IPEEC Building Energy Efficiency Taskgroup

- **International Partnership for Energy Efficiency Cooperation (IPEEC):** International forum dedicated to accelerating the adoption of energy efficiency policies and practices.

- **Building Energy Efficiency Taskgroup (BEET):** Governments work collaboratively to research and support the development of effective building efficiency policies.


Argentina


Australia


Brazil


Canada


China


EU

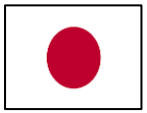

France


Germany


India

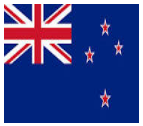

Indonesia


Italy


Japan


Korea


Mexico


New Zealand


Russia


Saudi Arabia


Singapore


S Africa


Spain


Turkey


US


UK

Building Energy Code Project (BEET3)

- Project Partners

International Partnership for Energy Efficiency Cooperation

GBPN Global Buildings Performance Network

Pacific Northwest NATIONAL LABORATORY

- Project Focus
  - Identify key areas for international collaboration on building energy code implementation -- how to realize greater energy savings from codes.
  - Share building energy code approaches and experiences.

- Building Energy Codes Portal
  - www.gbpn.org/laboratory/building-energy-codes-portal

Pacific Northwest
NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

BEET 3 – Delivering Energy Savings in Buildings

Lessons Learned from Code Implementation and Compliance

MEREDYDD EVANS

Pacific Northwest National Laboratory (PNNL)

Webinar #2 – November 12, 2015

Outline

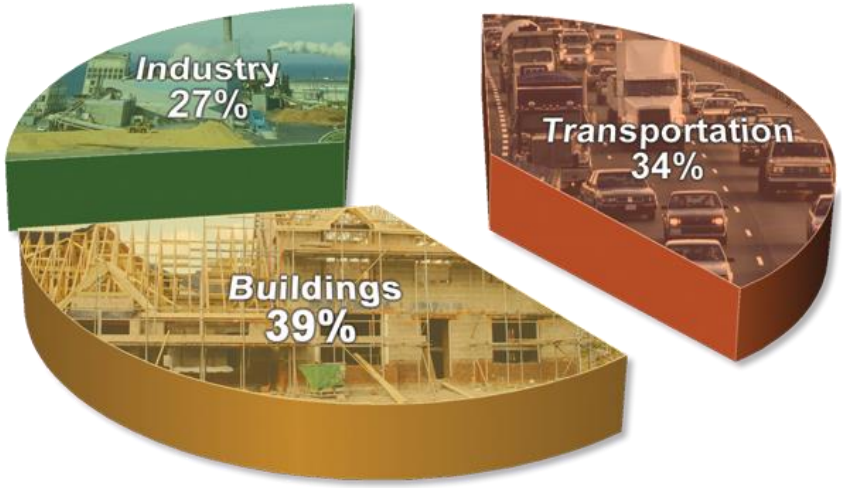
Pacific Northwest
NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

- Why is Implementation of Building Energy Codes (BEC) Important?
- Common Elements of Implementation Systems and Options for Implementation
- Compliance Evaluation
- Challenges and Opportunities for International Collaboration
- Conclusions

Why is Implementation of BEC Important?

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

- Buildings account for over one-third of global energy consumption, and this number is growing with income.
- For example, in the U.S., buildings account for nearly 40% of energy use.



- Code benefits
  - Reduced energy consumption
  - Improved economic performance
  - Reduced CO_2 emissions and other pollutants
  - Improved energy security
- But! Implementation is critical to achieving actual savings.

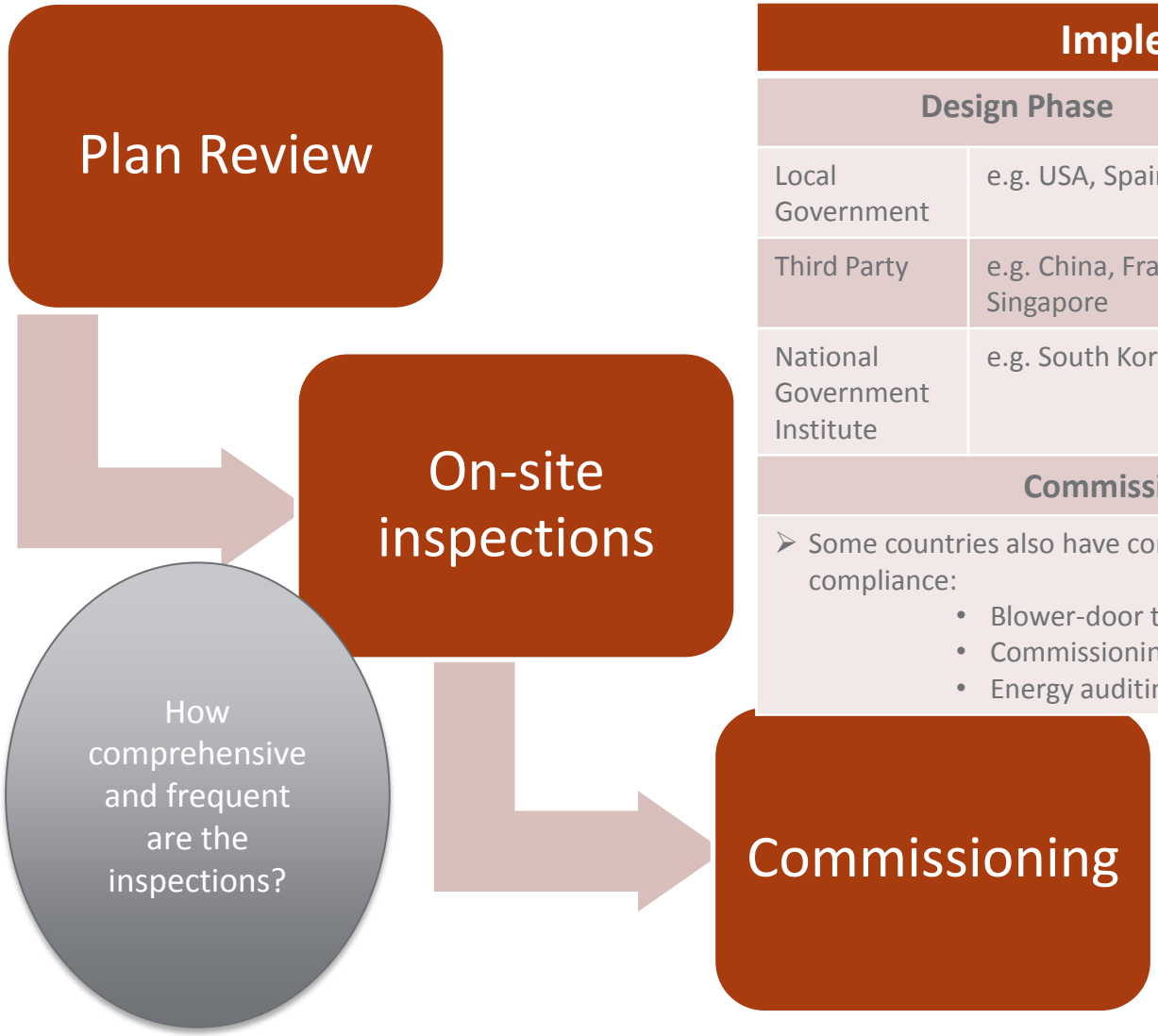
Sources:
http://www.gbpn.org/laboratory/building-energy-codes-portal;
www.energycodes.gov

Common Elements of Implementation Systems

1. Capacity Building and Education
2. Compliance Checking Systems: Design, Construction and Commissioning (Note: many jurisdictions only check building design, but growing understanding of need for more extensive, yet cost-effective checks to produce energy efficient buildings)
3. Compliance Checking Tools: Mainstreaming Compliance
   - Compliance-checking software, clear rules for simulation-based compliance
   - User guides
4. Building Material Testing and Labelling
   - Test protocols: tailor to local conditions (e.g. India)
   - Independent labs
   - Clear labels to make compliance easier
5. Evaluation of the Overall Process

Implementation Process: Options and Roles

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965



Implementation Roles			
Design Phase		**Construction Phase**	
Local Government	e.g. USA, Spain, NZ	Local Government	e.g. USA, Australia, Canada, Spain
Third Party	e.g. China, France, Singapore	Third Party	e.g.China, France, Germany, Italy
National Government Institute	e.g. South Korea	None	e.g. Russia, Indonesia

Commissioning/End-of-pipe tests

- Some countries also have commissioning requirements to ensure compliance:
  - Blower-door tests (U.S. for commercial buildings; France)
  - Commissioning of HVAC equipment
  - Energy auditing requirements (Korea)

Key Energy Efficiency Properties: Options for Checking

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

- Properties:
  - U-value tests (thermal loss):

    Review of building design and actual construction, material labels, infrared camera (no examples to date)
  - Air leakage:

    Review of building design and actual construction, blower door test
  - Solar heat gain:

    Review of building design and actual construction, material labels, flame test on window to check for film (no examples to date)
  - Equipment efficiency:

    Review of building design and actual construction, equipment labels, commissioning
- Role of checks:
  - Design review ensures the proposed design meets code requirements
  - Construction review matches building materials and labels with the proposed design, and checks installation
  - Commissioning, other end-of-pipe tests check for proper installation

Compliance Evaluation Systems

- Compliance assessment (rate and effectiveness):
  - Focused on the results at the system level, not in individual buildings, so requires more statistical approach
  - Useful for learning and improving both implementation and the code itself
  - Not many countries have compliance assessment, and when they do, it may not be publicly available
- Methodological issues: how to accurately represent the compliance rate? How to sample buildings? Weight measures based on importance for energy?
- Measuring performance against code-compliant design: option for taking evaluation one step further

Challenges and International Collaboration Opportunities

- Implementation Challenges:
  - Gap between policy goals at the national level and resources available at the local level.
  - Capacity, particularly at local level, given competing inspection needs
  - Coordination among all stakeholders
  - Potential conflicts of interests when third parties conduct review and inspections
- International Collaboration Opportunities:
  - Develop and exchange evidence-based information on:
    - The effectiveness of different approaches to enforcement
    - Measuring performance again code-required design
    - Design of code compliance software and tools
    - Innovative ways to incentivize private sector initiatives on code compliance

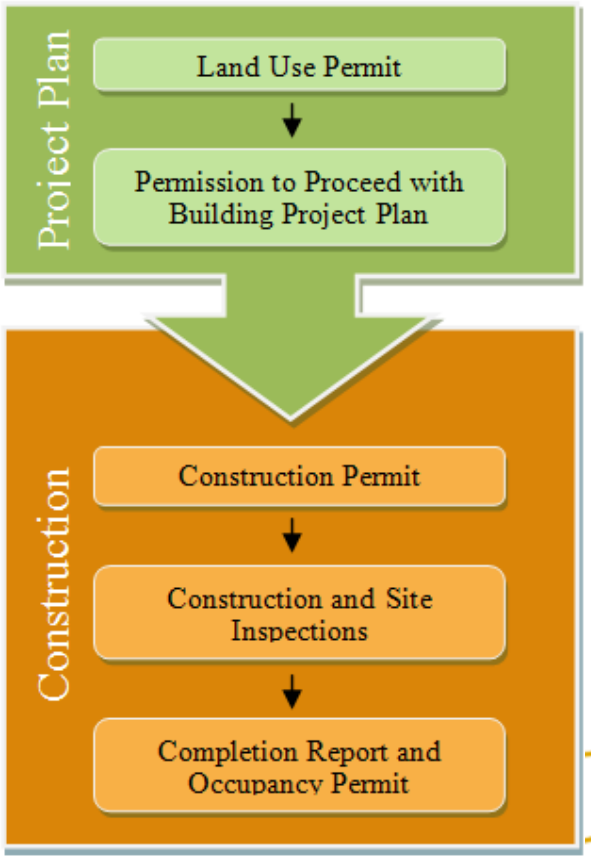
Conclusions

- Countries increasingly recognize the need to strengthen implementation to achieve goals
- Codes have become more stringent and complex over time, which can make implementation more difficult
- Most jurisdictions require the review of building designs for compliance with the building energy code; some also inspect buildings to ensure code compliance
- Some countries have local building code officials conduct the reviews and inspections while others may rely primarily on certified third-party reviewers and inspectors.

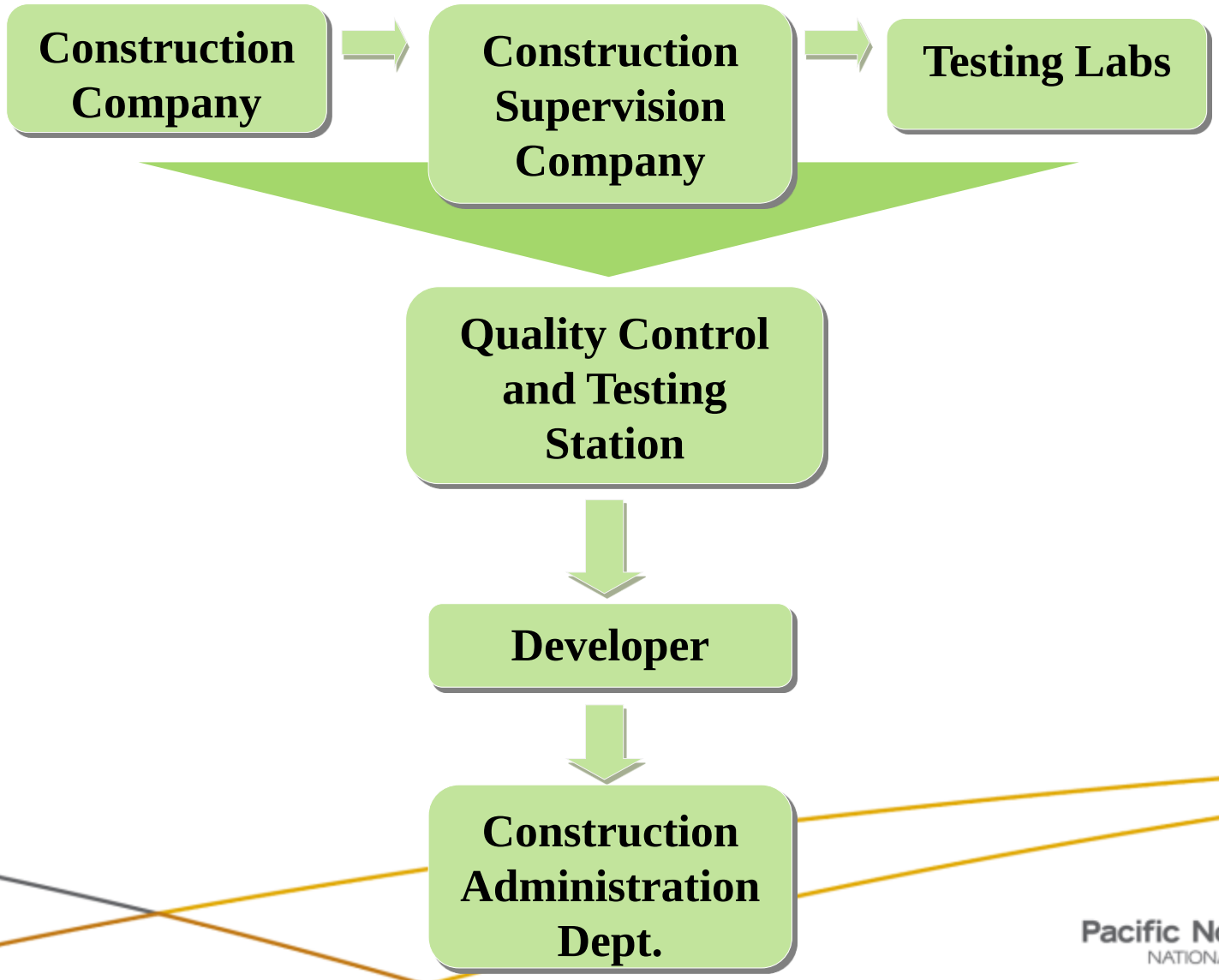
- Discussion questions: How countries can learn from each other? What kinds of materials and information would be most useful for people to learn from?

Case Study: Enforcement System in China

- Key code enforcement steps in Chinese building construction



Construction site inspection roles in China



China's Acceptance Code

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

1-3	General Provisions, Terms and Basic Requirements
4-13	Energy Efficiency Checks/Specifications of 10 Items (e.g., Roofing)
14	Site Inspection of Energy Efficiency Work
15	Quality Acceptance of Divisional Work of Building Energy Efficiency

Appendices A-C

Appendix A Reinspection Items of Materials & Equipments on Construction Site of Building Energy Efficiency Work

Appendix B Forms for Quality Acceptance of Building Energy Efficient Divisional, Sub-divisional Works & Inspection Lots

Appendix C Inspection of Energy Efficiency of External Wall with Core

Explanation of Wording in the Code

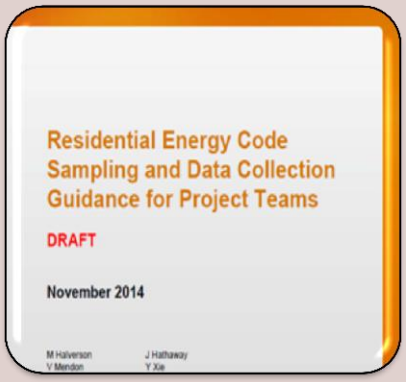
Case Study: Enforcement in U.S.

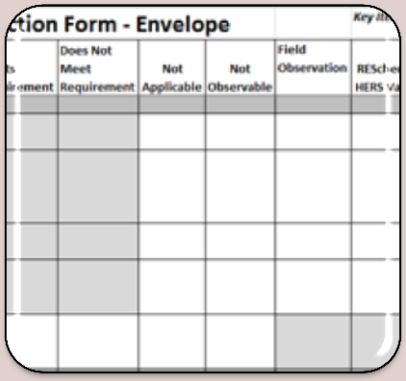
- Varies by jurisdiction, but generally, local government officials play key role
- Review of plans, covering all issues including energy
  - REScheck and COMcheck software help mainstream compliance
- Typically 2 or more site inspections during construction
  - Time available to check for energy issues is limited
  - Larger jurisdictions may employ specialized staff for HVAC and other energy inspections; some jurisdictions use 3rd parties (ex. HERS raters)
- Increasing number of “end-of-pipe” test requirements, including blower door tests in commercial buildings, commissioning of certain systems

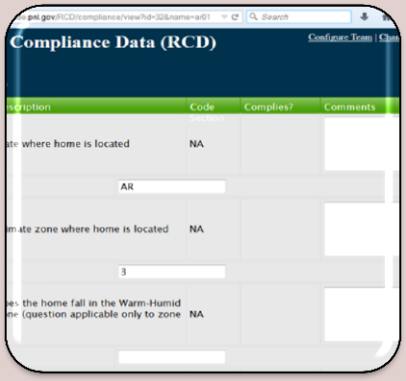
U.S. Compliance Assessment: Residential Field Study Methodology:

Pacific Northwest NATIONAL LABORATORY

Proudly Operated by Battelle Since 1965







8-step guidance document

State sampling plans

State-specific data collection tools

Online data tool and database

http://www.energycodes.gov/residential-energy-code-field-study

Discussion Questions

- How can we best improve compliance given existing resources at the local level?
- What can evaluation teach us, and can the answers be useful internationally? Can linking compliance with studies of measured performance provide insights to improve compliance?
- How can we most effectively improve capacity? Can trained third parties help, and if so how?