



International  
Energy Agency  
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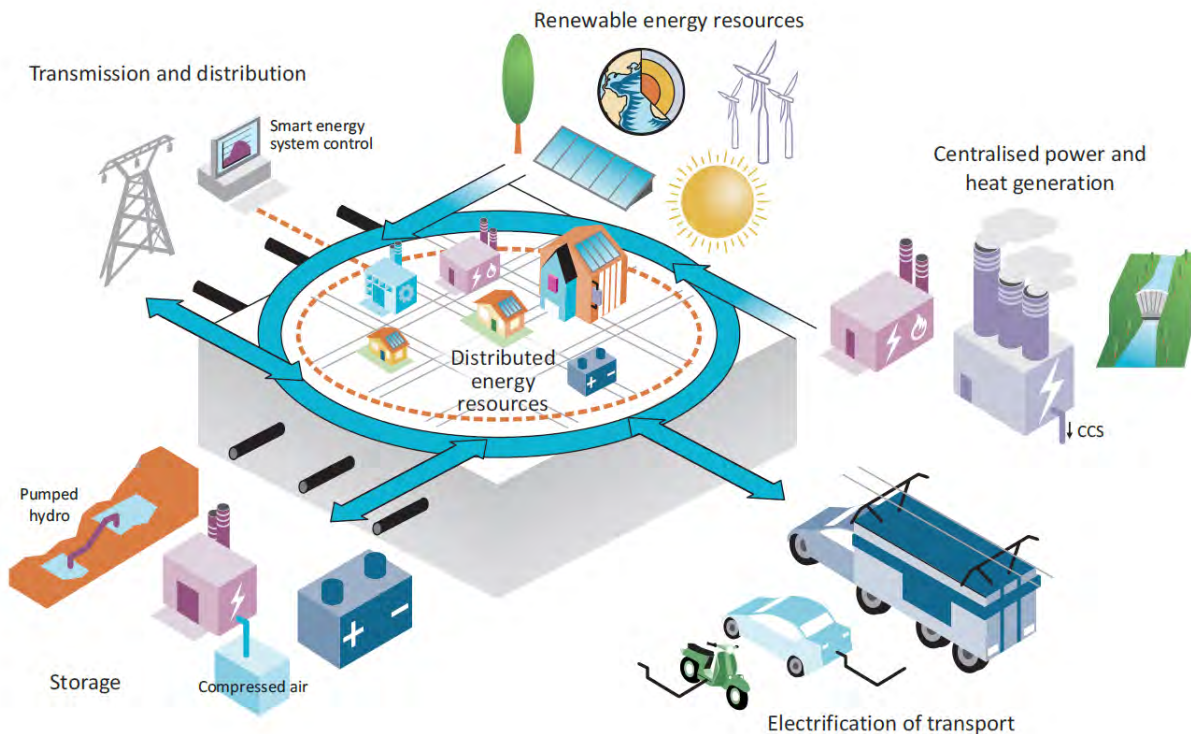
# Technology and Policy for the Built Environment - Vital for Sustainable Cities

## Conference on Energy Efficiency in Cities

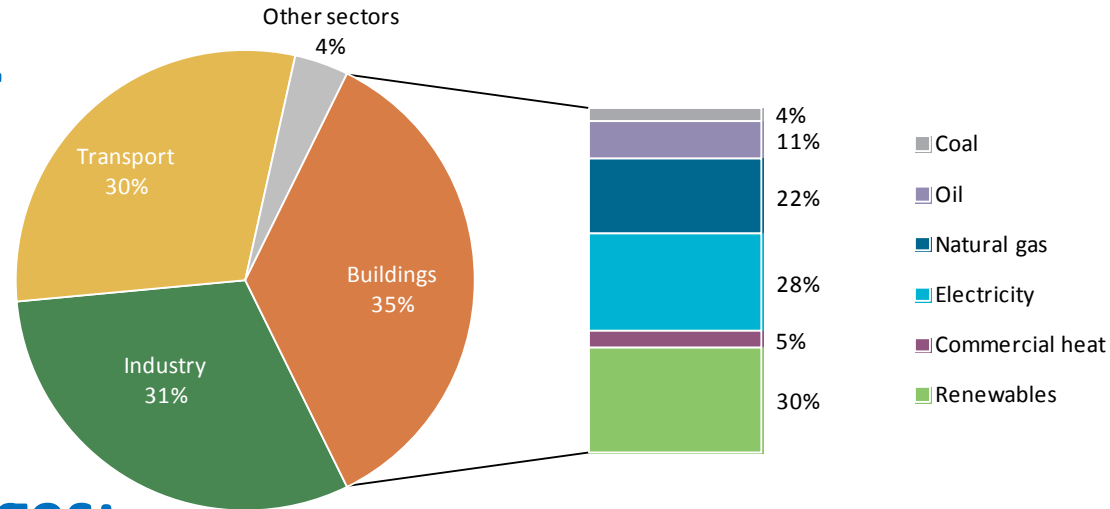
*Marc LaFrance, IEA*

*Mexico City, 18 June 2014*

- **Building on IEA capacity: From macro energy systems integration to urban energy systems analysis**



- Largest end-use sector
- 1/3 carbon emissions
- 50% of electricity
- Major portion of GDP
- Opportunities/challenges:

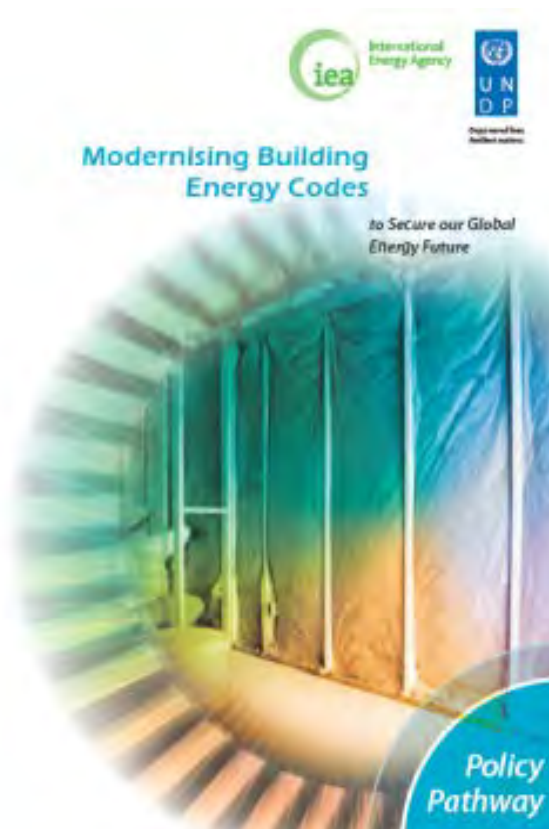


- 75% - 90% of OECD building stock still in service by 2050
- Large population growth in developing world will drive new floor area that needs to be efficient (2.5 billion more by 2050)

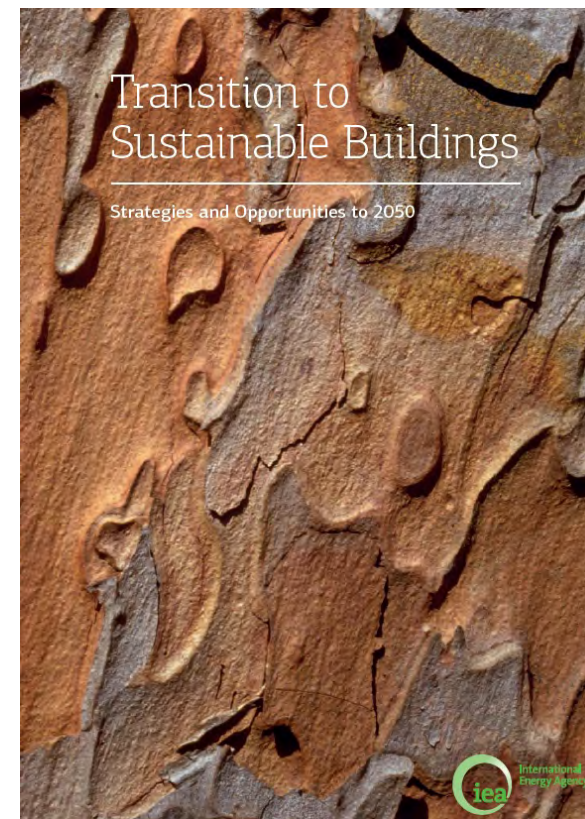
# 2013 BUILDING PUBLICATIONS



Dec 2013

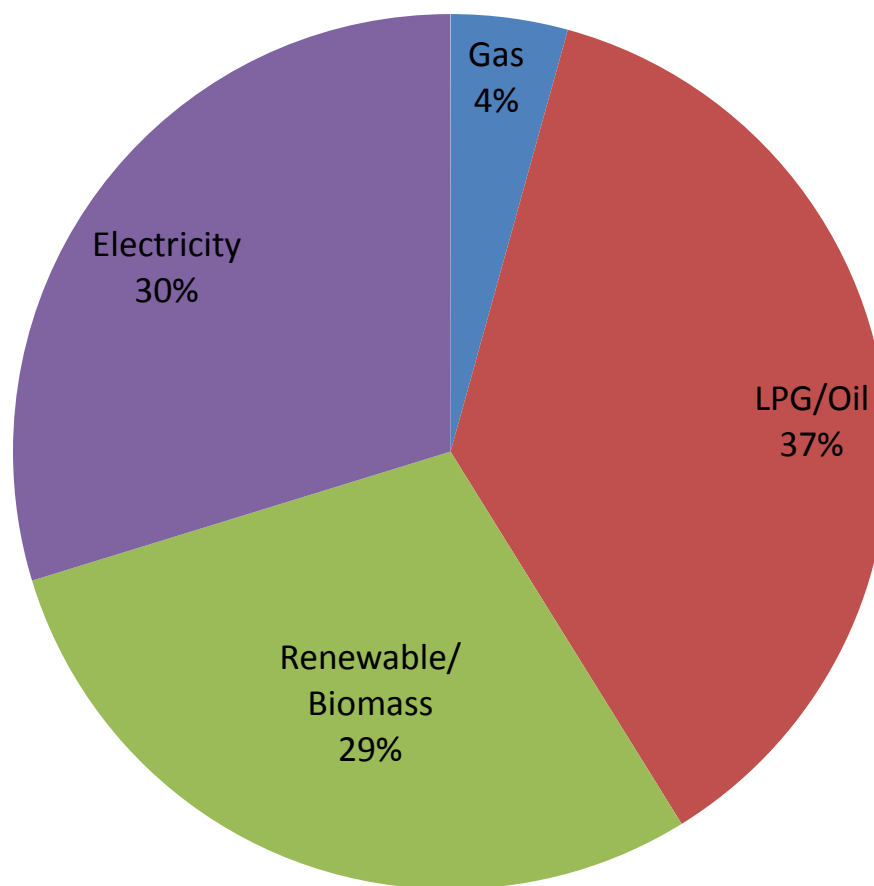


Aug 2013

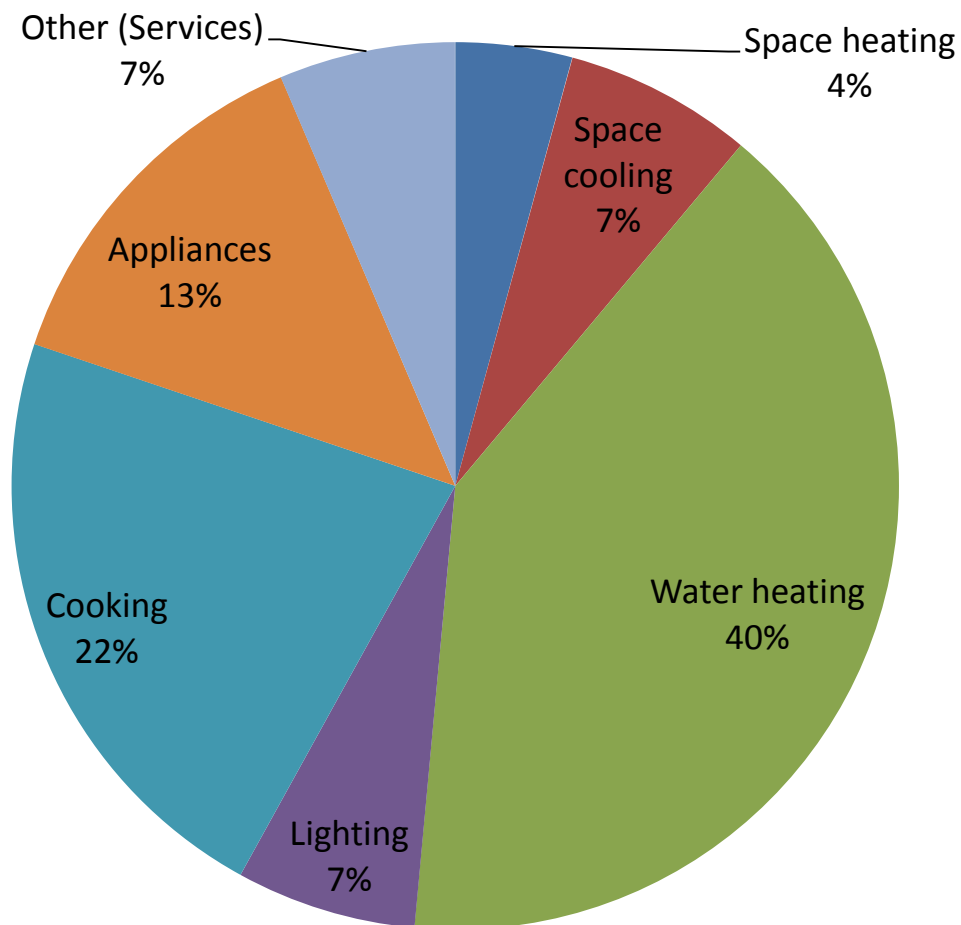


Jun 2013

## Mexico Building's Energy Supply



## Building's Final Energy in Mexico

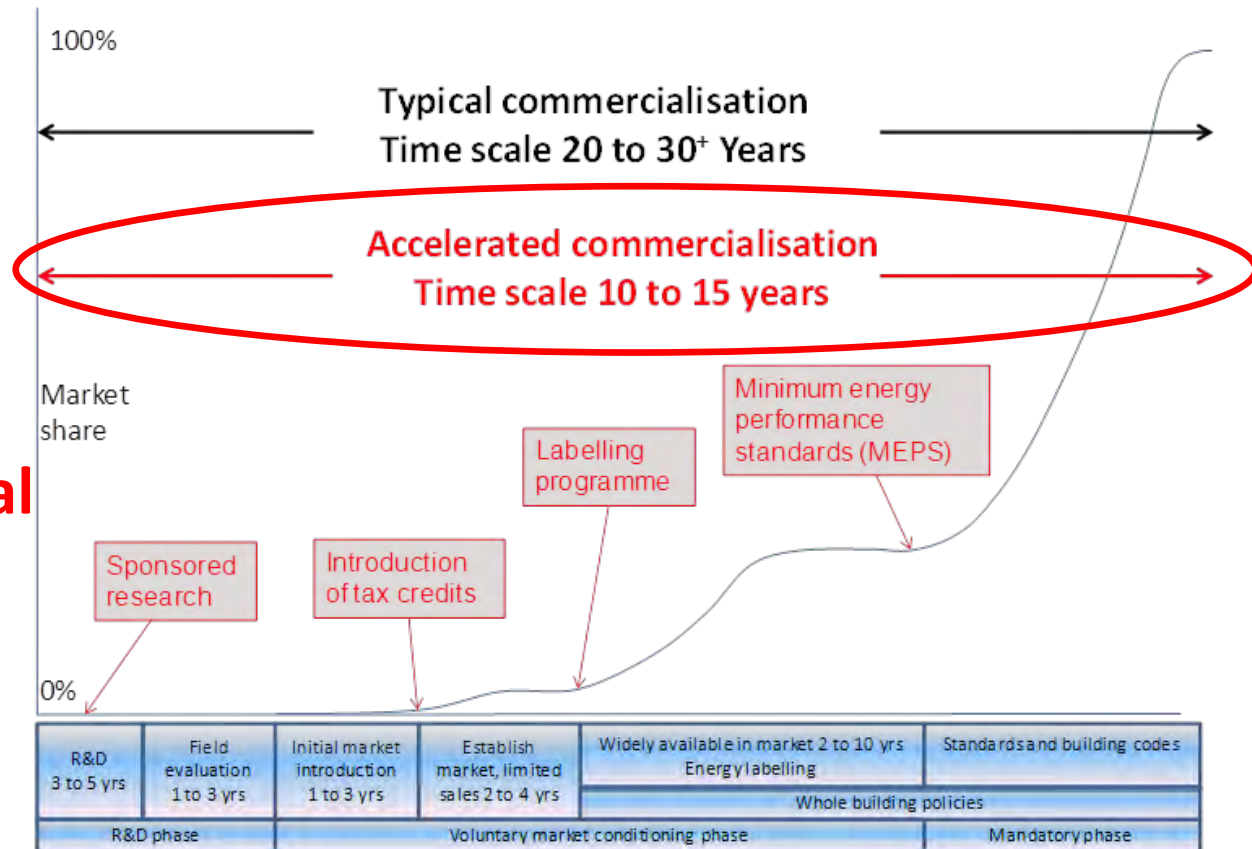


# Priority Recommendations

	ASEAN	Brazil	China	European Union	India	Mexico	Russia	South Africa	United States
<b>Technology</b>									
Advanced envelope – cold climate			Red	Gold			Red		Red
Reduced cooling loads – hot climates	Gold	Gold				Gold			
Heat pumps			Gold	Red			Gold		Gold
Solar thermal		Red			Gold	Red		Red	
More efficient use of biomass	Red				Red			Gold	
<b>Policy</b>									
Building codes with supporting infrastructure	Gold	Gold	Gold		Red	Gold	Gold	Gold	
Appliance and equipment standard	Red	Red	Red		Gold	Red		Red	
Deep renovation of existing buildings				Red			Red		Red
Zero-energy new buildings				Gold					Gold

Note: Recommendations limited to top two for technology and policy, all items could be relevant for most countries. Red indicates immediate priority, while gold indicates second priority.

- Promote integrated policy packages
- Deep renovation critical in mature markets
- **Building codes critical in emerging markets**
- Systems level performance supported by advanced components





# Policies Need to Be Tailored to Climate, Culture and Typical Building Practices

Average Monthly Data (Base 21° C)  
(Example with Limited Data)

	Heating Degree Days	Cooling Degree Days	Climate Type
Mexico City	134	20	Heating
Ciudad Juarez	146	112	Mixed
Cancun	7	143	Cooling

Note: Sample data over last 36 months, would want 30 year data. Base temperature would vary and most likely be higher for cooling degree days.

Source: weather underground

# Transformation to Low-Energy Buildings

Transforming construction to low energy buildings

Inefficient – still common and old stock

- Single pane windows.
- No insulation.
- High air leakage.

Typical building code in advanced regions

- Low-e double glaze windows.
- High levels of insulation.
- Low air leakage.

Zero-energy buildings

- Highly insulated windows and dynamic solar control.
- Optimised designs and orientations.
- Daylighting.

**EMERGING MARKETS**

*KEY POINT: the world needs to shift from very old buildings to modern buildings, and then to low-energy or zero-energy buildings.*

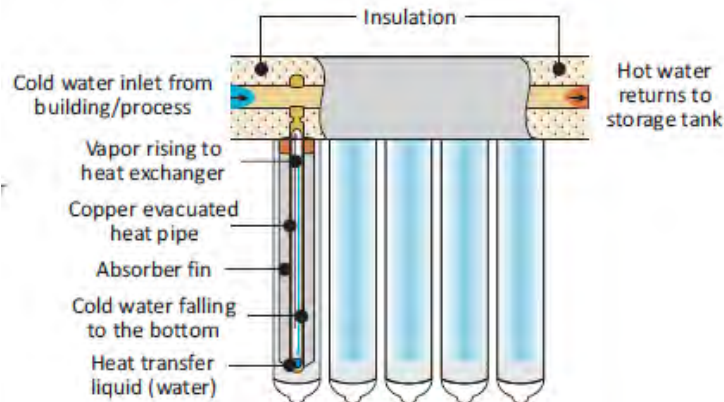
- **Reflective surfaces for hot climate (advanced envelope)**
- **Low cost solar thermal for hot water**
- **Air sealing for buildings when heating or cooling is used**
- **Efficient equipment (benchmarking, labeling and standards)**

## Urban Heat Island Impact – Beyond Efficiency



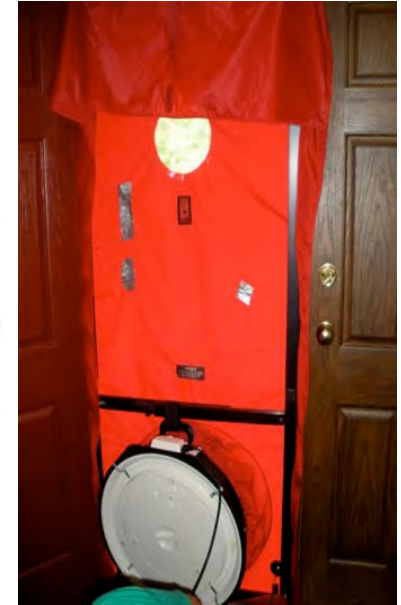
Source: LBNL, Heat Island Group

## Evacuated Tube Collector



Source: Sustainability Victoria

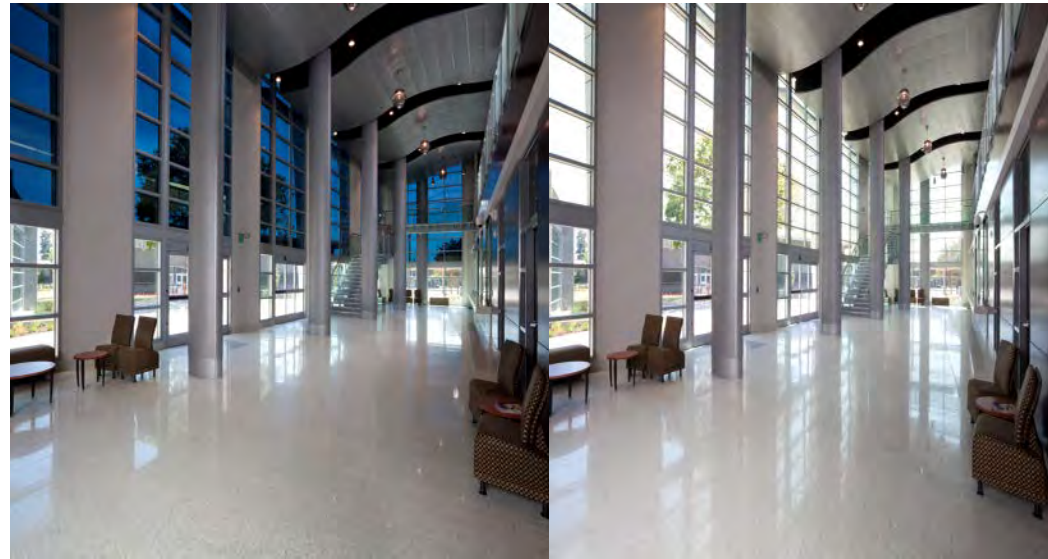
## Blower Door Test



Source: ORNL

# Dynamic solar control (more R&D needed)

- Lower cost, more economic viable dynamic exterior shading for global markets
- Dynamic glazings – large investment recently, on cusp of market viability for non-niche applications



Source: Sage Electrochromics

- **Advanced envelopes – insulation, reflective walls, roofs, insulated low-e glass, exterior shading, air sealing, and radiant barriers**
- **Small capacity cooling equipment – if needed**
- **More R&D needed for more affordable heat pump water heaters (HPWH)**
- **Fully integrated system may not need any cooling at all, HPWH's may be sufficient to handle daily sensible heat and latent (humidity) loads**



Source: Heat Pump & Thermal Storage Technology Center of Japan

# Policies – Integrated Across Levels of Government

## National/State Level

- R&D, manufacturing standards, education, etc
- Whole building performance metrics and certificates
- Targets and goals for performance
- Investment funds/incentives to avoid increased supply and electricity capacity
- **Building codes**

## Local/city level

- Public purchasing programmes
- Public housing/ government buildings
- Building code enforcement
- Voluntary “energy efficient” development and refurbishment zones
- Revolving investment funds
- **Building codes**

- Long term policy strategy to enable local/regional manufacturing of energy efficient products
- Product performance metrics and rating tools
- Availability of commodity based products to allow for cost effective applications
- Education for all market players



Thermal Chamber  
Source: Fraunhofer, IBP

## IEA Assessment Based on Key Criteria – Mexico Needs to Conduct its Own Self Assessment

Level of test and labelling infrastructure	ASEAN	Brazil	China	European Union	India	Japan/ Korea	Mexico	Middle East	Australia/ New Zealand	Russia	South Africa	United States/ Canada
Governance	L	M	H	H	M	M	M	L	M	L	M	M
Energy prices	L	M	M	H	M	H	L	L	M	L	M	M
Infrastructure and human capacity	M	L	M	H	M	H	M	L	M	M	M	H
Commodity of efficient materials	L	M	H	H	M	H	M	L	M	M	L	H
Voluntary programmes	L	L	L	M	L	L	L	L	L	L	L	L
Mandatory building codes	L	L	M	H	L	M	M	L	M	M	M	H

Note: H: high, M: medium, L: low

Source: See IEA Energy Efficient Building Envelope Technology Roadmap



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Buildings Webinar Series (May/June 2014) – [www.iea.org/workshops](http://www.iea.org/workshops)

Download Envelope Roadmap – free

<http://www.iea.org/publications/freepublications/publication/name,45205,en.html>

Download Building Code Policy Pathway – free

[http://www.iea.org/publications/freepublications/publication/PP7\\_Building\\_Codes\\_2013\\_WEB.pdf](http://www.iea.org/publications/freepublications/publication/PP7_Building_Codes_2013_WEB.pdf)

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