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Mapping of Existing Technologies to Enhance Energy Efficiency in Buildings in the UNECE Region

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Introduction

Objectives of the Study

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- To strengthen understanding of the UNECE member states on the potential impact of energy efficiency (EE) technologies in the buildings sector.
- Analyze and evaluate the correlation between the strictness and enforcement of existing standards, and the level of applied technologies.
- Analyze gaps between existing energy efficient technologies in buildings vis-à-vis application and adaptation.
- Review and assess the application and adaption of the relevant technologies at the nation level. Gaps are identified and analyzed in 5 main areas: knowledge, technical, regulatory, institutional, and financial.

Introduction

Objectives of the Study

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Building upon previous research

Mapping of Existing Energy Efficiency Standards and Technologies in Buildings	Mapping of Existing Technologies to Enhance Energy Efficiency in Buildings
Objective to identify which building energy efficiency standards are used by UNECE member States.	Objective of the study is to examine and analyze the current status of energy efficiency in buildings.
Aims to improve the knowledge of UNECE member States of existing energy efficiency standards and collect best practices related to existing standards. The goal is to develop and implement more effective energy efficiency policies in buildings in the UNECE region.	Aims to highlight the difference in the use of technologies among countries of the UNECE region and examine the correlation (if it exists) between the strictness and enforcement of existing standards and the level of applied technologies.
Methodology - survey, desktop research, and stakeholder engagement.	Methodology - desktop research and consultation with stakeholders.

Methodology

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Sub-region A		Sub-region B	Sub-region D
• Andorra • Austria • Belgium • Denmark • Finland • France • Germany • Greece • Iceland • Ireland • Italy • Liechtenstein	• Luxembourg • Monaco • Netherlands • Norway • Portugal • San Marino • Spain • Sweden • Switzerland • United Kingdom and Northern Islands	• Bulgaria • Croatia • Cyprus • Czech Republic • Estonia • Hungary • Latvia • Lithuania • Malta • Poland • Romania • Slovakia • Slovenia	• Canada • United States

Methodology

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Sub-region C	Sub-region E
• Albania • Armenia • Azerbaijan • Belarus • Bosnia and Herzegovina • Georgia • Israel • Kazakhstan • Kyrgyzstan • Montenegro	• Republic of Moldova • Russian Federation • Serbia • Tajikistan • The Former Yugoslav Republic of Macedonia • Turkey • Turkmenistan • Ukraine • Uzbekistan

Methodology

The first stage of the country analysis was based on a detailed overview of the following legislative documents adopted on the governmental level:

- National law decrees,
- National building standards, norms, and energy codes
- Other prescriptive documents determining non-obligatory requirements

Within the second stage, the following sources have also been considered:

- Country-specific reports on building energy efficiency, international directives
- Academic literature and news articles
- Market information
- Corporate suppliers and vendors
- Country-specific details reflecting implementation of EE technologies (e.g. availability of energy sources & fossil fuel resources depending on regional climatic zones)

Data Collection

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The data collected to measure and analyse the trends and patterns of application of energy efficient technologies is based on the following assessment criteria. The implementation of each technology in each country was evaluated by an impact score as defined below.

Impact Score	Assessment Criteria
10 (High)	The technology is strongly prevalent. There is governmental support and initiative to support promotion of the technology and there are active measures being undertaken which include financial support and incentives. Application of this technology is mandatory or in a transition phase to becoming mandatory. There could be fines for non-compliance. This technology might be made affordable and economically feasible through means of incentives and being widely implemented.
6 (Medium)	National legislation (laws building energy codes etc.) does not require implementation of this technology. There are only some cases when implementation of this technology is supported on the regional level (e.g. in some climate zones etc. but not in the whole country). Some prescriptive recommendations may exist in the legislative documents. This technology is frequently implemented during new construction or retrofits; despite the lack of proper regulatory framework it may be affordable and widely used. There is a moderate trend of implementation for the technology but there are still some gap areas which exist. This could be improved with public-private partnerships government support push-pull marketing strategies compliance standards and financial incentives.

Data Collection

Impact Score	Assessment Criteria
2 (Low)	Existing legislation does not require implementation of this technology. There are also no specific building energy codes that describe at least prescriptive requirements. This technology is only seldom implemented in some regions (including demo-projects implemented by the international public organizations and co-financed by the various funds). The technology is likely economically inefficient. It is being implemented but at a stage of infancy; market barriers exist which curtail adaptation. Much is mentioned about it in policies but there is not substantial applicability and efforts are required to promote the technology.
0 (Non-applicable)	Implementation of this technology is not economically feasible and not mandatory. This technology is not applicable (only in some specific cases).
NI – No Information	No information as of now on the data point.

Data Collection

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	Retrofit				New construction			
	MFB	SFB	CB	PB	MFB	SFB	CB	PB
3.1Building envelope and glazing								
Insulation of external walls	6	2	6	6	10	2	10	10
Insualtion of attic/ground floor slab	6	2	6	6	10	2	10	10
Insulation of roof	6	2	6	6	10	2	10	10
Installation of new modern EE windows	6	6	6	6	10	6	10	10
Arrangement of new entrance/entrance doors	6	0	6	6	10	0	10	10

The following buildings types were analysed:

- MFB – multi-family buildings
- SFB – single-family buildings
- CB – commercial buildings
- PB – public buildings

Two categories for analysis:

- Retrofit – any type of buildings (MFBSFBCBPB) under renovation
- New construction

Data Collection

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	Kazakhstan							
	Retrofit				New construction			
	MFB	SFB	CB	PB	MFB	SFB	CB	PB
3.1Building envelope and glazing								
Insulation of external walls	10	2	10	10	10	2	10	10
Insualtion of attic/ground floor slab	10	2	10	10	10	2	10	10
Insulation of roof	10	2	10	10	10	2	10	10
Installation of new modern EE windows	10	6	10	10	10	6	10	10
Arrangement of new entrance/entrance doors	10	0	10	10	10	0	10	10
3.2 Heating/Domestic hot water/cold water supply								
3.2.a Improvement of decentralized heating source								
Installation of new gas-fired boilers	6	6	6	6	6	6	6	6
Installation of new diesel boilers	2	2	2	2	2	2	2	2
Installation of new electrical boilers	2	2	2	2	2	2	2	2
Installation of new coal boilers	6	6	6	6	6	6	6	6
Installation of new biomass boilers	2	2	2	2	2	2	2	2
Installation of sollar collector system	2	2	2	2	2	2	2	2
Installation of heat pumps	2	0	2	2	2	0	2	2
3.2.b Improvement of centralized heating source								
Installation/arrangement of new individual heat point with wheater compensation control	10	0	10	10	10	0	10	10
3.2.c Common measures								
Insulation of pipes, equipment	6	0	6	6	6	0	6	6
Installation of balancing and individual thermostatic valves	10	2	10	10	10	2	10	10
Installation of pumps, radiators, heat exchangers with high efficiency factor	10	0	10	10	10	0	10	10
Application of FCD for the heating, water pumps	10	0	10	10	10	0	10	10
Occupancy sensors for cold water supply system (water taps, flushing)	0	0	0	0	0	0	2	0
Waste water technologies for recuperation of heat for DHW	0	0	0	0	0	0	0	0
3.3 Air conditioning, Ventilation and Cooling								
Application of air recuperators	2	0	2	2	2	0	2	2
Application of FCD for the pumps, fans, AHU control	0	0	0	0	0	0	0	0
Installation of VAC equipment with high efficiency factor	10	0	10	10	10	0	10	10
Application of variable flow cooling system	0	0	0	0	0	0	0	0
Insulation of distribution pipes	6	0	6	6	6	0	6	6
Installation of balancing and individual thermostatic controls	10	2	10	10	10	2	10	10

Relevant existing energy efficiency technologies were divided into five broad categories

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- Building envelope and glazing
- Heating/Domestic hot water/Cold water supply
- Air conditioning Ventilation and Cooling
- Appliances
- Lighting

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Building Envelope: Insulation and Glazing

- Insulation of external walls
- Insulation of attic/ground floor slab
- Insulation of roof
- Installation of new modern EE windows
- Arrangement of new entrance/double doors

Heating domestic hot and cold water supply

Improvement of decentralized heating source

Improvement of centralized heating source

Common measures

Different approaches to heat supply system depend largely on the availability of energy prices, infrastructure technological development, and energy policy of the respective country

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Heating domestic hot and cold water supply

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Improvement of decentralized heating source

- Installation of new boilers
- Installation of solar collector system
- Installation of heat pumps

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Heating domestic hot and cold water supply

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Improvement of centralized heating source

- Installation/arrangement of new individual heat point with weather compensation controls

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Heating domestic hot and cold water supply

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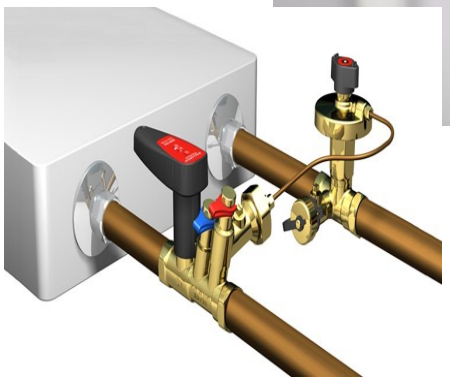
Common measures

- Insulation of pipes
- Installation of balancing and individual thermostatic valves
- Installation of pumps radiators heat exchangers with high efficiency factor
- Application of FCD for the heating water pumps
- Occupancy sensors for cold water supply system (water taps, flushing)
- Waste water technologies for recuperation of heat for DHW



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Air conditioning Ventilation and Cooling

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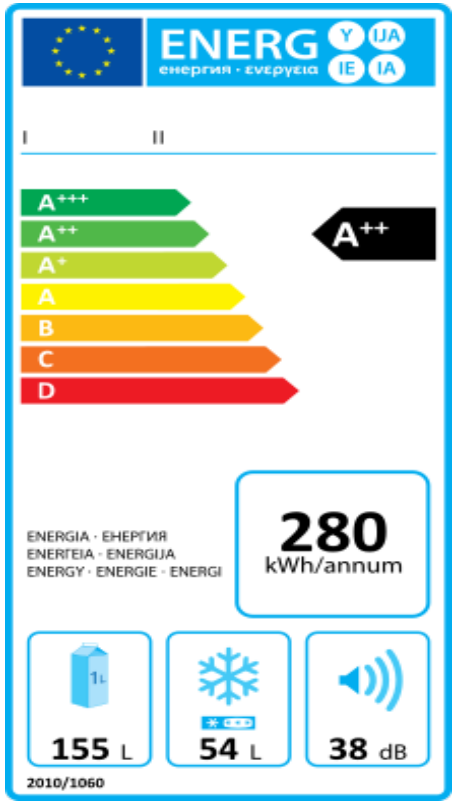
Air conditioning Ventilation and Cooling

- Application of heat air recuperator
- Application of FCD for the pumps fans AHU control
- Installation of VAC equipment with high efficiency factor
- Application of variable flow cooling system
- Insulation of distribution pipes
- Installation of balancing and individual thermostatic controls

Data Collection

Appliances

Energy efficient appliances (EE labeling)



Data Collection

Lighting

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Modernization of existing building lighting system

- Installation of new EE lamps (LED/CFL)
- Occupancy/vacancy/daylight sensors
- Exterior lighting control
- Application of ''day light'' solution in architecture

Conclusions

- Energy efficiency in the building sector is improving only incrementally and in disjoint fragments.
- This is particularly surprising, given that recent advances in technology design have yielded remarkable advancements in efficiency and this trend is expected to continue. For example, energy efficient boilers and windows commercially available but inconsistent application.
- The substantial gaps between what is available in the market and what is used makes it clear that implementation, rather than just technical advancement, is key to increasing energy efficiency.

Conclusions
Case Study

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Source: FT Times, EU Energy special report

Less is more as domestic energy consumption falls

Environmentally conscious consumers have regulators to thank for reduced energy use

A wave of regulation has meant that household appliances — from fridges to lightbulbs — have become significantly more efficient, contributing to a reduction in energy consumption.

The EU first introduced compulsory labelling for household appliances, rating them on a scale of A (most efficient) to G (least efficient) in 1995. This was followed by the Ecodesign directive in 2009, which sets out minimum performance standards, removing the least efficient appliances from the market.

When the EU announced these plans, household appliance manufacturers were resistant, says Sian Lewis, of the Association of Manufacturers of Domestic Appliances. “But now they are ever so enthusiastic,” she says. Energy efficiency, therefore, has become a selling point, says. “The industry, having not wanted the labels in the first place, really dedicated a lot of time and energy and resources into investing in saving energy.”

Conclusions

- The research study analyses the public policy and results achieved by UNECE member States
- Identifies the differences and best practices in the buildings sector

The analysis entails:

- Gap analysis,
- Barriers of implementation,
- Comparative assessment of adaptation

of the five energy efficiency technology types to understand the current energy efficiency technology trends in the building sector.

Recommendations

Policy and Legislation

- The UNECE region countries should consider going beyond the EU directives and promote energy efficiency policies that are more locally-nuanced. Energy efficiency policies should be made while considering the local perspectives and challenges.

Investment and Finance

- Substantial financial barriers to households taking advantage of energy efficiency opportunities still remain. To help overcome the complexity of investments and lack of capacity at the individual and suppliers level, Energy Service Companies (ESCO) should be more heavily promoted by Governments.

Recommendations

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Technological Adaptation

- Building simulation software tools can effectively assess the performance of energy efficiency technology from a holistic, performance-based criteria perspective. Such systems can even use localized climate data, utility tariffs, and fuel costs. The information generated by using such models could produce dynamic energy production and consumption simulations to find the optimal energy efficiency solution for each property.

Capacity Development

- Energy efficiency and renovations are essential elements of lifecycle management, a discipline that has so far been largely neglected in education, in favor of courses focusing on new development. Courses are needed for both young people and mature students, and for both new recruits and professionals.

Recommendations

Role of Public and Private Sector

- Government plays a central role in supporting economic growth. It needs to provide good policy, strong institutions, and efficient public services to ensure the private sector can thrive. Governments must also commit to develop and sustain the institutions that implement, oversee, and regulate those policies. This is the enabling environment that encourages the private sector to invest. The private sector is critical to economic growth, but it cannot and does not act alone, a balanced strategy is required, an example is the “Technology push and Market pull strategy”.

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Thank you!

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