



CLIMATE CHANGE DUE TO THE EFFECT OF SULPHUR DIOXIDE AND CLIMATE ACTION FOR SUSTAINABLE DEVELOPMENT

Saraswati Malik
Ph.D (Scholar) Environment Science
Shri Venkateshwara University
Gajraula, Distt. Amroha, Uttar Pradesh

Professor: Dr. Abhishek Swami
Shri Venkateshwara University
Gajraula, Distt. Amroha, Uttar Pradesh

ABSTRACT

Climate change due to the effect of sulphur dioxide And climate action for Sustainable Development emission of Sulphur dioxide and other greenhouse gases are increasing in India with the increasing demand for electricity. The aspiration for rapid economic growth leading to rapid industrialization coupled with accelerated urbanization and mechanization of agriculture has been responsible for this increasing demand of electricity ever since the independence. Coal & oil combustion, oceans, volcanoes, industrial boilers are some sources that are producing large volume of Sulfur dioxide erupted frequently appear to overdrive the oxidizing capacity of the atmosphere resulting in climate change due to rapid warming. In this study we will evaluate the contribution of Sulfur dioxide in climate change and the methodology by which the resources use efficiently to overcome from the Situation.

Sulphur Dioxide's Impact on Climate Change and Climate Action for Sustainable Development With the rising demand for electricity, sulphur dioxide and other greenhouse gas emissions are rising in India. Since independence, there has been an increased need for electricity due to the desire for quick economic expansion, which will lead to rapid industrialisation, along with accelerated urbanization and mechanized agriculture. Coal and oil combustion, the oceans, volcanoes, and industrial boilers are some of the sources that frequently erupt significant volumes of sulphur dioxide, which appears to override the atmosphere's ability to oxidize and cause climate change owing to rapid warming. In this study, we will assess how sulphur dioxide contributes to climate change and how well resources are used to overcome from the Situation.



KEYWORDS

Sulphur dioxide, industrialization, sustainable development, greenhouse gas, Environmental degradation, eco-friendly technologies.

INTRODUCTION

United Nations Sustainable Development Goals (SDGs), established on September 15, 2015 entitled as “Transforming our world: the 2030 Agenda for Sustainable Development”, are a follow up of Millennium Development Goals (MDGs) but with some major differences. On one hand, where MDGs were mainly focussed on poverty and hunger (largely of less developed countries), SDGs have 17 agendas covering around 169 targets and is applicable to all the countries and regions of the globe. The goals are much broader. Sustainable Development Goal 13 is to limit and adapt to climate change. It is one of the 17 sustainable development goals. The official mission statement of this goal is to take urgent action to combat climate change and its impact in their terms, extending to social and economic aspects of human society and their dimensions with natural environment, by putting sustainability at the centre. The two key features i.e. economic security and environmental sustainability have been mainly highlighted in the wide range of categories. There is no denying the fact that to achieve the SDGs by 2030 is an ambitious project and its success will definitely obviate various issues related to sustainability of life on earth. Several of the targets set in SDGs were to be achieved by 2024, which means only little time to go

Concept of Sustainable Development

In the last decade sustainable development has become an important objective for many governments and other decision-making bodies across the world. Sustainable development and environment are closely related. But what do we mean by the word sustainable development? Sustainable development refers to creating a style of economic development which is sustainable within the context of planet’s ecosystem and human society. The concept is a synthesis of economic and ecological ideas. In the context of sustainable development the definition of Brundtland Commission (1987) is most appropriate – sustainable development is a development which meets the needs of the current generation without jeopardizing the needs of the future generations. Sulphur dioxide belongs to highly



reactive gases. It reacts easily to form several harmful compounds such as – sulphuric acid, Sulphurous acid, and Sulphate particles. It is produced due to many human and natural activities.

Long-term exposure to sulphur dioxide can lead to more serious problems, such as: respiratory illness, alterations in the lungs' defences, increased cardiovascular disease.

Sulphur dioxide has numerous industrial and commercial uses, such as: food additives, lubricant, adhesive, disinfectant, refrigerant, bleach.

Sulphur dioxides are considered indirect greenhouse gases, along with nitrogen oxides, carbon monoxides, and non-methane volatile organic compounds (VOCs). An indirect greenhouse gas has an effect on atmospheric warming through either chemical reaction or changing the Earth's capability to balance radio-active energy. Sulphur dioxide is a contributor to aerosols, which can absorb solar radiation and warm the atmosphere or cool the atmosphere by creating cloud droplets that reflect sunlight. Coal is the primary fuel for electricity generation in India and its usage is continuously increasing to meet the energy demands of the country.

SO₂ emissions from coal combustion mainly depends on the Sulphur content in the coal unlike the emissions of CO₂ and NO which depends on the operating conditions and the design of the plant. Sulphur content in Indian coal is much lower compared to the coal in the United States. Table 1A and 1B gives the elemental analysis of coal used in power plants in India and shows the Sulphur content as less than 0.5% compared to 1.8 % Sulphur content in USA (Ohio) coal¹⁴ (Visuvasan et al., 2005), though lignite has higher Sulphur content. Acid rain by SO₂ emissions is presently not observed but may become a problem in future with increasing use or blending of Indian coal with imported coal of higher Sulphur content.

Power plant combustors operate at temperatures usually around 1200 K. These temperatures are above the thermal decomposition temperature of calcium Sulphate; it does not serve as a Sulphur retaining agent. The small amount of Sulphur found in power plant coal ash is of no practical significance in reducing SO₂ emissions to the atmosphere²³ (Rees et al., 1966). Hence in these estimates all the Sulphur in the coal is considered to have been converted to SO₂. [Moti L. Mittal Department of Environmental and Occupational



Health, University of South Florida, Tampa, Florida, USA Chhemendra Sharma and Richa Singh]

As fine particles, Sulphate aerosols have major impacts on climate because they can reflect incoming solar radiation and act as cloud condensation nuclei (CCN) that modify the microphysical properties of clouds. SO₂ is also a regional and global issue because Sulphate has a long atmospheric lifetime and can be transported long distances. Driven by the rapid economic development, SO₂ emissions from India have been continuously increasing over the past two decades. On the basis of the most recent emission estimates, 4,8,9 India has surpassed the U.S. to be the world's second largest SO₂ emitting country, after China, since 2010. [Zifeng Lu,^{*},[†] David G. Streets,[†] Benjamin de Foy,[‡] and Nickolay A. Krotkov[§]]

This paper presents emissions of Sulphur dioxide (SO₂) from thermal power plants in India for a period of nine years from 2001-02 to 2009-10.

OBJECTIVES

1].SDG 13 intends to take urgent action in order to combat climate change and its impact. Climate change threatens people with increased flooding, extreme heat.

Increased food and water scarcity, more disease, and economic loss. Human migration and conflict can also be a result. Many climate change impacts are already felt at the current 1.2 °C (2.2 °F) level of warming. Additional warming will increase these impacts and can trigger tipping points, such as the melting of the Greenland ice sheet. Under the 2015 Paris Agreement, nations collectively agreed to keep warming "well under 2 °C". However, with pledges made under the Agreement, global warming would still reach about 2.7 °C (4.9 °F) by the end of the century.

2] EPA research improves knowledge of the impacts of climate change on human health and the environment. The scientific information and tools can be used by communities to effectively, equitably and sustainably tackle the climate crisis.

3] Climate action plans typically include targets for reducing greenhouse gas emissions and detailed steps for meeting and tracking those targets. Plans may also include elements such as resilience strategies and clean energy targets.



4] Climate actions plans are a tool that is being utilized by many different governing bodies to set specific, effective, and track able targets for greenhouse gas emissions reductions and mitigation actions. These plans give the public and businesses the ability to track and weigh in on present and future actions against climate change.

5] The goals of climate change adaptation are to reduce risk and vulnerability to climate change, strengthen resilience, enhance well-being and the capacity to anticipate, and respond successfully to change. The impacts of climate change affect people and nature in many different ways requiring different adaptation actions. The goals for these adaptation actions can relate to health, water or food security, jobs and employment, poverty eradication and social equity, biodiversity and ecosystem services at international, national, and local levels.

6] The available evidence suggests that current adaptation efforts may be insufficient to help ensure sustainable development in many communities worldwide even under the most optimistic greenhouse gas emissions scenarios. Climate change adaptation is, therefore, urgent to the extent that meeting important societal goals requires immediate and long-term action by governments, business, civil society, and individuals at a scale and speed significantly faster than that represented by current trends.

CONCLUSION

1] From the above analysis we have seen that, India is an environmentally rich country and to maintain the concept of sustainable development she cannot neglect the environment. The socio-economic pressures on environment should be minimized by decreasing population pressures, increasing literacy and organizing more environmental awareness and poverty alleviation programmes. Poor people are dependent on natural resources for their daily necessities, so they have to be engaged in environmental restoration like forest management, managing waste materials, recycling and also in other environment management strategies which create incentives for them for limited use of natural resources. Secondly, the developmental activities should be carried out by using environmental friendly technologies or clean technologies. Thirdly, a country's institutional



capacity to implement and enforce environmental governance is a key consideration which has worked against the efficiency of the regulatory agencies in India.

2] This study will keep on projecting greener and eco-friendly technologies for saving and sustaining our environment and Society for Environmental Sustainability will also keep a closer watch on the developments around the globe, in relation to the Sustainable Development Goals.

3] Geographically, the distribution of coal-fired power plants is relatively uniform across the country except for the north eastern states. Uttar Pradesh, Orissa, Gujarat, Chhattisgarh, Maharashtra, and Tamil Nadu are the six states with power-plant emissions >500 Gg SO₂ in 2012, and together, they accounted for 60% of total emissions in that year. The emission increment is highest in Chhattisgarh (330 Gg in eight years), followed by Gujarat (318 Gg) and Orissa (300 Gg). Delhi is the only state where the SO₂ emissions in the power sector have decreased in the past few years, mainly due to the conversion of coal-fired plants to gas-fired ones and the relocation of big power plants outside of the city of New Delhi.

4] From the above analysis we have seen that, India is an environmentally rich country and to maintain the concept of sustainable development she cannot neglect the environment. The socio-economic pressures on environment should be minimized by decreasing population pressures, increasing literacy and organizing more environmental awareness and poverty alleviation programmes. Poor people are dependent on natural resources for their daily necessities, so they have to be engaged in environmental restoration like forest management, managing waste materials, recycling and also in other environment management strategies which create incentives for them for limited use of natural resources. Secondly, the developmental activities should be carried out by using environmental friendly technologies or clean technologies. Thirdly, a country's institutional capacity to implement and enforce environmental governance is a key consideration which has worked against the efficiency of the regulatory agencies in India. Moreover, co-operation is needed rather than competition between the countries, non-exploitation motivation should be encouraged and export and import operation should be encompassed without jeopardizing the environment as well as biodiversity. Environmental degradation produces unsustainable development and alleviation of poverty is a non-separable element



of sustainable development. Poverty alleviation can no longer be kept for trickledown effect.

REFERENCES

Balakrishnan, M (1993): Environmental Problems and Prospects in India, pp 1-93, Oxford and IBH Publishing Co. Ltd., New Delhi.

Bhattacharya, Rabindra N. (ed 2001): Environmental Economics – An Indian Perspective, Oxford University Press, New Delhi.

Census of India 2001, Series-1 India, Paper-1 of 2001; Census Results, Occasional Paper No. 1 of 1993, Census of India, Govt. of India, New Delhi.

Central Pollution Control Board (from 1983 to 2003): Annual Report, Government of India
Central Water Commission (CWC) 1998, Water Statistics of India, Delhi, India: Central Water Commission. [Development goal 2030]

Arora NK, Fatima T, Mishra I, Verma M, Mishra J, Mishra V (2018) Environmental sustainability: challenges and viable solutions. *Environ Sustain* 1(4):309–340 Bastin L, Gorelick N, Saura S, Bertzky B, Dubois G, Fortin MJ, Pekel JF (2019) Inland surface waters in protected areas globally: current coverage and 30-year trends. *PLoS One* 14:e0210496 Boden TA, Marland G, Andres RJ (2017) Global, regional, and national fossil-fuel CO₂ emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, US Department of Energy, Oak Ridge, Tenn. USA. http://cdiac.ess-dive.lbl.gov/trends/emis/meth_reg.html Flitcroft R, Cooperman MS, Harrison IJ, Jufe-Bignoli D, Boon PJ (2019) Theory and practice to conserve freshwater biodiversity in the Anthropocene. *Aquat Conserv*. <https://doi.org/10.1002/aqc.3187> Independent Group of Scientists appointed by the Secretary-General, Global Sustainable Development Report (2019) The future is now—science for achieving sustainable development. United Nations, New York Sachs J, Schmidt-Traub G, Kroll C, Lafortune G, Fuller G (2019) Sustainable development report 2019. Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN), New York World Wide Fund for Nature (2014) Living planet report. In: McLellan R, Iyenger L, Jefries B, Oerlemans N (eds) Species and spaces, people and places. Gland, Gland WWF World Wide



Fund for Nature (2018) In: Grooten M, Almond REA (eds) Living planet report-2018: aiming higher. Gland WWF, Gland Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

[2000-2011] Amann M (ed) 2012 Future Emissions of Air Pollutants in Europe—Current Legislation Baseline and the Scope for Further Reductions. TSAP Report No 1 (Laxenburg, Austria: International Institute for Applied Systems Analysis (IIASA))
(<http://gains.iiasa.ac.at/images/stories/reports/TSAP/TSAP-BASELINE-20120613.pdf>)

Gottwald M and Bovensmann H (ed) 2011 SCIAMACHY— Exploring the Changing Earth's Atmosphere (Dordrecht: Springer) (doi:10.1007/978-90-481-9896-2) Granier C et al 2011 Evolution of anthropogenic and biomass burning emissions of air pollutants at global and regional scales during the 1980–2010 period *Clim. Change* 109 163–90 Hsu N C, Gautam R, Sayer A M, Bettenhausen C, Li C, Jeong M J, Tsay S-C and Holben B N 2012 Global and regional trends of aerosol optical depth over land and ocean using SeaWiFS measurements from 1997 to 2010 *Atmos. Chem. Phys.* 12 8037–53

Garg, A.; Shukla, P. R.; Kapshe, M. The sectoral trends of multigas emissions inventory of India. *Atmos. Environ.* 2006, 40, 4608–4620

Kurokawa, J.; Ohara, T.; Morikawa, T.; Hanayama, S.; Greet, J. M.; Fukui, T.; Kawashima, K.; Akimoto, H. Emissions of air pollutants and greenhouse gases over Asian regions during 2000–2008: Regional Emission inventory in ASia (REAS) version 2. *Atmos. Chem. Phys. Discuss.* 2013, 13, 10049–10123.