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## Obama climate adviser open to geo-engineering to tackle global warming

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Mooted geo-engineering fixes for climate change include placing mirrors in space that reflect sunlight from the Earth. Photograph: Blue Line Pictures/Getty Images

The global warming situation has become so dire that **Barack Obama's** chief scientific adviser has raised with the president the possibility of massive-scale technological fixes to alter the climate known as 'geo-engineering'.

John Holdren, who is a member of the president's cabinet, said today the drastic measures should not be "off the table" in discussions on how best to tackle climate change. While his office insisted that he was not proposing a dramatic switch in policy, Holdren said geo-engineering could not be ruled out.

"It's got to be looked at. We don't have the luxury of taking any approach off the table," Holdren said in an interview with Associated Press. He made clear these were his personal views.

The suite of mega-technological fixes includes everything from placing mirrors in space that reflect sunlight from the Earth, to fertilising the oceans with iron to encourage the growth of algae that can soak up atmospheric carbon dioxide. Another option is to seed clouds which bounce the sun's rays back into space so they do not warm the Earth's surface.

Such global-scale technological solutions to climate change may seem fantastical, but increasing numbers of scientists argue that the technologies should at least be investigated.

Holdren's comments do not mean that the US government is raising the priority of geo-engineering. A spokesman for the US Government's Office of Science and Technology Policy (OSTP) - which Holdren directs - said "the administration's primary focus is still to seek comprehensive energy legislation that can get us closer to a clean energy economy, and can create green jobs while reducing dependence on foreign oil."

Advocates of the technology have welcomed the comments. Stephen Salter, an engineer

at Edinburgh University and a pioneer of techniques to seed clouds so that they reflect the Sun's rays back into space, said: "Everyone working in geo-engineering works with some reluctance: we hope it'll never be needed, but we fear it might be needed very very urgently. Holden is echoing that exactly. It's very encouraging – we've had extremely negative reactions from the UK governments."

Salter said that geo-engineering techniques were the only methods that would lower world temperatures quickly enough. Even if the world stopped emitting CO2 tomorrow, he said, the world would continue to get hotter for several decades. "Opponents say it would take the pressure off getting the renewables developed. I've been working on renewables since 1973 and stopped because we're too late, we wasted too much time. We may have a panic very soon because of the way the Arctic ice is going."

Greenpeace chief scientist Doug Parr, however, has said: "The wider point is not the pros and cons of particular technologies, but that the scientific community is becoming so scared of our collective inability to tackle climate emissions that such outlandish schemes are being considered for serious study. We already have the technology and know-how to make dramatic cuts in global emissions - but it's not happening, and those closest to the climate science are coming near to pressing the panic button."

Holdren acknowledged that some of the potential geo-engineering solutions could have side effects, and that such actions should not be taken lightly.

Though cloud-seeding, for example, would cool the earth, it would also lead to more acidic oceans, since the amount of CO2 in the atmosphere - and therefore the CO2 absorbed into the seas - would keep increasing. But Holdren added: "We might get desperate enough to want to use it."

His comments seemed to go against those he made in a speech to the annual meeting of the American Association for the Advancement of Science in 2007. There, he highlighted geo-engineering's potential to help cool the atmosphere or to remove greenhouse gases, but acknowledged the methods would likely require significant investment, and also warned against expecting a single technological solution to solve energy and climate problems. "Belief in technological miracles is generally a mistake," he said.

Writing last year in a special edition of the Royal Society journal *Philosophical Transactions* that was dedicated to geo-engineering, Brian Launder of the University of Manchester and Michael Thompson of the University of Cambridge said: "While such geo-scale interventions may be risky, the time may well come when they are accepted as less risky than doing nothing. There is increasingly the sense that governments are failing to come to grips with the urgency of setting in place measures that will assuredly lead to our planet reaching a safe equilibrium."

In a series of papers, experts said that a reluctance "at virtually all levels" to address rising greenhouse gas emissions meant carbon dioxide levels in the atmosphere were on track to pass 650 parts per million, which could bring an average global temperature rise of 4C. They called for more research on geo-engineering options to cool the earth.

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