IMPACT OF CLIMATE CHANGE ON URBAN DEVELOPMENT

Ravi Budhiraja
Chairman
Maharashtra Water Resources Regulatory Authority, Mumbai

Training Program on Building Urban Climate Change Resilience
TERI – APN – GoM
YASHADA, Pune, 18 May 2015
Climate is Changing because of Global Warming

**MERCURY RISING** Global warming is caused when the atmospheric concentration of greenhouse gases like CO₂ increases. Excessive burning of fossil fuels like petroleum is the main cause.

**HOW HOT IT WILL GET**

<table>
<thead>
<tr>
<th>Year</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1850</td>
<td>13.77°C</td>
</tr>
<tr>
<td>1900</td>
<td>14.43°C</td>
</tr>
<tr>
<td>1950</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>2050</td>
<td></td>
</tr>
<tr>
<td>2100</td>
<td></td>
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</tbody>
</table>

Annual average temperatures and projections worldwide

**Global average rise in sea levels (in metres)**

- Compiled projection from several models

**CO₂ emissions across the globe**

- From burning fossil fuels
- From burning liquid fuels
- From burning solid fuels
- From burning gaseous fuels

(Times of India, 2012)
Greenhouse gases are our friends up to limits---

- Natural greenhouse effect makes earth’s average surface temperature about 33°C warmer than it would otherwise be (+14°C versus -19°C).

- But, we are increasing the CO₂ content of the atmosphere by a more than 0.5% per year through burning various fuels in large quantities.
In 1896, Arrhenius first speculated that changes in the levels of CO₂ in the atmosphere could substantially alter the surface temperature through the GH effect and warned that if burning coal were to double the concentration of CO₂ in the atmosphere, the temperature of the earth could rise by several degrees.
Trend in Mean Temperature in India (1901 – 2012)
Climate Change Impacts: Global

- Change in rainfall patterns and melting of snow, glaciers and ice caps, affecting water resources,
- Increased frequency of heavy precipitation leading to heavy floods,
- Rising sea levels – increased coastal and sea bank erosion and sea water ingress,
- More intense and longer droughts/dry spells,
- Decreasing crop yields,
- Adverse impact on human health,
- Negative impact on human habitat, and
- Reduction in marine biodiversity.

Resilience refers to the ability to absorb and recover from change, stresses and shocks (from extreme events).

Climate Change Impact on Rainfall (2021-2050)

INDIA
Change in Annual Rainfall (2021-2050 over 1961-1990)

INDIA
Change in Number of Rainy Days (2021-2050 over 1961-1990)

Change (%)
- < -5
- -5 to 5
- > 5

(CRIDA, 2014)
Impact on Floods and Dry Spells (2021-2050)

INDIA
Change in Number of Events with >100mm Rainfall in Three Consecutive Days (2021-2050 over 1961-1990)

Change (%)
- < -5
- -5 to 5
- > 5

INDIA
Change in Incidence of Dry Spells of ≥14 days (2021-2050 over 1961-1990)

No./Season (June-Oct)
- Decreasing
- No Change
- Increasing

(CRIDA, 2014)
Climate Change Impact on Temperature Increase (2021–2050)

INDIA
Change in Maximum Temperature (2021-2050 over 1961-1990)

INDIA
Change in Number of Hot Days during March - May (2021-2050 over 1961-1990)

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Source of Data: Computed using PRECIS RCM IPCC SRES A1B daily weather data sets provided by ITM, Pune

(CRIDA, 2014)
URBANIZATION OF INDIA

- India’s urban population is expected to grow from 377 million in 2011 to 590 million by 2030,
- Cities are centers of economic growth of a country but also lead to enhanced energy use and higher GHG emissions,
- Rapid urbanization is placing a burden on infrastructure, energy and water consumption, and public services,
- Pattern of urbanization is lopsided—rapid growth of peri-urban areas,
- Economic, social and environmental cost of unstructured urban growth outweighs the benefits of urbanization,
- Cities face challenges of good governance, rapid population growth, migration, transport, water, energy, health, air and water pollution, waste disposal.
Water Resources and Use in Maharashtra

- Surface water allocated to the State = 126 BCM
- Groundwater Resources = 33 BCM
- Water available for planned water use = 148 BCM (SW+GW)
- Water storages created so far = 33 BCM
- Present water use (SW+GW) = 40 BCM
- Estimated water demand in 2030 (SW+GW) = 103 BCM

![Pie chart showing water use distribution]

- 72% Surface water use for Irrigation
- 19% Surface water use for Domestic
- 9% Surface water use for Industry

- 85% Groundwater use for Irrigation
- 10% Groundwater use for Domestic
- 5% Groundwater use for Industry
Rural - Urban Population Growth in Maharashtra

India (2011)
- Rural: 31%
- Urban: 69%

Maharashtra
- Rural: 45%
- Urban: 55%

<table>
<thead>
<tr>
<th>Year</th>
<th>Rural (Crores)</th>
<th>Urban (Crores)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961</td>
<td>1.12</td>
<td>2.84</td>
</tr>
<tr>
<td>1971</td>
<td>1.57</td>
<td>3.47</td>
</tr>
<tr>
<td>1981</td>
<td>2.2</td>
<td>4.08</td>
</tr>
<tr>
<td>1991</td>
<td>3.05</td>
<td>4.84</td>
</tr>
<tr>
<td>2001</td>
<td>4.1</td>
<td>5.57</td>
</tr>
<tr>
<td>2011</td>
<td>5.08</td>
<td>6.15</td>
</tr>
<tr>
<td>2021</td>
<td>6.2</td>
<td>6.59</td>
</tr>
<tr>
<td>2031</td>
<td>6.91</td>
<td>7.36</td>
</tr>
<tr>
<td>2041</td>
<td>7.12</td>
<td>7.76</td>
</tr>
<tr>
<td>2051</td>
<td>7.26</td>
<td>8.52</td>
</tr>
</tbody>
</table>
- No. of Municipal Corporations: 26
- No. of Municipal Councils: 212
- Wastewater Generated: 6383 MLD
- Wastewater treatment capacity: 58%
- About 80% of water pollution is due to discharge of untreated domestic sewage into rivers, lakes and ponds.
- Presently, only 18 municipal corporations and 10 municipal councils have made arrangement for sewage treatment and disposal.
Climate Change Impacts in Maharashtra

- Increased temperatures
- Increased frequency of occurrence of extreme temperature events
- Change in amount and timing of rainfall
- Increased frequency of intense rainfall events
- Warmer and wetter monsoon seasons
- Increase in number of days with high rainfall (>25mm/day)
- Increased risk of severe and widespread floods

<table>
<thead>
<tr>
<th>Increase in temp. and rainfall over the year 2000</th>
<th>2021-2050</th>
<th>2071-2100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. annual temperature</td>
<td>1.8°C</td>
<td>3.4°C</td>
</tr>
<tr>
<td>Min. annual temperature</td>
<td>2.2°C</td>
<td>4.5°C</td>
</tr>
<tr>
<td>Annual rainfall</td>
<td>10.7%</td>
<td>8.9%</td>
</tr>
</tbody>
</table>

Source: Centre for Science and Development, 2014)
There is no proper assessment of wastewater generated and treated,

Need to close the gap between wastewater generated, treatment capacity and actual treatment,

Most cities do not have adequate sewage treatment facility or infrastructure for its safe disposal, thus aggravating the problem further,

Increase investment in infrastructure, capacity building and education to address water and wastewater issues,

Adopt decentralized and low cost technologies for WW treatment,

Promote safe reuse of treated wastewater for irrigation, industry, and secondary domestic purposes,

Develop guidelines and a coherent policy for wastewater treatment and use.
• Use of non-potable/grey water for cleaning streets and flushing toilets, go for dual pipeline system,
• Charging water to discourage wasteful practices,
• Encouraging more private investment to finance new infrastructure such as STPs and desalination plants,
• Increase transparency in urban water supply and sanitation,
• Emission-monitoring is an important step for building, environmentally sustainable cities. Prepare & publish City Green House Gases Emission Inventory Report,
• ICLEI HEAT+ software is a web-based system designed to help local government’s benchmark emissions levels against local, state, national, provincial, and international standards.

(http://www.iclei.org/)
• Climate change risk can lead to a significant setback to the development gains. Efforts should be taken to create awareness on climate resilience and disaster management, sensitize citizens, decision makers, and city planners.

• As the pace of urbanization is increasing in Maharashtra, the challenge of domestic water supply and wastewater management is a serious concern.

• ULBs need to make assured arrangement of drinking water supply and sanitation by adopting various water saving/conservation measures like reducing losses, non-revenue water, limiting water supply within prescribed norms, compulsory water metering, appropriately charging of water supply and wastewater disposal, rain water harvesting, promoting use of water saving devices and fixtures, etc.

• Tree cover provides resilience to the urban landscape. They act as recharge zones, flood mitigation, coastal protection and improve water quality through carbon sequestration. Thus restoration of degraded watersheds around city areas provides multiple benefits towards better livelihoods and environment.
Source: London-based company The Eco Experts has revealed the countries best-equipped to cope with climate change on a map, Green is best, scaling down to red being worst. Read more: http://www.dailymail.co.uk/sciencetech/article-2908213
THANK YOU

www.mwrra.org

TOGETHER WE STRIVE FOR A CLIMATE RESILIENT SOCIETY