Pacific Northwest
NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

ECBC Implementation: Progress, Lessons Learned and Tools

MEREDYDD EVANS, SHA YU

Pacific Northwest National Laboratory

Prepared for Webinar “Large-scale Energy Efficiency in Indian Buildings: The Impact and Role of the Energy Conservation Building Code” – December 2, 2014

Outline

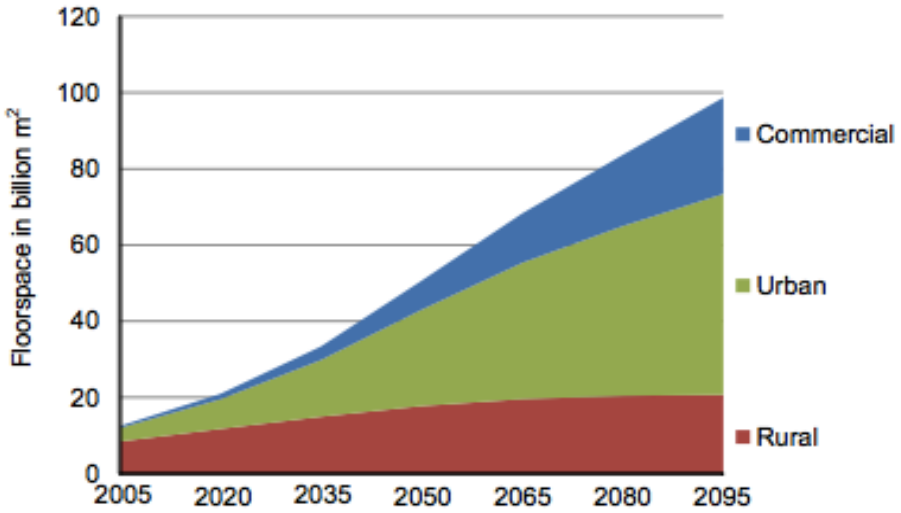
Pacific Northwest
NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

- Introduction
- Implementation progress and lessons learned in Rajasthan
- Tools for implementation
- Takeaways

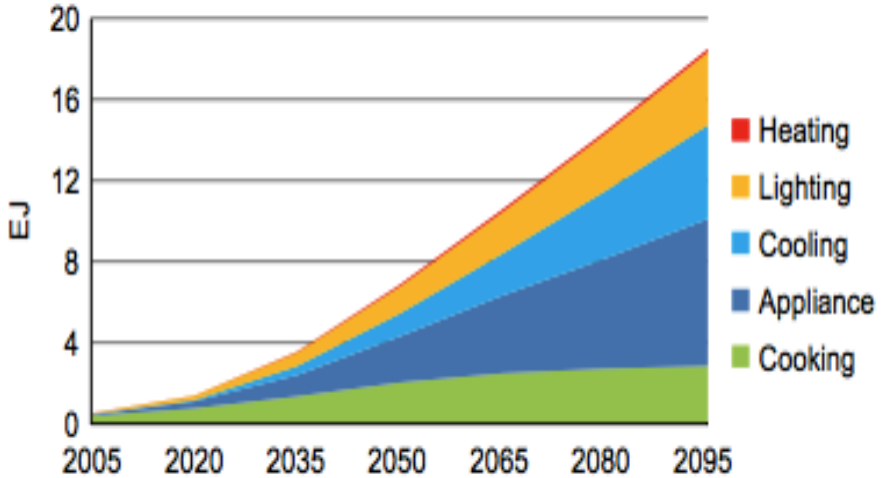
Rapid Growth in Floorspace and Building Energy Use in India

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

Aggregate Floorspace Growth



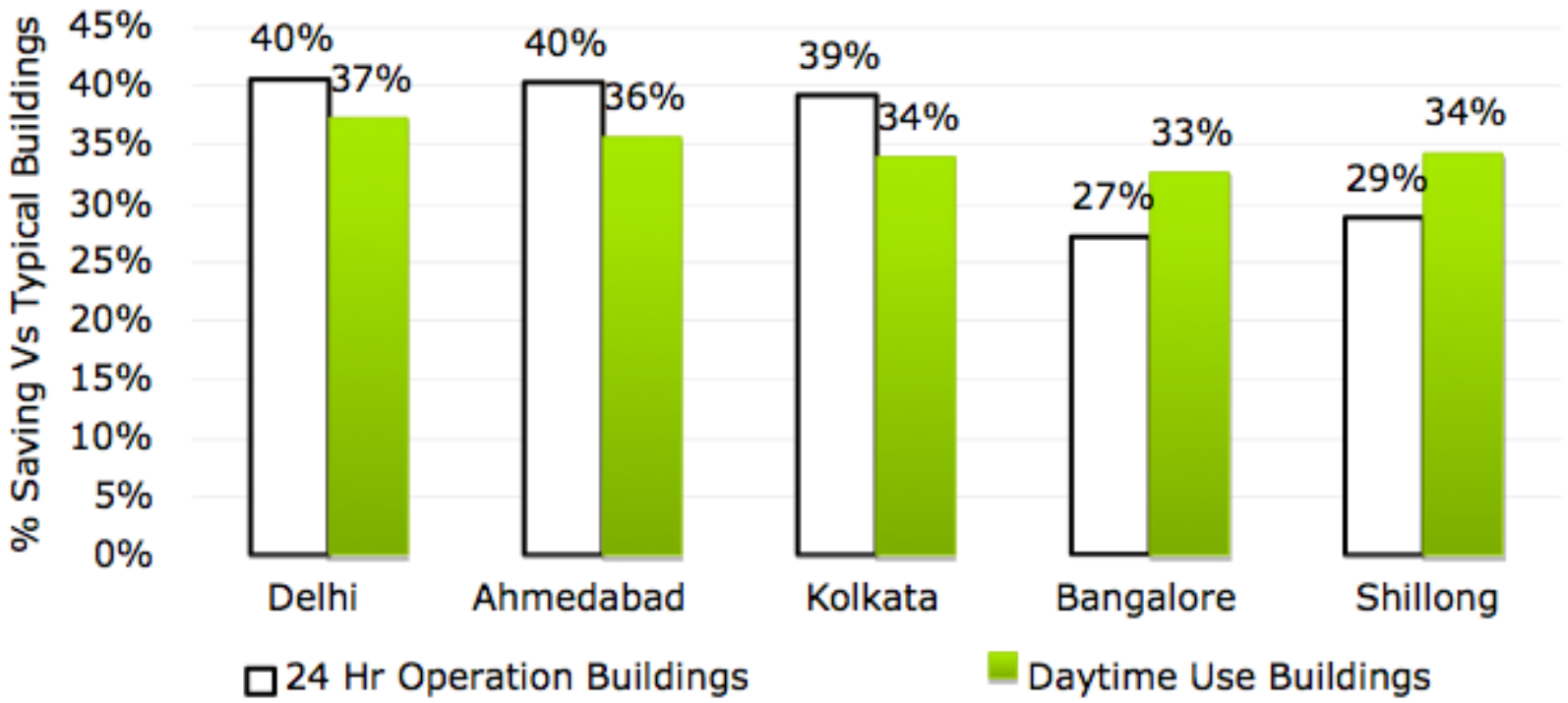
Final Energy Demand Without Codes (Commercial Buildings)



35 billion m^2 of new buildings is expected to be added by 2050. Buildings account for 35% total energy consumption and building energy use is expected to grow 8% annually.

Source: Chaturvedi et al. 2014,
Yu et al. 2014

The Business Case for ECBC



ECBC implementation could save **25-40%** energy!!

Sources: Mathur 2014, Yu et al. 2014.

Benefits of Building Energy Codes

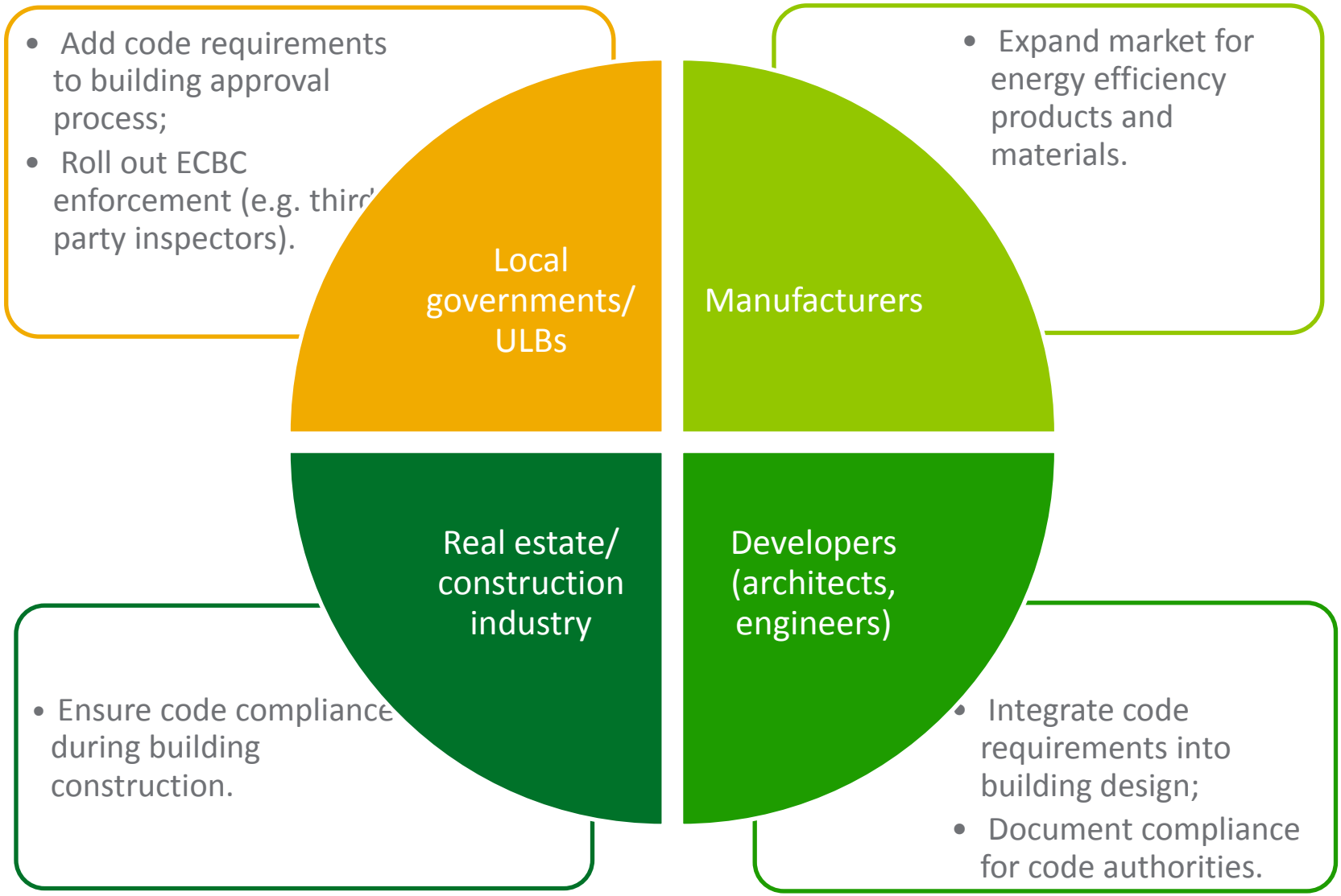
- Reduce energy consumption;
- Reduce CO_2 emissions;
- Lower costs through energy savings;
- Accelerate deployment of energy-efficient technologies.

ECBC Overview

- Issued in 2007 by Ministry of Power and Bureau of Energy Efficiency.
- Mandatory for all new commercial buildings with connected load of over 100 kW or contract demand of over 120 kVA -- unlike voluntary labels (e.g. LEEDS).
- Addresses building envelope, HVAC, lighting, electrical system, hot water and pumping.
- Compliance approaches:
  - Prescriptive;
  - Trade-off option;
  - Whole building performance.

ECBC Implications for Different Stakeholder Groups

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965



Progress: State Adoption Status

State and local governments have the authority to adopt and mandate ECBC.

Status of Activities	States/UTs
Notification Issued	Rajasthan, Odisha, Uttrakhand, Punjab, Karnataka, Andhra Pradesh and UT of Puducherry
Amended ECBC to suit their local and regional climatic condition	Uttar Pradesh, Kerala, Chhattisgarh, Gujarat, Bihar, Tamil Nadu, Haryana, Maharashtra and West Bengal
In process of amendment	Himachal Pradesh, Assam, Tripura, Mizoram, Jharkhand, Goa and Madhya Pradesh

Source: BEE India, November 2014.

ECBC Milestones in Rajasthan

Since 2011, DOE and PNNL have worked with Government of Rajasthan and MNIT to roll out ECBC and build capacity among stakeholders.

Lessons: Barriers for Implementation

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

State and local governments lack capacity and resources to implement and enforce code.

- ULBs (primary enforcement entities) lack technical expertise and manpower to implement ECBC effectively.

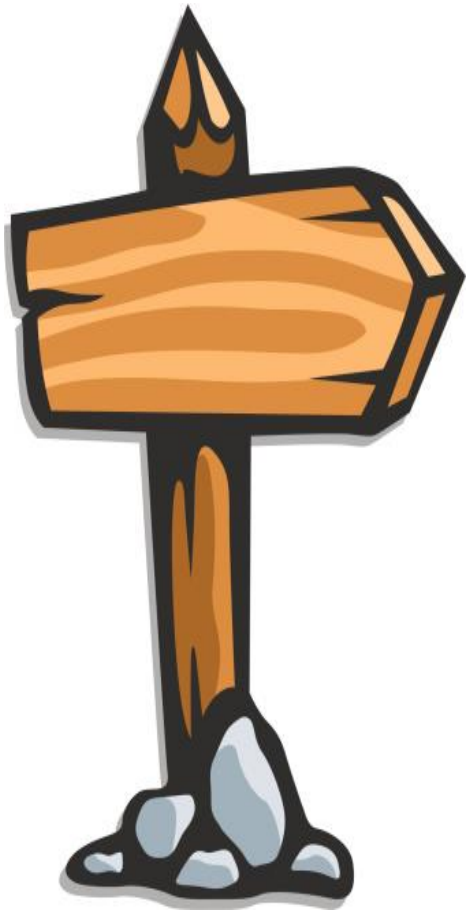
Building professionals lack capabilities/access to energy simulation programs required for whole building compliance path.

Capacity for **testing** building materials and equipment is still limited.

- Could result in overestimation of products/materials' energy performance.

Stakeholders cited lack of code training as most important barrier.

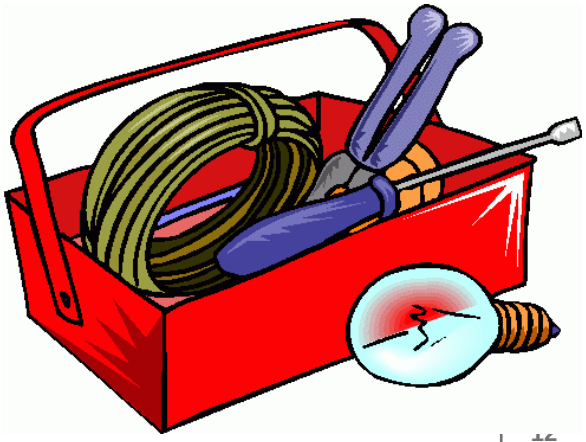
Next Steps to Mainstream Implementation



- Improve capacity through expanded training and use of certified third parties;
- Expand understanding of code benefits and ULBs' willingness to implement;
- Expand India's materials testing and rating capabilities;
- Enhance functionality and usability of compliance software.

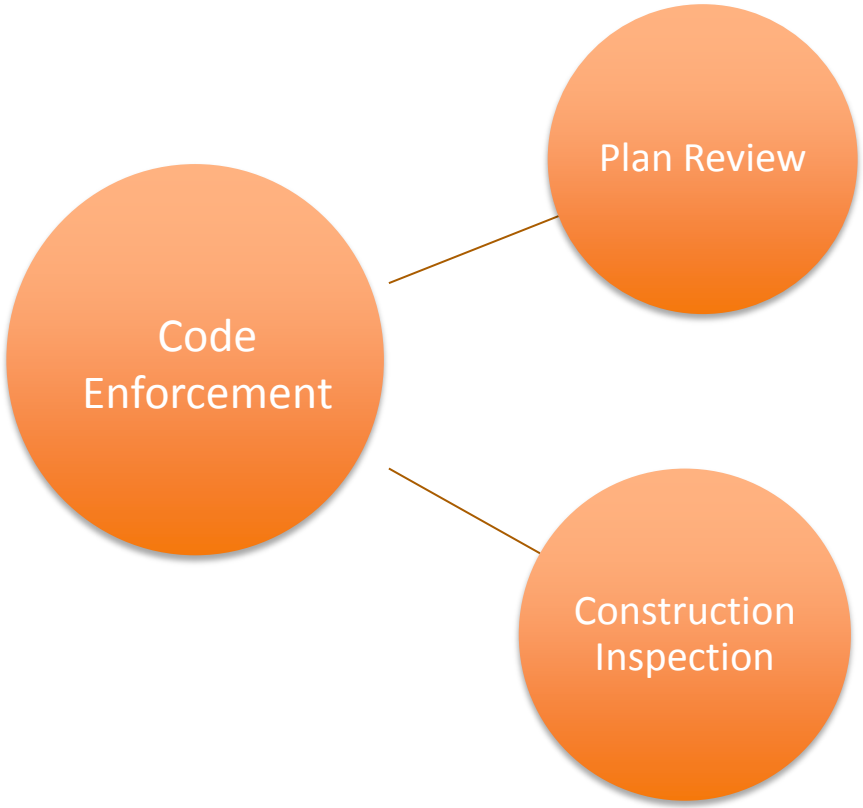
Tools for Mainstreaming Code Implementation

- Third-Party Assessors
- Training and Capacity Building
- Compliance Software



Tools: Options for Third-Party Assessors

- Addresses ULBs' lack of capacity and resources.
- Third parties' involvement in ECBC implementation:



- Review of plans;
- Review of products, materials, and equipment specifications;
- Review of product listings;
- Review of tests and certification reports (if applicable);
- Review of supporting calculations.

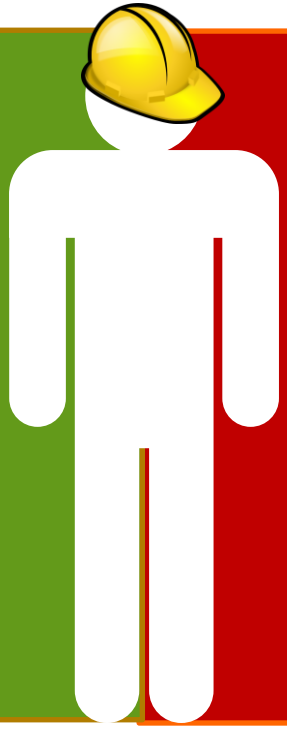
- Inspection of the building and its systems (compared to plans) during construction;
- Evaluation of materials substituted in the field;
- Inspection immediately prior to occupancy.

Tools: Third-Party Assessors

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

Pros

- Alleviate burdens on local and state governments;
- Benefit from third party's technical expertise and resources;
- Reduce permitting application time;
- Provide signal to build market awareness.



Cons

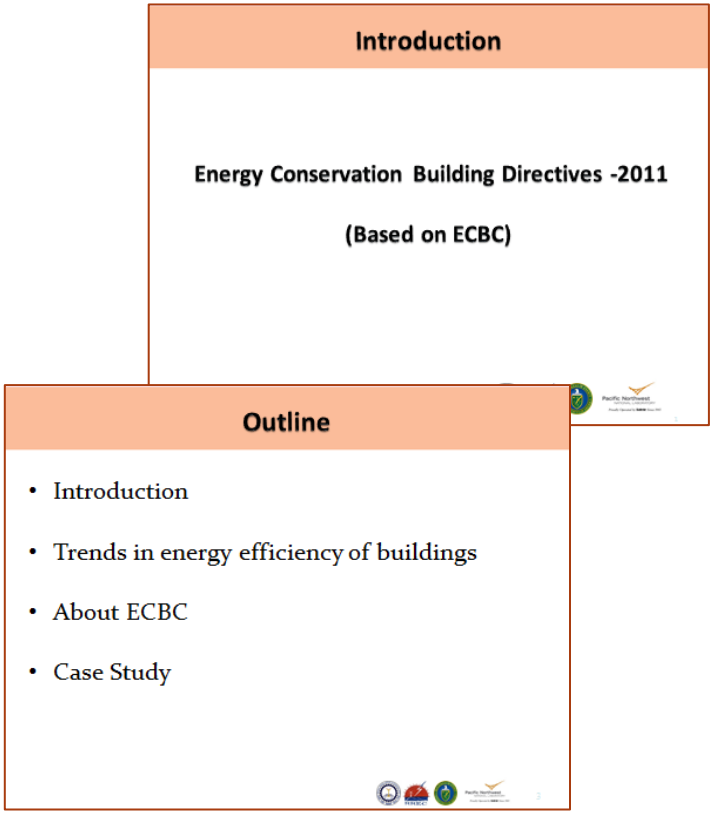
- May increase construction costs by asking developers to hire third-party inspectors;
- Difficult to guarantee a fair process (require checks and balances).

Effective third-party systems:

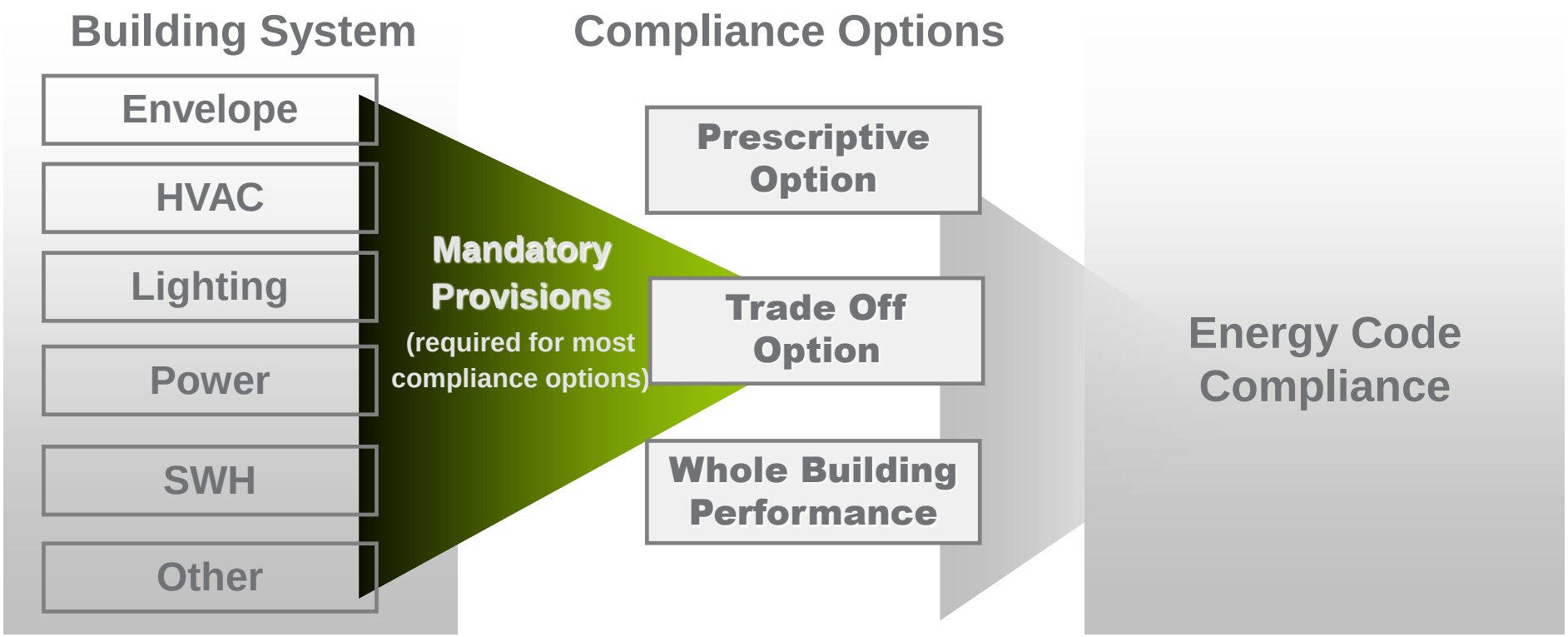
- Have third-parties trained and certified by accredited entities;
- Perform random checks on approved projects;
- Involve penalties (e.g. license revocation) for violation.

Tools: Training

- PNNL and MNIT have developed training materials on ECBC overview, technical requirements and conceptual applications, and compliance checking procedure.
- MNIT has organized several training sessions on ECBC awareness and general specifications. Current training has three major components:
  - Presentation introducing building energy efficiency and ECBC;
  - Discussion sessions on specific questions;
  - Exercise on ECBC specifications and compliance approaches.



Tools: Example of Codes 101 Training



- ✓ Set **minimum energy efficiency standards** for design and construction;
- ✓ Encourage **energy efficient design or retrofit**;
- ✓ Ensure that the building design does not constrain **the building function, comfort, health, or the productivity of the occupants**;
- ✓ Have appropriate regard for **economic considerations**.

Tools: Compliance Software

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

- Facilitates ULBs' compliance checking and streamlines code implementation process.

- ECOnirman Prescriptive:
  - Web-based conformance tool, based on prescriptive and trade-off approaches.
  - Computes compliance results for building components from user inputs.
  - Generates reports to demonstrate ECBC compliance.

- COMcheck and REScheck (U.S.):
  - Based on trade-off and prescriptive compliance approaches.
  - Help determine and demonstrate compliance for commercial and residential buildings.

ECOnirman Prescriptive

REScheck•Web™

COMcheck•Web™

Takeaways

- ECBC has significant impact on building energy savings.
- Rajasthan's code experience can help with the learning process and encourage adoption in other states.
- Implementation strategies must address the lack of capacity and human resources of code authorities and building professionals, as well as streamlining the enforcement process.
- Priorities/Next steps:
  - ULBs: adopt code in building bylaws; build capacity and code awareness; expand training programs.
  - Building professionals: enhance awareness and understanding of code specifications/requirements (also in preparation for certification program).

Resources

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

- Training resources:
  - ECBC User Guide and training modules: http://www.eco3.org/ecbc/
  - Energy codes training in the U.S.: https://www.energycodes.gov/resource-center/training-catalog ; https://www.energycodes.gov/training-courses/building-energy-codes-101 ; https://www.energycodes.gov/resource-center/ace
- Software:
  - ECOnirman Prescriptive: http://www.eco3.org/ECOnirman-Prescriptive/
  - REScheck, COMcheck: http://www.energycodes.gov/software-and-web-tools
- Technical documents:
  - BEE India's ECBC schemes: http://beeindia.in/schemes/schemes.php?id=3
  - Rajasthan Energy Conservation Building Directives: http://www.rrecl.com/PDf/ECB%20Directives%202011.pdf
  - GBPN report on "Residential Buildings in India: Energy Use Projections and Savings Potentials": http://www.gbpn.org/newsroom/report-residential-buildings-india-energy-use-projections-and-savings-potentials