SDGs

SDGs – BUILT SECTOR

SUSTAINABLE DEVELOPMENT GOALS

Green buildings can improve people's health & wellbeing

Green buildings can use renewable energy, becoming cheaper to run

Building green infrastructure creates jobs & boosts the economy

Green building design can spur innovation & contribute to climate resilient infrastructure

Green buildings are the fabric of sustainable communities & cities

Green buildings use 'circular' principles, where resources aren't wasted

Green buildings produce fewer emissions, helping to combat climate change

Green buildings can improve biodiversity, save water resources & help to protect forests

Through building green we create strong, global partnerships

3 GOOD HEALTH AND WELL-BEING

7 AFFORDABLE AND CLEAN ENERGY

8 DECENT WORK AND ECONOMIC GROWTH

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

15 LIFE ON LAND

17 PARTNERSHIPS FOR THE GOALS

LIVEABILITY INDEX

Four pillars of comprehensive development

Category Indexes

Liveability Standards Performance along set benchmarks

1. INSTITUTIONAL
- Governance index

2. SOCIAL
- Identity and Culture Index
- Education Index
- Health Index
- Safety and Security Index

3. ECONOMIC
- Economic Index

4. PHYSICAL
- Housing and Inclusiveness Index
- Open Space Index
- Mixed Use and Compactness Index
- Energy Index
- Mobility Index
- Water Index
- Waste Water Index
- Solid Waste Index
- Pollution Index

25% weightage
25% weightage
5% weightage
45% weightage

CITY LIVEABILITY INDEX

LIVEABILITY BENCHMARKING & WEIGHTAGE

Comprehensive Development		pillar	Adjustment	Liveability Index
Institutional (25% weight)	Governance Index (A)	A	T=A*0.25	City Liveability Index = T+U+V+W
Social (25% weight)	Identity and Culture Index (B)	$R=\dfrac{B+C+D+E}{4}$	U=R*0.25	
	Education Index (C)			
	Health Index (D)			
	Safety and Security Index (E)			
Economic (5% weight)	Economic Index (F)	F	V=F*0.05	
Physical (45% weight)	Housing and Inclusiveness Index (G)	$S=\dfrac{G+H+J+K+L+M+N+P+Q}{9}$	W=S*0.45	
	Open Space Index (H)			
	Mixed Use and Compactness Index (J)			
	Energy Index (K)			
	Mobility Index (L)			
	Water Index (M)			
	Waste Water Index (N)			
	Solid Waste Index (P)			
	Pollution Index (Q)			

THE PROTOTYPE
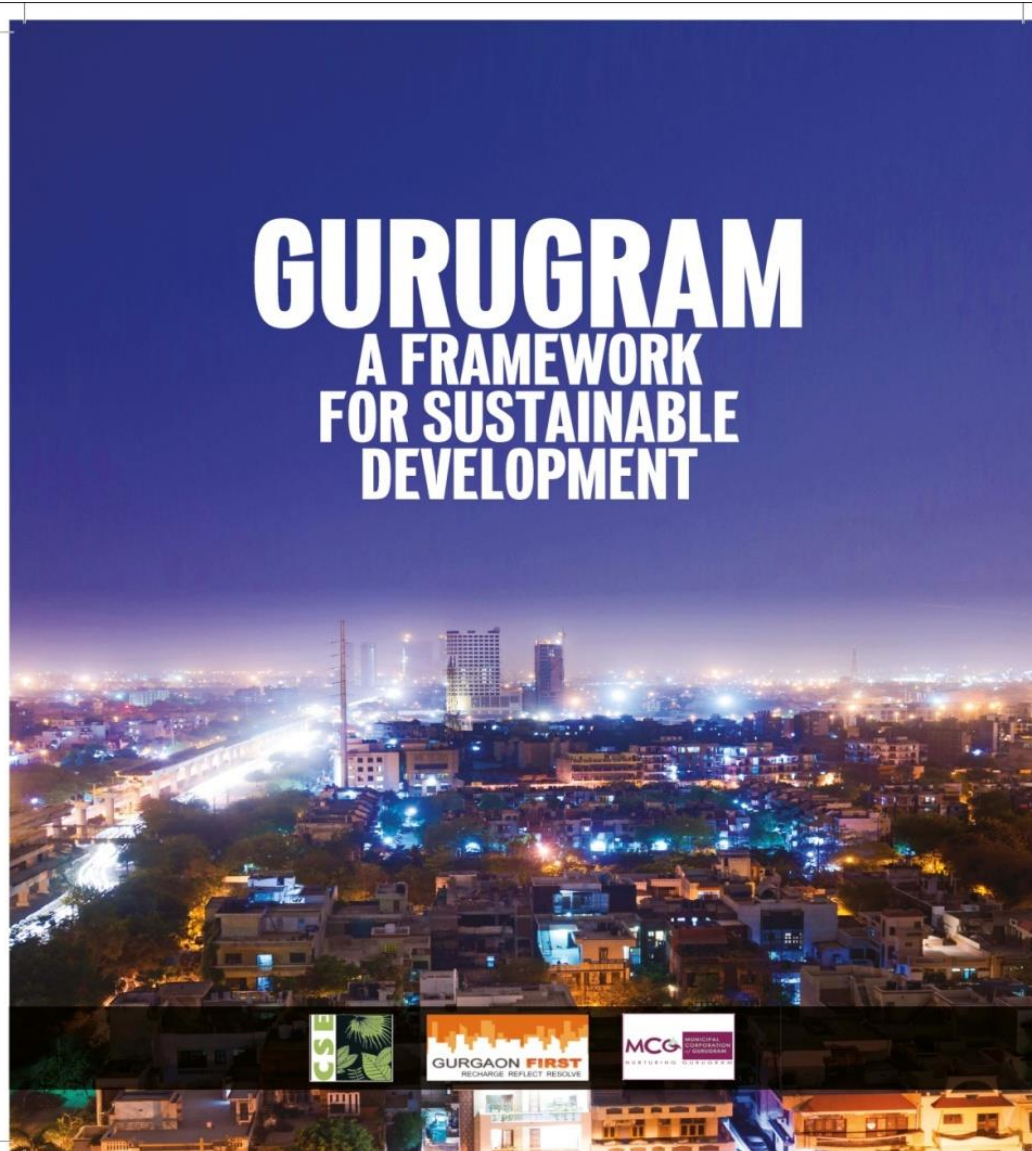
What is Gurugram?

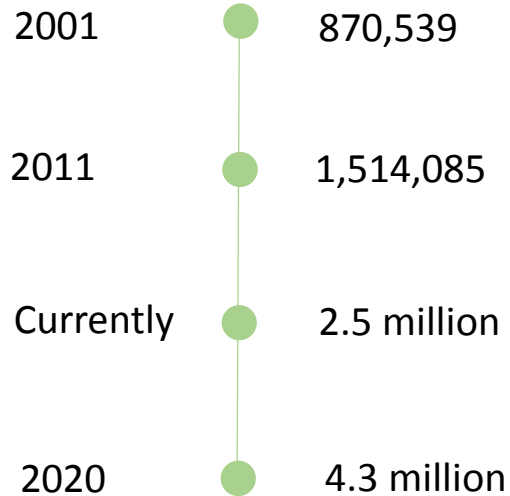Millennium City

Singapore of India

Private City

THE CITY

- IT and BPO based SEZ called cyber city
- Houses more than half of fortune 500 companies
- Attracted USD 73 billion worth investments as of June 2012, of which 87% is marked by private sector
- Second most urbanised in the state
- City with third highest per capita income in the country
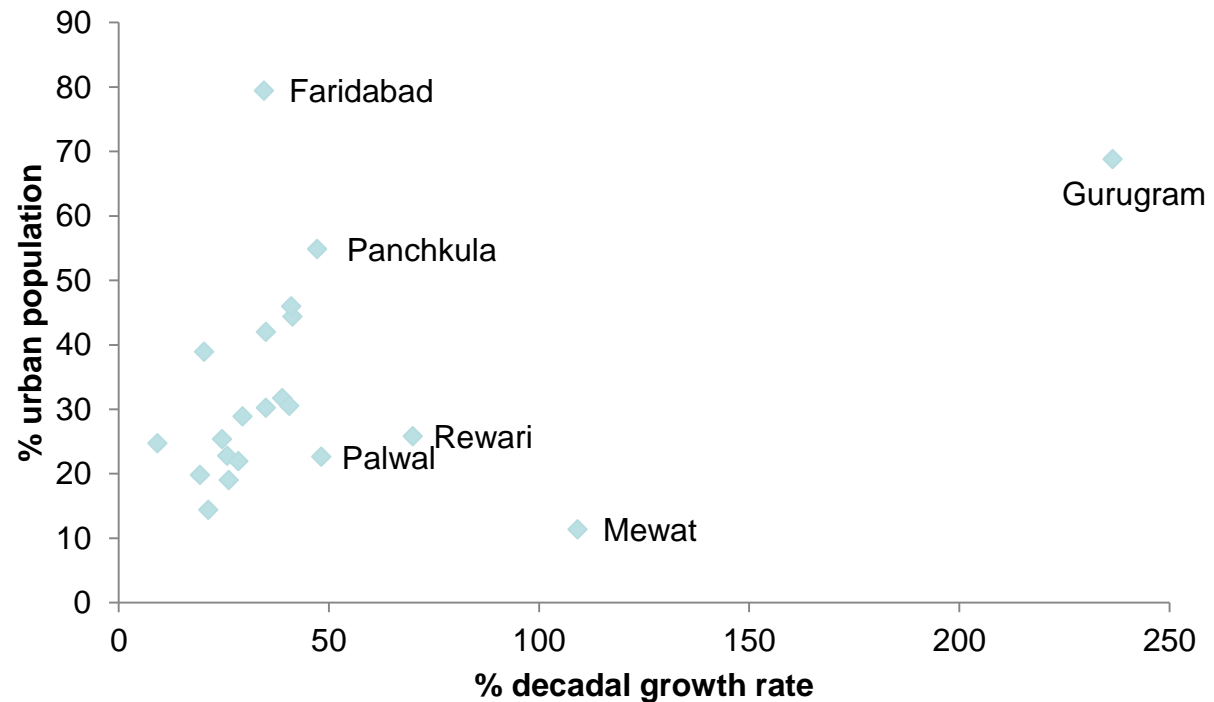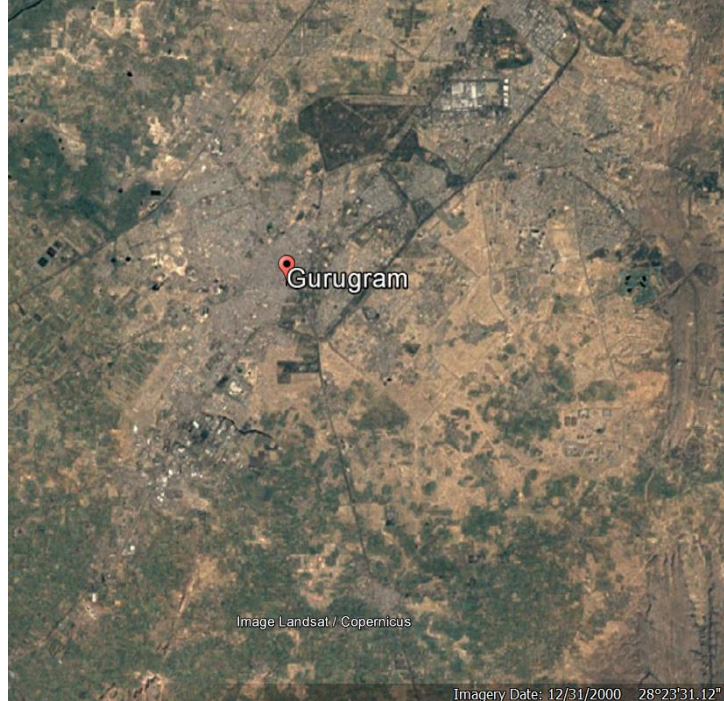- Contributes 48% of Haryana's revenue

POPULATION & URBANISATION

Population in Gurugram

Year	Population
2001	870,539
2011	1,514,085
Currently	2.5 million
2020	4.3 million

Urbanisation Vs Decadal Growth rate of Urban Population

Labeled points: Faridabad, Gurugram, Panchkula, Rewari, Palwal, Mewat

Y-axis: % urban population (0–90)
X-axis: % decadal growth rate (0–250)

Imaged in 2000

Imaged in 2008
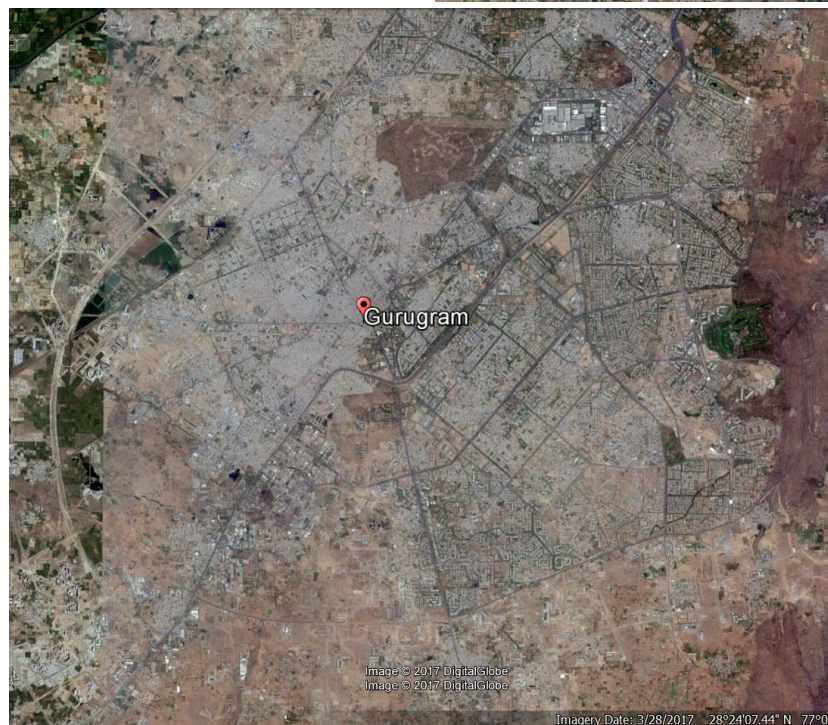
Imaged in 2017

POPULATION & URBANISATION

Explosive growth

At what cost???

Millennium city

Water

Sewage

Air

Mobility

Energy

Solid waste

Sustainability for all

Issues: per capita supply, quality, duration of supply, water pressure, groundwater levels, water infrastructure and equity of access.


- *Source:* Yamuna river's Tajewala headworks
- *Suppliers*: Haryana Urban Development Authority (new city) and Public Health and Engineering Department (old city)

- Gurugram's supply system is designed to carry about **245 million litres a day** (MLD) at its head at Kakaroi village.
- About **50% of this water is lost** through evaporation and diversion.
- Only **30% of the city's water needs are met** from river Yamuna
- About two thirds of residents have access to piped water, but the **supply is irregular**
- **70% of city's residents depend on ground water**.
- However, official demand supply gap is 43%
- CSE estimated (in 2005-06), Gurugram's water demand to increase by 34% by 2011
- **New demand-supply gap: 57%**

WATER – GROUNDWATER BLUES
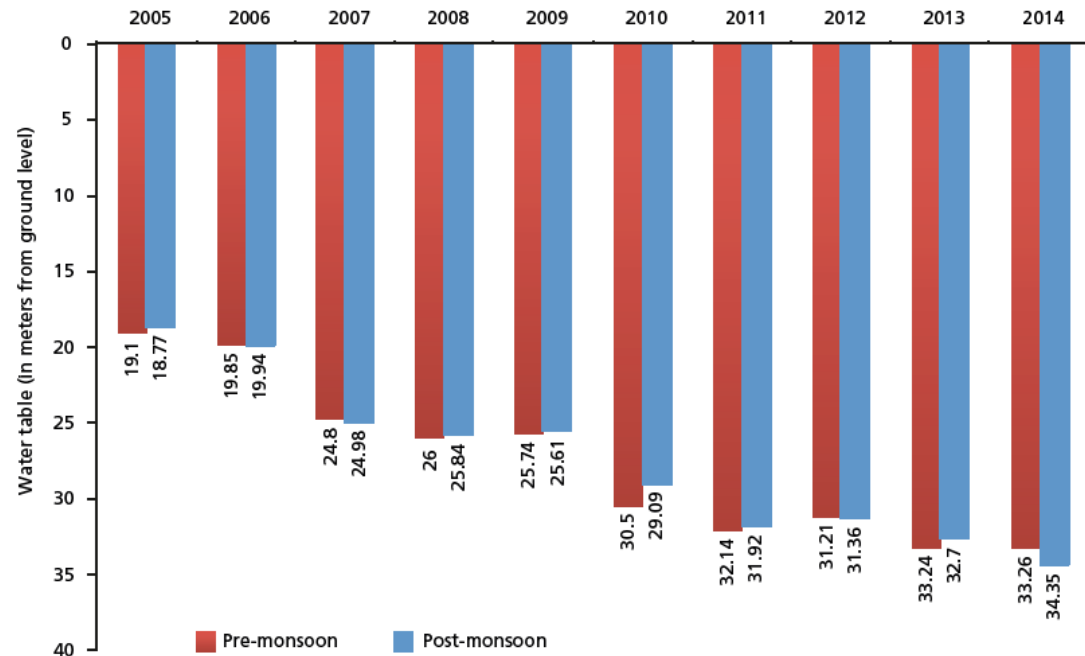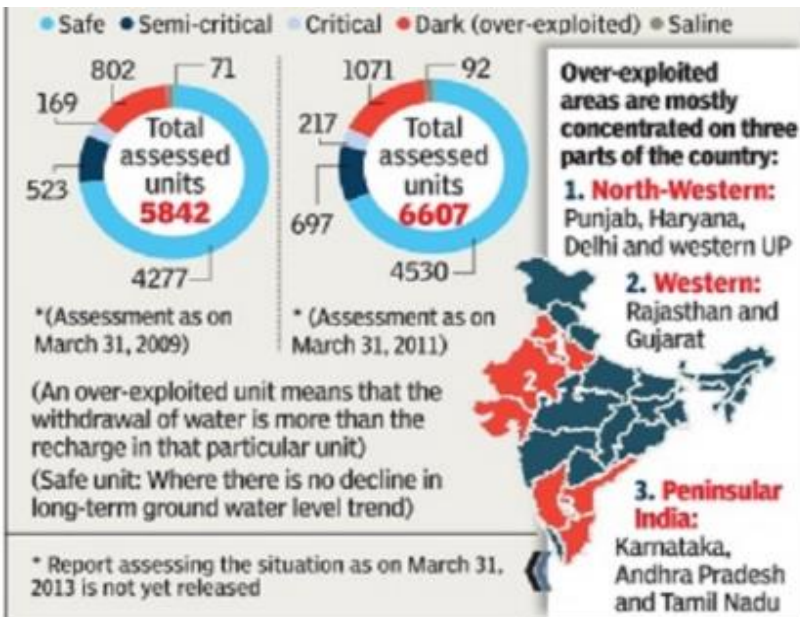
Central Ground Water Board (2013) identifies 3 regions where over exploitation of groundwater is taking place

- Water table in Gurugram has dropped from **43 m below ground level (bgl) in 2003 to 51 m bgl in 2006**.
- **Depletion rate: 1-3 m/year.**

According to the groundwater cell of the Agricultural Department, between 2005 and 2014, **the water table has dropped by 74%**

- High **concentrations of nitrate and fluoride**. This area has naturally occurring fluoride-bearing minerals in its rock strata. This puts at risk people who depend on wells and tankers that supply untreated groundwater.

- **Aquifers are additionally contaminated by** excessive and unscientific exploitation of groundwater, agricultural and industrial activities in the vicinity, poor sanitation, inadequate septage management and solid waste disposal.

- **Aravalli hills**, **responsible for one third of groundwater recharge**, are also under severe environmental stress.

- **To ensure long-term sustainability of water sources for the city**, rainwater harvesting is a simple and effective solution. It can be done using roads, roundabouts, parks, rooftops, paved areas – almost the entire city. A lot can be achieved by recharging the deep, confined aquifers and by storing water in tanks or ponds and water bodies.

SEWAGE

The challenges: *Water-intensive excreta disposal leading to pollution; sewage from areas unconnected to sewer lines dumped, leading to more contamination; unscientific management and ineffective treatment*

SEWAGE - ESTIMATES

- Estimates of how much sewage Gurugram produces vary.
  - City generates about **225 MLD of sewage, and its treatment plants can process only 148 MLD**.
  - In 2007, government's estimate put the quantum of sewage generation at 129.6 MLD
  - Joint Association of Federation of Residents Welfare Associations (JAFRA) estimated it to be about 260 MLD.
  - The official forecast for the year 2021 projects sewage generation of 533 MLD, but JAFRA projects a figure of 864 MLD.

- Official forecast for sewage treatment capacity is 255 MLD- means half of official and 30% of unofficial estimates of actual sewage generation

- Three sewage treatment plants (STP), belonging to HUDA (O&M outsourced to private agencies), also treat sewage from 37 municipal villages in gurugram and hence are overloaded

- New colonies mostly remain unconnected or partially connected to the main line

SEWAGE - TREATMENT

- Quality of water treatment is another issue

- **Inefficient treatment**: Random samples from outlets of the STPs, tested by the Haryana State Pollution Control Board (HSPCB) resulted in aqueous pollutant concentration of 182 mg/l. In March 2012, the HSPCB had sent a notice for poor maintenance of treatment systems.

- **Poor maintenance**: drains through which treated water is transported are dirty.

- Some private developers (residential and commercial) provide decentralised waste treatment services. After treatment, **the waste is transported in tanker trucks and disposed off into Yamuna or unlined drain**.

- **Faecal-sludge**: areas unconnected with sewer lines discharge the sullage rfom septic tanks or pits into road-side storm-water drains. It also ends up in garbage dumps and water bodies

- There are 3 new STPs (100, 68 and 50 MLD) coming up and other upgradations planned

AIR

- Gurugram - land-locked region - extremely vulnerable to trapping of toxic air
- Key pollution sources: vehicles, industrial areas, construction activities, high use of diesel generator (DG) sets, waste burning, road dust and biomass *chulhas.*
- Explosive growth in motorisation and extensive use of DG sets result in direct toxic exposure
- Other issues:
  - High night time pollution
  - Early morning inversion effect
  - Proliferation of pollution hotpots at busy intersections and commercial areas such as Sadar Bazaar, old Gurugram, Udyog Vihar, and MGF Mall on MG Road.

AIR – AIR QUALITY INDEX (AQI)

AQI Category, Pollutants and Health Breakpoints								
AQI Category (Range)	PM_{10} 24-hr	$PM_{2.5}$ 24-hr	NO_2 24-hr	O_3 8-hr	CO 8-hr (mg/m^3)	SO_2 24-hr	NH_3 24-hr	Pb 24-hr
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.5 – 1.0
Moderately polluted (101-200)	101-250	61-90	81-180	101-168	2.1- 10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very poor (301-400)	351-430	121-250	281-400	209-748*	17-34	801-1600	1200-1800	3.1-3.5
Severe (401-500)	430 +	250+	400+	748+*	34+	1600+	1800+	3.5+

- Indicator based on ambient concentration values of air pollutants and their likely health impacts (known as health breakpoints)

- Six categories
- Eight major pollutants
- 24-hourly averaging period

- Gurugram-**PM2.5 peaked at 600** µg/m3 when it should be under 90.

Note: CO in mg/m3 and other pollutants in µg/m3 ; 24-hourly average values for PM10, PM2.5, NO2, SO2, NH3, and Pb, and 8-hourly values for CO and O3.
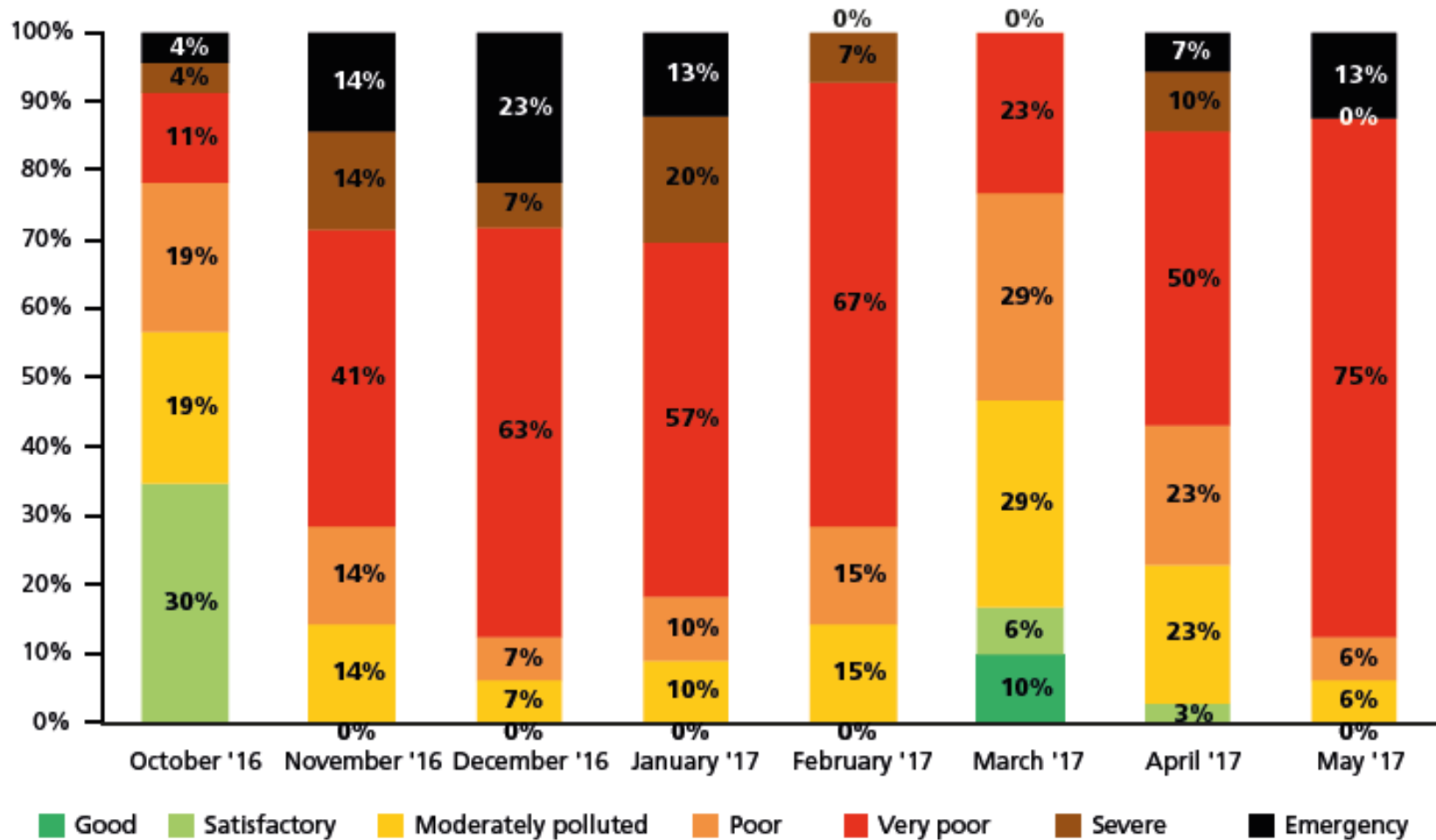
AIR
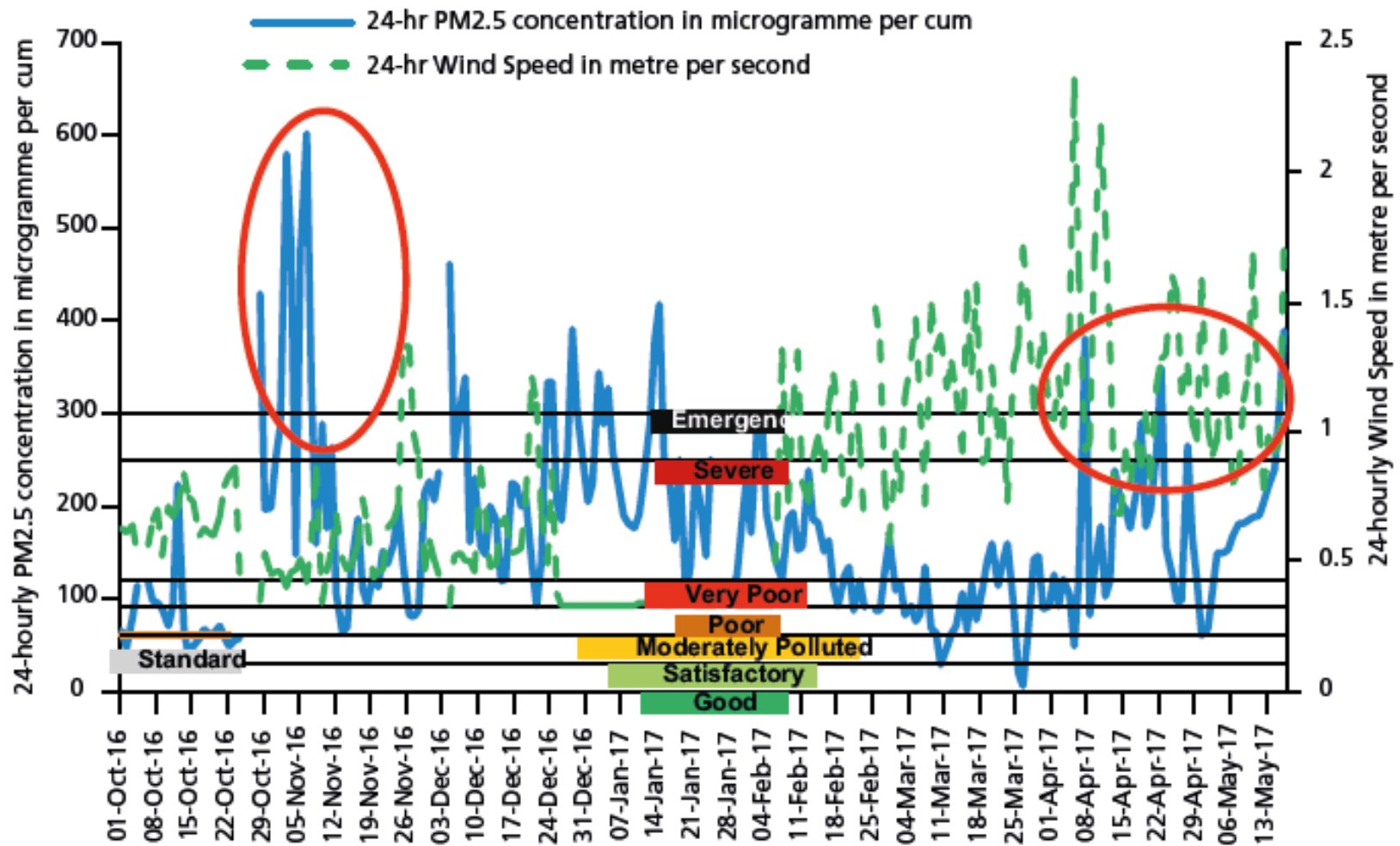
CSE analysis of air quality data from Central Pollution Control Board

Trends in PM2.5 levels in Gurugram – October 1, 2016 to May 1, 2017
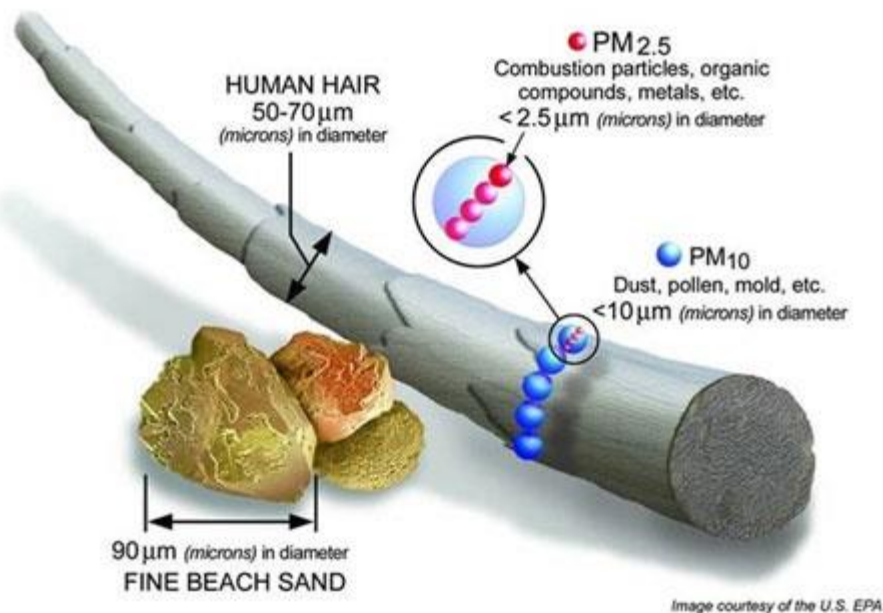
AIR – AQI CATEGORIES

CSE analysis of air quality data from Central Pollution Control Board

Categorisation of PM2.5 levels on the basis of AQI categories in Gurugram

AIR – PM2.5

HUMAN HAIR
50-70 μm
(microns) in diameter

PM 2.5
Combustion particles, organic
compounds, metals, etc.
< 2.5 μm (microns) in diameter

PM10
Dust, pollen, mold, etc.
<10 μm (microns) in diameter

90 μm (microns) in diameter
FINE BEACH SAND

Image courtesy of the U.S. EPA

While PM10 can settle in lungs, PM2.5 can pass through the lungs into our blood supply making them – *the invisible killer*.

- PM2.5 is suspended particulate matter that is 2.5 micrometres or less in diameter.

- The particles can settle in the lungs and worsen asthma and other respiratory problems

- According to CPCB, prolonged exposure to 'very poor,' quality of air can lead to respiratory illness.

- According to the health department, in February 2017, the civil hospital Gurgaon registered a 40% rise in asthma cases.

- PM2.5 emitted from diesel are more toxic than regular PM2.5
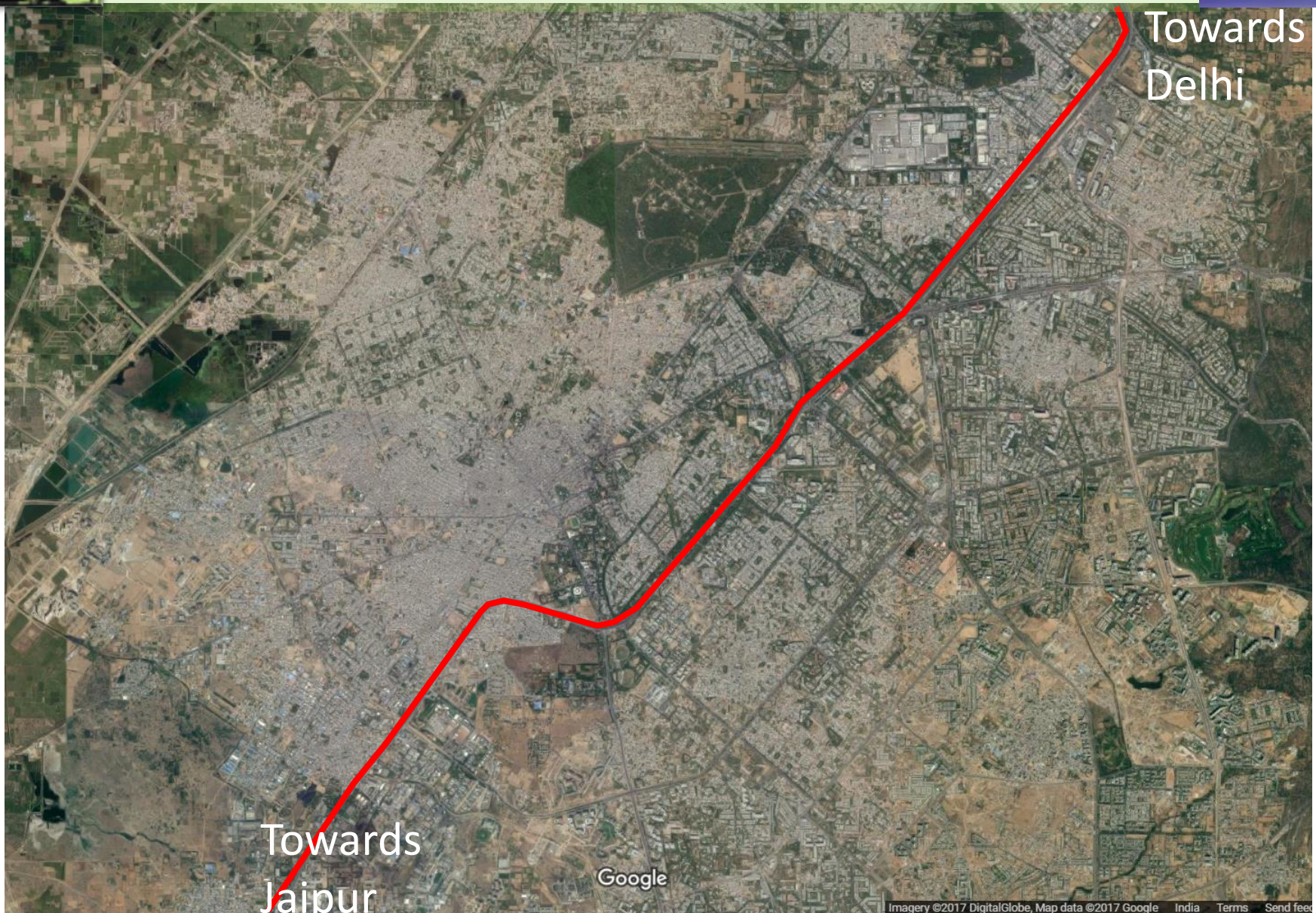
AIR – COMPARISON AQI
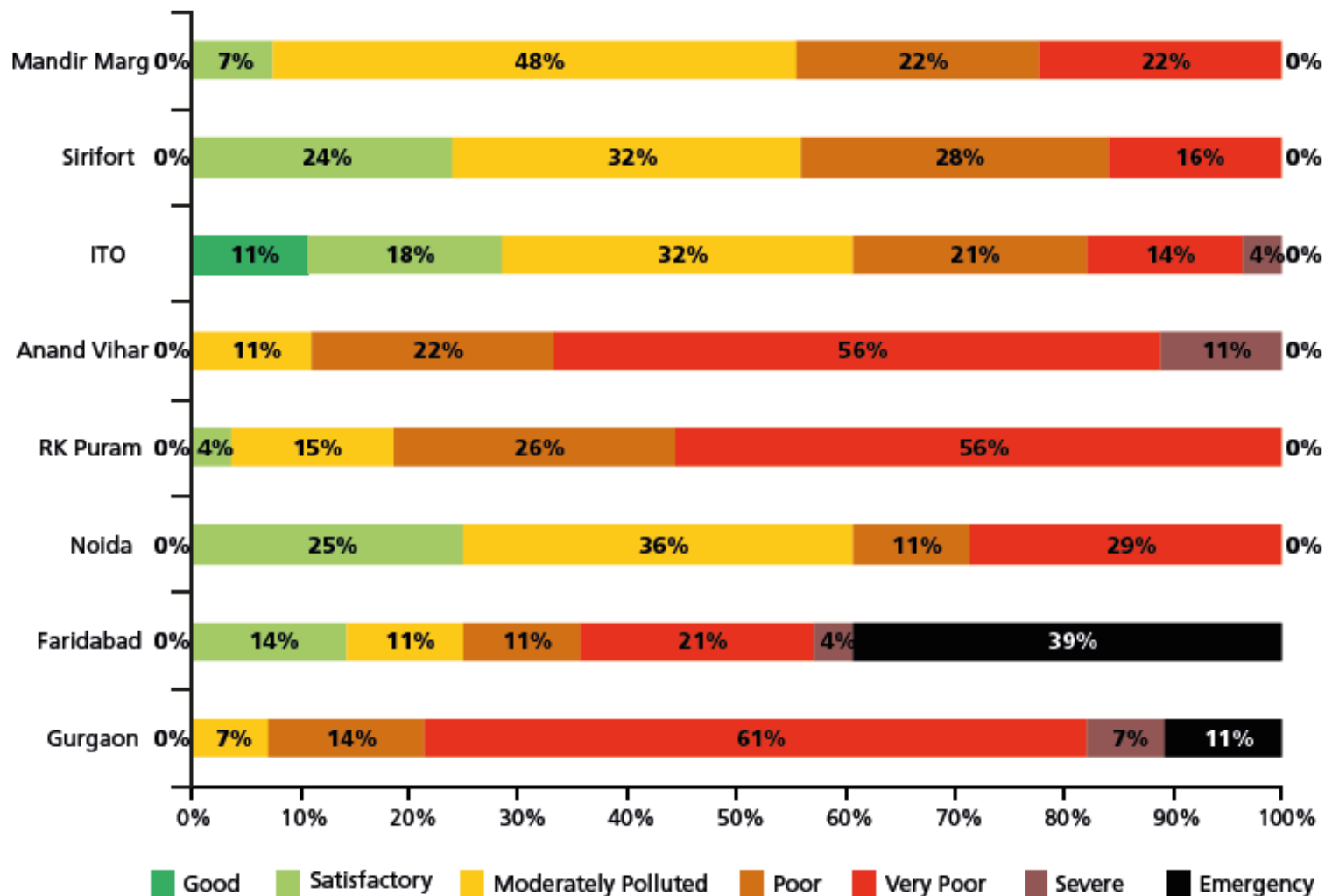
CSE analysis of air quality data from Central Pollution Control Board

Comparison and categorisation of PM2.5 levels on the basis of AQI categories in Delhi & Gurugram – April 19 to May 16 2017

MOBILITY

Towards Delhi

Towards Jaipur

MOBILITY – ISSUES

- Roads are overwhelmed with private vehicles.
- Automobile dependence edges out public transport, walking, cycling.
- Result – increased travel time and fuel costs, compromised safety on roads, rising number of fatalities and air pollution.

487 people died in road accidents in Gurugram in 2013, of which 40% were pedestrians and cyclists

Source: Hindustan Times
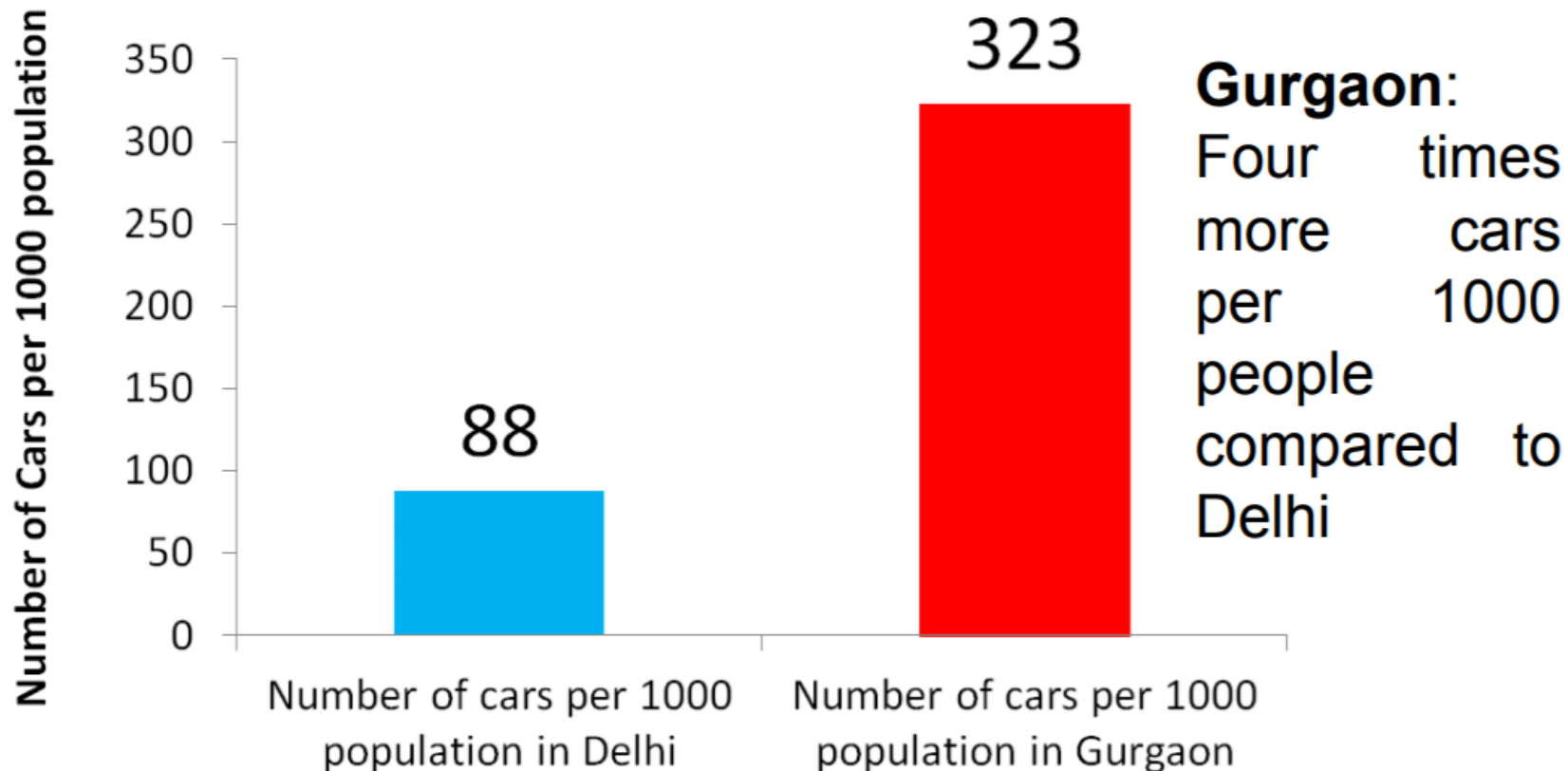
MOBILITY – THE VEHICLE SCENARIO

Annual registration of:

Cars ↑ By 352%

Two wheelers ↑ By 69%

Buses ↓ By 300% between 2008 and 2015

Intermediate public transport ↓ By 39% between 2006 and 2015

Vehicle ownership: 43% households own two-wheelers; 33% own cars

Source: Statistical Abstract of Haryana, 2005-06 to 2014-15

MOBILITY – VEHICLE DENSITY

Gurgaon: Four times more cars per 1000 people compared to Delhi
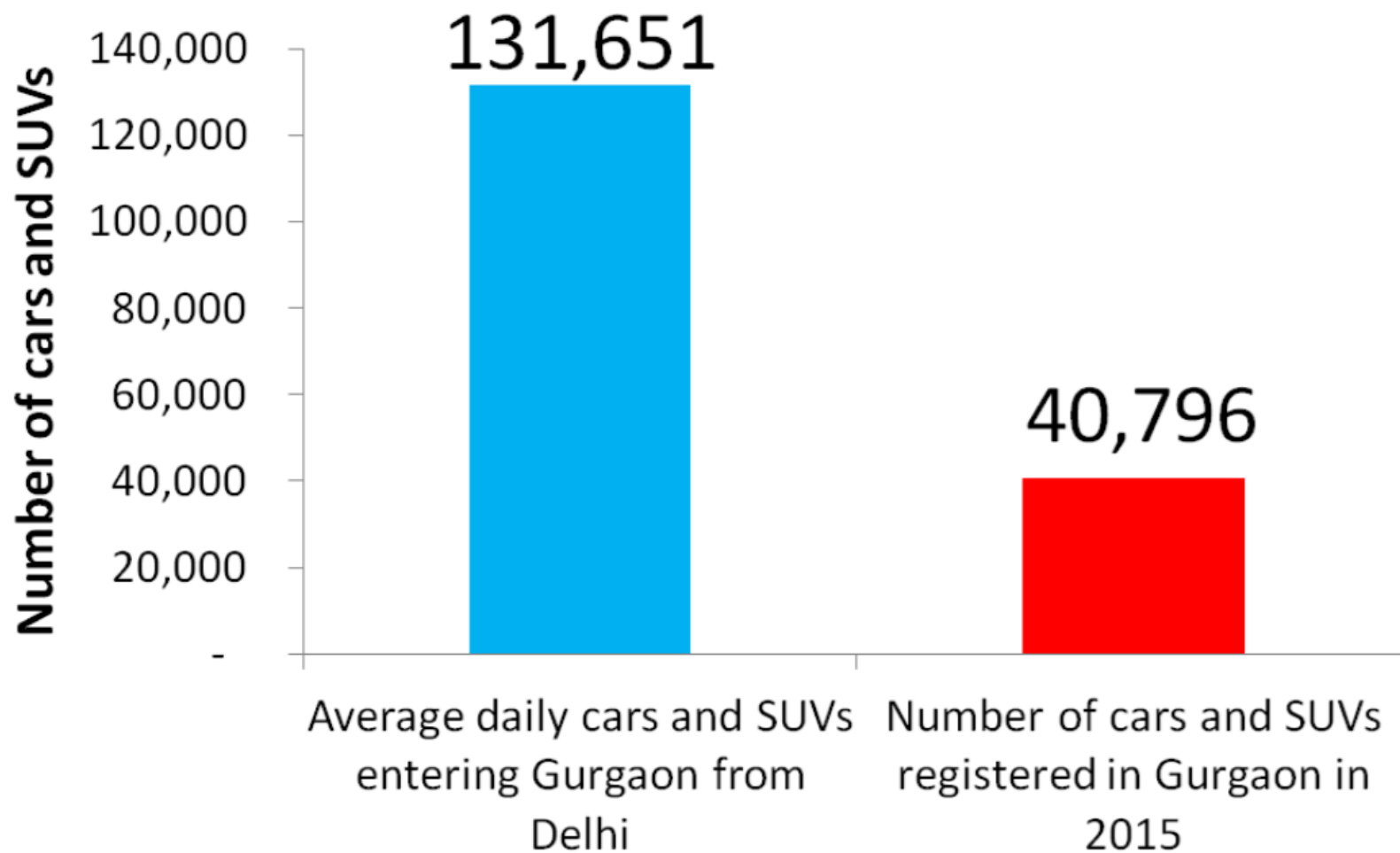
Source: Economic survey of Delhi 2014-15, Statistical abstract of Haryana 2014-15, Census of India 2011
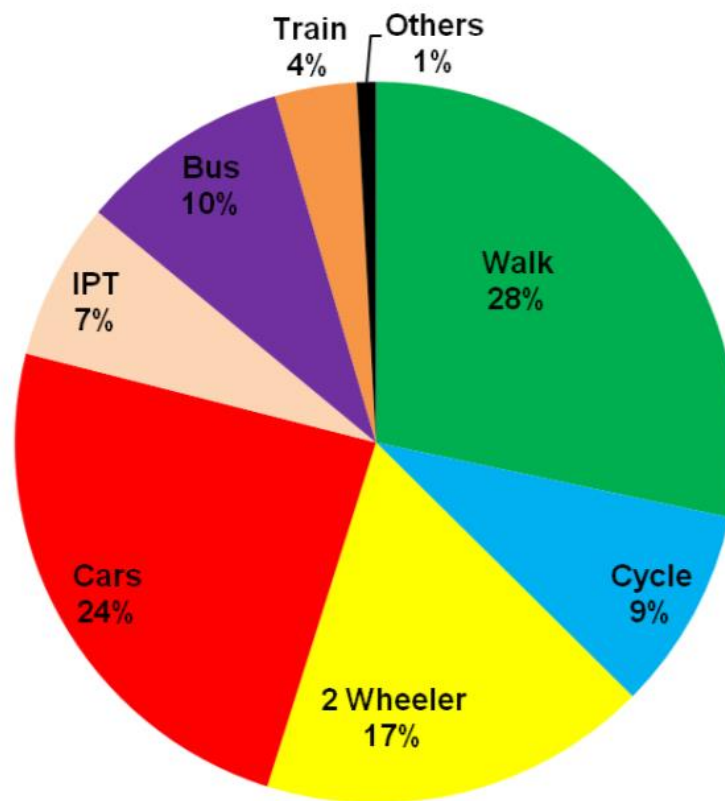
MOBILITY – INFLUX FROM DELHI

Source: CSE traffic count study, 2015

MOBILITY – MODAL SHARE

- 41% by cars and two wheelers
- 37% walk and cycle
- 14% by bus and train
- Share of public transport, walk and cycle dropped by 18% from 2010

Source: Census of India, 2011

MOBILITY – PUBLIC TRANSPORT

- Poor public transport penetration
- Delhi Metro and Rapid metro only serve a portion of the city
- **50% less than the service level benchmark** of 60 buses per lakh population
- Infrastructure engineered only for vehicles; not for pedestrians or public transport users.

MOBILITY – PARATRANSIT

- Unmetered auto rickshaw, passenger tempo and cycle rickshaw are the only feeder options available.
- Feeder services are poorly designed with no dedicated parking

MOBILITY – ROADS

- Gurgaon needs additional land equal to **175 football fields to meet parking demand from** new cars **every year**.

"Gurujam"

The image was taken on a 'car-free day' observed on 23 September, 2015
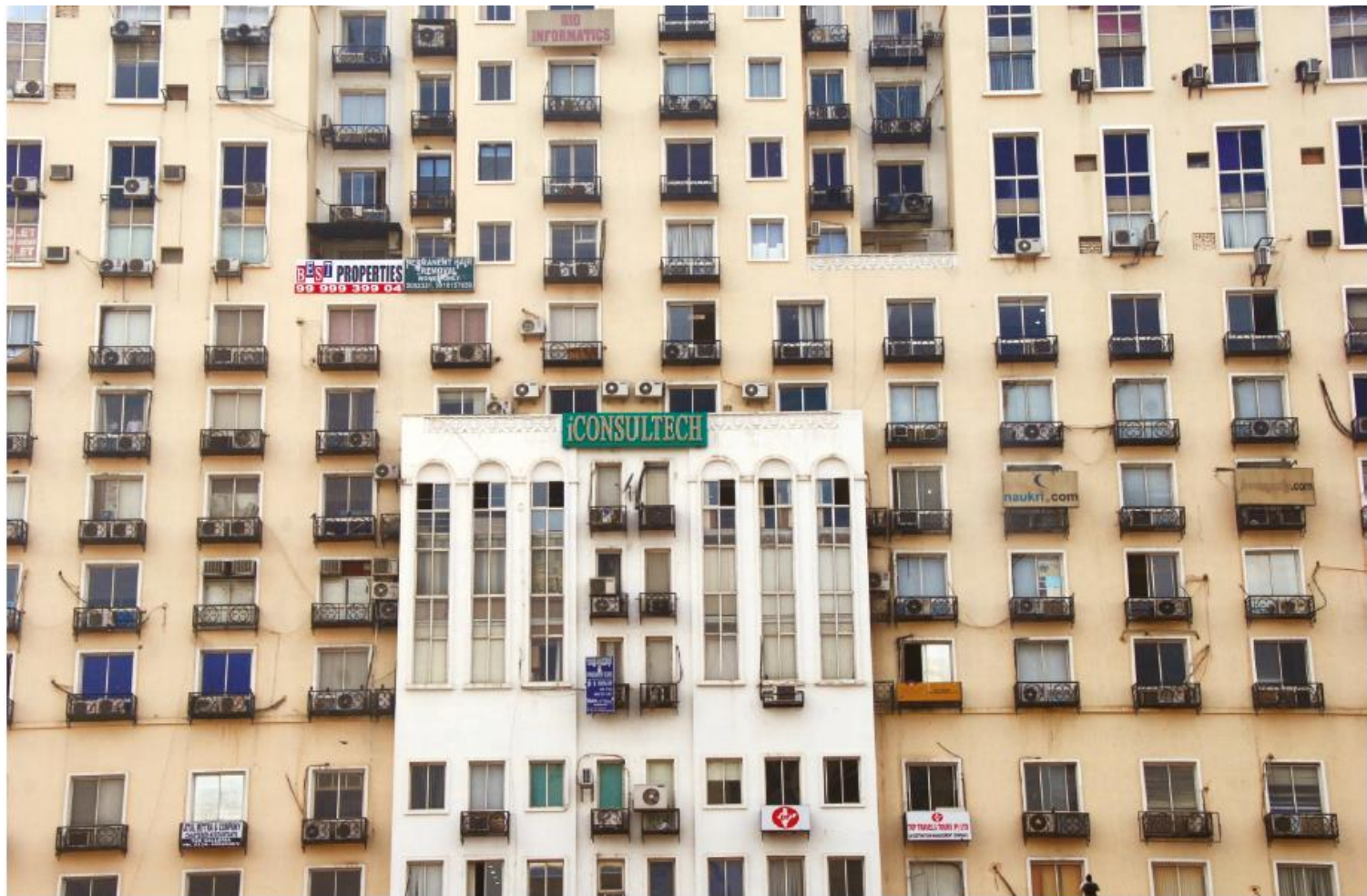
The challenge*: Constantly rising energy demand, along with energy-intensive lifestyles and building construction, leading to pollution and climate change impacts; and slow transition to renewables*

ENERGY

Main sources of energy in Gurugram

- Electricity 19%
- LPG 7%
- Kerosene 3%
- Diesel 61%
- Petrol 10%

Sector-wise break-up of electricity consumption

- Residential 16.13%
- Commercial 4.01%
- Industrial 8.51%
- Transportation 71.22%
- Municipal 0.13%
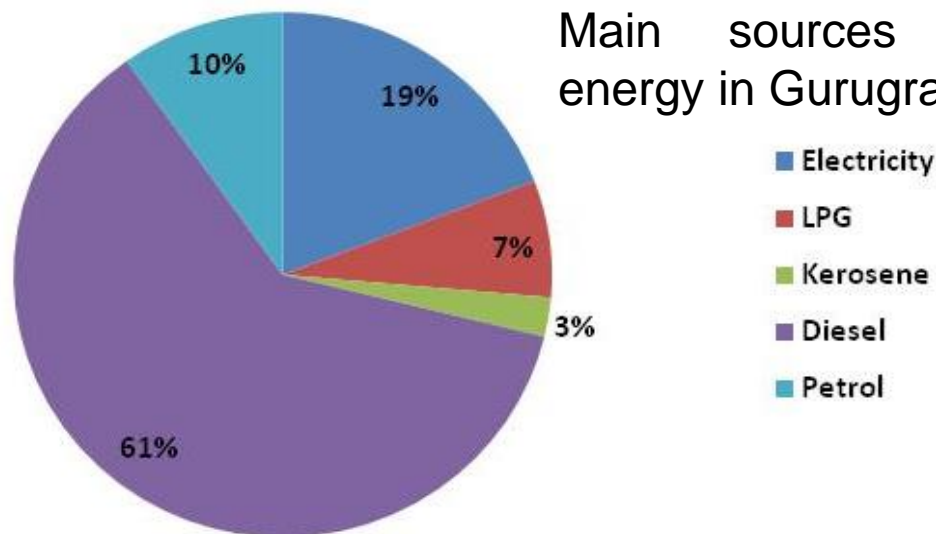
Issues:

- **10-12 hour power outages** (summers), with average of half an hour
- **Very high dependence on diesel generators** (DG) for captive power generation
- No norms or regulations on use of DG for back up
- DGs send PM and NO to the air
- Growing affluence - more energy intensive
- Rising demand from city-wide infrastructure

ENERGY - COMPLIANCE

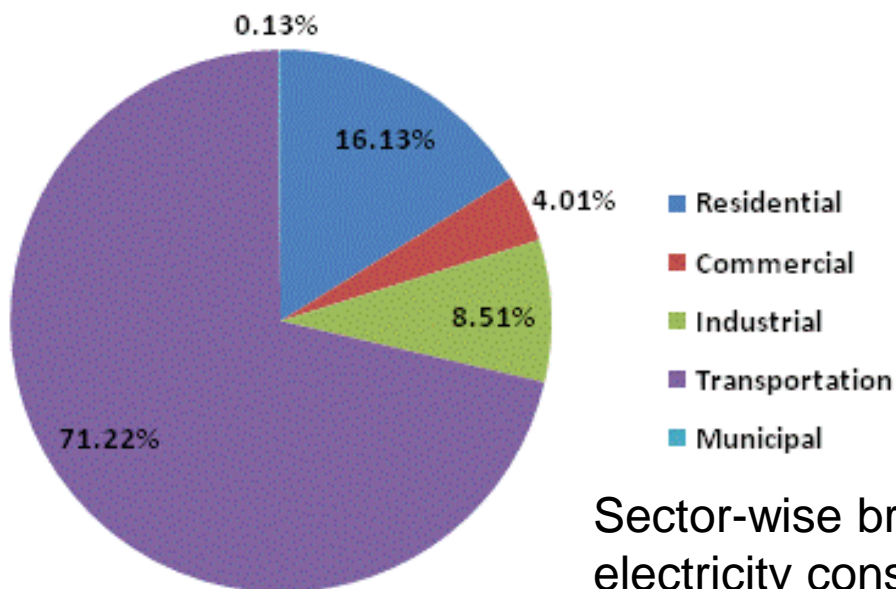- The **Energy Conservation Building Code (ECBC)** is a Central government policy for energy regulations in buildings that the state governments will have to implement.
- The **National Building Code**, which sets the building principles and norms for building construction across the country, has also added a new chapter on sustainability criteria for the building sector.
- The Haryana government has **mandated implementation of ECBC in government buildings** and is in the process of modifying municipal building bye-laws accordingly.
- Haryana state has **amended the schedule of rates** to include energy efficient material; introduced CFL; promoted solar water heating systems and street light luminary systems; and initiated preparation of an energy-efficient building module for replication
- It has also **introduced monetary incentives for architectural firms and buildings** that adopt energy efficiency measures, and has announced financial support to bear the energy audit costs of commercial buildings
- The Master Plan of Gurugram has set a goal of **total savings of 298.97 MU, with 155.17 MU from renewable energy installation and 143.61 MU from energy efficiency measures**

ENERGY – TOWARDS RENEWABLES

- Haryana gets a high intensity solar radiation for 320 days in a year
- The state's overall solar potential is 4.5 GW
- The solar capacity target is 3,200 MW by 2021-22 of this, 1,600 MW will be from rooftop solar

New Solar Policy, 2016 of Haryana encourages:

- setting up solar plants on barren panchayat lands and on canals
- enabling mechanisms for off-grid solar applications
- creating a green energy fund
- facilitating wheeling of solar through utilities.

Daily Solar Radiation - Horizontal (kWh/m2/day)
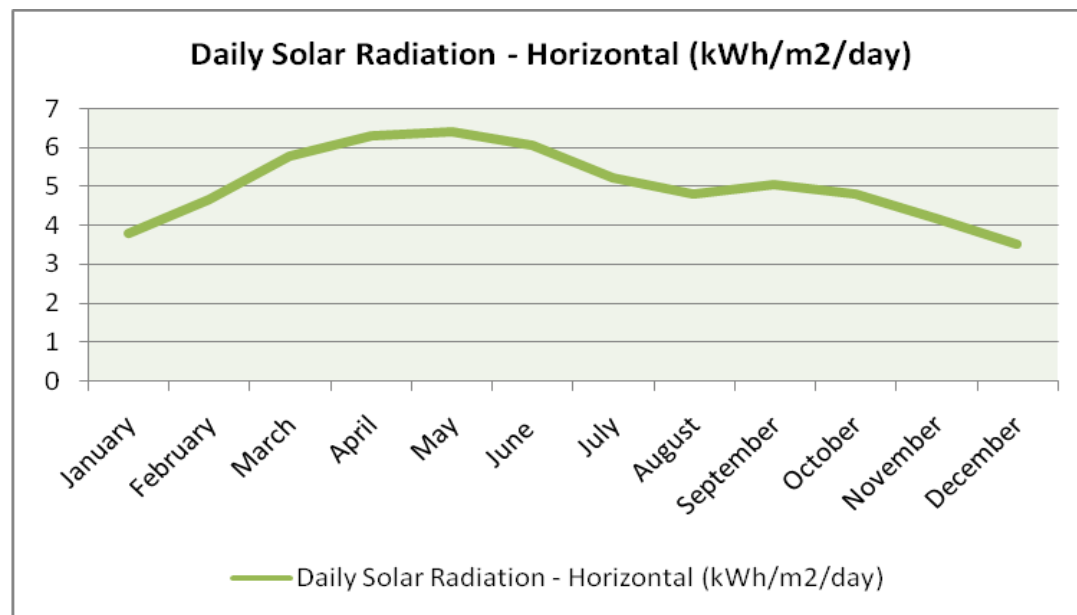
Monthly Average Insolation Incident on a Horizontal Surface in Gurgaon

Solar Rooftop Calculator

Democratizing power
CSE's Rooftop solar calculator will help you decide if solar is a viable option for your electricity demand. It is a small foot step to reduce our big carbon footprint.

❮ Enter Calculator ❯

- Haryana Renewable Energy Development Agency (HAREDA) spearheads Haryana's solar initiatives.
- Haryana's **solar power installed capacity is about 25 MW** through rooftops and small solar power projects.
- **Haryana is the second state after Tamil Nadu** to have mandated the use of solar by buildings of and beyond 500 square yards.
- Under the New Solar Policy net metering has been operationalised and the local administration has launched a **'single-window' for all clearances and approvals for solar PV and solar thermal**.
- Research and development on solar power is being done at the Gurgaon National Institute of Solar Energy (NISE).
- **17 MW of solar rooftops have been installed without subsidy** in gurugram
- A CSE study shows **rooftop solar power generation for buildings is cheaper than using diesel generator sets in Gurugram**; this CSE study assesses the feasibility of solar rooftops in residential societies.

SOLID WASTE

The challenges: *High volumes of waste generation; inefficient collection and transportation practices; and limited disposal options*

SOLID WASTE

- Data on waste generation is limited
- Gurugram generates over 1,000 tonne per day (TPD) of solid waste – of this, about 600-700 TPD goes to landfill.

Solid waste projections for Gurugram

Year	Population	Per capita waste generation (gm/capita)	Total waste (MT/day)
2006	1,250,000	320	400
2011	1,514,085	350	525
2021	2,600,000	400	1040

Source : Municipal Corporation of Gurugram, 2013

- Waste generation is **growing at 5% annually**
- By 2041, Gurugram would be producing **2,839 million tonne of waste**.
- Per capita waste generation in Gurugram is about **320 gm/day,**
- About 400 MT of municipal waste is collected every day within the controlled area, of which about 75-80 MT is generated within the municipal area and rest in HUDA sectors, private developers' area, and urban villages
- Composition: 50-52% of municipal solid waste is biodegradable, 12-15% is dry recycles and 30-35% inert component .
- Municipal solid waste and domestic waste water treatment contribute about **3% and 2% to CH4 and N2O emissions** of the state respectively

- The Municipal Corporation of Gurugram has issued a notification dated November 18, 2015 identifying eight dumping sites for C&D waste disposal.
- The notification mandates that dumping of C&D waste in any other area other than the designated dump sites will attract penal charge.
- Disincentives for violation and incentives for compliance

The Construction and Demolition Waste Management Rules, 2016 makes it ***mandatory for developers or waste generators to submit a waste management plan*** along with their building plan, non-deposition of which, may lead to non-grant of permission to the building.

- Gurugram generates 700 TPD of C&D waste
- There are around 161 big construction sites and more than 1,000 small and mid-sized construction sites in and around Gurugram.
- Recycled material can be used in non load bearing application like kerb stones, drain covers, paving blocks in pedestrian areas, etc.

SUSTAINABILITY FOR ALL

The challenges: Ensure the right of the urban poor to the city and its resources – affordable housing and reliable basic services

SUSTAINABILITY FOR ALL

- Housing and equitable access to resources for all, especially urban poor, has to be a defining parameter of sustainability.
- 70% of hosing demand in Haryana is from EWS and LIG categories; 20-25% from mid-segment and 5% from the luxury segment.
- In 2011, Gurugram had 10.2% share of state's slum population

- According to Census 2011, there are about 1.5 million migrants working in informal sector
- A study by Center for Policy Research shows there are one million more

Udyog Vihar

Cyber City

IFFCO Chowk

HUDA city centre

HUDA city centre

Google

Imagery ©2017 DigitalGlobe, Map data ©2017 Google   India   Terms   Send feed

SUSTAINABILITY FOR ALL

- The state reserves 20% of plots in a colony for EWS & LIG
- Formal housing: 16721 EWS plots in residential colonies and 35833 EWS flats in group housing colonies, still unable to meet the demand
- Location of formal housing: peripheral areas

- Rental housing: very high demand among migrant workers because of proximity to work
- Sub-standard living conditions: overcrowding, shared toilets and lack of basic services
- Rental housing is provided by tenant, contractor or landlord built in private or gram sabha land
- Alternative: Self construction on encroached land without access to basic services

CLIMATE CHANGE

- Strong need to take cognizance of increased incidence of extreme weather events due to climate change
- Gurugram has already faced intense flooding due to high intensity rain and storm surge
- Paralyse city functioning and life
- Adversely affect infrastructure, public assets and vulnerable regions

Road design guidelines are needed to promote sustainable roads to minimize ecological footprints, environmental degradation, resource depletion, and negative impacts on safe access, health and pollution burden

SETTING SUSTAINABLE GOALS FOR GURUGRAM

GURUGRAM
A FRAMEWORK FOR SUSTAINABLE DEVELOPMENT

Clean water for all

- Reduce overall water demand by at least 25 per cent from current levels through water efficiency and conservation measures while maintaining quality of life.
- Ensure equitable access to clean water for all and prevent water guzzling.
- Promote decentralised wastewater treatment for reuse and recycling.
- Conserve rainwater and increase groundwater recharge in Aravallis, water bodies, *nullah*s etc to augment local availability of water to meet daily water needs and reduce dependence on water supply from longer distances.

Clean air for all

- Meet the national ambient air quality standards for all pollutants in a time-bound manner to protect public health.
- Map the exposure levels and local pollution sources across the city for stronger local action to reduce public health risk.
- Take an integrated approach towards controlling outdoor air pollution sources as well as indoor pollution sources like biomass *chulha*s as these also contribute hugely to outdoor pollution.

Reducing the energy footprint

- Reduce energy intensity of the built environment of the city by at least 30-35 per cent to prevent energy guzzling and contribute towards India's INDC commitment of reducing energy intensity of growth.
- Improve energy savings in buildings by setting energy performance targets and adopt enabling strategies.

SETTING SUSTAINABLE GOALS FOR GURUGRAM

Sustainable and affordable mobility for all

- Ensure that at least 90 per cent of daily motorised travel trips are carried by affordable, reliable and modernised public transport systems, efficient para-transit and extensive non-motorised transport.
- Eliminate traffic fatalities and road injuries.
- Make commuting safe and accessible for women.
- Promote universal road design for the differently-abled.
- Promote compact city design to reduce distances and vehicle-km travelled and increase public transport and walking.
- Preserve and build open public spaces and enable equitable access.

Building a solar city

- Make Gurugram a solar city – enhance the use of renewables.
- Promote rooftop solar power in all new and existing residential, commercial, and institutional buildings and link it to reduced use of diesel generator sets.
- Install renewable energy solutions to meet electricity generation equivalent to 5 per cent of the demand load.

Promotion of zero landfill development – minimise and reuse solid waste

- Aim for near zero landfill development with not more than 10 per cent of waste to go to landfill sites.
- Promote mandatory decentralised segregation and collection in all residential colonies and institutions, and composting sites at colony and ward levels.
- Promote properly designated and operated construction and demolition waste sites and recycling facilities that are well audited.

Sustainability agenda to include poor

- Sustainability demands equitable access for all -- including poor households, renters and slum dwellers -- to basic resources and services including water and sanitation, energy and waste management; adequate, safe and affordable housing; appropriate housing typologies for all income classes; and policy support for self constructed housing of the poor.
- Develop urban villages as model villages with all sustainability paramaters.

Protecting and expanding forests and green areas

- Earmark at least 10 per cent of the land area as forests.
- Earmark another 15 per cent as additional green areas – such as tree cover, parks, roadside green belts etc.
- Protect at least 5 per cent of Gurugram as a wildlife sanctuary, national park or community reserve or conservation reserve.
- Earmark wastelands in and around the Aravalli hills as forests to increase the forest cover.
- This will help sequester greenhouse gas emissions; trap toxic pollution and prevent heat islands; help recharge groundwater and revive aquifers; protect local biodiversity and meet community requirements. Currently, only 8.28 per cent of Gurugram's geographical area is under forest cover and about 3 per cent under tree cover.

Water

- All new and existing building complexes and colonies must implement an area-wide plan for rainwater harvesting.

- Introduce a groundwater abstraction and use permit system that can cap extraction and use at sustainable yield of groundwater only from the shallow aquifer in each sector.

- At least 20 per cent of open spaces in a building complex should be pervious.

- Meet per capita daily water requirement targets from a judicious mix of municipal supply, locally harvested rainwater and treated wastewater

- Monitor sector-wise bulk water consumption

- Implement periodic (pre-monsoon and post-monsoon) inspection, maintenance and monitoring programmes for rainwater harvesting structures

- Conserve and revive water bodies and enhance storage and retention capacity in the city.

- Create new ponds/tanks in different sectors

- Leverage drainage networks and road design to enhance water holding and retention capacity of the city

- Tap storm water drain networks for rainwater harvesting

- Drainage network to become eco-mobility zone
- Landscaping across the city should be done with drought-tolerant native plants
- Need water-wise, legal and administrative measures and incentives to promote water conservation measures in buildings.
- Create Rainwater Harvesting or Water Conservation Cell to coordinate all water conservation and augmentation measures
- Promote and mandate water-efficient fixtures in buildings.
- Promote water-efficient irrigation systems with features such as automatic sub-soil drip irrigation systems with timer controls.

Sewage

- Set up decentralised sanitation systems at building and colony level for treatment, recycling and reuse of water.
- Promote options of separating grey and black water with dual plumbing system or single stack system with separate recirculation lines for flushing.
- Monitor water quality to ensure sewer lines do not contaminate storm water drains
- Need safe management and disposal of faecal sludge through the sanitation service chain

AGENDA FOR ACTION – MANAGING WATER AND SEWAGE

- Mandate industry and construction industry to re-use treated water.
- Initiate a public awareness and outreach programme.
- Estimate sustainable yield of groundwater for each sector based on natural recharge rates.
- Set up an online register of tubewells/borewells
- Demand forecasting to be done for augmenting city water supply and to bring water source near the demand centre. This will save pipeline laying cost, maintenance cost and also reduce water losses due to leakages.
- Need hydrological assessment of aquifers of Gurgaon and comprehensive water database and assessment of climate change on water resources
- Database of water bodies (existing, encroached and polluted) should be prepared and placed in public domain. The database should be updated every five years
- Develop high water recharge zone maps as well as high contamination zone maps

Air quality monitoring

- Set up real time air quality monitoring systems
- Implement graded response action plan as notified by MoEFCC
- Map air pollution hotspots in the city for local interventions
- Assess relative contribution of air pollution sources in the city to refine the integrated plan.
- Undertake satellite-based monitoring for tracking and enforcing agriculture waste burning

Industrial air pollution

- Enforce emissions standards and restrict use of dirty fuels
- Ensure strict implementation of emission norms, use state of the art Technology
- Develop and implement siting and zoning policy for large developments, industrial units and other polluting activities.
- All power plants in the region should meet the new emissions standards and also move to natural gas.

AGENDA FOR ACTION – ENSURING CLEAN AIR FOR ALL

Vehicular emissions and clean fuels

- Ensure on-schedule implementation of BS VI fuel and emission standards from April 1, 2020
- Expand CNG programme for public transport buses, taxis and autos on CNG and control toxic diesel emissions
- Promote zero emissions battery operated vehicles as feeder for integration and in targeted commercial areas to be pedestrianised
- To ensure 100%compliance with the Pollution Under Control (PUC) programme link PUC certificates with annual vehicle insurance
- Ensure stringent and regular auditing of PUC centres and calibration of PUC equipment with strong penal action against defaulters
- Create a roadmap for introducing centralised and mechanized emissions testing centres
- Enforcement of law against visibly polluting vehicles
- Control and divert truck traffic from the city. Check overloading

Dust Pollution
- Phase-in mechanical and vacuum-based street sweeping wherever feasible and selective sprinkling of recycled water
- Make construction bodies accountable for adopting dust control measures for road digging
- Implement truck loading guidelines
- Increase subsidy for purchase of equipment that eliminates the need for burning stubble and straw. Promote reuse and recycling of waste straw from agricultural field
- Increase green cover in the city and provide open public spaces under URDPFI guidelines

Use of DG set
- Ensure that only those DG sets that meet the emissions standards are allowed to operate
- Promote roof top solar power at building level to minimize use of DG sets.
- Operating time of very large DG sets should be regulated according to graded response action plan
- Only approved clean fuels should be allowed to operate big DG sets
- Discourage DG sets in social events as per graded response action plan

AGENDA FOR ACTION – FACILITATING MOBILITY

GURUGRAM
A FRAMEWORK FOR SUSTAINABLE DEVELOPMENT

Walking and cycling
- A network plan for footpaths and bicycles
- Adopt traffic calming measures & street design guidelines
- Safe and at-grade pedestrian crossings with pedestrian signals
- Introduction of cycle sharing systems as feeder to public transport
- Encroachment (parking) to be made punishable offence

Bus services
- Augment bus fleet & rationalise bus routes (200 m to bus stop)
- Develop bus depots and other related infrastructure
- (affordable) fare integration and common ticketing
- Give right of way to buses
- Proper regulations and organisation of paratransit

Metro and multi-modal integration
- Demarcation of influence zones around metro stations for TOD
- Provide NCR connectivity for public transport
- Implement traffic impact assessment for infrastructure projects
- Plan efficient deployment of intermediate public transport

Parking
- Implement parking policy as a travel demand management measure
- Physically demarcate legal parking areas
- Strict penalty for violation of parking rules and encroachment
- Introduce and further upgrade dynamic pricing
- Reform parking lease agreements to increase parking revenue

Road safety
- Institutionalise road safety audit system with specific audits for vulnerable sections
- Maintain spatial database of road traffic collisions
- Strict enforcement of traffic rules related to speed, lane driving, etc.

Inclusive urban design
- Promote compact city design and planning to reduce distances
- Adopt and mandate active street design guidelines with focus on cyclists, pedestrians, differently-abled, children, women, etc.
- Promote street level activity and well watched streets
- Carry out periodic risk assessment and gender safety audit

AGENDA FOR ACTION – PROMOTING ENERGY EFFICIENT LIVING

- Enforce Energy Conservation Building Code
- Extend the coverage of ECBC to Multi-Storey Residential Buildings.
- Set operational energy efficiency target for buildings based on BEE's energy star rating programme for buildings.
- Perform mandatory energy audit for new and existing commercial buildings with connected load of 100 kW and existing government and institutional buildings:
- Use of glazing should be within 30-40 per cent of the building façade to prevent trapping of heat and increased demand for cooling.
- Actively promote passive architectural and design features for efficient use of energy in housing, commercial and industrial sector.
- Build awareness through dissemination to promote more energy efficientcooling systems
- Leverage the green energy conservation fund set up by Haryana Government.
- Promote energy efficient appliances
- Promote use of environment friendly and recycled material
- Open parking areas
- Street lighting
- Sensors for automatic on/off of street lights

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- Street lighting
- Sensors for automatic on/off of street lights
- Proper pump-system design (efficient Pump, pumps heads with system heads) and installation of variable speed drivers
- Power saver installation in pump house
- Implement on time and with scale the existing notification No. 22/52/2005- 5 Power under the Energy Conservation Act, 2001 of Haryana Government that has specified the minimum capacity installation of solar photovoltaic power plant for different category of buildings and areas and these are mandatory. The requirement will be progressively increased. These include:
  - All new residential buildings built on a plot size of 500 square yards and above falling within the limits of Municipal Corporations, Municipal Councils, Municipal Committees, Haryana Urban Development Authority (HUDA),Haryana State Industrial and Infrastructure Development Corporation (HSIIDC) sectors will install capacity of solar photovoltaic power plant. The minimum capacity will be of 1 Kilo Watt peak (KWp) or 5 per cent of sanctioned load, whichever is higher

- All private educational institutes, schools, colleges, hostels, technical/ vocational education institutes, universities etc with sanctioned load of 30 Kilo Watt (KW) will install minimum 5 Kilo Watt peak (KWp) Or 5 per cent of sanctioned load, whichever is higher.
- Solar rooftop programme to be expanded and leveraged to minimize use of diesel generator sets
- Solar water heating shall be provided to meet 20 per cent of the hot water demand
- It is mandatory to use the Solar Water Heating System in all the buildings stated above and also in case of all other buildings having plot area more than 1000sq.m and all public buildings. Promote solar water heating systems in residential buildings.
- The sharing concept shall be introduced
- Energy generated under this model to be considered for DISCOMs Renewable Purchase Obligation (RPO).
- Develop Gurugram as a 'Solar City'
- Promote development of Solar Parks
- Creation of separate fund to develop required infrastructure to attract more renewable energy projects

AGENDA FOR ACTION – MANAGING URBAN WASTE

- Take stringent action against open burning of biomass, leaves, tyres etc to control such activities. Impose a complete ban on garbage burning.
- Ensure proper collection of horticulture waste (biomass) and composting cum-gardening approach
- Action on decentralised solid waste disposal, reuse and recycle should be strengthened to prevent open disposal and burning of waste.
- Implement the order of 21 April 2017 of the Municipal Corporation of Gurugram (MCG) that directs all C&D waste generators to be responsible for collection, segregation and storage of C&D waste.
- Set up strong monitoring and surveillance system for implementation of the C&D rules and on-site dust control measure
- For material handling and construction demolition, it should be obligatory on part of the developers to provide evidence of debris disposal at designated sites.
- Promote reuse and recycling of construction and demolition waste.
- Urban local body to make an action plan on waste management in accordance to the Solid Waste Management Rules of 2016 with a time bound strategy.

- Promote waste segregation at source
- User fee to be paid by waste generator
- Bio-degradable waste should be processed, treated and disposed of through composting or bio-methanation within the premises as far as possible and the residual waste shall be given to the waste collectors or agency as directed by the local authority
- Spot fines on littering
- Mapping and integration of concerned stakeholders with solid waste management
- Composting at the community and RWA level to be promoted
- Build public awareness programmes
- Inclusion of informal sector in waste management and disposal
- Waste to energy plants may be set up based on best available technology, and minimal population exposure to pollution
- Implement roadmap to reduce plastic use
- Aggressively promote use of biodegradable plastics and cotton cloth and jute bags to be initially supplied by the MCG.
- Recognise the recyclers and dealers in the city and authorising them.

- Encourage collection centres under the Extended Producer Responsibility (EPR) model as per the plastic waste management rules, 2016
- Introduce spot fines on littering and for usage of disposable plastic. Give decentralize power to different authorities to impose the ban.
- Integration of informal sector in the EPR framework of the city for plastic waste management.
- Incentives to be given to consumer for depositing used plastic bottles (PET), other articles in the form of coupons- a vending machine system to be created.
- For an integrated solution, a waste pickers audit should be conducted and they should be induced in the formal waste system with ID cards as "sanitation workers of MCG".
- Need better equipments of waste workers, better and well-maintained dustbins, better processes and more motivation and training
- Municipal Corporation of Gurugram has launched a waste management portal that enables RWAs to collaborate with MCG for effective waste management.

AGENDA FOR ACTION – PROTECTING THE GREENS

- Implement strategies for protection of the Aravallis
- Protection of bund lands
- At least 20 percent of forests need to be in dense category (at present there is barely any dense forest).
- Green belts and planting of trees alongside roads, railway lines, canals, and other unutilised lands.
- All resident families need to have green space within 2 km of aerial distance of at least 5 hectares area for providing multiple forest ecosystem services.
- Develop mandatory guidelines for the protection of areas providing eco system services, such as ground water recharge zones, stream buffers, flood plains, water bodies, forest and vegetation areas, ponds, lakes, and sacred groves.
- Mapping of natural forests and plantation and protection of linear strip of vegetation
- Beneficiaries of mining and quarrying should be required to repair and re-vegetate the area in accordance with established forestry practices.
- Infrastructure and road building projects need to minimize requirement of tree felling and ensure replanting

AGENDA FOR ACTION – ENSURING SUSTAINABILITY FOR ALL

- Earmark zones for affordable housing and self constructed housing for the poor in master plan
- Ensure basic services and amenities
- Prioritise connectivity to work place and/or public transport systems
- Promote appropriate building typologies, architecture and low-cost material for safe ad comfortable dwelling
- Promote affordable rental housing options
- Develop model urban villages as an integrated part of compact and inclusive city
- Appropriate fiscal strategy and incentives to fund and support affordable housing development.

- Enable and support community action
- Involve RWAs and local residents for participatory planning
- Recognise and publicly reward RWAs for their efforts, this will increase sense of ownership towards the city
- Involve local universities