International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Fighting Global Warming by Climate Engineering

Abhimanyu Chakravarti

Department of Mechanical Engineering, Janardan Rai Nagarrajasthan Vidyapeeth University, Udaipur, Rajasthan, India

Abstract: ***The best way to reduce global warming is, without any doubt, cutting down anthropogenic emission of greenhouse gases. But the world economy is addict to energy, which is mainly produced by fossil carbon fuels. As economic growth and increasing world population require more and more energy, we cannot stop using fossil fuels quickly, nor in a short term. On the one hand, replacing this addiction with carbon dioxide-free renewable energies, and energy efficiency will be long, expensive and difficult.***

Keywords: Climate engineering, ozone

1.Introduction

The most serious and important problem humankind has ever had to face might be global warming with disastrous consequences and costly adverse effects. Adaptation and mitigation strategies might not be sufficient. In May 2013 the CO_2 concentration in the Earth's atmosphere officially exceeded 400 ppm.

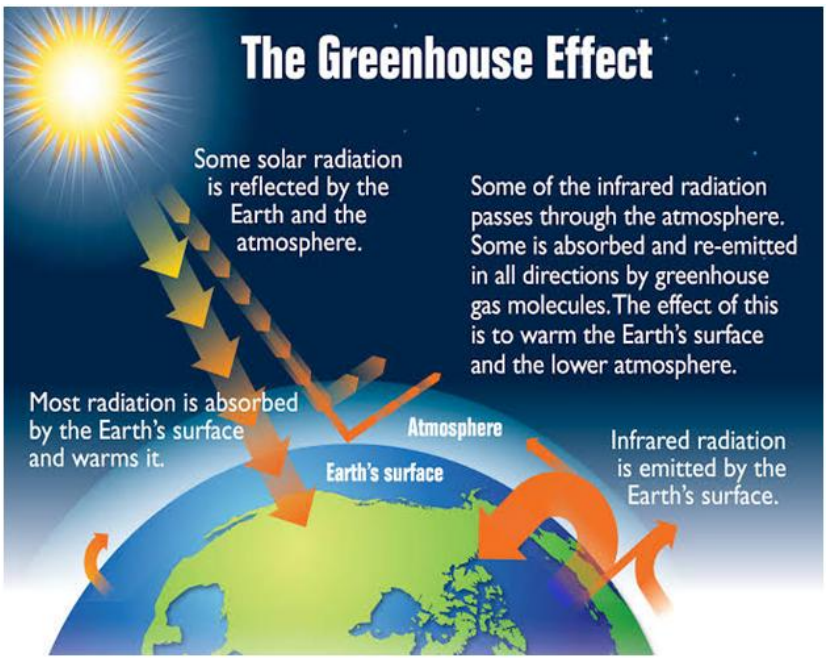
Gases below 450 ppm in order to keep the temperature rise under a 2 °C target.

Many scenarios have been considered in order to slowly decrease our greenhouse gases (GHG) emissions to try to keep the average temperature heat rise under +2 °C. But without an international agreement signed by the biggest polluters, this <2 °C figure will remain only empty words and will not be followed by actions and effects.

Human GHG emissions have already been so important and some of these GHG have such extraordinarily long lifetimes that even if by a magic wand we could stop all emissions overnight, the average temperature of Earth would continue to rise or stay at current levels for several hundred years.

Global warming results from the imbalance between the heat received by the Earth and, the heat reradiated back to space. The shortwave incoming solar radiation also called global irradiance or solar surface irradiance is the radiation flux density reaching a horizontal unit of Earth surface in the 0.2-3 µm wavelength range. Both are expressed in W m^{-2}.

The GHGs trap some heat and, by greenhouse effect, warm the Earth surface.



This review focuses on using several MR, night sky radiation and giant heat pipes as active heat transfer tools to cool down the Earth by artificial vertical wind generation and, at the same time, production of sustainable CO_2-free renewable energy without the drawbacks of current climate engineering strategies. This review sheds light on innovative activity and innovation dynamics in heat-transfer technologies and CO_2-free renewable energy.

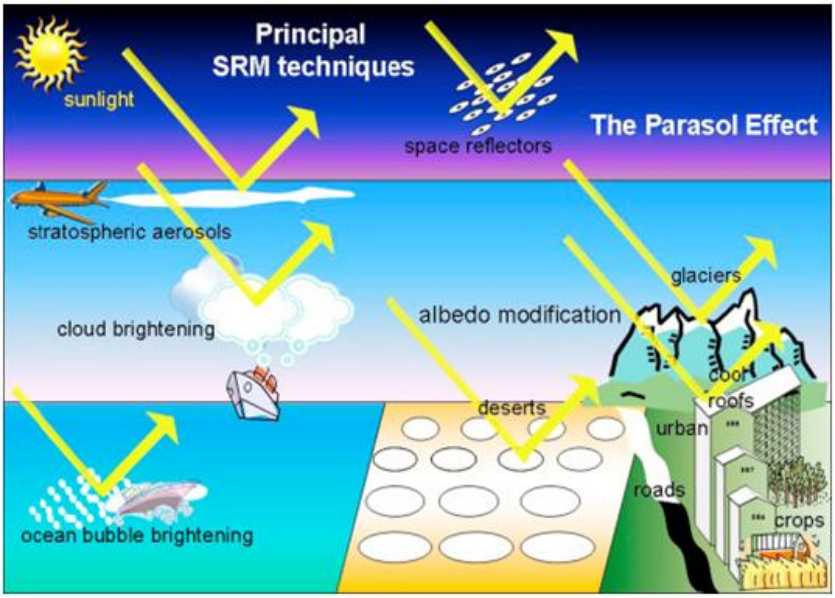
2.Overview

Geoengineering or climate engineering (CE) consists in a large set of technologies that deliberately reduce solar

insolation or increase carbon removal directly from the atmosphere, on a large scale, with the aim of minimizing, counteracting, mitigating, limiting, counterbalancing or reversing anthropogenic climate change in order to reduce Global Warming or its consequences. geoengineering is defined as the "deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change".

Solar Radiation Management (SRM) proposals aim to reduce Global Warming by reducing the amount of light received on the Earth and by its atmosphere. It includes several techniques like space solar reflectors; stratospheric injection of aerosols; seeding tropospheric clouds by salt aerosols or ice nucleation to make them whiter and also surface albedo change (urban, rural, or atmospheric approaches).

Overview of the principal SRM:-geoengineering techniques that attempt to increase the reflection back to space of the incoming solar radiation. These techniques are often referred as acting by a "parasol or umbrella effect".



1. Space mirrors and science fiction-like proposals

The idea of this GE scheme is to send into orbit giant mirrors (55, 000 orbiting mirrors each of 100 km^2) made of wire mesh; or to send trillions of light and small mirrors (the size of a DVD), in order to deflect sunlight back to space. In other words numerous artificial mini-eclipses that will obscure the sun. This option is widely considered unrealistic, as the expense is prohibitive, the potential of unintended consequences is huge and a rapid reversibility is not granted.

2. Cloud whitening

The idea is that sea water can be pumped up and sprayed into the air to increase the number of droplets, and produce fine sea salt crystals increasing the reflectivity of low altitude clouds. Together, many droplets and salt aerosols are expected to make whiter clouds and reflect more intensity of sunlight. It seems harmless and not too expensive, but needs to be done on a huge scale to have any global effect. This proposal (and several others) is backed financially by former directors from Microsoft. According to Latham in the first decades of operation, the amount of disseminated salt over land would be several orders of magnitude less than naturally produced. This mechanism is based on the Twomey and Albrecht effects: increasing number or surface area of droplets increases the scattering of light, thus increasing albedo. As reducing droplet size lowers their sedimentation velocity, precipitation could be delayed or inhibited, increasing cloud lifetime, so there will be an increased cloudiness.

3. Other albedo changes

The proportion of light reflected from the Earth's surface back to space is called albedo after the Latin word albus for white. In the Earth radiation budget it is identical to the outgoing shortwave radiation, with spectral properties in the range of those of the incoming light from the sun.

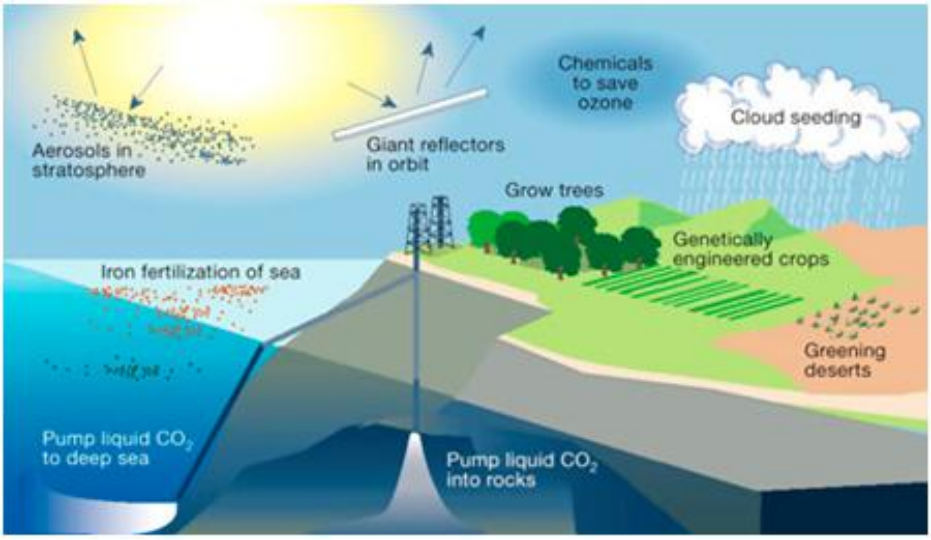
Road asphalt is hotter during the summer; meanwhile white roofs stay cooler allowing saving some electricity used for air conditioning and thus avoiding CO_2 emissions.

3.Discussion about SRM

SRM methods may be able to reduce temperatures quickly and some of them like stratospheric aerosols at comparatively low cost. However, even if they could reduce some of the most significant effects of global warming and lessen some of its harmful impacts, these technologies could also have significant unanticipated harmful side effects. Moreover, they would not eliminate the cause of climate change, the emissions of GHGs and the associated threat of ocean acidification. For many experts the whole idea of pursuing these "technical fixes" is controversial since SRM can probably restore on

average the Earth's global radiative balance, but regional climate discrepancies will remain.

Also, if CO_2 levels continue to rise during SRM, that means it must be maintained indefinitely to avoid abrupt and catastrophic warming and there must happen no technological, economical or political failure.



By pumping massive amounts of CO_2 and other GHGs into the atmosphere and by building mega-cities and thousands of kilometres of black paved highways, humans have already engaged in a dangerous geophysical experiment. The only difference with CE is that it was unintentional. The best and safest strategy for reversing climate change is to halt this build up of atmospheric GHGs and stop CO_2 emissions, but this solution will take time, and it involves a myriad of practical and political difficulties. Meanwhile, the dangers are mounting and even with a serious effort to control GHGs emissions, meaningfully reducing them in the very near term is an unattainable goal.

4.Conclusion

In this review the main GE methods proposed to perform SRM in order to reduce the effects of anthropogenic global warming were summarized, and some of their limitations introduced and ethical aspects reported. Before introducing the concept of ERM, a short review of the literature showing that anthropogenic waste heat release by thermal power plants might be important at a local scale was given, as well as a short overview of some drawbacks of several renewable energies, which makes them “not so green” or “not so neutral” for the climate change problem.

References

[1] Stern N, Peters S, Bakhshi V, Bowen A, Cameron C, et al. Stern review: the economics of climate change. London: HM Treasury; 2006.679 p. ; .
[2] Nakicenovic N, Alcamo J, Davis G, de Vries B, Fenhann J, et al. Intergovernmental Panel on Climate Change (IPCC) 2000 special report on emission scenarios, a special report of IPCC Working Group III; 2000.
[3] S. Solomon, G. K. Plattner, R. Knutti, P. Friedlingstein **Irreversible climate change due to carbon dioxide emissions**
[4] Proc Natl AcadSci, 106 (6) (2009), pp.1704-1709
[5] Wikipedia. (http://en.wikipedia.org/wiki/Greenhouse_effect) or in.
[6] K. E. Trenberth, J. T. Fasullo, J. T. Kiehl **Earth's global energy budget** Bull Am Meteorsoc, 90 (2009), pp.311-323