Phase 5

Naan mudhalvan project submission

Air quality analysis in tamilnadu

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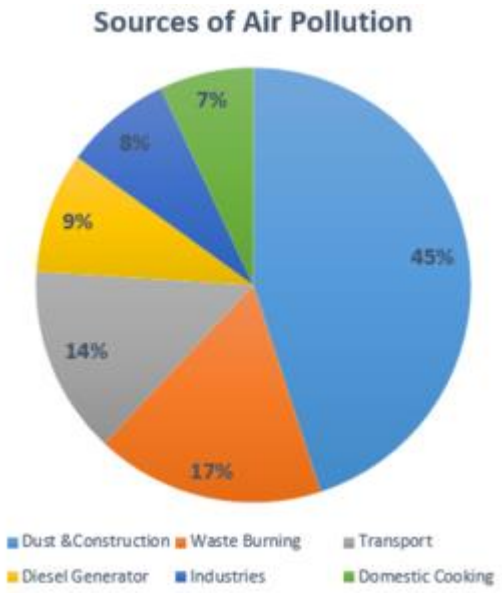
Air pollution in India

Air pollution in India is a serious environmental issue.[1] Of the 30 most polluted cities in the world, 21 were in India in 2019.[2][3] As per a study based on 2016 data, at least 140 million people in India breathe air that is 10 times or more over the WHO safe limit[4] and 13 of the world's 20 cities with the highest annual levels of air pollution are in India.[5] 51% of the pollution is caused by industrial pollution, 27% by vehicles, 17% by crop burning and 5% by other sources.[6] Air pollution contributes to the premature deaths of 2 million Indians every year. Emissions come from vehicles and industry, whereas in rural areas, much of the pollution stems from biomass burning for cooking and keeping warm. In autumn and spring months, large scale crop residue burning in agriculture fields – a cheaper alternative to mechanical tilling – is a major source of smoke, smog and particulate pollution.[7][8][9] India has a low per capita emissions of greenhouse gases but the country as a whole is the third largest greenhouse gas producer after China and the United States.[10] A 2013 study on non-smokers has found that Indians have 30% weaker lung function than Europeans



The Air (Prevention and Control of Pollution) Act was passed in 1981 to regulate air pollution but has failed to reduce pollution because of poor enforcement of the rules.[12]

In 2015, Government of India, together with IIT Kanpur launched the National Air Quality Index.[13] In 2019, India launched 'The National Clean Air Programme' with tentative national target of 20%-30% reduction in

PM2.5 and PM10 concentrations by 2024, considering 2017 as the base year for comparison. It will be rolled out in 102 cities that are considered to have air quality worse than the National Ambient Air Quality Standards.[14] There are other initiatives such as a 1,600-kilometre-long and 5-kilometre-wide The Great Green Wall of Aravalli green ecological corridor along Aravalli range from Gujarat to Delhi which will also connect to Shivalik hill range with planting of 1.35 billion (135 crore) new native trees over 10 years to combat the pollution.[6] In December 2019, IIT Bombay, in partnership with the McKelvey School of Engineering of Washington University in St. Louis, launched the Aerosol and Air Quality Research Facility to study air pollution in India.[15] According to a *Lancet* study, nearly 1.67 million deaths and an estimated loss of USD 28.8 billion worth of output were India's prices for worsening air pollution in 2019

Causes

Fuel and biomass burning

Fuel wood and biomass burning is the primary reason for near-permanent haze and smoke observed above rural and urban India, and in satellite pictures of the country. Fuelwood and biomass cakes are used for cooking and general heating needs. These are burnt in cook stoves known as *chulha* (also *chullha* or *chullah*) in some parts of India. These cook stoves are present in over 100 million Indian households, and are used two to three times a day, daily. Some reports, including one by the World Health Organization, claim 300,000 to 400,000 people die of indoor air pollution and carbon monoxide poisoning in India because of biomass burning and use of chullhas.[19] The carbon containing gases released from biomass fuels are many times more reactive than cleaner fuels such as liquefied petroleum gas.[20] Air pollution is also the main cause of the Asian brown cloud, which is delaying the start of the monsoon. The Burning of biomass and firewood will not stop until electricity or clean burning fuel and combustion technologies become reliably available and widely adopted in rural and urban India.

India is the world's largest consumer of fuelwood, agricultural waste and biomass for energy purposes. From the most recent available nationwide study, India used 148.7 million tonnes coal replacement worth of fuel-wood and biomass annually for domestic energy use. India's national average annual per capita consumption of fuel wood, agricultural waste and biomass cakes was 206 kilogram coal equivalent.[21] The overall contribution of fuelwood, including sawdust and wood waste, was about 46% of the total, the rest being agricultural waste and biomass dung cakes. Traditional fuel (fuelwood, crop residue and dung cake) dominates domestic energy use in rural India and accounts for about 90% of the total. In urban areas, this traditional fuel constitutes about 24% of the total.[21] India burns tenfold more fuelwood every year than the United States; the fuelwood quality in India is different from the dry firewood of the United States; and, the Indian stoves in use are less efficient, thereby producing more smoke and air pollutants per kilogram equivalent.

The unsanctioned tyre pyrolysis plants, which recycle rubber tyres into low-grade oil and carbon black are widespread in India and contribute to severe air pollution and health problems.

Fuel adulteration

Some Indian taxis and auto-rickshaws run on adulterated fuel blends. Adulteration of gasoline and diesel with lower-priced fuels is common in South Asia, including India.[23] Some adulterants increase emissions of harmful pollutants from vehicles, worsening urban air pollution. Financial incentives arising from differential taxes are generally the primary cause of fuel adulteration. In India and other developing countries, gasoline carries a much higher tax than diesel, which in turn is taxed more than kerosene meant as a cooking fuel, while some solvents and lubricants carry little or no tax.

As fuel prices rise, the public transport driver cuts costs by blending the cheaper hydrocarbon into highly taxed hydrocarbon. The blending may be as much as 20–30 percent.

For a low wage driver, the adulteration can yield short term savings that are significant over the month. The consequences to long term air pollution, quality of life and effect on health are simply ignored. Also ignored are the reduced life of vehicle engine and higher maintenance costs, particularly if the taxi, auto-rickshaw or truck is being rented for a daily fee

Adulterated fuel increases tailpipe emissions of hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NO_x) and particulate matter (PM). Air toxin emissions — which fall into the category of unregulated emissions — of primary concern are benzene and polyaromatic hydrocarbons (PAHs), both well-known carcinogens. Kerosene is more difficult to burn than gasoline, its addition results in higher levels of HC, CO and PM emissions even from catalyst-equipped cars. The higher sulfur level of kerosene is another issue.

Traffic congestion

Traffic congestion is severe in India's cities and towns.[24] Traffic congestion is caused by several reasons, some of which are: increase in number of vehicles per kilometre of available roads, a lack of intra-city divided-lane highways and intra-city expressways networks, lack of inter-city expressways, traffic accidents and chaos due to poor enforcement of traffic laws.

Traffic congestion reduces the average traffic speed. At low speeds, scientific studies reveal that vehicles burn fuel inefficiently and pollute more per trip. For example, a study in the United States found that for the same trip, cars consumed more fuel and polluted more if the traffic was congested, than when traffic flowed freely. An average trip speeds between 20 and 40 kilometres per hour, the cars pollutant emission was twice as much as when the average speed was 55 to 75 kilometres per

hour. At average trip speeds between 5 and 20 kilometres per hour, the cars pollutant emissions were 4 to 8 times as much as when the average speed was 55 to 70 kilometres per hour.[25] Fuel efficiencies similarly were much worse with traffic congestion.

Traffic gridlock in Delhi and other Indian cities is extreme.[26] This has been shown to result in a build up of local pollution, particularly under stagnant conditions.[27] The average trip speed on many Indian city roads is less than 20 kilometres per hour; a 10-kilometre trip can take 30 minutes, or more. At such speeds, vehicles in India emit air pollutants 4 to 8 times more than they would with less traffic congestion; Indian vehicles also consume a lot more carbon footprint fuel per trip, than they would if the traffic congestion was less. Emissions of particles and heavy metals increase over time because the growth of the fleet and mileage outpaces the efforts to curb emissions.[28]

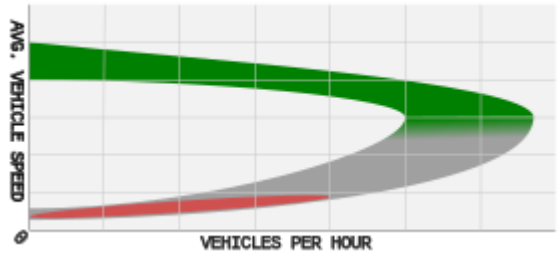
In cities like Bangalore, around 50% of children suffer from asthma

Traffic congestion is a condition in transport that is characterized by slower speeds, longer trip times, and increased vehicular queueing. Traffic congestion on urban road networks has increased substantially since the 1950s.[1] When traffic demand is great enough that the interaction between vehicles slows the traffic stream, this results in congestion. While congestion is a possibility for any mode of transportation, this article will focus on automobile congestion on public roads

As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in. When vehicles are fully stopped for periods of time, this is known as a **traffic jam**[2][3] or (informally) a **traffic snarl-up**[4][5] or a **tailback**.[6]

Drivers can become frustrated and engage in road rage. Drivers and driver-focused road planning departments commonly propose to alleviate congestion by adding another lane to the road. This is ineffective: increasing road capacity induces more demand for driving.

Mathematically, traffic is modeled as a flow through a fixed point on the route, analogously to fluid dynamics.



Causes

Traffic congestion occurs when a volume of traffic generates demand for space greater than the available street capacity; this point is commonly termed saturation. Several specific circumstances can cause or aggravate congestion; most of them reduce the capacity of a road at a given point or over a certain length, or increase the number of vehicles required for a given volume of people or goods. About half of U.S. traffic

congestion is recurring, and is attributed to sheer weight of traffic; most of the rest is attributed to traffic incidents, road work and weather events.[12][13] In terms of traffic operation, rainfall reduces traffic capacity and operating speeds, thereby resulting in greater congestion and road network productivity loss.

Traffic research still cannot fully predict under which conditions a "traffic jam" (as opposed to heavy, but smoothly flowing traffic) may suddenly occur. It has been found that individual incidents (such as crashes or even a single car braking heavily in a previously smooth flow) may cause ripple effects (a cascading failure) which then spread out and create a sustained traffic jam when, otherwise, the normal flow might have continued for some time longer

Separation of work and residential areas

People often work and live in different parts of the city.
Many workplaces are located in a central business district away from residential areas, resulting in workers commuting. According to a 2011 report published by the United States Census Bureau, a total of 132.3 million people in the United States commute between their work and residential areas daily

Movement to obtain or provide goods and services

People may need to move about within the city to obtain goods and services, for instance to purchase goods or attend classes in a different part of the city. Brussels, a Belgian city with a strong service economy, has one of the worst traffic congestion in the world, wasting 74 hours in traffic in 2014.

Economic theories

Congested roads can be seen as an example of the tragedy of the commons. Because roads in most places are free at the point of usage, there is little financial incentive for drivers not to over-use them, up to the point where traffic collapses into a jam, when demand becomes limited by opportunity cost. Privatization of highways and road pricing have both been proposed as measures that may reduce congestion through economic incentives and disincentives. Congestion can also happen due to non-recurring highway incidents, such as a crash or roadworks, which may reduce the road's capacity below normal levels.

Economist Anthony Downs argues that rush hour traffic congestion is inevitable because of the benefits of having a relatively standard work day[*citation needed*]. In a capitalist economy, goods can be allocated either by pricing (ability to pay) or by queueing (first-come first-served); congestion is an example of the latter. Instead of the traditional solution of making the "pipe" large enough to accommodate the total demand for peak-hour vehicle travel (a supply-side solution), either by widening roadways or increasing "flow pressure" via automated highway systems, Downs advocates greater use of road pricing to reduce congestion (a demand-side solution, effectively rationing demand), in turn plowing the revenues generated therefrom into public transportation projects.

Greenhouse gas emissions

Climate change in India is having profound effects on India, which is ranked fourth among the list of countries most affected by climate change in 2015.[30] India emits about 3 gigatonnes (Gt) CO_{2eq} of greenhouse gases each year; about two and a half tons per person, which is less than the world average.[31] The country emits 7% of global emissions, despite having 17% of the world population.[32] Temperature rises on the Tibetan Plateau are causing Himalayan glaciers to retreat, threatening the flow rate of the Ganges, Brahmaputra, Yamuna and other major rivers. A 2007 World Wide Fund for Nature (WWF) report states that the Indus River may run dry for the same reason.[33] Heat waves' frequency and intensity are increasing in India because of climate change. Severe landslides and floods are projected to become increasingly common in such states as Assam.[34] The climate change performance index of India ranks eighth among 63 countries which account for 92% of all GHG emissions in the year 2021.

Effects

Health costs of air pollution

The most important reason for concern over the worsening air pollution in the country is its effect on the health of individuals. Exposure to particulate matter for a long time can lead to respiratory and cardiovascular diseases such as asthma, bronchitis, COPD, lung cancer and heart attack.[38] The Global Burden of Disease Study for 2010, published in 2013, had found that outdoor air pollution was the fifth-largest killer in India and around 620,000 early deaths occurred from air pollution-related diseases in 2010.[39] According to a WHO study, 13 of the 20 most-polluted cities in the world are in India; however, the accuracy and methodology of the WHO study was questioned by the Government of India.[39] India also has one of the highest number of COPD patients and the highest number of deaths due to COPD.

Over a million Indians die prematurely every year due to air pollution, according to the non-profit Health Effects Institute.[40] Over two million children—half the children in Delhi—have abnormalities in their lung function, according to the Delhi Heart and Lung Institute.[40] Over the past decade air pollution has increased in India significantly. Asthma is the most common health problem faced by Indians and it accounts for more than half of the health issues caused by air pollution.[41][42] Air pollution is believed to be one of the key factors in accelerating the onset of Alzheimer's disease in India