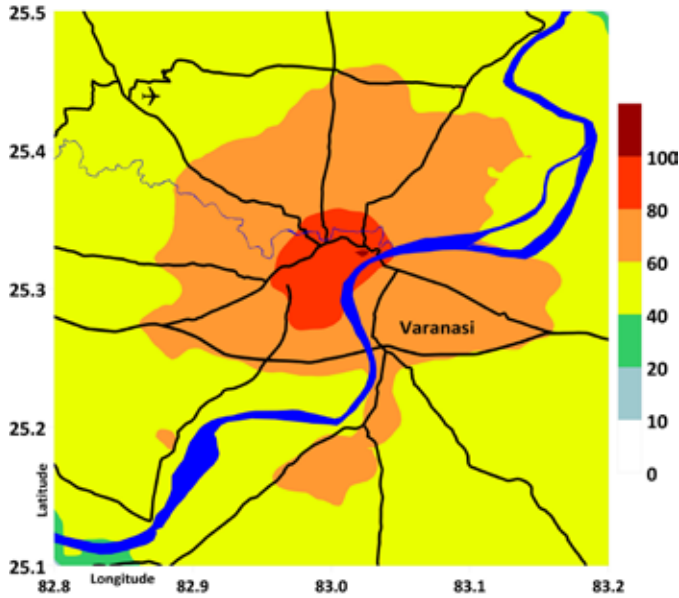


Modeled annual average PM_{2.5} concentration (2015) µg/m³



For urban Varanasi, average PM_{2.5} concentration was $78.4 \pm 10.3 \mu\text{g}/\text{m}^3$. This is almost twice the national standard (40) and more than 7 times the WHO guideline (10).

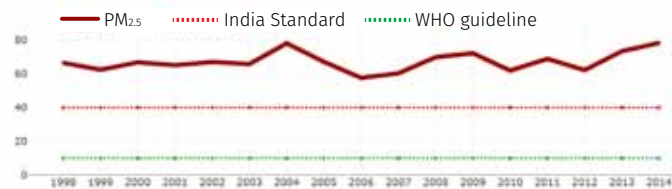
Air monitoring infrastructure

Varanasi has 1 Continuous Air Monitoring Station (CAMS) reporting data for all the criteria pollutants and 2 manual stations reporting data on PM₁₀, SO₂, and NO₂. There should be at least 23 CAMS in the city for efficient reporting.

Annual averages from the national ambient monitoring program (2011-2015) µg/m³

PM ₁₀	NO ₂	SO ₂
139.3 ± 15.9	26.2 ± 6.7	18.4 ± 2.5

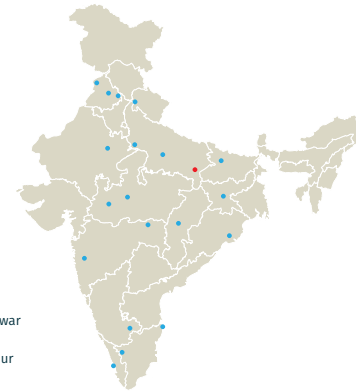
Trend in PM_{2.5} concentrations, based on satellite observations and global model simulations (1998-2014) µg/m³



The Air Pollution Knowledge Assessment (APnA) City Program

Clearing the air with data

- Agra • Amritsar • Bengaluru • Bhopal • Bhubaneswar
- Chandigarh • Chennai • Coimbatore • Dehradun
- Indore • Jaipur • Kanpur • Kochi • Ludhiana • Nagpur
- Patna • Pune • Raipur • Ranchi • Varanasi



Designing an effective Air Quality Management (AQM) plan for a city requires robust data on levels of pollution, affected areas, source contributors, peaking trends and possible control mechanisms.

The Air Pollution Knowledge Assessment (APnA) City Program seeks to make this database available and also serve as a starting point for understanding air pollution.

The program, implemented by Urban Emissions and facilitated by Shakti Sustainable Energy Foundation, seeks to create a comprehensive, city-specific information pool by pulling together data from disparate sources, surveys, mapping and atmospheric modeling.

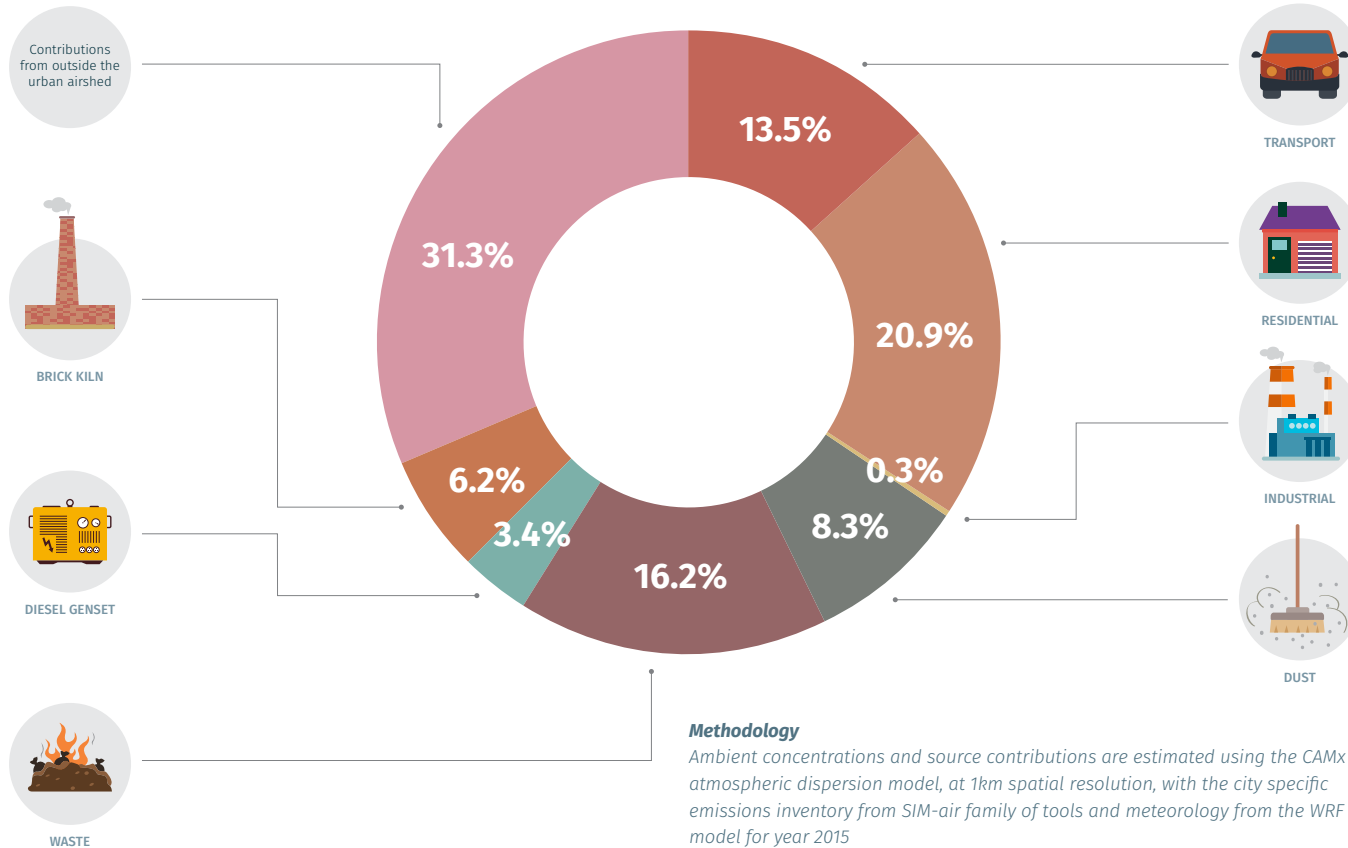
Policy options based on this information, and their implementation, would be the effective next steps in improving the air quality of our cities.

Varanasi

The city that has seen the dawn of time, is now seeing PM_{2.5} levels that are almost twice the national standard.

For detailed information on Varanasi Air Quality, visit www.urbanemissions.info/india-apna

How various sources contributed annually to the modeled ambient PM_{2.5} concentrations in 2015



Findings & Recommendations

- The modeled source contributions highlight domestic cooking and heating, transport (including on-road dust), brick kilns and open waste burning as the key air pollution sources in the urban area.

- An estimated 31% of the ambient annual PM_{2.5} pollution (in 2015) originated outside the urban airshed, which strongly suggests that air pollution control policies in the Indo-Gangetic plain need a regional outlook.

- The city needs to aggressively promote public and non-motorized transport and improve road infrastructure to reduce on-road dust re-suspension.

- By 2030, the share of emissions from residential cooking and lighting is expected to decrease with a greater share of LPG, residential electrification, and increasing urbanization. However, biomass and coal burning to provide warmth in the winter will still be an issue.

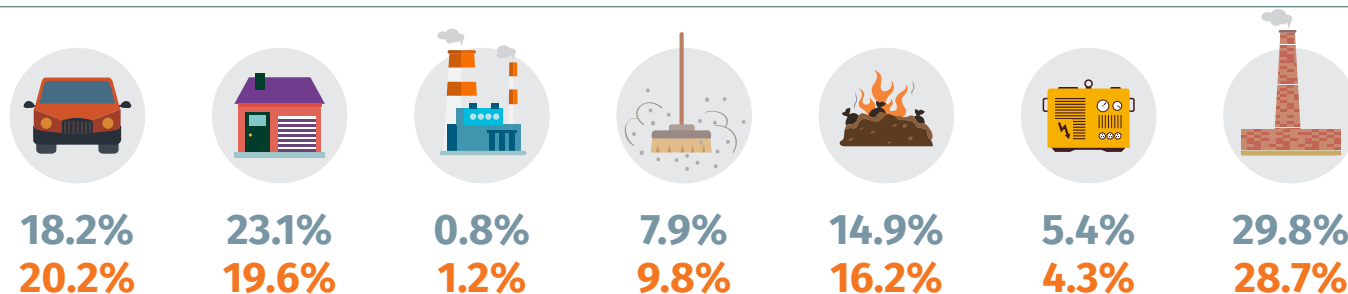
- By 2030, the vehicle exhaust emissions are expected to remain constant, if and only if, Bharat 6 fuel standards are introduced nationally in 2020, as recommended by the Auto Fuel Policy.

- The 450 brick kilns in the urban airshed (and more outside) are fueled mostly by coal, agri-waste, and other biomass. These kilns can improve their energy efficiency by upgrading from the current fixed chimney and clamp style baking to (for example) zig-zag.

- Most of the small and the medium industries need an energy efficiency management plan to address the emissions from coal, heavy fuel oil and gas combustion, or shift towards using electricity.

- Open waste burning is dispersed across the city and requires stricter regulations for addressing the issue.

PM_{2.5} estimated annual emissions inventory: 2015 and 2030



Total emissions in 2015 = 12,100 tons Total emissions in 2030 = 16,350 tons