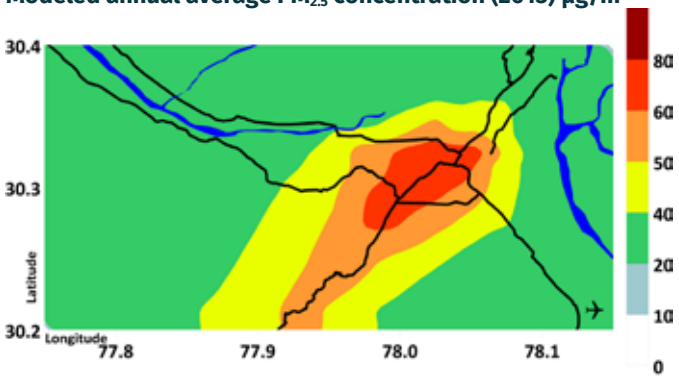
Modeled annual average $PM_{2.5}$ concentration (2015) µg/m³



For urban Dehradun, average $PM_{2.5}$ concentration was 51.2 ± 9.1 µg/m³. This is more than 5 times the WHO guideline (10) and considerably higher than the national standard (40).

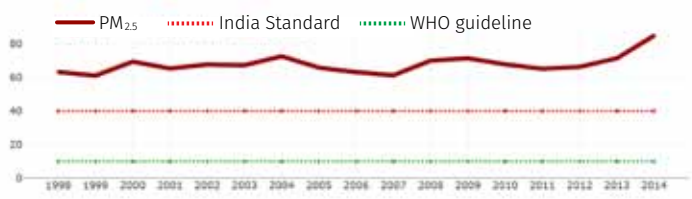
Air monitoring infrastructure

Dehradun has no Continuous Air Monitoring Station (CAMS) reporting data for all the criteria pollutants and 3 manual stations reporting data on PM_{10}, SO_2, and NO_2. There should be at least 13 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
170.3 ± 53.8	26.3 ± 8.0	23.9 ± 7.3

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



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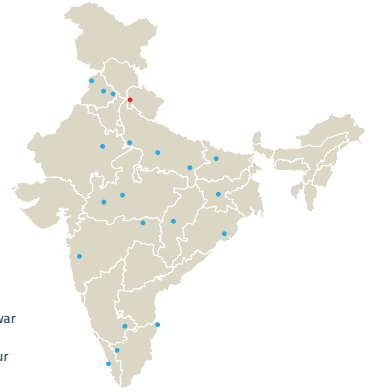
SHAKTI SUSTAINABLE ENERGY FOUNDATION

APnA CITY PROGRAM

Clearing the air with data

The Air Pollution Knowledge Assessment (APnA) City Program

Clearing the air with data



• Agra • Amritsar • Bengaluru • Bhopal • Bhubaneshwar
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• 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.

www.urbanemissions.info

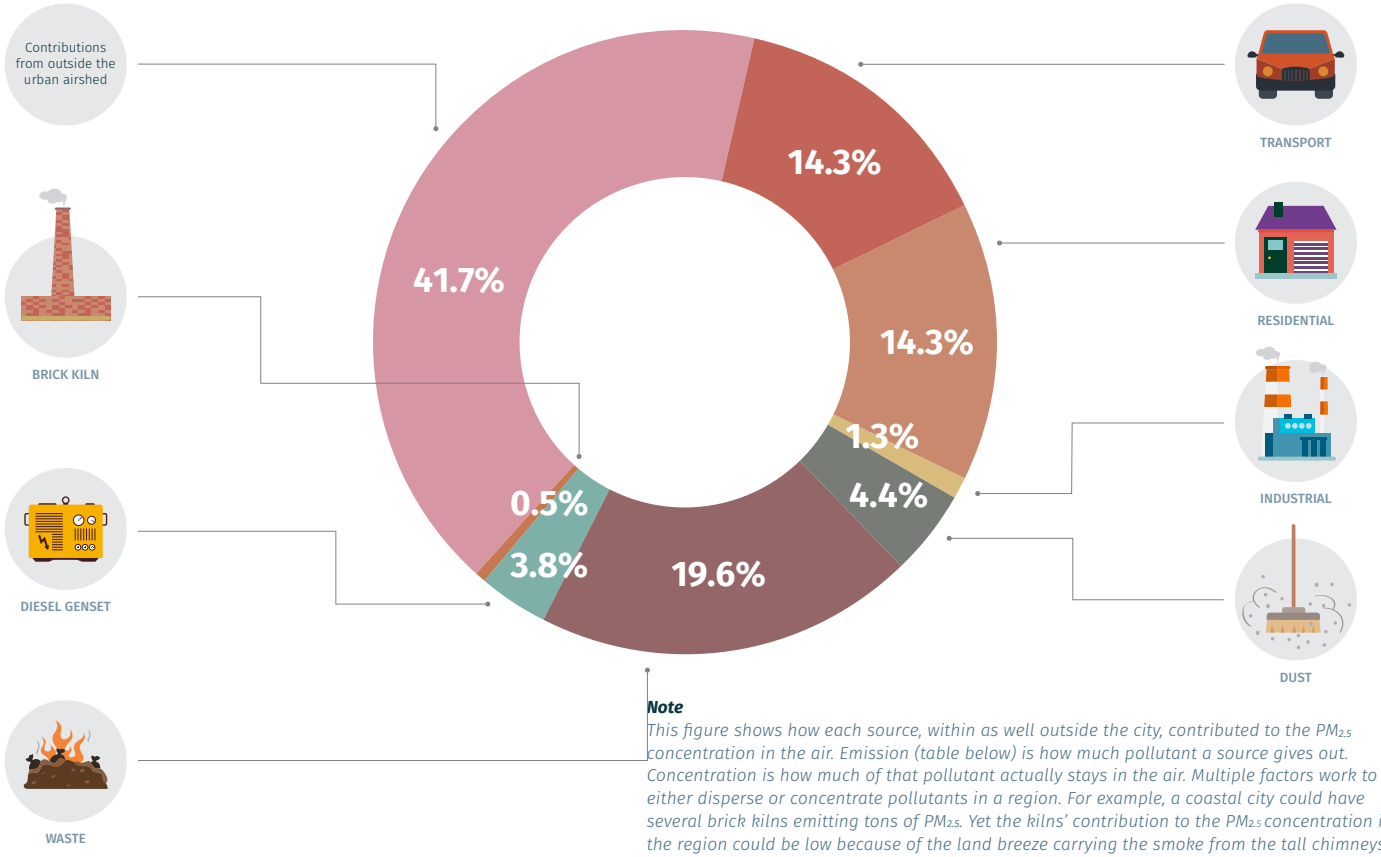
Photo: Rakesh Kumar Dogra

Dehradun

This air of this picturesque city has $PM_{2.5}$ levels that are 5 times the WHO standards.

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

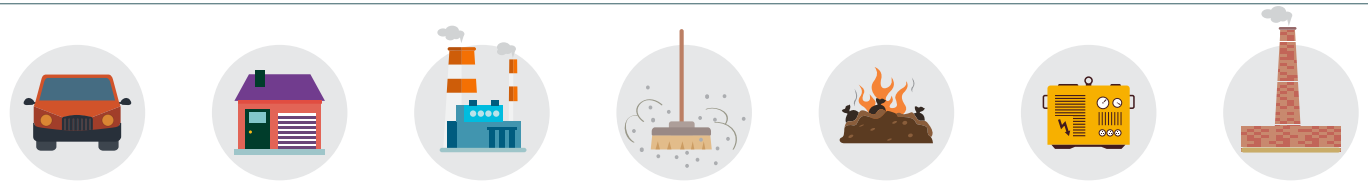
$PM_{2.5}$ concentration : source–wise percentage share in 2015



Note

This figure shows how each source, within as well outside the city, contributed to the $PM_{2.5}$ concentration in the air. Emission (table below) is how much pollutant a source gives out. Concentration is how much of that pollutant actually stays in the air. Multiple factors work to either disperse or concentrate pollutants in a region. For example, a coastal city could have several brick kilns emitting tons of $PM_{2.5}$. Yet the kilns' contribution to the $PM_{2.5}$ concentration in the region could be low because of the land breeze carrying the smoke from the tall chimneys to the sea. To know how source concentration is calculated please visit the APnA city website.

$PM_{2.5}$ emissions : source–wise share in tons in 2015 and 2030 (projected)



1,450	950	300	500	1,100	300	50
2,150	1,150	550	900	1,600	300	100

Total emissions in 2015 = 4,650 tons **Total emissions in 2030 = 6,750 tons**

Findings & Recommendations

- The modeled source contributions highlight domestic cooking and heating, transport (including on-road dust), and open waste-burning as the key air pollution sources in the urban areas
- 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 the need for heat during winters is expected to keep the share of biomass burning emissions high.
- The contribution of sources outside the urban airshed was an estimated 42% of the ambient annual $PM_{2.5}$ pollution (in 2015). This contribution stemmed largely from (metal and non-metal processing) industries and brick kilns located towards the state of Uttar Pradesh.
- With increasing tourism opportunities in the region, the share of transport related emissions is expected to increase. 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 vehicle exhaust emissions are expected to see some decline, if and only if, Bharat 6 fuel standards are introduced nationally in 2020, as recommended by the Auto Fuel Policy.
- Most of the brick kilns are outside the selected urban airshed and are fueled mostly by coal, agri-waste, and other biomass. These kilns can increase their energy efficiency by upgrading from the current fixed-chimney and clamp-style baking to (for example) zig-zag.
- Open waste burning is dispersed across the city and increasing with the expansion of tourism. This requires stricter regulations for addressing the issue.