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

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Objectives of the study

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- To strengthen understanding of the UNECE member States on the potential impact of energy efficiency (EE) standards and 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 their application and adaptation.
- Review and assess the application and adaption of the relevant technologies at the national level.

Scope of the study: 54 countries analysed based on a detailed overview of international directives, national legislation, prescriptive documents determining non-obligatory requirements, country-specific reports on building EE, academic literature and news articles, market information, etc. The results of the country analyses were consulted with national experts, members of the JTF on EE Standards in Buildings.

Methodology (1)

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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
3 (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.
2 (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. 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.
1 (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. The technology is likely economically inefficient.
0 (Non-applicable)	Implementation of this technology is not economically feasible and not mandatory. This technology is not applicable (only in some specific cases).

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Methodology (2)

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	Ukraine							
	Retrofit				New construction			
	MFB	SFB	CB	PB	MFB	SFB	CB	PB
3.1Building envelope and glazing								
Insulation of external walls	3	0	3	3	3	0	3	3
Insulation of attic/ground floor slab	3	0	3	3	3	0	3	3
Insulation of roof	3	0	3	3	3	0	3	3
Installation of new modern EE windows	3	2	3	3	3	2	3	3
Arrangement of new entrance/entrance doors	3	0	3	3	3	0	3	3
3.2 Heating/Domestic hot water/cold water supply								
3.2.a Improvement of decentralized heating source								
Installation of new gas-fired boilers	2	2	2	2	2	2	2	2
Installation of new diesel/oil boilers	1	1	1	1	1	1	1	1
Installation of new electrical boilers	2	2	2	2	2	2	2	2
Installation of new coal boilers	2	2	2	2	2	2	2	2
Installation of new biomass boilers	3	3	3	3	3	3	3	3
Installation of solar collector / solar cooling systems	1	1	1	1	1	1	1	1
Installation of heat pumps	3	3	3	3	3	3	3	3

Relevant existing energy efficiency technologies were divided into five broad categories: Building envelope and glazing; Heating/Domestic hot water/Cold water supply; Air conditioning Ventilation and Cooling; Appliances; Lighting

The following buildings types were analysed both for retrofits and new construction: MFB – multi-family buildings, SFB – single-family buildings, CB – commercial buildings, PB – public buildings

Methodology (3)

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Sub-region A		Sub-region B	Sub-region C	Sub-region E
• Andorra • Austria • Belgium • Denmark • Finland • France • Germany • Greece • Iceland • Ireland • Italy • Liechtenstein	• Luxembourg • Monaco • Netherlands • Norway • Portugal • Spain • Sweden • Switzerland • United Kingdom	• Bulgaria • Croatia • Cyprus • Czech Republic • Estonia • Hungary • Latvia • Lithuania • Malta • Poland • Romania • Slovakia • Slovenia	• Albania • Bosnia and Herzegovina • Montenegro • Serbia • The Former Yugoslav Republic of Macedonia	• Armenia • Azerbaijan • Belarus • Georgia • Kazakhstan • Kyrgyzstan • Republic of Moldova • Russian Federation • Tajikistan • Turkmenistan • Ukraine • Uzbekistan
	Sub-region F • Turkey		**Sub-region D** • Canada • United States	

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Examples of country analyses (1)

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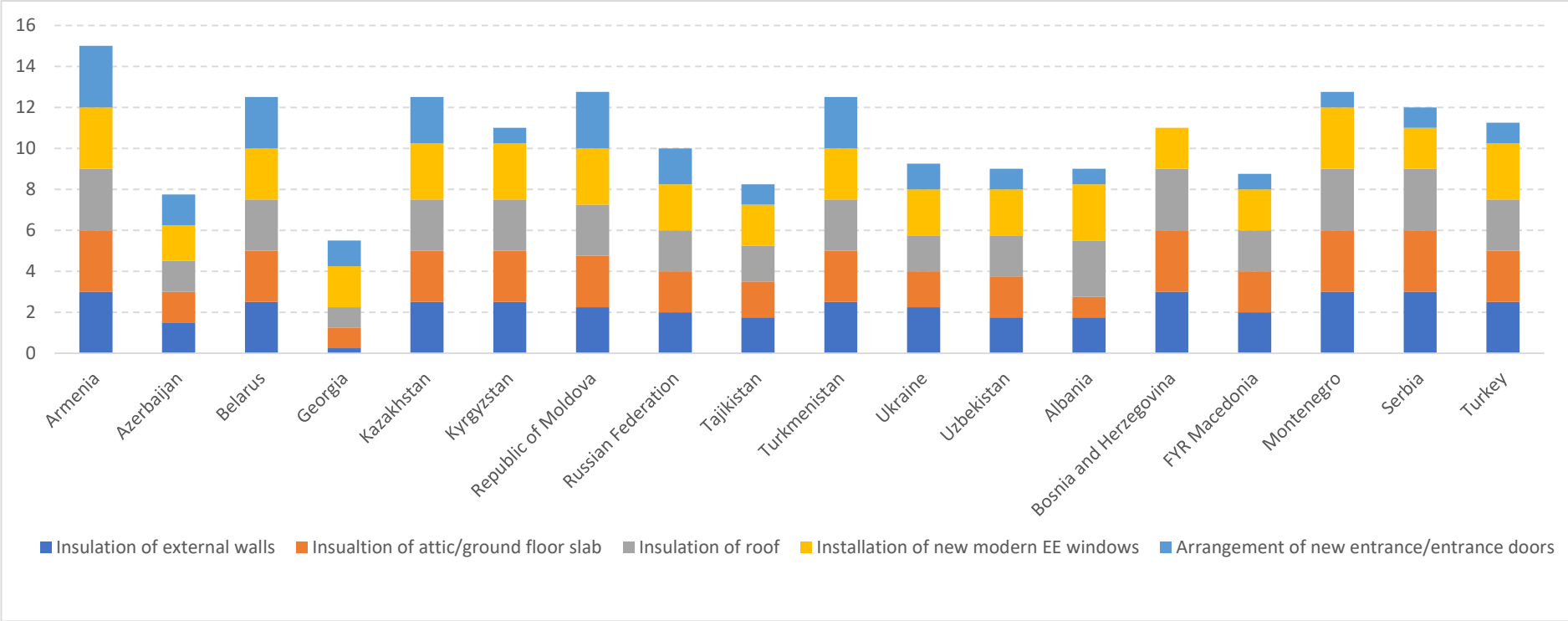
Technology mix of envelope modernization, existing buildings, sub-regions C, E, and F



*each bar in each stack represents the average impact score for the technology category, across all building types, for a given country

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Examples of country analyses (2)

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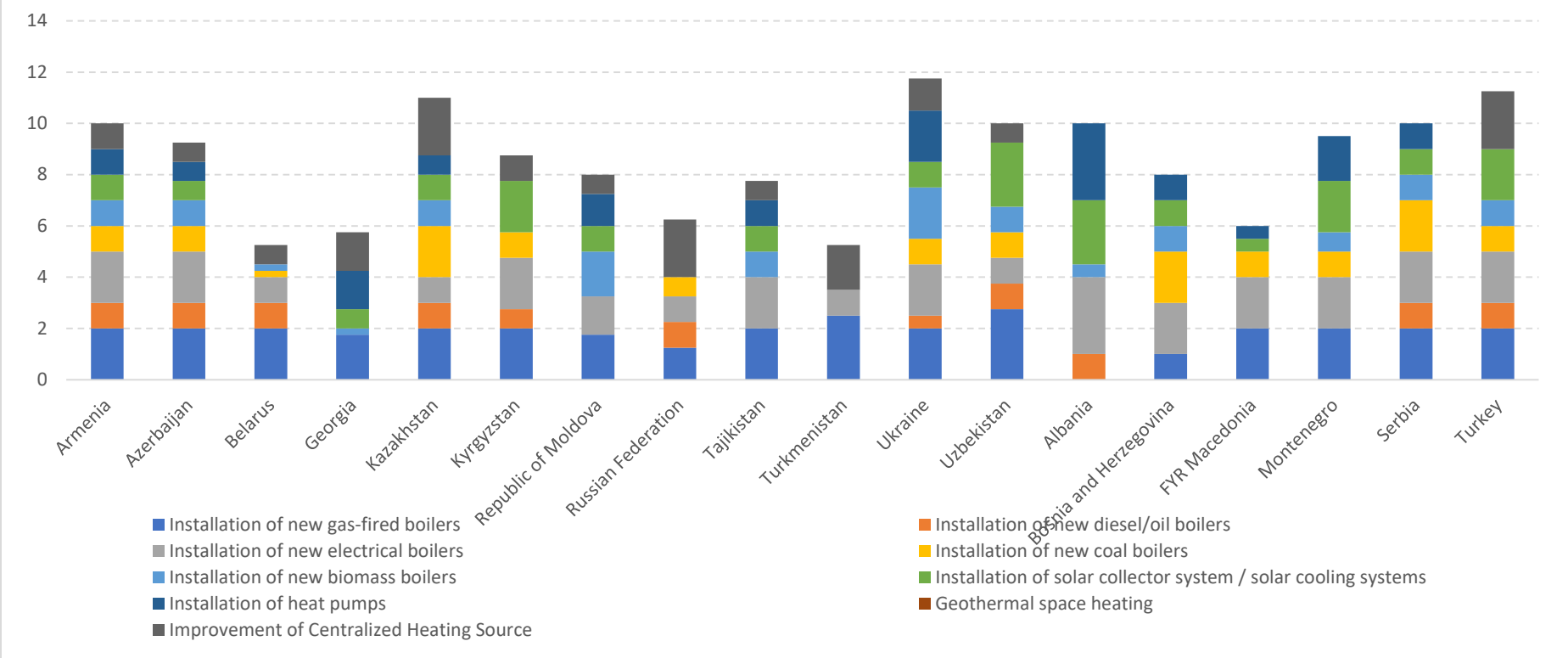
Technology mix for heating, existing buildings, sub-regions C, E, and F



*each bar in each stack represents the average impact score for the technology category, across all building types, for a given country

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Examples of country analyses (3)

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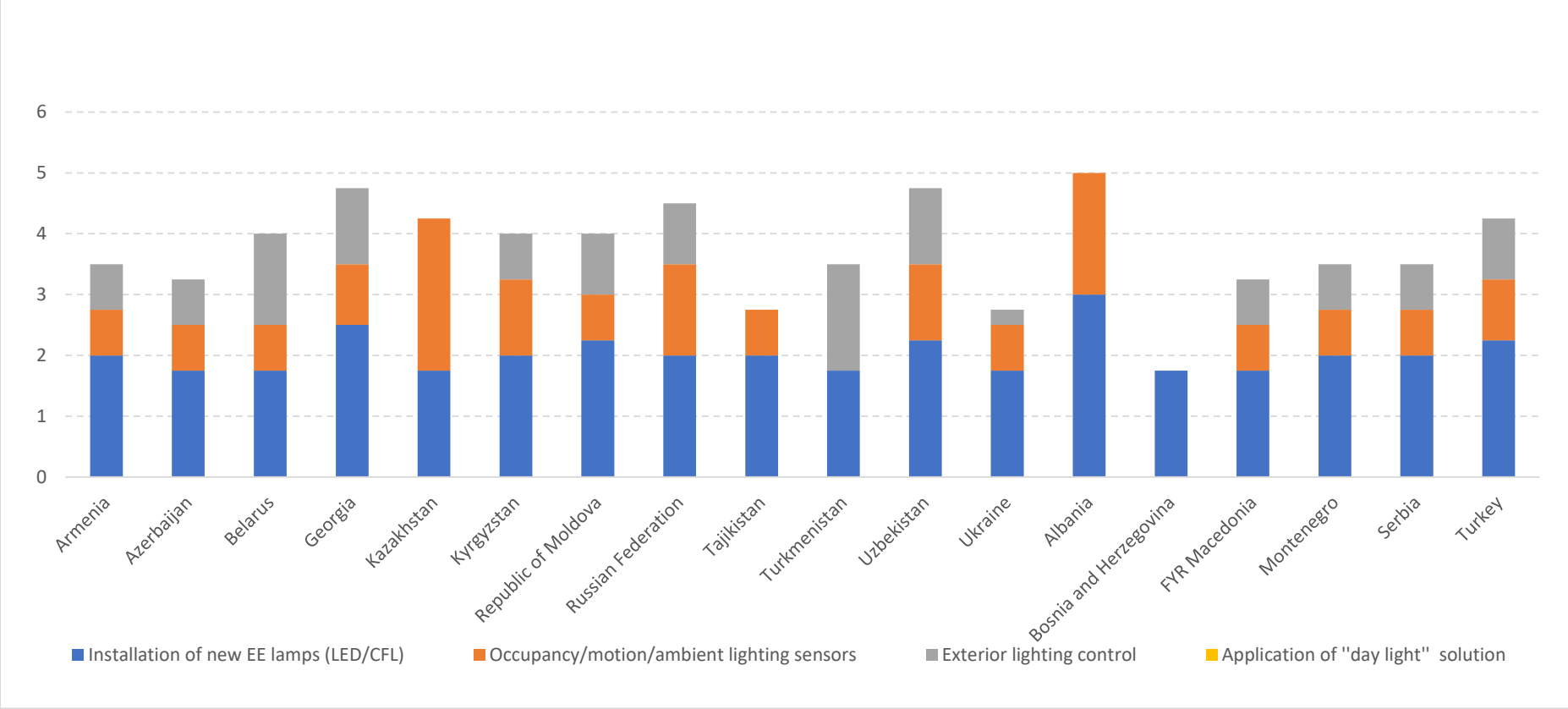
Application of lighting technologies, sub-regions C, E, and F, new construction



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Main Conclusions

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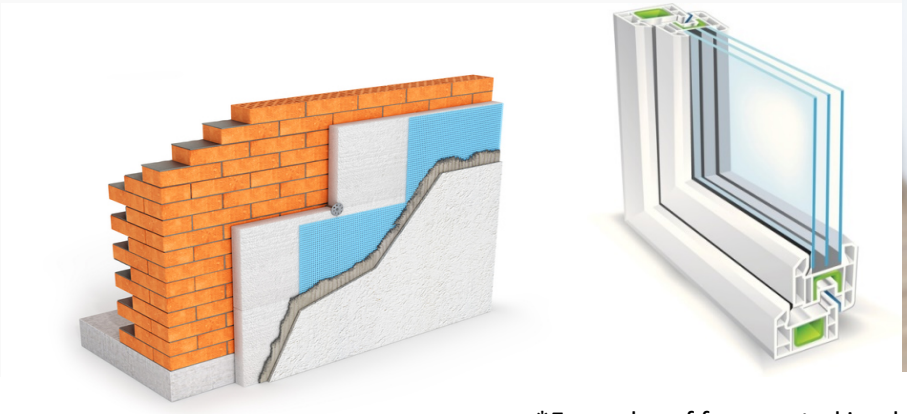
- **Countries** in Eastern and South-Eastern Europe, the Caucasus, and Central Asia, and the Russian Federation, **which traditionally have low domestic energy prices, have significantly increased mandatory energy efficiency requirements**, especially for the newly constructed buildings.
- However, **energy efficiency in the buildings sector is improving only incrementally and somewhat inconsistently**.



*Examples of fragmented implementation of EE technologies

Main Conclusions (cont.)

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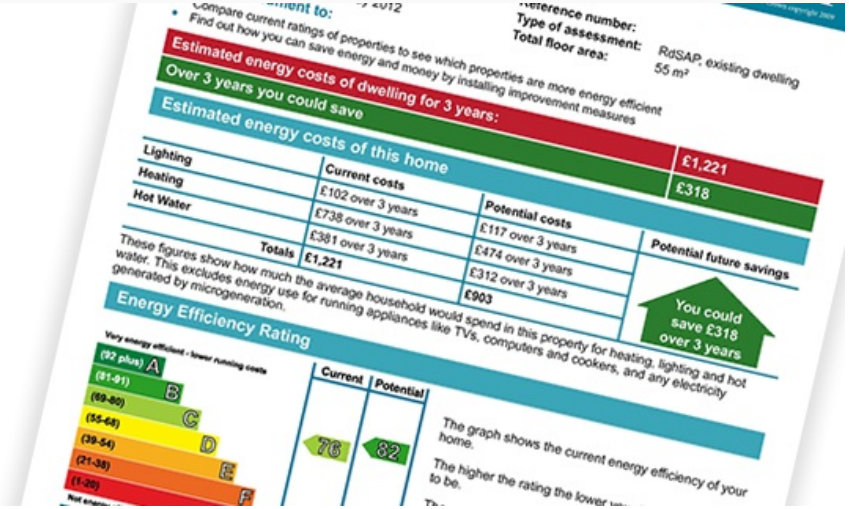
- **Positive correlation** between existence, scope, and stringency of **building standards** and application of **energy efficient technologies** and their diverse mix has been identified.
- **Energy performance certificates have accelerated retrofitting** of existing buildings but much needs to be done.



Main Conclusions (cont.)

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- Most countries in the UNECE region have banned, or are phasing out, incandescent light bulbs in favour of CFL and LED technologies. **Lighting sensors and controls are being implemented less frequently.**
- EU countries **show increased adoption of high energy efficiency boilers**, along with shifts to cleaner fuel sources. However, **strong concerns remain regarding the use of coal for residential space heating.**

*Examples of modern gas-fired boilers

Selected Recommendations

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1. Governments need to provide good policy, strong institutions, and efficient public services to ensure that the private sector can thrive; they must also commit to develop and sustain the institutions that implement, oversee, and regulate these policies.
2. Governmental research and development programmes should be designed to advance technologies which are currently too risky for the private sector to apply, which will require transparent collaboration between government, industry, and energy programme administration.
3. Governments should undertake initiatives to raise the bar for developing energy efficient technologies in buildings locally, which can also create access to new international markets.

Selected Recommendations (cont.)

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4. Governments of countries, in which coal is still used for residential heating because of its low cost, should promote the use of other fuels to drive the adoption of cleaner technologies. Installation of increased efficiency coal-fired boilers should be encouraged only in the short term as a stop-gap measure.

5. Local governments should publish city-level data demonstrating both decreased energy costs and higher income associated with higher levels of energy performance certification to promote building energy efficiency investments.

6. Governments could create tiered energy tariffs linked to EPC rating as buildings with higher ratings use energy less and / or more efficiently, and hence owners are directly compensated for the investment.

Selected Recommendations (cont.)

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7. Governments should promote creation of datasets and tools which guide analysis of, and demonstrate, the financial benefits of increasing energy efficiency through retrofitting existing buildings.

8. Governments should develop and promote various financial mechanisms to increase the uptake of energy efficiency projects across the buildings sector: individual, public and commercial.

9. Courses and programmes focused on renovation of existing buildings should be made part of standard civil engineering educational and training curricula because this discipline has so far been largely neglected in education in favour of courses focusing on new construction.

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Thank you!

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United Smart Cities: Implementing Smart Sustainable Cities approaches worldwide