Mapping of Existing Energy Efficiency Standards in Buildings in the UNECE region:

Main Outcomes

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Context: why looking into energy efficiency?

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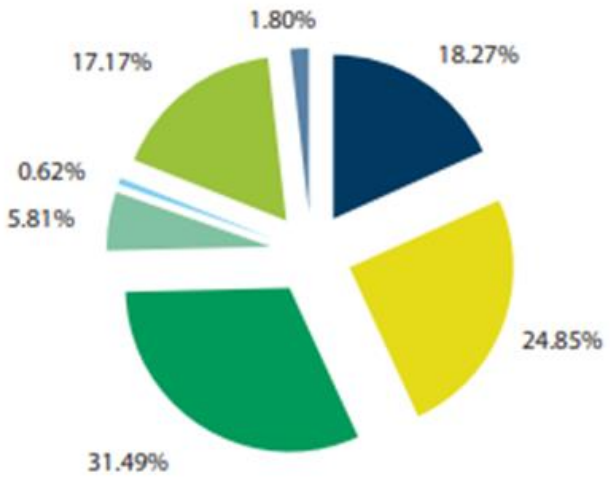
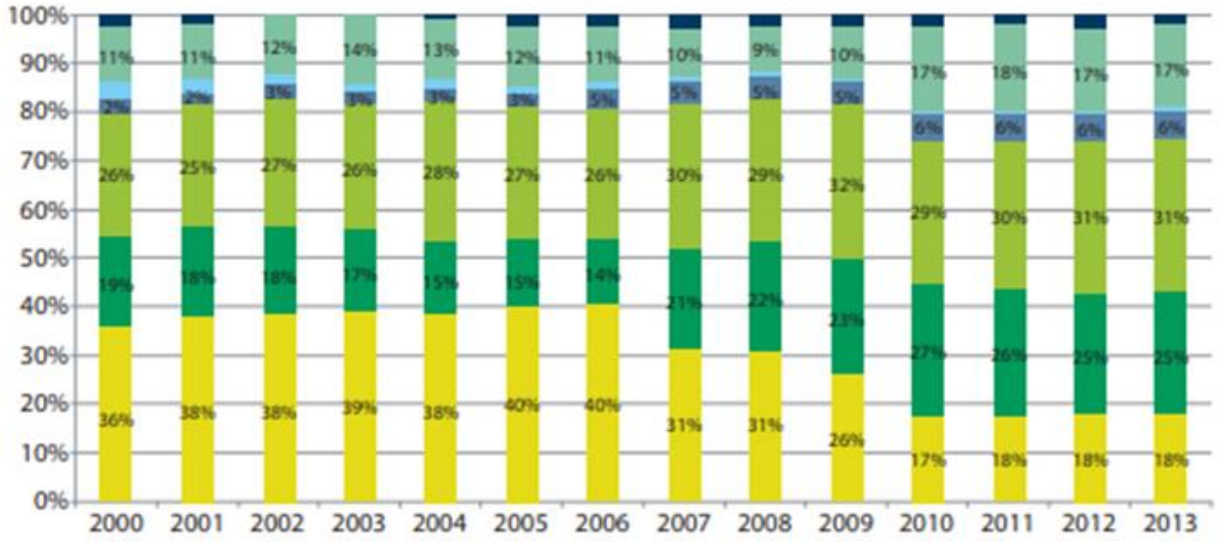
Figure 9: Total final energy consumption per sector (2013).



Industry | Agriculture/forestry | Transport | Non-specified (other) | Residential | Non-energy use | Commercial and public services

Source: IEA online energy statisti

Figure 10: Trend in energy consumption by sector, 2000–2013.



industry | Transport | Residential | Commercial and public services | Agriculture/forestry | Non-specified (other) | Non-energy use

Source: IEA

Mapping of Energy Efficiency Standards in Buildings: objectives

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- To examine the current status of the energy efficiency standards in buildings in the UNECE region
- To form a basis to improve knowledge of UNECE member States of existing energy efficiency standards in buildings
- To collect best practices related to existing standards
- To provide a gap analysis and harmonization of data and standards
- To prepare an initial assessment of energy efficiency technologies in buildings in relation to the existing standards

Mapping of Energy Efficiency Standards in Buildings: methodology

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Questionnaire (26 January-28 February 2018)

Collecting information from 56 member States on the current status of the energy efficiency requirements and technologies in building codes

Desktop Study

Review of relevant policy documents, previously published studies, technological developments and best practices related to existing standards across countries of the UNECE region

Consultation with the members of the JTF

Collection of feedback and comments from the members of the Joint Task Force on Energy Efficiency in Buildings

Mapping of Energy Efficiency Standards in Buildings: survey

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Part 1 general information
- name
- address
- contact details
- country
- organization

Part 2: Building Energy Codes
- Existing standards
- Type of building covered
- Stringency
- Energy performance gap
- Kind of presciptive requirements
- Inspections

Part 3: Energy Performance Certification
- Type of buildings covered by EPC
- Policy requirements level for EPC
- Existence of national registry database for EPC

Part 4: Building Materials and Products
- Existence of requirements
- Requirements to test the building materials

Part 5: Requirements for enforcement and compliance
- Existence of incentives for compliance
- Penalities for non compliance
- Monitoring of energy performance in building energy codes

Part Six – Energy Efficiency Technologies
- Deployment of technologies
- Which technologies exist
- Recent trends

Mapping of Energy Efficiency Standards in Buildings: gap analysis

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Objective: to **evaluate** the **most effective policies** and **identify best practices** to help member States **learn from one another**

- Comprehensiveness and stringency of the building energy codes
- Technical requirements of the building energy codes
- Comprehensiveness and stringency of the EPC
- Enforcement mechanisms, including incentive packages and penalties
- Energy efficiency materials and products requirements in building energy codes

Mapping of Energy Efficiency Standards in Buildings: country profiles

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Poland

The residential sector in Poland is dominated by individual property (~ 60%), followed by Cooperative property (~20%). In addition to relevant government agencies, energy agencies, such as the National energy efficiency agency, play an important role in promoting energy efficiency in the country's housing stock. In Poland, as early as 1994, a law was adopted that establishes requirements for buildings in terms of minimum requirements for energy efficiency, thermal insulation and other requirements relating to energy saving. In the development of the use of renewable energy in 2012 adopted a Resolution that prescribes to analyze the possibility of the use of decentralized systems of energy supply based on renewable energy sources [27, 28].

Main regulatory documents related to building energy codes

Technical regulations: Energy Savings and Thermal Insulation (2002)
The Act of 7 July 1994: Construction Law.
The Act of 29 August 2014: The Energy Performance of Buildings Law
Regulation of the Minister of Transport, Construction and Maritime Economy of 25 April 2012 concerning the detailed scope and form of construction
- 2002-2014
- Climate zones

Performance-based requirements in building energy codes

- Thermal characteristics and geometry of the building (envelope and internal partitions, etc.)
- Airtightness
- Space heating system and hot water supply units
- Air-conditioning system(s)
- Mechanical and natural ventilation
- Built-in lighting system
- Design position and orientation of buildings
- Passive solar systems and solar protection
- Indoor and outdoor climatic conditions
- Passive cooling
- Heat recovery
- Thermal bridges

Software: No data

Energy Performance Certification (EPC)/Energy Labelling/Energy Passport of the building

Coverage:
- Single-family houses
- Apartment blocks
- Commercial buildings
- Public buildings

- new residential
- new non-residential
- existing residential
- existing non-residential

Stringency: Mandatory

CPDD Energy Performance Certificate (2009)
Passive Houses (1992), Maximum cooling demand (kWh/m²·year): cooling-15; space heating-15; total primary energy-120. Voluntary
Methodology for calculating the energy performance of buildings

Existence of national registry database for EPC in your country: Yes

Building Materials and Products

Rating/certification of building materials: No data

Harmonization with other technical standards: No data

Requirements to test building materials and products by certified test laboratories: No data

Building Energy Codes Stringency and Coverage

Coverage:
- Family residential building
  Single-family residential building
  Multi-family residential building
- Collective residential building (Apartment blocks)
- Commercial buildings (Health-care building, Warehouse and production buildings)
- Public buildings (Health-care building, Warehouse and production buildings)

- new residential
- new non-residential
- existing residential
- existing non-residential

Stringency: Mandatory

End-uses energy: Space heating, Ventilation, Lighting interior, Water heating, Appliances, Auxiliary devices, Space cooling, Water heating, Lighting interior, Humidification

Prescriptive requirements in building energy codes

- Thermal insulation (including U-values for walls, floor, roof and windows)
- Airtightness
- Ventilation or air quality
- Daylighting requirements
- Specified thermal comfort levels for summer and winter
- Solar gains (G-values)
- Artificial lighting system, lighting density
- Boiler/AC system
- Renewable

Insulation (2017):
U-values (W/m2·K): Roof, f(θ0) – 0.18-0.10; External Wall, f(θ0) – 0.23-0.3; Internal Wall-1.0; Floor on the ground, f(θ0) -0.30-1.2; Window, f(θ0) – 1.1-1.5; Door – 1.3; Skylights, f(θ0) – 1.3-1.5;
Space Heating System (2017):
$EP_{H,nd}$ Values (kWh/m²·year) for heating, ventilation and hot utility water: Single-family residential building-95; Multi-family residential building-95; Collective residential building-85; Health-care building - 260; Public buildings-80; Warehouse and production buildings-90.
Space Cooling System (2017):
ΔEP_K Values (kWh/m²·year): Single-family residential building and Multi-family residential building-10; Collective residential building, Health-care building and Public buildings-25.
Water Heating System: $EP_{W,nd}$ Values, mean partial EP maximum value ratio for heating, ventilation and hot utility water
Lighting (2017): EP_L Values (kWh/m²·year): Single-family residential building and Multi-family residential building-3; Collective residential building, Health-care building, Public buildings and Warehouse and production buildings - for A_U ≤ 3500 EP_L = 90; for A_U ≥ 3500 EP_L = 100.

Requirements for enforcement and compliance

Requirements for regular inspection of heating and airconditioning (A/C) systems: No data

Penalties, incentives and other mechanisms for improving compliance with building energy codes in your country: bonuses, grants

Energy performance monitoring requirements: No data

Slovakia

The housing sector of Slovakia took third place in the overall balance of energy consumption of the country. The need to develop a strategy for the reconstruction of residential and non-residential buildings in Slovakia follows from Directive 2012/27/EC of the European Parliament and of the Council of 25 October 2012 on energy efficiency. A systematic approach to the reconstruction of buildings was made in the late 1990s, when it was found that many facilities built between 1960 and 1992 had insufficient thermal protection of structures and technical facilities of buildings had a high degree of wear and tear. For such buildings, there was a need to replace structures with quality components to create the necessary security and well-being in these buildings [29].

Main regulatory documents related to building energy codes

MTC SR: 555/2005 Coll. Act on the Energy Performance of Buildings and on Amendments to Certain Acts 300/2013 Coll.
Act amending Act no. 555/2005 Coll. on the Energy Performance of Buildings and on Amendments to some Acts as amended and amending, ISO, European and Slovak Technical norms, Plan for the restoration of relevant (public) buildings, Update of the Energy Performance of Building Concept of 2010 with a View to 2020.

- The first law act to energy performance of buildings was adopted by 2005

Performance-based requirements in building energy codes

- Thermal characteristics and geometry of the building (envelope and internal partitions, etc.)
- Space heating system and hot water supply units
- Air-conditioning system(s)
- Mechanical and natural ventilation
- Built-in lighting system (mainly in the non-residential sector)
- Design position and orientation of buildings
- Passive solar systems and solar protection
- Indoor and outdoor climatic conditions
- Thermal bridge, mandatory requirement to assess post-construction requirement of the thermal bridge: Yes

Non-renewable primary energy use

The existing standards for determining the energy characteristics of the buildings in operation are sufficiently accurate: Yes

Energy Performance Certification (EPC)/Energy Labelling/Energy Passport of the building

Coverage:
- Single-family houses
- Apartment blocks
- Commercial buildings
- Public buildings

- new non-residential
- new residential

Stringency: Mandatory

Existence of national registry database for EPC: Yes
Type of energy that the EPC refer to: Total primary energy, Non-renewable primary energy.

Existence of national registry database for EPC: Yes

Building Materials and Products

Rating/certification of building materials: Yes

Harmonization with other technical standards: European Union standards used for CE Marking

Requirements to test building materials and products by certified test laboratories: Yes

Building Energy Codes Stringency and Coverage

Coverage:
- Single-family houses
- Apartment blocks
- Commercial
- Public buildings

- new non-residential
- new residential
- Existing residential (e.g. after substantial refurbishment)
- Existing non-residential (e.g. after substantial refurbishment)

The buildings covered by the energy codes: They are separated by residential and nonresidential for the means of certification. For the needs of energy audits, there is more detailed breakdown.

Stringency: Mandatory

Prescriptive requirements in building energy codes

- Thermal insulation (including U-values for walls, floor, roof and windows)
- Specified thermal comfort levels for winter and summer
- Solar gains (G-values)
- External solar protections
- Ventilation or air quality
- Periodic transmittance and time lag of walls and roof
- Ventilation for summer comfort
- Solar absorbance of external surfaces (e.g. cool paintings for roofs and streets)
- Daylighting requirements
- Artificial lighting system, lighting density
- Boiler/AC system
- Renewables
- Thermal bridges

Requirements for enforcement and compliance

Requirements for regular inspection of heating and A/C systems: Yes, for both heating and A/C systems

Your country have specific incentives that complement or motivate compliance with building energy codes: Yes, Financial support,
Fines for non-compliance,
Also possible: Refusal for occupancy or construction permit

Energy performance monitoring requirements: Yes

Armenia

Armenia introduced in 2018 a mandatory building energy code with the adoption of a new regulation "Thermal Protection of Buildings", which was developed based on Russian Building Energy Code from 2003 (updated in 2012) and European codes and methodologies. It links building envelope construction and heat loss with established energy limits, taking into account differences in climatic conditions. It also includes a requirement for a building energy passport and an energy efficiency label with energy efficiency classes [30].

Main regulatory documents related to building energy codes

Law on Standardization, ΔL-01 (09.03.2012)
Law on Technical Regulation, ΔL-19 (09.03.2012)
Law on Licensing, the ΔL-193 (30.05.2001)
Law on Energy Saving and Renewable Energy, ΔL-133 (2004)
National Program on Energy Saving and Renewable Energy (2007)
National Energy Efficiency Action Plan (2010)
Amendments to RA Energy Saving and Renewable Energy Law (2019).
- 2013-2017
- Climate zones, Sub-regions

Performance-based requirements in building energy codes

- Thermal characteristics and geometry of the building (envelope and internal partitions, etc.)
- Airtightness
- Air-conditioning system(s)
- Space heating system and hot water supply units
- Mechanical and natural ventilation
- Built-in lighting system (mainly in the non-residential sector)
- Design position and orientation of buildings
- Passive solar systems and solar protection
- Indoor and outdoor climatic conditions
- Thermal bridge

The subset of ISO EPB standards: Full set of CEN EPB standards, a Subset of ISO EPB standards

Software used for compliance verification: Yes

The gap between predicted and actual performance levels: 60- 90%
There is mandatory requirement to assess post-construction requirement of the thermal bridge: Yes
There is mandatory requirement for air tightness testing: Yes

Energy Performance Certification (EPC)/Energy Labelling/Energy Passport of the building

Coverage:
- Single-family houses
- Apartment blocks
- Commercial
- Public buildings

- new non-residential
- new residential
- existing residential
- existing non-residential

Type of energy that the EPC refer to: Total primary energy.

Stringency: Mixed (both voluntary and mandatory)

Existence of national registry database for EPC: No

Building Materials and Products

Rating/certification of building materials: Yes

Harmonization with other technical standards: European Union standards used for CE Marking

Requirements to test building materials and products by certified test laboratories: Yes

Building Energy Codes Stringency and Coverage

Coverage:
- Single-family houses
- Apartment blocks
- Commercial
- Public buildings

- new non-residential
- new residential
- Existing residential (e.g. after substantial refurbishment)
- Existing non-residential (e.g. after substantial refurbishment)

Stringency: Mixed (both voluntary and mandatory)

The construction objects in the Republic of Armenia are divided into five categories depending on their scale, significance, significance and complexity, as well as the safety of citizens and the environment. I) low-risk objects: Category I; 2) objects of medium risk category II; 3) objects of medium risk category III category; 4) high-risk objects - category IV; 5) objects with the highest degree of risk - category V.
Mandatory measures to ensure the energy efficiency of buildings are established by the Decree of the Government of the Republic of Armenia. Indicators for assessing energy efficiency and energy consumption in building codes have not yet established

(Residential and public buildings: walls - 0.38-0.56 floors - 0.03-0.37 roofs -0.03-0.43 windows - 2.04-3.33)

Energy use for: heating, cooling, hot water, lighting, ventilation, Total primary energy use.

Prescriptive requirements in building energy codes

- Thermal insulation (including U-values for walls, floor, roof and windows)
- Airtightness
- Solar gains (G-values)
- Ventilation or air quality
- Ventilation for summer comfort
- Daylighting requirements
- Periodic transmittance and time lag of walls and roof
- Artificial lighting system, lighting density
- Boiler/AC system
- Renewables

Requirements for enforcement and compliance

Requirements for regular inspection of heating and A/C systems: Yes, for heating systems only

Penalties, incentives and other mechanisms for improving compliance: Yes

Energy performance monitoring requirements: No

Mapping of Energy Efficiency Standards in Buildings: recommendations

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1. To **harmonize building codes** and coverage of all kinds of buildings
2. To create a **national EE target**
3. To **strengthen** the **requirements** for i**nsulation,** ventilation and technical installations
4. To introduce or strengthen **quality assurance measures**, especially during the early stage of the certification process
5. To establish proper (electronic) monitoring systems of compliance, enforcement and quality control processes through a qualified workforce
6. To establish a **regular inspection of boilers and air-conditioning systems**
7. To continuously monitor, analyze and adjust energy usage in building energy codes
8. To **create incentives for companies for improving EE** through appropriate **policies, tax incentives and low-interest loans**
9. To facilitate the harmonization process of energy efficient materials and products testing and certification
10. To assist in the establishment of new harmonized building materials test mechanisms
11. To **make codes publicly available**

Mapping of Energy Efficiency Standards in Buildings: conclusions

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- Some countries apply building energy codes only to specific types of buildings
- Large variance in Energy Performance Certificates (EPC) implementation
- Lack of data in the field of energy performance measurement
- **Closing the energy performance gap** is set to become an increasingly important issue over the next decade

Mapping of Energy Efficiency Standards in Buildings: conclusions

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- Improving energy efficiency in buildings key to achieve objectives of 2030 Agenda, would bring about massive reduction in emissions
- Easier to achieve change in public buildings than multi-apartment. Grants + loans needed to incentivize homeowners to retrofit.
- Fundamental to develop comprehensive and consistent policies to ensure development and implementation of standards, in the spirit of the Geneva UN Charter on Sustainable Housing

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Thank you for your attention!

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