

# CLIMATE GEOENGINEERING GOVERNANCE

## Steve Rayner

James Martin Professor of Science & Civilization,  
Co-Director, Oxford Geoengineering Programme  
University of Oxford;

Honorary Professor of Climate Change & Society,  
University of Copenhagen



**Saïd Business School**  
UNIVERSITY OF OXFORD



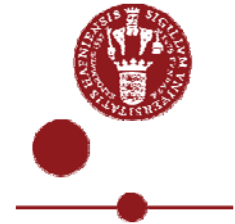
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# WHAT ARE TALKING ABOUT?

- What is it?
- Why might we want to do it?
- How might we do it?
- What should we worry about?
- How might we manage it?



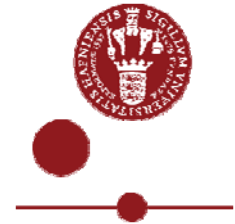


# WHAT IS CLIMATE GEOENGINEERING?

“deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change”

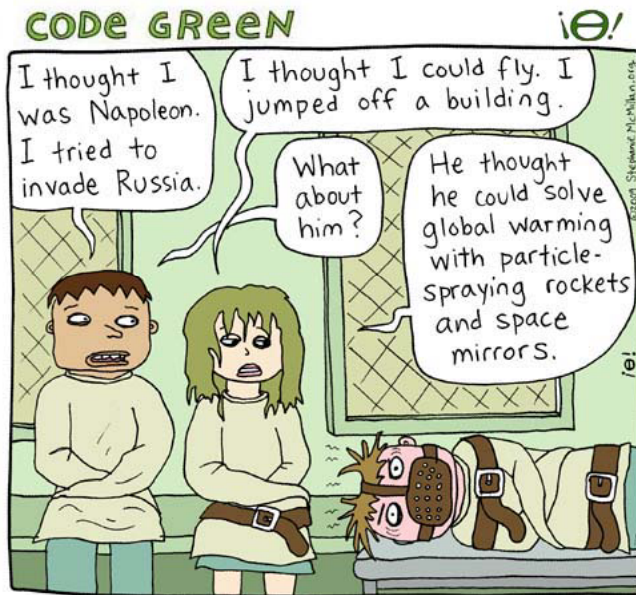


Royal Society Working Group

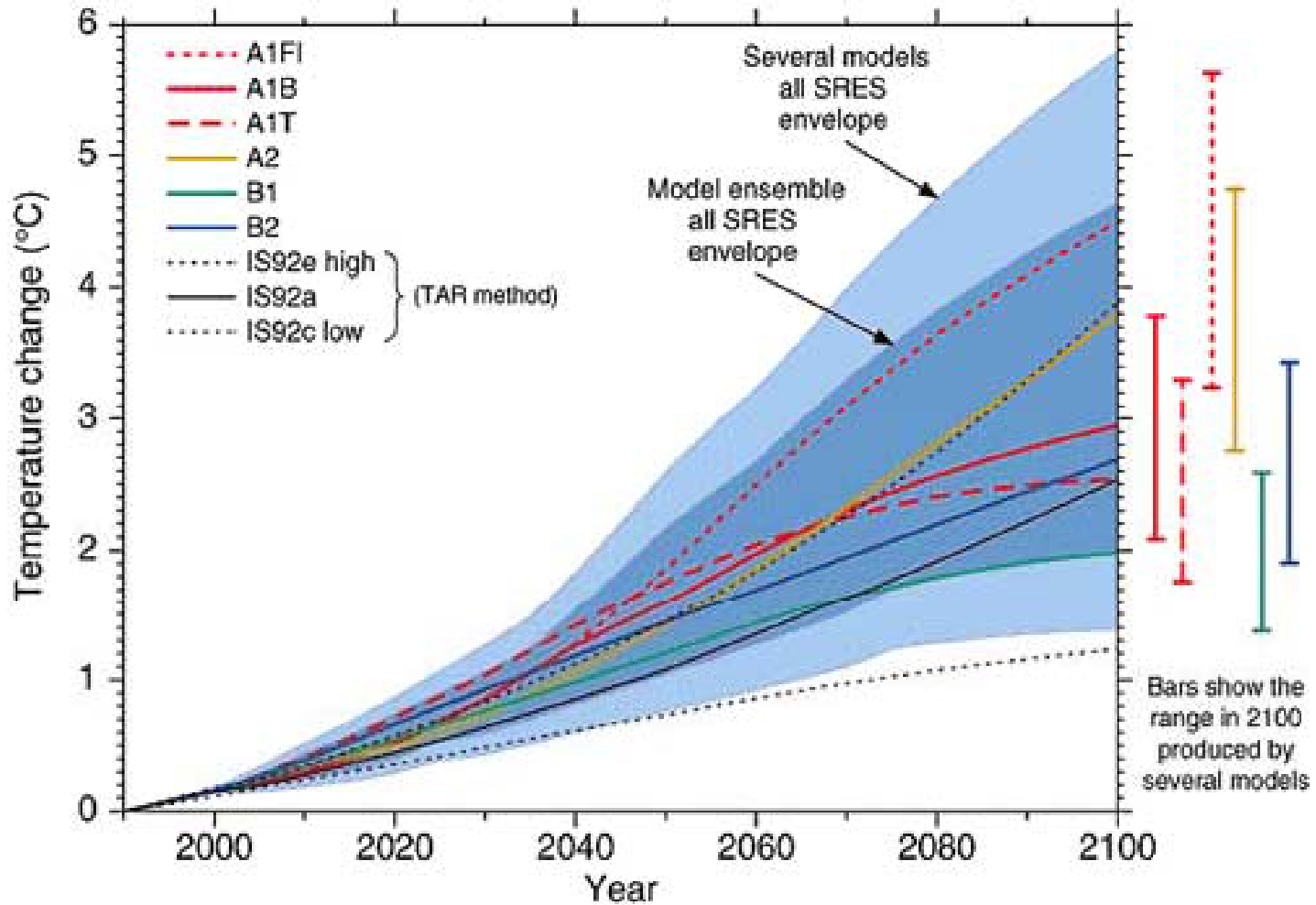


## WHY EVEN THINK ABOUT IT?

- World is nowhere near meeting mitigation targets
- Mitigation targets may be dangerously optimistic
- Concern to avoid possible “tipping points” – shave peaks

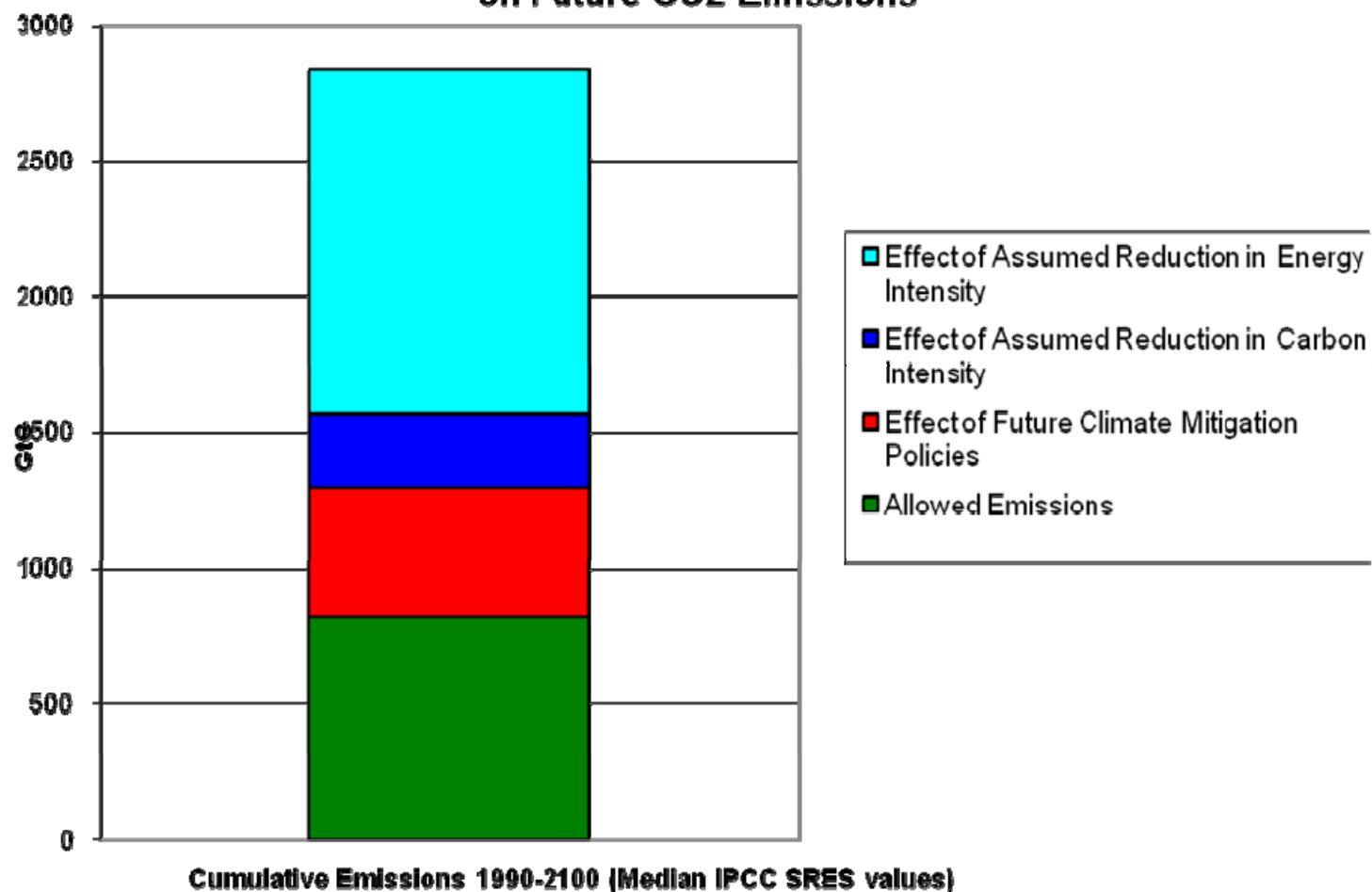


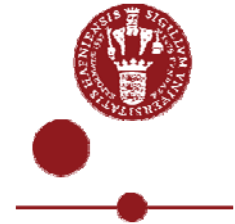
# IPCC EMISSIONS SCENARIOS



# EMISSIONS STABILIZATION CHALLENGE

IPCC Assumptions About The Effect of Technological Change on Future CO2 Emissions

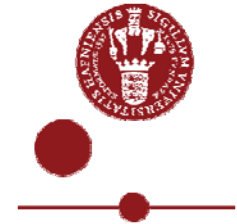




# FURTHER POSSIBLE MOTIVATIONS TO THINK ABOUT IT?

- Imagined absence of incumbents
- Technical fix to sidestep mitigation impasse
- To scare people into renewed mitigation efforts
- To restore atmosphere to pre-industrial condition
- Commercial potential for new industries & services

*But be wary of hubristic or exceptionalist claims*



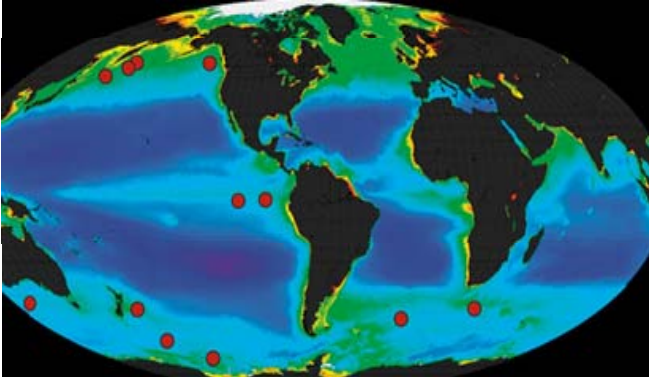

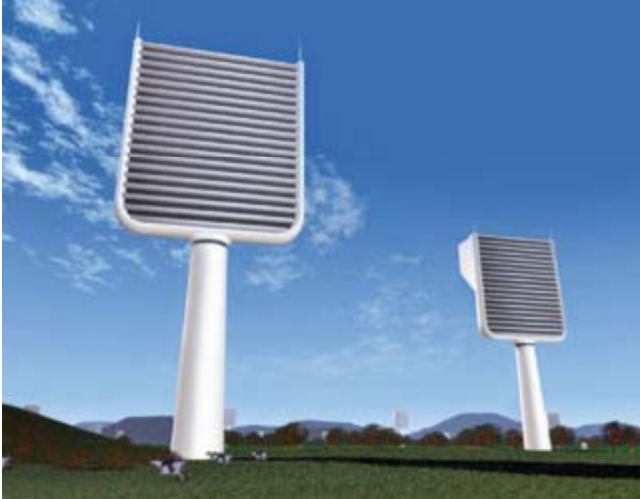

# HOW MIGHT WE DO IT?

- Imagined technologies
- Highly heterogeneous
- Two things to do
  - Reflect sunlight (SRM)
  - Remove carbon (CDR)
- Two ways to do either
  - Enhance natural processes
  - Black-box engineering





# HOW MIGHT WE DO IT?

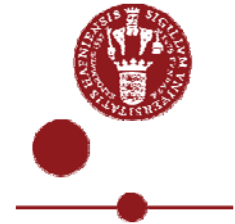
	CARBON DIOXIDE REMOVAL	SOLAR RADIATION MANAGEMENT
<b>EARTH SYSTEMS ENHANCEMENT</b>	<p>OCEAN FERTILIZATION</p> 	<p>STRATOSPHERIC AEROSOLS</p> 
<b>BLACK-BOX ENGINEERING</b>	<p>AIR CAPTURE</p> 	<p>SPACE MIRRORS</p> 



# WHAT SHOULD WE WORRY ABOUT?

- Moral Hazard
- Research as a slippery slope
- Unintended consequences/hubris (Asian monsoon?)
- Socio-technical lock-in
- Encapsulation and reversibility
- Public/political acceptability (deliberate pollution?)
- Costs (dangerously cheap or hideously costly)
- Control (private/public, national/international)
- Governance from research through to deployment





# ROYAL SOCIETY

“The acceptability of geoengineering will be determined as much by social, legal and political issues as by scientific and technical factors. There are serious and complex governance issues which need to be resolved.”

## RECOMMENDED

“The development and implementation of governance frameworks to guide both the research and development...and possible deployment.





# TECHNOLOGY CONTROL DILEMMA

- Ideal would be to establish governance “upstream”
- Technologies as realized seldom fit early concepts
- Problems of path dependency & socio-technical lock in
- Value of flexibility – be wary of capital intensiveness, hubrisitic claims, etc

*What might a governance architecture look like if constructed with the control dilemma in mind?*



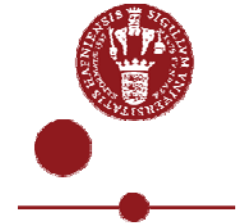


# TLC FACTORS

- Governance of technology requires management of both risk & perception of risk
- Public acceptability of technological risk highly dependent on issues of:
  - Trust
  - Liability
  - Consent

*Once these have been violated public confidence has proven almost impossible to restore*





# GEOENGINEERING PARADOX

- Technically easiest and fast-acting may be most difficult to govern
- Easiest to govern seem likely to be most distant from effective large-scale deployment

*Hard cases make bad law – focusing on SRM may not create valid precedents*

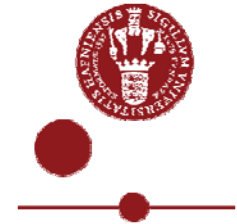




# A FLEXIBLE ARCHITECTURE

- A few (certainly less than 10) key guiding principles
  - Establish key societal goals and concerns, the “non-negotiables”
- More flexible technology-specific research protocols
  - Take account of specific technology characteristics & stage of development



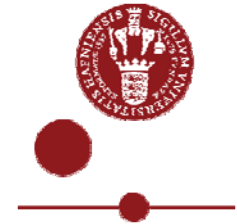


# GUIDING PRINCIPLES

- Applicable to highly heterogeneous range of technologies
- Recognize distinction between activities with potential transboundary impacts and those that do not
- Apply to all research stages through to initial deployment
- Draft principles could be articulated quite quickly







# TECHNOLOGY-SPECIFIC RESEARCH PROTOCOLS

- Recognize heterogeneity of concepts
- Allow different concepts to emerge over appropriate timescales
- Subject to periodic revision as technology is developed
- Enable regulators to address specific issues of reversibility & liability
- Will need longer to develop and embodied in research practice



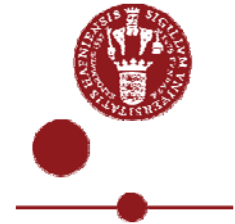


# OXFORD PRINCIPLES

SUBMITTED TO UK HOUSE OF COMMONS SCIENCE & TECHNOLOGY COMMITTEE

- Geoengineering to be regulated as a public good
- Public participation in decision making
- Disclosure of geoengineering research & open publication of results
- Independent assessment of impacts
- Governance arrangements to be clear before deployment

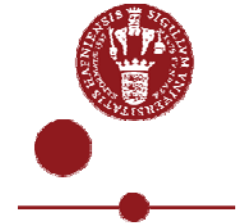




# REGULATION AS A PUBLIC GOOD

- Public goods are non-excludable – cannot opt in or out
- Examples include clean air & water, public health, public order, defence, etc
- Does not mean that private sector is excluded
- Does mean that (democratic) government controls the terms of supply – including funding
- Challenges of international coordination – but these are not insurmountable





# PUBLIC PARTICIPATION

- Affected public to be notified, consulted, and give consent
- Mechanisms for consent may vary
- Affected public may be local or national
- Explicit international agreement will be required for some technologies

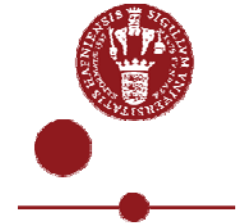




# DISCLOSURE & PUBLICATION

- Prompt and timely
- To include modelling as well as empirical research
- Both research plans (prior notification) & results
- To include publication of “negative” results
- No “national security” exceptions





# INDEPENDENT IMPACT ASSESSMENT

- Possible red-team and blue-team approaches
- To include socioeconomic and cultural impacts
- Potential to include risk mitigation requirements
- Possible basis for establishing liability ex ante
- Required at national & international levels

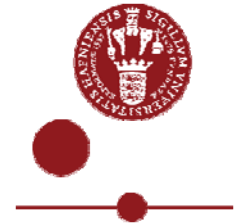




# GOVERNANCE BEFORE DEPLOYMENT

- Boundary between research & deployment may be fuzzy
- Credible capacity to enforce rules & terminate activity essential
- Use existing institutions where possible





# OXFORD PRINCIPLES

- Endorsed by House of Commons S&T Committee
- Accepted by UK Government in response to committee report
- Widely accepted at Asilomar conference and elaborated upon in conference report
- Are under consideration in the Royal Society's SRM Governance Initiative







# EXISTING ATTEMPTS TO REGULATE

- London Dumping Convention assigns jurisdiction to government of port of departure
- Convention on Biodiversity has proposed broad restrictions, probably exceeding its jurisdiction, which could only be operationalized by government actions
- So far, governments are holding to watching briefs and are not rushing to legislate





# CONCLUSIONS

- R&D to fully characterize technical and social aspects of specific geoengineering technologies can be justified
- Policy makers are already engaged and eager to receive guidance
- Guidance needs to recognize TLC issues & the control dilemma
- Irreversible & unencapsulated technologies cause most concern
- High-level principles can give assurance that governance concerns are being addressed seriously
- Specific protocols can embed norms in practice
- Ultimately technologies will not be employed unless widely deemed safe affordable & effective – in which case they are likely to be just one component of the climate response portfolio

