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Mitigating the Climate Change: A Review

Rashmi Mehrotra
Faculty of Education, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India

ABSTRACT: Climate change is characterised as the shift in climate conditions triggered primarily by natural systems and human activity to release greenhouse gases. Anthropogenic emissions have induced around 1.0 °C of global warming over the pre-industrial era so far, and if the existing pollution patterns continue, this is expected to exceed 1.5 °C between 2030 and 2052. The planet witnessed 315 cases of natural disasters in 2018 that are largely climate-related. Around 68.5 million inhabitants were affected and economic damages amounted to $131.7 billion, of which about 93 percent were hurricanes, earthquakes, wildfires and droughts.Economic damages due to wildfires in 2018 alone are almost equivalent to, and is very concerning, the collective losses from wildfires suffered over the past decade. In addition, the most fragile industries under climate assault have been food, water, health, wildlife, human environments and infrastructure. The Paris Agreement was adopted in 2015 with the key goal of restricting the growth in global temperatures to 2 °C by 2100 and of seeking measures to restrict the rise to 1.5 °C. The key methods for climate change mitigation, including traditional mitigation, negative pollution and geoengineering radiative forcing, are examined in this document.

Keywords: Climate Change, Fuel Switch, Mitigation, Nuclear Power, Renewable source, Environment.

INTRODUCTION

The change in climate trends caused primarily by greenhouse gas emissions is known as climate change. Emissions of greenhouse gases allow the earth's atmosphere to absorb heat, and this has become the key driving force underlying global warming. Natural processes and anthropogenic impacts comprise the primary sources of these pollution. Forest fires, floods, glaciers, permafrost, lakes, mud volcanoes and volcanoes are part of natural environments, while human activities are primarily attributed to power production, industrial and forestry activities, land usage and land-use transition.Researchers evaluated global greenhouse gas emissions from natural processes and anthropogenic behaviours scientifically, finding that the natural structure of the earth should be viewed as self-balancing and that anthropogenic emissions bring excessive burden to the system of the earth.

Conventional mitigation strategies are focused on reducing emissions of fossil-based CO_2. In order to minimise carbon dioxide emissions, negative emission systems seek to absorb and sequester ambient carbon. Finally, radiative forcing geoengineering strategies adjust the radiative energy budget of the planet to maintain or decrease global temperatures [2]. It is clear that traditional mitigation efforts alone are not adequate to achieve the goals set out in the Paris Agreement; the use of alternate routes seems, thus, necessary. Although different approaches proposed may still be at an early stage of progress, biogenic-based sequestration strategies are advanced to some degree and can be instantly implemented.

CLIMATE CHANGE MITIGATION STRATEGIES

Throughout the literature, there are three key climate change mitigation methods discussed. Second, traditional mitigation efforts employ innovations and techniques of decarbonisation that minimise CO_2 emissions, like the storage and use of solar energies, fuel switching, productivity gains, nuclear power and carbon capture. Any of these systems are well designed and bear an acceptable degree of controlled risk.A new collection of innovations and approaches that have been recently proposed represents a second path.These strategies are theoretically used to absorb and sequester CO_2 from the atmosphere and are related to as negative emission systems, also known as strategies of extracting carbon dioxide. Bioenergy carbon capture and storage, biochar, enhanced weathering, direct air carbon capture and storage, ocean fertilisation, ocean alkalinity enhancement, soil carbon sequestration, forestation and reforestation, wetland development and regeneration, as well as alternate negative emission use and storage are the key negative emission strategies commonly debated in the literature[1].

Finally, thru the control of solar and terrestrial radiation, a third path revolves around the idea of modifying the radiation equilibrium of the planet. These methods are called geoengineering technology with radiative forcing, and temperature stabilisation or reduction is the key goal. This is done without modifying greenhouse gas concentrations in the atmosphere, excluding negative emission technology. Stratospheric aerosol injection, underwater sky brightening, cirrus cloud thinning, space-based mirrors, surface-based brightening and various radiation control techniques are the major radiative forcing geoengineering methods that are discussed in the literature.In terms of realistic large-scale implementation, all these methods are either theoretical or at rather early trial stages and bear a lot of complexity and risk. At the present, geoengineering methods like radiative forcing are not used within policy systems.

CONVENTIONAL MITIGATION TECHNOLOGIES

As mentioned earlier, the key force behind the elevated rate of greenhouse gas accumulation in the environment is oil-related emissions; therefore, traditional mitigation technologies and initiatives should concentrate on both the energy supply and demand side. Mitigation initiatives mostly discussed in the literature include innovations and strategies employed in four key industries, supply-side electricity, and demand-side manufacturing, transportation, and infrastructure.Decarbonization can be accomplished within the power industry by the incorporation of wind energies, nuclear power, carbon capture and recycling, and also the transition to low-carbon sources such as natural gas and renewable fuels on the supply side. In addition, demand-side reduction initiatives entail productivity improvements made by the introduction of energy-efficient processes and industry-specific technology that mitigate power usage, the transition from fossil-based fuels to renewable fuels in the end-use fuel sector, and the incorporation of renewable energy technologies into the energy matrix of these industries.The publications on decarbonization and productivity technology and techniques serving those four key fields adopted will be discussed in this section.

Renewable energy

The share of renewable energy in overall final energy consumption worldwide was projected to be 18.1 percent in 2017, according to a recent Global Status Report on Renewables. In the entire literature, an array of modern clean energy innovations is discussed. Photovoltaic solar energy, concentrating solar power, solar thermal power for heating and cooling purposes, onshore and offshore wind power, hydropower, tidal power, geothermal power, biomass power and biofuels are among the most popular developments[2].

Nuclear power

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As of 2018, 450 nuclear power plants with a gross global installed capacity of 396.4 GW are operating, according to the latest study prepared by the International Atomic Energy Agency (IAEA). An rise of 30 percent in annual production is predicted to be realised by 2030 (from a base case of 392 GW in 2017). As a low-case forecast situation, it is projected that, based on the 2017 estimates, a 10 percent dip could be realised by 2030. In the long run, global potential is expected to cross 748 GW as a high-case scenario by 2050. An interesting study of the state of nuclear power has been conducted by a scholar.The investigation shows the important role that nuclear power has played in leading to the global development of electricity as well as its capacity for decarbonization in the global energy environment. The report provides an estimate of roughly 1.2-2.4 Gt CO2 emissions that are avoided annually via the introduction of nuclear power, as the power can alternatively be provided by the burning of coal or natural gas. The paper proposes that nuclear plant capacity would be increased to approximately 930 GW by 2050, with a cumulative investment of approximately $4 trillion, to be in line with the 2 °C goal set by the Paris Agreement[3].

While nuclear energy is deemed a low-carbon option for combating climate change, there are a range of significant pitfalls [6]. First, the capital outlay and maintenance costs associated with the production of nuclear power are very high. Moreover, the danger of environmental radiation contamination is a significant nuclear-related problem, caused largely by the possibility of reactor accidents and the dangers involved with the disposal of nuclear waste[4].

Carbon capture, storage and utilization

Carbon capture and recycling is a promising technique that is debated in the literature as a viable solution to decarbonization to be implemented both to electricity and to the manufacturing sectors. The technology includes the extraction and capture of CO2 gases from operations dependent on fossil fuels, like coal, petroleum or gas. The CO2 collected is then shipped and deposited for very long periods in geological reservoirs. Reducing pollution levels by using carbon fuels is the key priority. In the papers, three capture theories are described: pre-combustion, post-combustion and combustion of oxyfuel.The extraction and capture of CO2 by each technology requires a particular procedure [8]. However, post-combustion capture technologies are the most applicable for retrofit projects and have vast scope for use. Once CO2 has been collected effectively, it is liquified and transferred to appropriate storage facilities by pipelines or ships. Storage solutions include exhausted oil and gas reserves, coal beds and underground freshwater aquifers not used for potable water, depending on the literature. Protection in contrast to protected storage and the risk of leakage are some of the key drawbacks of carbon capture and storage.Negative environmental effects that can occur from onshore storage sites that suffer accidental leakage have been studied. The inquiry centred on the effect of leaks on agricultural property. Researchers have pointed out the possibility of leakage and related negative impacts. Other concerns connected to this technology include public acceptance and also the associated high costs of implementation. Another post-carbon capture pathway is the use of CO2 captured in the manufacture of plastics, oils, microalgae and concrete construction materials, as well as the use of improved oil recovery.

Fuel switch and efficiency gains

In the short term, fuel conversion from coal to gas in the power sector has been widely explored in the literature as a possible solution to the global transition to a low-carbon and, potentially, zero-carbon environment in the future. The transition to natural gas still extends to the industrial, automotive and development industries; nevertheless, the shift to renewable energy is a more competitive solution, as discussed earlier, generating more decarbonization opportunities in these sectors[5].

CONCLUSION

The immediate implementation of effective mitigation and adaptation mechanisms is of extreme significance based on the global state of climate emergency. Three main methods to combat climate change, traditional mitigation technology, negative carbon technologies, and radiative forcing geoengineering technologies is discussed in a systematic literature analysis. It is necessary to clarify that there is no ultimate approach to addressing climate change and that, if theoretically and commercially feasible, all the innovations and procedures addressed in this analysis should be implemented.As discussed earlier, decarbonization measures alone are not adequate to achieve the goals set out in the Paris Agreement, so the use of an alternate mitigation strategy is inevitable. While the idea of radiative forcing geoengineering is fascinating in terms of controlling the radiation expenditure of the planet, it is not a long-term remedy, since the root cause of the problem is not solved. It will, however, buy more time before the quantities of greenhouse gases are stabilised and reduced. However, it is also important to develop and validate the systems to be implemented and properly cater for side effects, which can be a lengthy process.

In the other hand, in tandem with existing decarbonization efforts, zero emission solutions have a solid approach. While some of the negative emission technologies mentioned in the literature review could still be at an early stage of growth, biogenic sequestration strategies are very advanced and can be instantly implemented. The capture of CO_2 through photosynthesis is a clear and solid process; however, as presented in the study, it needs to be efficiently implemented into a technical context.The problem at the moment is that, at a very early point, carbon pricing for negative emissions is mainly possible across voluntary markets for a very small variety of measures of carbon reduction, and technically non-existent for most of the technologies mentioned. Actually, apart from the current system for afforestation and reforestation projects, carbon pricing will be inadequate to support carbon removal projects economically. This could change in the near future, as carbon markets grow and provide rewards for carbon removal.Policymakers and governments should devise viable regulatory tools and funding mechanisms with a particular emphasis on carbon pricing in order to actively accelerate zero emissions initiatives. In addition, improved financial incentives and accessibility should be offered by the financial sector, as well as successful market-based strategies should be adopted to incentivize project developers to set up carbon removal projects.Biogenic-based sequestration programmes are currently in a strong position to leverage financial capital and policy support successfully, as most relevant techniques can be implemented immediately; nevertheless, it is important to actively create and enforce appropriate carbon pricing policies that concentrate on carbon removal. In addition, support for innovation and advancement of technologies is still a very critical part of going forward.

REFERENCES

[1] Intergovernmental Panel on Climate Change, *Climate Change 2014 Mitigation of Climate Change*. 2014.

[2] N. L. Panwar, S. C. Kaushik, and S. Kothari, “Role of renewable energy sources in

environmental protection: A review," *Renewable and Sustainable Energy Reviews*. 2011, doi: 10.1016/j.rser.2010.11.037.

[3] N. Kopytko and J. Perkins, "Climate change, nuclear power, and the adaptation-mitigation dilemma," *Energy Policy*, 2011, doi: 10.1016/j.enpol.2010.09.046.

[4] Intergovernmental Panel on Climate Change, "Climate Change, Adaptation, and Vulnerability," *Organization & Environment*, 2014, doi: http://ipcc-wg2.gov/AR5/images/uploads/IPCC_WG2AR5_SPM_Approved.pdf.

[5] J. M. Cullen and J. M. Allwood, "The efficient use of energy: Tracing the global flow of energy from fuel to service," *Energy Policy*, 2010, doi: 10.1016/j.enpol.2009.08.054.