

Assessment of atmospheric pollution reduction: Challenging issue for developing countries

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Abstract—Air pollution has been a menace in recent years posing serious threats to environmental and social wellbeing. One death out of every eight global deaths was linked to polluted air. The review of literature in the existing body of knowledge becomes paramount in order to continue with the research on the subject matter. The study will enable the road map for the assessment of the challenging issues related to atmospheric pollution in developing countries. A total number of thirty-five studies relevant to atmospheric pollution were selected out of the total number of fifty studies. The review of literature looked into details on different views from various scholars about the challenges faced by developing countries on air pollution and appropriate control measures. Discussion was also in the various countries that are on the priority list of industrial technologies for protection and exploitation of developed technologies, as well as the forms of technologies for future air pollution control measures. The findings from the literature review showed that the environmental health risk facing the world now is air pollution. This has resulted in the death of millions of people. It was also mostly mentioned that outdoor air pollution exposure levels have risen significantly in some parts of the world, particularly in countries with large populations' growth through rapid industrialization, such as China and India. The paper presented the assessment of atmospheric pollution reduction: a challenging issue for developing countries. The evidence in literature signals the need for concerted effort to clean up the air we all breathe to save millions of lives.

Keywords—Atmospheric pollution, challenging issues, developing countries.

I. INTRODUCTION

Environmental pollution has been one of the many challenges facing the world. Many people in the developing

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countries are affected by ill health that lead to disabilities of millions and death of people every year [1]. This is as a result of the impact of pollution which is more severe in developing countries. Air pollution has become one of the world's biggest threats to the future of our planet. Chronic air pollution shortens our lives and the lives of the ecologies around us. In parts of Asia, where air pollution is most pervasive, food crops and other plants are exhibiting signs of stress due to low air quality [2]. Air pollution in developing countries is derived not only from stack emission of pollutants from relatively large industries, like iron and steel, non-ferrous metals and petroleum products industries, but also from fugitive emission of pollutants from small-scale factories, such as cement mills, lead refineries, chemical fertilizer and pesticide factories, where inadequate pollution control measures exist and pollutants are allowed to escape into the atmosphere [3]. Air pollutant associated with climate change is sulfur dioxide, a component of smog. Sulfur dioxide and closely related chemicals are primarily known as a cause of acid rain. There are different kinds of pollution - some visible, some invisible - that contribute to global warming.

The most familiar and obvious form of air pollution is smog hanging over cities. Smog fills the air over the streets of Beijing Officials in China are dealing with a serious problem that's affecting people's health. At certain times, the air in big cities such as Shanghai is so polluted people cannot go outside [4]. Industrialization is an essential feature of economic growth in developing countries. Industrialization and its practices may also produce adverse environmental health consequences. China and other Asian countries face some additional environmental problems due to rapid economic development. One is the environmental pollution from hazardous industries or technologies transferred from developed countries, which are no longer acceptable for occupational and environmental health reasons in developed countries, but still allowable in developing countries due to looser environmental legislation [5]. This may be due to less attention given to environmental protection, inappropriate environmental standards inappropriate or not effectively implemented, and pollution control techniques not fully developed. In China, more than 70% of total energy consumption relies on direct coal combustion, from which large amounts of pollutants (suspended particulates, sulphur dioxide, etc.) are emitted under incomplete combustion and inadequate emission controls [5]. Any substance that people introduce into the atmosphere that has damaging effects on

living things and the environment is considered air pollution. Efforts have been made by industrialized countries for several years to reduce levels of sulfur dioxide, smog, and smoke in order to improve people's health. The result is only realized recently that the lower sulfur dioxide levels may make global warming worse. Just as sulfur dioxide from volcanoes can cool the planet by blocking sunlight, cutting the amount of the compound in the atmosphere lets more sunlight through, warming the Earth. This effect is exaggerated when elevated levels of other greenhouse gasses in the atmosphere trap the additional heat. Despite the progress made in the last 30 years, millions of people live in countries with monitor data showing unhealthy air for one or more of the six common air pollutants [6]. The exposure levels of the general population in developing countries are usually higher than that in developed countries, where air pollution is more strictly controlled, and resident areas are usually far from industries. The reason being that developing countries do not have the resources and technologies to combat pollution. The environmental pollution may halt the development and competitiveness of developing countries who depend on natural resources for their economic growth. Developing countries desire to ensure energy for all at a competitive price to achieve and sustain economic growth and poverty reduction [1]. As discussed further in this paper, a large number of epidemiological studies have already showed the close association of reduction in pulmonary function and increased incidence of chronic respiratory diseases among residents with long-term exposure to the common air pollutants [5]. The dirty air, known as smog, is a combination of weather conditions, fumes and smoke from cars and factories (6 Minute English, 2014). Volcanic eruptions can spew massive amounts of sulfur dioxide into the atmosphere, and sometimes causing cooling that lasts for years. The byproduct of the booming economy of China has led to the emit ion of more carbon dioxide [6]. The kinds of air pollutants emitted vary from industry to industry. The concentrations of different pollutants in the atmosphere also vary widely from process to process, and from place to place with different geographic and climatic conditions. It is hard to estimate specific exposure levels of various pollutants from various industries to the general population in developing countries, as elsewhere [5]. The World Health Organization (WHO) recently released estimates on air pollution, revealed that there were 7 million recorded premature deaths attributed to air pollution in 2012, a number more than double previous estimates. WHO's newly computed estimates confirm the placement of air pollution as the world's most severe environmental health risk [2]. EPA has implemented stricter standards and enforced greater penalties on big polluters in an effort to curb the activity. These strategies have all been helpful, but cities are recognizing that they need more and better technology to reverse the WHO's daunting numbers [2]. Accidental releases of toxic substances into the atmosphere resulting in serious health risks are usually more common in developing countries. In 1984, leaking isocyanide in Bhoja, India killed 2,000 people [3]. This paper presents an

investigation into atmospheric pollution reduction: a challenging issue for developing countries. It began with a discussion of threats of air pollution to environmental and social wellbeing, the challenging issue for developing countries and impact of air pollution in China. This is followed by the ten "strong measures" to control air pollution in China, and policy reformation and technological innovations. Finally, efforts by various governments and authorities to control air pollution.

The study addresses the following questions: How does air pollution affect the environment and social wellbeing? What are the challenging issues of air pollution for developing countries? What is the impact of air pollution on China, as a developing country? What are the policy reformation and technological innovations for air pollution? What efforts have the various governments and authorities done to control air pollution? From a discussion based on the key works in the literature, atmospheric pollution is explained. Different kinds of pollution and what it takes to succeed to as a country with significant pollution growth are discussed.

II. TREATS OF AIR POLLUTION TO ENVIRONMENTAL AND SOCIAL WELLBEING

With rapid development, many developing countries like China and other Asian countries, face some additional environmental problems [3]. While industrialization is an essential feature of economic growth in developing countries, industrial practices may also produce adverse environmental health consequences through the release of air and water pollutants and the disposal of hazardous wastes. This is often the case in developing countries, where less attention is given to environmental protection, and environmental standards are often inappropriate or not effectively implemented, and control techniques are not yet fully developed [3].

Air pollution affects practically everyone on the planet and causes more than 6 million premature deaths every year, according to the World Health Organization Air Pollution in Developing Countries report of 2013. Beijing was noticed to have been choked with pollutants that have registered far on the scale of acceptable levels. Beijing or New Delhi, India, had extremely unhealthy air quality levels. The health hazards of an air pollution vary, often based on how long and to how much a person is exposed. Acute effects include pneumonia while in the long term it can lead to emphysema, lung cancer, and cardiovascular diseases. Children, the elderly and those with already comprised immune systems are particularly susceptible. China has the world highest number of deaths attributed to air pollution. The World Health Organization estimated in 2007 that 656,000 Chinese died prematurely each year from ailments caused air pollution. The World Bank placed deaths related to outdoor pollution at 350,000 to 400,000 but excised those figures from a 2007 report under government pressure [7]. According to Chinese government statistics 300,000 die each year from ambient air pollution, mostly from heart disease and lung cancer. An additional 110,000 die from illnesses related to indoor pollution from

poorly ventilated wood and coal stoves and toxic fumes from shoddy construction material. The air pollution death figure is expected to rise to 380,000 in 2010 and 550,000 in 2020. The Chinese government has calculated that if the air quality in 210 medium and large cities were to be improved from "polluted" to "good" levels 178,000 lives could be saved [7]. According to the World Bank and WHO between 300,000 and 350,000 people, die from outdoor air pollution. Some think the true figure is much higher. Some estimate that indoor air pollution kills more than 700,000 people a year [7]. In December 2011, Kyodo reported: Air pollution is likely a main culprit for the almost 60 percent growth in lung cancer rates in Beijing during the past decade, China's state media reported Tuesday. "Increasing air pollution might be largely blamed" for the big rise, even though the smoking rate during the period has not seen an apparent increase. Research conducted at Beijing Institute for Cancer Research has shown that between 2000 and 2009, instances of lung cancer in the capital rose 56 percent. Health experts warn the absorption of small particles in people's lungs poses a long-lasting health danger [7]. Exposure to these pollutants is associated with numerous effects on human health, including increased respiratory symptoms, hospitalization for heart or lung diseases, and even premature death [6]. In Cubatao, Brazil 55.3% of school children had decreases in pulmonary function due to large quantities of mixed pollutants emitted from industrial pollution. A similar health effects occurred in Ulsan/Onsan in the Republic of Korea, where a special industrial zone was located [5]. Air pollution causes premature births, low-birth weight babies and depresses lungs functioning in otherwise healthy people. It has also been blamed for China's rising rates of cancer. Lung cancer is now the leading cause of death in China. In the last five years, the number of fatalities from the disease has risen 18.5 percent to 34 per 100,000 people. Air pollution is also linked to a variety of respiratory ailments. Around some factories, the asthma rate is 5 percent. It is estimated that 26 percent of all deaths in China are caused by respiratory illnesses (compared with 2 or 3 percent in the U.S.). Many people in Beijing and Shanghai get hacking coughs. In rural areas, respiratory disease is the number one killer [7].

III. CHALLENGING ISSUE FOR DEVELOPING COUNTRIES

China, the world's fastest growing economy, has earned another starting superlative: the highest annual incidence of premature deaths triggered by air pollution in the world, according to a new study [8]. China has become the world's largest emitter of mercury, carbon dioxide, and other pollutants. In the 1980s, China's particulate matter concentrations were at least 10 to 16 times higher than the World Health Organization's annual guidelines. Even after significant improvements by 2005, the concentrations were still five times higher than what is considered safe. These high levels of pollution have led to 656,000 premature deaths in China each year from ailments caused by indoor and outdoor air pollution, according to World Health Organization

estimates from 2007 [9]. A World Health Organization (WHO) report estimates that diseases triggered by indoor and outdoor air pollution kill 656,000 Chinese citizens each year, and polluted drinking water kills another 95,600 [8].

Platt [8] asserted that air pollution is estimated to cause approximately two million premature deaths worldwide per year. Damaging air pollutants include sulfur dioxide, particulate matter - a mixture of extremely small particles and water droplets - ozone, and nitrogen dioxide. China accounts for roughly one-third of the global total for these pollutants, according to. In neighboring India, air pollution is believed to cause 527,700 fatalities a year. In the United States, premature deaths from toxic air pollutants are estimated at 41,200 annually. The combustion of fossil fuels—whether to power China's many automobiles, its burgeoning factories or its expanding megacities—is a primary source of outdoor air pollutants [8]. The burning of coal or charcoal to heat homes, common throughout China, also produces a range of indoor air pollutants. Air pollution can trigger or worsen a wide spectrum of respiratory and cardiovascular ailments. WHO's air guidelines warn that pregnant women, the elderly, the sick, and young children are especially susceptible to suffering severe effects from high pollution levels [8]. Despite improvements in air quality, the economic impact of air pollution has increased dramatically. Although China has made substantial progress in cleaning up its air pollution, the economic impact on ozone and particulates in its air has increased dramatically [9]. In recent decades, China has experienced unprecedented growth with associated cost with health impacts from ozone and particulate matter, which can lead to respiratory and cardiovascular diseases [9]. Air pollution in China is at an all-time high. Among the world's ten most air polluted cities, 7 are in China namely: Taiyuan, Beijing, Urumqi, Lanzhou, Chongqing, Jinan and Shijiazhuang [10]. An air quality index of 500 is considered the worst possible and the air-quality monitoring device recorded a level of 755 in China. Surprisingly, the current air quality index for New York City is 19 [10]. Beijing activated for the first a new plan that restricts construction and industrial activity, curbs vehicle use by government officials and limits schoolchildren to limit outside activity, according to the state-run Xinhua news agency [10]. According to Staedter [10] 700 flights were canceled last year due to smog and low visibility. Beijing Hyundai Motor Company suspended production, and nearly 30 construction sites stopped construction for a day. There has been a sharp rise in the frequency of car accidents, respiratory illness and the big hospitals in Beijing, Jinan, Shijiazhuang and Nanning were also crowded with patients due to air pollution". According to Nielsen and Ho. [4] schools were closed, traffic became gridlocked and flights in and out of the metropolis were canceled in the northeast Chinese city of Harbin due to air pollution. For years, severe air pollution and rising from carbon emissions have been downsides to China's economic growth, even as that growth has lifted more than 600 million people out of poverty".

China has spent enormously to reduce air pollution and to limit carbon dioxide emissions, the main driver of climate change. China may be fighting air pollution battles because of its economy that is growing too fast and atmospheric challenges [4]. The Evidence is also growing that China's winter climate may be changing in ways that foster the episodic accumulation of fine particles, consistent with unusually stagnant meteorological conditions [4]. This use of national targets and technology mandates reflects the continuing legacy and institutional power of central planning in China. It is also a result of careful study of what has worked in the West. Much of the credit for the largely blue skies in America today goes to command-and-control regulations, and America's carbon policy consists of similar mandates, notably fuel-efficiency standards for cars and now, proposed standards for new power plants. However, the unprecedented pace of China's economic transformation makes improving China's air quality a moving target [4]. Economic growth has left air quality in many cities notoriously poor [11]. A heavy smog has smothered Beijing for many days, says the BBC's Damian Grammaticas, in the capital [11]. WHO guidelines say average concentrations of the tiniest pollution particles - called PM2.5 - should be no more than 25 microgrammes per cubic meter. Once inhaled, the tiny particles can cause respiratory infections, as well as increased mortality from lung cancer and heart disease [11]. China would not have achieved the impressive economic growth and development it has recorded in recent years if she had cared about pollution at the initial stage of development. The Chinese economic model is energy intensive, with a strong focus on investment and industrialization, and is being adopted by a number of developing countries [1].

IV. IMPACT OF AIR POLLUTION

Outdoor air pollution contributed to 1.2 million premature deaths in China in 2010, nearly 40 percent of the global total, 'Ambient particulate matter pollution' was the fourth-leading risk factor for deaths in China in 2010, behind dietary risks, high blood pressure and smoking. Air pollution ranked seventh on the worldwide list of risk factors, contributing to 3.2 million deaths in 2010. By comparison with China, India, which also has densely populated cities grappling with similar levels of pollution, had 620,000 premature deaths in 2010 because of outdoor air pollution. That was deemed to be the sixth most common killer in South Asia [7]. Beijing has the highest level of particulate on the average of 141 micrograms as compared to United States and Europe with a minimum of 50 and 40 micrograms respectively. Emissions of sulfur dioxide from coal and fuel oil can cause respiratory and cardiovascular diseases as well as acid rain. Sulfur dioxide emissions alone are thought to cause damage equal to 12 percent of China's Growth National Product. For instance, China's emissions of nitrogen oxide-the leading cause of urban smog-have increased 3.8 percent a year for 25 years. Unless things are dramatically changed nitrogen oxide emissions in China will double by 2020 [7]. Air pollution in

China is so severe, hence stringent measures must be put in place to curtail it. The ten strict measures to control air pollution in China [12]:

- Key industries to be renovated to reduce pollutant emissions. The clean transformation of urban dust and fuel quality to be accelerated.
- The high energy consumption of high-pollution and other key industries' production capacity to be strictly controlled.
- To reducing atmospheric pollutants emission intensity by 30% or more by 2017 through improvement of public transport and clean energy production.
- Develop natural gas, coal methane, and other clean energy supplies.
- To strengthen energy-saving and environmental indicator constraints on construction, land, power and water supply.
- To implement incentives and constraints on new energy saving mechanisms to increase sewage collection efforts, as well as increase support for the air pollution control. Strengthen international cooperation to cultivate environmental protection and new energy industries.
- To enforce laws and standards for industrial restructuring and upgrading. Formulate or revise emission standards for key sectors, using the proposed amendments of the Atmospheric Pollution Prevention Act and other laws. Heavy polluting industries and enterprises must disclose environmental information, and urban air quality rankings and penalties for violations will be established.
- Joint prevention and control mechanisms on atmospheric environmental targets and assessment systems must be established by densely populated urban areas around the Bohai Sea, including Beijing, Tianjin, the Yangtze River Delta, Pearl River Delta and other regions, must establish.
- To establish local government emergency management in response to heavily polluted weather, and limit emissions from polluting enterprises and vehicles.
- To develop a code of conduct that can be applied to the whole society, with the local government taking overall responsibility on local air quality. The primary responsibility for the implementation of corporate pollution lies with the State Council's relevant departments who should advocate conservation and green consumption patterns.

V. POLICY REFORMATION AND TECHNOLOGICAL INNOVATIONS

Environmental Impact Assessment (EIA) is an instrument of prevention aiming at the consideration of the human environment at an early stage of the development of a program or project [13]. EIA is particularly important for countries that develop projects in the framework of economic

reorientation and restructuring. EIA has become legislation in many developed countries and is now increasingly applied in developing countries and economies in transition [13]. EIA is integrative in the sense of comprehensive environmental planning and management considering in the interactions between different environmental media. On the other hand, EIA integrates the estimation of environmental consequences into the planning process and thereby becomes an instrument of sustainable development. EIA also combines technical and participative properties as it collects, analyses and applies scientific and technical data with consideration of quality control and quality assurance, and stresses the importance of consultations prior to licensing procedures between environmental agencies and the public which could be affected by particular projects. A clean-air implementation plan can be considered as a part of the EIA procedure with reference to the air [13] to be able to handle the problem of China. Environmental Protection Agency (EPA) needs to employ Environmental impact assessment (EIA) to provide a detailed statement on the environmental impact of the particular project having significant impact on the quality of the human environment in China and other developing countries.

VI. EFFORTS BY VARIOUS GOVERNMENTS AND AUTHORITIES TO CONTROL AIR POLLUTION

On a larger scale, governments are taking measures to limit emissions of carbon dioxide and other greenhouse gasses. One way is through the Kyoto Protocol, an agreement between countries that they will cut back on carbon dioxide emissions. Another method is to put taxes on carbon emissions or higher taxes on gasoline so that people and companies will have greater incentives to conserve energy and pollute less [13].

The importance of efficient management of outdoor and indoor air pollution cannot be overemphasized. Unless there is adequate control, the multiplication of pollution sources in the modern world that may lead to irreparable damage to the environment and mankind. Air pollution management requires a multidisciplinary approach as well as a joint effort by private and governmental entities [13]. United States Environmental Protection Agency (US EPA) calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria (science-based guidelines) for setting permissible levels. The set of limits based on human health is called primary standards. Another set of limits intended to prevent environmental and property damage is called secondary standards [6]. The Clean Air Act (CAA) requires states to develop a general plan to attain and maintain the NAAQS in all areas of the country and a specific plan to attain the standards for each area designated nonattainment for a NAAQS known as State Implementation Plans or SIPs. The adoption of ambient air quality standards based on air quality guidelines for different pollutants; these are accepted maximum levels of pollutants (or indicators) in the target area (e.g., at ground level at a specified point in a community) and can be either primary or secondary standards

[13].

VII. RESEARCH DESIGN/METHODOLOGY

A total number of thirty-five studies relevant to atmospheric pollution were selected out of the total number of fifty studies. The review of literature looked into details on different views from various scholars about the challenges faced by developing countries on air pollution and appropriate control measures. The research method adopted is literature study from various countries that are on the priority list of industrial technologies for protection and exploitation of developed technologies. Studies relevant to the forms of technologies for future air pollution control measures were discussed. The results from the literature study were analyzed to obtain specific issues that are relevant to the root causes of atmospheric pollution. Based on the identified causes of air pollution, needs are clearly defined, and strategies are proposed to control it.

VIII. CONCLUSION AND RECOMMENDATIONS

Developing countries have been facing pollution related air for several years, and air pollution is the cause of several deaths every year. China and India are the most affected countries due to their population and industrialization. It is believed that industrialization is an essential feature of economic growth in developing countries, and its industrial practices have contributed immensely to adverse environmental health consequences. It is also agreed that the world's biggest threats to the future of our planet is air pollution.

It is recommended that the ten "tough measures" to control air pollution in China must be employed in other developing countries that are yet to face the devastating effects of atmospheric pollution. Control measures should be put in place by governments and authorities to desist from the use of technologies that are unacceptable for occupational and environmental health reasons, just as it is applicable in developed countries. There should be an enforcement of stringent environmental legislations in developing countries to cater for the menace of atmospheric environmental pollution.

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