THE INDEPENDENT

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Scientist publishes 'escape route' from global warming

By Steve Connor, Science Editor

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A Nobel Prize-winning scientist has drawn up an emergency plan to save the world from global warming, by altering the chemical makeup of Earth's upper atmosphere. Professor Paul Crutzen, who won a Nobel Prize in 1995 for his work on the hole in the ozone layer, believes that political attempts to limit man-made greenhouse gases are so pitiful that a radical contingency plan is needed.

In a polemical scientific essay to be published in the August issue of the journal Climate Change, he says that an "escape route" is needed if global warming begins to run out of control.

Professor Crutzen has proposed a method of artificially cooling the global climate by releasing particles of sulphur in the upper atmosphere, which would reflect sunlight and heat back into space. The controversial proposal is being taken seriously by scientists because Professor Crutzen has a proven track record in atmospheric research.

A fleet of high-altitude balloons could be used to scatter the sulphur high overhead, or it could even be fired into the atmosphere using heavy artillery shells, said Professor Crutzen, a researcher at the Max Planck Institute for Chemistry in Germany.

The effect of scattering sulphate particles in the atmosphere would be to increase the reflectance, or "albedo", of the Earth, which should cause an overall cooling effect.

Such "geo-engineering" of the climate has been suggested before, but Professor Crutzen goes much further by drawing up a detailed model of how it can be done, the timescales involved, and the costs.

In his forthcoming scientific paper, Professor Crutzen emphasises that the best way of averting global climate disaster is for countries to cut back significantly on their emissions of greenhouse gases, notably carbon dioxide produced by burning oil, gas and coal. But in the absence of such measures, and with the average global temperature expected to rise more than 3C this century, there may soon come a time when more extreme measures have to be considered, he said.

"If sizeable reductions in greenhouse gas emissions will not happen and temperatures rise rapidly, then climatic engineering, as presented here, is the only option available to rapidly reduce temperature rises and counteract other climatic effects," Professor Crutzen said.

"Such a modification could also be stopped on short notice, if undesirable and unforeseen side-effects become apparent, which would allow the atmosphere to return to its prior state within a few years," he said.

Such an idea is so controversial that some scientists opposed its publication in the peer-reviewed scientific press, fearing that it may encourage the view that it is easier to treat the symptoms rather than the causes of climate change.

Professor Crutzen, however, argues that the "grossly disappointing" international political response to the necessity of cuts in greenhouse gas emissions means that it should no longer be considered taboo to think about geo-engineering of the climate.

"Importantly, its possibility should not be used to justify inadequate climate policies, but merely to create a possibility to combat potentially drastic climate heating," he said. "The very best would be if emissions of the greenhouse gases could be reduced. Currently, this looks like a pious wish."

His plan is modelled partly on the Mount Pinatubo volcanic eruption in 1991, when thousands of tons of sulphur were ejected into the atmosphere causing global temperatures to fall.

Pinatubo generated sulphate aerosols in the atmosphere which cooled the Earth by 0.5C on average in the following year. The sulphate particles did this by acting like tiny mirrors, preventing a portion of incoming sunlight from reaching the ground.

Professor Crutzen calculated that a relatively small amount of sulphur could cause similar cooling if it was released at high enough altitudes into the stratosphere, rather than at the lower altitude of the troposphere. Weather balloons or even artillery shells could be used to carry the sulphur.

"Although climate cooling by sulphate aerosols also occurs in the troposphere, the great advantage of placing reflective particles in the stratosphere is their long residence time of about one to two years, compared to a week in the troposphere," Professor Crutzen said.

"It may be possible to manufacture a special gas that is only processed photochemically in the stratosphere to yield sulphate," he said. Such a compound should be non-toxic, insoluble in water, non-reactive, and have a relatively short half-life of about 10 years.

It would cost between $25bn and $50bn - or about $25 or $50 per head in the developed world - to launch sufficient sulphate to last for up to two years.

But this high cost should be measured against the much bigger costs of environmental disasters, such as coastal flooding, caused by global warming, he said.

Side-effects could be an increase in the destruction of the ozone layer and whitening of the sky, although the particles would make sunsets and sunrises more spectacular, he said.

Other 'geo-engineering' ideas

* Reflecting mirrors:

Earth's natural reflectance or "albedo" reflects about 30 per cent of sunlight back into space. Increasing the albedo could be done by building giant unfolding mirrors in space, laying reflecting film in the deserts, or floating white plastic islands in the ocean to mimic reflective effect of sea ice.

* Swallowing up CO2:

Marine plankton absorb carbon dioxide from the atmosphere, which the microbes need for photosynthesis. The growth of plankton is limited by the relatively small amounts of iron in the sea. Scientists have conducted experiments on boosting plankton by throwing iron filings into the sea.

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