

Implementing Building Energy Efficiency Codes: Global Experiences

Anke Sofia Meyer

Senior Consultant, ESMAP, The World Bank

International Workshop

Mainstreaming Building Energy Efficiency Codes in Developing Countries

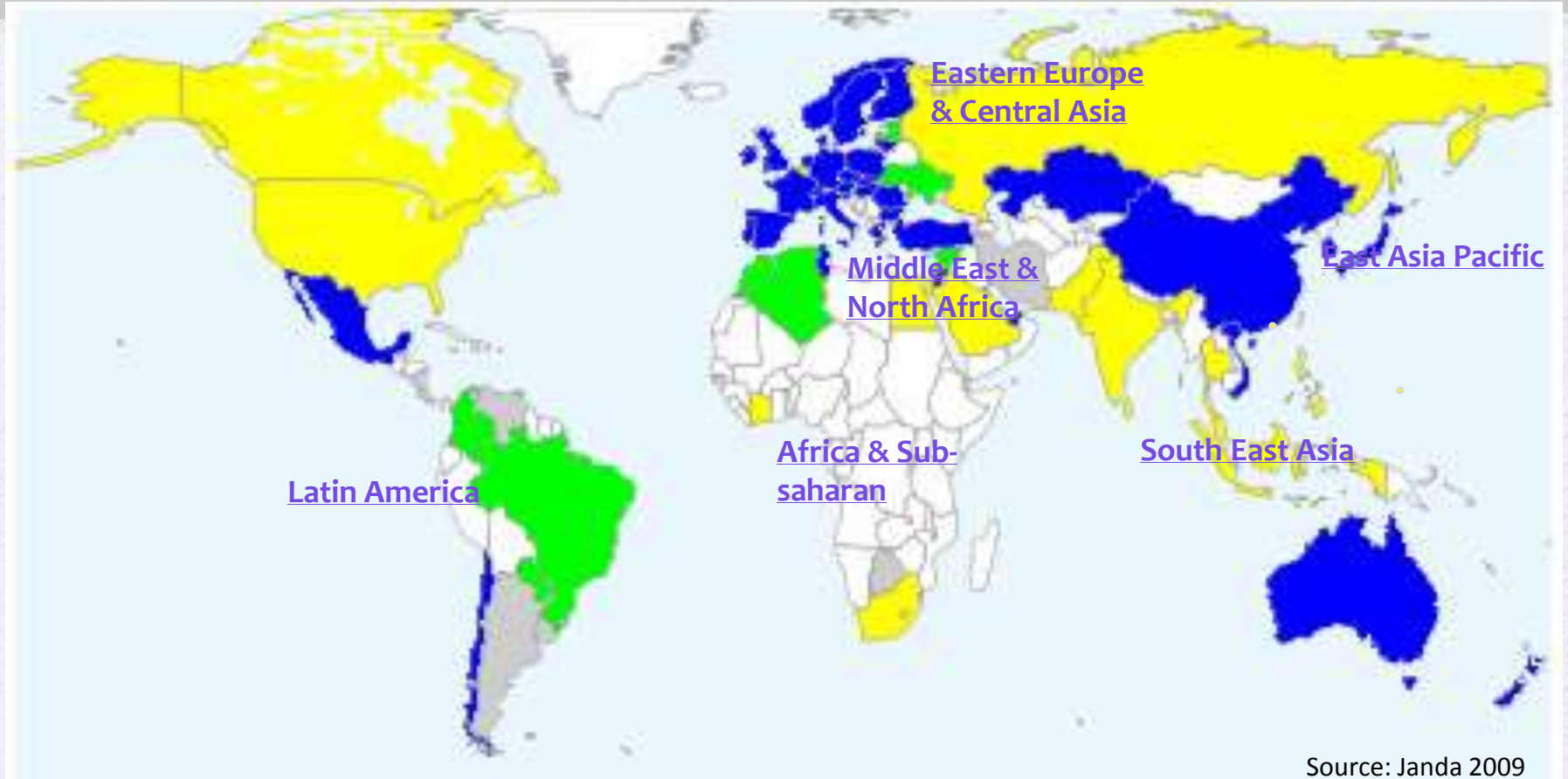
November 19/20, 2009

The World Bank, Washington DC

Status

- Many countries have adopted codes requiring the implementation of building energy efficiency (BEE) measures; their number is growing
- Industrialized countries: Basically all countries in North-America, Europe and the Pacific region have BEECs that are usually mandatory and apply to new residential and non-residential (public, commercial) buildings as well as extensions/renovations
- Developing countries: Many countries adopted BEECs, in most of them they are not mandatory, and actual implementation is almost non-existent

Status of BEECs in 81 countries, 2009



- Mandatory
- Mixed and/or Voluntary
- Proposed
- No Standards

Regional Status of BEECs

	Urban population Million (share of total)	BEEC development/implementation	Energy demand characteristics
Africa, sub-saharan	2005: 269 (35) 2030: 630 (48)	Voluntary BEECs have been developed in a few countries (S. Africa, Ivory Coast), but implementation is very limited.	Mostly cooling demand
North Africa	2005: 95 (50) 2030: 165 (61)	BEECs have been developed in several countries (Morocco, Algeria, Tunisia, Egypt, Jordan, Lebanon, Israel), but they are mostly voluntary and implementation is very limited. Exceptions: Kuwait and UAE	Cooling demand
Western Asia	2005: 138 (65) 2030: 226 (72)		
Eastern Europe	2005: 203 (68) 2030: 189 (73)	EU countries: required to follow EPBD and implement BEECs Other countries: many have developed BEECs (Russia, Turkey, Armenia,...), but compliance is limited	Heating and in some countries also cooling demand, mostly in existing buildings
Latin America/ Caribbean	2005: 433 (78) 2030: 603 (85)	BEECs developed and mandatory in several countries (Mexico, Chile, Jamaica), but not applied Many countries have AC standards (Mexico, Brazil, Chile, ...)	Mostly cooling demand
East Asia	2005: 677 (45) 2030: 1038 (62)	Longest and most extensive experience with BEECs, some countries (China, S. Korea, Taiwan (China), Singapore) have enforced to some extent, others have developed BEECs, but they are either not mandatory or problems with implementation exist (Thailand, ...)	Mostly cooling demand, in China and S. Korea also heating demand
South Eastern Asia	2005: 246 (44) 2030: 439 (62)	Voluntary BEECs have been developed in a few countries (Pakistan, India), but implementation is very limited	Mostly cooling demand
South Central Asia	2005: 504 (31) 2030: 966 (43)		

Source: Meyer 2009; regional definitions and urban data from United Nations Secretariat, *World Population Prospects: The 2006 Revision and World Urbanization Prospects: The 2007 Revision*

History of BEECs

- Many countries started with code development in the 1970s: Denmark 1972, USA 1975, Germany 1976, South Korea 1977, Japan 1979, ...
- Initially BEECs were prescriptive, but soon included additional performance compliance options – this satisfies the needs of different users and gives designers and building owners choices
- Initially, code updates were rare; more recently, many countries require revisions and updates every 3-5 years

Implementation of BEECs is far from perfect

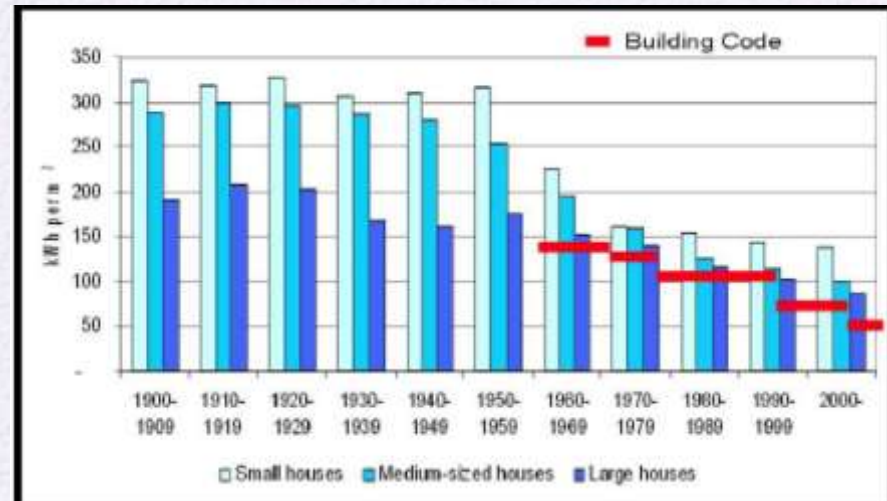
	BEEC Compliance
Japan	Less than 1/3 of new residential buildings and ¾ of new commercial buildings in 2004
England/Wales	57% of new houses (2004 study)
Germany	60% of single family homes receiving EE subsidies
USA	Range from below 50 to almost 100% in US states New York: only 43% of self-certified building plans complied with building code (incl. with BEEC) Washington State: ~95%
Canada – Vancouver	Over 80%
China	About 80% construction compliance in 30 or so largest cities, but believed to be much lower in medium and small cities
Source: Based on Meyer 2009	

But Progress Can Be Observed

New buildings today consume much less energy than older buildings – in EU and USA about 60% less than buildings from before the mid 1970s energy crisis

Example Denmark

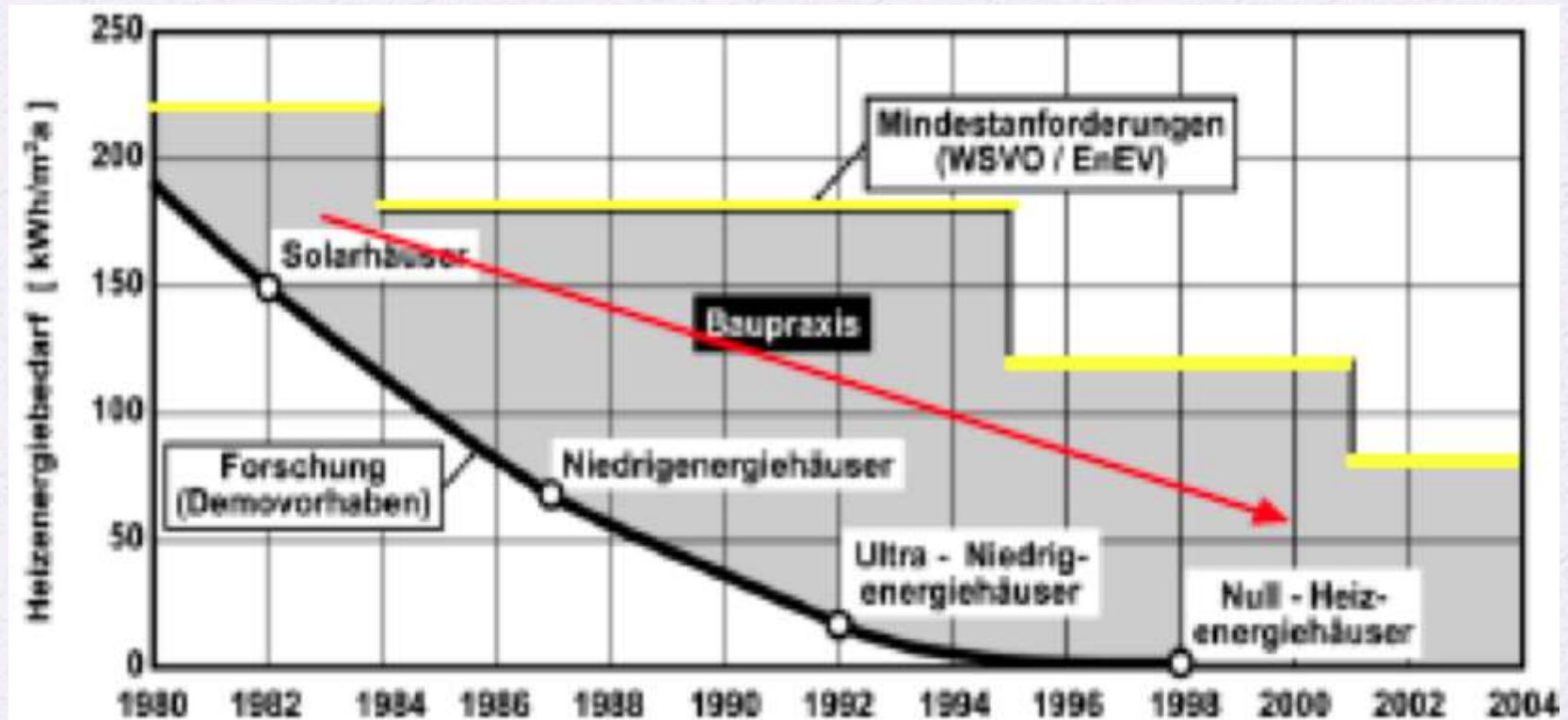
Actual energy consumption in single family houses in Denmark, relative to energy efficiency requirements in building codes (Source: Laustsen 2008)



Towards Zero Energy Consumption

- (Net) zero energy goals for new buildings in many countries (states):
 - UK: zero carbon homes by 2016
 - California: net zero residential (commercial) buildings by 2020 (2030)
- Result of adopting strict climate change policies, decades of experience with BEECs, ongoing R&D of improved technologies, and introduction of voluntary labels and standards such as low- or green-energy buildings

RD&D of ultra-low-energy buildings and its impact on building codes and building practice in Germany (in Meyer 2009)



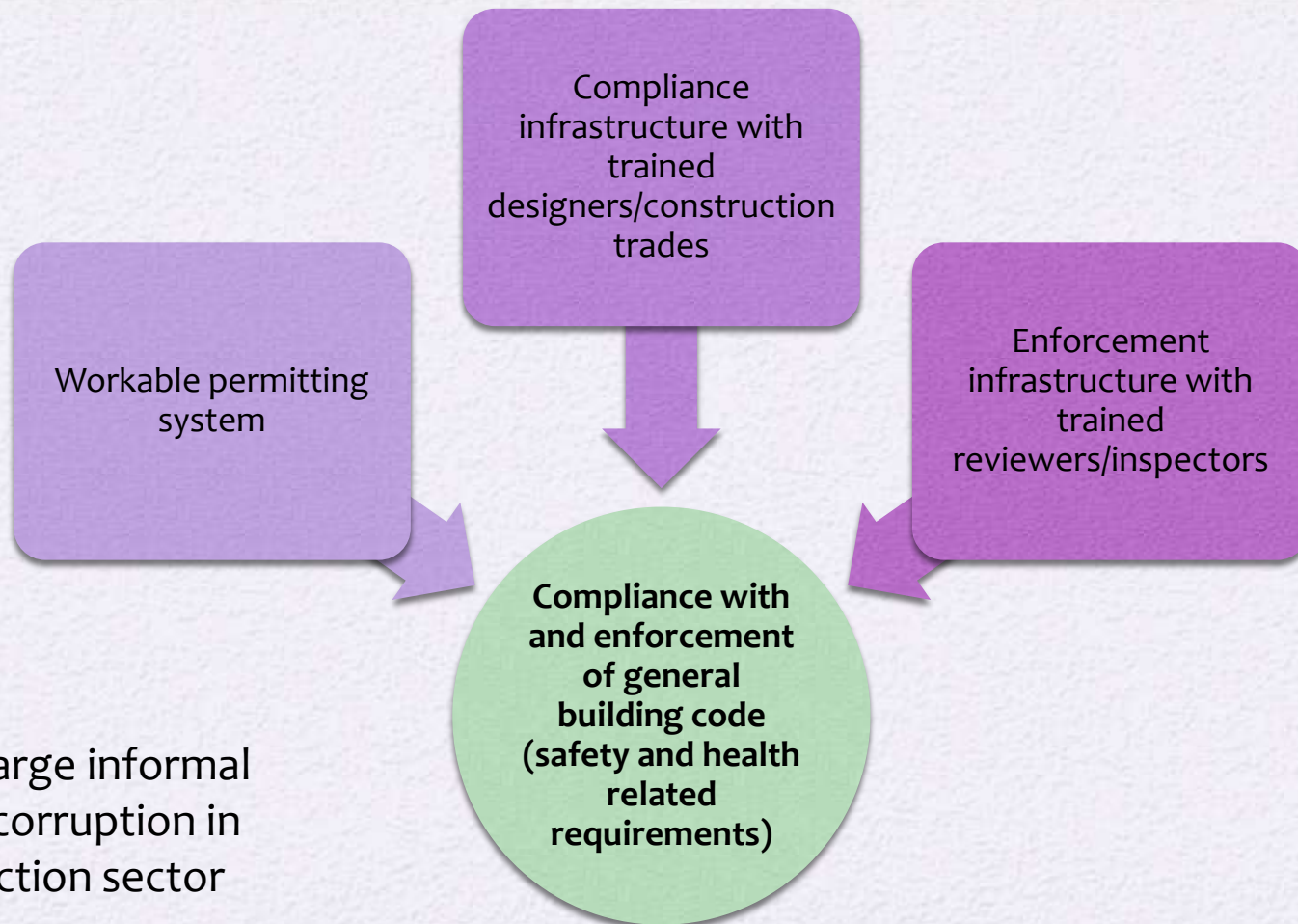
Major Issues in BEEC Compliance

- 1) What is needed to
 - move from code development to implementation?
 - achieve good/improve compliance with BEECs?
- 2) Institutional models for enforcement of BEECs
- 3) Financing of measures to improve compliance and enforcement
- 4) Role of voluntary/green rating schemes
- 5) M&V: BEEC compliance and actual energy performance of buildings

Major issues

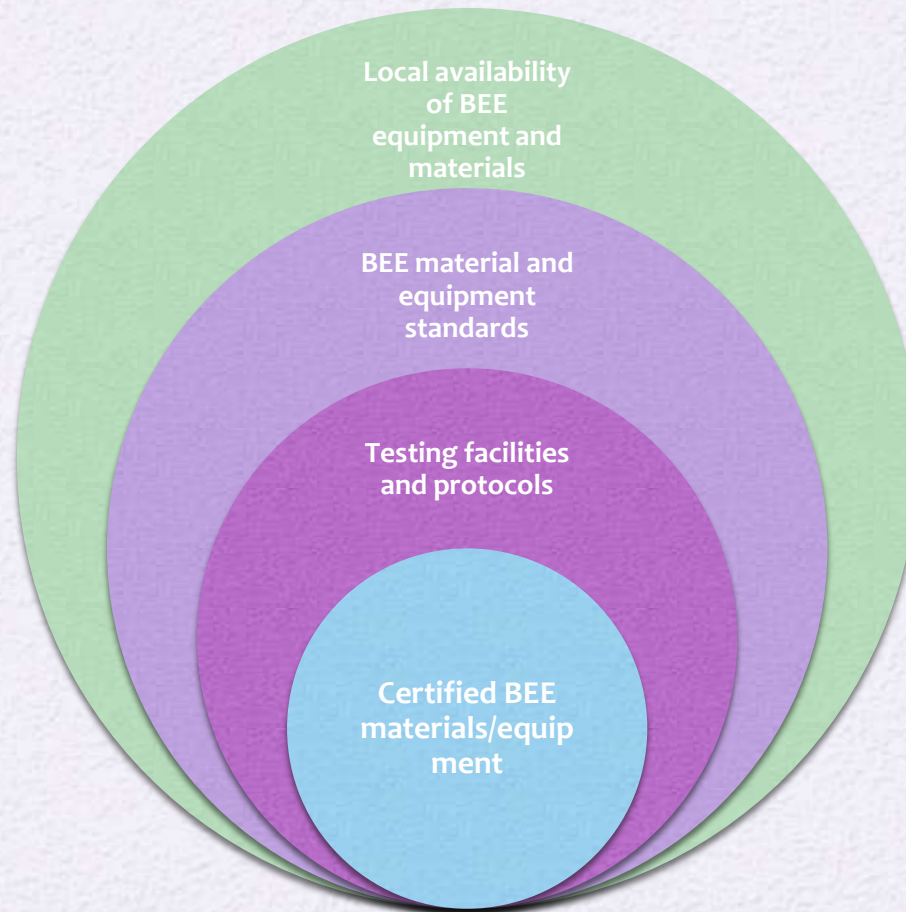
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What Building Codes?



Issue: Large informal sector, corruption in construction sector

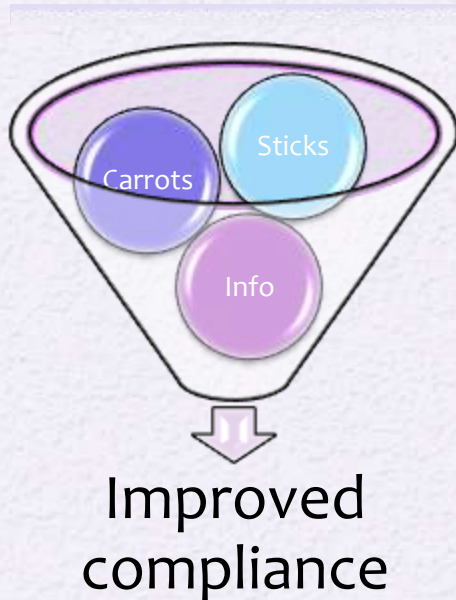
Don't forget building materials and equipment



Universal problems underlying weak BEEC compliance and enforcement

- BEECs not considered relevant compared with life/health codes
- BEECs change often and become more complicated
- Builders and consumers lack know-how and information
- Insufficient resources of local authorities (especially smaller towns): budget, staff, know-how
- Political pressure not to act upon lacking compliance

Multiple Instruments to Improve BEEC Compliance



Sticks: Regulation

- BEECs need to be adopted at the appropriate administrative level (e.g., states in Canada, India, Mexico, the USA, sometimes even individual municipalities)
- Enforcement (review of design/plans and inspections during and after completion of construction) is usually at the local level together with enforcement of general building code requirements (not in a separate enforcement structure)
- Penalties for non-compliance such as fines/withholding of permits/loss of certification

Carrots: Incentives

- Financing of demonstration projects, incremental costs
- Grants/subsidies and other benefits

Information/capacity building

- Compliance forms and procedures, user manuals and guidebooks
- Training programs and capacity building for code officials, designers, architects and engineers, construction trades
- Outreach and public information programs for building and real estate industries and the general public
- Metering, audits, certificates and information/checklists for buyers and consumers

Major issues

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Models for enforcement of BEECs

- The institutional arrangements for BEEC enforcement generally depend on the system of code enforcement in the building sector in general
- Several enforcement models
 1. **Government agency (local/state)**
 2. **Private sector/third party**
 3. **Self-certification to owner/government**
 4. Civil penalties only
 5. Mix of models (e.g., China and California with models 1 and 2)

Institutional Options for Enforcement of Building Codes, including BEECs

	Government agency	Private 3 rd party	Self-certification
Key features	Government agency responsible for plan review/inspections, issues permits	3 rd party responsible for plan review/inspections (some sample checks by government)	Builder provides compliance statement to owner/government (some sample checks of statements by government)
Information/Infrastructure needs	Trained public sector staff	Trained and certified 3 rd party staff (some training of public sector staff if spot checking)	Knowledgeable builders and owners; energy labels and certificates for buildings help
Costs	Usually recovered from builder	Higher for owner	Low
Non-compliance risk	Low, provided funding for enforcement is adequate	Low – 3 rd party depends on certification for income (but also on satisfied builders)	High, unless owner places high value on EE; lower if builder certified
Examples	USA: prevailing option	France, Mexico, some in UK, some in USA, China (with some public oversight)	Germany

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Financing of measures to improve compliance and enforcement

- General public budget
- Permit fees
- Building Owner
- Utilities – examples especially from USA (California)
 - Interest especially when building energy consumption is driven by cooling needs with resulting pressure on electricity generation and peak load contribution
- Carbon Finance?

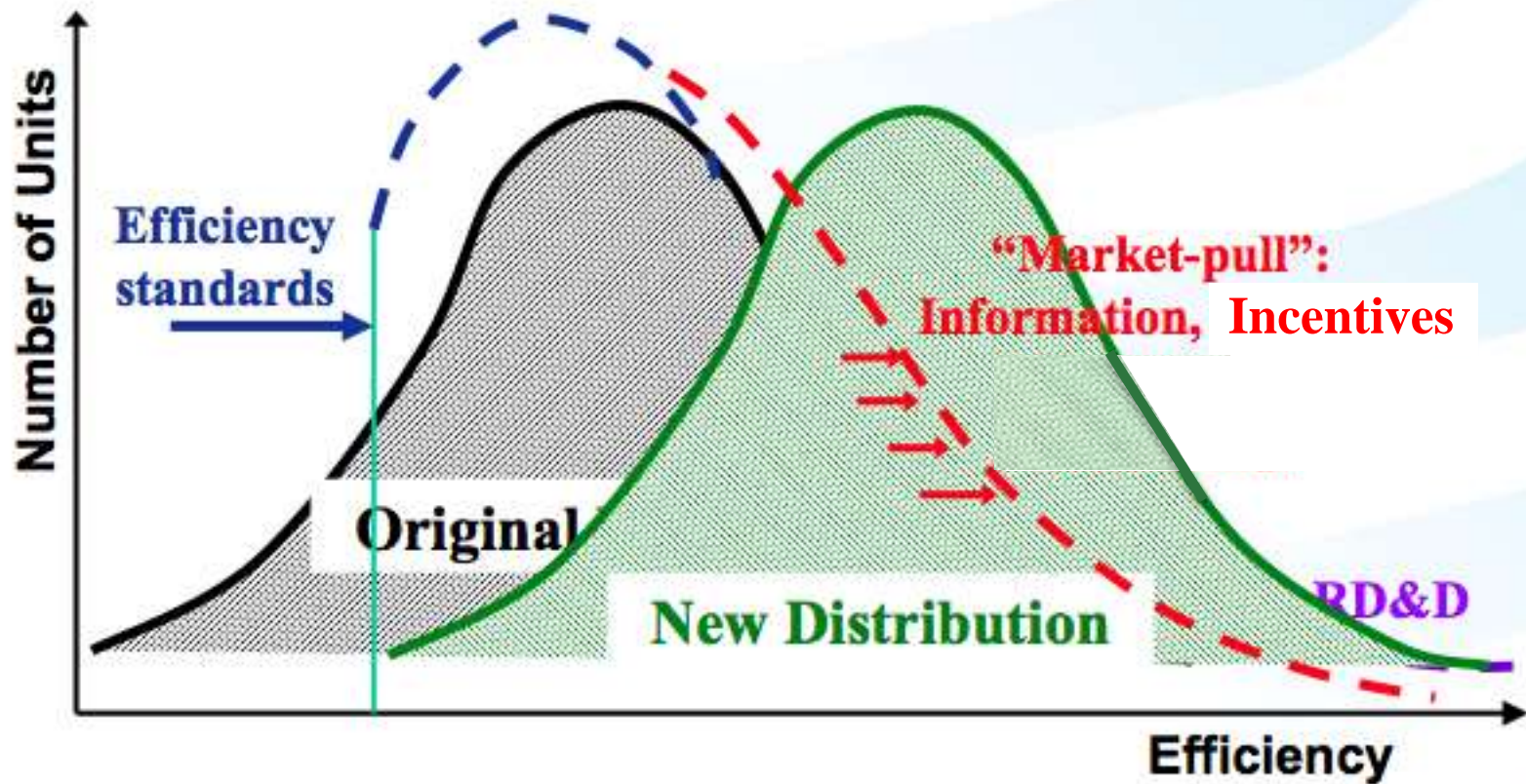
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Role of voluntary/green rating schemes

- Green building councils and green building rating systems are being developed and green buildings built, even where BEECs are not implemented/enforced
- Can they substitute for BEECs that are not complied with; can they transform the market?
UNLIKELY

Push and Pull Strategy to improve energy performance of new buildings



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M&V: BEEC compliance and actual energy performance of buildings

- BEECs regulate the design and construction of buildings, not the actual energy performance
- Typically, buildings consume more energy than according to design, even when built to code
- Challenge for any carbon finance approach!

Case Studies

Mexico

Residential BEEC developed by housing agency, promoted through national low-income housing program based on sustainable building practices, some carbon financing

India

Many ongoing activities to move from BEEC adoption to implementation

China

First BEEC adopted 1986; substantial efforts at building up enforcement structure; during past few years finally substantial compliance

Egypt

BEECs adopted, but no compliance resources and enforcement structure for building codes, incl. BEECs

California Example

- Strong and long-standing policy emphasis on reducing energy demand and combating climate change
- Compliance is not perfect (about 70%), but rate is one of the highest in the USA - due to intensive and continuing training and education for all actors
- Funding for those programs mostly from public benefits funds administered by utilities
- Extensive use of third party home energy raters to verify compliance with certain EE requirements and correct installation supports enforcement officials

Thank you!