



# How Simple Math Adds Up to Complicated Politics

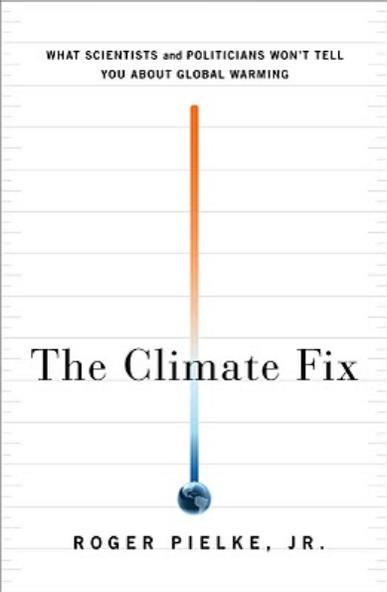
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University of Colorado

Washington Policy Center  
**29 July 2010**  
**Seattle, Washington**

Center for Science and Technology Policy Research  
University of Colorado/CIRES Boulder, CO USA  
<http://sciencepolicy.colorado.edu>

**Coming September 2010 . . .**

WHAT SCIENTISTS and POLITICIANS WON'T TELL  
YOU ABOUT GLOBAL WARMING



**The Climate Fix**

ROGER PIELKE, JR.



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## Outline

- Understanding the mitigation challenge
- Where do emissions come from?
- Decarbonization – UK Case
- Policy Jujitsu

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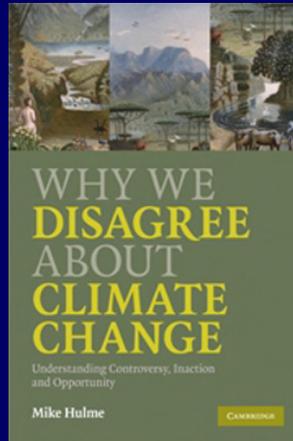


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## Mike Hulme, on debates about climate science

"... arguments about climate change are invested with powerful ideological instincts and interests. Solutions to climate change vary from market-based mechanisms and technology-driven innovation to justice-focused initiatives and low-consumption localism as a form of lifestyle, each carrying ideological commitments. It is despairingly naive to reduce such intense (and legitimate) arguments to the polarities of 'belief' or 'scepticism' about science."



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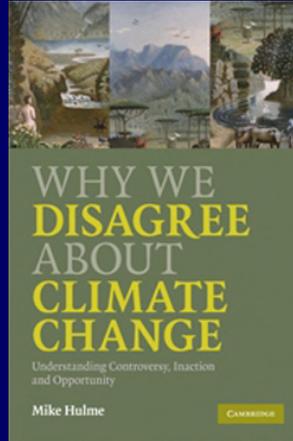


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## Mike Hulme, on debates about climate science

"The problem here is the tendency to reduce all these complexities into a simple litmus test of whether or not someone believes orthodox scientific claims about the causes and consequences of climate change. This is dividing the world into goodies and baddies, believers and deniers. Climate change demands of us something much more sophisticated than this..."

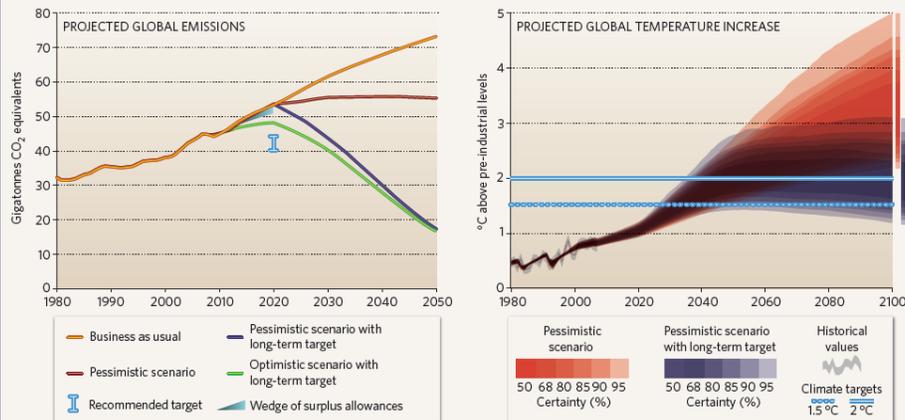


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## Conventional Wisdom

### EFFECTS OF NATIONAL EMISSIONS PLEDGES IN THE COPENHAGEN ACCORD



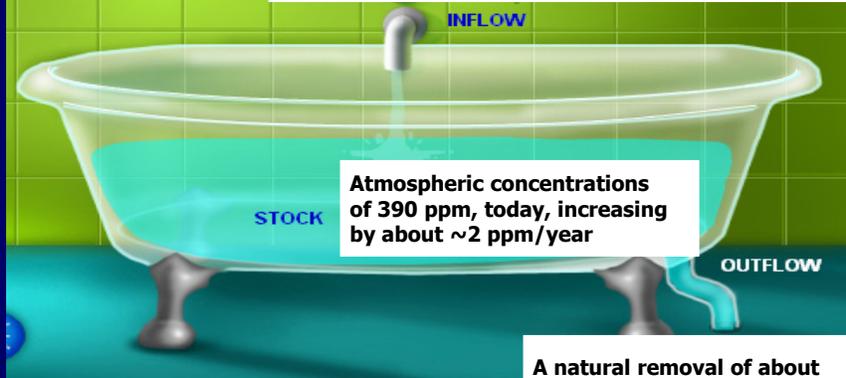
The pessimistic scenario assumes that nations meet only their lowest stated ambitions, and use all surplus allowances and land-use credits. The optimistic scenario assumes that nations meet their highest stated ambitions, and do not use surplus allowances or land-use credits. The long-term target is to halve emissions from 1990 levels by 2050.

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## Understanding the Build-Up of Carbon Dioxide

- Human emissions of about 9.0 GtC per year and growing
- About 12 GtC per year expected in 2030



A natural removal of about 4 GtC per year

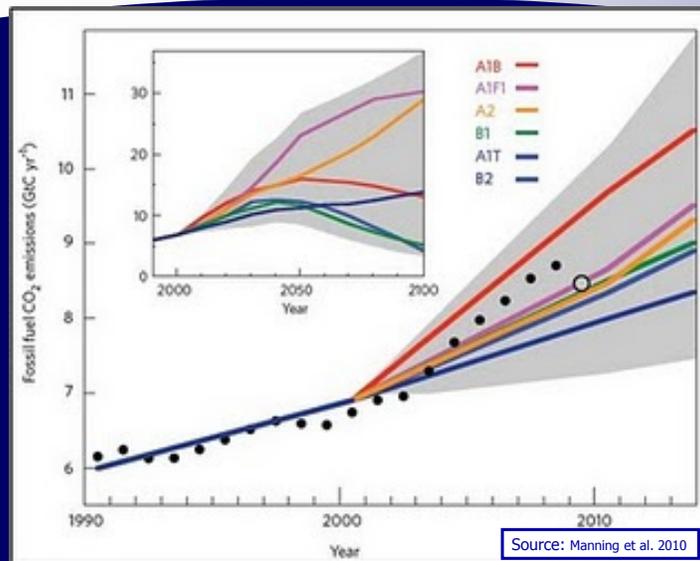
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## Emissions are growing faster than expected



Source: Manning et al. 2010

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## Where do emissions come from?

People engage in economic activity that uses energy from carbon emitting generation



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## Where do emissions come from?

People	Population	P
Engage in economic activity that	GDP per capita	GDP/P
Uses energy from	Energy intensity of the economy	TE/GDP
Carbon emitting generation	Carbon intensity of energy	C/TE

$$\text{Carbon emissions} = C = \cancel{P} * \frac{\text{GDP}}{\cancel{P}} * \frac{\text{TE}}{\cancel{\text{GDP}}} * \frac{C}{\cancel{\text{TE}}}$$

The "Kaya Identity"

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## What tools do we have to reduce emissions?

	Factor	Lever	Approach to Policy
P	Population	Less people	Population management
GDP/P	GDP per capita	Smaller economy	Limit generation of wealth
TE/GDP	Energy intensity	Increase efficiency	Do same or more with less energy
C/TE	Carbon intensity	Switch energy sources	Generate energy with less emissions

$$\text{Carbon emissions} = C = \frac{P * GDP}{P} * \frac{TE * C}{GDP * TE}$$

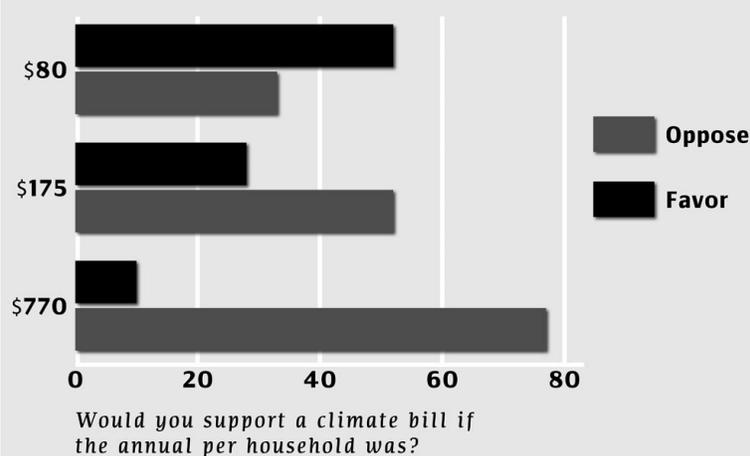
GDP
Technology

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## The Iron Law of climate policy

**FIG. 2.4** The problem with democracy  
National Poll, % replying:



Source: YouGov/Polimetrix Poll, June 28th-30th 2009

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## The Iron Law of climate policy

People around the world are willing to pay some price for climate policies, but this willingness has its limits.

These limits mean that reducing GDP or noticeably reducing GDP growth are simply not options as a strategy of emissions reduction.

### A Boundary Condition for Policy Design:

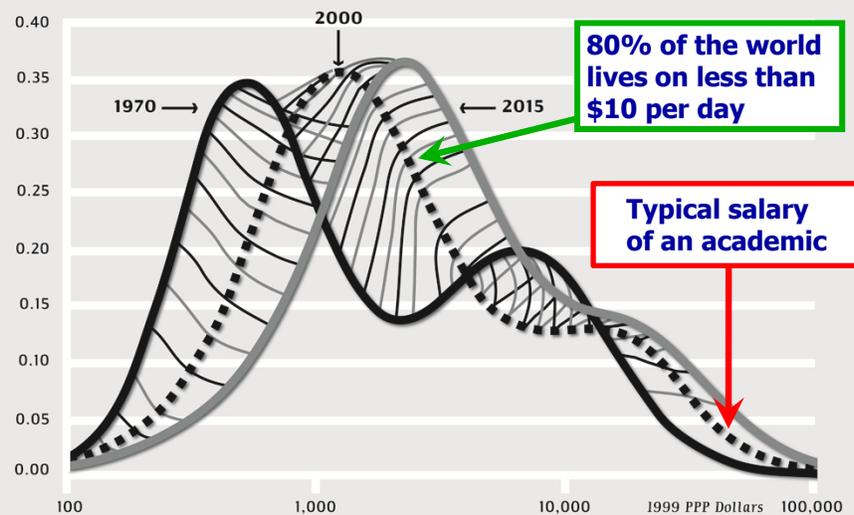
Climate policies must not cost too much, better yet, they should foster economic growth

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## Reducing GDP or GDP growth is not an option

**FIGURE 3.1** Evolution of Global Income Distribution: 1970-2015  
(the lines connecting the curves connect equal percentiles)



Source: Dikhanov, Y., 2005. Trends in Global Income Distribution, 1970-2000, and Scenarios for 2015. Human Development Report Office.

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## Decarbonization defined

$$\text{Carbon emissions} = C = \frac{P * \text{GDP}}{P} * \frac{\text{TE} * C}{\text{GDP} * \text{TE}}$$

$$\text{Emissions} = \text{GDP} \times \text{Technology}$$

$$\frac{\text{Emissions}}{\text{GDP}} = \text{Technology}$$

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## Decarbonization: CO<sub>2</sub> per \$1,000 GDP

**Decarbonization of the economy** is reflected in a decrease in the ratio of carbon dioxide emissions to GDP . . .



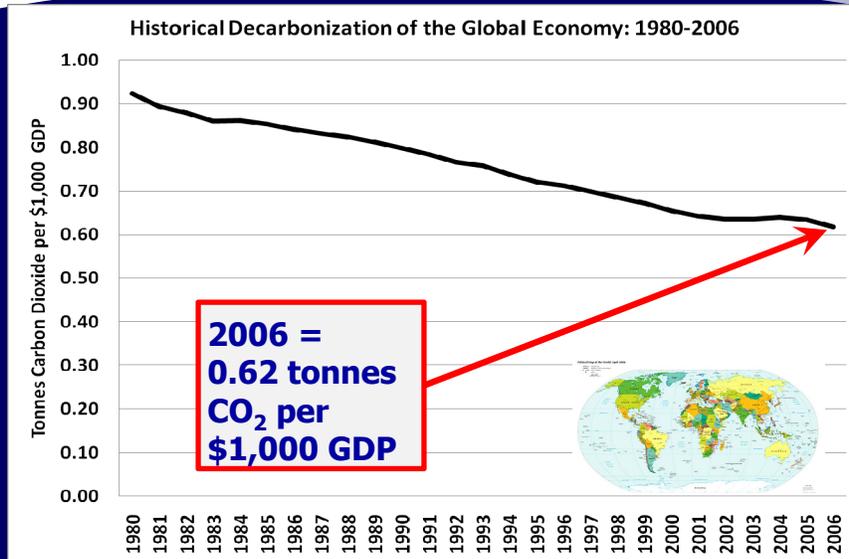
$$\text{For 2006} = \frac{29.12 \text{ Gt CO}_2}{\$47.267 \text{ Trillion}} = 0.62 \text{ tonnes CO}_2 \text{ per } \$1,000 \text{ GDP}$$

. . . in a manner consistent with desired stabilization targets

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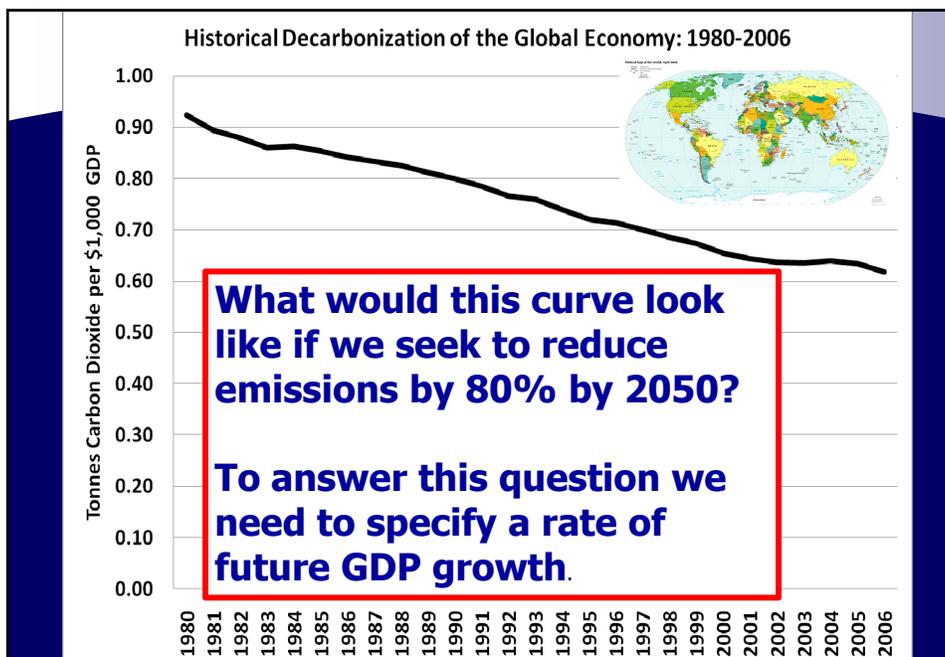
## First, some good news . . .



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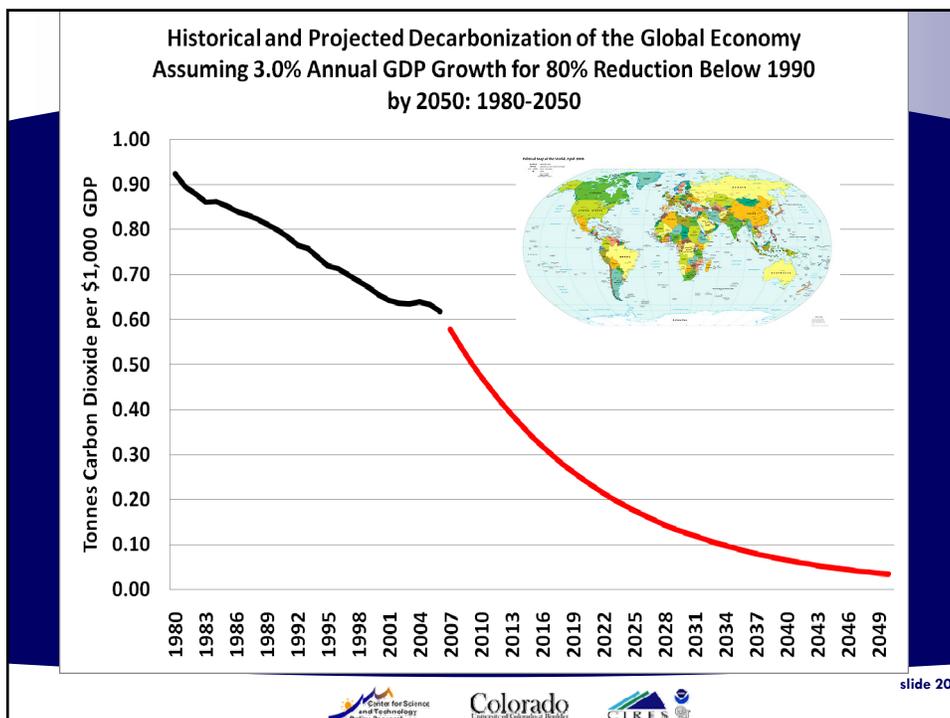
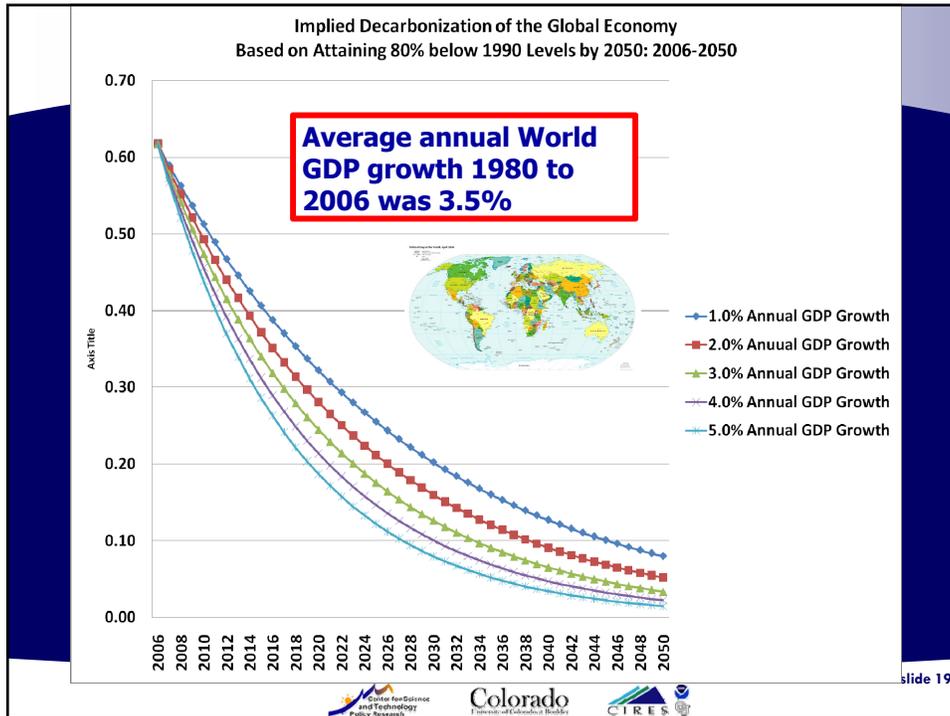


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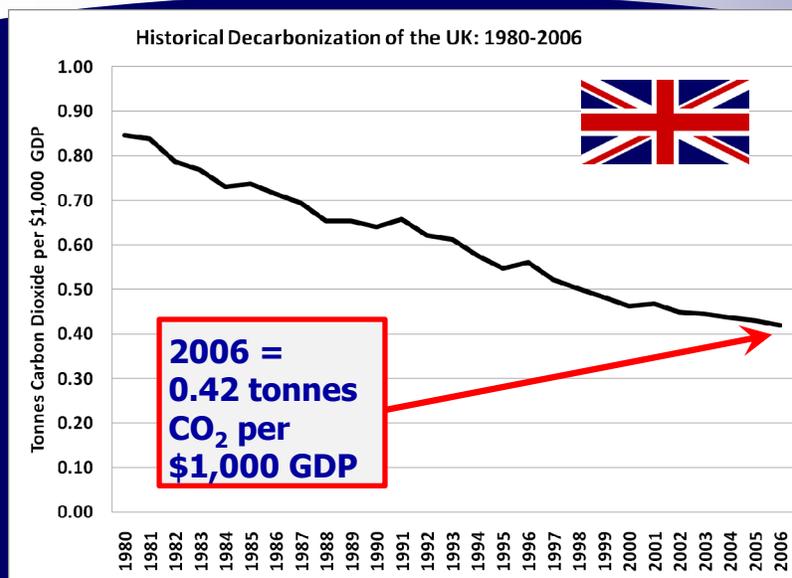


## The Case of the United Kingdom



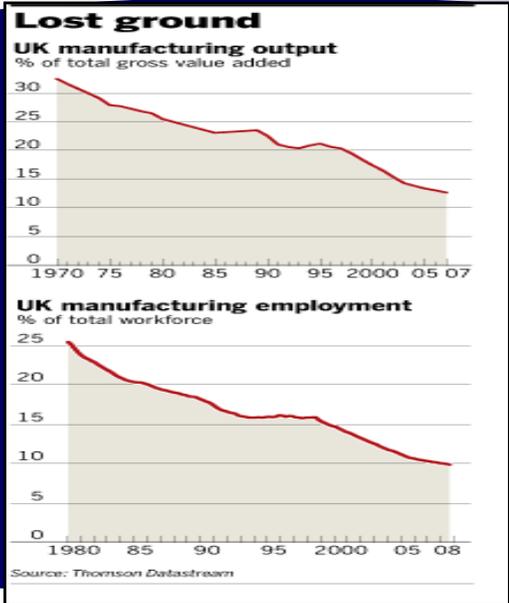
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## Decarbonization of the United Kingdom economy



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# UK Decarbonization

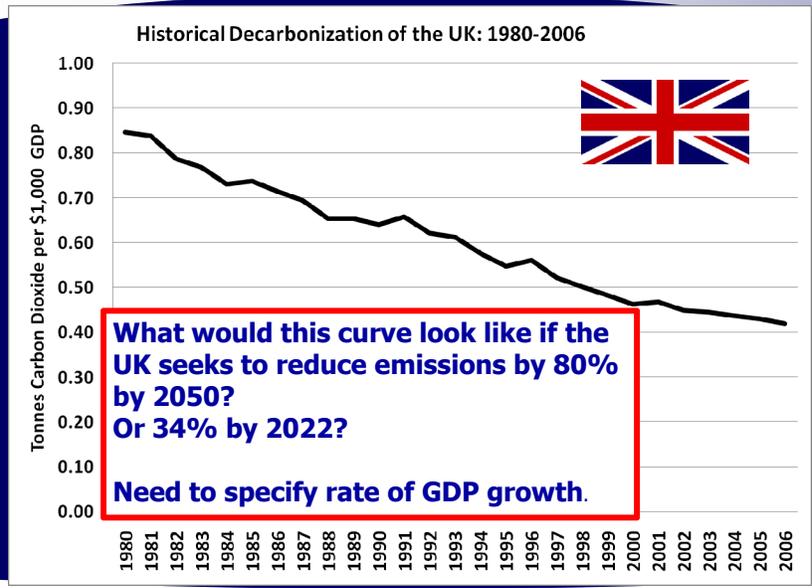


Source: FT  
9 Feb 2009

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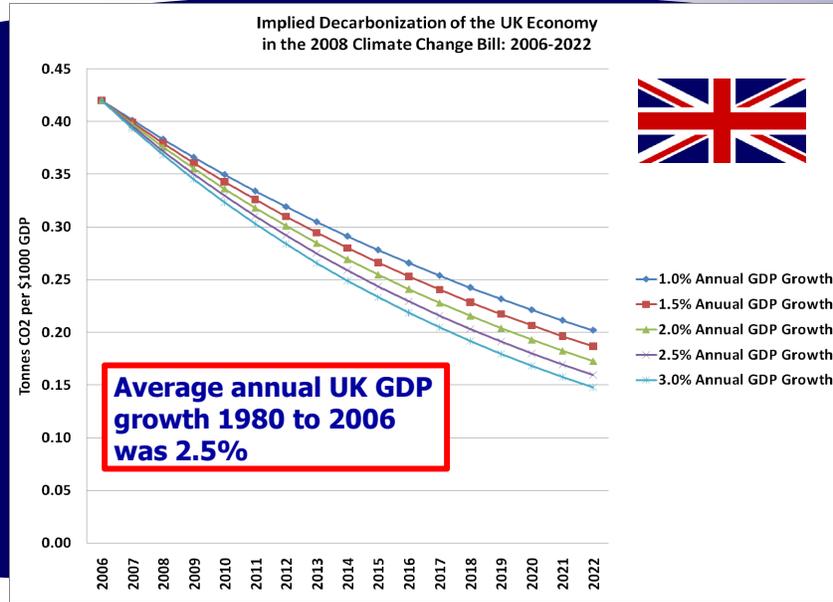
# Decarbonization of the United Kingdom economy



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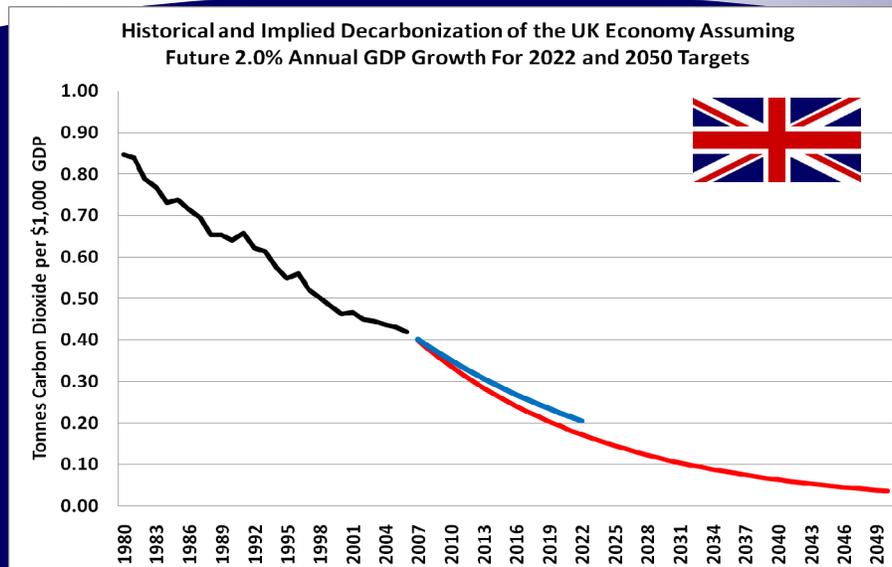


## Implied decarbonization in the 2008 CC Act



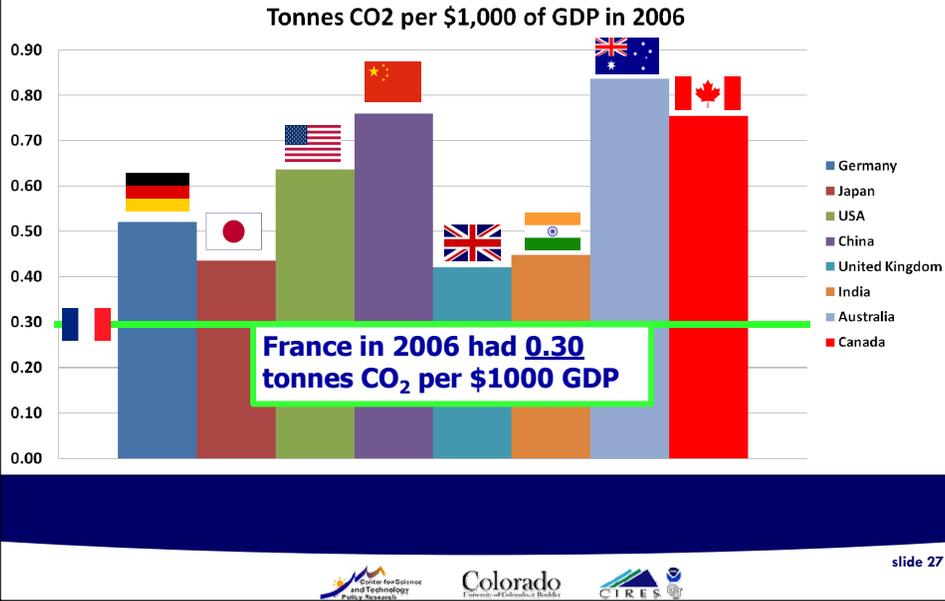
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## Decarbonization implied by UK Climate Change Act

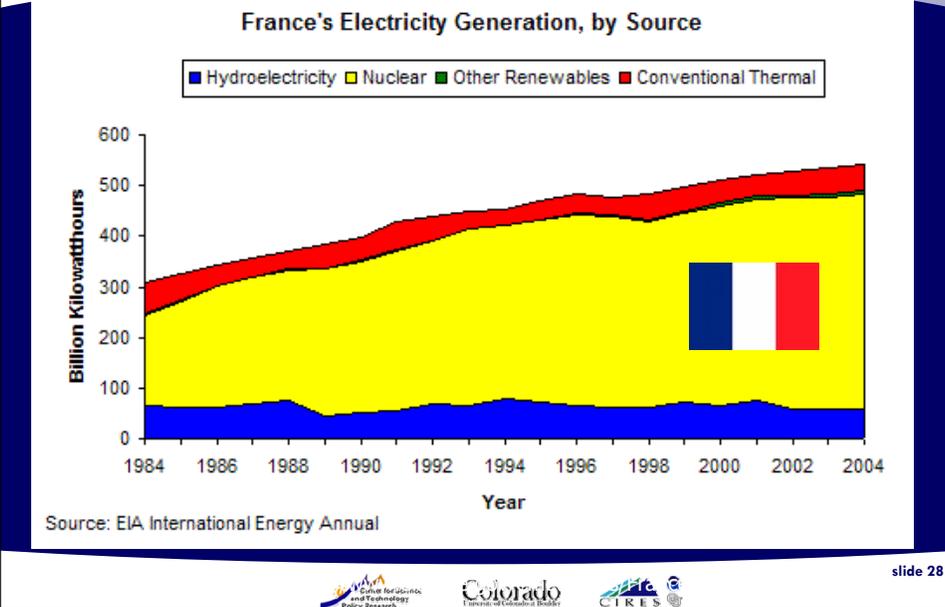


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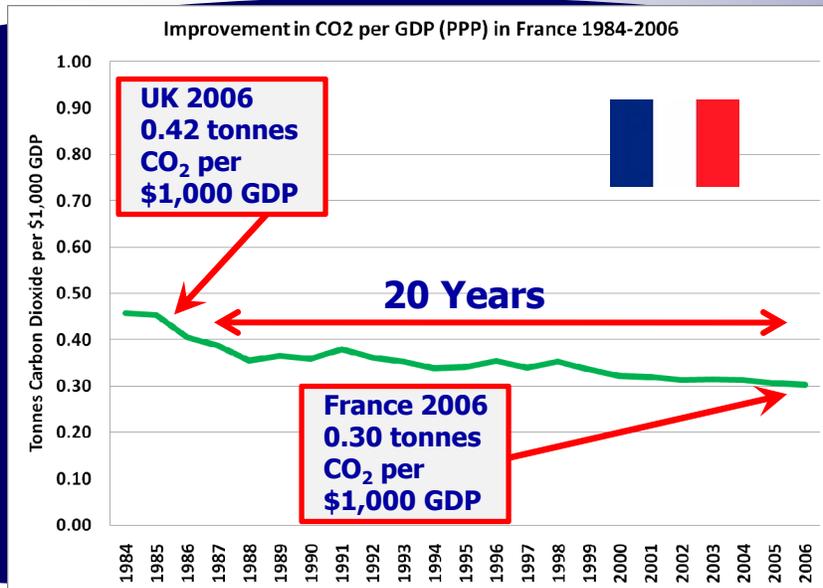
## France as a point of comparison



## Explaining Decarbonization in France



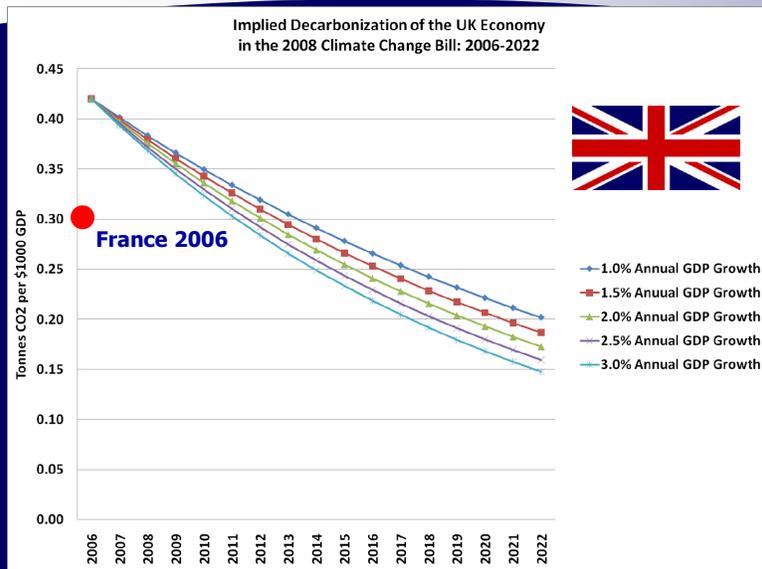
# Decarbonization in France 1984 to 2006



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# Can the UK Become France by 2015?



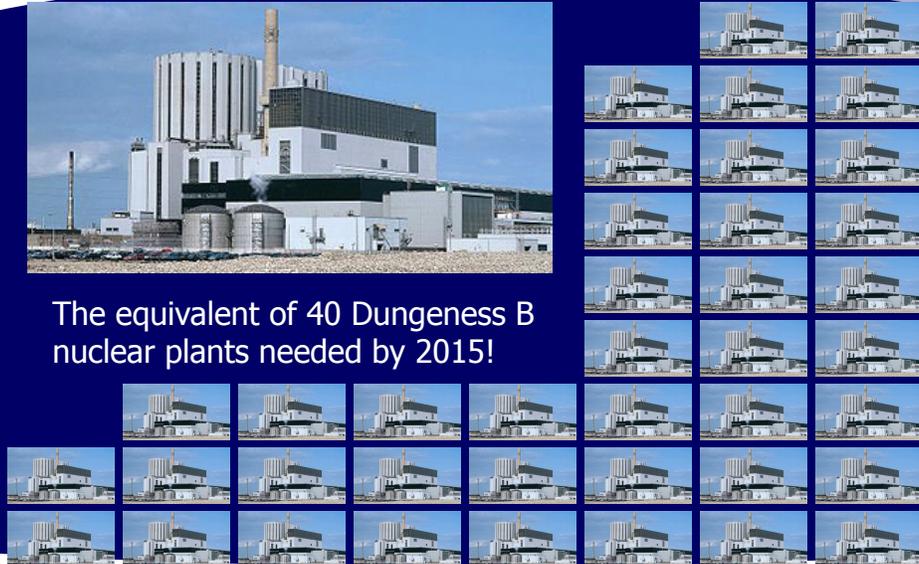
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## Dungeness B Nuclear Power Plant



The equivalent of 40 Dungeness B nuclear plants needed by 2015!



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## A policy maker's response . . .



"[Pielke's analysis] raises questions which I do not think have been factored into the thinking behind the Climate Change Act.

The task (of cutting emissions by 80% from 1990 levels by 2050) is already staggeringly huge and, as we have seen, well beyond our current political capacity to deliver.

Heathrow is a prime example of ducking the responsibility. It is hard to see any tough choices being made in the current climate."

Colin Challin, Member of UK Parliament  
Chairman of the All Party Parliamentary Climate Change Group  
11 February 2009  
BBC News -- <http://news.bbc.co.uk/1/hi/sci/tech/7881868.stm>



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# The Heathrow 3<sup>rd</sup> runway debate . . .



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# . . . In broader context



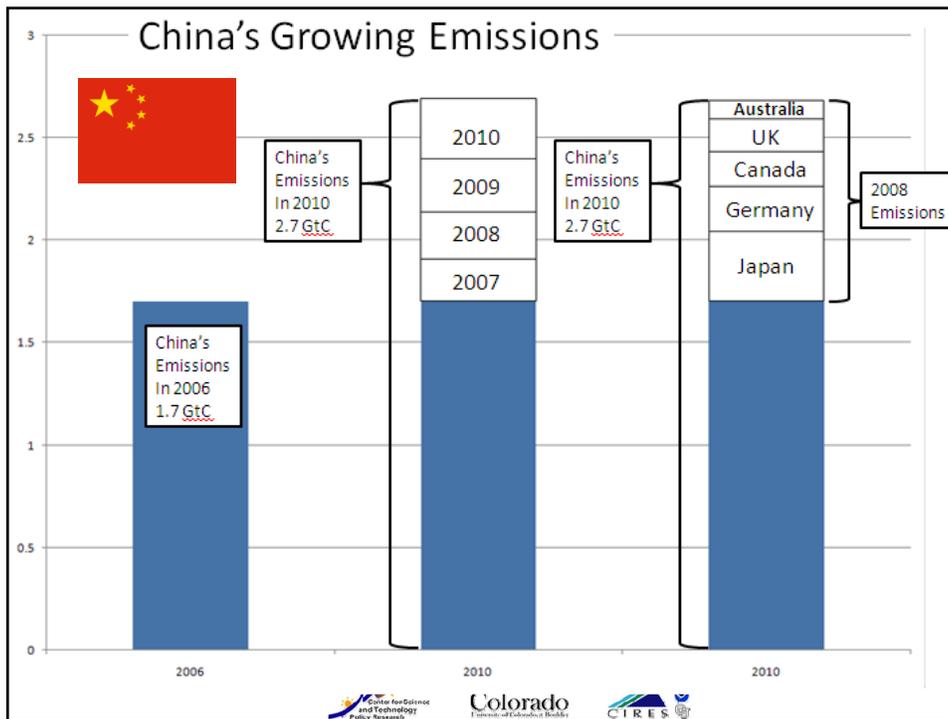
## ← CHINA'S AIRPORT BOOM →

To stimulate development outside of major cities such as Beijing and Shanghai, the Chinese government plans to open about **100 new airports by 2020 at a cost of some \$62 billion**. The expansion sites—from Mohe, the northernmost town in China, to Hainan island in the south to Bachu in the far west—are like a treasure map for GE's infrastructure units.



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## A Global Perspective

To achieve stabilization at a 2°C warming, we would need to install  $\sim 900 \pm 500$  MW [mega-watts] of carbon emissions-free power generating capacity each day over the next 50 years. This is roughly the equivalent of a large carbon emissions-free power plant becoming functional somewhere in the world every day. In many scenarios, this pace accelerates after mid-century. . . even stabilization at a 4°C warming would require installation of 410 MW of carbon emissions-free energy capacity each day.

Caldeira et al. 2003



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## 1.5 billion (!) people lack access to electricity



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## Can we change the narrative?

- From
  - We use too much energy
  - Fossil fuels are too cheap
  
- To
  - We need more energy
  - Fossil fuels are too expensive

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## How fast can decarbonization occur?

- The honest answer is “no one knows”
- Historical rates of 1-2% per year have occurred in developed countries
- For short periods some countries have achieved rates >2% per year
- Achieving 17% (for instance) reductions in US emissions by 2020 while maintaining modest economic growth requires rates of decarbonization of >5% per year (!)



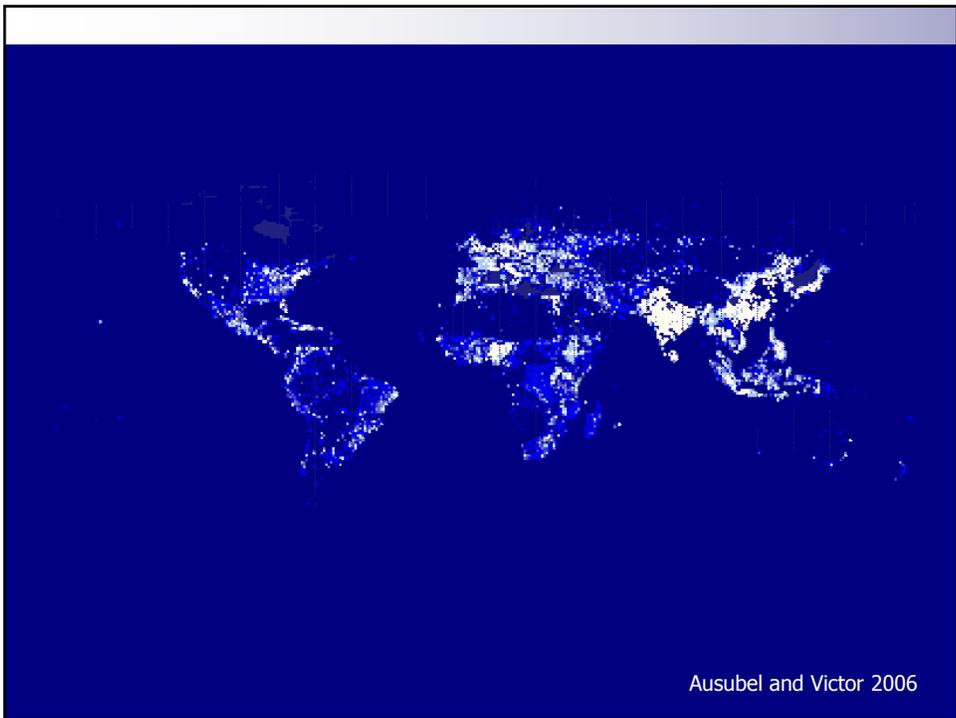
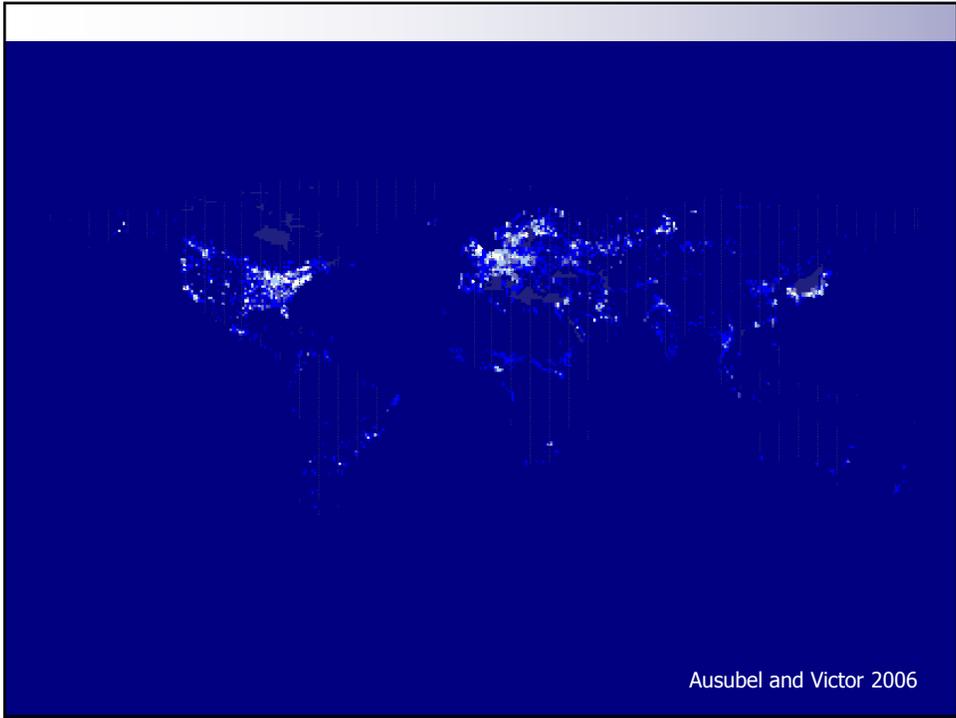
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## What about current policy options?

- The policy logic of targets and timetables is exactly backwards
- Cap and trade cannot succeed
  - European experience
- A carbon tax cannot alone do the job
- How do we deal with other “wicked problems”?
  - Advancing human life spans
  - Increasing agricultural production
  - Winning the Cold War



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## Outline

- Understanding the mitigation challenge
- Where do emissions come from?
- Decarbonization – UK Case
- Policy Jujitsu



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## How to provide feedback!

- [pielke@colorado.edu](mailto:pielke@colorado.edu)
- <http://rogerpielkejr.blogspot.com>
- Papers etc. can be downloaded from:  
<http://sciencepolicy.colorado.edu>

Thank you!



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