Scoping Study for Policy Initiatives to minimize Urban Heat Island Effect for Low Carbon Urban Growth

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&

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supported by SHAKTI
SUSTAINABLE ENERGY FOUNDATION
"Heat island" is an area specific phenomenon where the temperature of one area is higher than that of the surrounding areas.

Source: USEPA
Viscous cycle affecting health & economics

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CAUSAL FACTORS

UNCONTROLLABLE VARIABLES

Anti-cyclone conditions, Season, Diurnal conditions, Wind Speed, Cloud Cover

UHI

Anthropogenic heat, Air Pollution

Sky view Factor, Green Areas, Building Materials

Population Related

Urban Design and Structure related

CONTROLLABLE VARIABLES

Source: (Memon, Leung, & LIU, 2007)

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Summary of Research Findings

Transportation modes
Building energy efficiency (air conditioning)
Building equipment

Landuse Planning
- Planned transport CO2 emission
- Planned soft/ green surface distribution

Building Morphology
- Ground coverage
- Floor Area Ratio
- H:W ratio

Surface character
- Ground Cover
- Building Material
- Water Bodies

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Policy instruments for UHI Interventions: INTERNATIONAL

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Climate Zones of India compared with projected urban growth for 2031

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Governmental and Non-Governmental organisational structure Legislative Framework

Present conditions, Needs and future concerns at National or International Level

Acts → Ministries

Leads to formulation of Policies

Lays their focus through

Policies

For Specific issues Formulate

Mandatory Provisions

Eg. ECBC for Commercial Buildings

Provides focus areas, issues to take action on

Guidelines

Eg. URDPFI guidelines are formulated by MoUD to streamline Urban Development

Bound to follow

For implementation, give way to

Programs

Benefits from

Eg. URDPFI guidelines, cities can formulate Master Plans. TERI etc developing Solar city Master Plans

Organizations

Eg. BEE was formed under the Energy Efficiency Act and is a statutory body under MoP

Works at both Central and State Level

State & Cities

Can formulate organizations, programs, mandatory provisions for subjects under state list.

Determines fund allocation

Eg. BEE

Help through collaboration in implementation

Non-Governmental Organizations

Through the channel of policy visions

Help through collaboration

Five Year Plans
## Overview of Indian Policy Instruments w.r.t UHI

<table>
<thead>
<tr>
<th>Policy Instruments</th>
<th>Acknowledgement of UHI effect</th>
<th>Identification of Causal Factors</th>
<th>Suggested Mitigation Measures</th>
<th>Implementation Suggestions</th>
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<tbody>
<tr>
<td>MoEF</td>
<td></td>
<td>(Color)</td>
<td></td>
<td></td>
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<tr>
<td>National Environmental Policy</td>
<td>Focus: Prevention of Env degradation</td>
<td></td>
<td>Land-use Planning</td>
<td>Setting up env. standards, Action plans, Env Clearance</td>
</tr>
<tr>
<td>National Mission on Green India</td>
<td>Mission is in the context of Climate Change</td>
<td></td>
<td>Building Morphology</td>
<td></td>
</tr>
<tr>
<td>Environment Clearance (EC/EIA)</td>
<td>acknowledged as a contributor of air pollution Temperature rise</td>
<td>Built up density</td>
<td>Urban Lifestyle</td>
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<tr>
<td>National Mission on Sustainable Habitat</td>
<td>UHI effect adds on and intensifies climate change. UHI→Increased demand for cooling &amp; air-conditioning equipment → generating heat &amp; adding to rising temperatures &amp; GHGs</td>
<td>Loss of vegetative cover</td>
<td>Condemns lifestyle tends of increasing AC use</td>
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<tr>
<td>National Urban Transport Policy</td>
<td></td>
<td>Good urban Planning</td>
<td></td>
</tr>
<tr>
<td>Urban and Regional Development Plan Formulation and Implementation</td>
<td>the basic form of our urban centres</td>
<td>Open spaces</td>
<td>Green roof, open spaces, pervious ground cover.</td>
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<tr>
<td>JNNURM</td>
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<td>Model Building Bye Law</td>
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<td>National Solar Mission</td>
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<td>Solar -Master Plan</td>
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<tr>
<td>MoP</td>
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<tr>
<td>National Mission for Enhanced Energy Efficiency</td>
<td>Urban Area warmer than surrounding,, Leads to increased use of AC’s and refrigeration in hotter cities.</td>
<td>Modification of land surface by Urban Development</td>
<td>Energy efficient buildings</td>
<td>Manual on cool roof</td>
</tr>
<tr>
<td>Bureau of Energy Efficiency</td>
<td></td>
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<td>Energy Conservation Building Code (ECBC)</td>
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## Local Govt

**DDA- UTTIPEC**

**Street Design Guidelines ‘for equitable distribution of road space’**

Recognizes UHI effect as an environmental impact causing climatic discomfort.

High Albedo Material, trees, reflective paving

**Surat and Indore Municipalities (Supported by TARU)**

Recognizes the difference in air temperatures of dense urban areas with rural areas

Passive Ventilation Techniques, Cool Roof

## Non Govt

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### Rating Systems

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<td>ICBC (LEED) Rating</td>
<td>Urban Heat Island Effect (UHIE) refers to a phenomenon common to <strong>dense urban clusters</strong>. This phenomenon is extremely pronounced in <strong>metropolitan cities</strong>.</td>
<td>Dense urban clusters restrict the flow of wind</td>
<td>min 50% roof area &amp; non roof area under shade/vegetation &amp; or high reflective material</td>
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<tr>
<td>GRIHA</td>
<td></td>
<td>Hard paved surfaces</td>
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Rating systems although have given UHI due recognition, the points for ratings given are evaluated on basis of surface characteristics majorly.
MOUD  MOP  MOEF  MNRE

- URDPFI Guidelines
- National Urban Transport Policies
- Green Building Rating Systems
- Master Plan/ Development Plan/ Building Bye laws
- ECBC rating
- BEE star rating
- National Mission on Green India
- National Building Code
- National Mission on Green India
- National Environment Policy/ EIA
- National Sustainable Habitat Mission
- National Solar Mission
- National Urban Transport Policies

Transportation use
- public
- private
- mobility preferences

Building Equipment
- air-conditioners
- lights
- lifts & pumps
- comfort aspirations

Cooking & Appliances
- burners & stoves
- fridges & ovens
- washers & dryers
- home conveniences

Landuse Planning
- buildings
- transportation infrastructure
- industry
- parks

Building Morphology
- ground coverage
- Floor Area Ratio
- H:W ratio

Solar exposure & sky view
- wind speeds & air movement
- vegetation cover & water

Surface Character
- ground cover
- building material
- water bodies

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-CBDs may have stricter codes for energy conservation than low rise/low density areas

-Allow greater densities where the weather is favourable

-Allow greater densities at public transportation nodes

-Have a mixed use development for higher density model with day use commercial at the lower levels and night use residential at the higher
RESEARCH
- Empirical research to prepare a comprehensive and comparable database on UHI intensity in Indian cities in various climatic contexts
- Research to assess the extent of the impact of UHI on the environment, energy use, economics, and health in the Indian context
- Simulation research to help disaggregate the relative impact of various causal factors on UHI individually and in combination with other parameters, with the help of numerical models
- Estimation of the feasibilities and impact of various mitigating strategies in the local contexts of the country

POLICY
- Comprehensive incorporation of UHI strategies developmental instruments
- Attempts to synergize the take of various ministries on the UHI issue.