Engineering our climate

Fact Sheet

Lesson 2: *Is there a future in geo-engineering?*

We all know that the World's climate is changing. The Earth is getting warmer as a result of the enhanced greenhouse effect caused by anthropogenic activity. The warmer it gets, the more severe the impacts will be. So what is the solution? Is there one? The response to global warming has been to address the cause by reducing greenhouse emissions, from individual and local scale action to national policies and international agreements but so far, little real progress has been made.

Until now geo-engineering has been a topic of discussion amongst scientists and academics but in recent years the idea of manipulating the Earth's climate to cope with the impacts of climate change has become an option that some governments see as a possibility worth considering. However, geo-engineering was a previously taboo subject for a reason; it raises so many difficult questions.

Scientific research carried out so far into a range of geo-engineering techniques suggests that the Earth's climate could be manipulated effectively to counteract the warming caused by high levels of carbon dioxide in the atmosphere. Although the evidence suggests that these techniques could work, more research is needed into how they could practically be implemented. It is not just the techniques themselves which need further research but also the potential impacts of employing these methods. The effects can be predicted but are unknown especially in the longer term. That said, the effects of global warming are also uncertain. This is integral to the debate: the unknown. Many say that the problem is by the time we can be certain, it will be too late.

A summary of some of the discussion points on geo-engineering:

Both positions argue that reducing carbon emissions at the source, changes to the economy, increases in energy efficiency and the development and growth of renewable sources of energy are vital.

Arguments for...	Arguments against...
* Geo-engineering could lessen the impacts of global warming. * We can, should and must reduce emissions but we might want geo-engineering to reduce the risk of carbon dioxide which is already in atmosphere. * There are no current proposals that have clear validity at the moment, but we are faced	* There is a risk that serious consideration of geo-engineering could give the impression that there is less urgency to reduce emissions. * Many warn that geo-engineering is difficult, the outcome unpredictable, the side effects possibly perilous and the expense phenomenal. * Geo-engineering is a get-out-of-jail-free

with such an enormous problem that we need to do all we can to see if there are any geo-engineering proposals that could work through to the market place. * It could be cost effective. For example the sea water mist method could counteract a century's worth of warming for just $9 billion. * Geo-engineering ideas have the advantage of being cheap- at least in relative terms. "The benefits are so great, at low cost that at the very least it makes sense to invest in a real research program".	card. * We should worry about the side effects. For example there are serious concerns that artificially changing cloud cover could disrupt global precipitation patterns. A cool but dry planet wouldn't be an upgrade from where we are now. * Scepticism of manipulating large scale planetary systems due to failure of previous attempts. * Concern over ecological uncertainty. * Investment in scientific research distracts from the solution of reducing emissions. * Impacts will not be uniform and there will be conflict between the winners and losers.

Geo-politics play a role in finding the solutions to global warming. It is widely accepted that those countries that are likely to suffer the most from the consequences of climate change are those who have contributed the least greenhouse gas emissions. Countries have different priorities for their futures, depending on their level of development.

National policies can be influenced by global agreements. The Kyoto Protocol is the current international response to global warming. It sets targets to reduce emissions, depending on a country's level of development. At present there is a commitment from 183 countries but it is not legally binding. The process of developing the Kyoto Protocol has been extremely slow and many countries have made limited progress in significantly reducing their emissions, particularly those countries which contribute the most.

China: signed up to the Kyoto protocol but there is no obligation to reduce emissions as it is a developing country. 2050 China Energy and CO2 Emissions Report drafted by major Chinese think tanks has stated that appropriate national policies could halt the growth of China's emissions by 2030, with emissions growth beginning to slow as soon as 2020. This is not yet policy but suggests that the Chinese government is open to discussion. China has over taken the USA as the largest contributor of carbon dioxide emissions.

USA: recently pledged to spend $150 billion on the development of renewable energy and technology. They have not signed up to Kyoto yet but contribute 25% of global emissions. They criticise the agreement for not requiring newly industrialising countries like China and India to cut emissions.

Although geo-engineering may offer a potential solution there is concern that it could let governments 'off the hook'; economic development could continue as usual with little attempt made to reduce emissions and geo-engineering would be used as a quick fix instead. This technological fix may be adopted by some governments and not others, yet the impacts could be international. The complex discussions attempt to balance one unknown environmental risk against another.

Geo-engineering does have a future but we cannot be sure about what that future involves.

Key terms:

Technological fix: a 'fix' or solution to a problem using technology.

Anthropogenic activity: human activity usually used to describe environmental effects that humans have on an environment. Man-made CO^2 is considered responsible for global warming as a greenhouse gas.

***Kyoto protocol*:** an international environmental treaty that aims to reduce greenhouse gas emissions. 183 countries have ratified the agreement which came into force in 2005.

Enhanced greenhouse effect: the greenhouse effect warms the Earth by trapping incoming solar radiation. The scale of the warming effect has been increased by the human contributions of carbon dioxide into the atmosphere.