

## The Emperor's New Climate: Geoengineering as 21<sup>st</sup> century fairytale

The idea of re-engineering the entire planet (geoengineering) used to be the stuff of science fiction, but in the past few years a small group of geoengineering enthusiasts has worked hard to give it a veneer of respectability. On 1<sup>st</sup> September, they will have succeeded in getting the world's oldest scientific academy, the UK's Royal Society, to legitimize dangerous planet-tinkering schemes with minimal transparency and even less public participation.

170 years after Hans Christian Andersen penned his tale of the Emperor's New Clothes, an analogous tale is being woven around an event in his homeland that will affect the entire planet: the global climate change negotiations this December in Copenhagen. This time, it's not a naked emperor making the people squirm, but the equally indecent posturing of world leaders preparing to meet to agree on a post-2012 climate treaty that can reduce greenhouse gas (GHG) emissions enough to slow global warming.

The Royal Society will play an important role in this performance by offering a prestigious platform and global microphone to some modern-day tricksters. The emperor in the children's fable, encouraged by dishonest tailors, pretends he can see the invisible threads of his fancy new clothes just as the political establishment, aided by scientists, will pretend that technology will save us from the climate crisis. In order to get us all to have faith in this fallacy, they need first to engineer momentum and then get us to believe in fairy tales.

ETC Group opposes geoengineering and warns that devoting resources for research and experimentation will put us on a dangerous path. Seen alongside the full set of possible and urgent responses to anthropogenic climate change, we regard geoengineering as the wrong avenue, towards which further political will and resources will only be squandered. Our research shows that all geoengineering technologies, by virtue of being large-scale, highly centralized and having commercial applications as well as latent military uses, will always deliver inequitable outcomes. We further believe that the illusion of a "techno-fix" serves as an all too convenient excuse for the powerful to drag their heels and further refrain from making the urgent changes required to reverse the climate's trajectory. In a sane and sensible world, the geoengineering option would not be on the table at all, and nobody in their right mind would be agitating for experiments.

### Geoengineering Momentum

Less than a decade ago, geoengineering was considered crackpot science, more likely to be found in the sci-fi section of the bookstore than in serious studies on global warming. Today, influential scientists are making a concerted effort to mainstream it. The geoengineering charm-offensive is sidelining democratic debate about the risks inherent in geoengineering technologies and a vital

international discussion over who should be in control of Gaia's thermostat and who will suffer the impacts and reap the potential profits from geoengineering's deployment.

### **The Royal Society's recent history: Bigger scale, smaller engagement?**

Back in 2003, the Royal Society announced the formation of a working group on nanotechnology tasked with identifying "the environmental, health and safety, ethical and societal implications, and uncertainties that may arise from the development of the technology both at present and in the future."<sup>1</sup> Working group members included science and non-science experts in ethics, health, the environment and consumer concerns – a diversity that was necessary, according to Sir Alec Broers, then-President of the Royal Academy of Engineering, in order "to look closely at the various issues surrounding nanotechnology and consider the many and varied points of view..."<sup>2</sup> The study process included a call for written evidence and several oral-evidence sessions and workshops, including separate meetings between the working group and civil society organizations, regulators, industry and scientists and engineers. The working group's process culminated a year later in a report, "Nanoscience and nanotechnologies: opportunities and uncertainties," published in July 2004 and widely recognized as a responsible and full consideration of the issues.<sup>3</sup> By contrast, the geoengineering working group, including the world's most prominent geoengineering advocates, has opted to follow a playbook from the pre-biotechnology era – a downstream (and historically unsuccessful) approach. Over the eleven months since the study was launched, the working group has managed only to call for written evidence; there has been no attempt at engagement with the public or the broader science community. Further, the membership of the geoengineering working group is limited to climate scientists and engineers with two exceptions – an international lawyer and a social scientist who has already made clear his opinion that funding should be made available for geoengineering R&D.<sup>4</sup> Given the potential for enormous societal impacts (after all, that's the goal of geoengineering), the Royal Society's insular, opaque and languid process is incomprehensible at best, appalling at worst.

Geoengineering is deadly serious. Cooling the earth by shooting sulphates into the stratosphere or whitening clouds to reflect sunlight may sound like science fiction, but these techniques are garnering credibility from institutions, the press and politicians and policy makers. Some indicators:

#### **Institutions giving geoengineering serious consideration:**

The Royal Society's report on geoengineering is the jewel in a crown that has been forged over the past few years by other institutions that have brokered (mostly invitation-only) discussions or published papers. They are overwhelmingly in the United States and Europe and they range from the extremely powerful to the marginal fringe.

- In the USA, institutions involved include NASA (National Aeronautics and Space Administration), the Defense Advanced Research Projects Agency (DARPA), the National Academies, the Carnegie Institute, the American Ecological Society, the Council on Foreign

<sup>1</sup> <http://royalsociety.org/news.asp?year=&id=1660>

<sup>2</sup> *Ibid.*

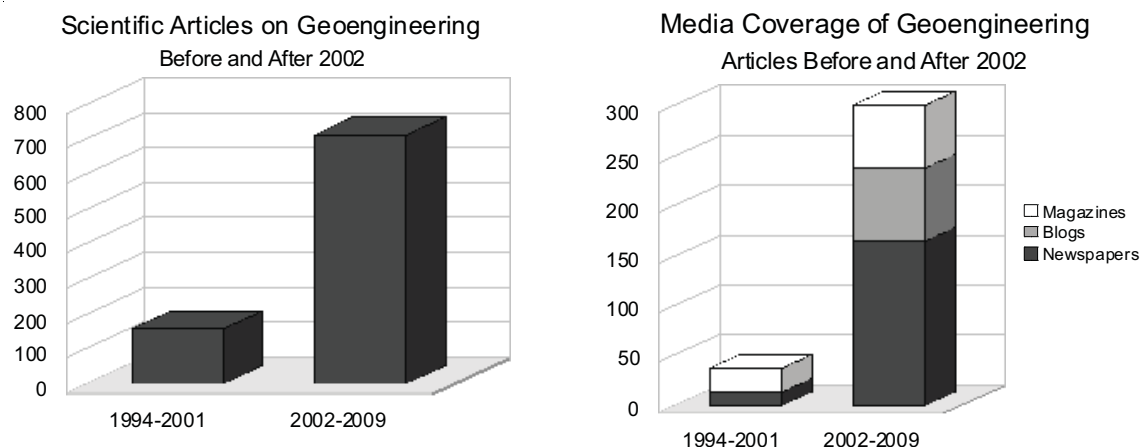
<sup>3</sup> ETC Group called the report "impressive and constructive." See [http://www.etcgroup.org/en/materials/publications.html?pub\\_id=89](http://www.etcgroup.org/en/materials/publications.html?pub_id=89)

<sup>4</sup> See, for example, Steve Rayner's comments in House of Commons Innovation, Universities, Science and Skills Committee, *Engineering: turning ideas into reality*, Fourth Report of Session 2008–09, Volume III, oral and written evidence, pp. 352 ff.

Relations, the American Meteorological Society, Novim Group, the World Bank to name a few. There is also a large group of conservative think tanks with strong links to big oil that have abandoned the old tactic of denying climate change and joined the chorus in favor of a techno-fix, including the Copenhagen Consensus Center, the Heartland Institute, the American Enterprise Institute, the Cato Institute, the Hoover Institution, the Hudson Institute and the Competitive Enterprise Institute.<sup>5</sup> In Europe, geoengineering discussions have been led by institutions such as the International Risk Governance Council (Switzerland), the International Institute for Applied Systems Analysis (Austria), the Institute of Mechanical Engineers (UK), the Alfred Wegener Institute for Polar and Marine Research (Germany), the Met Office Hadley Centre (UK).

### Media Blitz: Increase in Publications

In 2002, two key science journals – *Nature* and *Science*, representing both sides of the Atlantic – published articles that argued for geoengineering’s legitimacy as an approach to combat climate change.<sup>6</sup> (In the same year, U.S. Department of Energy scientists Edward Teller, Roderick Hyde and Lowell Wood submitted an article to the U.S. National Academy of Engineering in which they argued that geoengineering – not reduction of GHG emissions – “is the path *mandated* by the pertinent provisions of the UN Framework Convention on Climate Change.”)<sup>7</sup> Once prominent climate scientists had endorsed geoengineering as a scientifically-credible endeavor, interest in the field exploded, both in scholarly journals (almost a five-fold increase) and in the popular press (a 12-fold increase), as seen in the graphs below:<sup>8</sup>



<sup>5</sup> Alex Steffen, “Geoengineering and the New Climate Denialism,” 29 April 2009, available on the internet at <http://www.worldchanging.com/archives/009784.html>

<sup>6</sup> M.I. Hoffert, K. Caldeira, *et al.* “Advanced Technology Paths to Global Climate Stability: Energy for a Greenhouse Planet,” *Science*, Vol. 298, 1 November 2002, pp. 981-987 and P.J. Crutzen, “Geology of Mankind,” *Nature*, Vol. 415, 3 January 2002.

<sup>7</sup> E. Teller, R. Hyde and L. Wood, “Active Climate Stabilization: Practical Physics-Based Approaches to Prevention of Climate Change,” 18 April 2002.

<sup>8</sup> Publication searches were conducted August 25, 2009. For scholarly articles: Google Scholar for the years 1994-2001 and 2002-present (search terms “geoengineering” “climate” “change” in the following categories: Biology, Life Sciences, and Environmental Science; Chemistry and Materials Science; Engineering, Computer Science, and Mathematics; Physics, Astronomy, and Planetary Science; Social Sciences, Arts, and Humanities. For major media coverage: Lexis Nexis for the years 1994-2001 and 2002-present (search terms “geoengineering” “climate” “change”) in newspapers stories (major world newspapers), weblogs and magazines.

## **Policymakers testing the waters:**

For the most part, prominent public officials have avoided speaking out on geoengineering, knowing that it could easily – and rightly – provoke a popular outcry. Nevertheless, in the U.S. Chief Science Advisor John Holdren has clearly stated that geoengineering options are “on the table.” U.S. Energy Secretary Steven Chu has also indicated his support for technological solutions to climate change and “benign” geoengineering schemes, and Steve Koonin, now the Undersecretary of State for Science in the U.S. department of Energy was instrumental in preparing a recent report looking at the technical feasibility of aerosol sulphates in the stratosphere.<sup>9</sup> The UK Parliamentary Committee on the Innovation, Science, University and Skills issued a report that recommended more public funding for research in the area. In April, the Portuguese Ministry for Science, Technology and Higher Education convened a Chatham House Rules session on geoengineering.<sup>10</sup> In early 2009, the German Minister of Research authorized an ocean fertilization experiment in the Scotia Sea despite an international ban on the practice that his own government had helped to broker at the UN Convention on Biological Diversity in 2008.<sup>11</sup>

There is consensus that urgent action must be taken on the climate crisis and that is always the geoengineers’ opening pitch. They then, however, begin a recital of well-practiced fairytales to bolster their case for more research funding, more political support, and for getting on with real-world experimentation:

### **Fairytale number 1: Sober scientific research is needed**

“We have no choice but to carefully explore climate engineering’s potential benefits and risks...Any real scientific research program will steer clear of value judgments and focus instead on the physical science and technology of climate engineering. Scientists have values, but science is about facts.” – Ken Caldeira<sup>12</sup>

Science is the opiate of the policymaker. It is never value-free and research always takes place in a social-political-economic-ecological context. Over the past decade in particular, the dense and intricate relationships that bind science to business and politics and society as a whole have been brought into the open, signaling the end of an era of “blind faith in the men with white coats.”<sup>13</sup> Critical political questions about research priorities and experimentation should be answered before, not after, the scientific research is undertaken.

### **Fairytale number 2: Geoengineering technologies can be tested with small-scale experiments**

“Properly designed field-experiments of limited duration and scale could significantly enhance our empirical understanding of the radiative forcing properties of stratospheric aerosols...” – Novim Group<sup>14</sup>

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<sup>9</sup> J. J. Blackstock, D. S. Battisti, K. Caldeira, D. M. Eardley, J. I. Katz, D. W. Keith, A. A. N. Patrinos, D. P. Schrag, R. H. Socolow and S. E. Koonin, *Climate Engineering Responses to Climate Emergencies* (Novim, 2009), archived online at: <http://arxiv.org/pdf/0907.5140>

<sup>10</sup> See <http://www.irgc.org/Geoengineering.html>

<sup>11</sup> For more information, see ETC Group news release, “German Geo-engineers Show Iron Will to Defy Global UN Moratorium,” 8 Jan. 2009 at [http://www.etcgroup.org/en/materials/publications.html?pub\\_id=710](http://www.etcgroup.org/en/materials/publications.html?pub_id=710)

<sup>12</sup> <http://www.thebulletin.org/web-edition/roundtables/has-the-time-come-geoengineering>

<sup>13</sup> Ben Page of MORI, quoted in James Wilsdon and Rebecca Willis, *See-through Science: Why Public Engagement needs to Move Upstream*, Demos 2004 available online at <http://www.demos.co.uk/publications/paddlingupstream>, p. 15.

<sup>14</sup> J. J. Blackstock, D. S. Battisti, K. Caldeira, D. M. Eardley, J. I. Katz, D. W. Keith, A. A. N. Patrinos, D. P. Schrag, R. H. Socolow and S. E. Koonin, *Climate Engineering Responses to Climate Emergencies* (Novim, 2009), archived online at: <http://arxiv.org/pdf/0907.5140>

At this stage, proponents of geoengineering want a cautious “yellow light,” so they can undertake real-world “small-scale” experimentation. This research agenda comprises three phases: 1) Non-invasive laboratory and computational research; 2) field experiments; and 3) monitored deployment.<sup>15</sup> The lobby is eager to get on with phases two and three. However, when it comes to geoengineering, real-world experimentation actually becomes deployment: There is but one earth. Small-scale tests will forever be regarded as inadequate and pressure will come to bear to move swiftly to larger-scale interventions (with greater risk and less predictability). This dynamic has been evident in the case of ocean fertilization where in the wake of 13 smaller, real-world tests with inconclusive or negative results, a small minority is now vocally arguing for scale-up, claiming that small-scale tests cannot test the efficacy of the technique. Had the previous tests delivered more positive results, there would still have been pressure for scaling up. Hence, no matter what the outcome of geoengineering experiments, the imperative will be toward larger and larger scale. Computer modeling leads to testing and testing to deployment. This pattern is familiar to people who know the history of genetically modified crops and nuclear weapons.

**Fairytale number 3: Geoengineering will complement, not displace, efforts to reduce carbon emissions.** “I disagree that geoengineering the climate is a dangerous distraction...we now need a ‘plan B’ where a geoengineering strategy is drawn up in parallel with other measures to curb CO<sub>2</sub> emissions.”<sup>16</sup> – James Lovelock

There is limited money, limited scientific capacity and limited policy space, and the fact is geoengineering has already distracted from a focus on cutting emissions. Geoengineering is emerging in some policy circles as a third category of climate-change response, distinct from mitigation and adaptation – in part thanks to the attention paid to it by the Royal Society and the National Academies in the U.S. – despite the fact that its benefits are speculative and its risks are planetary. But as long as policymakers can point to a potential techno-fix that will delay making apparently unpopular decisions (e.g., mandating energy efficiency, penalizing GHG-intensive industries, lowering consumption levels, halting deforestation, etc.), they will sequester funds for it. It is currently estimated that less than 1% of the resources that are urgently needed to assist developing countries adapt to climate change have been made available.<sup>17</sup> In this context, it is unconscionable to spend money on pipe dreams.

**Fairytale number 4: Geoengineering would be held in reserve in the event of a climate emergency.** It’s “an insurance policy, a backup plan.”<sup>18</sup> – Ken Caldeira

Depending on where you live and how much money you have (or don’t have), you may already be feeling the heat of climate chaos. While some have argued that climate “tipping points” have already been passed, we still haven’t agreed on who gets to declare a state of climate emergency. At any point the climate engineers feel they’ve got a geoengineering scheme ready to audition on the world stage, they’ve got ample data showing that the climate emergency is already underway. (Kofi Annan’s Global Humanitarian Forum, for example, estimates that climate change is already killing 300,000 people a year and affecting 300 million, 99% of whom are in the developing world.<sup>19</sup>) “Are we in a climate emergency and what should we do about it?” are fundamentally political questions

<sup>15</sup> Blackstock *et al.* op.cit. p. 38.

<sup>16</sup> James Lovelock’s submission to “What can we do to save our planet?” *The Independent*, 2 January 2009, <http://www.independent.co.uk/environment/climate-change/what-can-we-do-to-save-our-planet-1221097.html>

<sup>17</sup> Global Humanitarian Forum, “The Anatomy of a Silent Crisis,” Geneva 2009, p. 4, available on the Internet at [http://ghfgeneva.org/Portals/0/pdfs/human\\_impact\\_report.pdf](http://ghfgeneva.org/Portals/0/pdfs/human_impact_report.pdf)

<sup>18</sup> Ken Caldeira, “How to Cool the Globe,” *The New York Times*, 24 October, 2007.

<sup>19</sup> Op.cit. pp. 1-4.

that can't be answered by a few – an international process and consensus are mandatory.

**Fairytale number 5: Geoengineering is cheap.**

“It is remarkable to think that we could cancel out this century's global warming with....about \$9 billion and the benefits of preventing the temperature increase would add up to about \$20 trillion.” – Bjorn Lomborg<sup>20</sup>

Geoengineering is the Big Mac of climate-change response: fast, unhealthy and deceptively cheap in the short-term. The long-term costs are liable to be much higher, particularly if a large-scale intervention causes unpredictable consequences. We know that rainfall patterns could react unexpectedly to aerosol injections; ocean acidification will worsen as more carbon absorption is masked by tinkering with the global thermostat, and a host of other side effects could be extraordinarily costly to repair.<sup>21</sup> That geoengineering is cheap is speculation, not science.

**Fairytale number 6: Geoengineering will buy us time.**

“[G]eoengineering could be another potential component in our approach to climate change that could provide the world with extra time to decarbonise the global economy.” – Institute of Mechanical Engineers<sup>22</sup>

Geoengineering is a delay tactic. We have known about global warming for 40 years and the collective failure of wealthy governments to act decisively is the direct cause of the current crisis. Industrialized countries and polluting industries have no credibility to act or right to contemplate planet-altering schemes on behalf of the rest of us. Far from buying us more time, geoengineering will waste more time – and precious resources – on solutions that will move us even further away from the goal of restoring the biosphere to a state that is sustainable for the species which inhabit it. Each hour devoted to speculative techno-fixes is another hour of greenhouse gas emissions going into the atmosphere, more species destroyed, more acidic oceans, more devastating human impacts.

**Fairytale number 7: Unilateralism works; multilateralism doesn't.**

“[A] seeming global consensus on the need to halt rising greenhouse gas levels masks a lack of consensus on willingness to pay the required costs... and the needed global consensus on greenhouse gas curbs will be long in coming.” – Lee Lane<sup>23</sup>

One of the most dangerous aspects of geoengineering is that it could be unilaterally deployed. A single country, corporation or individual, or some coalition of the willing convened by those who possess the technology, could conceivably attempt to geoengineer the planet. Intentionally manipulating the earth's soil, oceans, clouds and atmosphere is a project that will not be contained by any national border, no matter how secure. It's not hard to imagine different countries wanting to control the climate's thermostat in conflicting ways. Multilateralism is the only option here. There is simply no alternative.

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<sup>20</sup> Bjorn Lomborg, *Global Warming's Cheap Effective solution*, Copenhagen Consensus on Climate, available at <http://www.project-syndicate.org/commentary/lomborg43/English>

<sup>21</sup> Gabriele C. Heger and Susan Solomon, “Risks of Climate Engineering,” *Science*, 21 August 2009: Vol. 325. no. 5943, pp. 955 - 956 and Alan Robock, “20 reasons why geoengineering may be a bad idea,” *Bulletin of Atomic Scientists*, Vol. 64 No. 2, May/June 2008, p. 17.

<sup>22</sup> Institute of Mechanical Engineers, *geoengineering – Giving us time to act?* Available on the Internet at <http://www.imeche.org/about/keythemes/environment/Climate+Change/Geoeng>

<sup>23</sup> Lee Lane, former advisor to President George Bush on climate change, directs the American Enterprise Institute's Geoengineering Project. The quote is from testimony he gave to the Select Committee on Energy and Global Warming, March 9, 2009, available at [http://interns.aei.org/publications/filter.all.pubID.29491/pub\\_detail.asp](http://interns.aei.org/publications/filter.all.pubID.29491/pub_detail.asp)

## **Conclusion: From Naked Emperor to See-Through Science?**

In the fairytale, calling the swindlers' bluff exposed the Emperor's vanity and his advisers' servility. Today, we must call the bluff of the geoengineers and expose governments that would bow to sophistic science rather than get on with the urgent business of climate change mitigation and adaptation. Perhaps more than any other field, geoengineering points to the urgent need for an international framework to evaluate new technologies, so that governments, in consultation with civil society and the scientific community, can make reasoned and equitable decisions regarding their possible development and/or deployment. The possibility of "dual-use" geoengineering to be unilaterally deployed and its possible commercial applications call for an urgent global resolution. The current governance gap over geoengineering needs to be closed, which will happen only through serious international discussion under the auspices of the United Nations, which, for all its weaknesses, still operates under the essential principle of one nation, one vote. Until then, any effort to bring these technologies out-of-doors is nothing short of geopiracy and should be banned.

Comments on this report are welcome: [etc@etcgroup.org](mailto:etc@etcgroup.org)