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Energy Efficiency in buildings – day 3

Maxine Jordan, IEA, and Ian Hamilton, UCL Energy Institute

Pretoria, Wednesday 16th October 2019

Buildings energy efficiency sessions in partnership with:

UCL ENERGY
INSTITUTE



Welcome back!

- Review: What we learned yesterday and questions
- Polls:

- Question 1: Which features of a building code should be performance based rather than prescriptive?

Area of glazing allowed

Insulation

Type of shading device to be installed

Colour of surface finishes

Use of commissioning

Air tightness

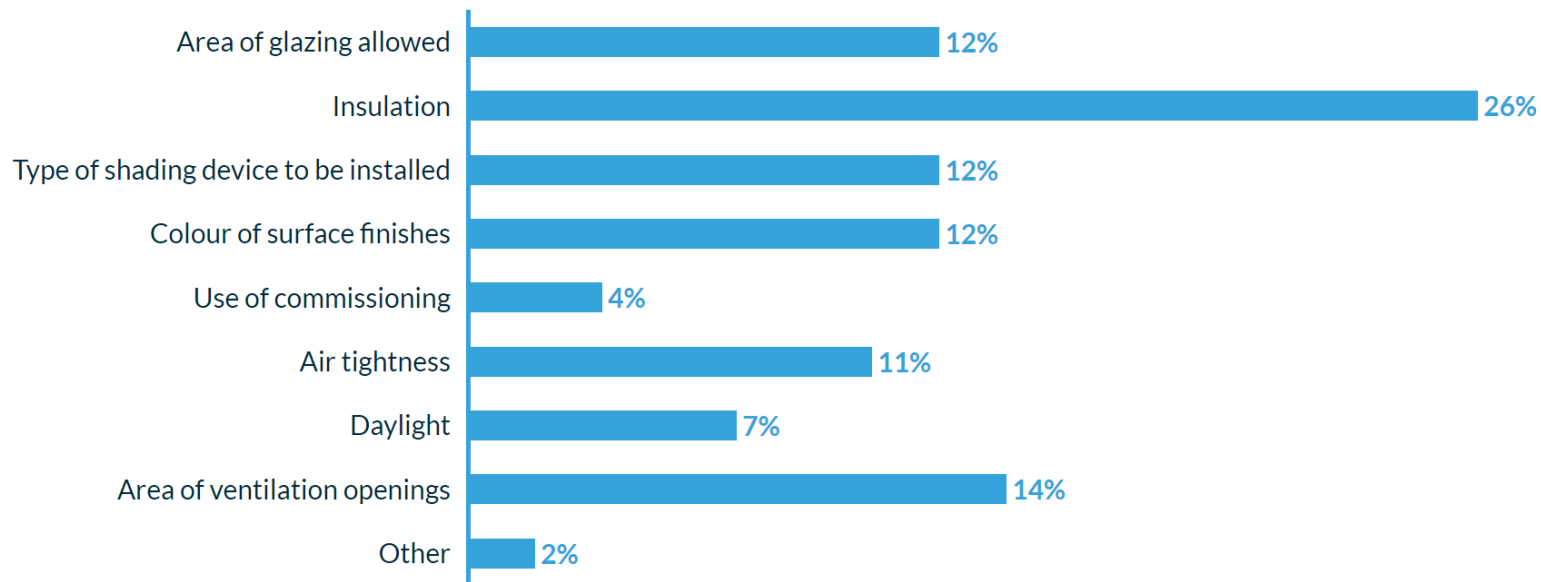
Daylight

Area of ventilation openings

Other

Results

Which features of a building code should be performance based rather than prescriptive?





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What are the steps? Implementing codes and standards

Buildings: Maxine Jordan, IEA and Ian Hamilton, UCL Energy Institute

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Energy Efficiency Training Week: Buildings programme

1. Where to start: Energy use in buildings
2. Where to start: Energy efficiency potential in buildings
Special session: GlobalABC Regional Roadmaps
3. Toolkit: Energy efficient building design technologies
4. Toolkit: Energy efficient building system technologies
Special session: Green Building in Africa – *Elizabeth Chege, KGBS*
Special session: The GlobalABC Africa Roadmap for buildings and construction
5. What are the steps? Determining the current status of policies
6. Toolkit: Energy efficiency policies and target setting *with guest speaker: Hlompho Vivian, GBC SA*
- 7. What are the steps? Implementing codes and standards**
8. What are the steps? Building operations and procurement *with guest speaker: Christelle Van Vuuren, Carbon Trust*
Special session: The multiple benefits of energy efficiency
9. Did it work? Evaluation and energy efficiency indicators
Special session: Financing energy efficiency in buildings
10. Buildings quiz

Energy Efficiency Training Week: Buildings

7. What are the steps?: Implementing codes and standards

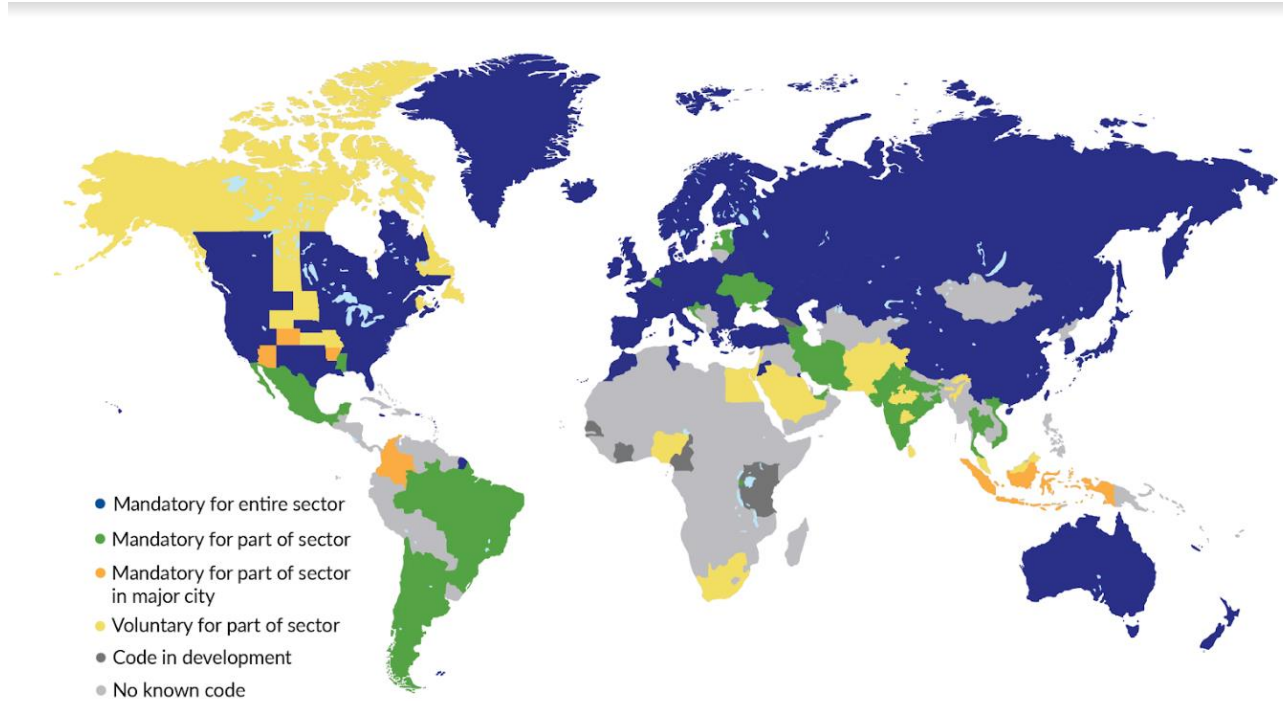
Trainers: Ian Hamilton, UCL Energy Institute

Purpose: To teach the fundamentals of building energy codes and standards. This course will include discussions of regulation types (e.g. mandatory, voluntary and stretch codes) and compliance paths (e.g. prescriptive, performance and outcome-based).

Scenario: A respected industry association claims that the building energy codes are out of date.

Discussion question: How do you advance building energy codes in your jurisdiction?

Why codes?



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

Building energy code types

Code type

- Prescriptive
- Simple trade-off
- Performance
- Outcome-based

Document type

- Model code
- Stretch code



Building energy code types

1. **Prescriptive codes:**

- Specify requirements for key elements such as wall and ceiling insulation, window and doors, roofs, foundations, heating, ventilation air-conditioning, equipment efficiency, water heating, lighting fixtures, and controls.
- Compliance with these codes is commonly assessed by checking the list of prescribed requirements.

2. **Simple trade-off codes:**

- Allow for trade-offs between similar building components. For example, less efficient insulation for more efficient windows in the building envelope.

3. **Performance codes:**

- Specify a minimum required level of energy consumption or intensity for the whole building. They require energy modelling to be conducted at design stage.
- Compliance is commonly checked by comparing the modelled energy performance of the design with a reference building of the same type.

4. **Outcome-based codes:**

- Demonstration of performance during the operation of buildings.
- Compliance is typically possible through energy performance certificates or with energy disclosure policies.

Code document type: Model code vs. regulation

- **Model code:** a code document that is designed to be copied and adopted for implementation by multiple jurisdictions.
 - To enable increased consistency across multiple jurisdictions
 - To simplify the code adoption and implementation process
- **Regulation:** a code becomes a regulation when it is legally adopted for implementation by a jurisdiction.
 - A legal regulation that has been notified or adopted by a government
 - Binding requirements that are able to be enforced by the government

Model code examples: United States, Mexico and India

- **International Energy Conservation Code**

- Available for use across multiple countries
- Currently used in Mexico and the United States as a model code

- **ASHRAE (90.1 and 90.2)**

- Available for use across multiple countries
- Commonly used for state and city commercial building codes in the United States

- **Energy Conservation Building Code**

- Developed for local adoption by states in India
- Originally based on ASHRAE 90.1

Code achievement type: Stretch codes vs. base code

- **Stretch code:** a code that has higher energy efficiency requirements than the base code.
 - To allow leading local jurisdictions to adoption higher energy efficiency requirements
 - To enable incentive programs tied to higher efficiency levels
- **Base code:** the minimum code with a set of requirements that are typically directly from the model code.
 - Commonly used by the majority of jurisdictions

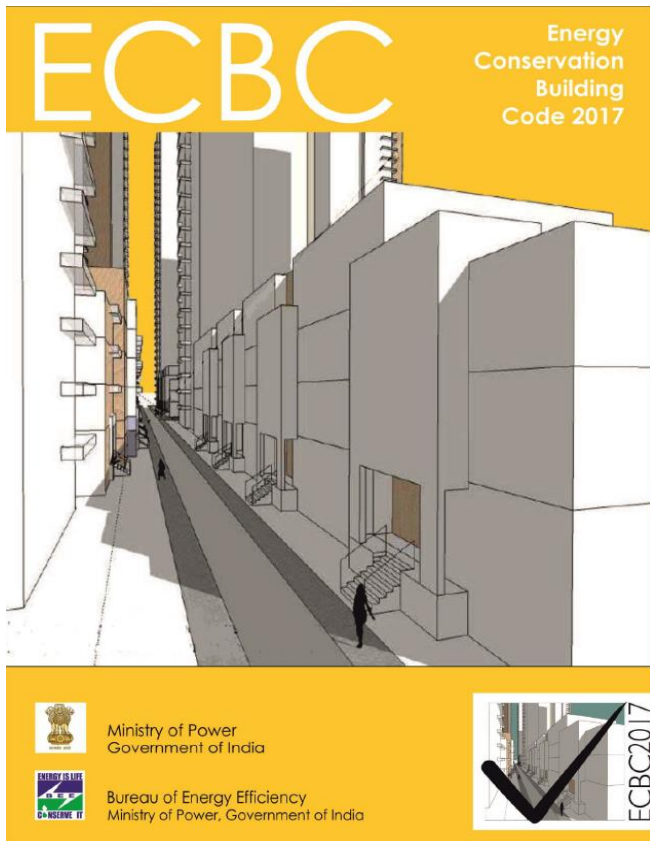
Building code activity in Africa

Group discussion on local examples

Stretch code examples: India

- **India**
 - 2017 Energy Conservation Building Code includes multiple tiers in the code, ranging from the base code and two stretch levels that are more efficient (called ECBC+ and SuperECBC)
 - This is an example of a single code document that can be adopted by local jurisdictions with both base and stretch code requirements available to builders

India's Energy Conservation Building Code 2017



Code update process:

- **Working Groups**

- Market Assessment
- Technical Analysis
- International Best Practice
- Expert Comments

- **Technical Committee**

- Regional and National Workshops
- Public Consultation

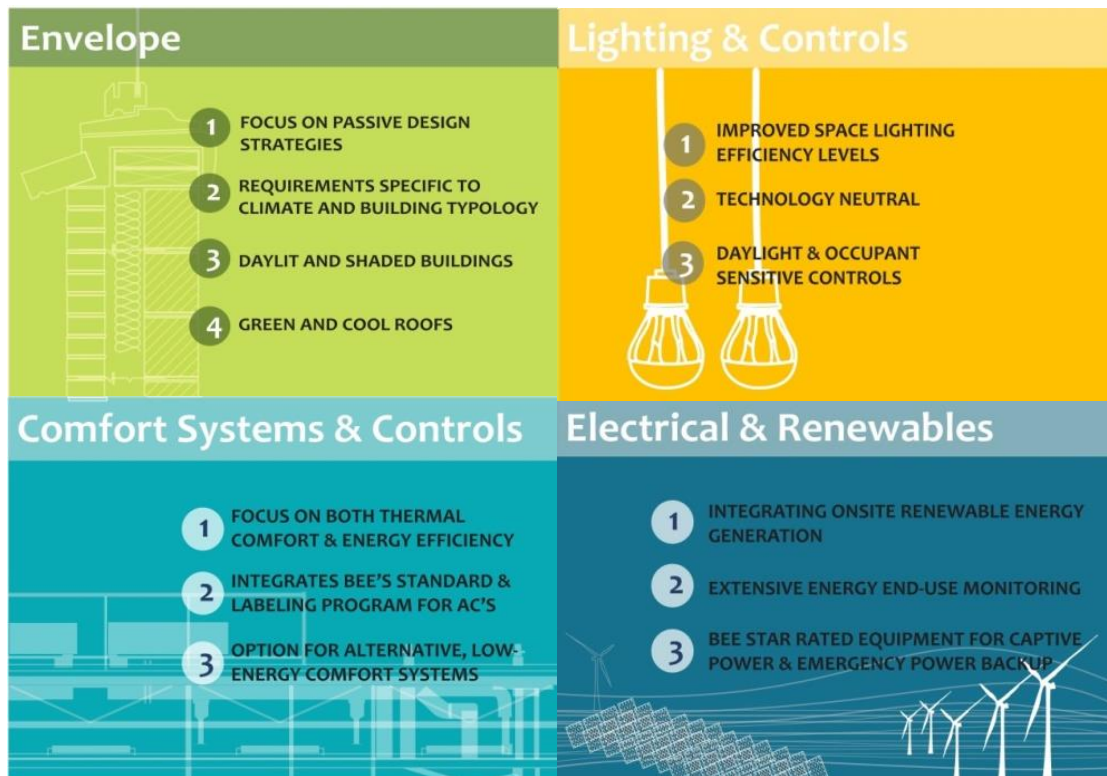
- **Steering Committee**

- Overall Review and Guidance

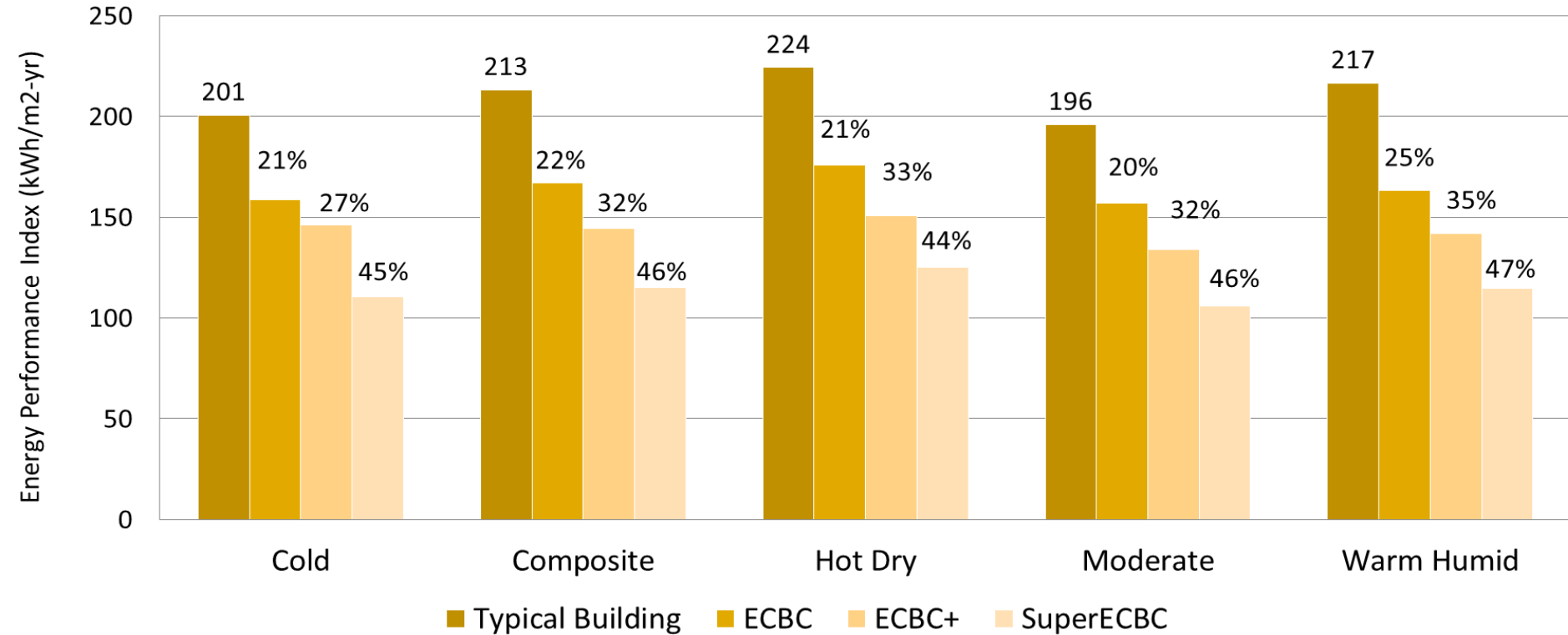


India's Energy Conservation Building Code 2017: Objective

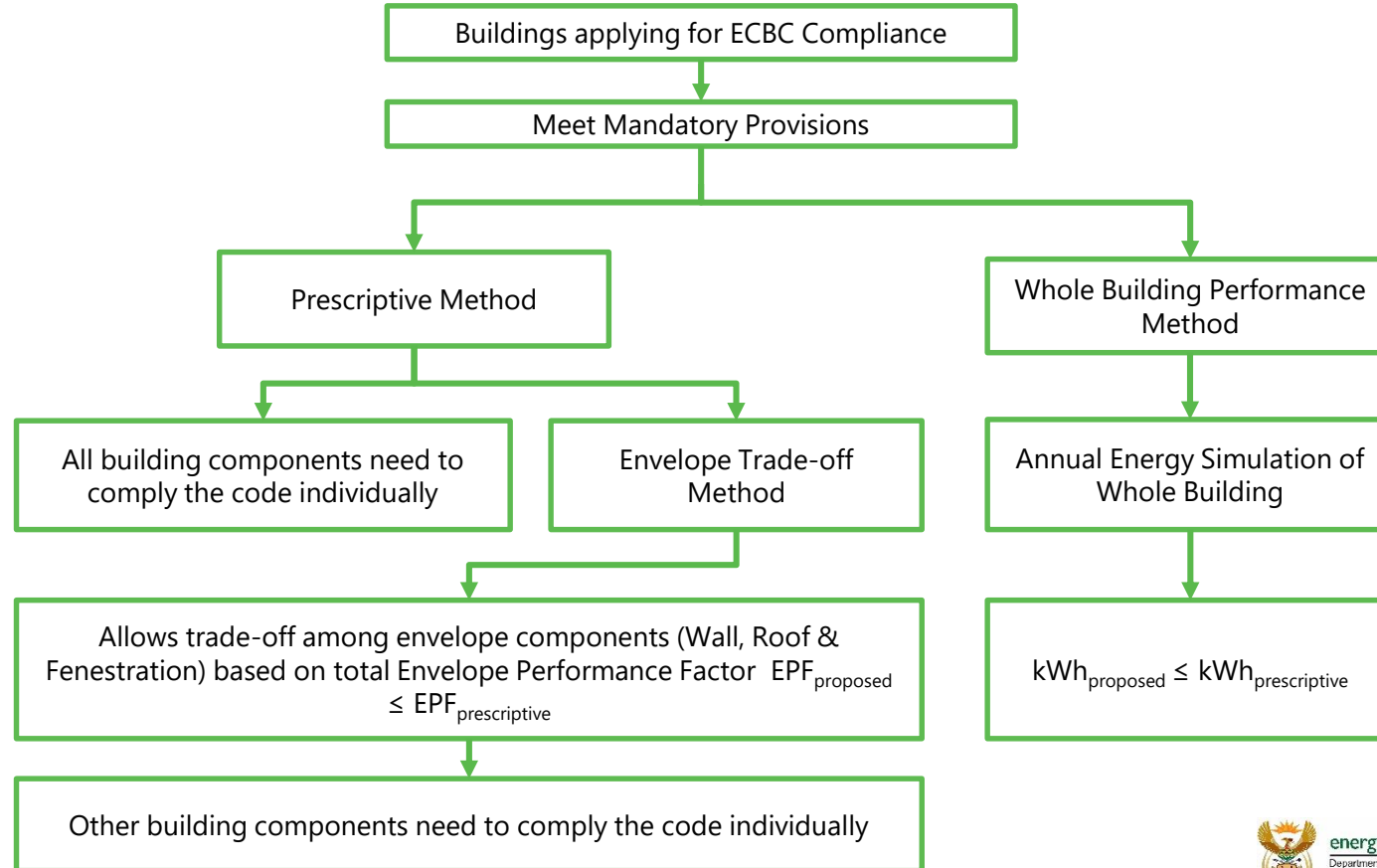
- Systematic implementation and enforcement
- Strong push towards energy efficiency
- Net Zero Energy Building Vision by matching both energy efficiency and renewable energy
- Response to recent technological advancements
- Applicable to various categories of buildings and passive design strategies
- Technology neutral



India's Energy Conservation Building Code 2017: Estimated impact



India's Energy Conservation Building Code 2017: Compliance



India's Energy Conservation Building Code - Residential



ENERGY CONSERVATION BUILDING
CODE FOR RESIDENTIAL BUILDINGS 2018
PART I: BUILDING ENVELOPE



BUREAU OF ENERGY EFFICIENCY (BEE)
(Ministry of Power, Government of India)
Website: www.beeindia.gov.in



ECBC-R development & consultations

- The approach, the development and the code draft has been reviewed by the Steering Committee, the Technical Committee, by a consultation on the web site of India Bureau of Energy Efficiency (BEE) and by consultations in cities like Chennai, Delhi, Calcutta, Mumbai
- All comments have been taken into account and included in the draft code in consultation with BEE
- Final draft submitted to BEE
- Applicable to all residential buildings built on a plot area of $\geq 500 \text{ m}^2$

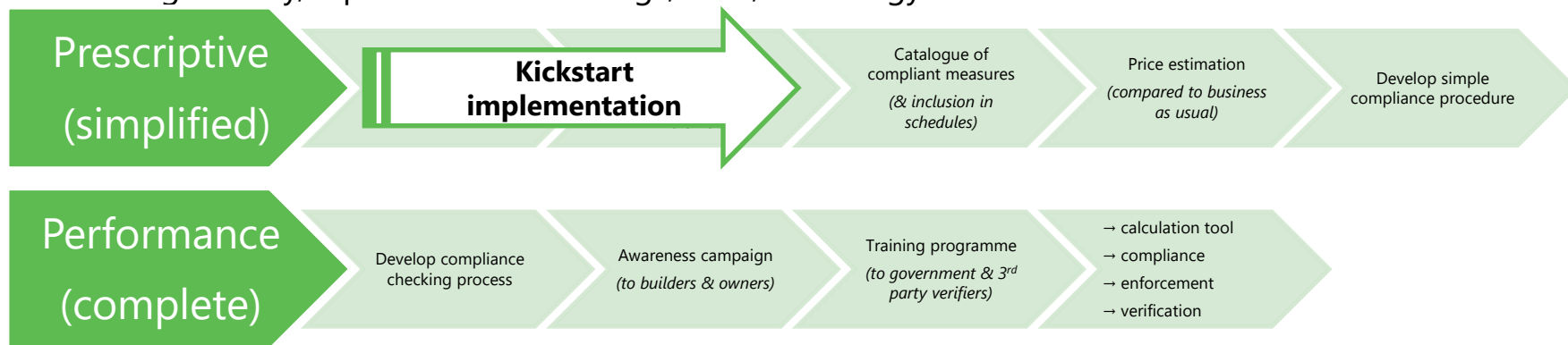


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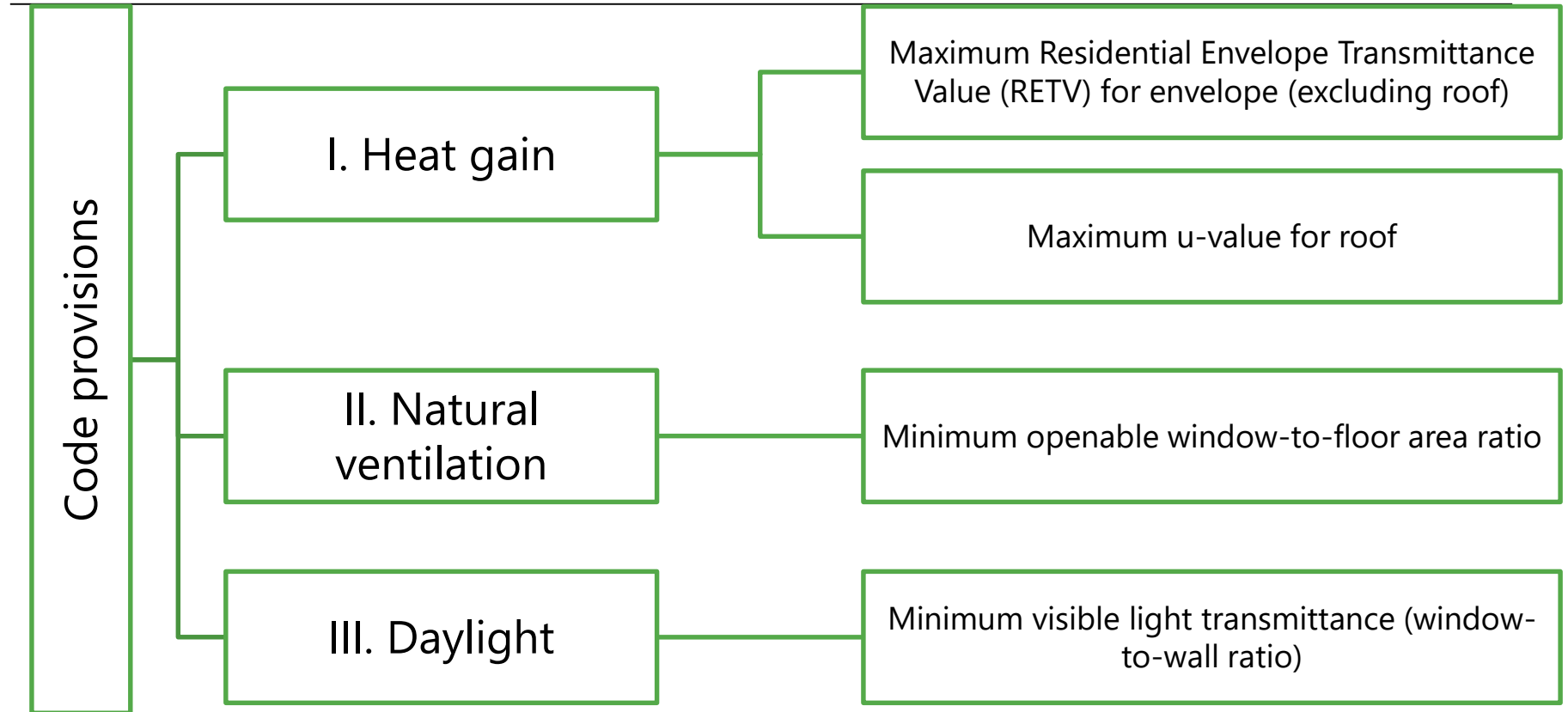
ECBC-R: a simplified two tier process

- Development: Review experience in the region Singapore, Hong Kong, others...
 - Buildings survey, representative buildings, > 20,000 Energy Plus simulations across climates



- Adoption and enforcement: Model bye-laws developed at the national level can be adopted by the states to implement the building code.
 - Rajasthan: www.dnaindia.com/jaipur/report-rajasthan-gets-unified-building-by-laws-2553952
- Review and update: Further improvement could be achieved:
 - 15 W/m² can be lowered to 12 W/m²

ECBC-R: building envelope requirements



Standards

How is a standard different than a code?

Examples



Standards

“What’s the difference between a code and a standard?”

As we saw previously, codes are comprehensive legal documents that enable energy efficiency for buildings as a whole.

Often, building energy codes include requirements from or refer directly to a range of standards, such as specific standards for equipment, products or materials.

Codes and standards process

Set roles with stakeholders

Create a roadmap timeline with targets

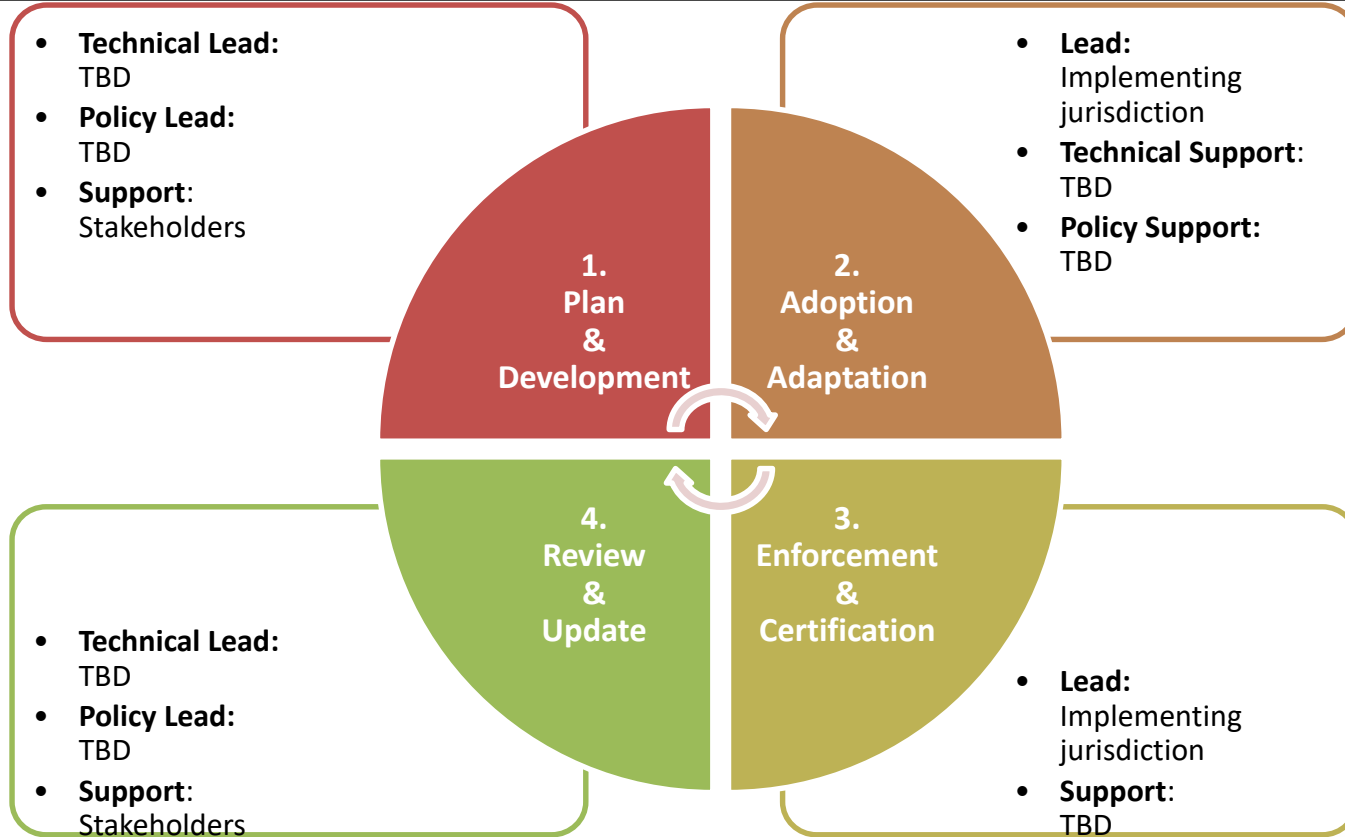
Understand the steps of implementation

Achieve continuous improvement



Building energy codes: 4-step cycle and 4-part governance

ASSESS, DEVELOP & IMPROVE



IMPLEMENT

Building energy codes: implementation

Before issuing construction permit:

- review plans;
- review test reports of construction materials;
- review calculation assumptions;
- review thermal calculation results.

Check
compliance at
the design stage

At the construction stage:

- at least one to two random on-site checks;
- review list of materials substituted in the field;
- review test reports indicating the approval of the changes;
- ensure insulation is well installed.

Check
compliance at
the construction stage

When the building is occupied:

- meter energy consumption at least during the first two years of occupancy;
- adjust heating, cooling, ventilation and lighting systems;
- implement energy management system;
- work with end-users on their behaviour.









Check compliance
when the building
is occupied

Check compliance
prior to the occupancy
of the building

Before issuing occupancy permit:

- conduct blower-door test;
- fix the leaks;
- check each building system;
- conduct comprehensive commissioning.

Who: Stakeholders influence action across building lifecycle

NEW BUILDINGS			EXISTING BUILDINGS				
 Land Use/ Planning	 Design	 Construction	 Sale or Lease	 Tenant Build-Out	 Operations & Maintenance	 Retrofit	 Demolition & Deconstruction
Local governments	Design & construction professionals	Design & construction professionals	Buildings owners and managers	Buildings owners and managers	Buildings owners and managers	Buildings owners and managers	Design & construction professionals
Developers and self-help builders	National and provincial governments	Building investors	Developers and self-help builders	Building occupants	Energy utilities	Building investors	Buildings owners and managers
	Local governments	Suppliers & manufacturers	Building occupants	Design & construction professionals	Building occupants	Building occupants	
						Design & construction professionals	

Stakeholder engagement tools

- **Responsibility matrix:** also known as the RACI (Responsible, Accountable, Consulted, Informed) matrix. This tool can be used with stakeholders to clearly identify which roles are appropriate for each stakeholder throughout the roadmap development and implementation process
- **Gap analysis:** can be used to identify where there is potential for improvement to move from the current situation to the desired market for energy efficiency
- **SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis:** building on the gap analysis, a SWOT analysis can be done in a collaborative setting with stakeholders to better understand what opportunities can drive energy efficiency and what weaknesses can be addressed with further capacity building
- **PIE (Progress, Impact, Effort) multi-matrix:** such as the Building Efficiency Policy Assessment Sheets developed by the Building Efficiency Initiative at Johnson Controls, can be used to enable stakeholder discussion on the current level of progress with a policy, technology or programme approach and then to identify how important the impact can be for each approach and the level of effort needed to make the approach successful. This information can then be used to recommend targets and timelines.

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Scenario:

A respected industry association claims that the building energy codes are out of date.

What stakeholders need to be consulted for improving the building code and what capacities need to be put in place to support that?



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