

Air Pollution: A New Approach on Global Warming

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Abstract: - In a move to curb pollution from the coal-based power sector. The Union Ministry of Environment, Forest and Climate change (MOEF&CC) had announced new emission limits for power stations, both existing and upcoming. The enhanced pace of developmental activities after industrial revolution i.e. 18th century and rapid urbanization have resulted in stress on natural resources and quality of life. Pollution is now a common place term that our ears are attuned to. We hear about the various forms of pollution and read about it through the mass media. Air pollution is one such form that refers to the contamination of the air, irrespective of indoors or outside. A physical, biological or chemical alteration to the air in the atmosphere can be termed as pollution. Thus air pollutants are substances emitted into the air from an anthropogenic, biogenic, or geogenic source, that is either not part of natural atmosphere or is present in higher concentrations than the natural atmosphere, and may cause a short term or long term adverse effect. It occurs when any harmful gases, dust, smoke enters into the atmosphere and makes it difficult for plants, animals and humans to survive as the air becomes dirty. A WHO report released in May 2014 showed that most of Indian cities are death traps due to very high air pollution levels. The urban air quality database of WHO, covering 1600 cities across 91 countries showed that Indian cities are among those with highest levels of (Particulate Matter) PM 10 and PM 2.5 and less. Black carbon is also a kind of particulate matter, responsible for global warming.

I. INTRODUCTION

Air Pollution is principally caused by the industrial activity. Most industries consume lots of Coal or petroleum products and their burning produces various gaseous pollutants. SO_2 , CO and CO_2 are the common pollutants produced by this activity. This is one of the serious environmental concern of the urban Asian cities including India where majority of the population is exposed to poor air quality. The poor are often the most affected segment of the population as they do not have adequate measures to protect themselves from air pollution. Most of the Indian Cities are also experiencing rapid urbanization and the majority of the country's population is expected to be living in cities within a span of next two decades. Since poor ambient air quality is largely an urban problem this will directly affect millions of the dwellers in the cities. Recent studies published in American Association For The Advancement of Science (AAAS, 2016) shows that 55 lacks people are killed worldwide every year due to air pollution. Out of which more than 25

lacks are from developing countries like India and China. In 2013 China witnessed with 16 lacks death while India with 14 lacks in 2014. The study was carried in 188 countries in between 1990 to 2013.

Human activities are releasing tiny particles, aerosols into atmosphere into large quantities. The Indian and global modeling studies show that aerosols enhancing scattering and absorption of solar radiation and also produce brighter clouds that are less efficient at releasing precipitation. Despite fatal effect of these tiny particles, Indian government has taken very little initiative to curb vehicular emissions, a major source of particulate matter. The Auto Fuel Vision and Policy – 2025 report, submitted by an expert panel to the government in May 2014, recommended upgrading to Bharat Stage (BS) VI auto fuels by 2024. But even if this costly transition is effected, India will be behind European standards by 10 years. More recently, the Environment Pollution (prevention and Control) Authority, advises the Supreme Court on pollution in the National Capital Region, recommended the entire country should move to BS VI standards by 2020. But there is very little progress on ground.

II. HUMAN ACTIVITY AND AEROSOLS

New Science shows that the core of particulate matter – black carbon – is responsible for increasing global warming, changes in atmospheric thermal structure, surface cooling, disruption of regional circulation systems such as the monsoons, suppression of rainfall, and less efficient removal of pollutants. Diesel vehicles releasing 25% of the total black carbon emissions while other sources are biomass based cook-stoves, industrial sources like cook ovens and brick kilns.

Until 1950s the extra-tropical regions played a dominant role in emissions of aerosols, but since the 1970s the tropical regions have become major contributors to aerosol emissions, particularly black carbon. The chemistry and hence the radioactive effects of aerosols emitted in the extra-tropics are very different from that of the aerosols emitted in the tropics. Black carbon belongs to a basket of pollutants commonly called short lived climate forces (SLCFs). Besides their short life in the atmosphere, these are harmful for health and also cause significant warming.

III. BLACK CARBON AND GLOBAL SOLAR HEATING

The six greenhouse gases i.e. “Kyoto six” (GHGs) listed by the International Panel on Climate Change (IPCC) include the very long lived carbon dioxide (CO₂), the key target of climate mitigation, methane(CH₄), nitrous oxide(NO_x), sulfur hexafluoride(SF₆), and two fluorocarbons(CFCs). While CO₂ stays in the air for more than 100 to 500 years, methane and nitrous oxide live for 12 to 20 years. IPCCs recent report shows that black carbon is 800 times more potent than CO₂ over a 100 year period. The combined effect of SLFCs with CO₂ mitigation could accelerate attainment of the 2°C temperature rise stabilization target. Here CO₂ is responsible for 75% of the warming, and SFLCs responsible for the remaining quarter. While CO₂ warm the atmosphere for longer time, short, frequent high intensity spikes caused by SLFCs.

Black carbon also accelerate ice-melt rate when it settles on snow. Bright snow surfaces reflect a high amount of solar energy back into space, out of which substantial fraction is absorbed by black carbon and get emitted later on. Himalayas and Arctic are, therefore, vulnerable. Black carbon is also interfere with cloud formation and rainfall pattern. It is assumed that the large reduction of absorbed solar radiation by the land and sea surface due to interception of sunlight by aerosols should lead to an overall reduction of rainfall. Numerous climate model studies have been published which suggest that inclusion of the aerosol dimming can help to explain the Sahelian drought, the decrease in Indian monsoon rainfall and the north - south shift in east Asian rainfall.(Andreae et al,2005; Ramnathan et al, 2001).

IV. COMPAING WARMING IMPACTS OF GHGs AND SLFCs

It is very difficult to compare global warming potential (GWP) of long lived CO₂ with short lived SLFCs. If GWP of CO₂ over 100 years is one then that of black carbon is 846. A short time horizon like 20 years will capture all of black carbon’s radiative forcing because it is short lived – few hours to few days. So SLFCs radiative forcing is regionally concentrated. It also travel short distances and create hot spots and vary according to local conditions. A comperative GWP under Kyoto protocol action to reduce GHGs is evaluated using the 100 year global warming potential metric. The effect of CO₂ over 100 year has been given a GWP value of one. GWP of all other pollutants are compared in relation to CO₂) table 1.

Table – 01: GLOBAL WARMING POTENTIAL (GWP)

Pollutants	GWP, 20 years	GWP, 100 years
Carbon dioxide	1	1
Carbon monoxide	18.6	5
Sulphur dioxide	-268	-71
Nitrogen oxide	-560	-149
Fossil methane	85	30
Nitrous oxide	264	265
Black carbon	3200	846

Organic carbon	-160	-43
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Sources : IPCC

V. SOURCES OF EMMISIONS

Organization like TERI, UNEP/ WHO, World Bank, BARC/CESE/IIT, etc have carried out studies in the past to estimate the contribution of various sources towards the ambient air quality. Black carbon is a product of incomplete combustion and comes from a variety of sources, including open burning, biomass based cook stoves, industrial sources like coke ovens, brick kilns, and diesel vehicles. However, climate science says all particles do not warm. Some cool too. Among various fractions of particulate matter, organic carbon and sulphate have cooling effect as they are light – reflecting. But black carbon is light absorbing. Therefore net effect depends upon their ratio. Biomass-based cook stoves of the poor have a mix of both warming and cooling pollutants. However, evidences are stronger on the net warming impacts of diesel vehicles and brick kilns.

Transport sector, dominated by Diesel combustion, is responsible for as much as 25% of global black carbon emissions. Total emissions from petrol vehicles are less than 10% of diesel black carbon emissions. WHO brands diesel particles as class-I carcinogen for their strong link with lung cancer. India has implemented Euro IV in about 30 cities, about 10 years behind Europe and Euro III in the rest of the country, about 15 years behind Europe. However, it has been observed that even under Euro IV particle standards diesel vehicles may still warm the climate over the next 100 years (Mark Z Jacobson of Stanford University).

In USA transport black carbon constitutes 52% of the total emissions while in Europe where diesel vehicles are 50 – 70 per cent, diesel black carbon accounted for 43% of black carbon emissions in 2010 as against 20% global average (International Council on Clean transportation). Black carbon reduction technologies become effective for cars at Euro V level and for heavy duty vehicles at Euro VI level.

VI. GLOBAL CONTRIBUTION

The developed nations are the biggest emitters of CO₂ may now blame developing countries that they burn fuels inefficiently. The UNEP Integrated Assessment Report of 2012 shows that Northeast Asia, Southeast Asia and the Pacific account for the largest share of global black emissions. China accounts for 60 – 80 per cent of the emissions in the region. North America and Europe account for the second largest share.

VII. REQUIRES CAUSUS APPROACH

Scientists such as Veerbhadrhan Ramanathan of the Scripps Institution of Oceanography, University of California, San Diego, have concluded that the effect of nearly 40% of the warming by CO₂ is masked by cooling particles like

sulphates. Therefore the aggressive air pollution control will remove both cooling and warming particles and net effect of warming due to CO₂ will be more aggressive. A group of scientists in the 2014 Proceedings of the National Academy of Sciences stats that reducing the emissions of SLCFs can reduce the rate of warming in the short term but will only have a limited effect on long term warming, driven mainly by CO₂ emissions. So measures to control short lived forces are no substitute for early and stringent CO₂ mitigation.

VIII. CONCLUSION

The rapid urbanization in India has resulted in a tremendous increase in the number of motor vehicles which are the main source of air pollution in urban India. The vehicle fleets have even more than doubled in most of cities in the last one decade. This increased mobility, however, come with a high price. Although, the air quality can be improved through a combination of technical and non-technical measures, legislative reforms, institutional approaches and market-based instruments. There are certain unique challenges which the country has to face in tackling the problem of urban air pollution. These include, the transport features which are different from the developed countries particularly in terms of the types of vehicles commonly used, the manner in which the road network is operated and sharing of the limited space by pedestrians and non-motorized modes with modern vehicles in Indian cities. Vehicles in India are often much older and usually comprise technologies considered as out-dated in the developed world. The institutions responsible for managing urban air quality are also not as well developed as those in the developed countries. The country has however taken a number of measures for the improvement of the air quality in cities.

These include, right from the improvement in the fuel quality, formulation of necessary legislation and enforcement of vehicle emission standards, improved traffic planning and management etc. The non-technical measures taken include, awareness raising regarding the possible economic and health impacts of air pollution and available measures for improving air quality, increasing use of cleaner fuels and purchase of vehicles with advance emission control devices, increasing institutional framework and capacity building for the monitoring of vehicle emissions. Other sources of air pollution increase are cocking with burning of wood, cow dung, and other things.

After a long wait, Union Environment Ministry finally released the first ever draft proposal on Air Quality Index (AQI) and health alert for public comments in October 2014. The proposed AQI is an important step to achieve clean air standards and reduce public health risk.

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