

# Progressing a research agenda on geo-engineering – a personal view

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## An insurance policy?

Existing Tyndall Centre research demonstrates that maintaining temperatures at or below the UK's and EU's 2°C threshold between acceptable and dangerous climate change is increasingly unlikely. Moreover, emission mitigation currently being discussed, even if fully implemented on a global scale, would probably not keep atmospheric concentrations of greenhouse gases at levels much below 650ppmvCO<sub>2</sub>e (i.e. ~ a 50% chance of 4°C)<sup>1</sup>. If this position is broadly accepted, it is difficult to construct a cogent argument for not researching the viability or otherwise of geo-engineering options as a potential bridging technology to a low-carbon future (or perhaps even a long-term foil for ongoing carbon emissions). However, given the process of conducting such research will be inevitably controversial, I suggest a position on contentious issues is developed prior to instituting a research programme. Below are some provisional thoughts on several issues for which early consideration may help mitigate later criticism.

## Funding integrity

There is a real and perceived risk that the prospect of 'engineering' our collective way out of 'dangerous' climate change may act as a diversionary impetus, both financially and intellectually. This is a serious issue, and any attempt to earmark existing or even future mitigation and adaptation funds for researching geo-engineering options should be scrupulously avoided (there are parallels here with concerns raised about nuclear fission and fusion research and deployment diverting resources away from renewables and energy efficiency). Consequently, funding for geo-engineering must be from new monies made specifically available for such research.

## Moral imperative?

Important moral arguments exist as to why *carbon sequestration* (carbon negative as opposed to carbon neutral) from the atmosphere should be researched in preference to *insolation* approaches whereby temperature/heat is controlled. Carbon dioxide is a well mixed gas and hence its removal from the atmosphere has global rather than

specifically regional benefits. By contrast, insolation approaches have the potential to 'safeguard' specific regions rather than provide a common global good. Assuming that any successful roll out of geo-engineering options is likely to be on a decadal timeframe, it is probable significant climate change impacts will already be apparent. In such a situation, there is a significant risk that insolation-based options would be used to 'protect' those wealthier nations that had both funded the research and been responsible for significant historical emissions in preference to those more vulnerable and politically marginalised regions. Consequently, issues of equity and the 'common good' (in conjunction with acidification – see below) strongly favour sequestration research over insolation.

## Ecosystem impact

Another issue that should inform funding priorities for geo-engineering, is the risk of significant adverse ecosystem impacts arising from the respective options. One upshot of this argument is that ocean sequestration approaches should receive a low priority for funding. Whilst carbon uptake from some ocean approaches *may* be amenable to short-term quantification, our longer-term understanding of ocean circulation and ecosystem dynamics is much less well developed. Insolation approaches also fair poorly under this ecosystem caveat. In theory at least, insolation options facilitate increased CO<sub>2</sub> concentrations without temperature repercussions; however, rising CO<sub>2</sub> levels are already being linked to serious ocean acidification concerns that would only be exacerbated if insolation approaches were widely deployed.

## In brief

*The high and unchecked level of global emissions is rapidly consuming the greenhouse gas budget associated with temperature rises of up to 4°C. In light of this and global society's failure to tackle even emissions growth, geo-engineering is increasingly becoming an area worthy of serious investigation. However, any subsequent research programme should consider the following caveats:*

- *No diversion or weakening of either current or future mitigation and adaptation funding*
- *Prioritise approaches applicable at a global rather than specifically regional level*
- *Focus funding on approaches with lower over higher eco-system impacts*

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<sup>1</sup> Anderson, K. and Bows, A., Reframing the climate change challenge in light of post-2000 emission trends, *Philosophical Transactions A*, 366, 3863-3882. (<http://journals.royalsociety.org/content/a7877169j7163rh2/>)