प्रधान मंत्री आवास योजना-शहरी
Pradhan Mantri Awas Yojana-Urban

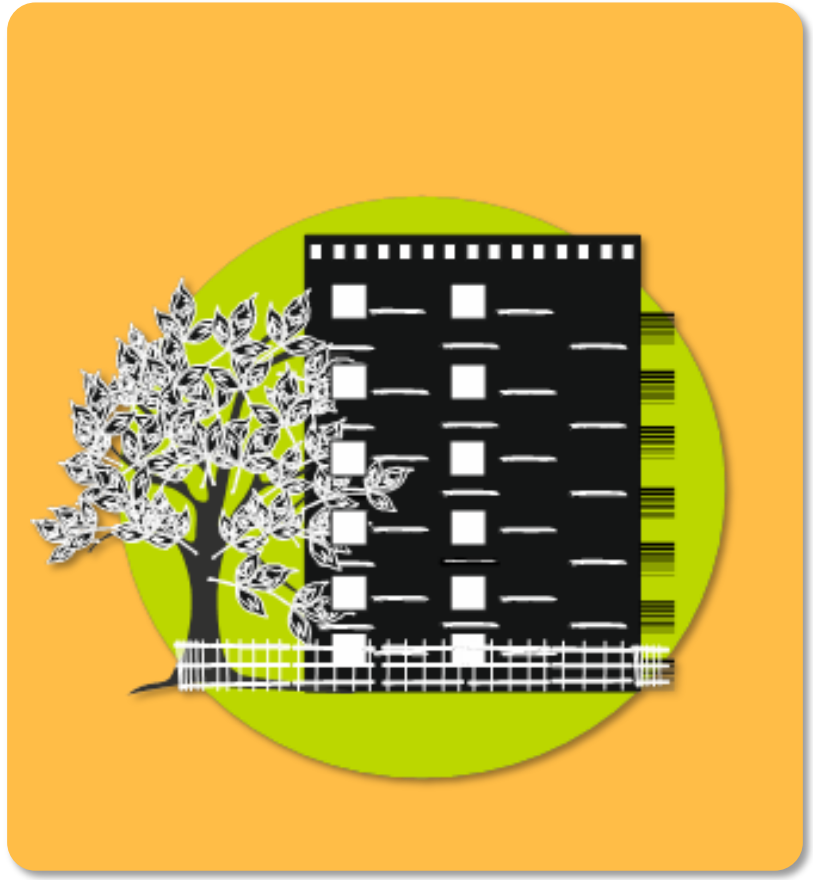
GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

Ministry of Housing and Urban Affairs
Government of India

Azadi Ka Amrit Mahotsav

bmtpc

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH



Thermal Comfort Performance based Design Standard for Affordable Housing in India

First Expert Group Consultation

May 06, 2022 | Le Meridien | New Delhi

eds environmental design solutions

Wuppertal Institut

hunnarshālā FOUNDATION

The Team

Ministry of Housing and Urban Affairs
Government of India

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

eds environmental design solutions

Building Policies, Building Performance Analysis, Sustainable Design Practices, Training

Wuppertal Institut

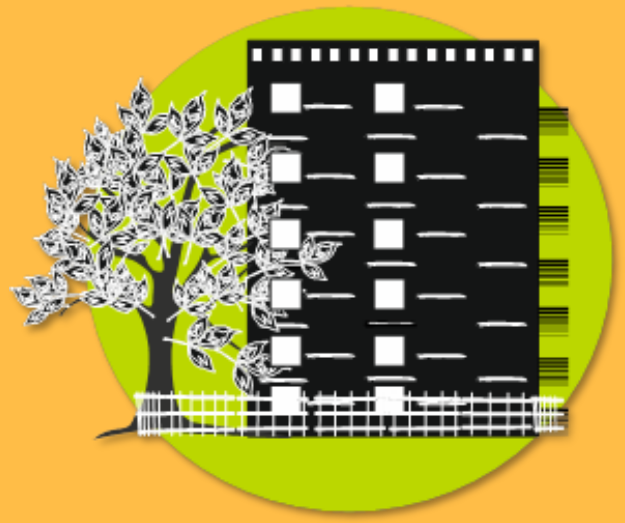
Research and Development in Building Policies, Development of Technical Standards

hunnarshālā FOUNDATION

Affordable Housing Design and Policy, Research in Traditional Building Techniques

Total Housing Inc.

Affordable Housing Policies & Strategy Formulation, Micro Finance, Urban Renewal



Context and background

Outlines the guiding principles and conceptual approach towards standard development.

Context

1. India is rapidly urbanizing.
   - Urban population will nearly double by 2051 to 880 Million
2. So is the demand for affordable housing.
   - Nearly 90% of affordable housing demand is unmet.
3. Inadequate housing increases vulnerability to climate change
   - about a quarter of India's urban population—live in informal settlements, vulnerable to climate risks

Affordable, low-carbon, climate-resilient housing is critical to improving quality of life and supporting economic development in cities around the world.

Source:

1. Affordable And Quality Housing Is Still A Dream For Many In India
2. Resilient and affordable housing for all: Lessons on house building from Kochi and Trivandrum, India, Coalition for Urban Transitions

Program Overview

1 Thermal Comfort Performance based **Design Standard**

1. Develop Design Standard for Affordable Housing based on Thermal Comfort Performance
2. Facilitate Design Standard in bye-laws of 6 ULBs across India

2 **Design Guidelines** for Thermally Comfortable Homes

1. Develop Design Guidelines for 5 Climatic Zones in India
2. Develop Training Modules for Dissemination

3 Thermal Comfort **Action Plan**

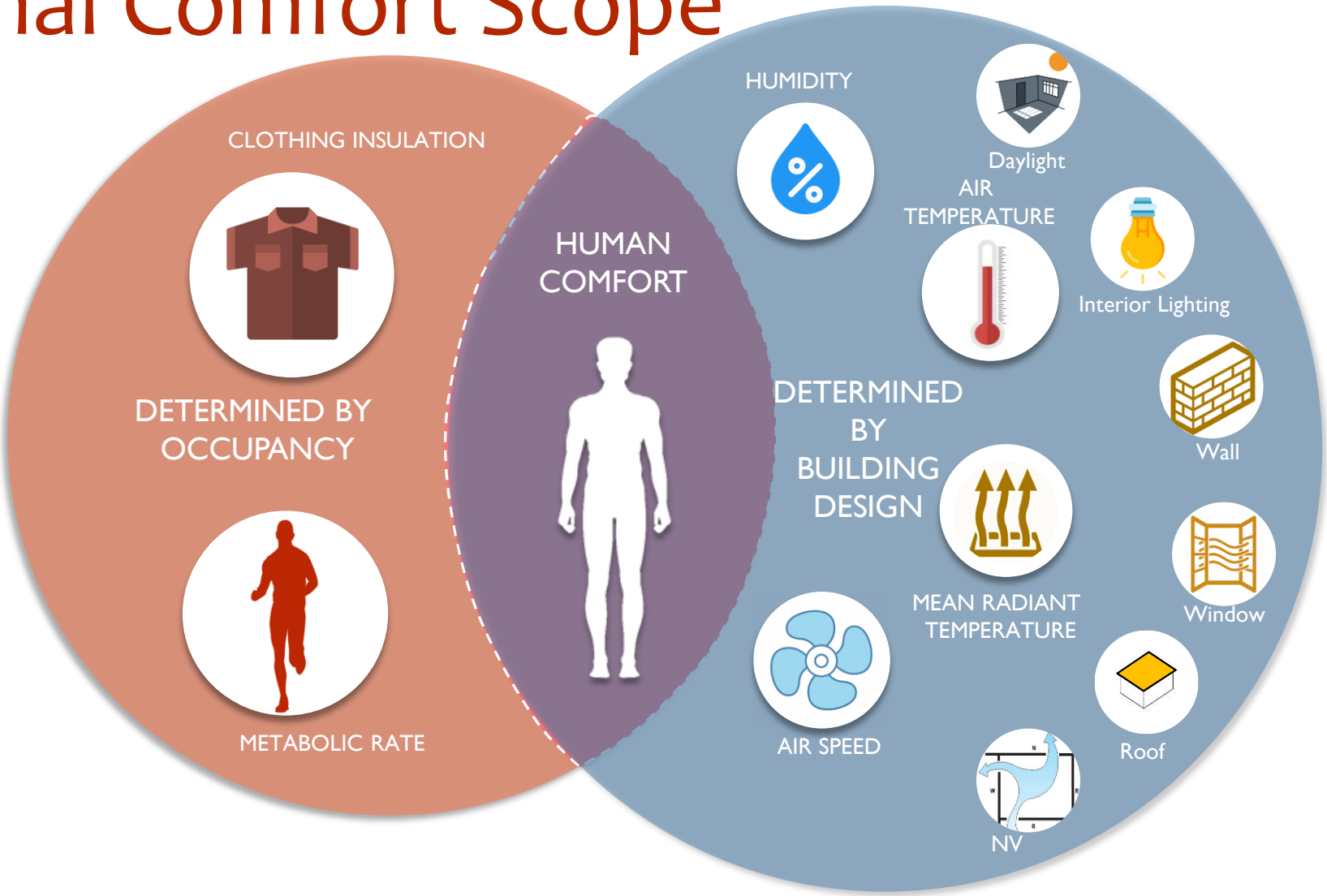
1. Develop Thermal Comfort Action Plan for Short (upto 5 yrs), Medium (10-15 yrs) & Long (15-30 yrs) term.
2. Design Financial Incentive Schemes

Workshop Objective

Review and feedback on:

1. Approach for Development of Design Standard for Thermally Comfortable Affordable Housing
2. Affordable Housing Characteristics
   - Affordable Housing Typologies
   - Affordable Housing Material Characteristics
3. Thermal Comfort Standards and Indices

Thermal Comfort Scope



प्रधान मंत्री आवास योजना-शहरी
Pradhan Mantri Awas Yojana-Urban

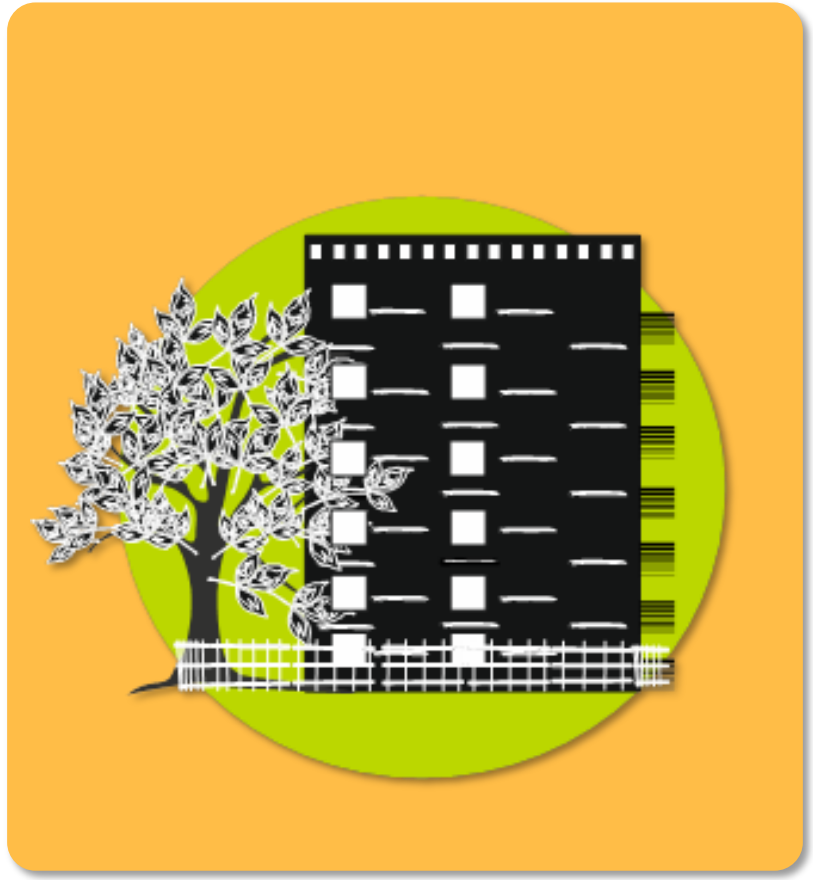
GLOBAL HOUSING TECHNOLOGY CHALLENGE INDIA

Ministry of Housing and Urban Affairs
Government of India

Azadi Ka Amrit Mahotsav

bmtpc

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH



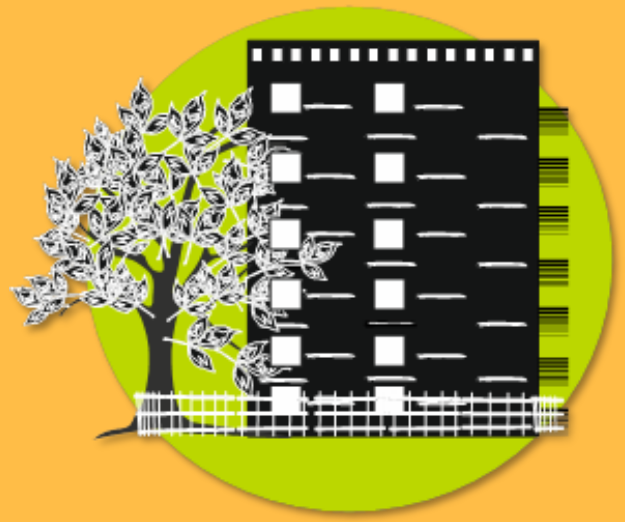
Thermal Comfort Performance based Design Standard for Affordable Housing in India

APPROACH & METHODOLOGY FOR STANDARD DEVELOPMENT

eds environmental design solutions

Wuppertal Institut

hunnarshālā FOUNDATION



Development Approach

Outlines the guiding principles and conceptual approach towards standard development.

Guiding principles for developing standard

1) Target enhancing thermal comfort by 50 % (over existing performance)
2) Employ passive design strategies to enhance comfort (i.e. without mechanical conditioning systems)
3) Through standard promote use of,
   - local building materials (also low in embodied energy),
   - low or 'No' cost strategies to enhance comfort, and,
   - expeditious construction techniques/technologies

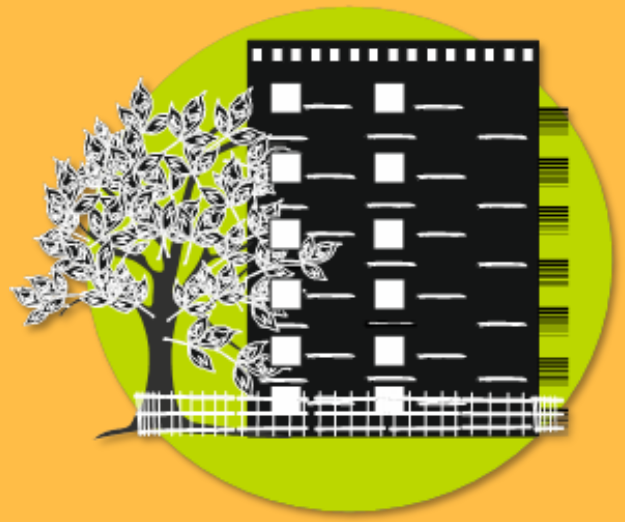
Approach to standard development

Establish
COMFORT POTENTIAL

Establish
MINIMUM PERFORMANCE
through Passive Means

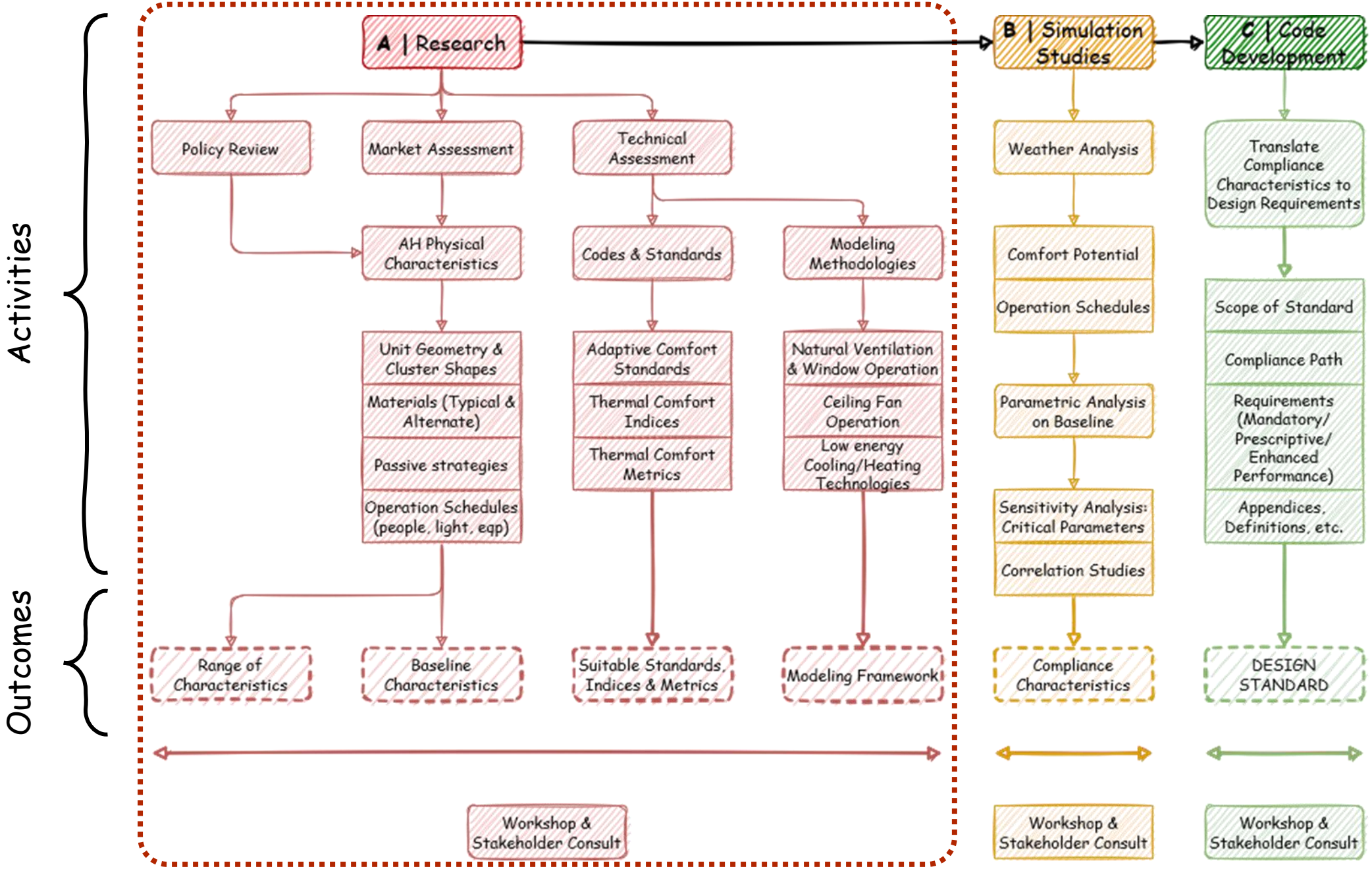
Establish
ENHANCED PERFORMANCE by
Low energy or added cost technologies

Image Credit: Andrew Marsh



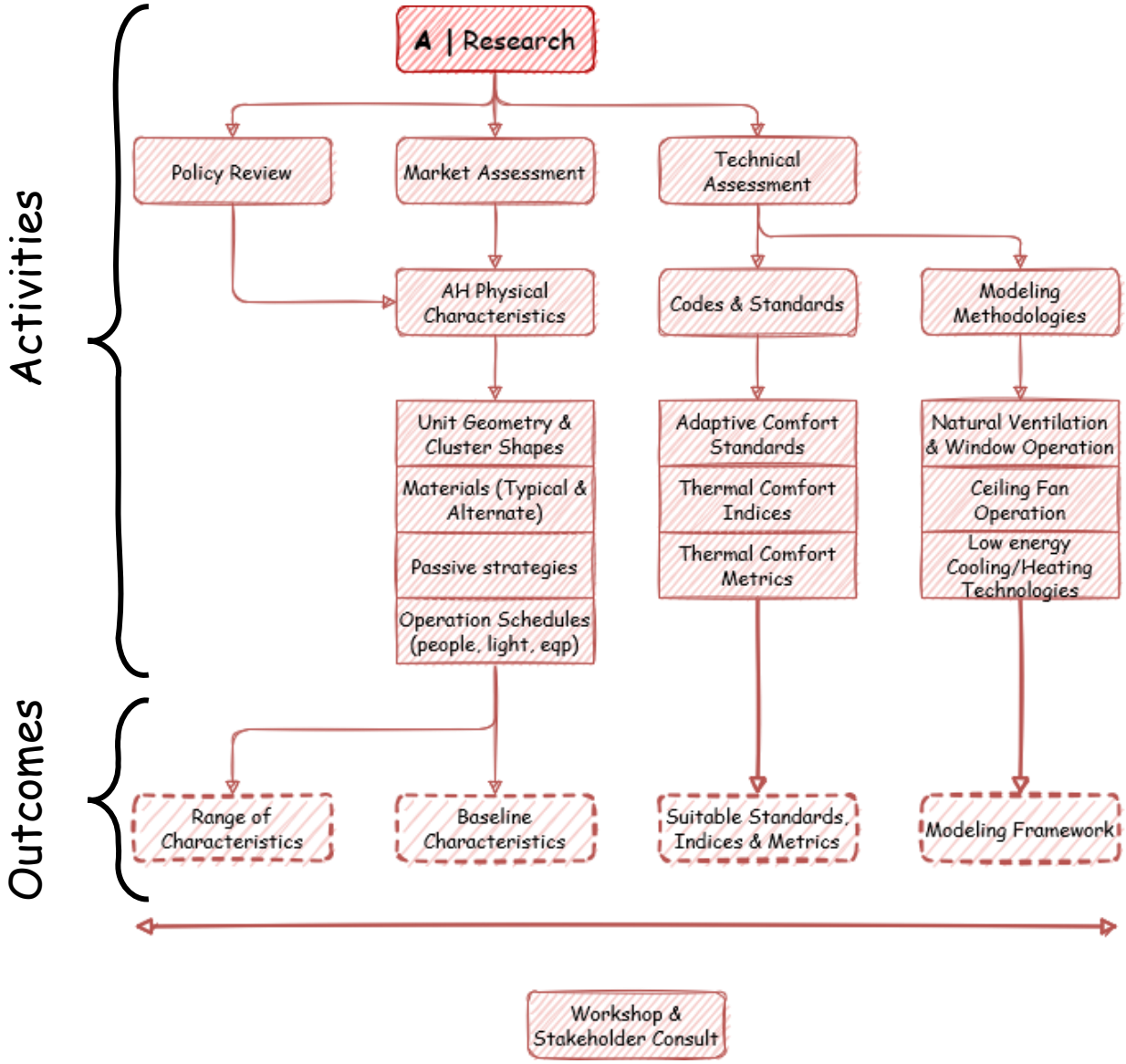
Development Methodology

Outline key steps/tasks in developing standard.


Activities
Outcomes
A | Research
B | Simulation Studies
C | Code Development
Policy Review
Market Assessment
Technical Assessment
AH Physical Characteristics
Codes & Standards
Modeling Methodologies
Unit Geometry & Cluster Shapes
Materials (Typical & Alternate)
Passive strategies
Operation Schedules (people, light, eqp)
Adaptive Comfort Standards
Thermal Comfort Indices
Thermal Comfort Metrics
Natural Ventilation & Window Operation
Ceiling Fan Operation
Low energy Cooling/Heating Technologies
Range of Characteristics
Baseline Characteristics
Suitable Standards, Indices & Metrics
Modeling Framework
Workshop & Stakeholder Consult
Weather Analysis
Comfort Potential
Operation Schedules
Parametric Analysis on Baseline
Sensitivity Analysis: Critical Parameters
Correlation Studies
Compliance Characteristics
Workshop & Stakeholder Consult
Translate Compliance Characteristics to Design Requirements
Scope of Standard
Compliance Path
Requirements (Mandatory/ Prescriptive/ Enhanced Performance)
Appendices, Definitions, etc.
DESIGN STANDARD
Workshop & Stakeholder Consult

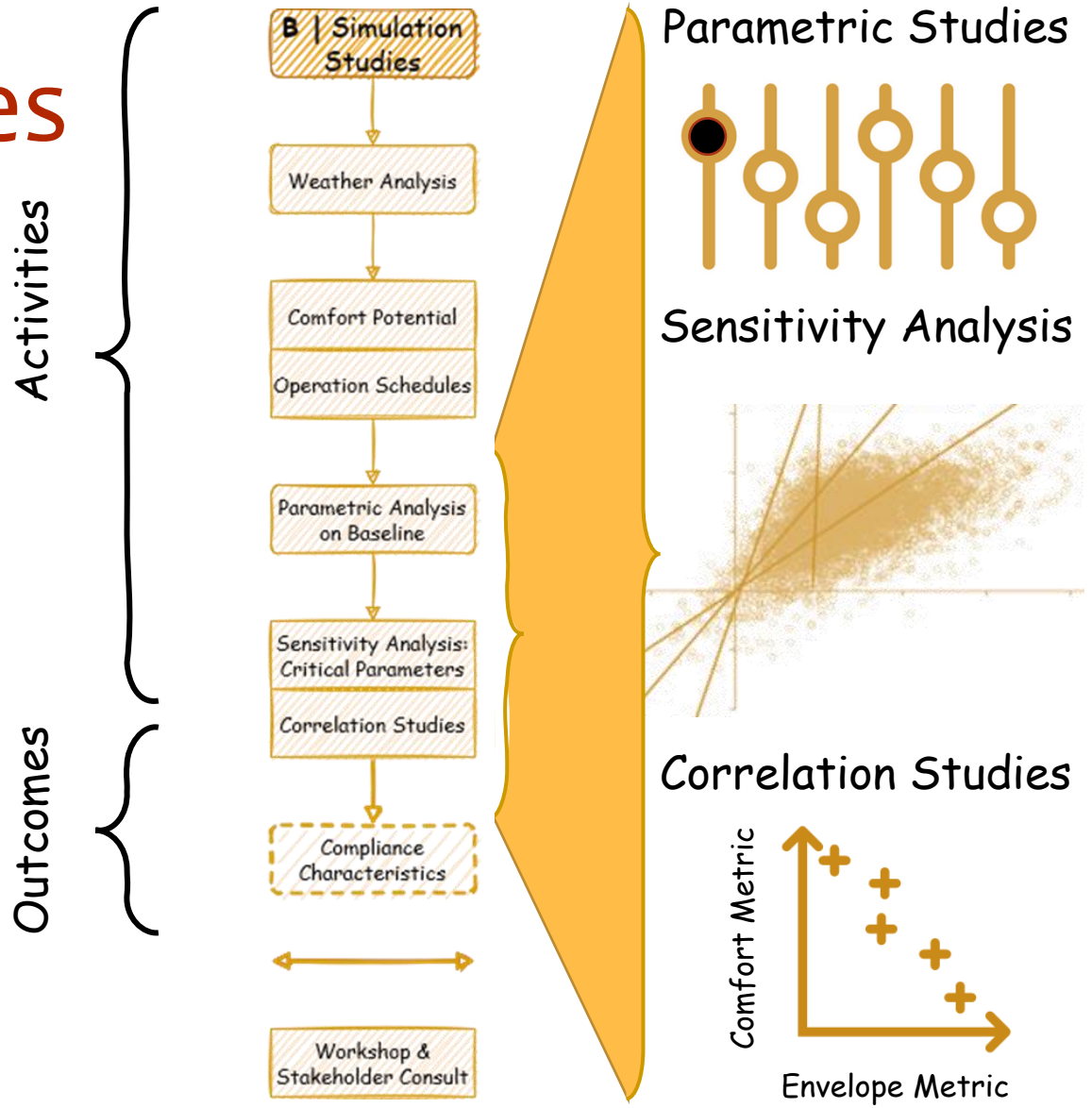
A| Research

1. Review policies to outline affordable housing typologies and their attributes (area, family characteristics, etc.)
2. Conduct market analysis through data in public domain (journals, industry & technical reports, project information – pvt. & govt., case studies) to outline:
    1. typical building characteristics,
    2. range of attributes
    3. exemplary building practices
3. Review technical documents (codes, standards, peer reviewed journals, technical reports, etc.) to outline suitable:
    1. adaptive comfort models
    2. thermal comfort indices & metrics
    3. energy modeling best practices



B| Simulation Studies

1. Weather analysis to
   1. realize comfort potential for climate zone
   2. outline natural ventilation and window operation potential
2. Parametric studies to identify
   1. Sensitivity and Correlation of building parameters to comfort performance
3. Establish minimum and enhanced performance characteristics

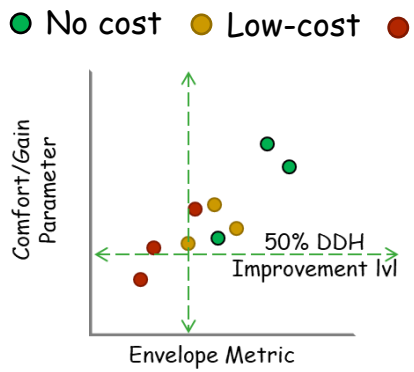


C| Code Development

1. Translate performance characteristics to Design features
2. Frame prescriptive Requirements
3. Devise compliance paths and adapt requirements for Mandatory/Prescriptive/ Enhanced Performance
4. Compile Design Standard

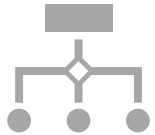
Activities

Outcomes



Analyzing Simulation Studies

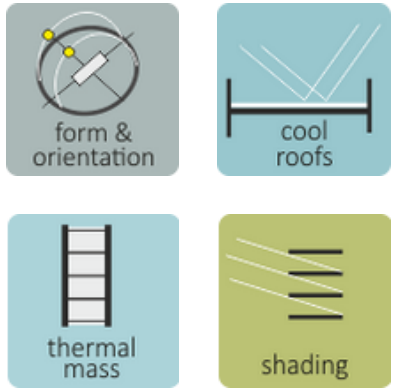
Translating Analyses to Requirements



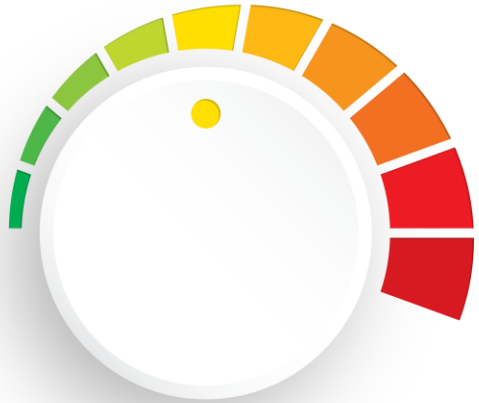
Devising Compliance Paths

Expected Outcomes

A Standard based on Adaptive Comfort Models



A Standard focused on Envelope Measures & Passive Design



A Standard that establishes Minimum & Enhanced Performance Criteria

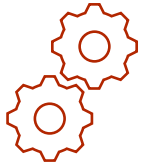
Ease of Compliance – key to uptake & adoption

Easy to Interpret
Outline Min. performance criteria
Layout standard by Sections
Examples of calculations

Easy to Comply with
Form based Prescriptive approach
Alternative paths to document beyond code performance

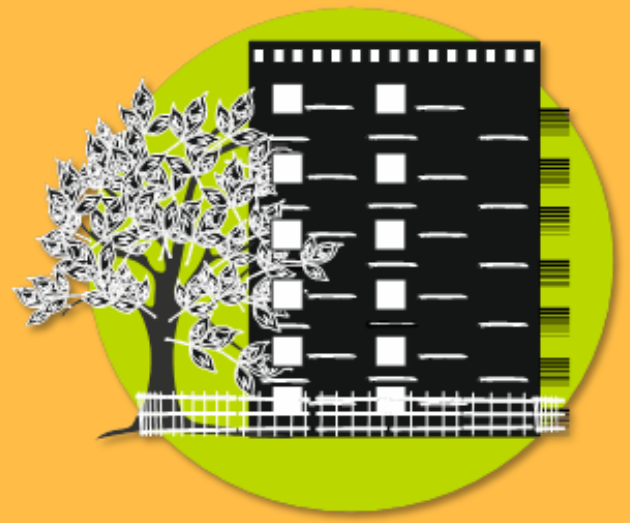
Easy to Verify
Checklist based compliance.

Prescriptive approach
Easy to adopt and document.



Performance approach
Equation or simulation based compliance for flexibility in design & to promote beyond code performance

Performance bundles approach
Pre-defined design bundles to reduce burden of compliance on end user



Thank You!