Balance of upstream and downstream activities
  - Geographical distribution



# Impacts of Kyoto on Big Oil

(without the U.S. but with some U.S. domestic action)

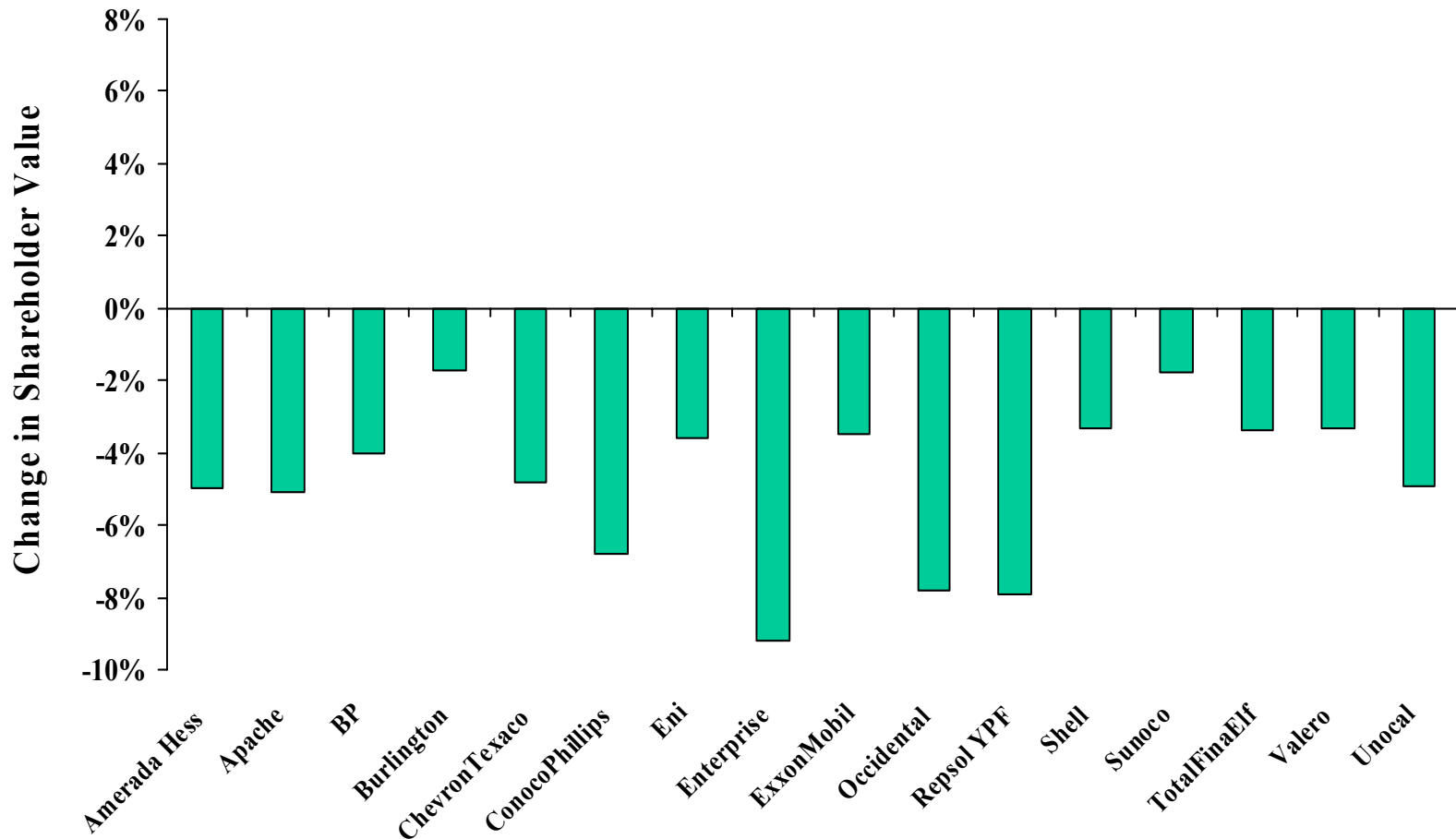


Source: WRI, *Changing Oil*; 2002





# Impacts of Accelerated Introduction of New Automotive Technologies



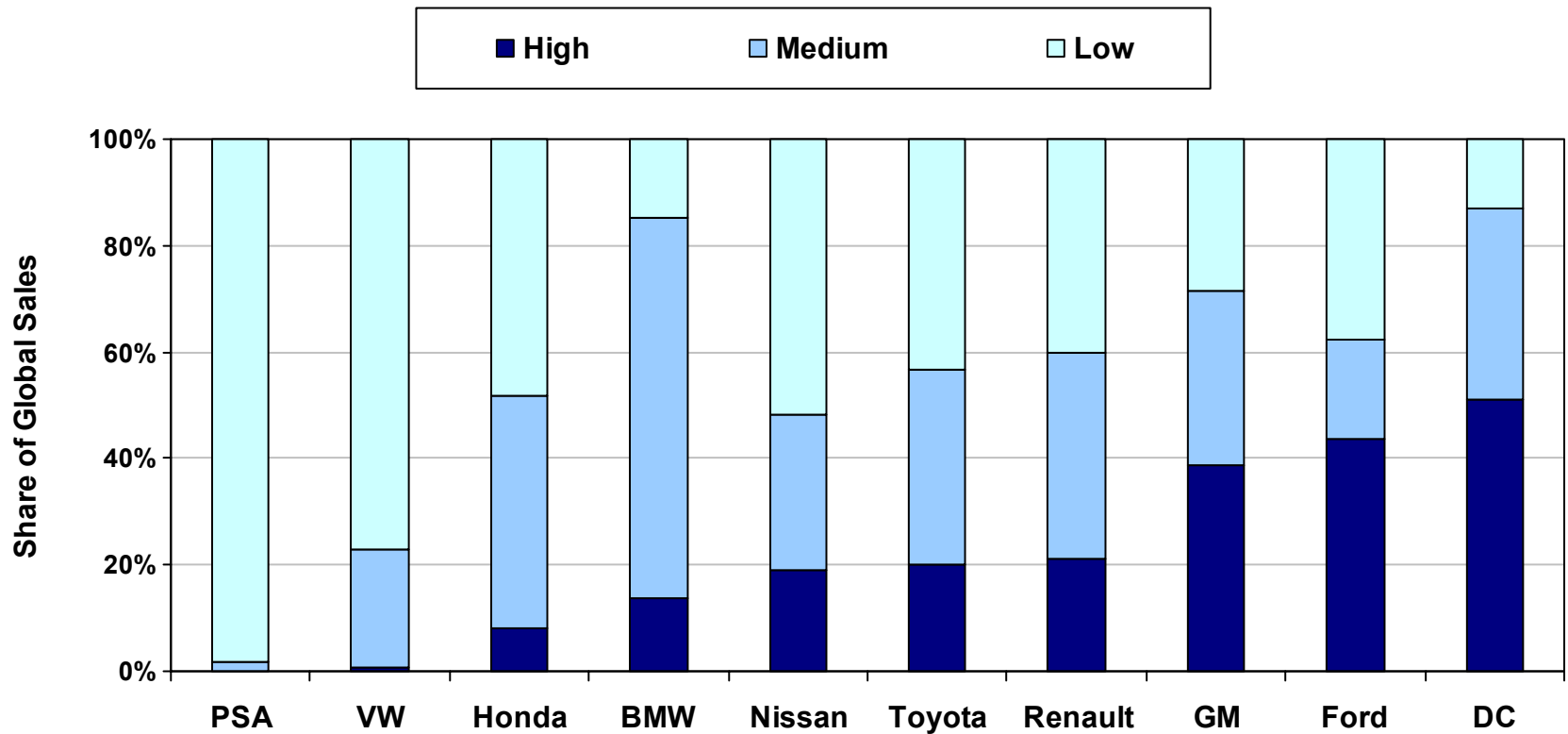
Source: WRI, *Changing Oil*; 2002



# Carbon constraints will also affect auto producers

Financial Driver	Risk	Opportunity
<b>Cost structure</b>	Carbon constraints could raise costs, from R&D to design to production.	More efficient OEMs could have a relative cost advantage.
<b>Brand</b>	Lagging behind in development of cleaner technologies could harm brand.	Being viewed as a leader on climate change could enhance brand equity.
<b>Innovation</b>	Carbon constraints puts pressure on innovation capacity.	Leadership in low carbon technologies could translate into first-mover advantages.
<b>Product segmentation</b>	OEMs that depend on carbon-intensive segments could see sales and profits fall.	OEMs producing lower-carbon vehicles could see sales and profits grow.

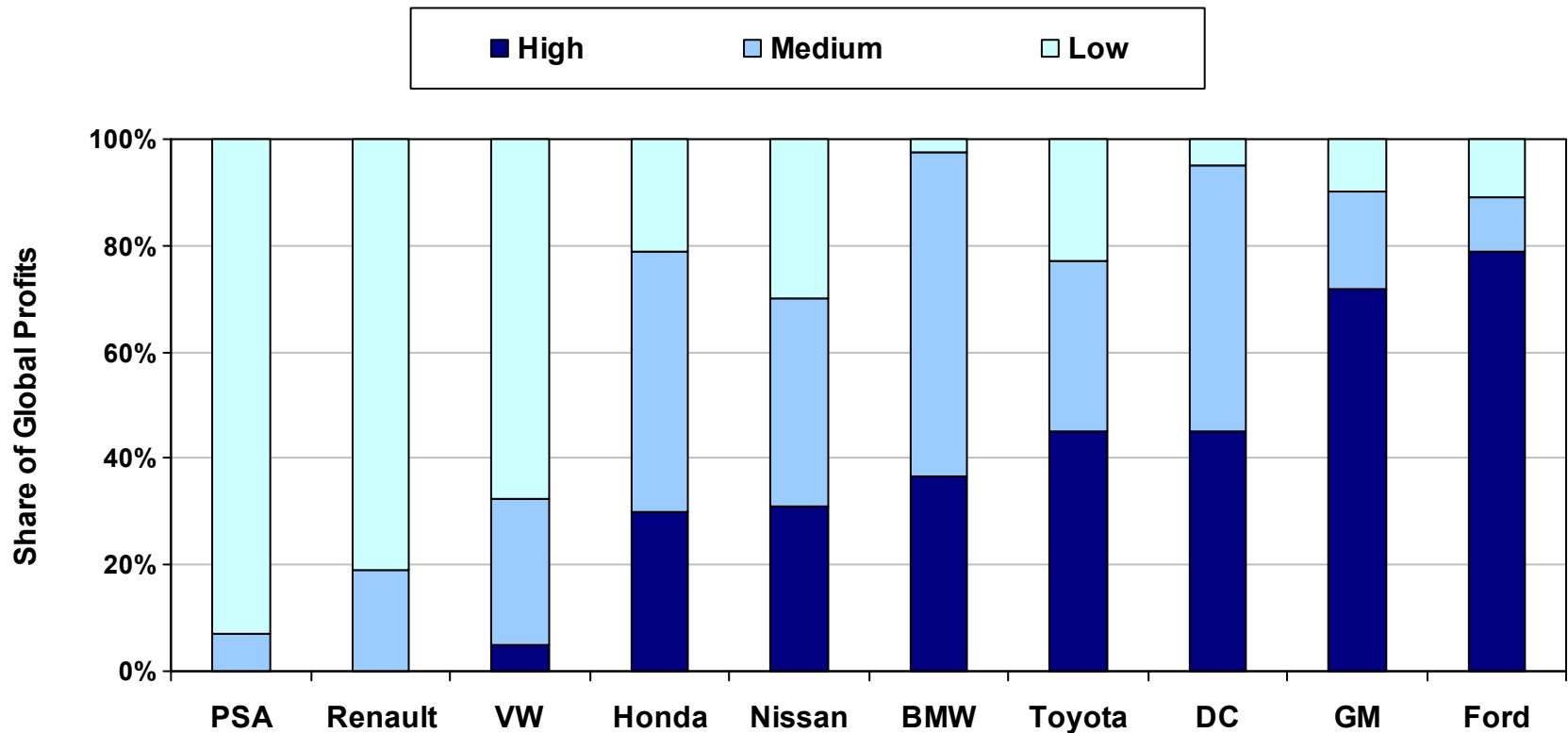
# Carbon-intensity of Sales



Source: WRI, *Changing Drivers*; 2003



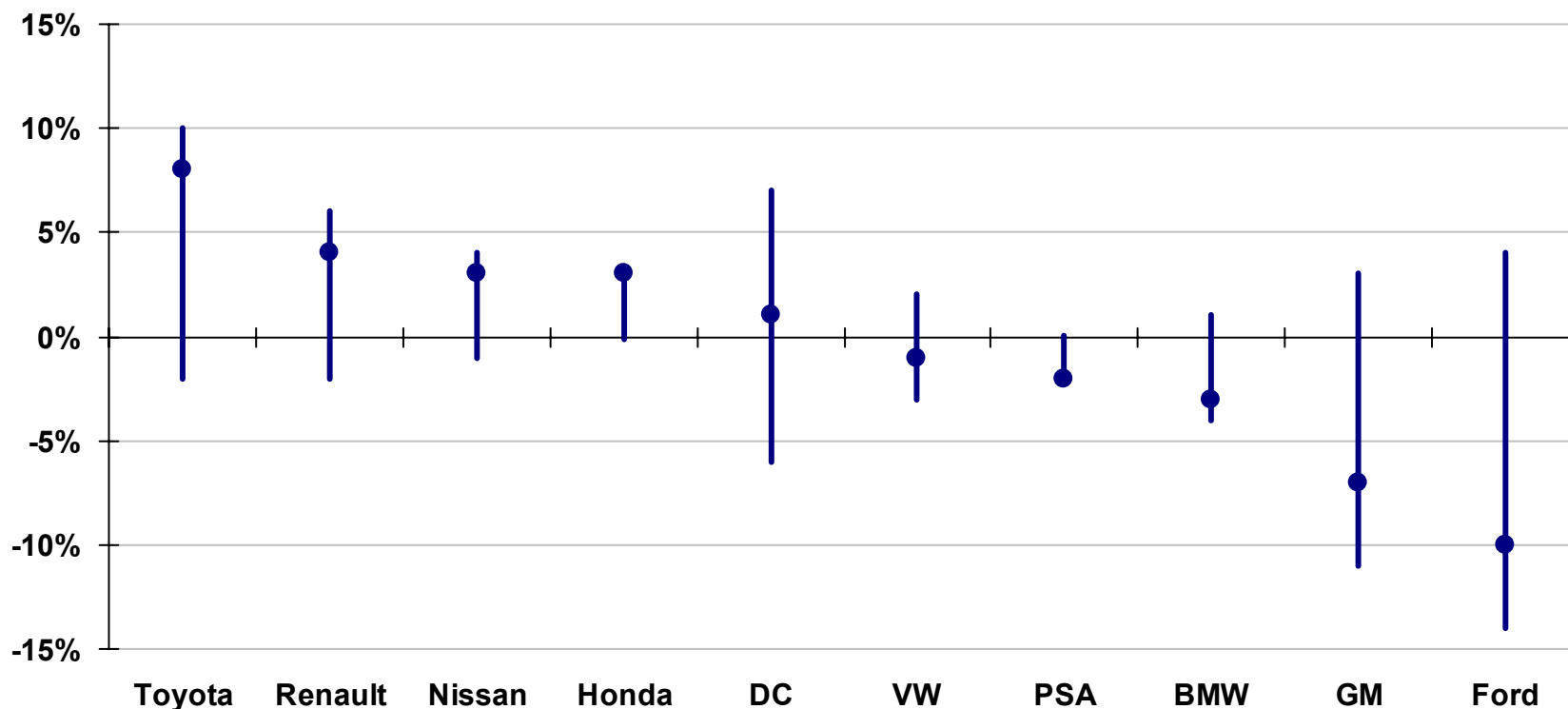
# Carbon-intensity of Profits



Source: WRI, *Changing Drivers*; 2003



# Implications of Carbon Constraints for Future Earnings



Source: WRI, *Changing Drivers*; 2003



# Comments and Conclusions

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# Conclusions (1)

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- The energy system has been intimately intertwined with the environment – often to the environment's detriment
- In some areas, impacts *are* being successfully addressed (e.g., criteria pollutants)
- Other issues remain unresolved (e.g., vulnerable ecosystems, climate change)

# Conclusions (2)

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- Climate change poses a real and growing threat.
  - Significant political solutions are being adopted (albeit slowly)
  - One consequence of that global effort is the development of a new (and potentially huge) emission market.
  - Fuel switching, including to renewable energy, is also likely – although only over the longer term
  - Corporations are at risk if they do not plan accordingly – but there are potential opportunities for market leaders
- While previous changes in the energy sector have been driven by supply scarcity, future changes may be driven by environmental constraints.

