

Gift Wrapping the Future as a present to the present

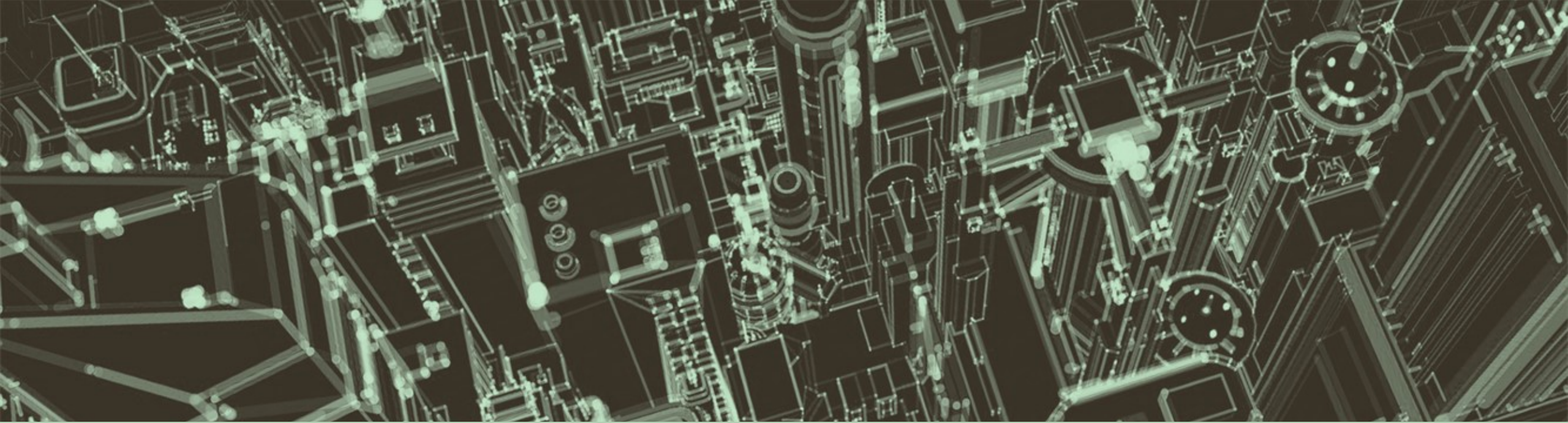
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Running Order

- Introduction / Context
- Environmental and Ecological Impacts of Industrialization
 - Air Pollution
 - Water and Marine Pollution
 - Loss of Biodiversity and Habitat
- Environmental Justice Issues – linked to air pollution
- Policy & Solutions
- Summary



Introduction / Context



Focus

Noida

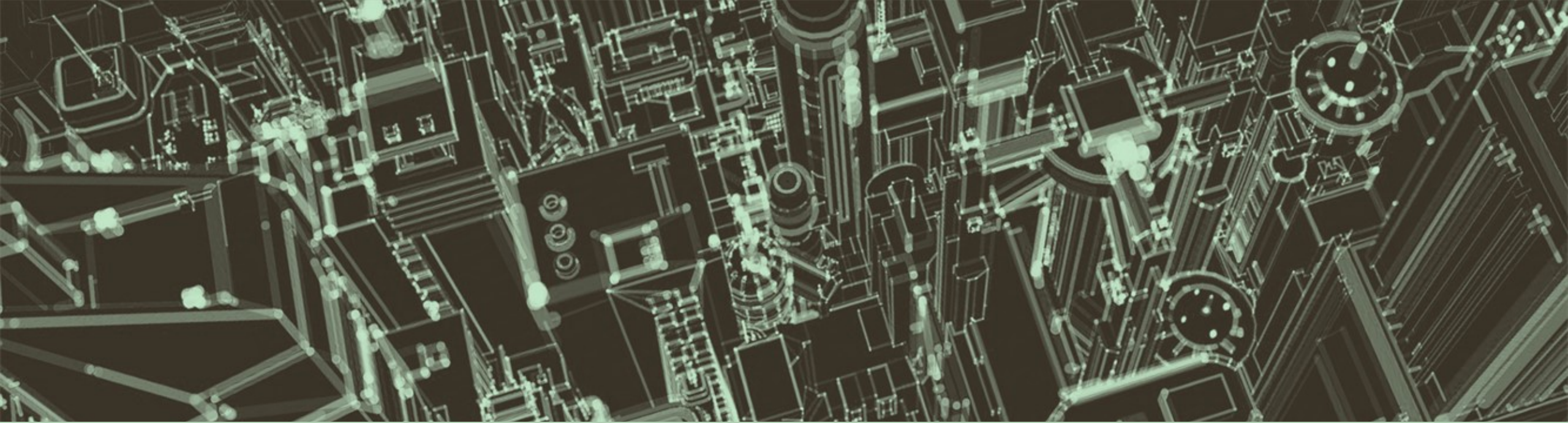
Pune

Kolkata



Changes from Independence to now

	1947	2023
Population (India)	340,000,000	1,400,000,000
City Size		
Noida	N/A	203km ²
Kolkata	361km ²	1,900km ²
Pune	129km ² (1958)	516km ²
Urban Population (%)	17%	31% (2011)
Urban Population (number)	62,000,000	380,000,000
Total GDP (India)	\$20,000,000,000	\$3,700,000,000,000
Life Expectancy	32	70
Poverty (%)	70	21
Poverty (number)	238,000,000	294,000,000

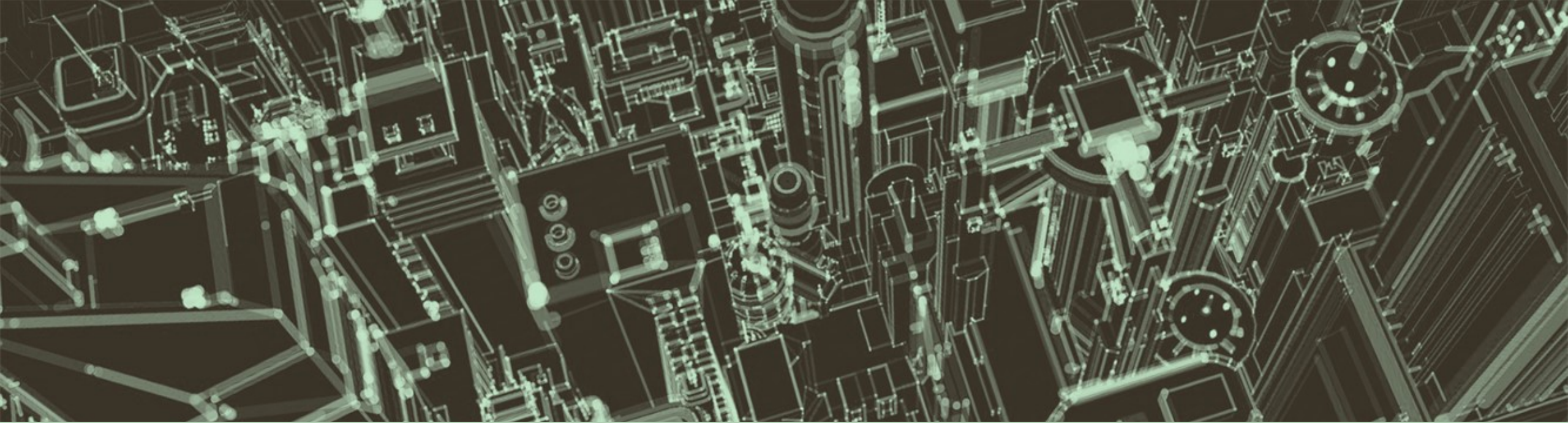


Environmental and Ecological Impacts of Industrialisation



India's Energy use

- 2021 Energy share:
 - Coal 46%
 - Oil 23%
 - Natural Gas 6%
- Carbon Dioxide Emissions from Energy Sector 2,552.8mt (BP, 2022)
- 4% pa growth rate in CO₂ emissions 2011-2021 – “Net Zero by 2070”
- Industrial growth has been powered largely by fossil fuel use, and will continue to do so for some time without dramatic changes being introduced.



Air Pollution and Climate Change



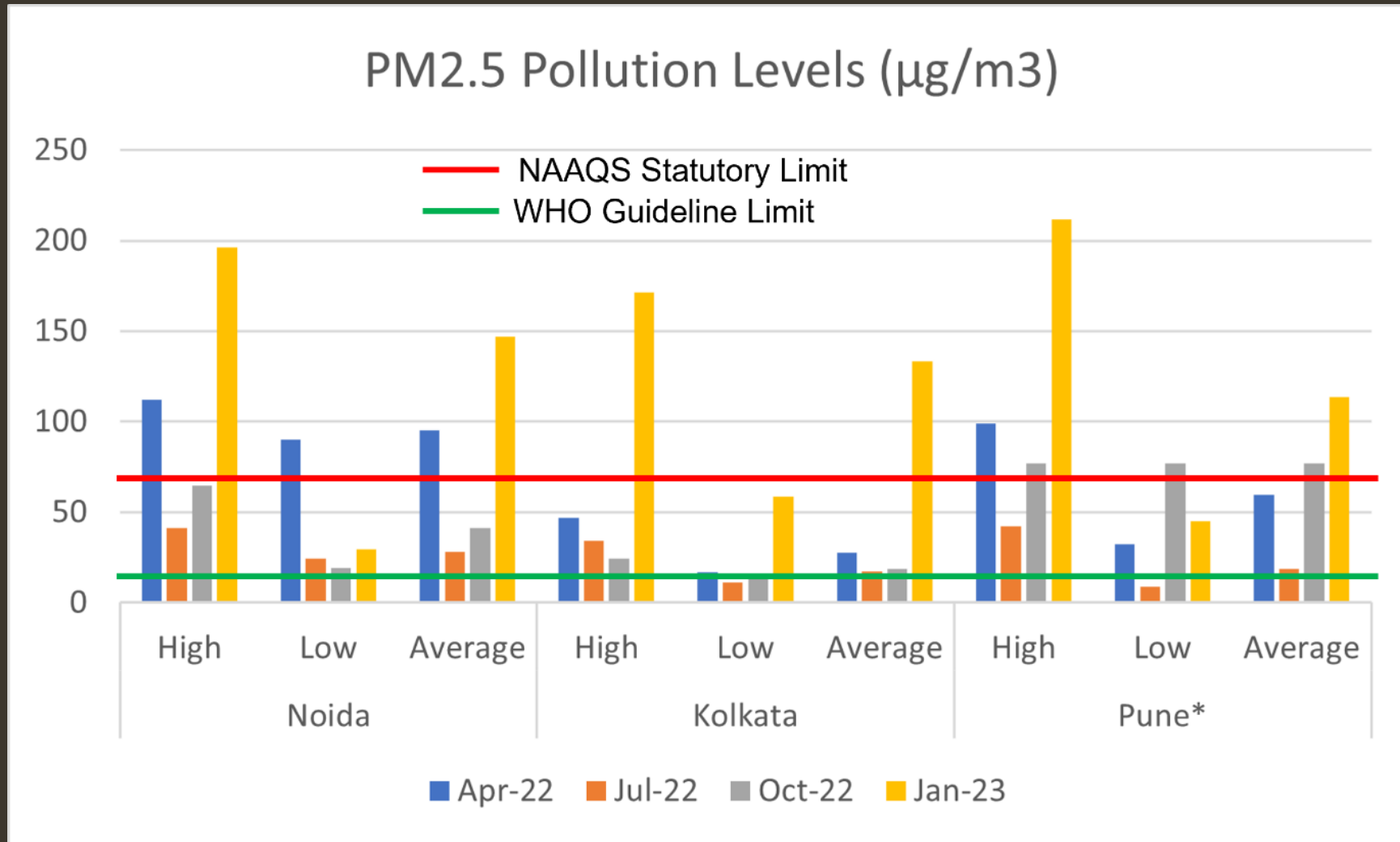
Emissions and associated impacts from fossil fuel combustion

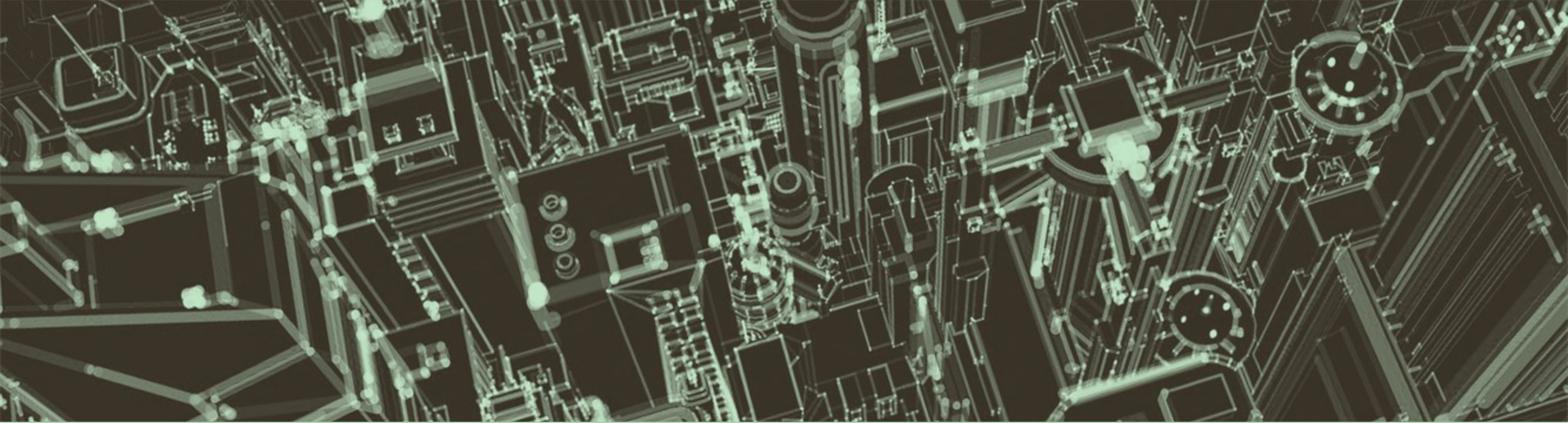
	Coal	Oil	Gas	Petrol	Diesel
CO ₂	✓	✓	✓	✓	✓
CO		✓	✓	✓	
SO ₂	✓	✓	✓		✓
NO _x	✓	✓	✓	✓	✓
PM	✓	✓	✓	✓	✓
Heavy Metals	✓				
Ash	✓				
VOC		✓	✓		
PAH		✓		✓	
Methane			✓		
N ₂ O (Nitrous)			✓		

Emissions standards – WHO and India

Pollutant	Averaging Time	AQG Level	NAAQS Level
CO	Annual	-	2 $\mu\text{g}/\text{m}^3$ (8hr)
	24h	4 $\mu\text{g}/\text{m}^3$ (24h)	4 $\mu\text{g}/\text{m}^3$ (1hr)
SO ₂	Annual	-	50 $\mu\text{g}/\text{m}^3$
	24h	40 $\mu\text{g}/\text{m}^3$	80 $\mu\text{g}/\text{m}^3$
NO ₂	Annual	10 $\mu\text{g}/\text{m}^3$	40 $\mu\text{g}/\text{m}^3$
	24h	25 $\mu\text{g}/\text{m}^3$	80 $\mu\text{g}/\text{m}^3$
PM ₁₀	Annual	15 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$
	24h	45 $\mu\text{g}/\text{m}^3$	100 $\mu\text{g}/\text{m}^3$
PM _{2.5}	Annual	5 $\mu\text{g}/\text{m}^3$	40 $\mu\text{g}/\text{m}^3$
	24h	15 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$

Pollution Levels in 3 cities





Water and Marine Pollution



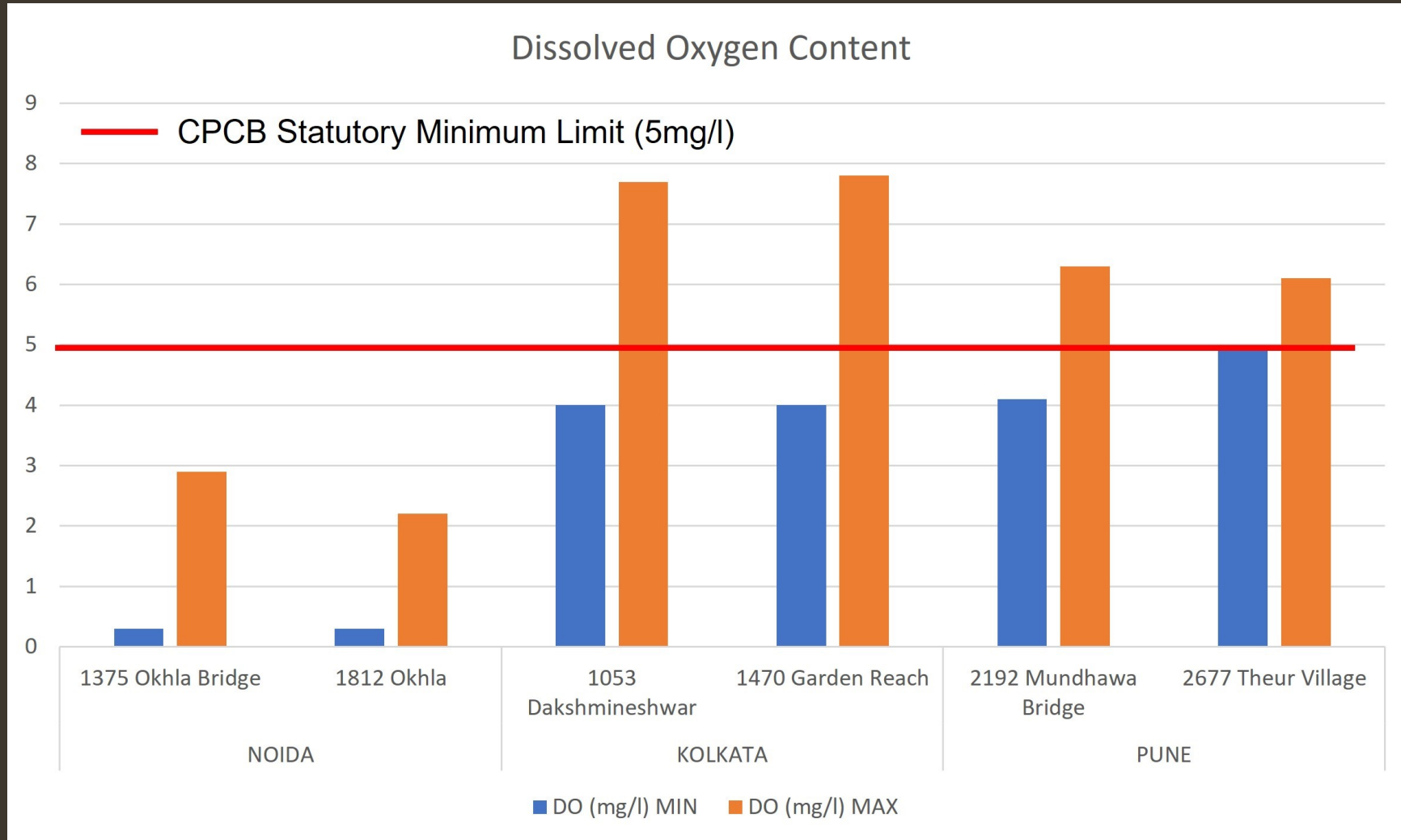
Urbanisation creates water pollution

- Risk of freshwater pollution recognised by law in Rivers (Prevention of Pollution) Act 1876 in UK
- Completion of Bazalgette sewers in London marked an end of cholera outbreaks
- Marine Pollution – plastic is a big issue BUT
 - Eutrophication
 - Oil Pollution
 - Acidification
 - Heating

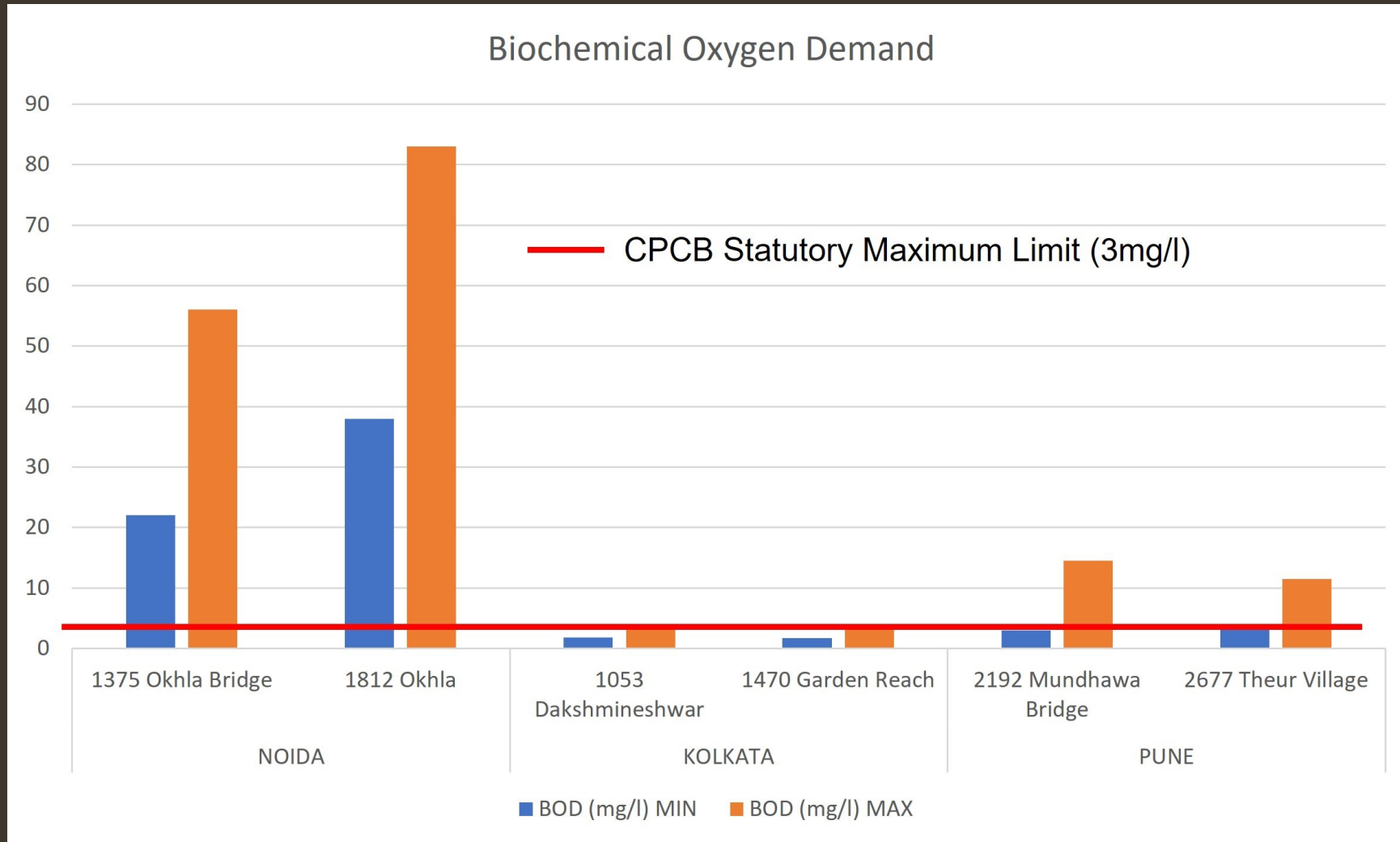
Focus on 3 issues

- **Dissolved Oxygen**
 - Need sufficient oxygen to support aquatic life. CPCB limit is 5mg/l.
 - Below 2mg/l = hypoxic, below 0.2mg/l = anoxic
- **Biochemical Oxygen Demand**
 - Under 1mg/l = pristine, 2-8mg/l moderately polluted, >8mg/l heavily polluted
 - CPCB Limit is 3mg/l
 - High BOD causes death of aquatic life
- **Faecal Coliform**
 - Indicator – the higher the number, the more likely water is to contain disease causing organisms
 - CPCB limit is 2,500mpn/100ml (2006 Bathing Water Directive target is 200mpn/100ml)

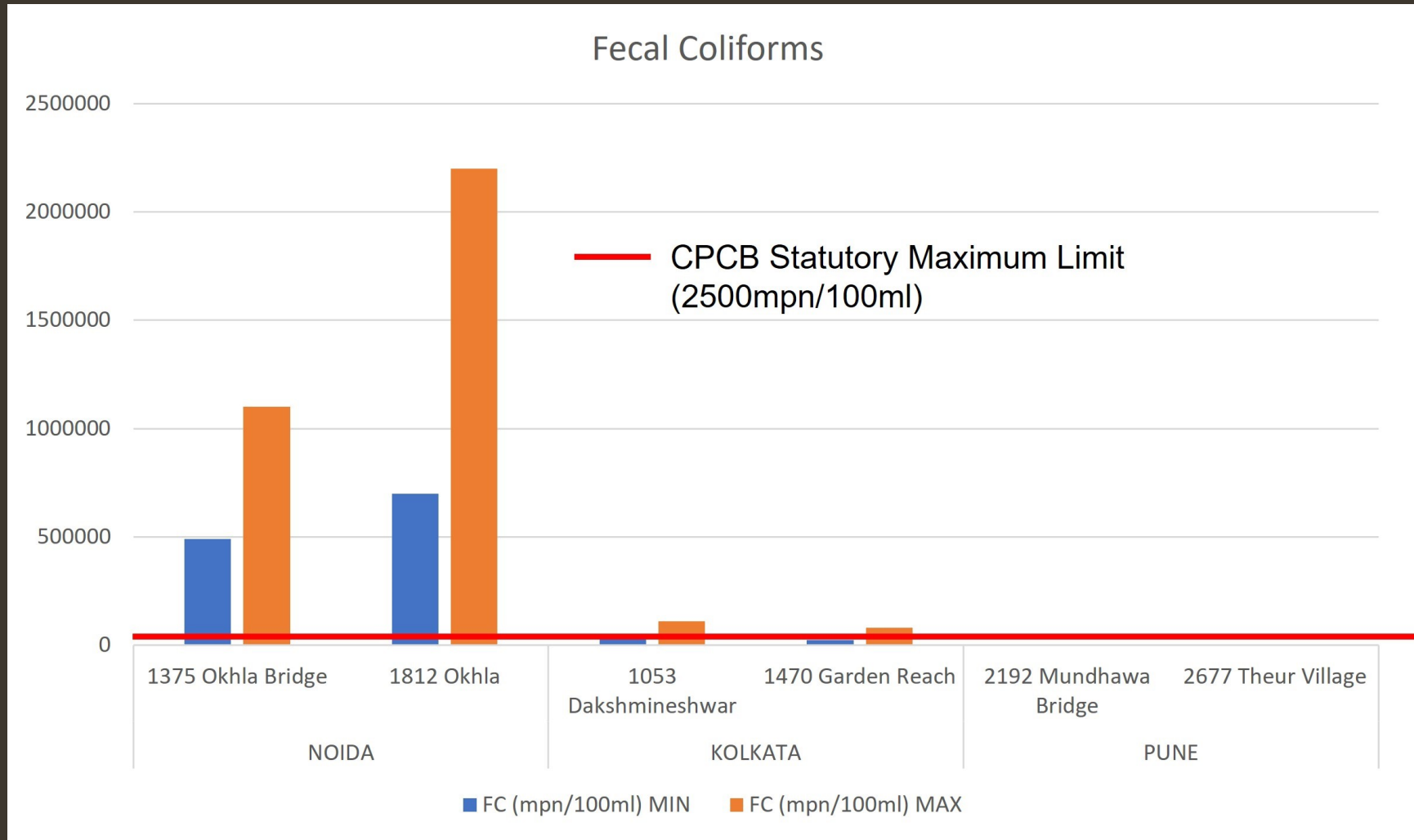
Dissolved Oxygen

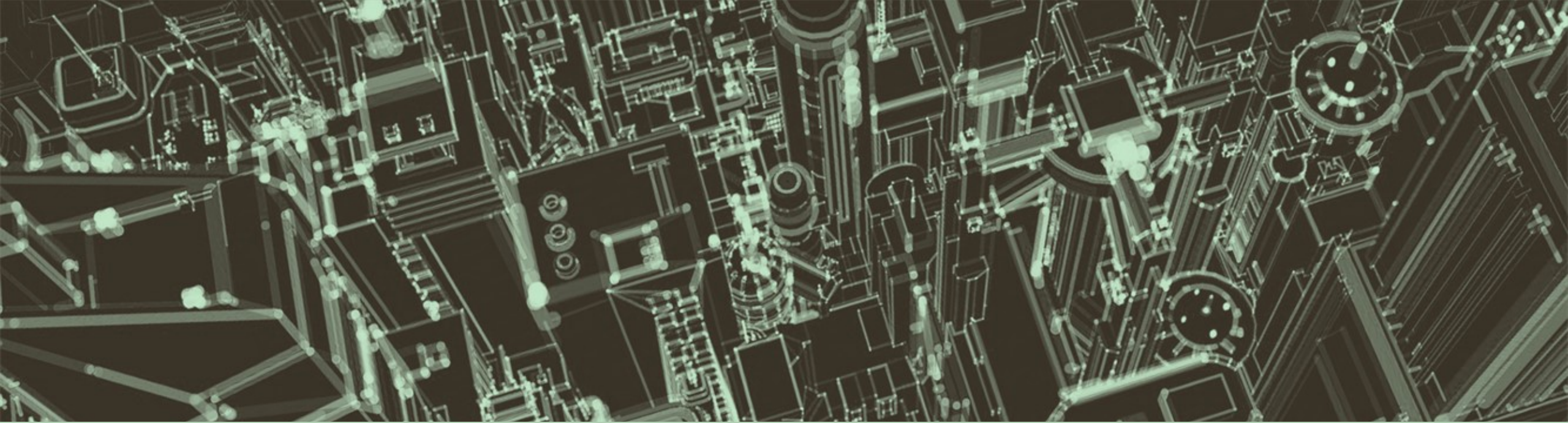


Biochemical Oxygen Demand



Faecal Coliform Content





Loss of Biodiversity and Habitat



Industrialisation is greedy for land

India is:

“a megadiverse country with only 2.4% of the world's land area, accounts for 7-8% of all recorded species, including over 45,000 species of plants and 91,000 species of animals. The country's diverse physical features and climatic conditions have resulted in a variety of ecosystems such as forests, wetlands, grasslands, desert, coastal and marine ecosystems which harbour and sustain high biodiversity and contribute to human well-being. Four of 34 globally identified biodiversity hotspots: The Himalayas, the Western Ghats, the North-East, and the Nicobar Islands, can be found in India.” (IUCN, 2022)

Industrialisation is greedy for land

- 7 types of land use in India:
 - Residential – may also include hotels
 - Commercial – warehouses, malls, restaurants etc
 - Industrial – light, medium, heavy.
 - Agricultural – limited development possible
 - Recreational – sports arena, pools, golf etc
 - Public use – schools, universities, healthcare
 - Infrastructure development

Industrialisation is greedy for land

- Since independence, around 300,000km² of farming land has been lost to urban sprawl.
- “urban sprawl is taking its toll on the natural resources at an alarming pace.” Sudhira et al (2004)
- “Human-wildlife conflicts have become more frequent because of human population growth, infrastructure expansion and development, climate change and other factors forcing loss of natural habitat.” (Anand, 2023)
- In 2022, the IUCN listed 73 species as critically endangered (up from 47 in 2011)

Noida

- Swallowing up of farmland and Saharanpur jungle by incomplete developments means wildlife incursions are common.
- Leopards, python, poisonous snakes, Nilgai (Blue Bulls) all spotted in the city in January 2023
- Great Indian Bustard and Indian Vulture are now thought to be extinct in the region (IUCN CR)
- To the south of the city the Aravulli forests are under threat from development

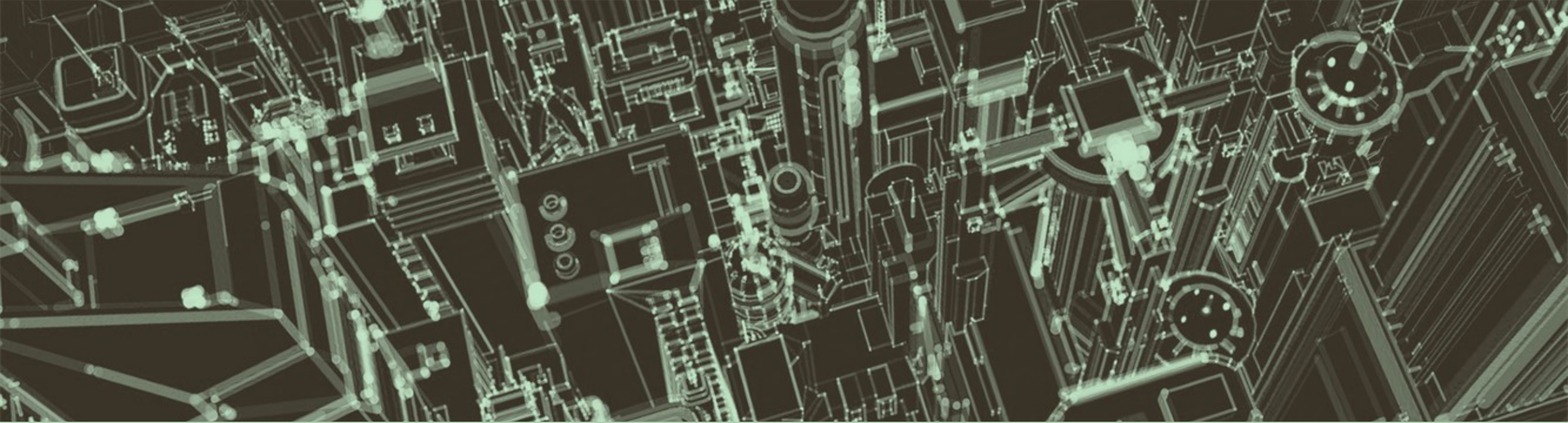
Kolkata

- Indian Vulture extinct, Red-headed vulture bordering on extinct (IUCN, CR)
- The IUCN lists over 300 species in West Bengal that are at least threatened, and loss of habitat caused by a combination of climate change and urban expansion is the cause for the majority of them.
- Even the fishing cat, which is the West Bengal logo, is endangered



Pune

- Kondana Soft-Furred rat lives only in the Singhad plateau, 5km SW of Pune – area is protected,
- Other endangered species in the locality:
 - Caracal (long-eared cat)
 - Lesser Florican / Likh / Kharmore /
 - Great Indian Bustard
 - Smooth Indian Otter
 - Ratel / Honey Badger
 - Indian Longbilled vulture
 - Rusty spotted cat



Environmental Justice Issues



What is environmental injustice?

- Humans are both instigators of environmental damage and victims of a poor environment
- Often the poorer areas of the city/country/world which suffer more because of (eg) rising sea levels, high pollution
- Often the richer areas which benefit from the economic activity which causes the problems
- States, local / regional governments / corporations need to recognise environmental (and associated social etc) impact of their activities in other areas
- Recognition is a first step only

How to spot it...

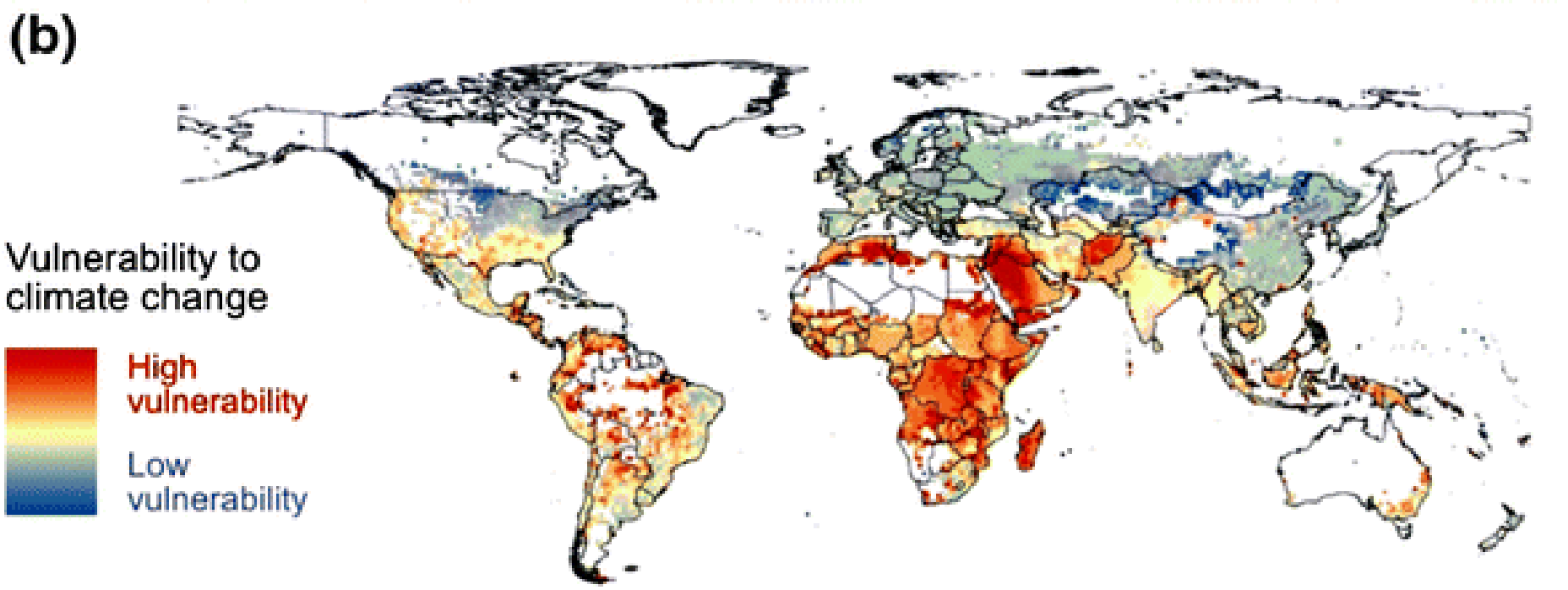
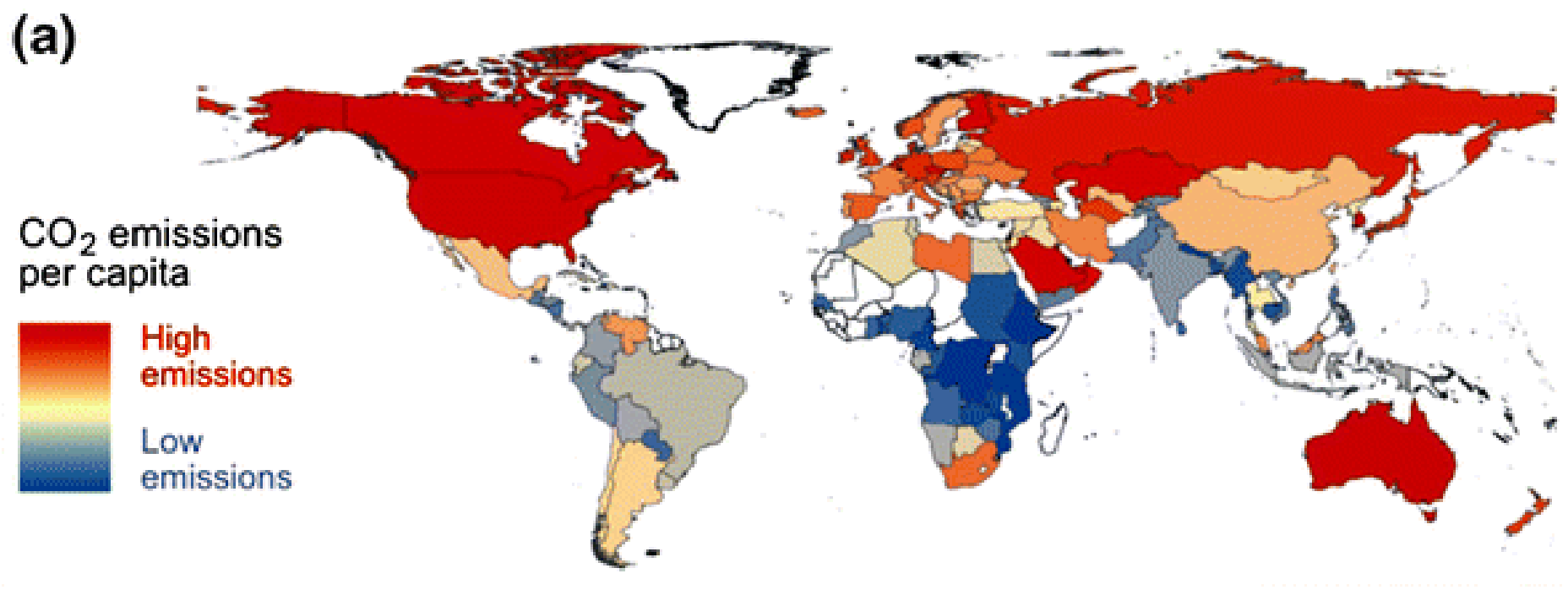
- Most robust way to think of EJ is the correlation between “pollution, poverty and/or people of color” (Banzhaf)
- If negative impact of projects or policies on some sectors of society (usually the poorest) is disproportionately large, then environmental injustice is present.

Air / Climate

- In Delhi, low income groups 64% higher risk of death and 68% higher risk of developing asthma from air pollution than those in high income groups. Garg et al (2011)
- Across India Chakraborty & Basu (2021) used a range of indicators and found clear evidence that poorer and more marginalised communities in cities face significantly higher levels of $PM_{2.5}$ and associated health problems



Air / Climate



Air / Climate – India

- 3rd largest CO₂ emitter – not aiming for carbon neutrality until 2070
 - 110th largest CO₂ emitter per capita
- 6th highest total GDP
 - 122nd GDP per capita – richest 42 people have more wealth than poorest 555,000,000

Air / Climate – Noida

- Noida's Sector 62 is home to several universities and IT companies
- One of the more expensive districts of Noida in which to purchase property.
- Likely that the air pollution figures are significantly impacted by the proximity of the monitoring station to the NE-3 Delhi to Meerut expressway (“one of the most congested areas in the National Capital Region” (Dash, 2013))
- In 2019, “Delhi had the highest per-capita economic loss due to air pollution” and given the proximity of Delhi to Noida, it is thus likely that the impacts in both cities are replicated.

Air / Climate – Kolkata

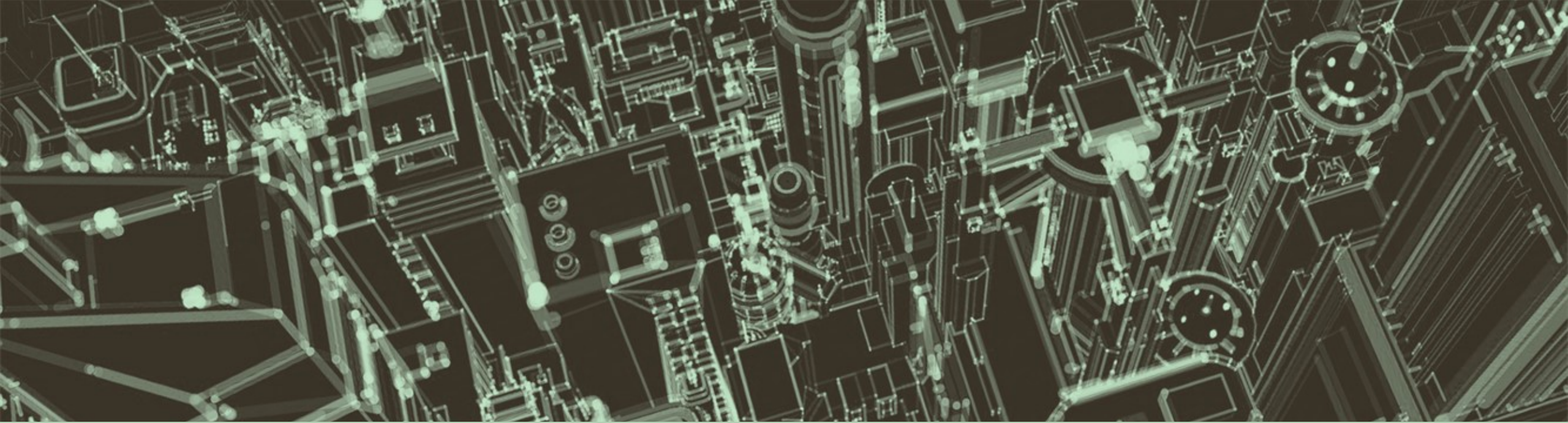
- Sector II in Kolkata, includes Rabindra Bharati University as the site of the monitoring station
- Falls within Bidhannagar (formerly Salt Lake City), which was designed and built in the late 1950s and early 1960s (BMC, 2023)
- According to the 2011 Census, Bidhannagar has one of the highest percentages of adult literacy in India, and the second highest proportion of inhabitants who have graduated University.
- Evidently, it is not a poorer area of Kolkata.

Air / Climate – Pune

- Alandi is a site of religious significance, and the economy of the region is built on the pilgrimage trade – a spiritual place, it is surrounded by Industrial Sites (Kadam & Aher 2021, 100).
- Kadam & Aher also report that 80% of the residents say that there is insufficient opportunity for employment
- There is a strong caveat when dealing with air pollution figures in Pune, however, which is that many of the monitoring sites do not post regular results.

Summary

- The most badly affected areas in the three cities are not the poorest, and show no evidence of marginalisation.
- High air pollution levels seem to step from the proximity of the monitoring sites to sources of pollution – the NE-3 Expressway (Sector 62, Noida), VIP Road / Bangaon Road (Bidhannagar, Kolkata) and surrounding industrial areas (Alandi, Pune).
- Initially suggests (following Banzhaf et al) no direct environmental injustice.
- However, all previous research is consistent – being richer gives access to air filtration which is not accessible to poorer inhabitants, and so injustices can still be determined here.



Policy and Solutions



UDHR Article 25(1)

- “Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.”

Office of the High Commissioner for Human Rights

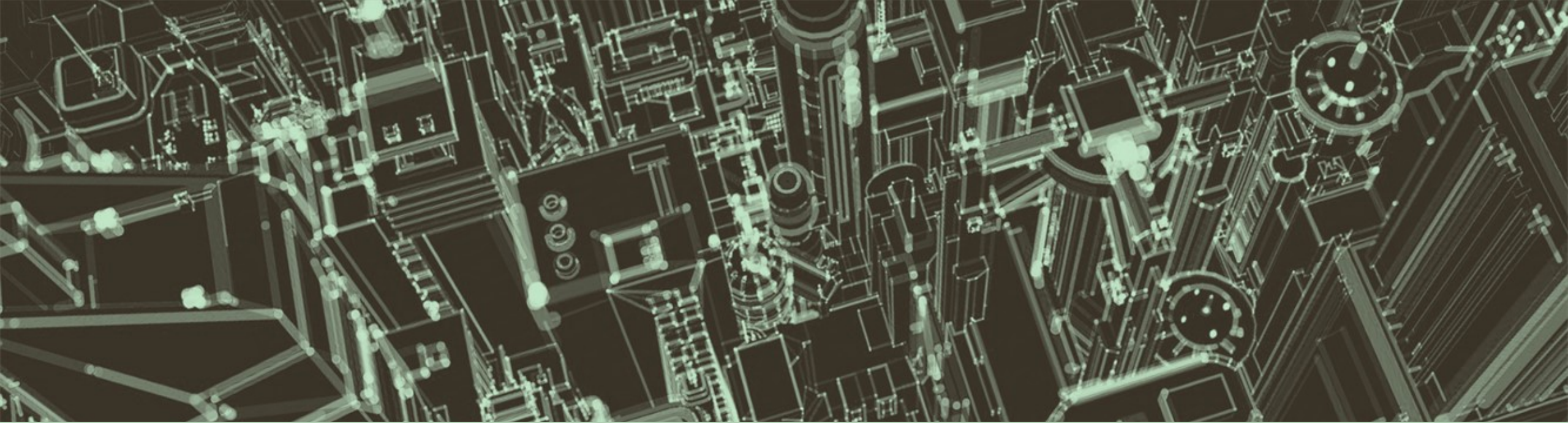
- “The environment is never specifically mentioned in the UDHR, yet if you deliberately dump toxic waste in someone's community or disproportionately exploit their natural resources without adequate consultation and compensation, clearly you are abusing their rights.
- As our recognition of environmental degradation has grown so has our understanding that changes in the environment can have a significant impact on our ability to enjoy our human rights.
- In no other area is it so clear that the actions of nations, communities, businesses and individuals can so dramatically affect the rights of others - damaging the environment can damage the rights of people, near and far, to a secure and healthy life”

Virendra Gaur & Ors v State of Haryana (1994)

- Supreme Court of India considered Article 21 of the Constitution (“No person shall be deprived of his life or personal liberty except according to procedure established by law”) and concluded that “Environmental ecological, air, water, pollution, etc. should be regarded as amounting to violation of Article 21.

Indian Bar Association (2013)

- “It is true that Part III of the Constitution relating to Fundamental Rights does not specifically devote any Article to the Environment or protection thereof per se. However, with the development of law and pronouncement of judgments by the Supreme Court of India, Article 21 of the Constitution has been expanded to take within its ambit the right to a clean and decent environment” (p14).

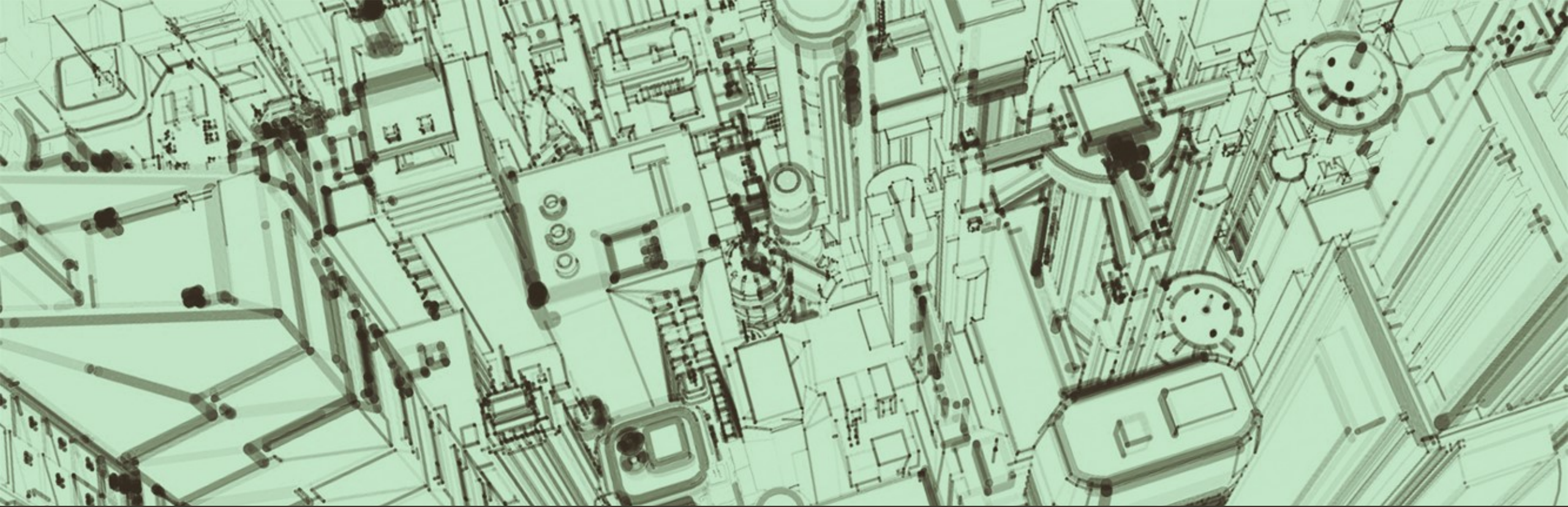


Summary



Tentative Conclusions

- India has industrialised dramatically over the last 70 years
- Overall, life expectancy has improved, and poverty rate has decreased
- India is major global producer, and its citizens are major global consumers
- Massive disparity – COVID shone a light on some of this.
- Despite a Constitutional Right to a clean environment, poorer people more likely to die of health related illnesses caused by air pollution
- Need for systemic change, settle for less



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