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## Gasping for Breath: Coal, Air Pollution and Public Health in Chennai

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A coal-fired thermal power plant in Ennore. Photo: Mukul Kumar

*Is the air we breathe killing us slowly? It is, apparently. In this article, The Hindu Centre's Public Policy Scholar, **Mukul Kumar**, highlights the effects of air pollution from coal-fired thermal power plants on coastal fishing communities in north Chennai. He emphasises that it is the poor, the elderly, and the young who are the most vulnerable to air pollution. Without policy changes, he points out, air pollution from coal-fired power plants and public health problems will worsen.*

**A**s the sun shines through the windows of Srinivasan's home in Kattukuppam, a coastal fishing community in north Chennai, he sees small particles of dust suspended in the air. "If the house is not cleaned for two days," Srinivasan says, "it will be covered by dust (*thoosi*). When my children play with sofa cushions, this dust fills the air." According to Srinivasan, problems of breathlessness and wheezing are widespread in

Kattukuppam, especially among children between the ages of six and 16 years. Srinivasan's 12-year-old son, for example, suffers from breathlessness and cannot play any sport for extended periods of time.

Among the elderly, Srinivasan observes, both respiratory and cardiac diseases are common. Srinivasan's own father, who had respiratory problems, ultimately died of cardiac arrest. Srinivasan, a 37-year old fisherman, points out that the health of his community has deteriorated during his lifetime. "My ancestors," Srinivasan says, "did not suffer from problems of breathlessness and wheezing like we do now. Fisher folk were known as strong and hardy people."

As President of Kattukuppam Fishermen's Cooperative Society, Srinivasan recently voiced concerns about the health effects of air pollution on his community. Kattukuppam is one of several coastal fishing communities located along Ennore Creek, which is encircled by coal-fired thermal power plants.

### **Urban Atmospheres**

It is often repeated that the atmospheres of Indian cities are amongst the most polluted on the planet. Indeed, the World Health Organisation (WHO) has reported that 13 of the 20 most polluted urban atmospheres are located in India <sup>1</sup>. Until recently, New Delhi had the dubious distinction of being at the very top of this global list. It is, therefore, a matter of some surprise that a coastal city like Chennai had a higher Air Quality Index (AQI) value than New Delhi for six months in 2015 <sup>2</sup>. [The higher the value of the Index, the worse the air quality, ranging from 0-50, classified as 'good', to 401-500 (Severe)].

Yet, what is seldom noted is the role of coal-fired thermal power plants in producing urban air pollution. Coal emissions are sources of particulate matter (PM), sulphur dioxide (SO<sub>2</sub>), nitrogen oxide (NO<sub>x</sub>) and heavy metals. Today, coal-fired thermal power plants in India are "responsible for 60 per cent of PM, 45 per cent of SO<sub>2</sub>, 30 per cent of NO<sub>x</sub>, and more than 80 per cent of mercury emissions of the industrial sector <sup>3</sup>."

According to a comprehensive study of air pollution in New Delhi published by researchers at the Indian Institute of Technology, Kanpur, "coal and fly ash" contributes to 30 per cent of PM<sub>10</sub> emissions during the summer months <sup>4</sup>. The same study also highlights that two large coal-fired power plants in New Delhi are "important sources" of summer air pollution in the city <sup>5</sup>.

Chennai is one of the handful Indian cities that have coal-fired thermal power plants within its city limits <sup>6</sup>. The existing capacity of coal-fired thermal power plants near Ennore Creek is 3,480 MW. In addition, the Tamil Nadu government has proposed to build several new coal-fired thermal power plants (totalling approximately 4,630 MW) in Ennore. This proposed expansion is larger than the Korba coal power plant cluster in Chhattisgarh (4,380 MW) <sup>7</sup>.

The expansion of coal power plants in Ennore will impact air quality and, by extension, public health. When particulate matter and heavy metals are suspended in the air and inhaled, they can cause devastating health problems by entering the brain, the lungs and the heart.

Air pollution, however, does not affect all urban citizens equally. Urban atmospheres are profoundly uneven, and ambient air pollution is often concentrated in communities located near busy roads or industrial clusters like Kattukuppam in Ennore <sup>8</sup>.

## “Unfit to Breathe”

According to a recent study titled “Unfit to Breathe”, published by the Coastal Resource Centre, a Chennai-based NGO, coastal communities in Ennore are exposed to dangerous levels of PM2.5 and heavy metals, including manganese, lead, arsenic and nickel <sup>9</sup>.

The study is based upon air samples collected from the rooftops of homes in four coastal communities—Kattukuppam, Mughathwara Kuppam, Athipattu and Ernavur—located within a three-kilometre radius of Ennore Creek’s cluster of coal-fired thermal power plants. The samples were tested at Chester LabNet, a US-based laboratory.

The Coastal Resource Centre found that PM2.5 exposure levels ranged from 105.7 to 141.5 micrograms/m<sup>3</sup>. The four samples were 1.7 to 2.3 times higher than standards promulgated by the Ministry of Environment, Forests and Climate Change. Astonishingly, PM2.5 levels were even higher than Manali Industrial Area, an industrial cluster in Tamil Nadu that was until recently classified as “critically polluted” by the Ministry of Environment, Forests and Climate Change.

**Figure I. Air Quality in Ennore and Manali Industrial Area (Unit: Micrograms/m<sup>3</sup>)** <sup>10</sup>

Station	Feb. 3	Feb. 7	Feb. 9	Feb. 24
Manali	37.12	37.68	49.2	40.36
Ennore	141.5	124.0	105.7	113.5

**Source:** The Coastal Resource Centre (2016)

Although there are many sources of particulate matter, it appears coal-fired thermal power plants contribute to the PM2.5 load in Ennore. Dr. Mark Chernaik, Staff Scientist at the Environmental Law Alliance Worldwide, offered the following opinion about the air samples:

The four elements that occur in the highest levels in coal ash are aluminium, calcium, iron, and silicon, with somewhat varying compositions. These four elements comprise a strikingly high fraction of total PM2.5 in the filtered air samples, varying from 20.4 per cent to 57.6 per cent (average: 33.1 per cent). By contrast, these same four elements comprised only 1.3 per cent of total PM2.5 levels of a typical urban area in the US (Wilmington, DE). One can, therefore, conclude that overall PM2.5 in these samples are likely impacted by sources of coal ash emission and not significantly impacted by sources of liquid fuel combustion (e.g. vehicle emission and diesel generators) alone. <sup>11</sup>

Although there are no ambient air standards in India for lead, nickel or manganese, the Coastal Resource Centre found that several of the air samples in Ennore exceed the U.S. standards. The presence of manganese in all four samples exceed California Office of Environmental Health Hazard Assessment Standards by 1.2 to 2.5 times. Lead in Kattukuppam and Athipattu exceed the U.S. Environmental Protection Agency’s Ambient Air Quality Standards for long-term exposure by 3.7 and 1.07 times, respectively. Nickel levels in Athipattu exceed the California Office of Environmental Health Hazard Assessment standards by 1.2 times.

The Coastal Resource Centre found that arsenic in the Kattukuppam air sample exceeds the standards of the Ministry of Environment, Forests and Climate Change by 1.25 times. Arsenic not only irritates the skin and mucous membranes, and affects the brain and nervous system, it is also a known carcinogen.

Dr. Rakhal Gaitonde, a public health specialist based at the Indian Institute of Technology, Madras, expressed concerns about the levels of air pollution in Ennore: “The air sampling results show a very concerning level of toxic substances. Their presence at such high levels shows that there is a significant possibility of chronic health effects [12](#) .”

“The measurement of such toxic substances,” Dr. Gaitonde adds, “from the roof tops of human settlements is indeed a cause for concern [13](#) .”

### Health Effects

A growing body of literature has documented the adverse health effects of ambient air pollution [14](#) . Microscopic PM2.5 particles, which become lodged deep inside the lungs, can aggravate a range of health problems, from asthma and lung cancer to cardiac arrhythmias and heart disease. Some of the most common symptoms of these diseases include shortness of breath, wheezing, fatigue, dizziness, and coughing and chest pain, among others. Within urban communities, moreover, these health effects are also unevenly distributed: the poor, the elderly, the young and those with pre-existing respiratory and cardiovascular problems are particularly vulnerable to toxic air pollution [15](#) .

**Figure 2. Estimated 2010-11 Health Impacts due to Emissions from Coal-fired Power Plants in India [16](#)** (Unit: People Per Year)

Effects	Health Impacts
Total premature mortality	80,000 to 115,000
Child mortality (under 5)	10,000
Respiratory symptoms	625 million
Chronic bronchitis	170,000
Chest discomforts	8.4 million
Asthma attacks	20.9 million
Emergency room visits	900,000
Restricted activity days	160 million

**Source:** Guttikunda and Jawahar (2014)

Children are especially vulnerable to certain heavy metals such as lead. When exposed to lead early in life, a child’s memory, behaviour, and IQ levels may be affected. According to one study of school-aged children in Chennai, IQ and blood lead levels are inversely related: as blood lead levels increase, IQ levels decrease. “Lead exposure,” the study concludes, “is a significant problem among Indian children, with many having blood lead levels associated with increased neurodevelopment risk [17](#) .”

The nearest private and public hospitals to Kattukuppam are 10 km and 18 km away, respectively. Srinivasan estimates that, on an average, families spend Rs. 20,000 annually just for normal health care problems. When

Srinivasan asked his doctor about how to prevent health problems associated with air pollution, the doctor responded, “Well, you could wear a mask, but the only way to really protect yourself from air pollution in Kattukuppam is to move to Singapore.”

Srinivasan and the Kattukuppam Fishermen’s Cooperative, however, are not moving anywhere. Instead, they have called upon state authorities, including the Tamil Nadu Pollution Control Board, to provide affordable healthcare facilities to local communities and to monitor the emissions and waste produced by coal-fired thermal power plants in Ennore.

These advocacy efforts by coastal fishing communities are not just a means of improving air quality in Ennore, but also of transforming the urban atmosphere as a whole, as emissions from coal-fired power plants can travel more than two hundred kilometres <sup>18</sup>. It is thus in the interest of all urban citizens, from New Delhi to Chennai, to ensure that state authorities implement new air pollution standards and make continuous emissions monitoring data easily accessible to the public <sup>19</sup>. Without strong enforcement and accountability measures, the problem of air pollution from coal-fired thermal power plants in Indian cities will worsen <sup>20</sup>.

#### Endnotes:

1. <sup>△</sup> **Krishna Kumar, R. (2016)**. "Air pollution levels up by 8 per cent: UN Report," *The Hindu*, May 25.
2. <sup>△</sup> **Rukmini, S., and Bansal, S. (2015)**. "The air you breathe in Chennai is worse than in Delhi," *The Hindu*, July 15.
3. <sup>△</sup> **Bhati, P. (2016)**. "Delayed by Design," Down to Earth, Centre for Science and Environment, May 31.
4. <sup>△</sup> **Sharma, M., & Dikshit, O. (2016)**. Indian Institute of Technology, Kanpur, "Comprehensive Study on Air Pollution and Green House Gases (GHGs) in Delhi," Submitted to Department of Environment, Government of National Capital Territory of Delhi, and Delhi Pollution Control Committee, January, p. xiii.
5. <sup>△</sup> **Ibid.**
6. <sup>△</sup> Delhi, Chennai, Mumbai and Ahmedabad, for example, each have coal-fired thermal power plants within their city limits.
7. <sup>△</sup> **Guttikunda, S., Jawahar, P., & Goenka, D. (2015)**. "Regulating Air Pollution from Coal-Fired Power Plants in India," *Economic and Political Weekly*, 1, 1, p. 62.
8. <sup>△</sup> **Ministry of Health and Family Welfare (2015)**. *Report of the Steering Committee on Air Pollution and Health Related Issues*, Government of India, New Delhi.
9. <sup>△</sup> **The Coastal Resource Centre (2016)**. "Unfit to Breathe: A Report on Air Quality Around the Thermal Power Plant Cluster in Ennore, Tamil Nadu," (Chennai: The Other Media).
10. <sup>△</sup> **Ibid.** p. 12.
11. <sup>△</sup> **Ibid.** p. 14.
12. <sup>△</sup> **Ibid.** pp. 14-15.
13. <sup>△</sup> **Ibid.**
14. <sup>△</sup> See, for example, "Report of the Steering Committee on Air Pollution and Health Related Issues."
15. <sup>△</sup> **World Health Organisation (2016)**. "Air pollution levels rising in many of the world’s poorest cities," May 12, 2016.
16. <sup>△</sup> **Guttikunda, S., & Jawahar, P. (2014)**. "Atmospheric emissions and pollution from the coal-fired thermal power plants in India," *Atmospheric Environment*, 92, 2014, p. 458.
17. <sup>△</sup> **Belliniger, D. C, Hu, H., Kalaniti, K., Thomas, T., Rajan, P., Sambandam, S., Ramaswamy, P., & Balakrishnan, K. (2005)**. "A pilot study of blood lead levels and neurobehavioral function in children living in Chennai, India," *International Journal of Occupational Environmental Health*, 11, 2, 2005, pp. 138-143.

18. <sup>△</sup> **Guttikunda, S. K., and Jawahar, P. (2014).** “Atmospheric emissions and pollution from the coal-fired thermal power plants in India,” *Atmospheric Environment*, Vol. 92, August, p. 456.

19. <sup>△</sup> For a discussion of the delayed implementation of new emissions standards for coal-fired power plants, see Bhati, “Delayed by Design.”

20. <sup>△</sup> As the Steering Committee on Air Pollution and Health Related Issues comments, “Studies have also shown a strong correlation between high levels of PM10 and SO2, and proximity to coal-fired power plants. With substantial growth of coal-based power predicted even in the most conservative of scenarios, and lax standards to address stack emissions, this is a problem that is only going to worsen with time.” See “Report of the Steering Committee on Air Pollution and Health Related Issues,” p. 12.

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