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

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New UNECE study

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About UNECE | Our work | Themes | Where we work | Open UNECE | Events | Publications | Media

UNECE SUSTAINABLE ENERGY AREAS OF WORK / ENERGY EFFICIENCY / ACTIVITIES / ENERGY EFFICIENCY IN BUILDINGS

- Sustainable Energy
- Energy Efficiency
- Activities
  - Energy Efficiency in Industry Sector
  - Energy Efficiency in Buildings
  - Addressing Barriers to improve Energy Efficiency
- GEEE Bureau
- Meetings and Events
- Publications
- Media
- Past Activities

Energy Efficiency in Buildings

Admitting holistic approach to building design, delivery and operation and a paradigm that envisions buildings as energy producers and not solely or primarily as energy sinks, UNECE develops framework guidelines for energy efficiency standards in buildings, conducts research on existing energy efficiency standards and technologies in buildings in the UNECE region, etc.

Documents	ENG	FRE	RUS
Study on Mapping of Existing Technologies to Enhance Energy Efficiency in Buildings in the UNECE Region (March 2019):	PDF		
1. Country Sheets CIS Countries	PDF		
2. Country Sheets EU-North America	PDF		
Study on Mapping Energy Efficiency Standards and Technologies in Buildings in the UNECE Region (August 2018)	PDF		PDF
Framework guidelines for energy efficiency standards in buildings ECE/ENERGY/GE.6/2017/4	PDF	PDF	PDF

Meetings

Outcomes of the UNECE project on Energy Efficiency Standards in Buildings - Fifth Meeting of the UNECE Joint Task Force on Energy Efficiency Standards in Buildings, Yerevan, Armenia (14-15 March 2019)

This web page is available at:
http://www.unece.org/energywelcome/areas-of-work/energy-efficiency/activities/energy-efficiency-in-buildings.html

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 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)

	Armenia							
	Retrofit				New construction			
	MFB	SFB	CB	PB	MFB	SFB	CB	PB
3.1Building envelope and glazing								
Insulation of external walls	3	3	3	3	3	3	3	3
Insualtion of attic/ground floor slab	3	3	3	3	3	3	3	3
Insulation of roof	3	3	3	3	3	3	3	3
Installation of new modern EE windows	3	3	3	3	3	3	3	3
Arrangement of new entrance/entrance doors	3	3	3	3	3	3	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	1	1	1	1	1	1	1	1
Installation of new biomass boilers	1	1	1	1	1	1	1	1
Installation of solar collector system / solar cooling systems	1	1	1	1	1	1	1	1
Installation of heat pumps	1	1	1	1	1	1	1	1
3.2.b Improvement of centralized heating source								
Improvement of Centralized Heating Source	1	1	1	1	1	1	1	1
3.2.c Common measures								
Insulation of pipes, equipment	1	1	1	1	1	1	1	1
Installation of balancing and individual thermostatic valves	1	1	1	1	1	1	1	1
Installation of pumps, radiators, heat exchangers with high efficiency factor	1	1	1	1	1	1	1	1
Application of FCD for the heating, water pumps	1	1	1	1	1	1	1	1
Occupancy sensors for cold water supply system (water taps, autoflush)	0	0	1	0	0	1	0	0
Waste water technologies for recuperation of heat for DHW	1	1	1	1	1	1	1	1
Smart meters	1	0	1	1	1	0	1	1

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

- Andorra
- Austria
- Belgium
- Denmark
- Finland
- France
- Germany
- Greece
- Iceland
- Ireland
- Italy
- Liechtenstein
- Luxembourg
- Monaco
- Netherlands
- Norway
- Portugal
- Spain
- Sweden
- Switzerland
- United Kingdom

Sub-region F

- Turkey

Sub-region B

- Bulgaria
- Croatia
- Cyprus
- Czech Republic
- Estonia
- Hungary
- Latvia
- Lithuania
- Malta
- Poland
- Romania
- Slovakia
- Slovenia

Sub-region C

- Armenia
- Azerbaijan
- Belarus
- Georgia
- Kazakhstan
- Kyrgyzstan
- Republic of Moldova
- Russian Federation
- Tajikistan
- Turkmenistan
- Ukraine
- Uzbekistan

Sub-region D

- Canada
- United States

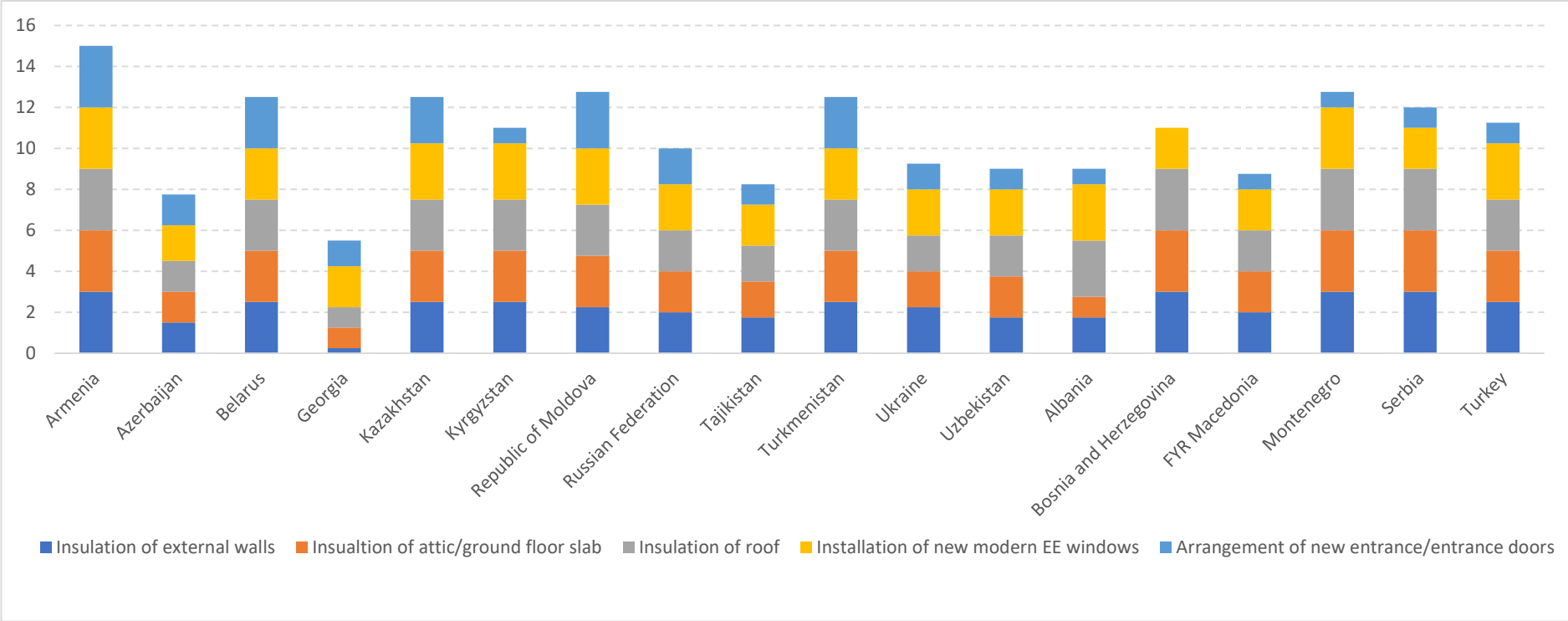
Sub-region E

- Albania
- Bosnia and Herzegovina
- North Macedonia
- Montenegro
- Serbia

Examples of country analyses (1)

ENERGY

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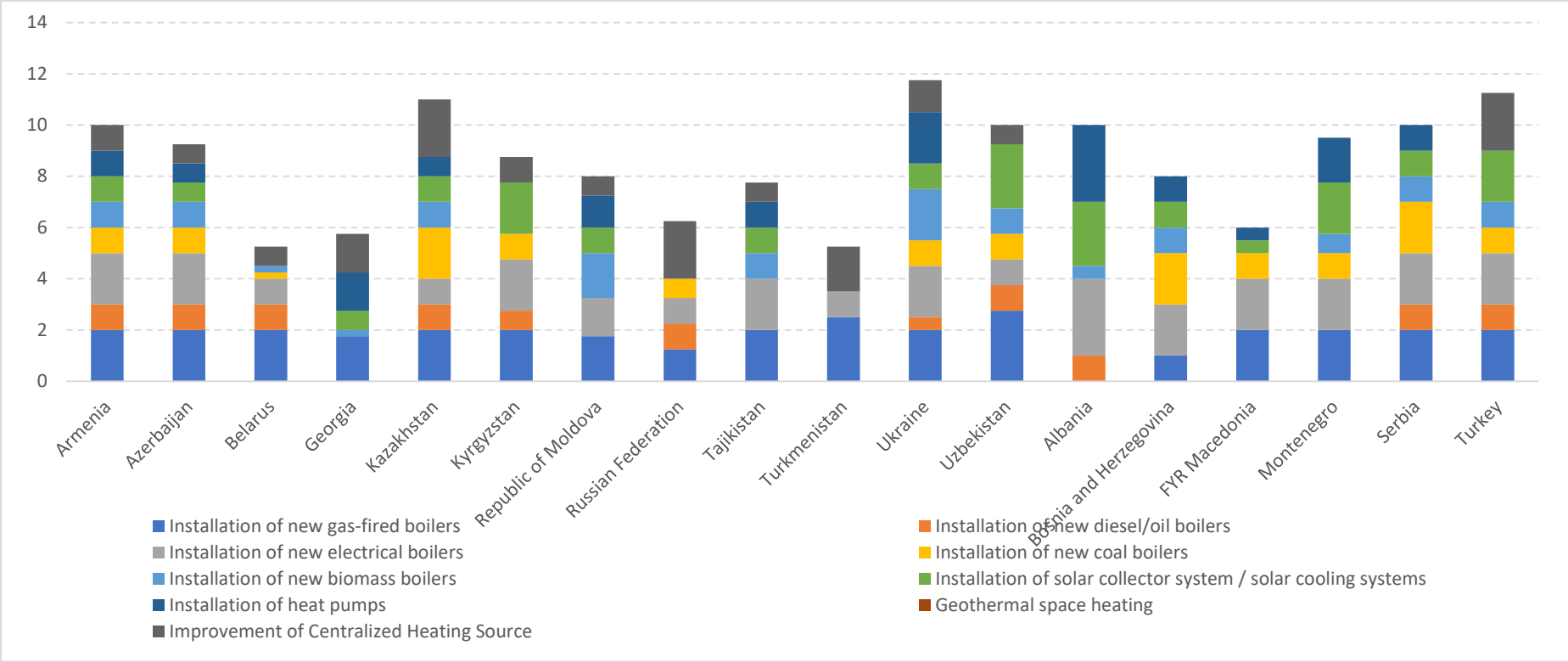
Technology mix for heating, existing buildings, sub-regions C, E, and F



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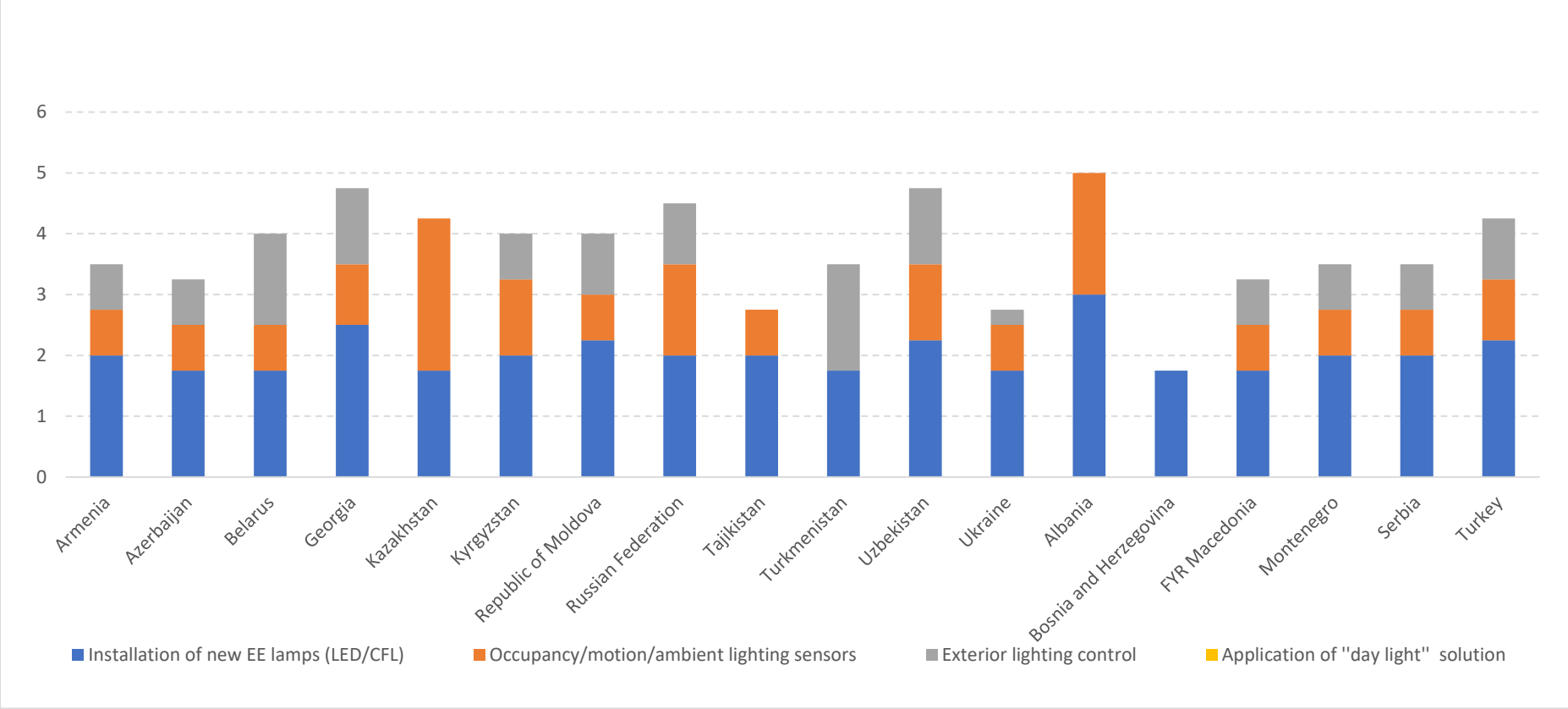
Application of lighting technologies, sub-regions C, E, and F, new construction



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Main Conclusions

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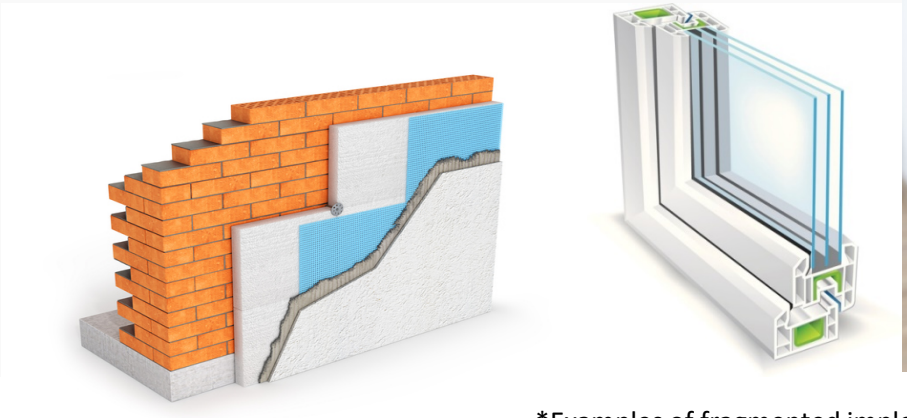
- **Energy efficiency in buildings is improving in all regions**. **Countries** in Eastern and South-Eastern Europe, the Caucasus, and Central Asia, and the Russian Federation, **which traditionally have low domestic energy prices, have significantly increased mandatory energy efficiency requirements**, 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.)

ENERGY

- **Three types of public policy tools are particularly successful at supporting energy efficiency improvements in buildings** (regulations – i.e. building standards; financial incentives – rebates, reduced-rate debt, tax deductions; and information awareness programmes).
- **Positive correlation** between existence, scope, and stringency of **building standards** and application of **energy efficient technologies** and their diverse mix has been identified. Countries with comprehensive and stringent building standards in place tend to have higher penetration rates of energy efficient technologies.

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Main Conclusions (cont.)

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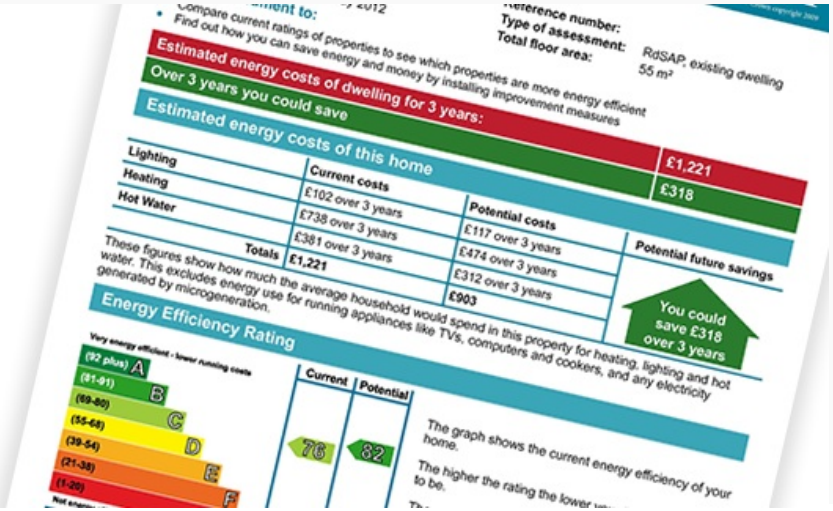
- **Effective design and implementation of public policy is key to increasing energy efficiency.** The substantial gaps between what is available in the market and what is being used makes it clear that effective governance and use of legal and financial instruments, rather than just technical advancement, are key.
- **Energy performance certificates have accelerated retrofitting** of existing buildings but much needs to be done.


Compare current ratings of properties to see which properties are more energy efficient
Find out how you can save energy and money by installing improvement measures

Reference number:
Type of assessment: RdSAP, existing dwelling
Total floor area: 55 m²

Estimated energy costs of dwelling for 3 years: £1,221
Over 3 years you could save £318

Estimated energy costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£102 over 3 years	£117 over 3 years	You could save £318 over 3 years
Heating	£738 over 3 years	£474 over 3 years	
Hot Water	£381 over 3 years	£312 over 3 years	
Totals	£1,221	£903	

These figures show how much the average household would spend in this property for heating, lighting and hot water. This excludes energy use for running appliances like TVs, computers and cookers, and any electricity generated by microgeneration.

Energy Efficiency Rating

Very energy efficient - lower running costs
(92 plus) A
(81-91) B
(69-80) C
(55-68) D
(39-54) E
(21-38) F
(1-20) G

Current 76 | Potential 82

The graph shows the current energy efficiency of your home.

The higher the rating the lower ... to be.

Main Conclusions (cont.)

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- **Three specific technology trends can be clearly observed:**
  - 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.
  - With the implementation of labelling and Ecodesign regulations, the **adoption of energy efficient appliances is on an upward trend.**
  - Most countries in the UNECE region **have banned, or are phasing out,** incandescent light bulbs in favour of compact fluorescent lamp (CFL) and light-emitting diode (LED) technologies. However, lighting sensors and controls are being implemented less frequently.

*Examples of modern gas-fired boilers

Main Conclusions (cont.)

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- **In addition to the numerous environmental benefits associated with decreased energy consumption and increased generation of renewable electricity, many of the technologies discussed in this report offer additional non-energy related social benefits, e.g.:**
  - boosting economic growth,
  - developing local competitive markets,
  - increasing employment,
  - promoting implementation of lower-cost and accessible energy efficient technologies,
  - and developing international markets.

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.
4. Governments should explicitly connect building energy efficiency measures to INDC targets to further encourage improvement.

Recommendations (cont.)

ENERGY

5. 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.

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

7. Governments should use EPC in a more expended way: e.g. by creating tiered energy tariffs linked to EPC rating or linking other incentives to EPC rating.

Recommendations (cont.)

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8. Governments should scale up effective promotion and awareness campaigns which are essential to encourage consumers to purchase appliances labelled with high energy efficiency ratings.

9. More stringent regulations are needed to promote exterior and interior lighting in non-residential buildings and develop social pricing structures for homeowners to install smart meters.

10. 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.

11. Governments should develop and promote programmes to encourage complete retrofit of decrepit and condemned residences, involving private real estate investors or developers.

Recommendations (cont.)

ENERGY

12. National and local governments need to coordinate and work together to design policies and building codes which can be adopted either nationally or locally; performance-based building codes should be preferred to prescriptive codes, as the flexibility should increase compliance.

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

14. Financial institutions should be empowered to understand the profitability of energy efficiency investments; this would require more effective promotion and dissemination of best practices, appropriate de-risking, and financing solutions for bankers. Clear technical and financial criteria should be defined by the financial institutions to grant loans.

15. 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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