FACT SHEET

Building energy standards and codes

Key points

- ***Once a building is constructed, it is very costly and sometimes impractical to attain the efficiency that can be achieved cost-effectively at the time of construction.***
- ***Energy-efficiency improvements in new buildings can have significant savings of energy for emerging countries.***

Building energy standards and codes explained

Building energy standards and codes are legal requirements that regulate buildings' energy performance and address energy consumption in the building envelope[1] and building equipment, such as heating, cooling and lighting. Europe and North America were the first to introduce energy-efficient design requirements in building after the first oil crisis of 1973. European Energy Performance in Buildings Directive requires member States of the European Union to establish requirements for energy efficiency in new buildings effective from January 2006. Separate energy efficiency requirements, known as prescriptive code, and energy performance requirements, known as performance code, are the two most widely used building energy standards and codes (Table 1).

Table 1: Types of building energy standards and codes

	Prescriptive code	**Performance code**
Description	Separate energy efficiency requirements are set for each component of the building (thermal transfer values for walls, roof and windows) and for each part of the equipment (heating/cooling system, lights, fans, pumps, etc.).	Performance building codes are based on annual energy consumption or the building's implied emissions of greenhouse gases
Pros	Easy to follow and verify	More flexibility in reducing energy consumption of buildings
Cons	Potential to hamper the adoption of the most cost-efficient measures for increasing the overall energy efficiency of buildings Potential to discourage innovation	Requires more skilled building professionals due to the use of computer-based models and sophisticated calculation on building energy performances

Source: Adjusted from J. Laustsen, *Energy Efficiency Requirements in Building Codes, Energy Efficiency Policies for New Buildings*, IEA Information Paper in support of the G8 Plan of Action (Paris, Organisation for Economic Co-operation and Development and International Energy Agency, 2008).

How they works

Building standards and codes have been in use a long time, enforced to ensure safety standards. There are now movements to upgrade building codes to reflect minimum environmental performance.

[1] Building envelop refers to the building fabric embracing the basic structure of buildings such as roofs, walls, window, floor, etc.

New buildings are typically subject to building codes, in many cases, as a legal obligation for construction approval. A few countries, such as Germany, apply the building codes to existing buildings when they are renovated. In Germany, a certain level of energy performance is required for renovations if more than 20 per cent of the building area is to be renovated.

Enforcement

Building standards and codes can be enforced in several ways. The responsibility of adoption, enforcement, inspection, and verification can be delegated to local authorities as the case in many countries including Canada, Japan, and China. In Singapore, the Building Construction Authority operating under the Ministry of National Development is in charge of operating the building energy codes.[2] Penalties for not complying with the energy code can include stopping construction and withholding permits and levying fines.[3]

- In Germany, enforcement is based on the self-certification of the builder-architect to the owner. In some states, municipalities carry out spot checks and if the requirements are not met, the Energy Saving Law specifies penalties between 5,000 and 50,000 euros.[4]
- Chinese authorities in Tianjin municipality are conducting third-party inspections to address some of the limitations. If the improper installation of wall insulation is identified through a random site inspection, for example, the General Station for Building Construction Quality Supervision can suspend the construction and require a developer to complete remedial measures before the sanction is lifted.[5]
- In Japan, all new constructions and remodelling of buildings larger than 2,000 square metres are mandated to submit an energy conservation report to local authorities. However, there is no provision for site inspections.[6]
- Building owners in Republic of Korea are required to submit an energy-saving worksheet signed by a licensed professional, such as architect, mechanical and electrical engineer. The relevant authority has the right to conduct an audit of the buildings after construction and revoke the permit or order the building to be rebuilt if elements of the energy-saving worksheet were not followed.[7]

Strengths of building standards and codes

- **Energy savings from building sector** (at national level): Building codes are cost-effective regulatory measures for reducing the energy consumption within buildings. A recent review of China's low-carbon development found that enforced building codes resulted in an energy savings of 31 million tonnes of coal equivalent (Mtce) from 2006 to 2008, which constituted 40 per cent of total energy savings in the building sector.[8]
- **Reduced utilities bills:** Tenants who live in buildings that are compliant with building codes can save on their utilities bills due to the energy savings achieved from the installation of technologies that meet energy-efficiency requirements.
- **Potential for creating new market:** Stringent requirements of building codes can create a new market for more energy-efficient appliances and equipment, such as double-glazed windows and LEDs, and encourage the development of new energy technologies.

[2] Singapore, Building Control Act 1989. Available from www.bca.gov.sg/BuildingControlAct/building_control_act.html#946439071-000193 (accessed 31 January 2012).

[3] Pacific Northwest National Laboratory, *Country Report on Building Code in Canada* (Richland, Washington, 2009).

[4] Liu Feng, A. S. Meyer and J. F. Hogan, "Mainstreaming Building Energy Efficiency Codes in Developing Countries: Global Experiences and Lessons from Early Adopters", World Bank Working Paper No. 204 (Washington D.C., World Bank, 2010).

[5] ibid.

[6] Alliance to Save Energy, *Building Energy Codes: Best Practices Report for APEC Economies* (Washington D.C., 2009).

[7] ibid.

[8] Climate Policy Initiative Beijing, *Review of Low Carbon Development in China: 2010 Report*, Executive Summary (Beijing, 2011).

Challenges to using building standards and codes

Such regulatory measures as building energy codes require strong enforcement, monitoring and verification. Even in developed countries, compliance doesn't come easily because of the high transaction costs required for inspection and verification. In the United Kingdom, for example, only 40 per cent of new buildings comply with the building codes[9] and compliance in the Netherlands is as low as 20 per cent due to reluctance to enforce regulations on building owners.[10]

The root causes of weak enforcement tend towards:

- **Lack of awareness on the opportunities arising from efficiency gains:** Most building owners are not aware of the opportunities for saving energy in buildings. Building owners can be more attentive to construction costs than energy costs over the life cycle of buildings.
- **Financial institutions hampering access to credit to cover additional costs:** Financial institutions may not be willing to provide loans for several reasons: ignorance of energy efficiency benefits; mismatch between the current financial scheme pursuing short-term profits and the energy efficiency gains achieved in a long run; and the risks associated with energy-efficiency projects.
- **Premature market:** High-tech energy-efficiency equipment is often not available in the local market of developing countries and thus only supplied by importing.

Implementing strategies

- **Communicate the benefits:** Building energy codes can be introduced on a voluntary basis to increase knowledge and expertise about energy efficiency among professionals in the initial stage. Demonstration projects for public buildings, such as schools, can be another good measure for outreach.
- **Supplement with incentives:** The incentives can be provided to both producers of energy-efficient products and goods and consumers, such as building users. The current German Minister for Environment, for example, proposed that tenants be allowed to pay less rent if the landlord does not ensure a certain level of energy use.[11]
- **Measures to discourage non-compliance:** Fines, sanctions, and injunctions can be imposed for any responsible part that violates the enforcement of building codes.
- **Ensure good quality of codes and continuous updates:** Building codes should be adapted to the local context and reflecting each country's building circumstances, such as climate. Generally, governments set national building codes that can be adopted or adjusted on a lower level of governance. As technologies progress and the costs of energy-efficient equipment decline, building energy codes should be regularly updated to remain relevant and effective.

Examples

Japan: The national Energy Conservation Law contains performance criteria for residential buildings that are both prescriptive and performance oriented. This focuses on heat transfer coefficients, resistance of insulation materials and summer solar heat gain coefficients.[12]

[9] J. Deringer, M. Iyer and Yu Joe Huang, "Transferred Just on Paper? Why Doesn't the Reality of Transferring/Adapting Energy Efficiency Codes and Standards Come Close to the Potential?", presented at the 2000 ACEEE Summer Study on Energy Efficiency in Buildings. Pacific Grove, CA, 20-25 August 2004.

[10] European Insulation Manufacturers Association, *Better Buildings through Energy Efficiency: A Roadmap for Europe* (Meerseen, Netherlands, 2006).

[11] Sonja Koeppel, Diana Ürge-Vorsatz, *Assessment of Policy Instruments for Reducing Greenhouse Gas Emissions from Buildings*, Report for the UNEP-Sustainable Buildings and Construction Initiative (Budapest, Central European University, 2007). Available from www.unep.org/themes/consumption/pdf/SBCI_CEU_Policy_Tool_Report.pdf (accessed 2 February 2012).

[12] Liu Feng, A. S. Meyer and J. F. Hogan, "Mainstreaming Building Energy Efficiency Codes in Developing Countries: Global Experiences and Lessons from Early Adopters", World Bank Working Paper No. 204 (Washington, D.C., The World Bank, 2010).

[13] ibid.

China: The Government enforced requirements for cost-effective reduction of heating and cooling loads, and new buildings must save 50 per cent on energy use. Cities with the largest construction markets, such as Beijing and Tianjin, have adopted more stringent regulations to further reduce the energy consumption by 30 per cent through the use of more envelope insulation and windows that have lower thermal losses.[13]

Further reading

Status of Energy Efficient Building Codes in Asia, by Joe Huang and Joe Deringer (Hong Kong, China, Asia Business Council, 2007).

Understanding Building Energy Codes and Standards, by R. Bartlett, M.A. Halverson and D.L. Shankle (Richland, WA, Pacific Northwest National Laboratory, 2003).