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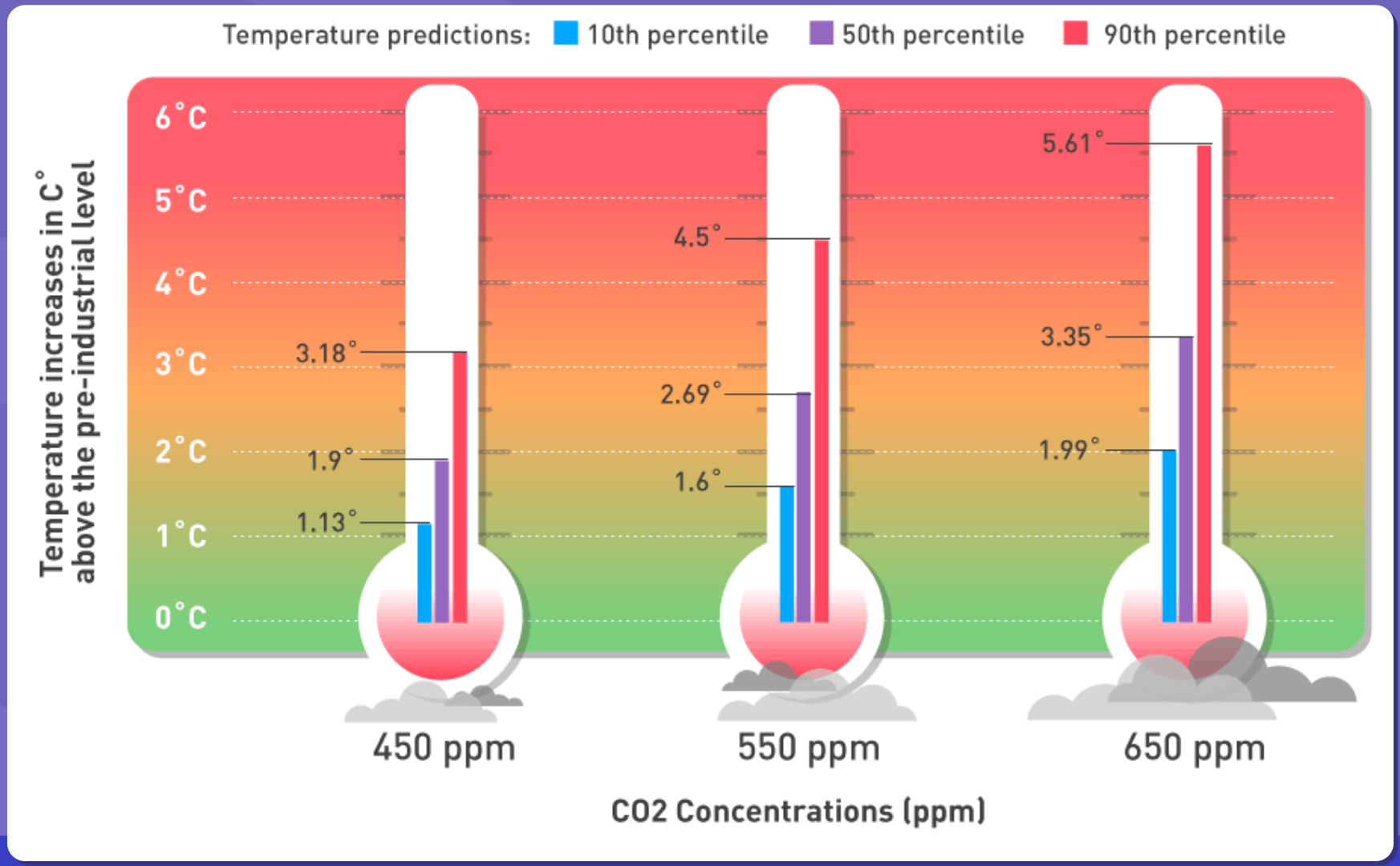
"The projections include a contribution due to increased ice flow from Greenland and Antarctica at the rates observed for 1993-2003…the upper ranges of sea level rise…would increase by 0.1 m to 0.2 m. Larger values cannot be excluded, but understanding of these effects is too limited to assess their likelihood or provide a best estimate or an upper bound for sea level rise."

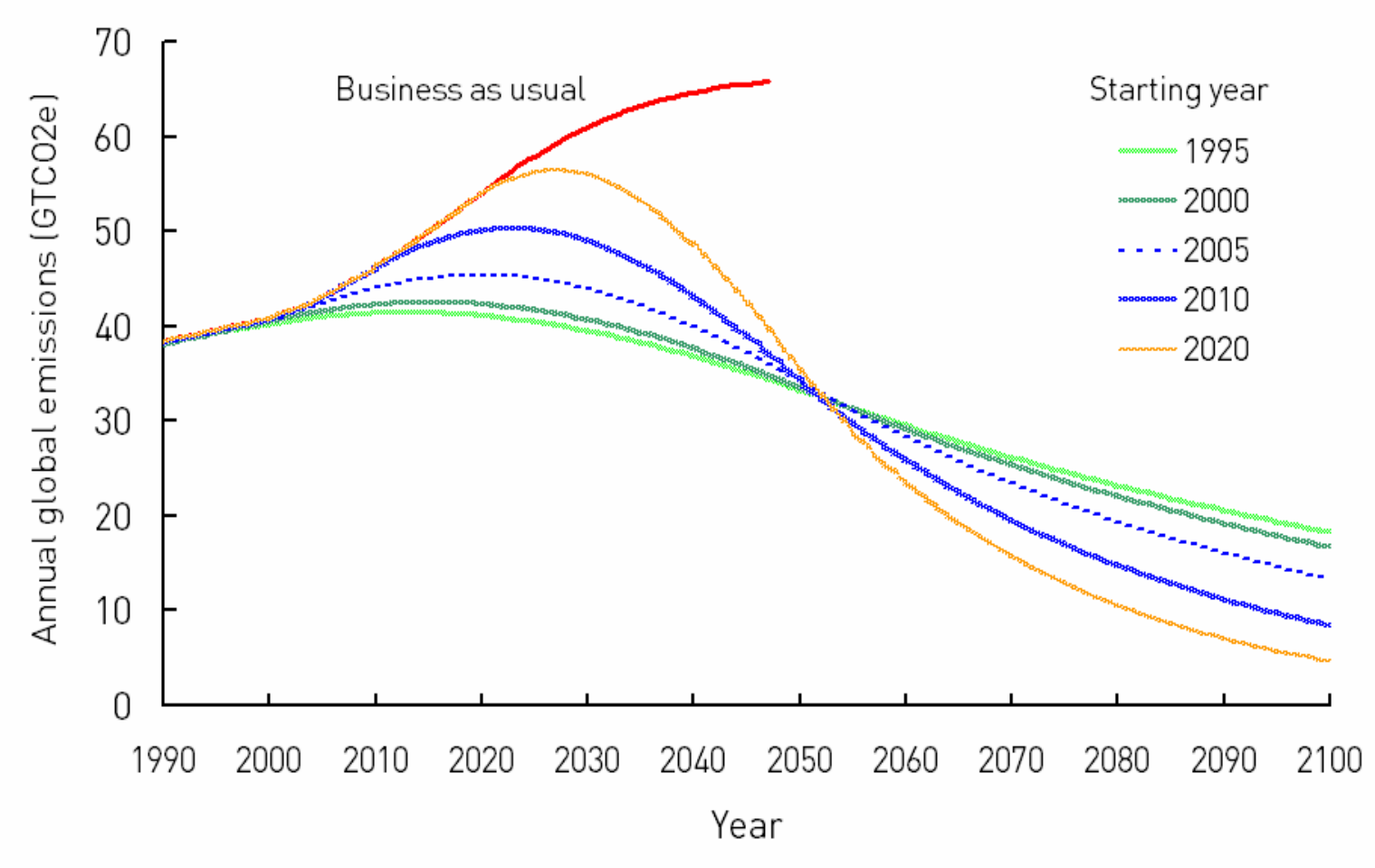
Source: IPCC 2007

# The fat-tail of climate risk…



# Delaying action means that future reductions of greenhouse gas emissions have to be much steeper

Shown here: Global emissions scenarios that limit further warming to 2° Fahrenheit



## Challenge:

We are purchasing a real option to avoid catastrophe, the price of which is the cost of developing new technologies sooner.

## Opportunity:

If: variance in damages › variance in cost

Then: option to hedge may be cheap

And: option gets cheaper with rising damage variance & falling cost variance

# A PB/CR Scenario

| | 2012 | 2017 | 2022 | 2027 | 2032 | 2050 |
|---|---|---|---|---|---|---|
| US, Japan, Canada, Australia, | At 2007 | 90% of 2007 | 70% of 2007 | | | 20% of 2007 |
| EU | | 70% of 1990 by 2020 | | | | 40% of 1990 by 2050 |
| Eastern Europe, Former Soviet Union | | 90% of 1990 by 2020 | | | | 70% of 1990 by 2050 |
| China/India | BAU | 115% of 2012 | 110% of 2012 | 100% of 2012 | NA | 65% of 2012 |
| Other developing countries | BAU | BAU | 115% of 2012 | 110% of 2012 | 100% of 2012 | 70% of 2012 |
| Tropical Deforestation | | 70% of 2007 by 2020 | | | | 20% of 2007 by 2050 |

# The Static View

- The marginal cost of co2 abatement rises steadily – though marginal benefits are flat
- We can estimate a co2 price where the lines meet.
- A price signal - tax or safety valve - set at this point will provide sufficient investment in technology and offsets.
- The variance around both lines cannot be accurately reflected.

# The Dynamic View

- A hard cap on emissions will result in strategic, rather than tactical, changes in energy strategy
- Capital investment flows to low-carbon technology will drive innovation more rapidly than carbon models are able to predict.
- The variance around marginal benefits – the fat tail risk – makes incremental abatement valuable.
- Slow incremental change – 1 ½ to 2% p.a. over 40 years in US Cap - are highly likely to succeed.

# USCAP
United States Climate Action Partnership


Chrysler, Excelon, Ford Motor, NRG Energy, Rio Tinto, Xerox

# Economic impact:

## Macro effects appear manageable

- IPCC: for 445 to 535 ppm, 2030: *maximum* global GDP reduction -3% (-0.12% GDP growth)
- MIT: for 167bmt (approx. 520ppm) 2030: U.S. GDP reduction -1.5%

The “double dividend” of cutting taxes on labor & capital, and falling oil prices, keeps MIT’s GDP reduction manageable.

# In 2007, the U.S. Will Have:

6.1 bn mt of co2 emissions:

- 21% residential, 33% transportation, and 46% commercial & industrial (40% electric power)

- 20% natural gas, 37% coal, and 43% petroleum

And 1.3 bn tons of non-energy sources:

52% from non-ag methane, 21% from agriculture

Source: EIA 2007e

# The U.S. Policy Debate

- The system that best incents developing world participation should win
- The system that best manages initial abatement cost volatility may win
- % of emissions covered and point or regulation are other big issues

# The Safety Valve

- A safety valve becomes a carbon tax at the trigger price, with no emissions cap
- Also, co2 prices with a safety valve will trade at artificially low levels due to limited upside
- The Bingaman-Specter $12/mt safety valve with 5% real appreciation takes 19 years to reach $30/mt – while current ETS prices for 2008-2012 are already above $30

# $30/ton & 6.1 bn mt-co2* per annum:

## Manageable with Gradual Long-Term Caps

- 1.4%  GDP
- 7.1% Government Expenditures
- 15.2% Adjusted Corporate Profits
- 19.4% Federal Government Expenditures
- 20.5% Fuel, Power, & Transport Expense
- 33.3% of Fuel and Power Expenses

*EIA U.S. co2 from energy, pre-offsets, 2007e

# Capitalization of the carbon market

## An efficient market will drive investment

| **2007 IEA** | **bn-mt / year** | @ $30/mt: **1 year** of allowances |
|---|---|---|
| US | 7 | $210 bn |
| Western Europe | 5 | $150 bn |
| Deforestation | 8 | $240 bn |
| Global | 46 | $1,380 bn |

# Environmental Markets

**Mission:** To connect policymakers with the financial markets expertise needed to build confidence in a cap on emissions and a global carbon market.

**Key Projects:**

- *Market Structure:* operational characteristics of an efficient carbon allowance market
- *Uncertainty:* option strategies for hedging climate sensitivity under various cap and trade proposals
- *Offsets:* developing global trading protocols for methane, deforestation and other non-co2 tonnage

**Network:** Securities firms, alternative investment firms, academics, carbon market modelers, “above the fray” leaders