URBANIZATION AND METHANE EMISSIONS IN INDIA

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abstract

As land cover , urban settlement represents the most profound alteration of the natural environment (in the flows of energy ,water , and materials) through the imposition of structures , buildings , paved surfaces , and compacted bare soils on the earth's surface .The mere existence of built features in a urban settlement alters the incoming solar energy , the rainwater from the clouds ,and the wind to different paths , leading to pollution and biodiversity loss . While most such changes or environmental impacts are often seen at the spatial scale of a field or a homestead , these discrete changes reach a global dimension by patchwork addition , in a process identified as ***globally cumulative*** (Turner et al .1990b). India lost about 1.5 million ha of land to urban growth from 1955 to 1985 , and a further 0.8 million ha added by the year 2000. The percentage of people in urban areas has been growing , the size of large settlements has been increasing enormously , their nature has been changing , and to some extent urban and rural areas have become less distinct particularly in the metro regions . Urban impacts occur within cities, around cities ,downwind and downvalley , and even long distances away . One of the impacts of urbanization with a global dimension is the emissions of methane . Concentration of methane in the atmosphere is increasing rapidly. Its strong ability to absorb infrared radiation, combined with its relatively short atmospheric lifetime of 10 years (as against 50-200 years for carbon dioxide), makes its control an important opportunity for mitigation of climate change It is estimated that 525 Tg methane is emitted per year into the atmosphere from all natural and anthropogenic sources . Atmospheric methane concentrations have been measured directly since 1978 when the globally averaged value was 1.51 ppmv. Currently, methane concentration in the atmosphere is 1.72 ppmv, corresponding to an atmospheric reservoir of about 4,900 Tg (1Tg = 1012g), and it is increasing at the rate of 14.617 ppmv per year (40 to 48 Tg per year) or 0.8 to 1.0 percent per year. The atmospheric concentration of methane in the Northern Hemisphere is 1.76ppmv, compared to 1.68ppmv in the Southern Hemisphere.While methane's concentration in the earth's atmosphere is small, it has a significant contribution to future global warming because it is a potent greenhouse gas with its global warming potential 21 times more than that of carbon dioxide. Methane currently contributes over 15 percent to the change in radioactive

forcing (global warming) from 1980 to 1990.The major anthropogenic sources of methane emissions include rice cultivation, livestock and other animals, biomass burning, coal mining, oil and gas systems, and waste disposal and landfills .In India, ironically, only a small fraction of the total waste generated is disposed of through the various disposal techniques available; a large part of the waste is simply dumped in open dump-yards. Decomposition of solid waste, when dumped into dump-yards without any disposal, gives rise to the generation of methane, which is a greenhouse gas and responsible for global warming, climate change and related impacts. The problems are already acute in cities and towns as disposal facilities are not keeping pace with the quantum of waste generated. According to the Central Pollution Control Board), the daily per capita generation of solid waste in small, medium and large cities/towns is about 0.1 kg, 0.3 to 0.4 kg and 0.5 kg, respectively. Twenty-three metropolitan cities, which contain as much as 32.5 percent of the urban population according to the 1991 Census, are the major contributors to the total waste generated in the country. 23 cities together generate 37.7 thousand tons out of 65.37 thousand tons of solid waste generated every day in urban areas of the country.In view of these facts, management of solid waste is primarily an urban environmental issue in India..

INTRODUCTION

Methane currently accounts for over 15 percent of expected future warming from climate change. Its global atmospheric concentration, which continues to rise, has more than doubled over the last two centuries after remaining fairly constant for the preceding 2,000 years. One of the impacts of urbanization with a global dimension is the emissions of methane . While methane's concentration in the earth's atmosphere is small, it has a sizable contribution to potential future warming because it is a potent greenhouse gas and because methane's concentration in the atmosphere has been increasing rapidly. Its strong ability to absorb infrared radiation, combined with its relatively short atmospheric lifetime of 10 years (as against 50-200 years for carbon dioxide), makes its control an important opportunity for mitigation of climate change It is estimated that 525 Tg methane is emitted per year into the atmosphere from all natural and anthropogenic sources . Atmospheric methane concentrations have been measured directly since 1978 when the globally averaged value was 1.51 ppmv. Currently, methane concentration in the atmosphere is 1.72 ppmv, corresponding to an atmospheric reservoir of about 4,900 Tg (1Tg = 1012g), and it is increasing at the

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EMISSIONS IN INDIA

India is currently the sixth largest and second fastest growing greenhouse gas contributor to climate change in the world. Also is the second most populous country in the world. It forms a natural subcontinent with distinct climatic zones covering an area of 328.7 million hectares and is inhabited by 853 million people (as per the1991 census). Divided into 25 state and union territories, 80% of the population still live in villages. However, with rapid industrialization, urbanization is accelerating in the four metropolitan cities of NewDelhi, Calcutta, Mumbai, and Chennai. The Himalayan range lies to the north and has a great bearing on the climate of the country. The regions in the foothills of the Himalayas have thick forests and a cold climate. On the east and west of the country lie two sections of the Indian ocean, the Arabian sea and the Bay of Bengal, receiving the drainage of some of the largest rivers, such as the Ganges, the Indus, and the Brahmaputra, which flow through the subcontinent. Much agricultural activity takes place on the fertile alluvial soils of the Gangetic plains which extends from Punjab in the North to West Bengal in the East. India’s climate ranges from temperate to tropical .

India is currently the sixth largest and second fastest growing GHG contributor to climate change in the world . Comparatively, the developed world is emitting 33 times more CO2emissions. In 1989, New Delhi hosted a conference on climate change and shortly thereafter ,the Global Warming and Climate Change Institute was established through the Tattoo Energy Research Institute (TERI) to address these problems in India. According to TERI, India’s carbon dioxide emissions have been increasing by 6% per year. Total emissions have increased tenfold since 1950. Emission levels follow economic growth, which has increased energy consumption. Energy consumption has led to both economic development and to the by-product of that development, environ-mental degradation. Industry, in turn, maybe vulnerable to climate change impacts . Factories along the coast are vulnerable to sea-level rise and greater government limitations on GHG emissions

and smog forming pollutants. In 1996, 595 Tg/yr of CO2emissions were from coal power generation alone. Power generation, as a GHG source , is the single biggest source of carbon dioxide emissions in India. In 1997, total CO2emissions from India contributed to 4% of the world's carbon, or 237 million metric tons of carbon emissions .If coal continues to be used at today's pace, emissions are projected to increase to 775million metric tons per year, as compared to the billion metric tons of power per year generated in the entire European Union .While per capita emissions are low at .3metric tons of carbon per capita (compared to 6 metric tons per capita in the U.S.) , cumulative CO2emissions are so compelling that the figure has drawn international attention. The high demand comes in large part from the industrial sector rather than the residential sector. Because the industrial sector is one of the largest consumers of power in India, it is clear that industry is inextricably linked to rising greenhouse gas emissions levels in India .On the one hand, India has low per capita emissions (33 times less than developed countries), but its cumulative emissions are some of the highest in the world . India's most notable activity in fulfilling its commitment to inventory development has been the Climate Change in Asia: India Country Report and the Asia Least-Cost Greenhouse Gas Abatement Strategy(ALGAS), implemented by the Asia Development Bank (ADB). India prepared its first inventory of greenhouse gas emissions in 1991 and issued an update in 1992under the ADB Country Report. Presently another inventory is being completed by the government-owned National Physical Laboratory and is being coordinated by the independent Tata Energy Research Institute funded by ALGAS. This inventory is more comprehensive than the two earlier versions, addressing sources of emissions that were not considered before and also introducing IPCC methodologies for comparison .Greenhouse gases included in this study areCO2, CH4, N2O and CO. The inventory does not include aerosols. This study estimate forecasts of CO2and CH4 emissions for the years 2000, 2010 and 2020, though currently no internationally agreed methodology exists. The CH4 emission projections include emissions from enteric fermentation in animals, emission from animal manure and emissions from rice cultivation. The study includes an analysis of various CO2reduction mitigation options consistent with national development objectives.

India is largely dependent on fossil fuels for its energy requirements. At present, coal accounts for about 60% of fossil fuel use in calorific terms followed by petroleum products (30%) and the remaining by natural gas. The relative emission of carbon dioxide (CO_2) for 1989-90 from coal, petroleum products and natural gas were estimated at 328.4 Tg/yr (65%), 162.7 (32%) and 17.5 (3%) respectively. Electricity generation in India accounts for the largest share of coal consumption as out of the total installed electricity generation capacity 70% is coal-based. Though

the major energy requirements of the country are met by fossil fuel sources, 72% of the Indian population lives in rural areas dependent on agricultural and related activities, use biomass resources like wood, agricultural crop residues, dung-cakes etc. for energy. In India, the amount of biomass burnt annually is estimated to be about 426 Tg or about 6.3% of the global level of 6800 Tg/yr. India also has a large cattle population that contributes around 40% to total methane emissions from the country . Industrial growth and increasing urbanization in India have led to associated environmental changes. The vehicular population has grown at around 13% per year during the last decade. Motor vehicles are estimated to contribute 8% of the total fossil fuel related CO_2 emissions in India against the world average of approximately 15%*)*. A variety of industrial processes, which transform materials by physical or chemical processes, are responsible for emissions of various greenhouse gases like CO_2, CH_4 and N_2O. (*Compiled from NATCOM resource documents)*

Urbanization and Landfills

The urban human population has nearly doubled from110 million in 1971 to 217 million in1991 and is expected to reach 325 million by the year 2000. In proportion, the number of vehicles in India has increased from20 million in 1990 to more than 26 mil-lion in 1994 and is expected to reach 50million in 2001. Landfills worldwide are estimated to produce 20 to 60 teragrams (Tg)(2) of methane per year, as a direct result of the natural decomposition of the organic component of waste streams. About two-thirds of these emissions are estimated to come from the more developed countries of the world, with eleven countries currently representing about 70 percent of global emissions. The United States is by far the largest emitter, followed by the People's Republic of China, Canada, Germany, the United Kingdom, and the Commonwealth of Independent States (CIS). The relative contribution of the developing countries is rapidly changing, however. With continuing trends in population growth and urbanization, developing countries could account for 30 to 40 percent of methane emissions from this source by 2000. In addition, economic growth may increase emissions from non-OECD countries.

The major anthropogenic sources of methane emissions include rice cultivation, livestock and other animals, biomass burning, coal mining, oil and gas systems, and waste disposal and landfills .In India, ironically, only a small fraction of the total waste generated is disposed of through the various disposal techniques available; a large part of the waste is simply dumped in open dump-yards. Decomposition of solid waste, when dumped into dump-yards without any disposal, gives rise to the generation of methane, which is a greenhouse gas and responsible for global warming, climate change and related impacts. The problems are already acute in cities and towns as disposal facilities are not keeping pace with the quantum of waste generated. According to the Central Pollution Control Board), the daily per capita generation of solid waste in small, medium and large cities/towns is about 0.1 kg, 0.3 to 0.4 kg and 0.5 kg, respectively. Twenty-three metropolitan cities, which contain as much as 32.5 percent of the urban population according to the 1991 Census, are the major contributors to the total waste generated in the country. 23 cities together generate 37.7 thousand tons out of 65.37 thousand tons of solid waste generated every day in urban areas of the country. In view of these facts, management of solid waste is primarily an urban environmental issue in India..

Conclusion

As per the USEPA report , there is substantial uncertainty exists in estimates of methane emissions from the major sources and the potential for reducing these emissions through economically viable projects and programs, it is clear that there are a number of economically viable opportunities to reduce methane emissions from these sources in countries around the world.

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