



Centre of Excellence for Research on Clean Air (CERCA)

Indian Institute of Technology Delhi

Research on Air Pollution and Climate Change

Monthly Newsletter - December 2020

What's in a Name?

Editorial

A lot, if you are a company. And a whole lot more if you are changing your name. The new Name brings attention to the company's changed circumstances and its vision for the future. International Business Machines changed its name to IBM when it saw its future not in hardware but in software and services.

It is suggested that Indian Oil Corporation should change its name to Indian Clean Energy Corporation (ICEC). It's clear that its Petrol and diesel business will be in secular decline. To compensate and to grow, in the near-term future its biggest opportunity is in automobile batteries, in manufacturing, charging infrastructure, swapping and leasing batteries thru the network of its gas stations. Long-term it is Hydrogen: repurposing its refineries to produce Hydrogen and its pipeline network to transport and its gas stations to dispense Hydrogen. The oil business will gradually shrink to a small part of its business by 2030.

This name change to ICEC would be a strong signal to society, particularly young people, that the company is preparing to deal with Air Pollution and Climate Change issues proactively. The ICEC stock will get re-rated because global ESG Funds will find its strategy acceptable and attractive.

Automobile emissions are a major source of air pollution and contribute to Climate Change as well. Air Pollution is one of the most serious health risks particularly in Delhi/NCR and large cities. Climate Change is a long-term threat to the world. It became clear during the lockdown that air quality improved significantly as there was a lesser number of vehicles on the road.

Electric Vehicles avoid any emissions and are the solution to automobile emissions and resultant air pollution problems. EVs are the future for a clean environment. In 2019, in China 1 Million EVs were sold, in Europe 560,000, and in the US 320,000, mostly Tesla. In India which has the worst air pollution problem, only 2000 EVs were sold as they are just not affordable as compared to IC (Diesel and Petrol) engines. The solution for India is to retrofit existing IC cars with an electric motor, batteries, etc which can be done at a much lower cost than a new EV.

"Electric Beetle" is an interesting name. It is the name of the lovely 70-year-old lady pictured above. It is a 70-year-old Volkswagen Beetle that has been converted to an EV with a top speed of 50 KM/H and a range that can be 100 KMs. This demonstrates in a nice, photogenic way that retrofitting is the way to go in India.

At present regulations require that a car use commercial (Taxi, Rental car, etc) can only be used for 5 years and other cars for a maximum of 15 years largely due air pollution concerns for older cars. The Electric Beetle proves that so long a car is road-worthy and electric, there should be no age limit. Through

retrofitting, millions of older, but road-worthy IC engine cars can be converted to EVs and reduce the air pollution burden.

The policy for reducing air pollution has to be based on “Polluter Pays” and subsidies for clean vehicles. Economic incentives and disincentives do work to bring in the desired change. Therefore, there should be a high and increasing Road Tax on IC vehicles and a Pollution Cess on petrol and diesel which should increase every year. This Road Tax and Pollution Cess should be escrowed in a Green Fund which can only be used to subsidize EVs new or retrofitted.

Thus, without any funds outlay from the Government, just by a change in the vehicle life policy and tax on IC engine vehicles and petrol/diesel, and subsidies for EVs the air pollution can be significantly reduced.

The goal should be to reduce air pollution by 25%, by 2030 by converting 90% of the vehicle population to EVs new or retrofitted. Another 25% reduction in pollution levels can be achieved by reducing emissions from power plants, industries, stopping agriculture waste burning; improved construction practices, and reduces household wood burning. Then, by 2030, we will have blue skies in Delhi/NCR and other parts of India.

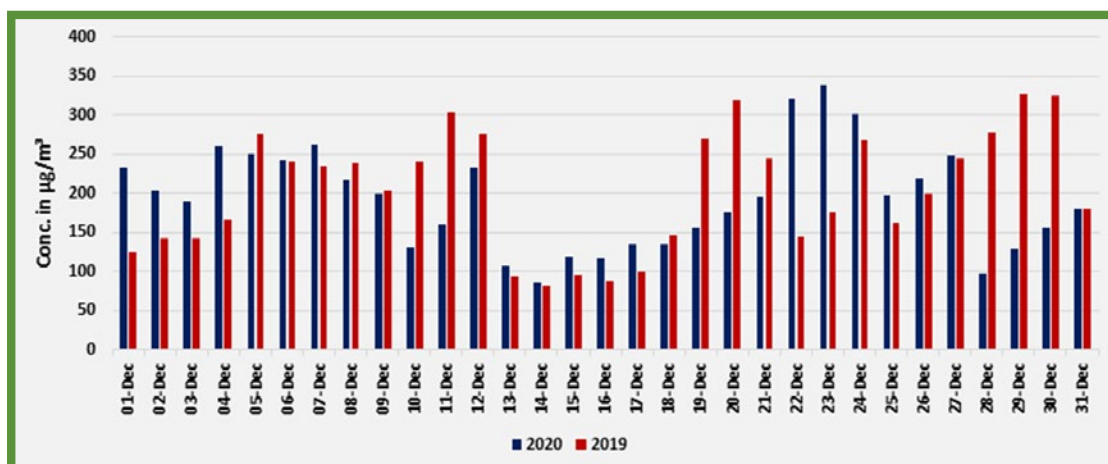
Arun Duggal

Founder, CERCA



We still have miles to go before we can sleep under Clear Blue Skies...

Comparative Delhi PM 2.5 Graph



About 6% decrease in PM2.5 levels in December 2020 in comparison to December 2019, has been observed.



CERCA Events & Expert Opinions



CERCA Webinar on Source Apportionment and Emission Inventories Studies In Non-Attainment Cities in India - Bridging the gap between Researchers & Regulators

CERCA, Indian Institute of Technology Delhi organized a webinar on “SA and EI studies in non-attainment cities in India: Bridging the gap between Researchers and Regulators” on 26th November 2020.

This half-day workshop aims to bring together various Domain Experts from the Government, Think Tanks, Academia, and Private sector to deliberate on the source apportionment studies carried out in different non-attainment cities in India.

The focus of this workshop is to bridge the gap between the researchers and regulators for a better understanding of the way forward to formulate on-ground implementable strategies in these cities.

The major outcomes and recommendation from speakers:

1

Development of emission inventories using real-time source apportionment techniques can be used by regulators to understand how sources change during the period and design of air quality management plans.

2

Need of Fastrack actions to meet the demands for clean air.

3

Necessity of substantial scientific inputs/knowledge in policy-making framework to achieve better air quality.

4

Need for detailed scientific analysis of sources and quantification of their contribution while preparing the cities action plans to allocate the resources in a judicious manner.

5

Final policy direction should have combined results of different techniques/tools and all cities should follow the uniform methodology and robust protocols to estimate source contribution and plan accordingly.

6

Preparing time targeted action plans based on infrastructural and socio-economic settings in a focused way, can be a sustainable and long-term solution.

7

There is a need for coordination among all stakeholders' departments to achieve the target under NCAP and to implement the SA and EI studies at the grass-root level.

8

There should be a formalization of unified guidelines for source apportionment studies, comprehensive national emission inventory under the NCAP.

9

Availability of scientific information in the public domain for the groups which are not part of NCAP implementation could be the key to air quality improvements through public participation in monitoring, self-reflection, and enhanced accountability of the regulator as well as polluters.

10

Establishment of correlation between policy measure/action taken and air quality improvements by independent researchers at regular intervals by updating base inventory.

11

Engagement of civil society and other stakeholders while formulating/advocating solutions for emission load reduction for identifying feasible solutions and alternatives to existing pollution-based operations of certain sectors.

12

Current emission estimates for India need to be improvised for correct representation of emission in climate and air quality models.

13

Overall approach for local air quality management should include land use land cover mapping for designing source apportionment methodologies for their effective implementation.

14

Airshed techniques for understanding pollutants influx and outflux can help to abate the pollution not only in the city as well beyond the boundaries.

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Figure 1: The active green wall, Pettit et. al., *Air Quality, Atmosphere & Health* (2019)

How Can Phytoremediation Work towards Reducing Indoor Pollution?

Bahni Ray, Assistant Professor, Department of Mechanical Engineering, IIT Delhi

People spend most of their time indoors where the air is often more polluted than outside because there are additional sources of pollutants and room ventilation system plays a major role. Especially now during the pandemic lockdown situation the time spend in indoor have drastically increased. According to WHO, exposure to smoke from cooking fires causes 3.8 million premature deaths every year.

Burning fuels such as dung, wood and coal in inefficient stoves or open hearths produces a variety of health-damaging pollutants, including particulate matter (PM), methane, carbon monoxide, polyaromatic hydrocarbons (PAH) and volatile organic compounds (VOC) which include a range of organic compounds that quickly vaporise at room temperature, such as ethyl acetate and benzene.

From the late nineties scientist has explored the use of plants as bio-filter to reduce indoor air pollution. Specific plants have the potential to reduce pollutants in air, remove carbon dioxide through photosynthesis and help reduce greenhouse gases in the atmosphere. This technology is named as air phytoremediation which has many advantages over the traditional indoor air pollution treatment methods like water scrubbing, electrostatic precipitators, HEPA filters.

Phytoremediation can be employed in abating particulate matters (PMs), volatile organic compounds (VOCs), inorganic compounds, persistent organic pollutants (POPs), and heavy metals (HM). For their life processes plants require intensive gas exchange, during which air contaminants are accumulated on leaf surfaces or absorbed into the tissues. Special leaf features and structures such as leaf folding, hairs, trichomes and wax layers have specific roles in pollutant removal and all favour the accumulation of PM.

One of the first real scale trials to reduce indoor air pollution was carried out with the very good indoor phytoremediation species *Dracaena deremensis* 'Janet Craig'. Three and six plants of this variety were placed in office rooms and it turned out that just three plants reduced pollution level by 75% below the threshold level of 100 ppb. While static systems such as pot plants have been found to be ineffective for high-capacity contaminant removal, research indicates that 'active green walls', which utilize mechanical assistance to funnel air into the biofilter substrate, improve the air purification efficiency.

Air phytoremediation technique is simple, cheap, and easy to implement and not produce secondary pollution. There is need for more research not only by biologist but also expertise from aerosol science, ventilation and air flow dynamics to understand the interdisciplinary nature of the biochemical process involved. The selection of plants and associated microbes will depend on how they capture specific pollutant. As recommended by researchers that active green walls perform better than potted plants, there is further need to explore the air flow direction and the effect of ventilation system in the indoor environment. That will help to determine the selection of appropriate active green wall depending on the (a) tolerance level of plants to pollutants, (b) the environmental condition of location like temperature, humidity, light intensity, wind speed, (c) plant property like leaf size, thickness, roughness, specific photosynthetic system, (d) the nature of pollutant, and most important (e) the size of the room.



The economic impact of air pollution in India estimated for the first time in a systematic manner

In 2019, 1.67 million deaths were attributed to air pollution. The lost output from deaths and morbidity due to air pollution accounted for economic losses of 36.8 billion USD, 1.36% of India's GDP. Reducing air pollution would therefore provide substantial health and economic benefit for India.

The association of air pollution with multiple adverse health outcomes is becoming well established, but its negative economic impact is less well appreciated. It is important to elucidate this impact for the states of India. GBD India 2019 was the aggregate of estimates of air pollution burden in India at the state level. Also, the economic impact of air pollution in India was estimated for the first time in a systematic manner. In 2019, 1.67 million deaths were attributed to air pollution (one in six of total deaths), out of which 58.7% is due to ambient PM_{2.5}, 36.5% due to household air pollution, and the rest due to ambient ozone. From 1990 to 2019, the death rate attributable to ambient PM_{2.5} exposure increased by 115.3%, while household air pollution decreased by 64.2%. The lost output from deaths and morbidity due to air pollution accounted for economic losses of 36.8 billion USD, 1.36% of India's GDP. Delhi had the highest- per-capita GDP loss, followed by Haryana. Reducing air pollution would therefore provide substantial health and economic benefits for India.

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Stubble burning hit a peak this year in Punjab between Nov 4th-7th

Punjab has recorded the maximum number of incidents of stubble burning this season. Efforts have been on for the last few years to reduce these in the North Indian States. While Haryana was able to reduce the incidents consistently over the last four years, Punjab failed to sustain the periodic reduction this year.

Suomi-NPP VIIRS detected fire data was used to track open burning in Punjab and Haryana.

Between Sep 22-Nov 30, Punjab has recorded 74590 incidents, maximum in the last four years (44004 cases in 2019, 56463 in 2018 and 56539 in 2017). Stubble burning hit a peak this year in Nov 4-7. Sangrur, Bhatinda, Ferozpur, Moga and Patiala are identified as the top 5 districts in Punjab.

In Haryana, only 5862 incidents are observed this year, lower than the previous years (6227 cases in 2019, 9120 in 2018 and 11344 in 2017). Fatehbad, Kaithal, Karnal, Sirsa and Jind are identified as the top 5 districts in Haryana.

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CERCA in Circulation



Economic Loss Per Capita was Highest in Delhi in India, says Lancet Study

Delhi suffered the highest per-capita economic loss, followed by Haryana, due to air pollution last year, a study in the peer-reviewed medical journal Lancet suggests. The economic loss due to lost output from premature deaths and morbidity from air pollution was 1.36% of the GDP in India in 2019.

[Read more>](#)



Former Delhi chief secretary appointed chairperson of Air Quality Commission

Former Chief Secretary of Delhi M.M. Kutty was appointed chairperson of the Commission for Air Quality Management in National Capital Region and Adjoining Areas (CAQM). Other full-time members include Mukesh Khare of IIT-Delhi, Ramesh K.J., Ex-Director General, India Meteorological Department (IMD), and A.K. Nautiyal, joint secretary in the Ministry.

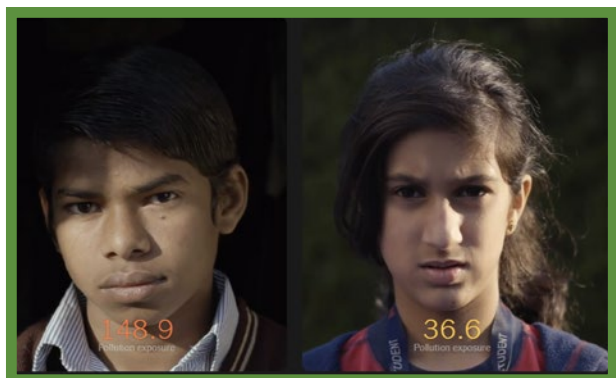
[Read more>](#)



Court Landmark verdict rules Air Pollution as the cause of death of the 9-year-old girl

Much has been spoken about the perils of air pollution over the years but in a landmark judgment, a court in the UK has ruled it as the cause of death of a 9-year-old girl who died in 2013.

[Read more>](#)



Who Gets to Breathe Clean Air in New Delhi?

A fascinating article in the New York Times, that compares the air quality breathed in by two children living very different lives in one of the most polluted cities in the world – Delhi!

[Read more>](#)

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