Global Warming; The Imperatives For Action From The Science of Climate Change

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The American Association for
the Advancement of Science
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The Office of Science and Technology

Chief Scientific Adviser

Transdepartmental S&T Group

Science and Engineering Base Group

Science In Government

International

Foresight

LINK

Science Review

SCIECE IN SOCIETY

Finance, Policy and Corporate Affairs

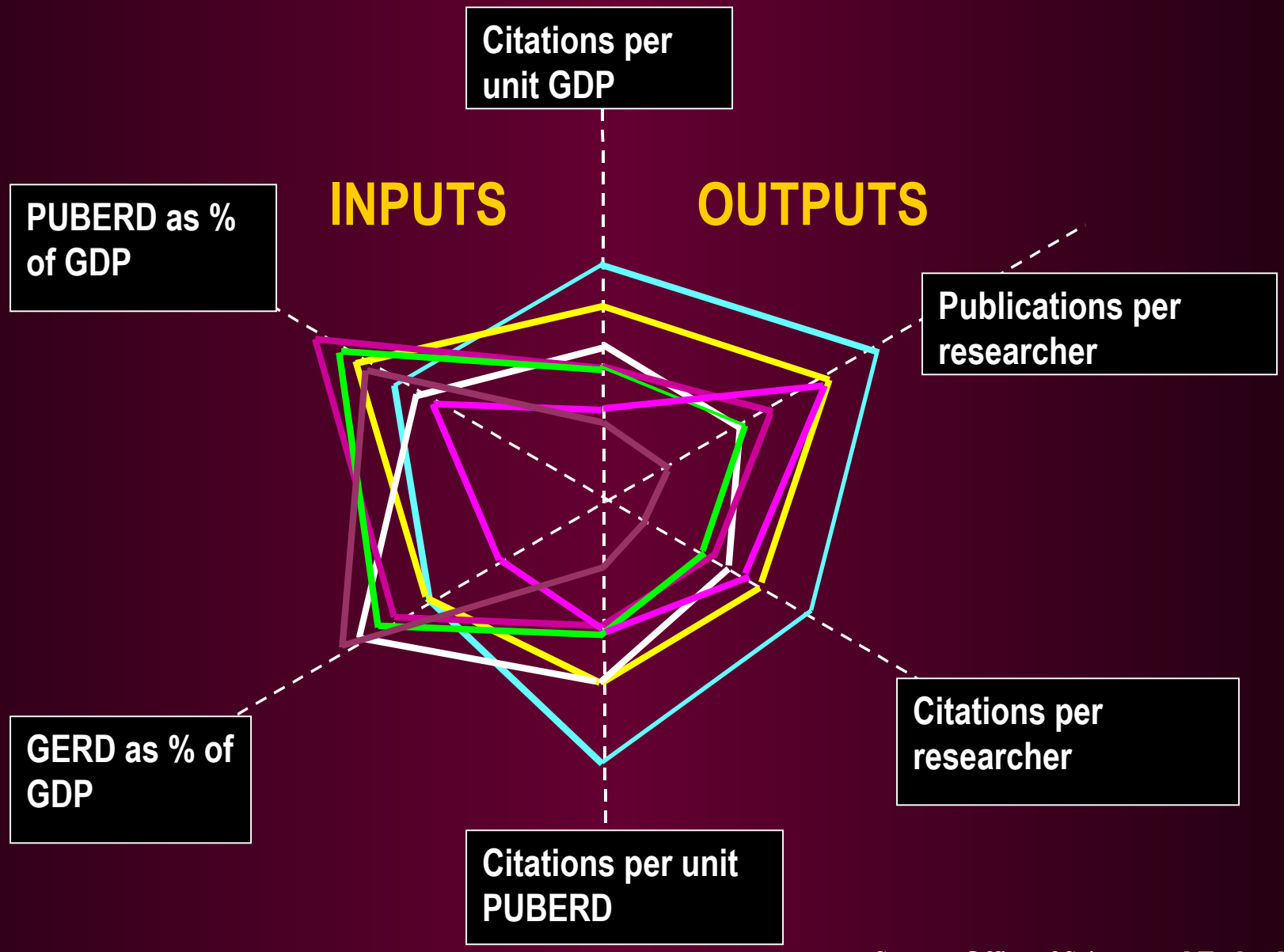
Research Councils

Exploitation

Good Science Is Imperative for Good Government

- The Chief Scientific Adviser (CSA):
  - Is responsible to the Prime Minister and Cabinet for the quality of scientific advice within Government and for advising on Government's S&T policy and on specific S&T issues
  - Ensures co-ordination of science policy issues within the UK Government and with Scotland, Wales and Northern Ireland

Research Footprint – Inputs / Outputs

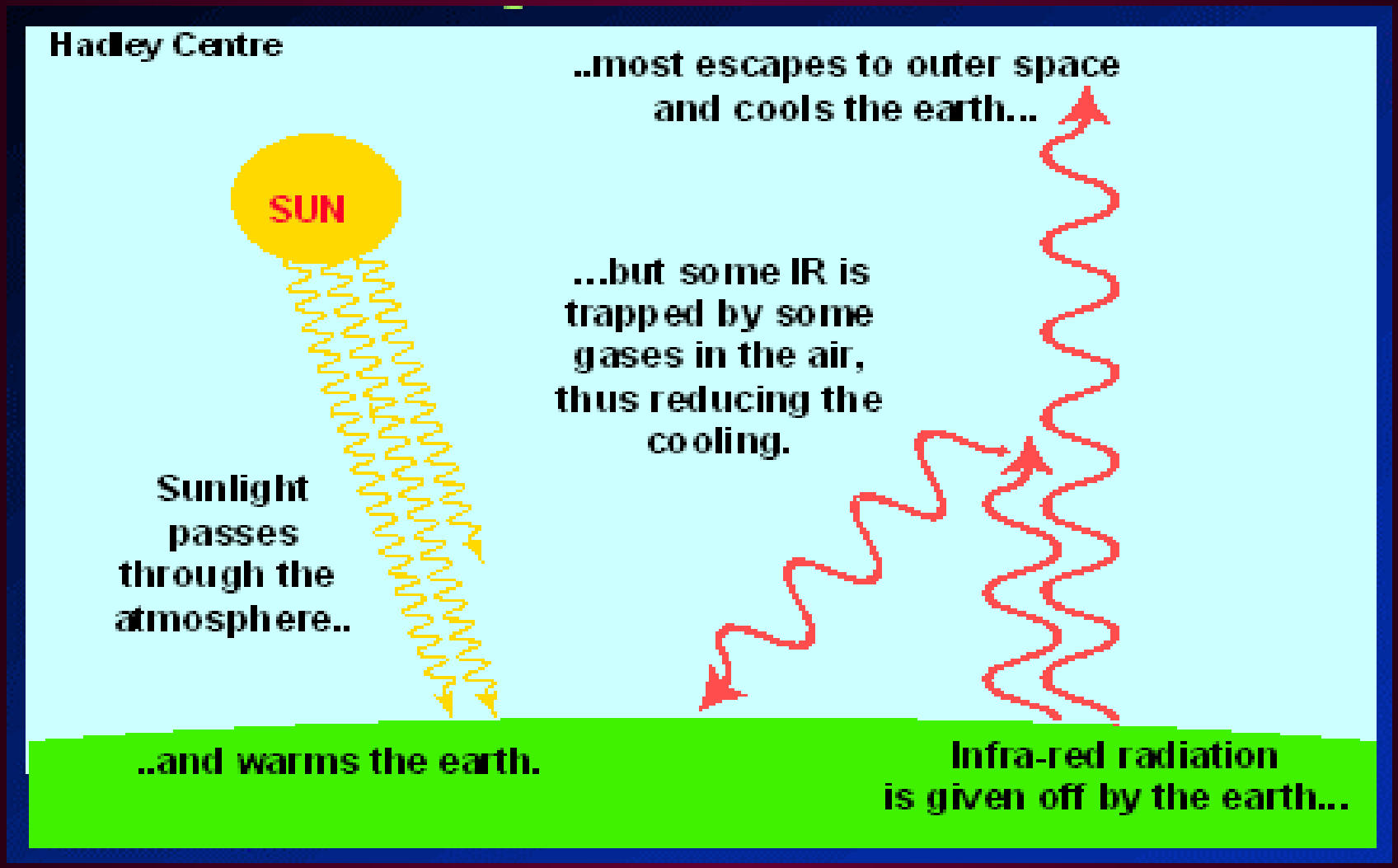


Source: Office of Science and Technology

The Chief Scientific Adviser's Role

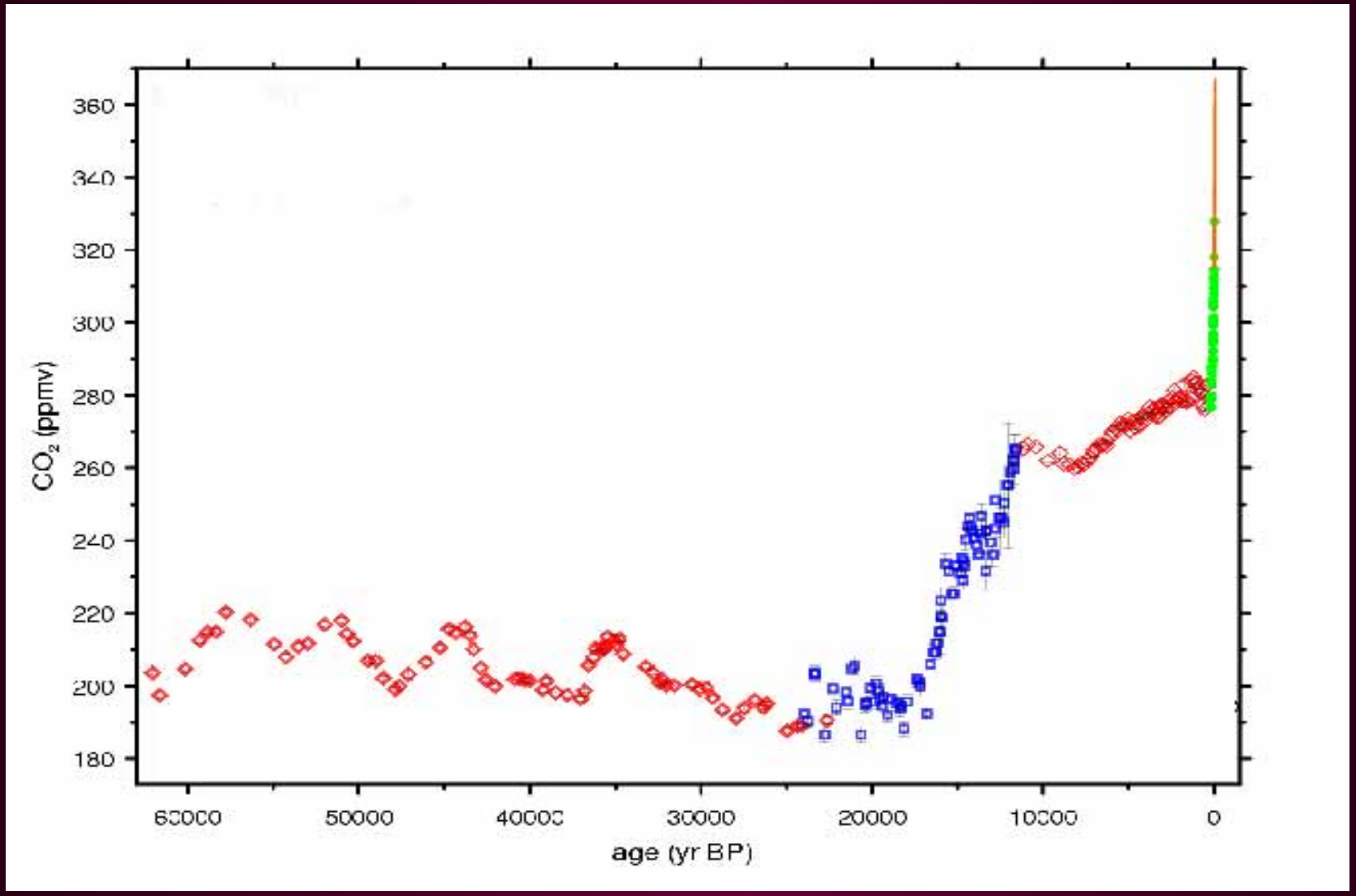
- Reactive
  - Foot and Mouth Disease (FMD)
  - BSE
- Proactive and strategic
  - GM Debate
  - Climate Change
  - Post 9/11 activity
  - Integrating scientific advice into policy making
  - Foresight

The Greenhouse Effect



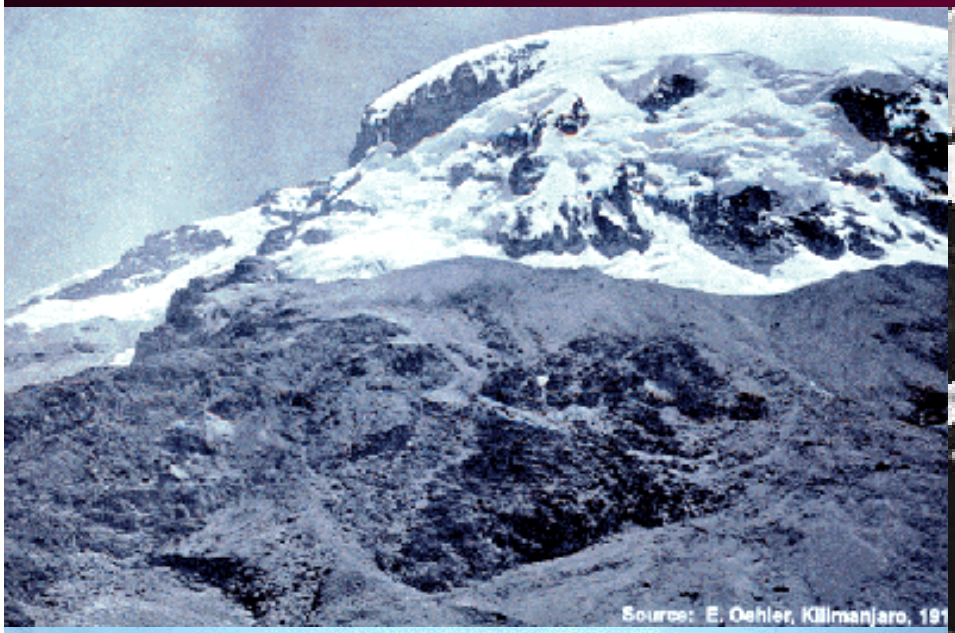
Source: The Met Office/Hadley Centre

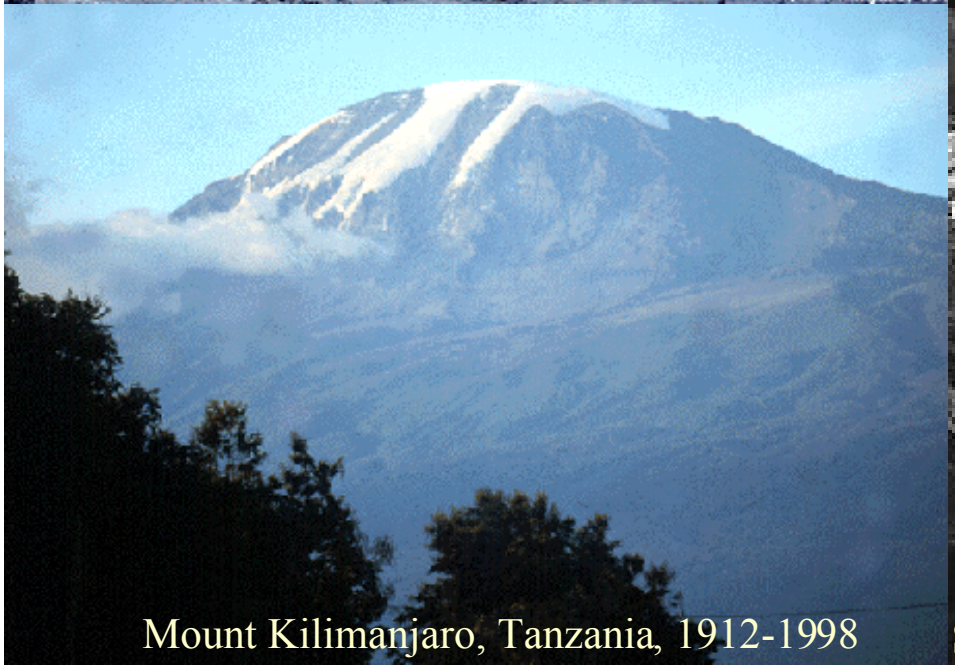
Carbon Dioxide Levels over the last 60,000 Years



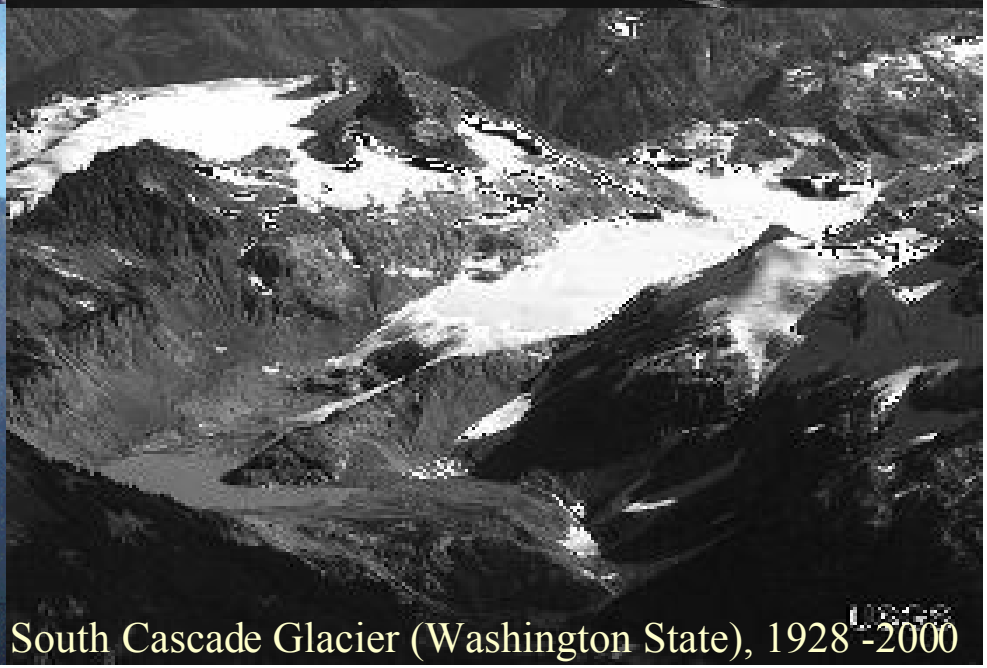
Source: University of Berne and National Oceanic and Atmospheric Administration

Climate Change Is Happening





Mount Kilimanjaro, Tanzania, 1912-1998

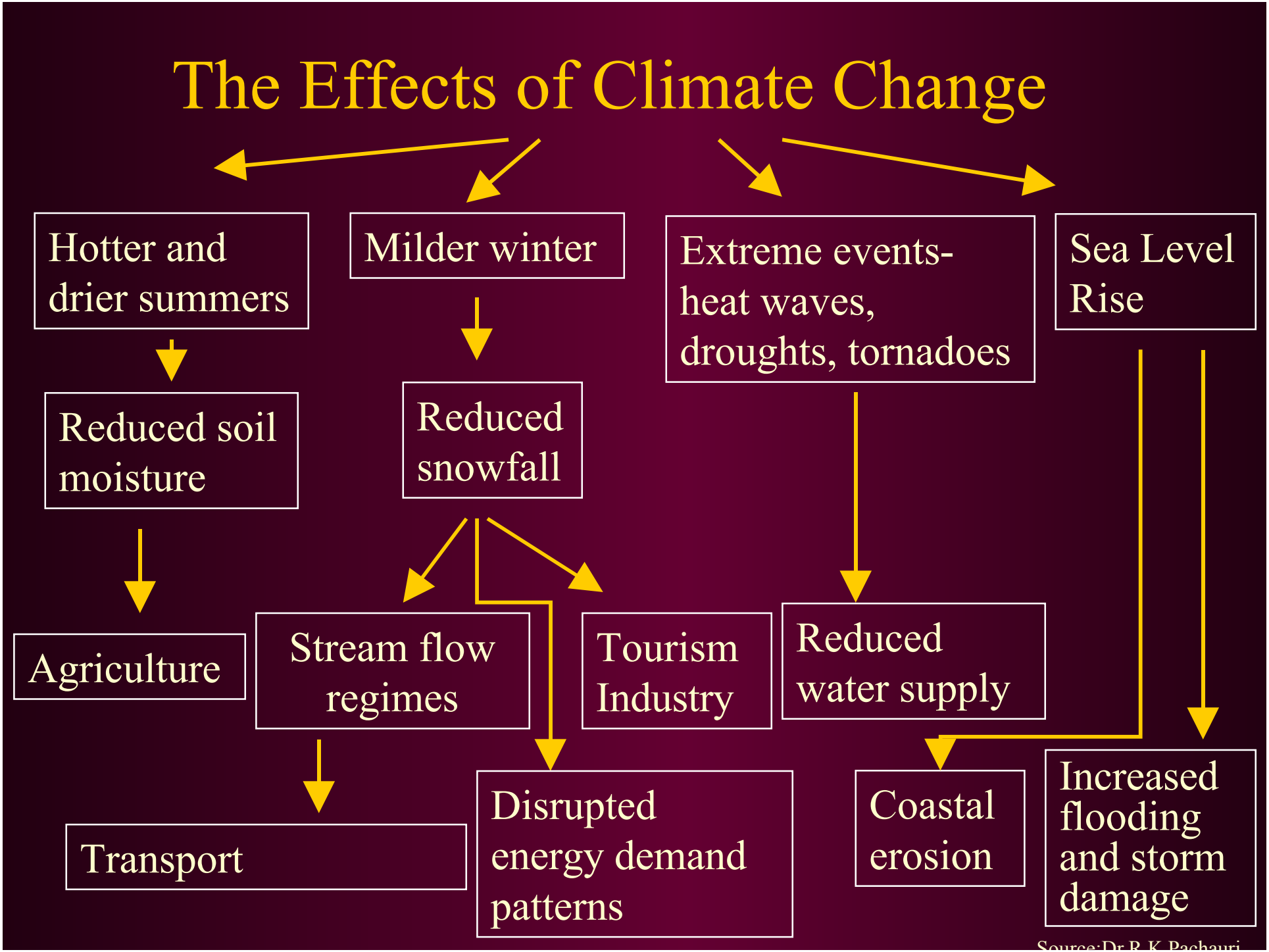


South Cascade Glacier (Washington State), 1928 -2000

…….And The Effects Are Real

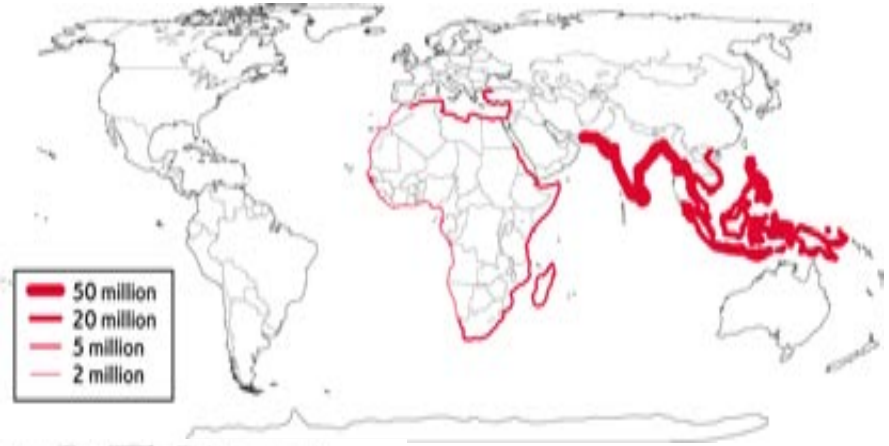
- Over 160,000 people die worldwide every year from the side-effects of climate change
- Scientific advice, including that of the US National Academy of Science is that man-made greenhouse gas emissions are having a noticeable effect on the earth's climate
- Climate models predict an increase between 1.4 – 5.8 over the next 100 years

The Effects of Climate Change

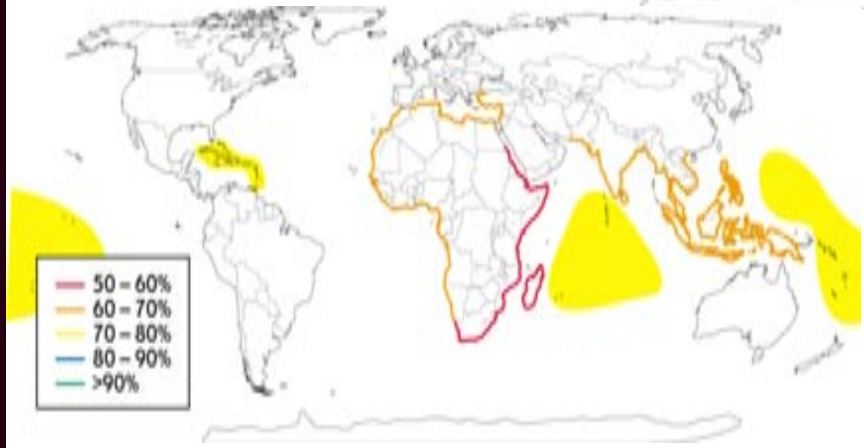


Source:Dr R.K.Pachauri

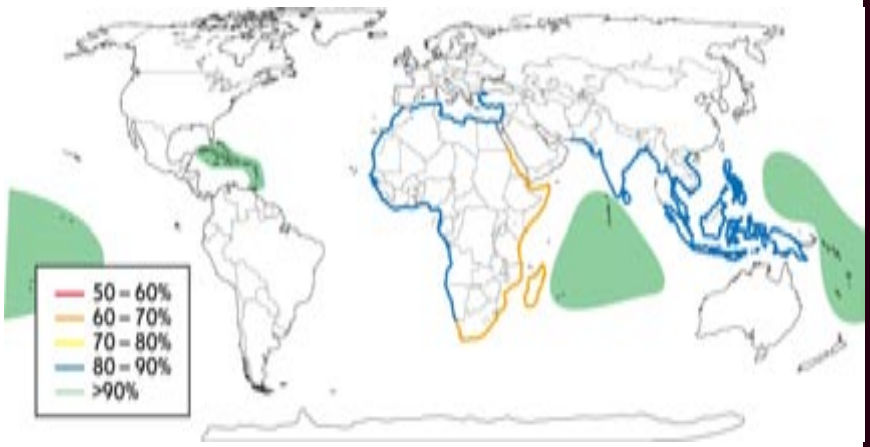
Annual Number of People Flooded



Change from the present day to the 2080s: unmitigated emissions



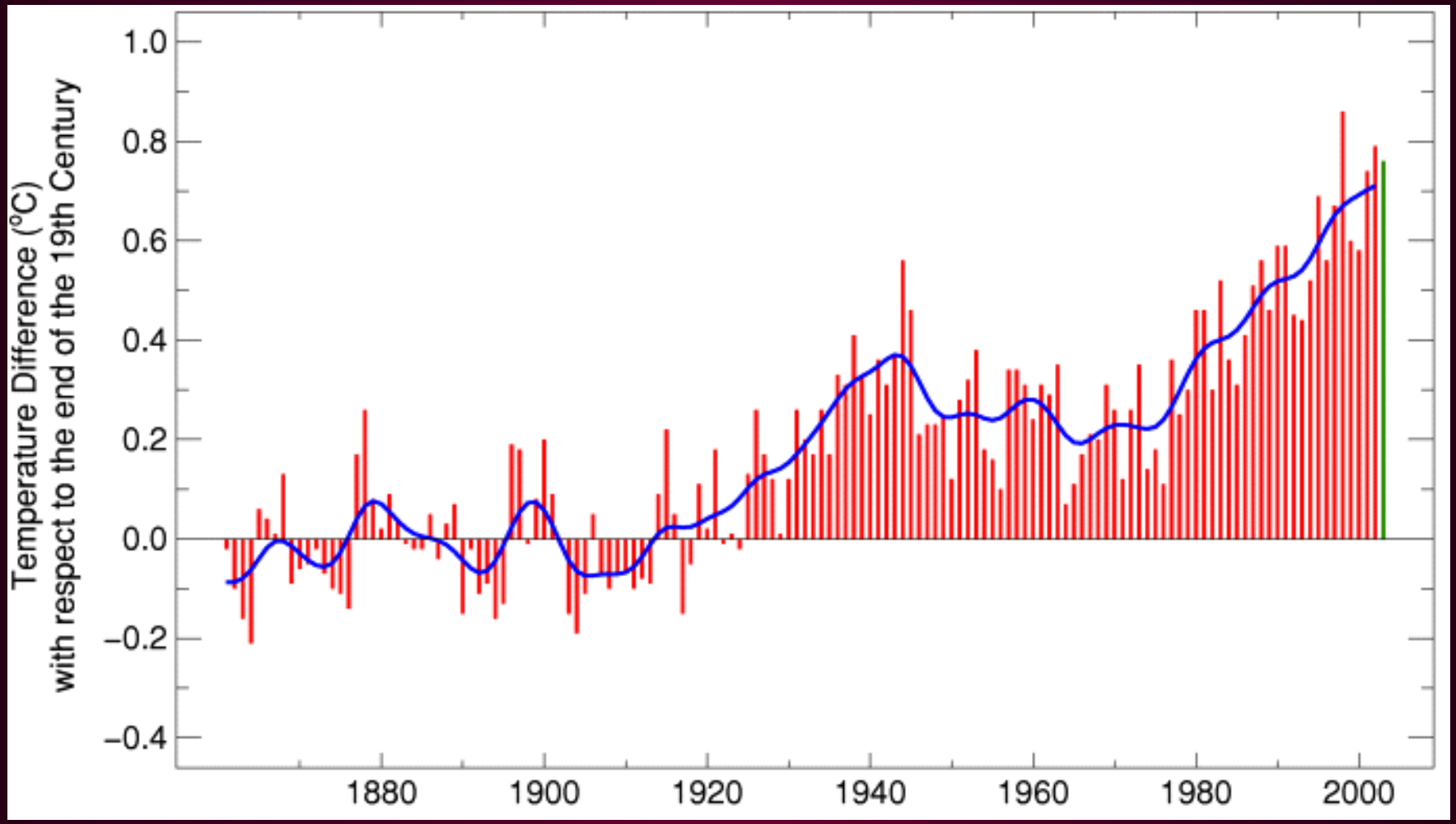
Stabilisation at 750 ppm



Stabilisation at 550 ppm

Reduction in change due to mitigated emissions scenarios

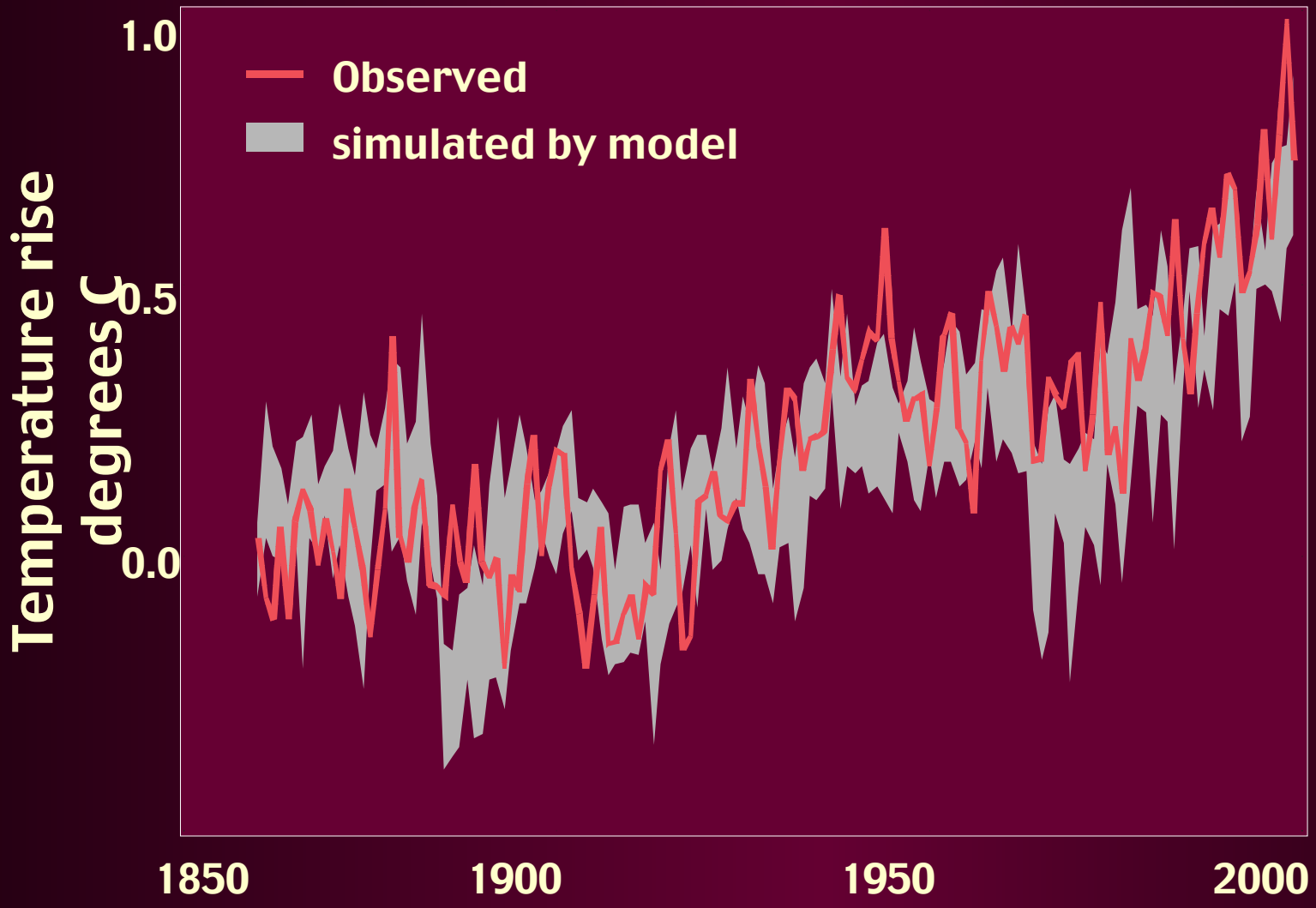
Global temperatures 1861-2003



N.B. 2003 in green includes a preliminary estimate for December

Source: DEFRA

Simulated Global Warming



Source: Hadley Centre

Difficult Non Linear Feedback Phenomena

- Deep sea methane clathrates
- Weakening the Atlantic Overturning Circulation- Thermohaline Gulf Stream, global heat conveyor
- Equatorial forest switch from CO_2 net absorption to net emission
- Change in earth's net albedo, including global ice and cloud cover

Adapt, Mitigate or Ignore

- We must actively reduce the production of greenhouse gases
- Adapt against the significant changes ahead and manage the risks
- Although market forces will continue to operate, the question is how much can we rely on these?
  - Must Adapt
  - Need to mitigate
  - Can't ignore

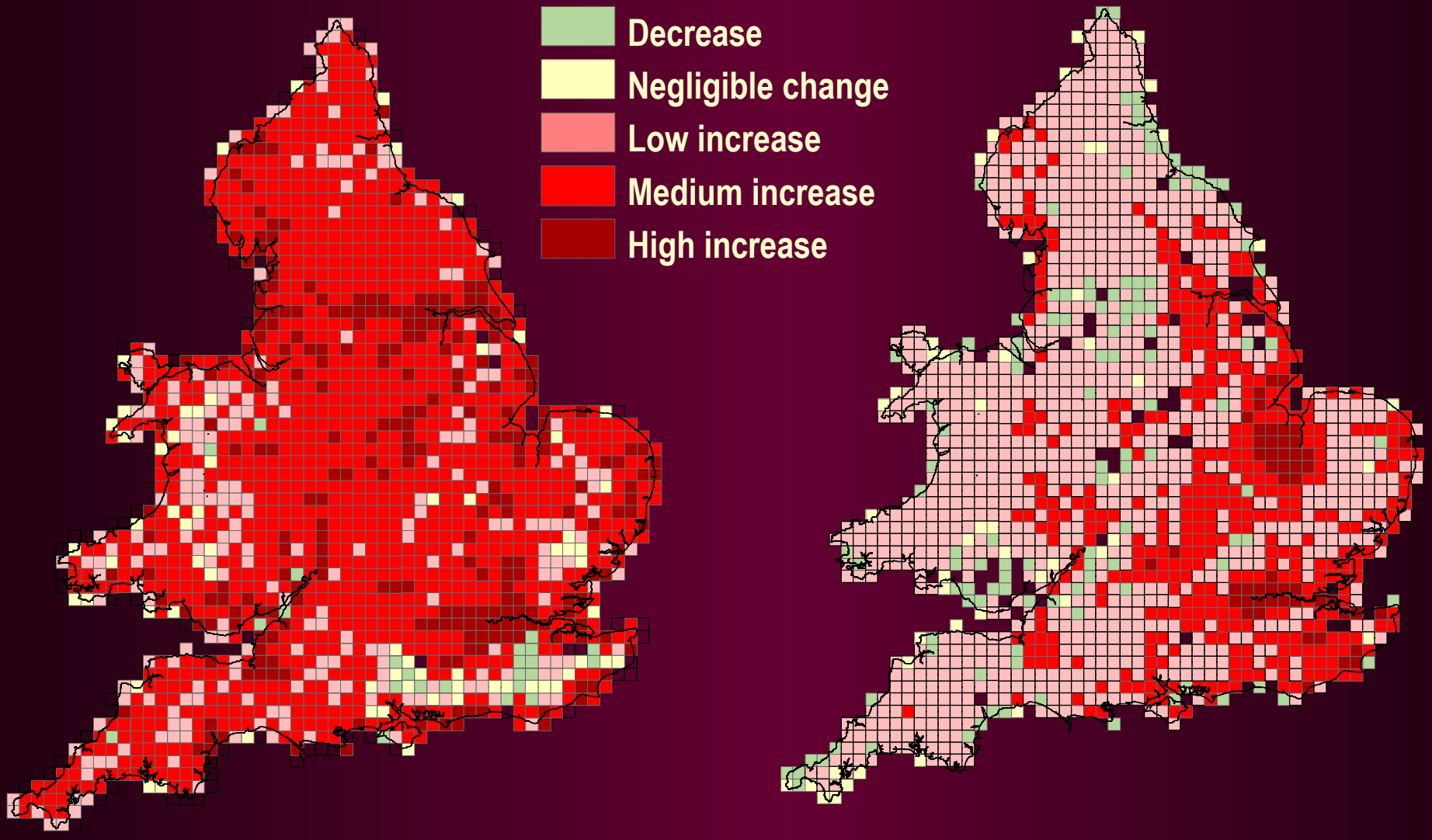
Adaptation

- In the UK - Foresight Project on Flood and Coastal Defences
- Involving around 50 top experts to assess the size of the problem, and to consider how the UK could respond
- The work is sponsored by the Department for Environment, Food and Rural Affairs and involves a range of Government Departments and bodies such as English Nature.

Scenario: World Markets 2080's

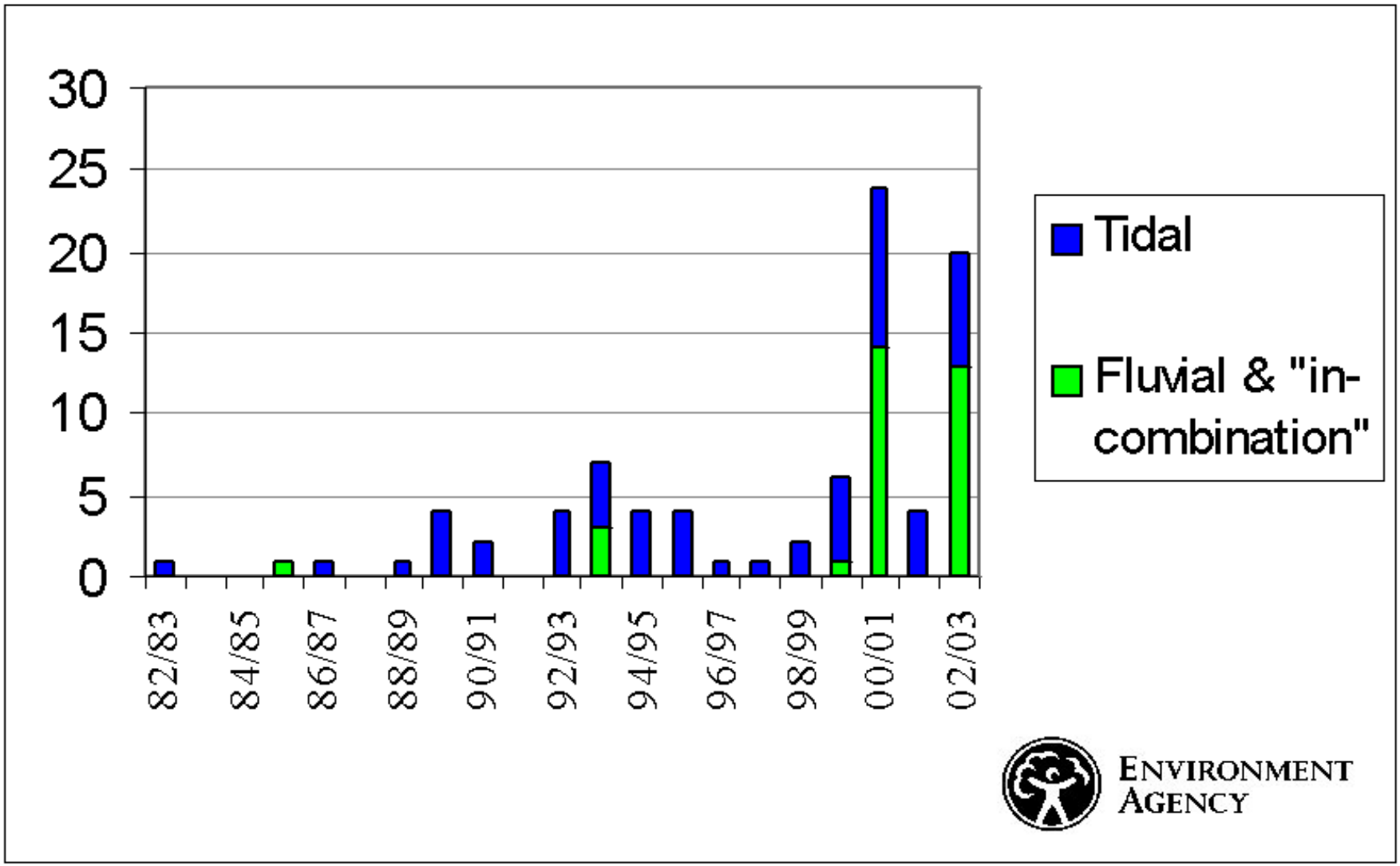
Change in annual economic damage (residential & commercial properties)

Change in number of people at high risk by 2080's



Source: Highway57

Thames Barrier Closures - Tidal, Fluvial and "in-combination"

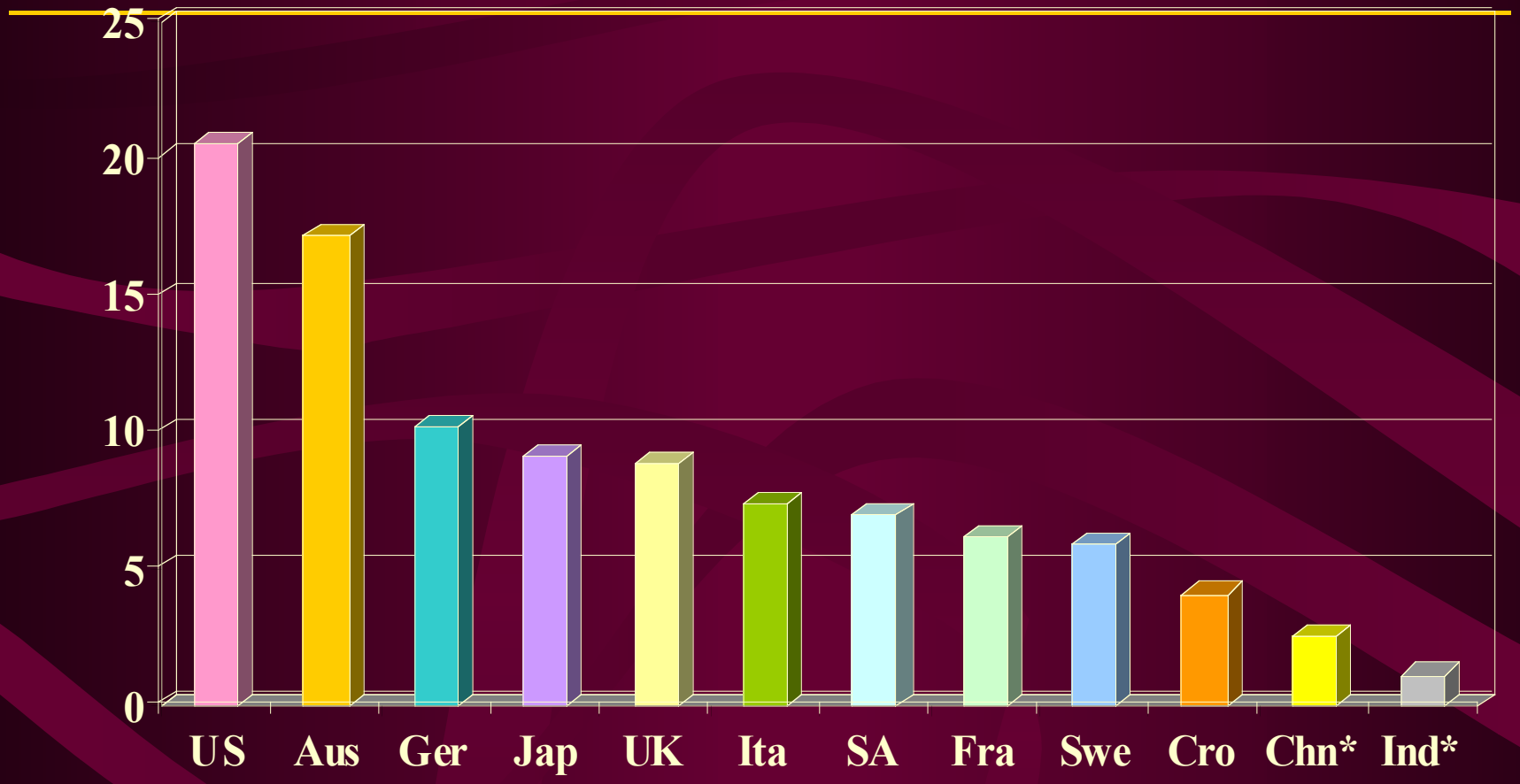


The Need for Mitigation

- Improve efficiency of energy usage
- Invest in RD&D in renewable energy, carbon sequestration, fusion
- Avoid exceeding a particular temperature/carbon dioxide global targets threshold
- Engage actively in North-South Science, Engineering and Technology capacity building

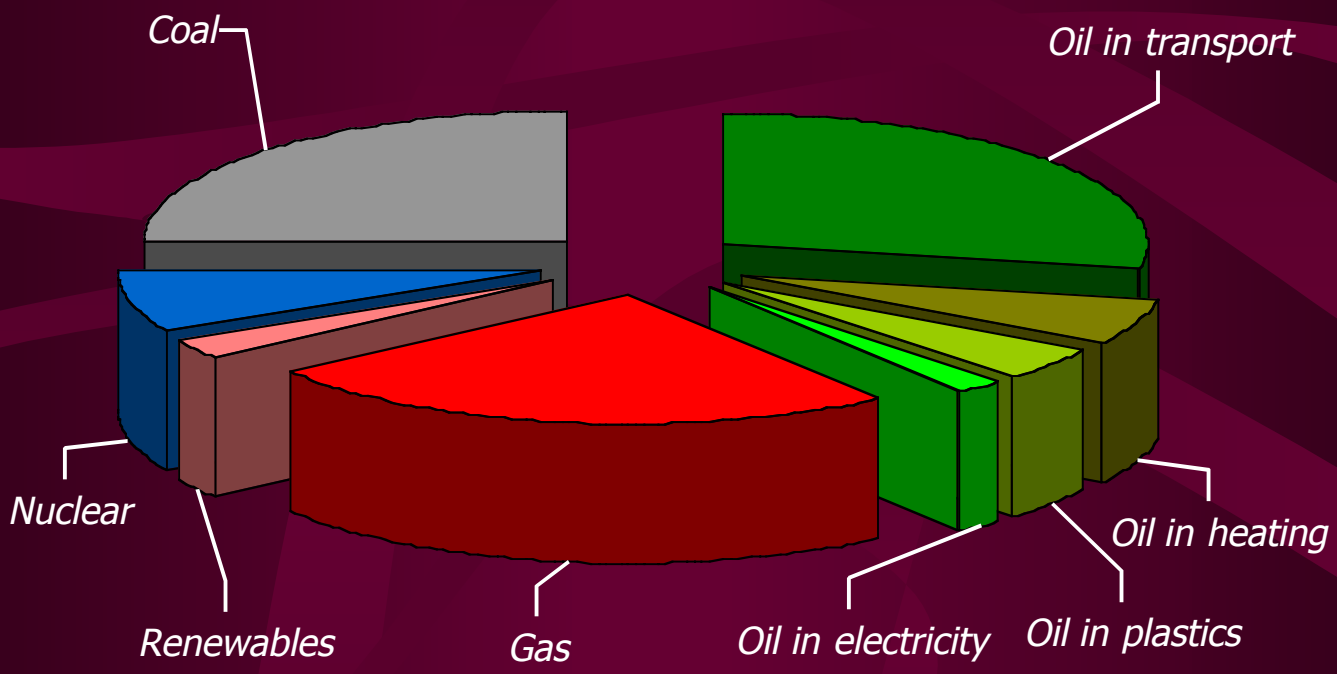
Energy-related CO_2 Emission

(2000, tonnes per person)



Source: IEA, *Beyond Kyoto and Climate Stabilisation* (October 2002)
*except China and India (source: World Bank, *World Development Indicators 2000)*

Global Energy Mix: 2002

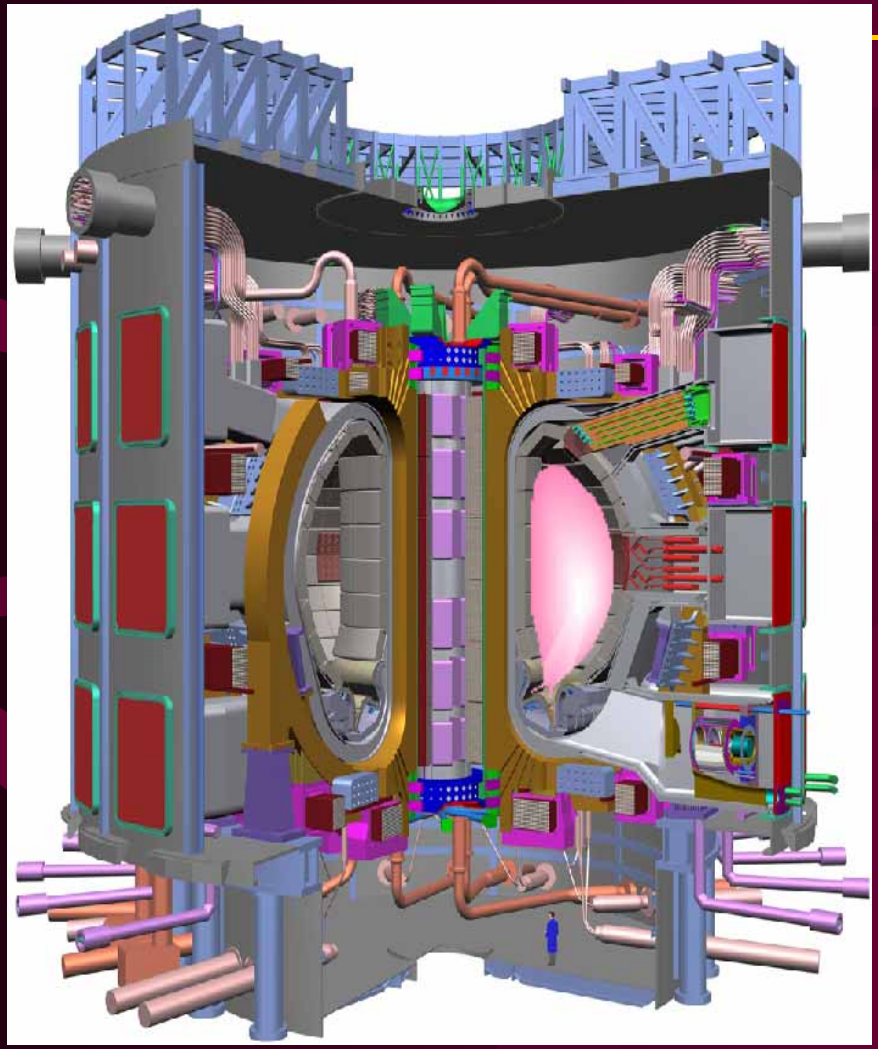


Source: Dr Michael Smith,2002

The UK Position

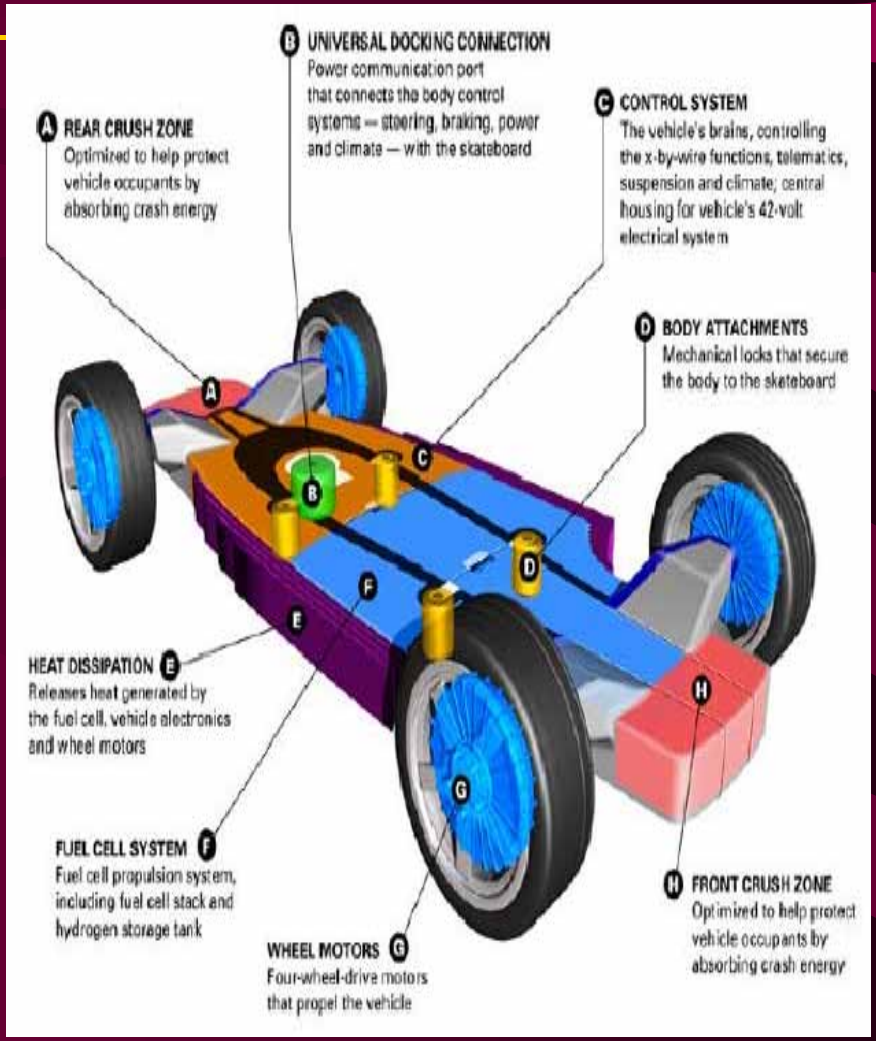
- UK is now seeking international commitment to reduce CO_2 emissions under UNFCCC
- Ambition is to cut emissions of greenhouse gases by 60% by around 2050
- UK Government already committed to action:
  - By reducing the amount of energy we consume
  - Increasing use of renewable and low CO_2 emitting energy sources
  - Energy efficiency

ITER



Source: ITER

Hydrogen "Skateboard" Car



Source: General Motors

Tidal Turbines

The International Challenge

- Global collaboration will depend upon individual countries having a clear vision of energy futures
- And understanding how critical research is to the development of the new technology options
- Countries are responding to change….
- …..but cannot solve the problem in isolation

"We have hard decisions to make. Our response to the threat of global warming will affect our personal well-being, the evolution of human society, indeed, all life on our planet."

- Spencer Weart, 2002
  Director, Center of History of Physics, AIP