Risky schemes may be only hope for cooling planet: scientists

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Members of Greenpeace protest in Mexico City in August 2009, demanding the Mexican goverment for commitments to stop the climate change. Sci-fi proposals to cool the planet are laden with risk but may be Earth's only hope if politicians fail to tackle global warming, scientists said on Tuesday in their biggest evaluation to date of "geo-engineering" concepts.

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The verdict by Britain's prestigious Royal Society came little more than three months before a UN showdown in Copenhagen on how to reduce the carbon emissions that drive climate change.

John Shepherd, a professor at Britain's University of Southampton, who

chaired a 12-member panel which assessed the evidence, said geo-engineering was filling a perilous political void.

"Our research found that some geo-engineering techniques could have serious unintended and detrimental effects on many people and ecosystems -- yet we are still failing to take the only action that will prevent us from having to rely on them," he said.

The report cautiously said some geo-engineering schemes were technically feasible but were shadowed by safety worries and doubts about affordability.

Provided these questions were answered, such projects could be a useful tool as part of a worldwide switch to a low-carbon economy, it said.

But, the report warned, other geo-engineering schemes are so costly or so freighted with risk and unknowns that they should only be considered a last-ditch fix.

Just five years ago, geo-engineering was widely dismissed by mainstream climate scientists as quirky or delusional. As recently as 2007, the UN's Intergovernmental Panel on Climate Change (IPCC) cautioned of its potential risk and unquantified cost.

But the schemes are now getting a serious hearing in many quarters, helped by mounting evidence that climate change is advancing faster than thought while progress towards a carbon-curbing UN treaty is moving at glacial speed.

Supporters say geo-engineering can buy time to let politicians hammer out a deal or wean the global economy off polluting fossil fuels.

The report, "Geoengineering the climate: Science, governance and

uncertainty," was based mainly on peer-reviewed literature.

It took a year to carry out, and the Royal Society came under fire from green groups who accused it of handing a cloak of respectability to a once-mocked scientific fringe.

The authors said geo-engineering fell into two main categories.

The most promising entails removal of carbon dioxide, such as by planting forests and building towers that would capture CO2 from the air.

Some of these projects could be harnessed alongside conventional methods to reduce emissions once they are demonstrated to be "safe, effective, sustainable and affordable," said the report.

The other category is called solar radiation management.

Instead of tackling CO2, it would act like a thermostat, turning down the heat that reaches Earth from the Sun.

Concepts in this field include deflecting the Sun's heat away from the Earth through space mirrors, scattering light-coloured particles in the high atmosphere to reflect the solar rays and using ships to spray water that would create reflective low-altitude clouds.

The advantage would be to lower temperatures quickly and could be tempting if global warming suddenly cranked up a gear, the report said.

But these techniques would not curb CO2 emissions that cause dangerous ocean acidification; their costs are unclear but possibly astronomical; and they may end up generating disasters of their own.

Even so, they should not be dismissed out of hand, given their potential in an emergency, said Ken Caldeira, a professor of climate modelling at Stanford University, California.

"We need to think if Greenland were to be sliding into the sea rapidly, causing rapid sea-level rise, or if methane started to de-gas rapidly from the Siberian permafrost, or if rainfall patterns were to shift in such a way that wide-spread famines were induced," he said.

"We would be remiss if we did not do what we could do to understand the potential of these options as well as their uncertainties and risks ahead of time."

Painting roofs white to reflect solar rays -- an idea gaining ground in California and other sunny places -- would provide only limited, local cooling and not affect the rise in global temperature.

"None of the geo-engineering technologies so far suggested is a magic bullet and all have risks and uncertainties associated with them," Shepherd said.

The panel called for funding of around 100 million pounds (162 million dollars) a year to kickstart research into the feasibility of geo-engineering schemes could be feasible -- and, if so, in what circumstances they should be applied and how they would be managed.

Here is a snapshot of the report's views on the main geo-engineering proposals:

-- CARBON REMOVAL PROJECTS --

These are schemes that remove carbon dioxide (CO_2), the principal

greenhouse gas, from the atmosphere.

Projects that are shown to be "safe, effective, sustainable and affordable" should be deployed alongside cleaner energy and other conventional methods to reduce carbon emissions. Among those highlighted in the report:

PLANTING TREES: Afforestation would suck carbon dioxide (CO2) out of the atmosphere through the natural process of photosynthesis. FOR: Safe, easy, swift and cheap to deploy, good for biodiversity. AGAINST: Only limited potential for carbon removal, potential conflicts over land use (forests vs. food crops).

BIO-ENERGY: Use trees, shrubs and other vegetation as an energy source, such as bio-mass and charcoal. FOR: Affordable and safe. AGAINST: Slow to reduce global temperatures, potential conflicts over land use.

ENHANCED WEATHERING: CO2 is removed from the atmosphere over thousands of years by a natural process involving the weathering, or dissolution, of carbonate and silicate soils. Enhanced weathering would accelerate the process by adding silicates to certain soils. FOR: High potential for storing CO2 in the soil. AGAINST: Expensive, slow to take effect and impact on soil acidity and vegetation unclear.

CARBON SCRUBBERS: Build hi-tech towers around the world to capture CO2 molecules from the air. FOR: Safe, technically feasible and very high cleanup potential. AGAINST: Costs unknown but likely to be high, need for infrastructure to store the carbon collected by the towers.

OCEAN FERTILISATION: Sow the open seas with iron nutrients to encourage the growth of marine plants called phytoplankton that suck up CO2 at the surface through photosynthesis. The phytoplankton die and

sink to the ocean floor, effectively storing the carbon forever. FOR: Technically feasible, not too expensive. AGAINST: May not work, given complex ocean currents; slow to reduce global temperatures; very high potential for damaging the marine ecosystem.

OCEANIC UPWELLING: Place huge vertical pipes in the sea to pump water from the depths to the surface and from the surface to the depths. FOR: Would boost the efficiency of the ocean as a means of storing CO2. AGAINST: Unfeasible, would only reduce atmospheric CO2 by a tiny fraction, environmental impact unknown.

-- SOLAR RADIATION MANAGEMENT --

These are schemes that would cool the planet by reducing heat from the Sun rather than by curbing fossil-fuel pollution.

Some of these could have a quick cooling effect, but would not address CO2 buildup, which causes ocean acidification and other problems. They may also have a potential for causing massive environmental problems.

As a result, solar radiation management is less preferable than carbon dioxide removal, says the report. It should only be applied in an emergency and for a limited time, and in any case should accompany reductions in carbon emissions. The principal schemes:

ALBEDO (REFLECTIVE MATERIALS): Cover desert areas with reflecting film or generate white clouds over parts of the oceans through spray generators aboard "cloud ships." FOR: Quick to implement and rapidly effective. AGAINST: Desert albedo would have a major impact on desert eco-systems, ocean albedo could affect weather patterns and ocean currents. Both very expensive.

STRATOSPHERIC AEROSOLS: Mimicking the dust spewed from volcanoes, these would be fine, white particles of sulphate that would be scattered into the stratosphere to reflect sunlight. FOR: Technically feasible, highly effective (could start to reduce temperatures within one year), can be deployed quickly and at low cost. AGAINST: Possible impact on ozone layer, high-altitude clouds, may disrupt regional rainfall patterns.

SPACE SUNSHADE: Place reflectors in orbit that would reduce the amount of solar radiation reaching Earth by one or two percent. FOR: Highly effective, and no theoretical limit on potential cooling. AGAINST: Would take decades to deploy; huge cost; potential effects on regional climate; impact of reduced sunlight on ecosystem unknown.

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