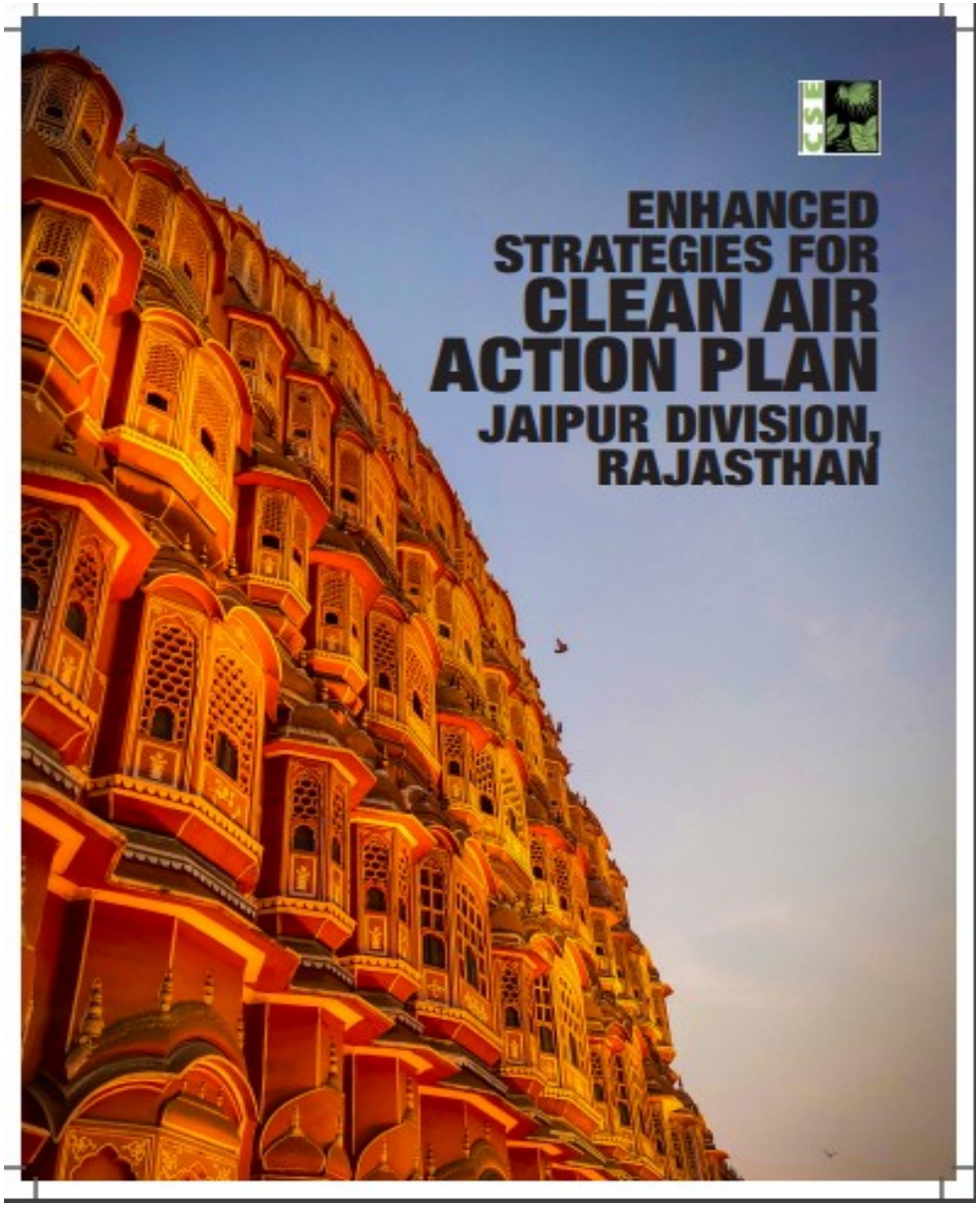
Jaipur region: Towards enhanced multi-sector strategies for clean air



Anumita Roychowdhury
Centre for Science and Environment

Stakeholder meeting:
Clean air action plan for Jaipur region: Building enhanced multi-sector Strategies

Collaborative initiative of
Rajasthan State Pollution Control Board and
Centre for Science and Environment

December 23, 2020

Cross sectoral action plan

RSPCB action plan for non-attainment cities:

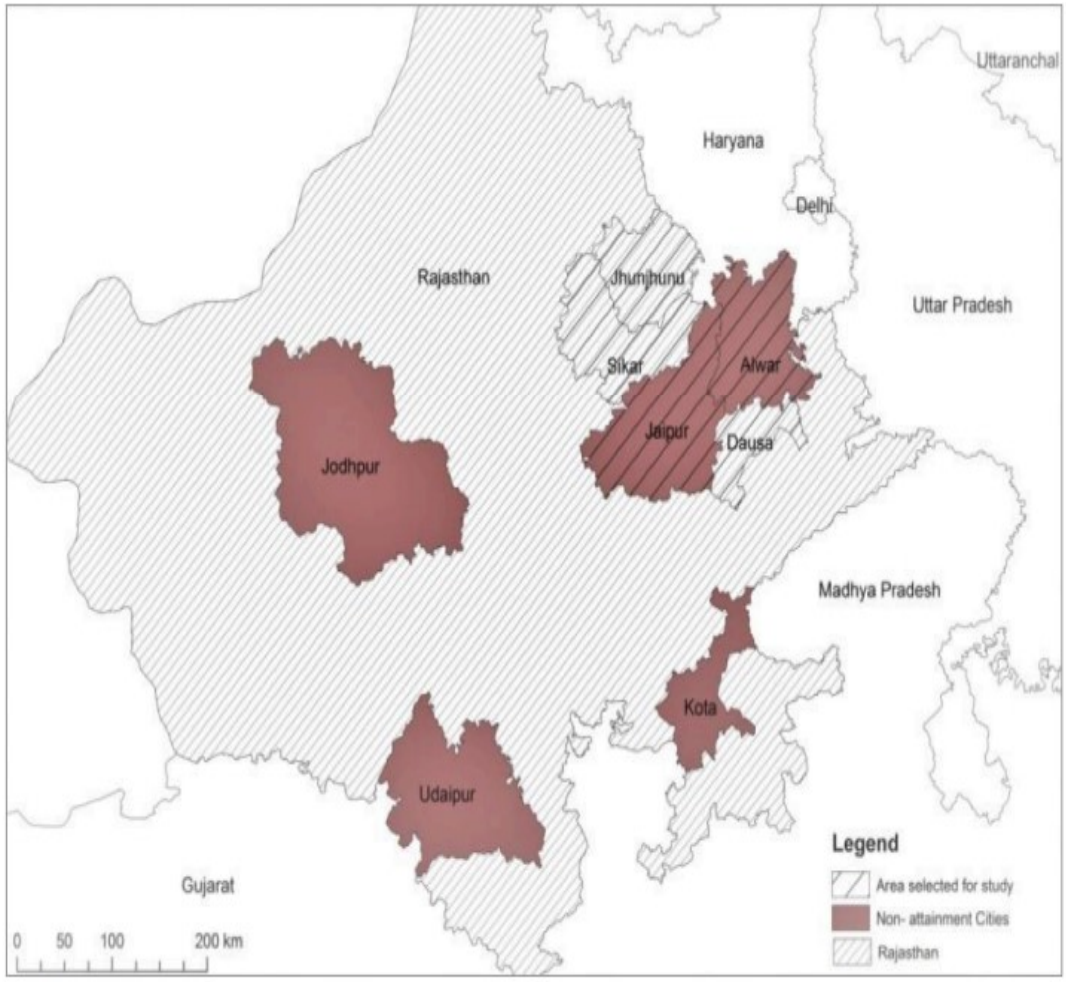
-- Alwar
-- Jaipur
-- Udaipur
-- Kota
-- Jodhpur

Enhanced strategy for Jaipur division

-- Jaipur
-- Alwar
-- Sikar
-- Jhunjhunu
-- Dausa

Sectoral plans

-- Air quality management and monitoring strategies
-- Industry and mining areas
-- Power plants
-- Vehicle and transportation strategies
-- Open burning
-- Construction activities
-- Diesel Generator Sets
-- Solid fuel burning
-- Road dust
-- Greening

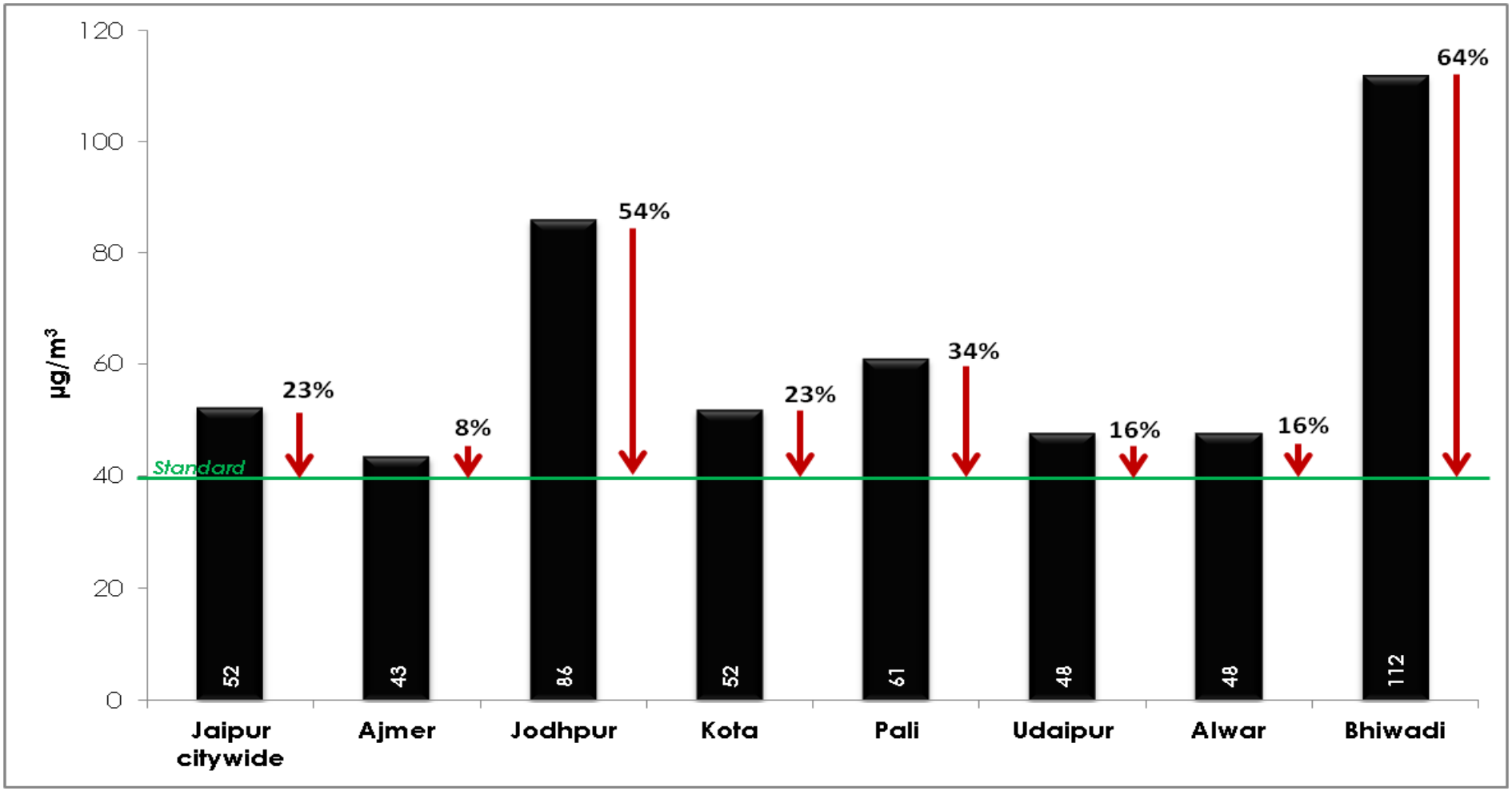


Source: CSE

Guiding principles

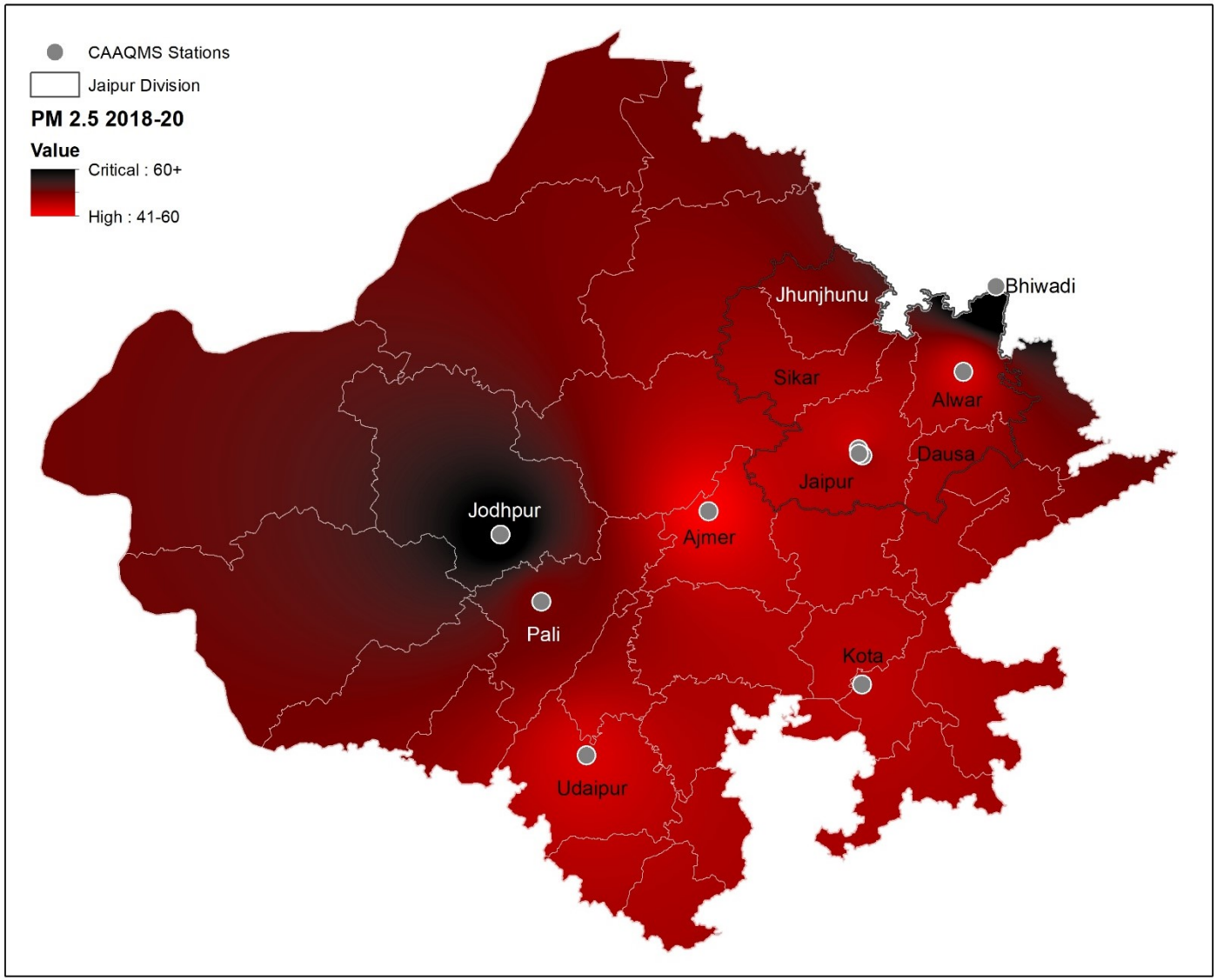
- **Comprehensive science based plan to meet clean air standards and to deliver on public health goals**
- **Regional approach to minimise regional influence on local air quality**
- **Multi-sector plan** with sector-wise targets and strategies with qualitative and quantitative indicators
- **Compliance and monitoring mechanism** for measurable outcomes
- **Adopt demand management strategies**
- **Equitous, affordable, innovative, and leapfrog solutions**
- **Adopt polluter pay principle and fiscal strategies**
- **Robust institutional arrangement** for effective implementation.
- **No regret and best practice approach**

PM2.5: Pollution reduction target (reduction target from 3-yr average baseline)



Note: 3-yr average is calculated as per USEPA method for each station. Jaipur citywide is average of three CAAQM stations in the city. Data upto 20 Dec 2020
Source: CSE analysis based on CPCB data

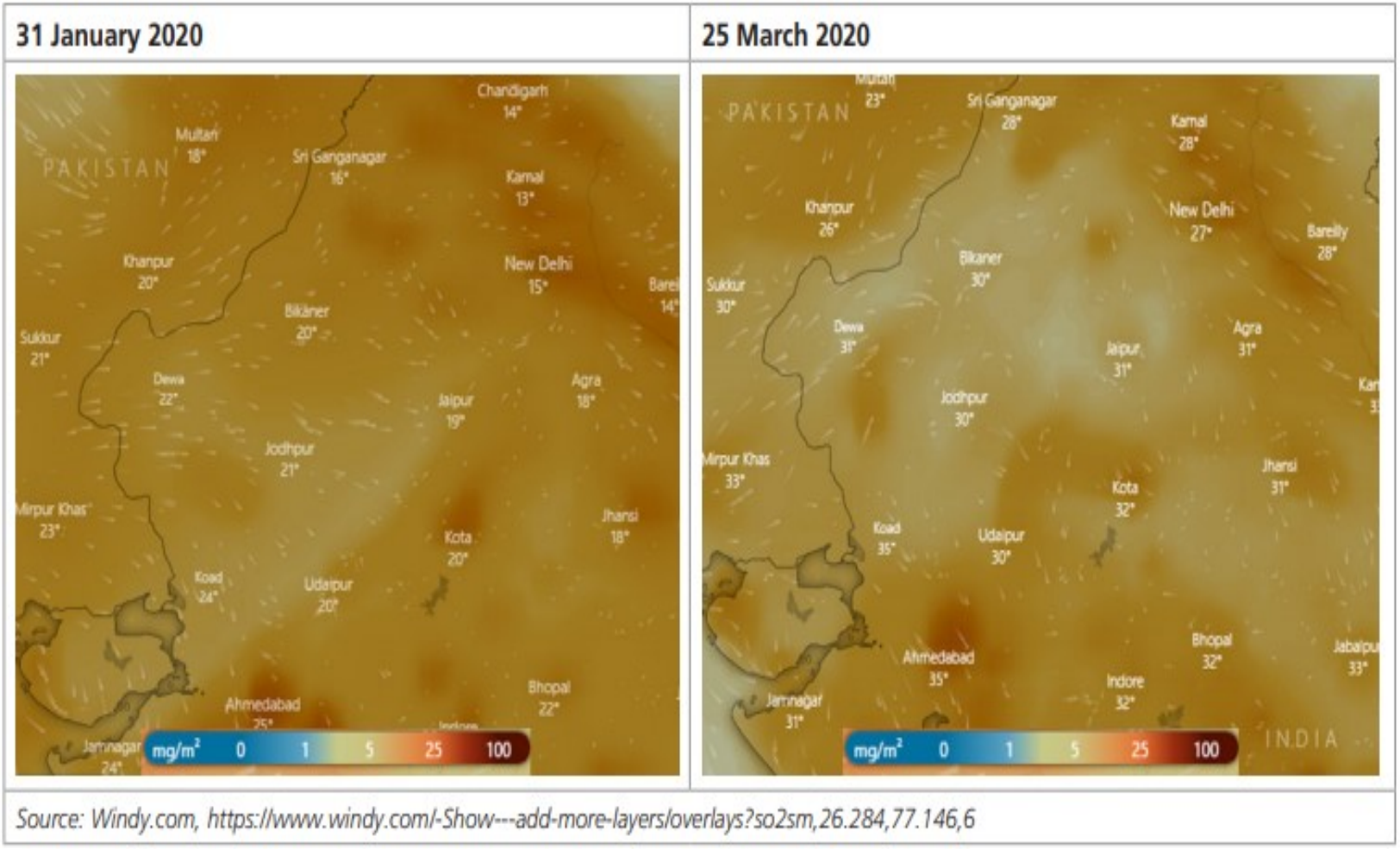
Need regional approach: $PM_{2.5}$ pollution profile (3-yr average 2018-20)



Note: Data upto 20 Dec 2020. Map not to scale
Source: CSE analysis based on CPCB data

Regional profile

Satellite imagery of Rajasthan-- SO2 build up in the region

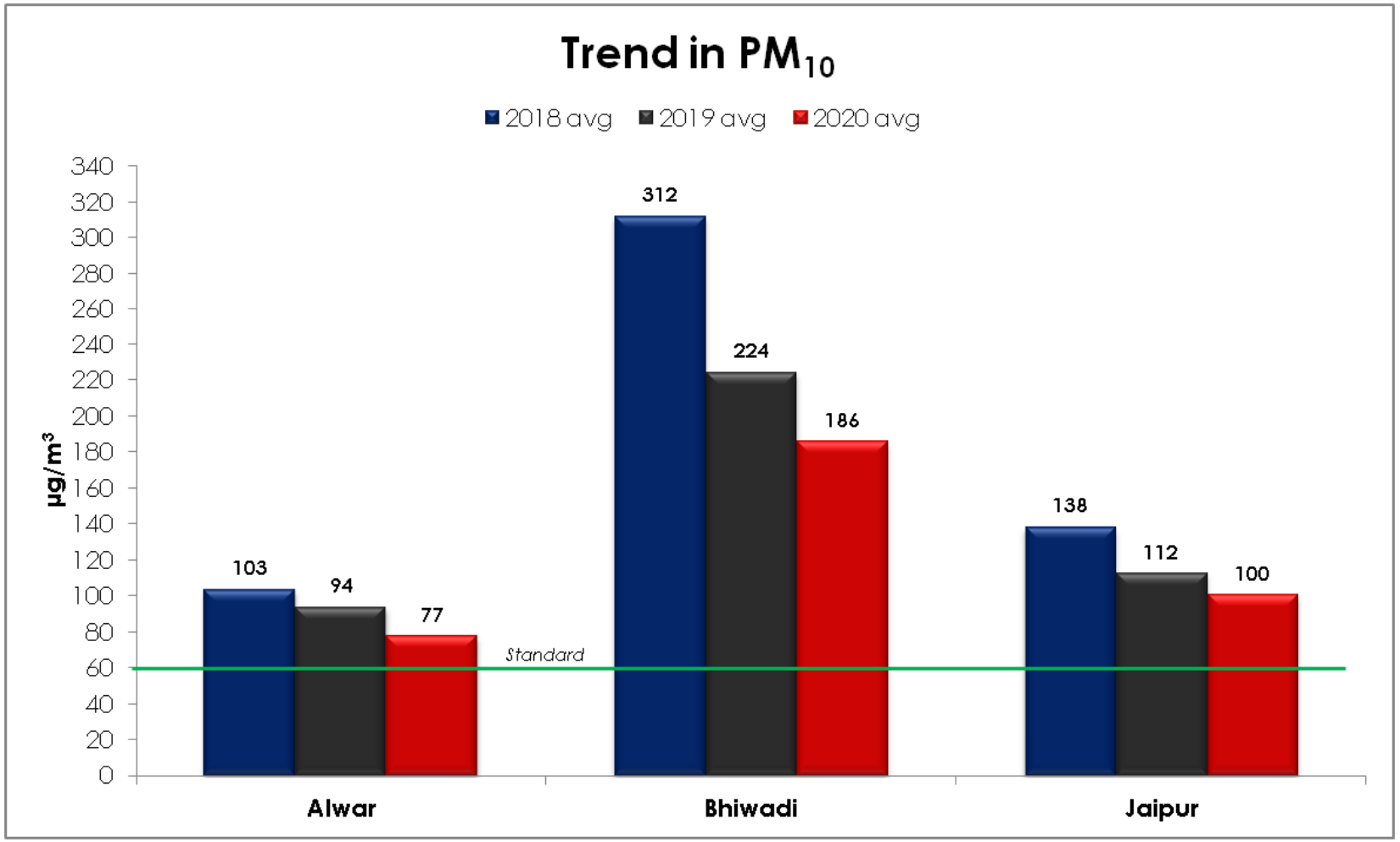


Source: Windy.com, https://www.windy.com/-Show---add-more-layers/overlays?so2sm,26.284,77.146,6

Dark Patches– High SO2 mass

PM_{10}: Downward: Need big cuts

(Long term annual average declining)

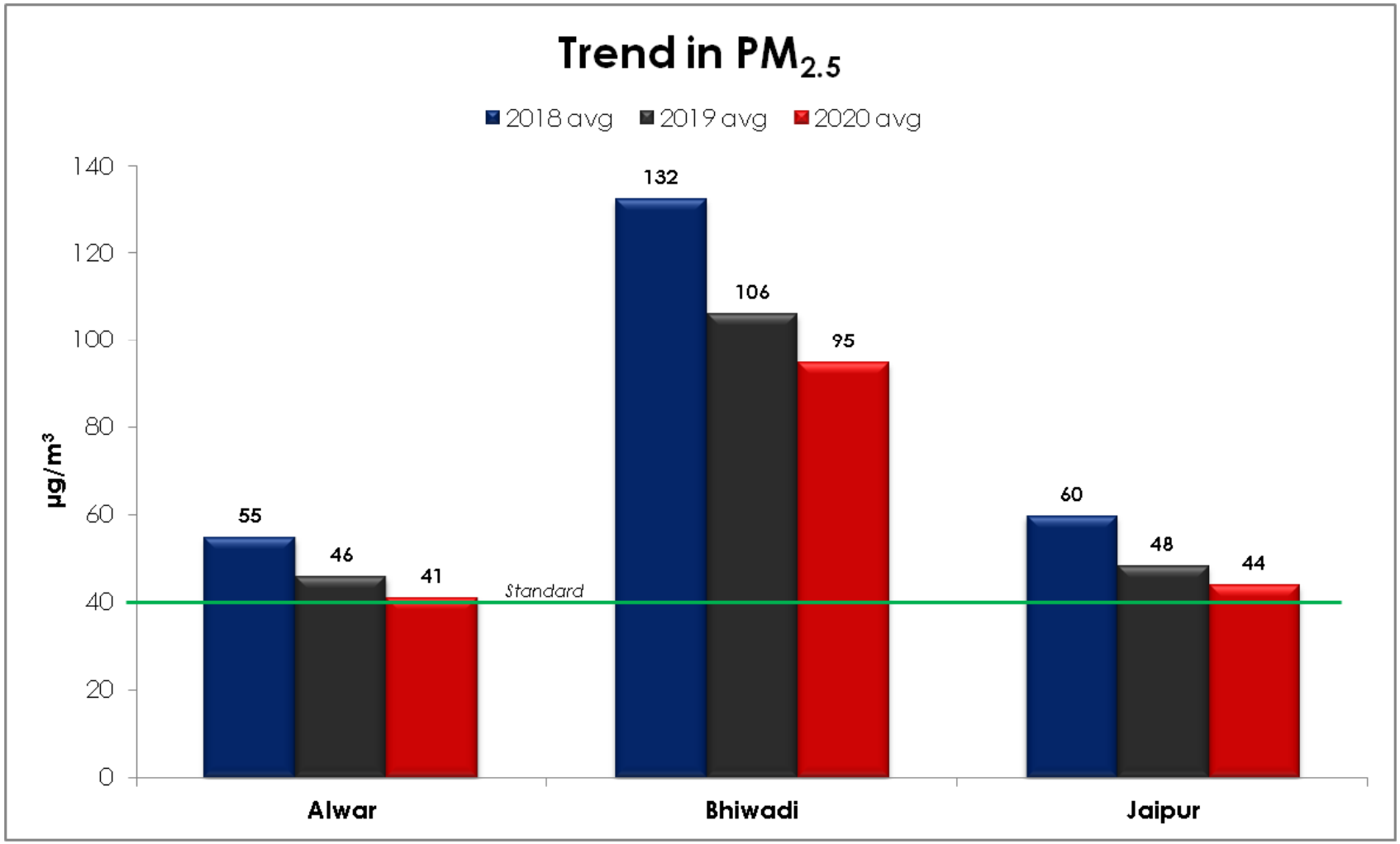


Note: Annual average is calculated as mean of monthly averages. Jaipur citywide is average of three CAAQM stations in the city. Data upto 20 Dec 2020

Source: CSE analysis based on CPCB data

PM2.5: Downward: Need further cuts

(Long term annual average declining)

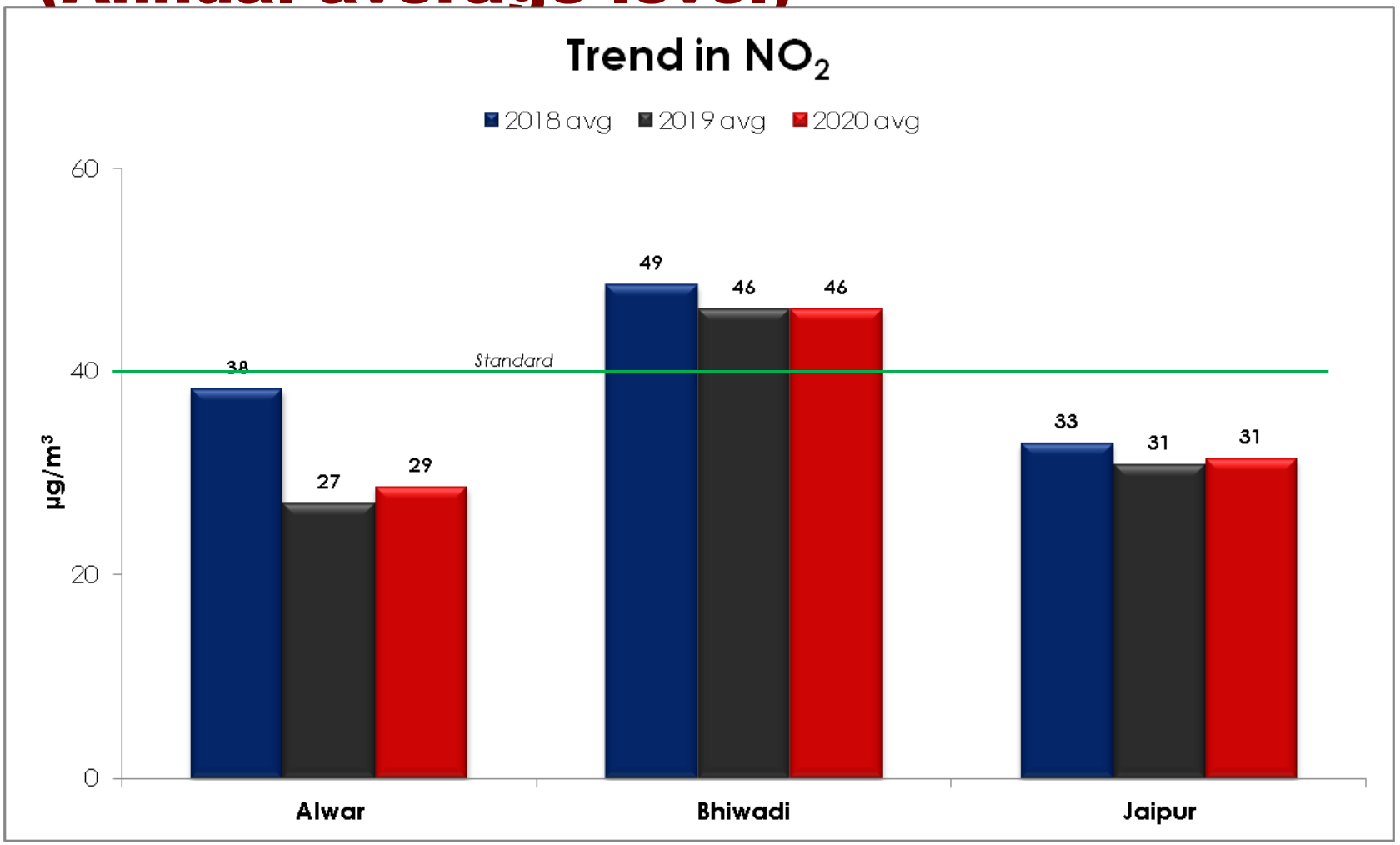


Note: Annual average is calculated as mean of monthly averages. Jaipur citywide is average of three CAAQM stations in the city. Data upto 20 Dec 2020

Source: CSE analysis based on CPCB data

NO_2: Stable

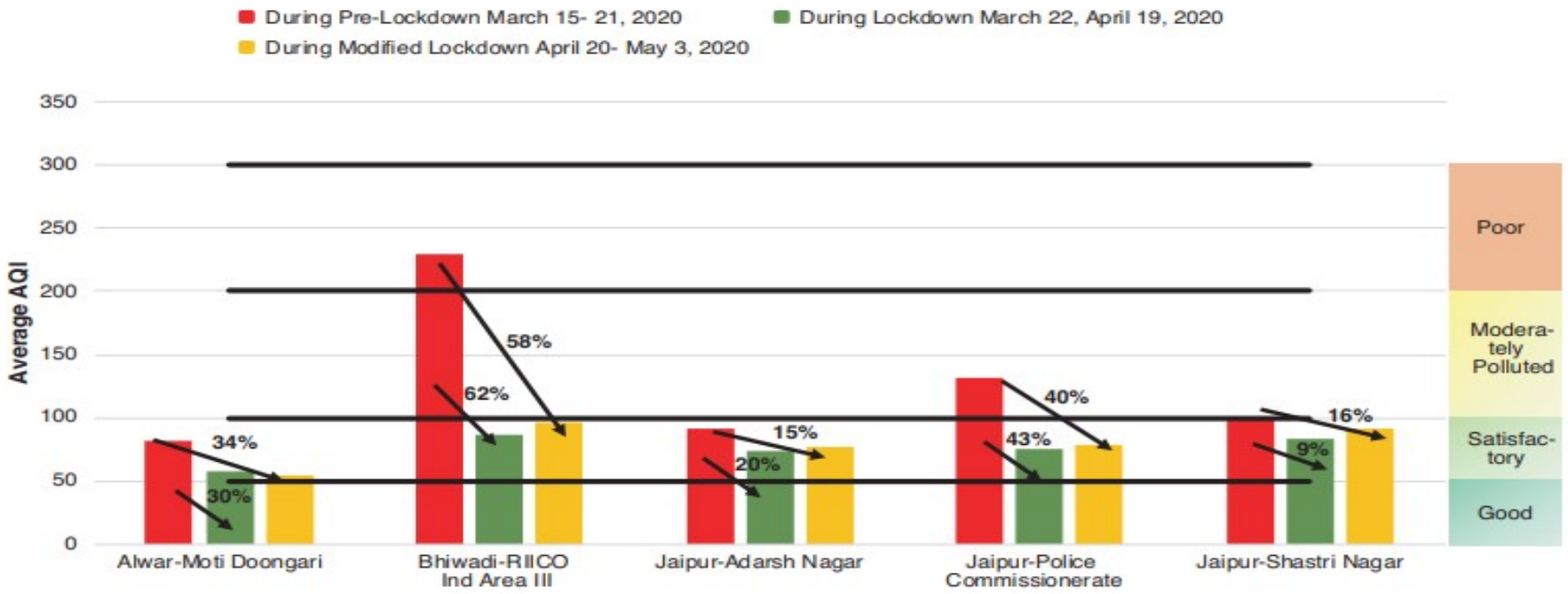
(Annual average level)



Note: Annual average is calculated as mean of monthly averages. Jaipur citywide is average of three CAAQM stations in the city. Data upto 20 Dec 2020
Source: CSE analysis based on CPCB data

RSPCB: Impact of lockdown on air quality in Jaipur region

Classification of days based on air quality index during the lockdown phases

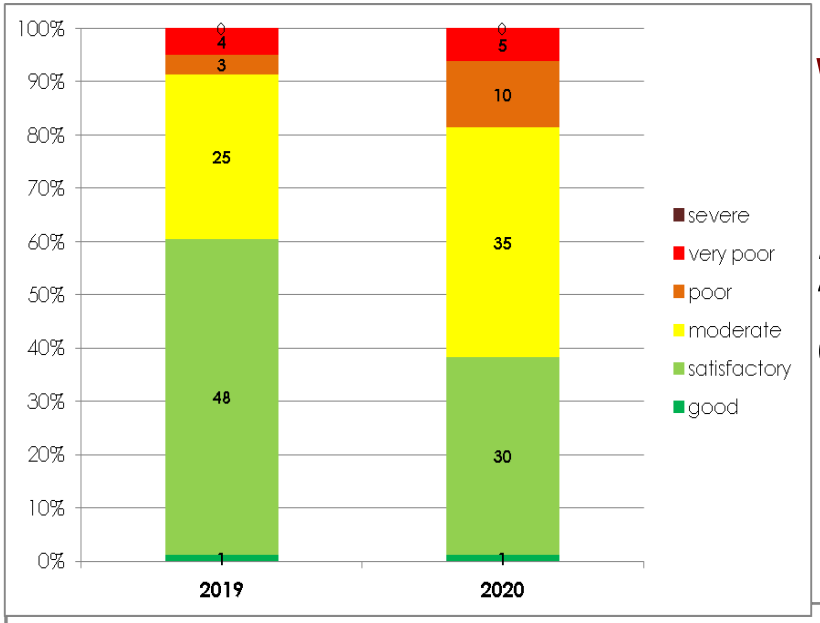


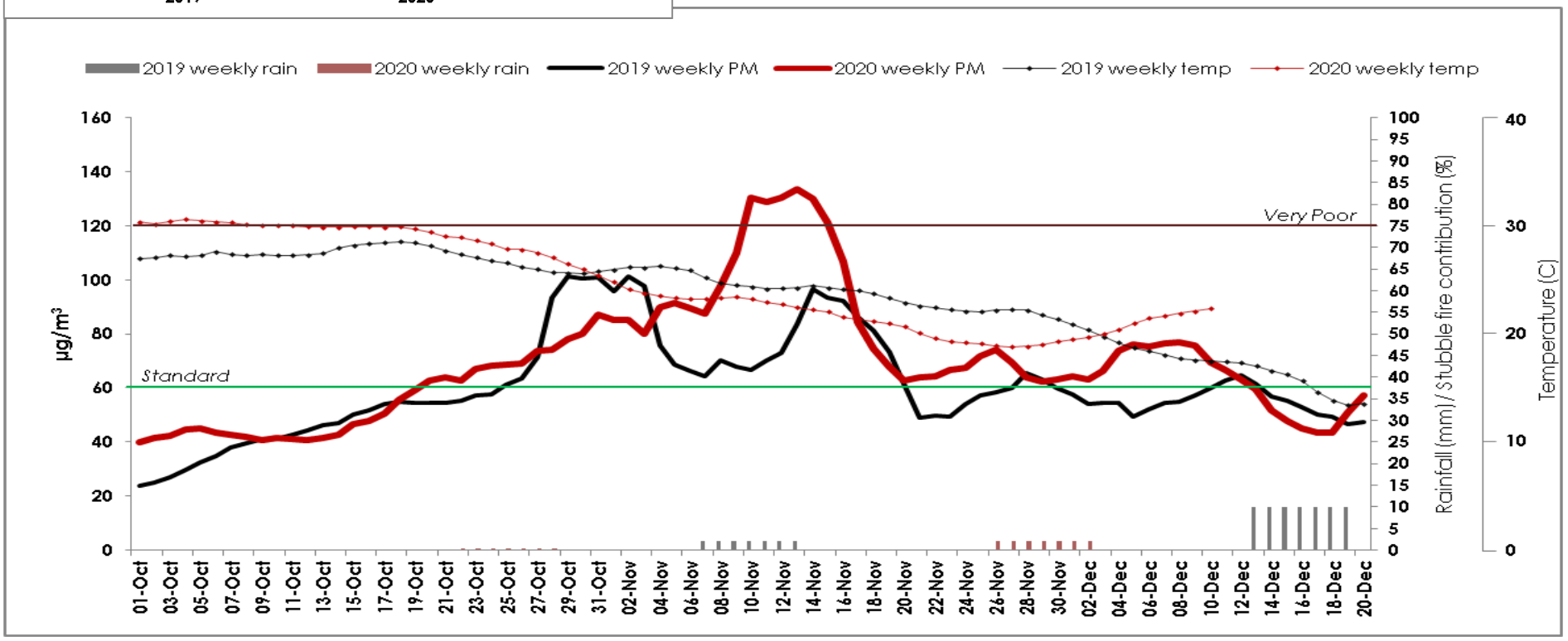
Source: RSPCB

- **Significant increase in number of days in satisfactory and moderate categories-** increased by up to 40 to 60%
- Highest reduction in average AQI levels in Bhiwadi

Winter pollution

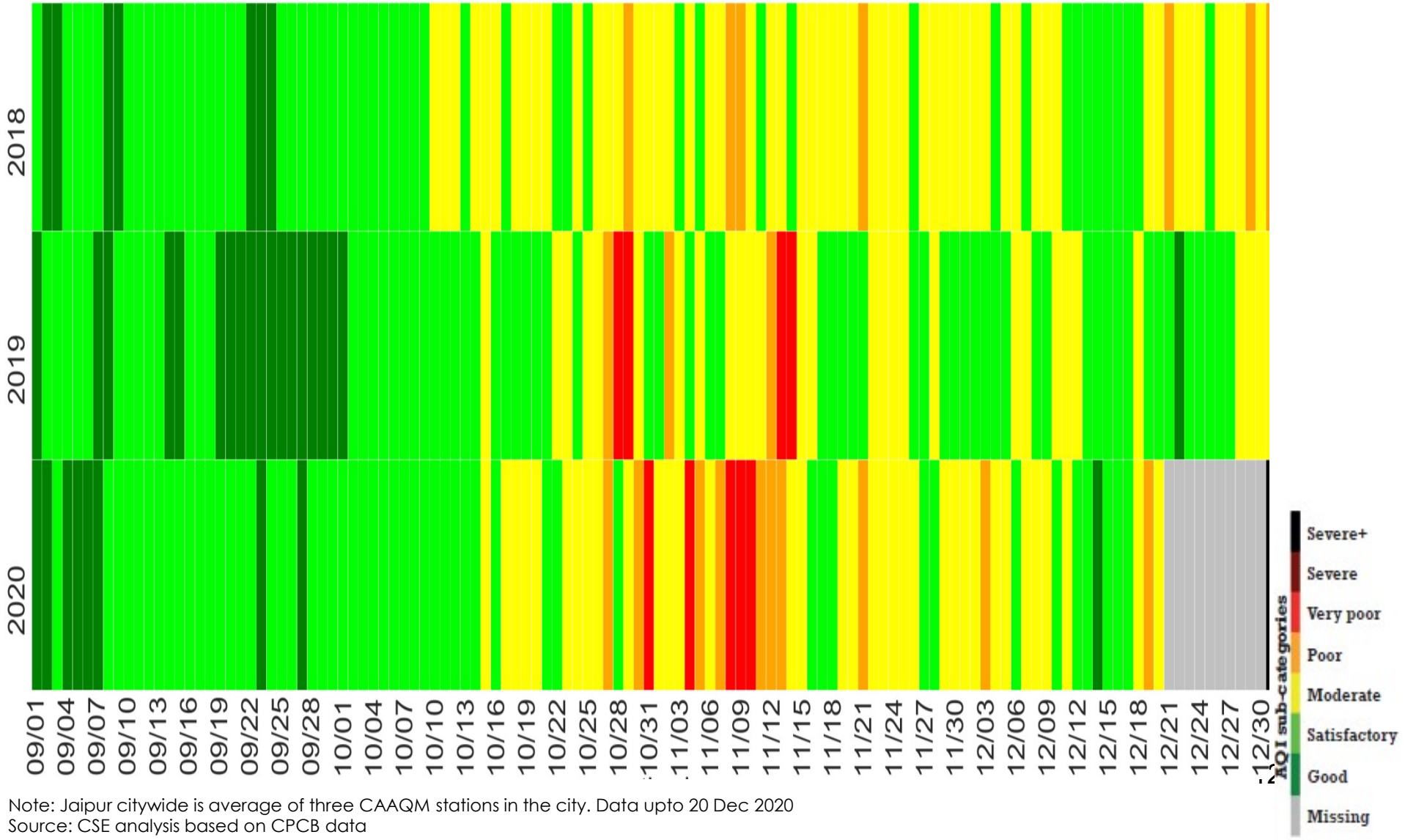
2020 winter: Number of days in “Poor” AQI (PM2.5) more than double





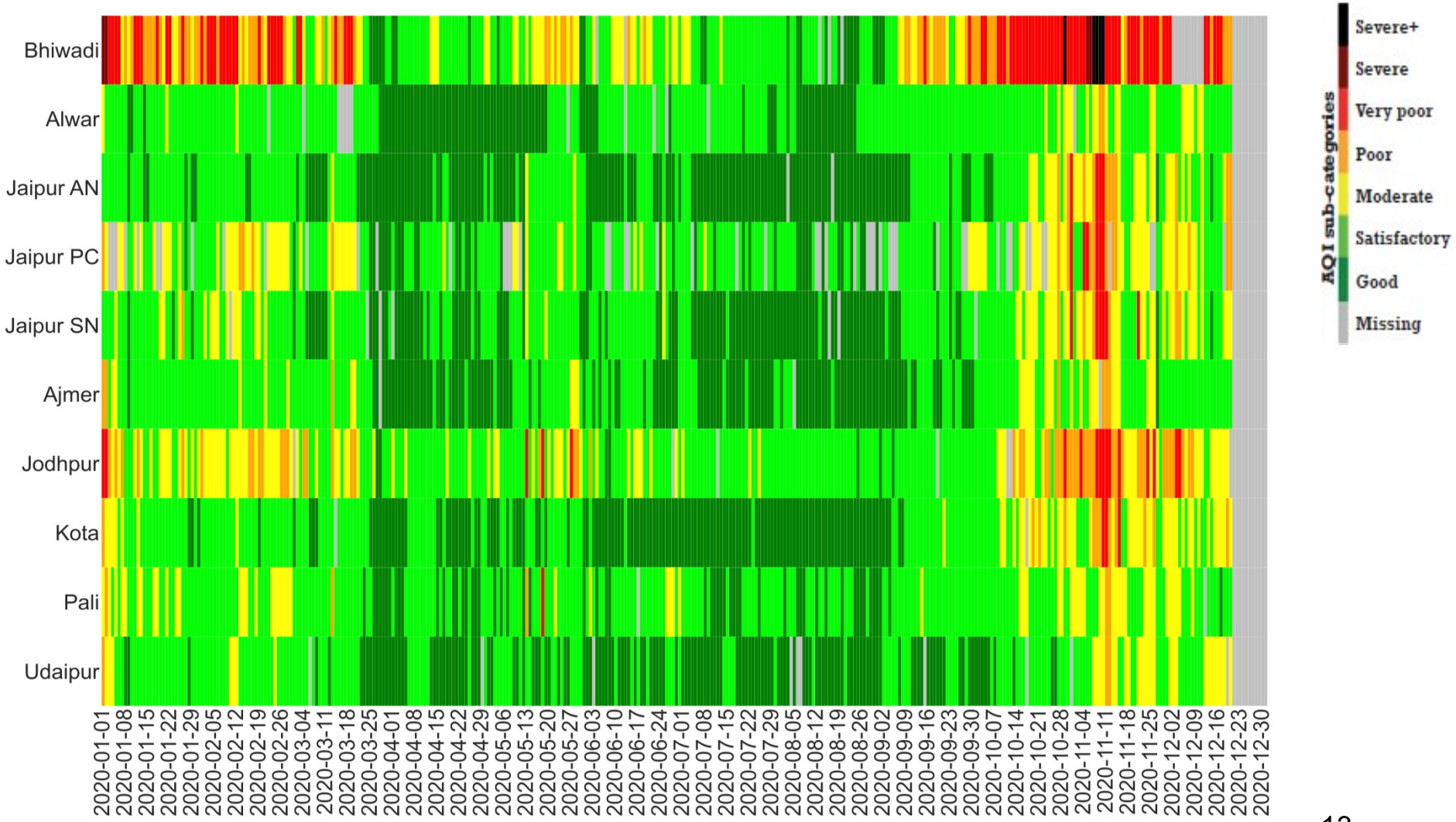
Note: Jaipur citywide is average of three CAAQM stations in the city. Data upto 20 Dec 2020
Source: CSE analysis based on CPCB data

Jaipur: Frequency and duration of winter episodes



Note: Jaipur citywide is average of three CAAQM stations in the city. Data upto 20 Dec 2020
Source: CSE analysis based on CPCB data

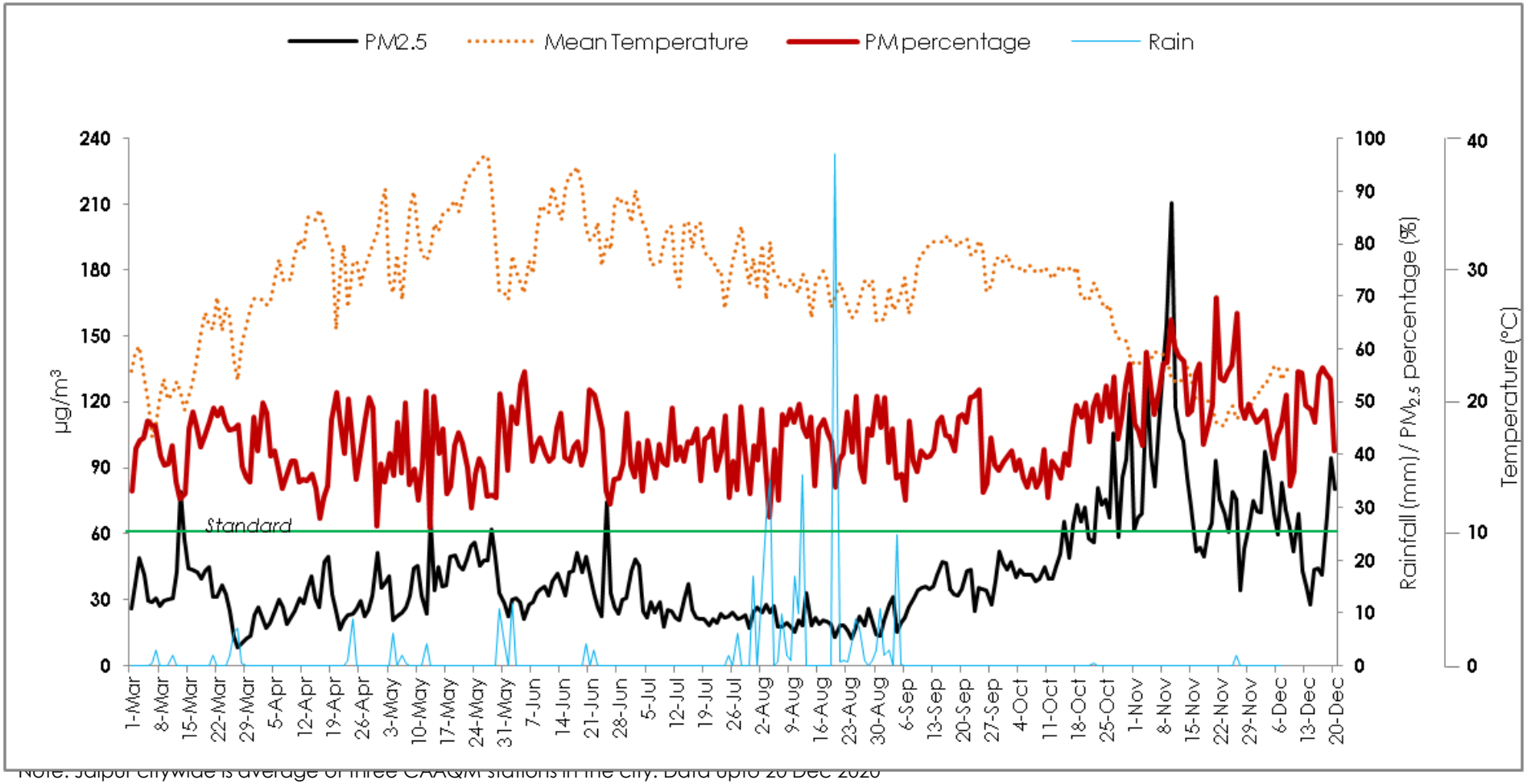
Air more toxic during winter in all the cities



Note: Daily 24-hr average is for each individual CAAQM stations . Jaipur AN = Adarsh Nagar,; Jaipur PC = Police Collecterate; Jaipur SN = Sanjay Nagar. Data upto 20 Dec 2020
Source: CSE analysis based on CPCB data.

Jaipur: Share of PM2.5 in PM10 increases during winter

Monthly average $PM_{2.5}$ percentage rose beyond 50% in November and hit a daily high of 70% during winter

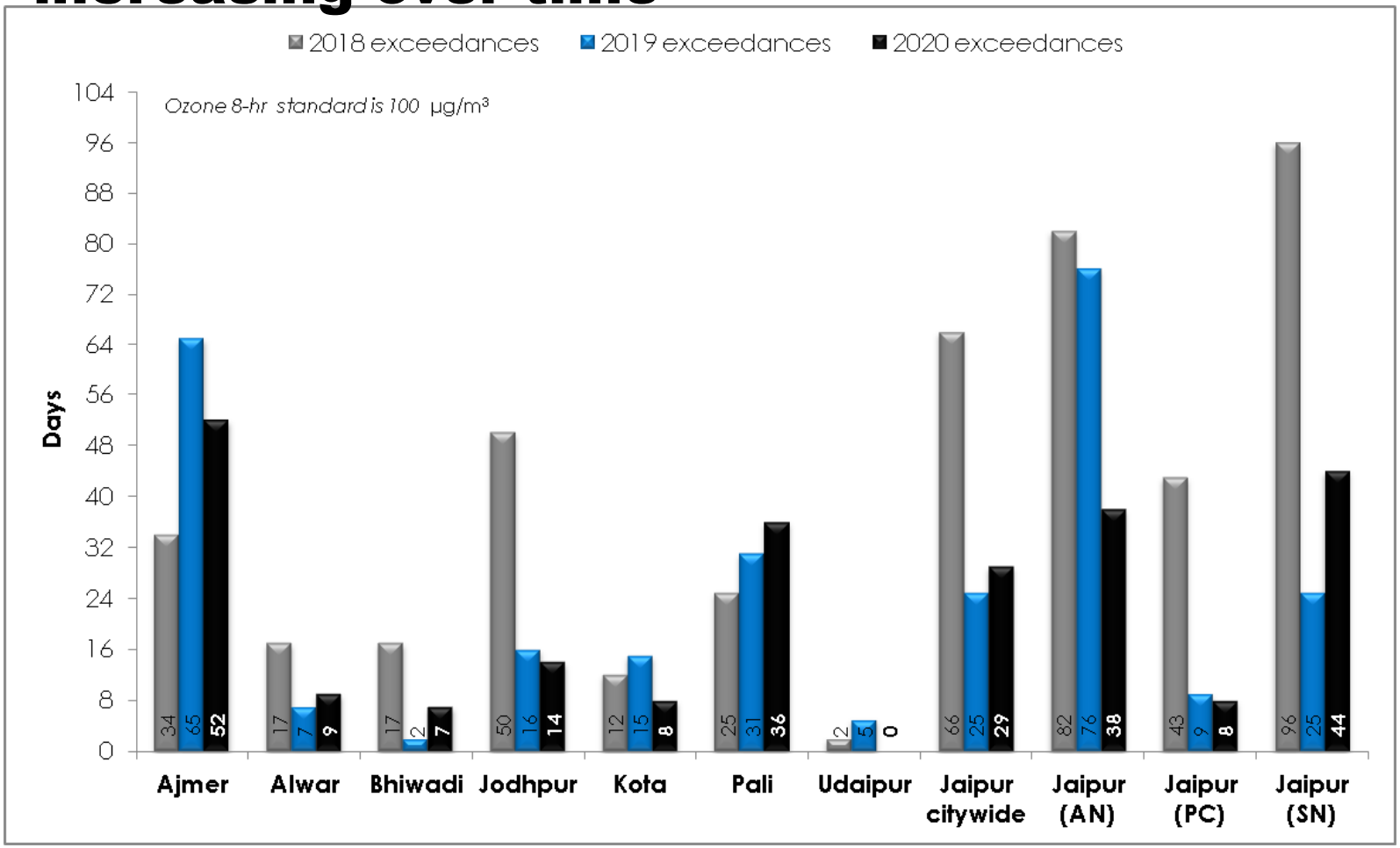


Note: Jaipur citywide is average of three CAAQM stations in the city. Data upto 20 Dec 2020

Source: CSE analysis based on CPCB data. Weather data from IMD

Ozone: The new challenge

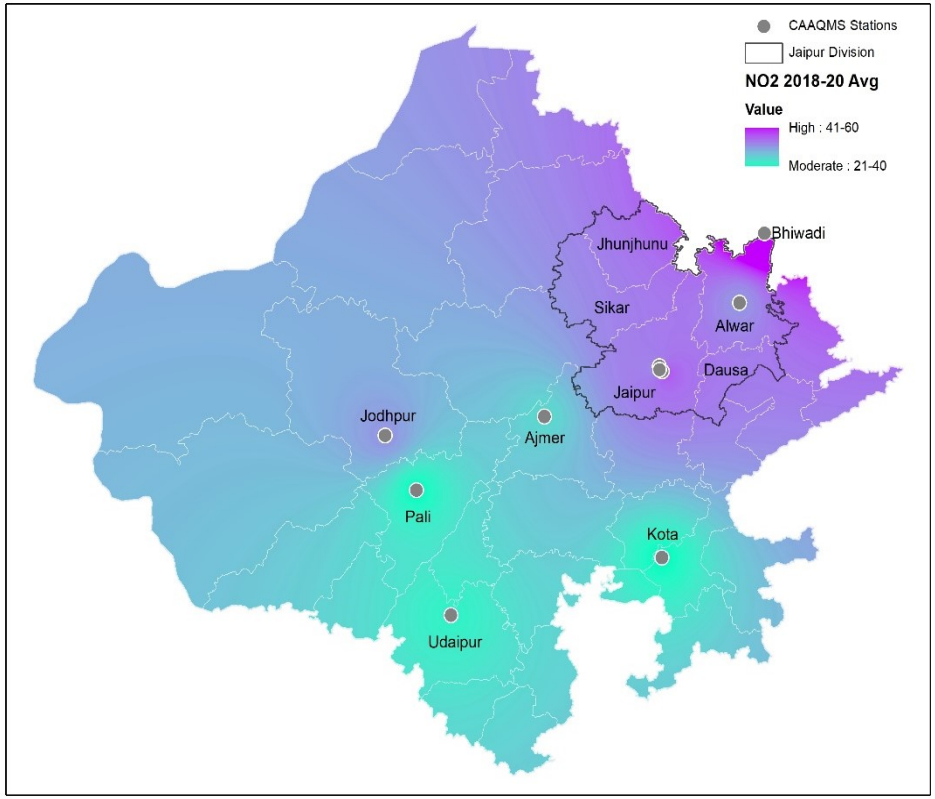
Number of days exceeding standards increasing over time

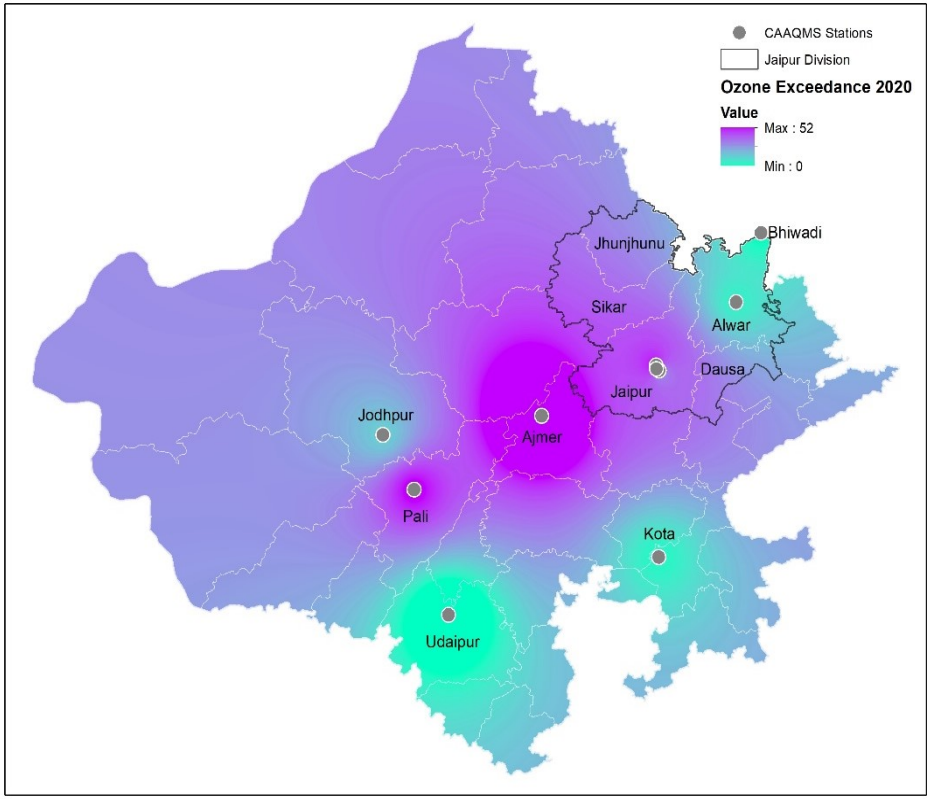


Note: exceedance is calculated as day when the daily maximum 8-hr average of ozone exceeded the 8-hr standard. Daily maximum 8-hr average of ozone is calculated as per USEPA method for each station. Jaipur citywide is when the average of three CAAQM stations in the city exceeded the standard. Ozone standard is that 8-hr average should not be exceeded for more than 2% of the days (8 days) in an year. Data upto 20 Dec 2020 .

Source: CSE analysis based on CPCB data

2020
NO2 vs Ozone





High NO2 areas have lower ozone
Within Jaipur Division, highest NO_2 levels appear around Alwar,
But ozone Exceedance lowest in Alwar.

Note: Data upto 20 Dec 2020. Map not to scale
Source: CSE analysis based on CPCB data

What about our health?

Health Risk

- **Air pollution ranks as the second-largest risk factor for premature deaths in Rajasthan** (2016, state-level disease burden estimates by IHME, ICMR and PHFI)

- **If air pollution concentration could be lowered, the life expectancy in Rajasthan could increase** by 2.5 years.

- **Number of deaths due to household air pollution** (39,288) **is lower** than the number of deaths due to ambient air pollution (43,295) in Rajasthan.

- **Disease profile of the state**, -- ischemic heart disease and lower respiratory infections identified as the leading cause of productive life year's loss in Rajasthan.

High economic cost of health risk

Lancet report 2020: Rajasthan

- Economic loss attributable to air pollution as a percentage of state GDP for Rajasthan is 1·70%

- Economic loss due to lost output from premature deaths and morbidity attributable to household air pollution as a percentage of state GDP in Rajasthan was 0·79%

- Total and per-capita economic loss due to premature deaths and morbidity attributable to air pollution in Rajasthan was 2294 US $ millions and 28.5 US $

- Economic loss due to premature deaths and morbidity as a percentage of state GDP in 2019 for Rajasthan was highest for ambient particulate pollution followed by household air pollution and then ambient ozone pollution

Source: Lancet, 2020, https://www.thelancet.com/action/showPdf?pii=S2542-5196%2820%2930298-9

Children – Most vulnerable

Children at higher risk:

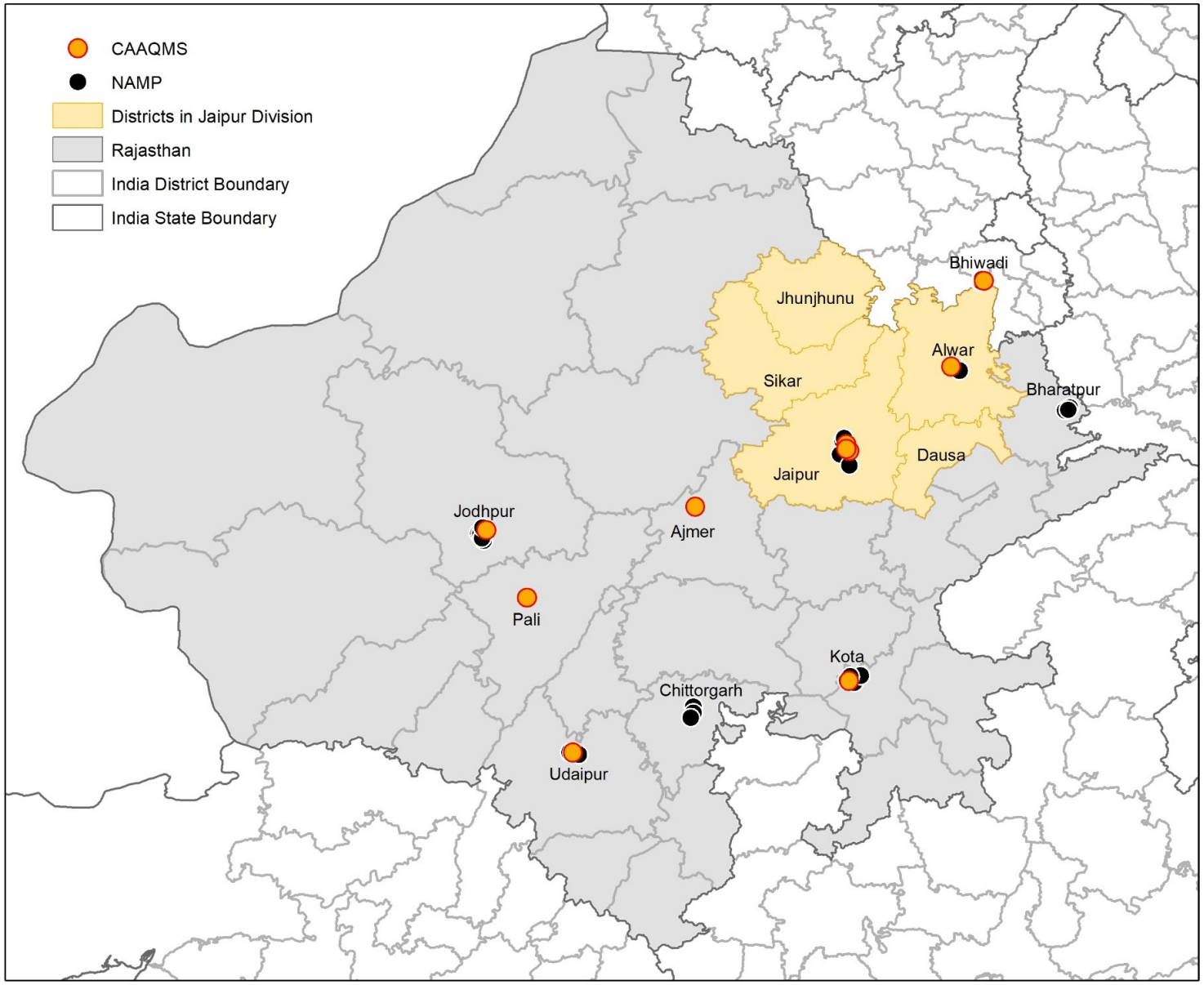
- **Rajasthan records highest number of deaths caused by Lower Rrespiratory Infection (LRI)**. In 2017-- death rate among 0–5 year age group was 126.04 per lakh.
- LRI is deeply impacted by PM2.5 concentration.

- **Evidence from J K Lon hospital in Jaipur:**
  - **2000:** Out of 105,908 children treatee in OPD, 22,762 children had respiratory disease – 21%
  - **2018:** Out of 445,398 children in OPD, 168,687 had respiratory symptoms – 38%
  - Hospital admission due to respiratory condition has increased from 2422 to in 2000 to 11584 in 2018 in that hospital

Agenda

Air quality monitoring …Improving our knowledge about air quality …

Expanding monitoring network



Monitoring network has expanded since 2016

Manual stations
2016: 30 stations
2019: 39 stations

Real time
2016: None
2020: 10 stations

41% of all monitors are in Jaipur division

Air Quality Monitoring: Next steps

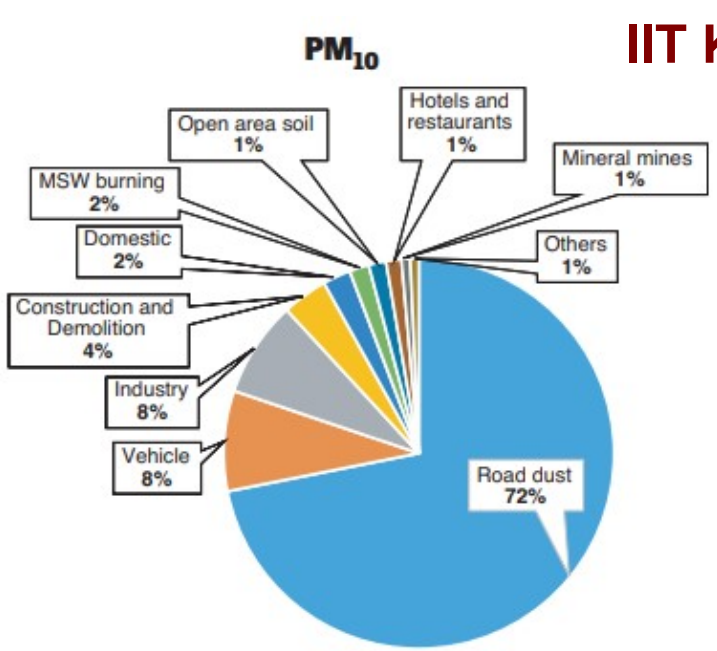
- Expand real time monitoring stations
- Daily air quality pubic information system based on national air quality index
- Develop capacity for pollution forecasting
- Use satellite data to assess ground level air quality
- Assess application of low cost sensor based monitoring
- Air quality monitoring to capture air-shed/influence area in the larger region including peri-urban and rural areas

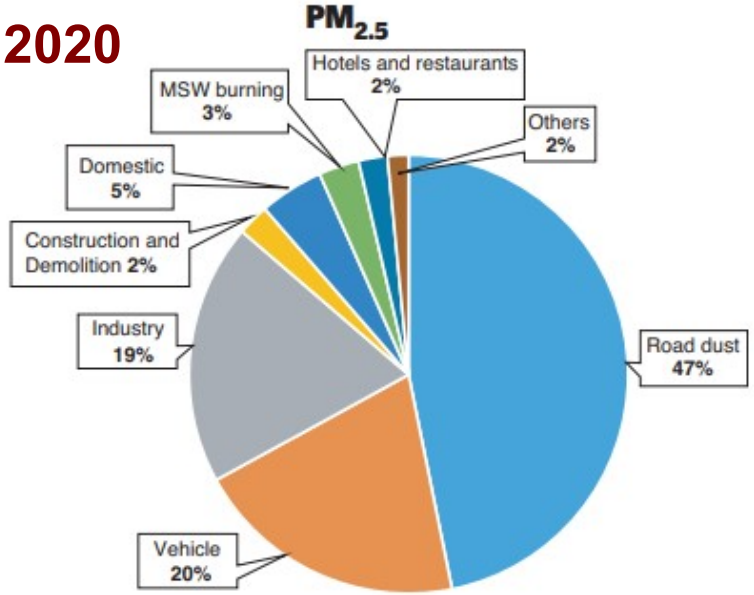
Assessing pollution sources

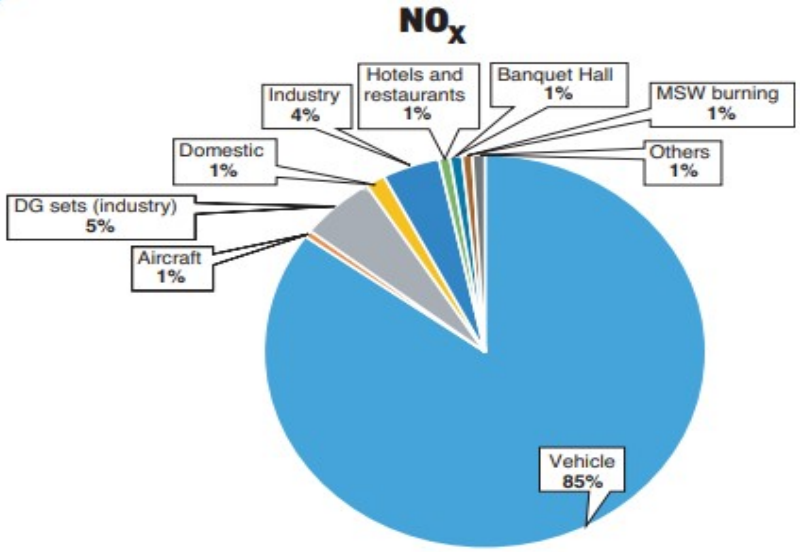
Where is pollution coming from

Jaipur- Emission Inventory

IIT Kanpur study, 2020



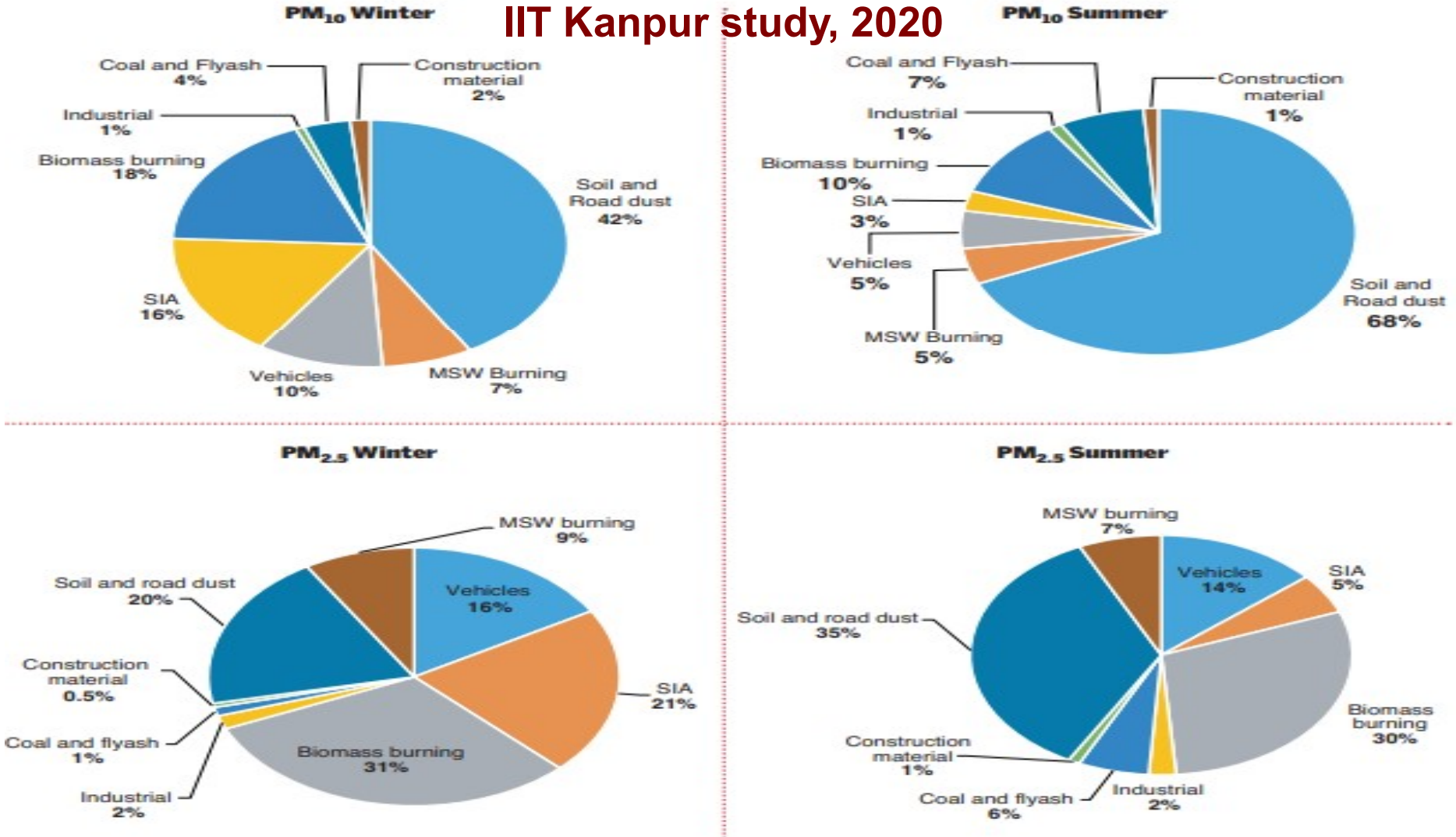




Source apportionment–

Contribution to air pollution concentration

IIT Kanpur study, 2020



Source: IIT Kanpur, 2020

Jaipur: Pollution profile

Emissions inventory – Contribution to the quantum of pollution

- **Road dust – 47%**
- **Vehicles – 20%**
- **Industry – 19%**

Nox: Vehicles largest contributor – 85%

Source apportionment -- Contribution to pollution concentration

Winter: Huge impact of combustion sources on PM2.5 concentration

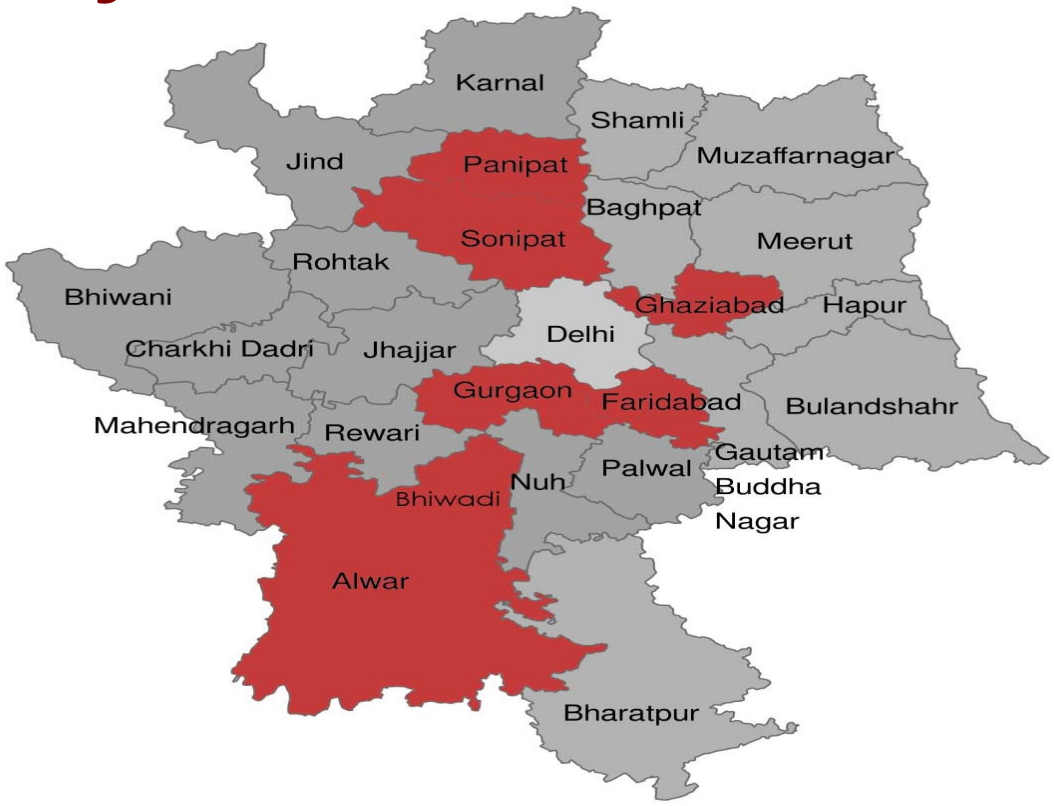
- Biomass 31%;
- Secondary aerosols – 21%
- Vehicles 16%

Understanding dust pollution

- **Road dust** contains maximum traces of highly toxic and cancer causing substances – accumulates toxins from combustion sources –(IIT Kanpur)

- Geographical disadvantage – loose soil and high wind effect in Indo-Gangetic Plain –
- Dry winters/summers add to the problem
- Only road sweeping will not help
- Address mismanaged urban construction and roads
- Urban greening agenda

Agenda: Industry



Industry clusters: Identifying hotspots

- Bhiwadi has the maximum number of large-scale industries that influence the urban air quality

District	Number of large-scale industries[20]	Number of medium-scale industries[21]	Nature of micro and small enterprises[22]	Major types
Alwar	15	7	Mineral grinding, food, auto component, oil, cement pipe, leather tanning, stone cutting, pottery, brick kilns	Chemicals, ceramics, automobile assembly, brewery
Bhiwadi	105	47	Metal works, automobile service and repairs	Metal works, food, automobile assembly
Jaipur (rural+ urban)	47	30	Rolling mills and induction furnace, gem cutting, C.I. casting, readymade garments, brick kilns, stonework and crusher	Cement, metal work, ceramics
Sikar	6	3	Food product, leather, chemical, brick kilns	Cement, dairy, fibre
Jhunjhunu	1	1	Stone crusher, brick kilns	Copper concentrate
Dausa	0	0	Stone carving, pottery, brass work	

Source: Government of Rajasthan (GoR)

Industrial pollution: Next steps

Need hotspot-wise action plan

Switch from coal to cleaner fuels -- only option for smaller units

Address natural gas pricing – bring under GST like coal

Encourage but monitor use of agro-residue as an intermediary fuel

Develop roadmap for centralized steam boilers -- Induction furnaces can be made mandatory (especially in Jaipur & Bhiwadi).

Ensure all industrial areas have plans for solid waste management

Control fugitive emissions from industries and industrial area – Ensure smart monitoring in large industries - CEMS regime

Strict adherence to RSPCB mineral grinding and Stone Crusher guidelines specially in Rajgarh and MIA in Alwar is important.

Industry to display consent details to identify illegal industries.

Brick Kilns

- Rajasthan has more than 1,500 brick kilns

Jaipur- traditional technology
Alwar- Out of 130, around 80 have converted to zigzag technology

Cities	Number
Jaipur	168
Sikar	100–150
Alwar	130
Jhunjhunu	100–125

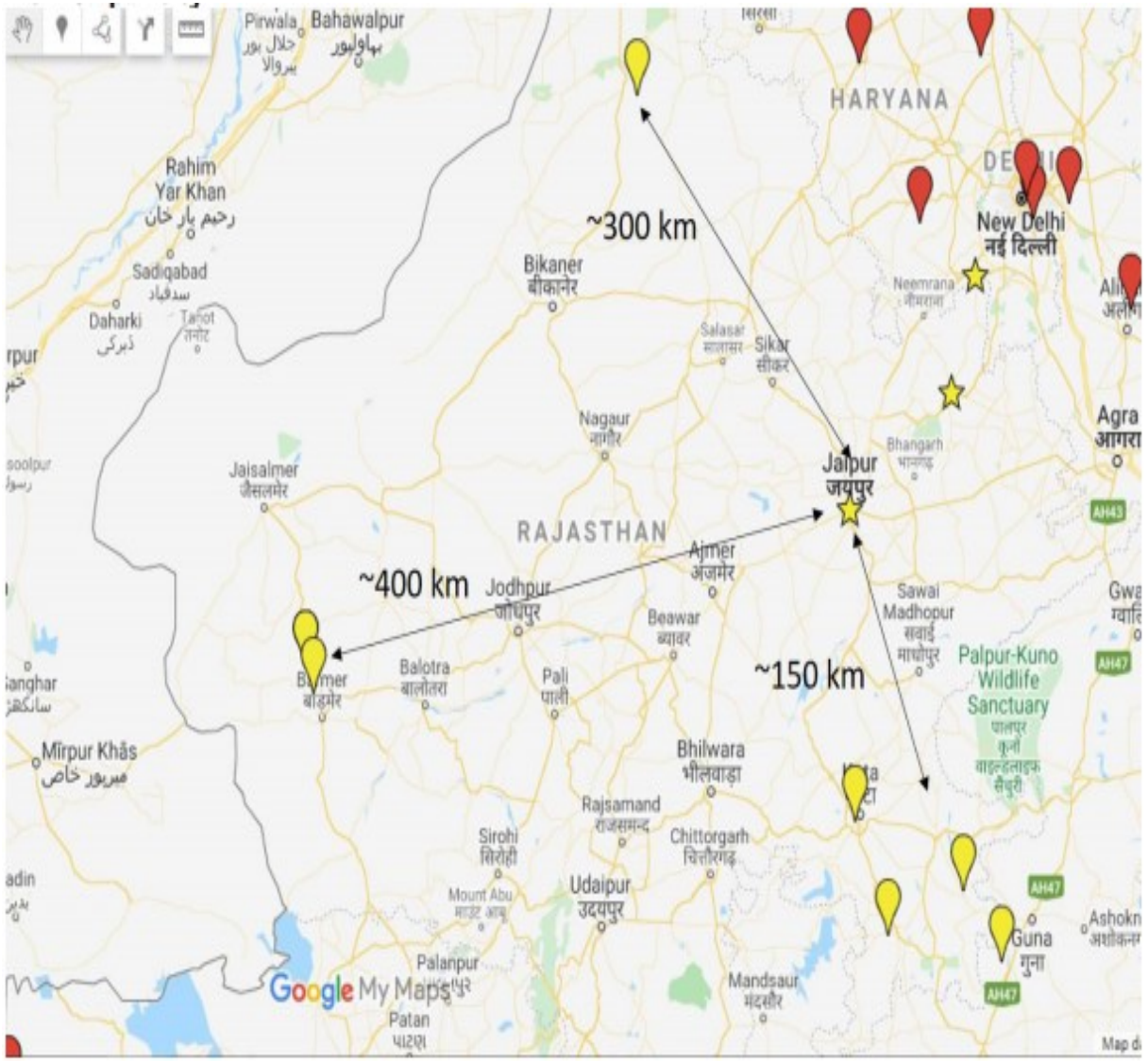
Source: CSE and RSPCB

- **An order was issued by the CPCB in 2017** under the directions of section 18 (1) (b) of the Air (Prevention and Control of Pollution) Act, 1981 for prevention and control of air pollution, for different types of brick kilns.

- (i) **Must provide consent, failing which brick kilns to be shut**;
- **Must meet the prescribed norm and siting guideline** with immediate effect,
- (ii) **Provide status on conversion of natural draft to induced draft brick kilns**,
- (iii) **Strictly enforce siting guidelines**,
- (iv) **Ensure the area around brick kilns is paved,**
- (v) **Ensure fine dust does not accumulate around brick kilns**.
- **Needs stringent implementation**

Power Plants

- Rajasthan has eight coal-based TPPs with 43 units totalling 10.2 GW of capacity



Current status

Compliance status of coal-based thermal power plant in Rajasthan:

- **One-third of Rajasthan's coal-based capacity is compliant with the PM standards** which is much below the national compliance rate of 56 per cent.
- **Majority of capacity is non-compliant with SO2 standards**-- no plant awarded work till November, 2020.
- **NOx compliance is better considering recently relaxed norms** of 450 mg/Nm3.
- **Compliance with Water and Mercury is average**

-- More than two third of the capacity is owned by state sector.

-- Two third of the capacity is less than 10-year-old.

-- Fly ash utilization is good.

-- Better transparency in disclosing water and mercury data in Rajasthan

Power plants: Next steps

- Plant wise detailed action plan crucial for meeting PM, SO2 and NOx standards before 2022 deadlines.
- Separate deadlines should be given to meet water norms.
- CEMS data connectivity need to be addressed and CEMS data should be made publicly available for bringing transparency.
- Water audits and CEMS audits are also recommended.
- A clear phase out plan for older units and a few of them can also trialed for biomass co-firing.

Vehicles

Motorisation

- High growth rate - vehicles 9% per annum; cars 11% per annum
- 30% of total registered vehicles in the state in Jaipur;
- 64% of total registered vehicles in Jaipur district.
- Per-capita vehicle ownership in Jaipur district very high -- 446 per thousand people -- compared to the regional average of 243 per thousand
- Share of two-wheelers is very high (i.e. more than 70% of total registered vehicles
- Second highest share of goods vehicles in Alwar, Sikar, Dausa and Jhunjhunu districts indicates the presence of industrial and freight activity in those areas.

Note: Districts of Jaipur region are shown in red
Source: Statistical Abstract 2018–19, Transport Department, GoR.

On-road emissions management

- PUC scheme online since October 2017. A total of 68.12 lakh vehicles checked till March 2019 have been checked. Vehicles challaned for not carrying valid PUC certificate
- Failure rate varies between 4-6% in petrol vehicles and less than 1% in diesel vehicles
- EPCA -CSE audit of PUC centres, 2017: Led to linking of insurance with PUC certificate; notification of new PUC norms for BS VI vehicles
- SC approved use of hologram-based colour coded stickers based on fuel type. (August 2018)
- Remote sensing pilot program for fleet screening to identify highly polluting vehicles on road. MoRTH framing rules
- Centralised inspection and maintenance centre

Old vehicles

Phase out of old vehicles

- **NGT order dated 01 January 2014** on phase out of 10-yearold diesel and 15-year-old petrol vehicles in Delhi-NCR region: **Directions issued to all the RTOs in Rajasthan.**

- **2018-19:** 21.2 lakh vehicles deregistered, **--** 12% of total registered vehicles

  Need vehicle scrappage policy and scrappage infratsructure

Clean fuel initiative

- **CNG programme:** As per the order of the transport department dated 10 July 2019, LPG and CNG vehicles get 50 per cent discount during registration.

- Registration of diesel autos/tempos restricted -- LPG and CNG vehicle registration is being promoted

- **CNG network and supply still limited:** Rajasthan State Gas Limited (RSGL) supplying CNG to vehicles at two stations on Delhi–Jaipur National Highway (NH-8) at Neemrana and Kukas. Two more stations are being set up on NH-8 between Neemrana and Kukas.

Electric Vehicles

- State government of Rajasthan is framing a draft electric vehicle policy to fast track the implementation of electric mobility

- State government is proposing 100% exemption to electric vehicles from taxes.

- Rajasthan State Industrial Policy, 2019:
  - Electric vehicle research and manufacturing zone,
  - Financial assistance to encourage electric vehicles and their component manufacturing units,
  - Allotment of land for short-term and long-term leases to reduce land cost for entrepreneurs.

Enormous potential in Jaipur

- Short trip length and predominance of two-wheelers
- Range can be comfortably achieved in a single charge by almost all existing EV models in the market.

Agenda: clean vehicles but also less vehicles on road

Mobility transition

Transportation and vehicle restraint strategies

How people travel

- **High share of walk trips:** Jaipur – 23%, Alwar – 32%
- **High share of cycling trips:** Jaipur – 12%; Alwar – 20%
- **Share of public ctransport** is between 10-18%
- **Decadal comparison of modal share in Jaipur city:** Public transport down by 18%
- **Dependence on two-wheelers high** – Jaipur – 37%
- 52% of trips fall within 0-5 km – walkable.

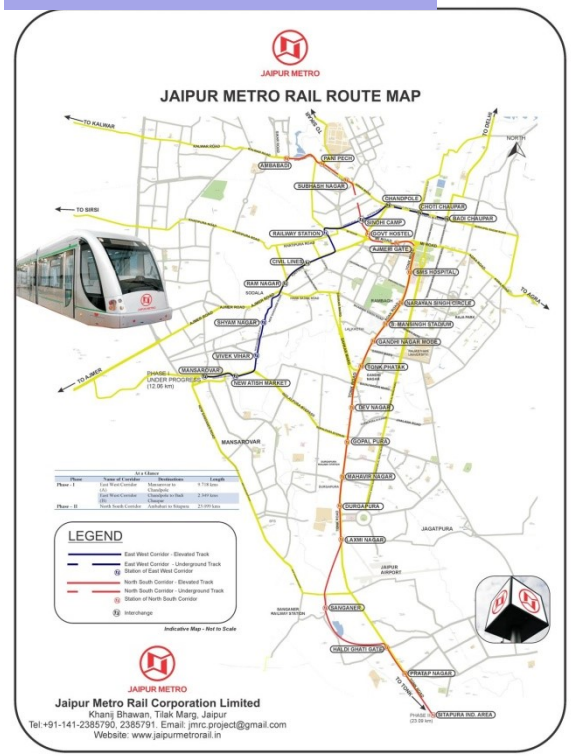
Opportunity…

- Jaipur City Mobility Plan has set the goal of 50% public transport modal share, 35% of NMT share and 100% coverage of footpaths on all roads by 2030

Jaipur: Public transport strategy

Jaipur Bus network

Metro route network



Metro-BRT convergance

Need scale and speed of action

Jaipur

- **Modernise bus fleet**
- **Multi-modal Integration of modes** – physically align infrastructure for all modes (like halting point for rickshaws) around bigger modes (buses)
- **ITS integration** – ETVMs, Smart Card, GPS tracking and central monitoring, PIS
- **Fare policy** to reduce journey cost by not penalising interchanges
- **Integrate Smart Card payment for all modes**
- **Leverge dedicated ring fenced urban transport fund – Rajasthan has taken the lead**

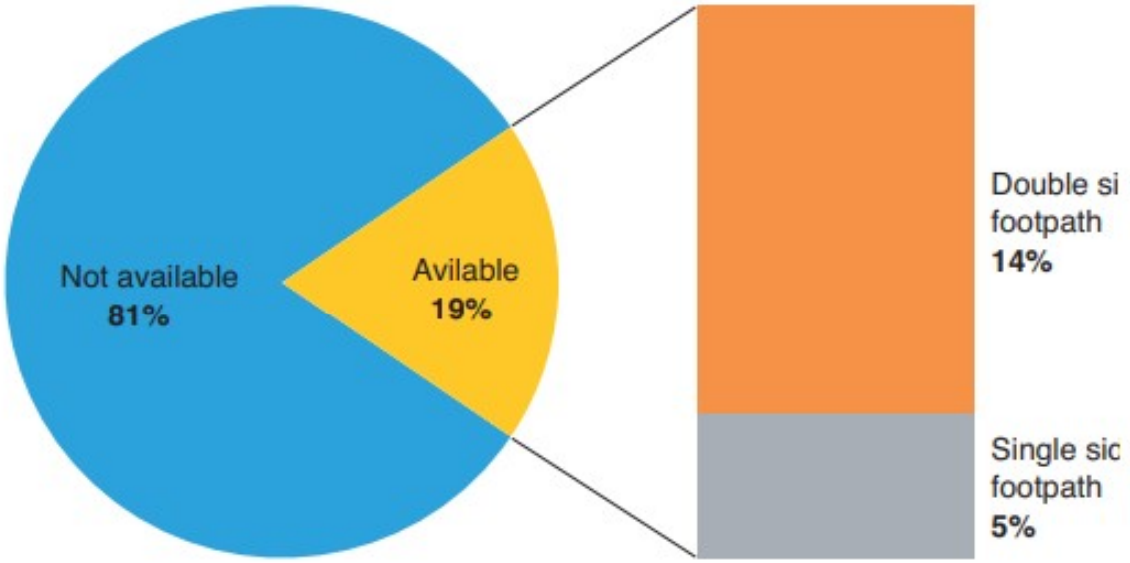
Smaller towns

Reorganise intermediate public transport (IPT - autos, shuttle, taxis) -- Define routes, permits, fares

Phase out diesel autos;

Electrification of para transit

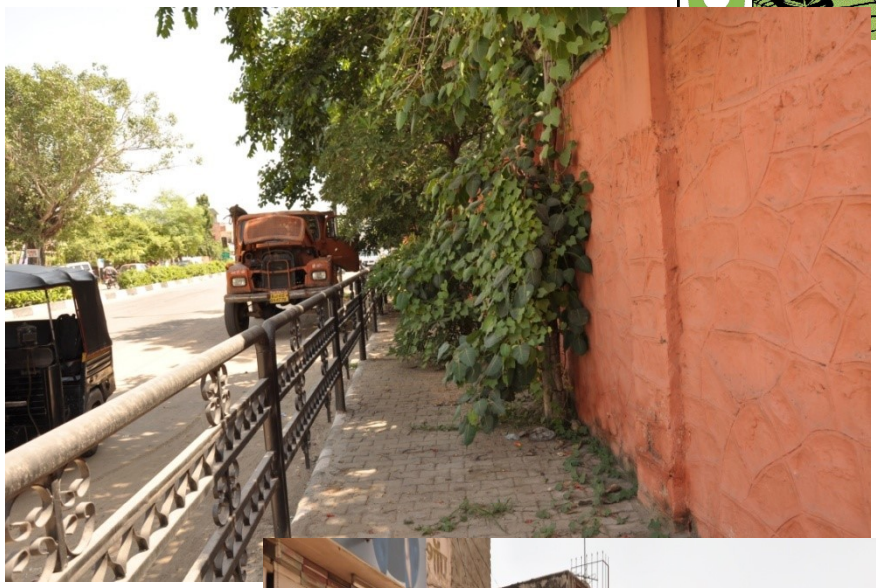
Jaipur: Footpath and walkability



Source: Comprehensive Traffic and Transportation Study for Jaipur Region, 2018

- 81% of roads do not have footpaths.

This requires makeover



Sign of change

Near Jaipur golf course

Footpath along statue circle

Footpath along vidhansabha road

- Implement urban street design guidelines
- Design for safe and universal access
- Implement zonal plans for NMT network
- High street density
- Safety and accessibility

Parking management


No solution yet to parking MESS

All busy market roads have become parking slots. No space is left for shoppers

About 62% of road network in Jaipur city vulnerale on-street parking facilities

'-- Unlimited & free parking incites more car ownership and usage

Makes enormous demand on land

-- Parking takes away space from other important development, walkways from pedestrians, and green areas

Rajasthan has implemented "Proof of parking" linked to vehicle purchase – needs robust implementation strategy

Parking Policy as vehicle restraint measure

Implement parking area management plan (SC directives in NCR)

- **Identifiy and demarcate** legal parking areas;
- **Penalise** illegal parking;
- **Introduce variable parking pricing** based on duration and user pay principle as per National Urban Transport Policy. Do not allow annual lump sum payment
- **Promote shared, priced and public parking**; **Residential parking permit**
- **Prevent parking encrocment in green areas** and parks etc
- **Demarcate emergency vehicle route** on all public roads within neighbourhoods and keep encroachment free
- **IT based parking area management and reform of contractual agreement**
- **Use part of parking revenue for local area development**
- **Organised parking for buses and commercial vehicles**

Control urban sprawl to reduce travel distances

Implement transit oriented development policy

-- Mixed land use development Use (Commercial/ Civic/ Residential within same block)
-- Mixed income development
-- Compact urban form with small bloc sizes
-- High density street network
-- Accessibility etc

Clean household fuels

Rajasthan: 89.3% rural and 18.7% urban households use firewood.

- PPAC study- LPG coverage in Rajasthan 79.7% and the numbers of registered double-cylinder connections 12.54 million.

- **Ujjwala Yojana-** as on December 2016, a ttal of 2,13,668 LPG connections were made available to beneficiaries across the Jaipur division

Target 100 per cent coverage of households by distribution of LPG/PNG

Restrict use of coal in hotels and restaurants, link this with licensing policy

Waste Management to control waste burning

Rajasthan Solid Waste Management Policy and Strategy, 2019-

- **Jaipur's daily production** of SW is 1,150 tonnes per day -- collection efficiency is around 80%
- **Three disposal sites in Jaipur:**
  - Mathura Das Pura (oldest site and is about 17 km from the main city)- 300- 400 TPD is dumped
  - Languriya (3–4 km from Mathura Das Pura)- area of landfill is 483 bigha.
  - Sewapura (located at a distance of 20 km from the main city on Jaipur–Delhi highway) and 200–300 TPD of garbage is being dumped

Next steps

- Ensure robust collection system for segregated waste -- Decentralised waste management system
- Address horticultural waste -- composting network
- Enforce complete ban on garbage burning
- Landfill management and roadmap for zero landfill policy
- Develop a siting policy for WTE plants.

Construction and Demolition Waste

- Jaipur Municipal Corporation notified the construction and demolition waste management bylaws in 2018 which cover the duties of waste generators, service providers and their contractors, and the municipal corporation.

- To set up C&D recycling plant in the city

Next steps

- Provide network of decentralized C&D waste segregation and collection Obligatory for developers to -- on-site recycling and/or disposal at designated sites.
- Set-up facilities for recycling of C&D waste
- Promote recycling of construction and demolition waste.
- Control fugitive emissions from material handling, conveying and screening Implement provision of Central regulations for construction and demolition waste management rules 2016.
- Ensure dust pollution control in all construction sites

Agenda for clean air

Mobility transition

- Public transport strategy
- Vehicle restraint measures – parking policy

Clean energy transition

- **Ban coal in NCR** – Delhi has done this
- Shift to natural gas and electricity for all energy needs
- Ensure implementation of 2015 TPP standards

Need circular economy

- Address hotspots – solid waste, C&D waste, industrial waste, plastics

Clean energy access – 100% LPG in households and eateries

Taking this collaboration forward

Deep dive support to multi-sector action:

- Industry
- Power plants
- Vehicles
- Transport
- Waste management

Regional airshed level interventions

Capacity building and knowledge sharing

Support public engagement to build public support

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