HI-SMART

HI-SMART: HIGHER EDUCATION PACKAGE FOR NEARLY ZERO ENERGY AND SMART BUILDING DESIGN

MODULE #1

CHAPTER 3: REQUIREMENTS, CERTIFICATES, AUDITS

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To monitor the efficiency of a given building and design its development/refurbishment to an even better performing level, a status quo analysis is needed. Energy performance certificates (EPC) and energy audits (EA) are the main tools for this purpose, both of them giving an overview on energy consumption/needs and advice on how to raise energy performance. The differences between them are presented below.

	EPC	Energy audits
Regulated by	EPBD + national regulations	EED, EN 16247 standard
Focus on	all buildings and building units with some exceptions	industrial and large buildings, corporations
Based on	mostly asset method (calculations), in certain countries and cases operational method (historical data)	both asset method (calculations), and operational method (historical data)
Due	- when a new building is built - when a building or building unit is sold or rented - public buildings	in every 4 years
Inform about	energy performance of the building with standardised user profile	energy performance of the building with real user profile, technology and logistics

Table 1.3.1: Differences of EPCs and energy audits (own compilation)

1.3.1 ENERGY PERFORMANCE CERTIFICATES

The Energy Performance Certificate is a legal document certifying the energy performance of houses and building units by evaluating the entire energy supply system (heating, domestic hot water, cooling, ventilation and lighting) system.

The Energy Performance Certificates are regulated by EPBD as well, because the system of certificates is a crucial tool to promote the energy performance of buildings.

According to the EPBD “Energy performance certificate” means a certificate recognized by a Member State or by a legal person designated by it, which indicates the energy performance

of a building or building unit, calculated according to a methodology adopted in accordance with Article 3 (calculation the energy performance of buildings). Other relevant articles are:

- Article 11: Energy performance certificates
- Article 12: Issue of energy performance certificates
- Article 13: Display of energy performance certificates

The ultimate goal of EPCs is to create a demand-driven market for energy efficiency in the building sector.

EPCs not only provide new and objective information for the building industry (owners, occupants and real-estate actors) to compare and assess buildings, but also can be a transparent tool to justify and design energy efficiency improvements. EPCs will put energy performance into the decision-making process at real-estate transactions by providing recommendations for the cost-effective or cost-optimal upgrading and can potentially influence builders and real estate owners to invest in greater volume in energy performance.

The framework of EPCs is shaped by each member state in order to show the energy performance of a building or building unit, calculated based on a methodology in accordance with the EPBD.

EPCs are obligatory to be produced for every building (and building unit) that

- is newly constructed,
- is sold or rented to a new tenant
- undergoes major renovation (>1000m^2) or
- is a public building where the total useful floor area is over 250 m^2 (due to exemplary reasons).

EPCs include the energy performance of a building and its reference values such as the minimum energy performance requirements. EPCs should include recommendations for the cost-optimal or cost-effective improvements of the energy performance of the building or building unit or even of a building element. These recommendations listed by the creator of the EPC should be technically feasible for the specific building and may provide an estimate for the range of payback periods or cost-benefits over its economic life cycle. An indication as to where the owner or tenant can receive more detailed information shall also be mentioned. Financing possibilities may also be provided to the owner or tenant.

Energy performance can be shown both as quantitative values (e.g., in kWh/m^2*year) and as rating results (A+, A, B, C and so on). The better the rating of a building, the more economically it uses energy, the lower the expected energy costs (presuming proper use of the building).

The transparency is an important requirement of the EPBD, because a copy of the EPC for buildings that are constructed, sold or rented out to a new tenant or buyer shall be shown and handed over to them. And for public buildings with a total floor area of over > 250 m^2 EPCs should be displayed in a room frequently visited by the public.

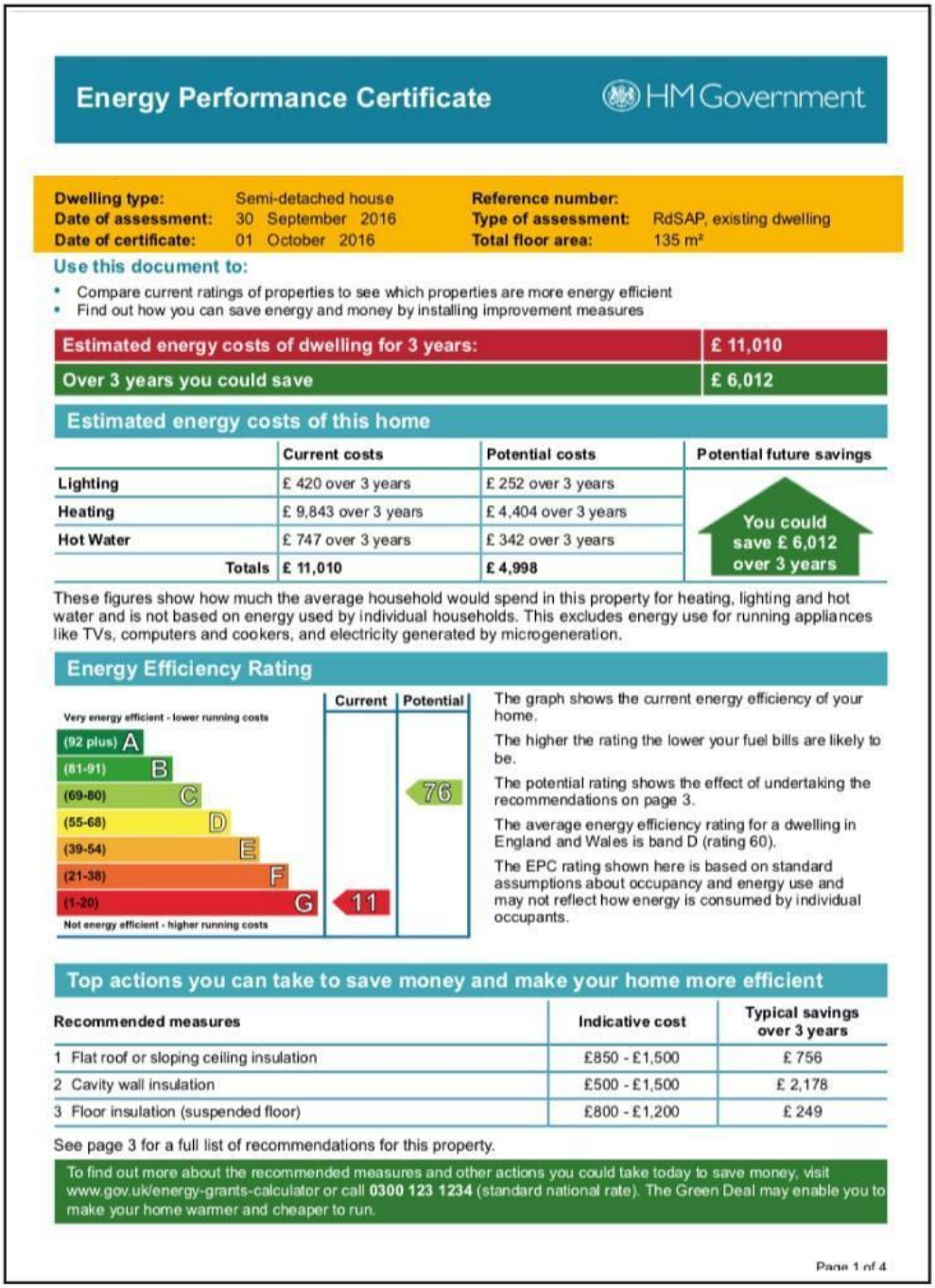
The validity of the energy performance certificate shall not exceed 10 years.

There are two types of calculation methodologies of EPCs: asset rating (using standardized values) and operational rating (based on measured data). Asset rating gives an independent result of users' habit, which is hardly feasible in case of the operational method.

First page of the EPCs summarizes the main results presenting at least:

- basic information on the building,
- date of the certificate,
- the visualized result of the EPC by rating,
- achievable level of performance and main recommendations for reaching it.

(See Figure 1.3.1)



Energy Performance Certificate

HM Government

Dwelling type:	Semi-detached house	**Reference number:**	
Date of assessment:	30 September 2016	**Type of assessment:**	RdSAP, existing dwelling
Date of certificate:	01 October 2016	**Total floor area:**	135 m²

Use this document to:

- 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

Estimated energy costs of dwelling for 3 years:	**£ 11,010**
Over 3 years you could save	**£ 6,012**

Estimated energy costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£ 420 over 3 years	£ 252 over 3 years	You could save £ 6,012 over 3 years
Heating	£ 9,843 over 3 years	£ 4,404 over 3 years	
Hot Water	£ 747 over 3 years	£ 342 over 3 years	
Totals	**£ 11,010**	**£ 4,998**	

These figures show how much the average household would spend in this property for heating, lighting and hot water and is not based on energy used by individual households. This excludes energy use for running appliances like TVs, computers and cookers, and electricity generated by microgeneration.

Energy Efficiency Rating

The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

The EPC rating shown here is based on standard assumptions about occupancy and energy use and may not reflect how energy is consumed by individual occupants.

Top actions you can take to save money and make your home more efficient

Recommended measures	Indicative cost	Typical savings over 3 years
1 Flat roof or sloping ceiling insulation	£850 - £1,500	£ 756
2 Cavity wall insulation	£500 - £1,500	£ 2,178
3 Floor insulation (suspended floor)	£800 - £1,200	£ 249

See page 3 for a full list of recommendations for this property.

To find out more about the recommended measures and other actions you could take today to save money, visit www.gov.uk/energy-grants-calculator or call **0300 123 1234** (standard national rate). The Green Deal may enable you to make your home warmer and cheaper to run.

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Figure 1.3.1: An EPC from UK

Source: https://www.everest.co.uk/epc-energy-performance-certificate-in-depth-guide/

All Member States should create a system in order to ensure that EPCs are carried out in an independent manner by qualified and/or accredited experts. Furthermore, an independent quality control system also should be established to validate the input data, results and recommendations, on-site visit of the building or other equivalent measures.

List of qualified experts and information on performed EPCs shall be publicly available. The responsible authorities shall make a random selection of at least a statistically significant percentage of all energy performance certificates issued annually and subject those certificates to verification.

Table 1.3.2 presents similarities and differences between the regulatory frameworks of High-smart project countries.

	Hungary	**Slovakia**	**Germany**
Bodies in charge of qualified experts' accreditation	Professional association	Governmental body	No accreditation scheme
Registers of qualified and/or accredited experts	Mandatory register	Mandatory register	Voluntary registers
Type of software used to calculate energy performance certificates	Private software	Private software	Private software
On-site visit or inspection requirements to issue an EPC in the case of existing residential buildings	Not required	Required	Not required
Bodies responsible for performing quality checks on energy performance certificates	Professional association	Central governmental body	Central / regional governmental bodies
Calculated (asset rating) or actual energy consumption (operational rating)	Asset rating	Operational rating	Operational rating
Penalty system for qualified experts and/or companies for poor quality of EPC issued	Administrative and monetary penalty	Monetary penalty	Monetary penalty
EPC registers	Central EPC register	Central EPC register	Central EPC register
Public access to EPC databases	Access for some organisations	Public access with protected privacy	No public access
Performance indicator	kWh/m^2a	kWh/m^2a	kWh/m^2a
Recommendations for improvement the energy performance	Yes	Yes	Yes

Table 1.3.2: EPC schemes in Hungary, Slovakia and Germany (own compilation)

The examples from the member states show that there are widely different methods for including nZEB in the EPC. Often no adaptation is needed, or only small adjustments or additional energy performance classes; a scale may be suitable for including nZEBs and even the 'plus energy' building level (a building that produces more energy than it consumes over an annual period). Many member states chose not to show the nZEB level explicitly on the EPC front page.

1.3.2 ENERGY AUDITS

The EED declares that large companies should conduct energy audits at least every four years. The definition of the energy audit by the EU says that "a systematic procedure with the purpose of obtaining adequate knowledge of the energy consumption profile of a building or group of buildings, an industrial or commercial operation or installation or a private or public service, identifying and quantifying cost-effective energy saving opportunities, and reporting the findings". Aim of the energy audits is to support the contribution of the private sector to the EU 2020's objectives. Energy audits should be performed in an independent way, based on standards such as:

- EN 16247-1 (Energy audits) - defines the attributes of a good quality energy audit, from clarifying the best approach in terms of scope, aims and thoroughness to ensuring clarity and transparency. It applies to commercial, industrial, residential and public-sector organisations, excluding individual private dwellings (for which EPC can/must be effectuated.
- EN ISO 50001 (Energy management[1]) – For energy audits carried out as part of an energy management system
- EN ISO 14001 (Environmental management) – Where the management system includes an energy audit

Energy audits help every relevant stakeholder concerned by the building's or a system's energy efficiency to assess the existing energy consumption and identify the whole range of opportunities to save energy. This should then result in recommendations on concrete saving measures and allow the identification and prioritization or ranking of transferrable opportunities for improvement. In this way, energy audits tackle the information gap that is one of the main barriers to energy efficiency.

Energy audits are also the basis for the development of a market for energy services. The result of an energy audit may be, for example, a recommendation for window replacement, for insulation of piping in a factory or for setting up a comprehensive energy management system in commercial buildings, among other recommendations. Furthermore, energy audits are not only focus on technical solutions such as replacements or retrofits, as significant

[1] An energy management system is a set of interrelated or interacting elements of a plan which sets an energy efficiency objective and a strategy to achieve that objective.

opportunities for improvement may also exist in connection to the operation, both industrial and commercial, for example the more efficient operation and continual optimization of operating procedures, control parameters, logistic and layout optimization and maintenance planning. So, actions proposed by the audit can be free, can have a short or long payback period.

Energy audits may also be part of a broader environmental audit that considers storage possibilities, connection to district heating and cooling networks or potential for demand response in industries and commercial buildings. A private or public service, e.g. city public transport system, may also be subject to an energy audit that results in the identification of cost-effective energy saving opportunities.

Member states should promote and regulate high quality and cost-effective energy audits to all final customers, fulfilling minimum criteria based on the EED's criteria and carried out by qualified and/or accredited experts or supervised by independent authorities. For large enterprises, this process should be mandatory with an effective, proportionate and dissuasive penalty system.

Energy audits are obligatory for 'large enterprises that are not SMEs' for which various definitions can therefore be observed across Member States. The definition of SMEs (dispensed from energy audits) in the EED is based on threshold values for employees and two financial criteria that are linked in a defined way, as well as certain additional criteria for the determination of the status of an enterprise. Some Member States use the employee and financial thresholds according to the EU definition, but they link them in a different way from that stated in the Directive; others have modified the threshold values and some have decided to include additional companies in the mandatory audits. Others are also encouraged to undertake energy audits and implement the resulting recommendations. Penalties for non-compliance vary considerably in Member States, ranging from EUR 10,000 to 200,000 EUR.

In general (based on the Commission Recommendation 2003/361/EC of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises) large enterprises have more than 250 employees AND a turnover higher than 50M EUR OR/AND a balance sheet over 43M EUR (see Figure 1.3.2).

Employ-ees	Turnover	Balance Sheet Total	Outcome	Reason
< 250	≤ €50m	≤ €43m	SME	Meets all criteria
< 250	≤ €50m	> €43m	SME	Meets main and one secondary criteria
< 250	> €50m	≤ €43m	SME	Meets main and one secondary criteria

Figure 1.3.2: Who does not need an energy audit?

Source: https://ec.europa.eu/energy/sites/ener/files/documents/EED-Art8-Implementation-Study_Task12_Report_FINAL-approved.pdf

Generally, the main elements of an energy audit are:

- Review of current technical plans (electrical, construction, installation etc.)
- Live survey of the building (measured up-to-date energy consumption data)
- Review of the building structure (exterior walls, cover/roofing panel, doors/windows)
- Review of heating and cooling systems (heat generators, heat transmitters, control engines, etc.)
- Review of sanitary hot water system
- Review of the lighting system
- Explore common failures and bugs at the operating experience
- Address life-cycle costs (or returns on investment) rather than simple payback periods

	Hungary	Slovakia	Germany
Bodies in charge of the EED implementation	Governmental body, operational level: Hungarian Energy Authority (HEA)	Governmental body, operational level: national energy agency	Governmental body
Audit is mandatory for companies	large enterprises (in line with the EC definition)	exceeding certain energy demand thresholds in 2009 (5,500 MWh; 2,500 MWh in agricultural sector), amended according to EED in 2014: all large enterprises (in line with the EC definition) + all organisations that request public funding for energy projects	having (a) 250 or more employees or (b) less than 250 employees, but more than EUR 50m turnover and EUR 43m balance sheet (for two consecutive financial years). The respective entity usually has to undertake an economic activity to fall under the regulation (does not depend on the private or public legal nature).
Number of companies under the scope of the regulation	4-7000	1000	app. 50.000
Exceptions	A certified ISO 50001 energy management system can serve as an alternative if it includes an audit and meets all requirements of the mandatory audit. A member of a group of undertakings which would qualify as an SME as such and which has an average total annual energy consumption of less than 3 GWh in the 3 years preceding the year of the audit	Energy management systems that require the implementation of energy audits can be used as a substitute as a stand-alone audit for the first time and then continue with ISO 50001.	All municipalities and institutions with predominantly statutory activities. Companies having an ISO 50001 certified energy management system or an environmental management system in line with EMAS in place

Centrally recorded energy audits	Energy auditors have to submit information about the audit online to the HEA.	Yes	No
Minimum coverage	not defined	90% of energy demand including transport (cross-border transport, should be audited as part of the headquarters' energy impact)	90% of the energy consumption of a company, including transport (cross-border as well)
Penalties for non-compliance	companies: up to app. EUR 32,000 in the case of non-compliance with the requirement to implement an audit and up to roughly EUR 48,000 in case of repeated non-compliance energy auditor: up to EUR 320 in case of not meeting the audit requirements	EUR 5,000 - 30,000 depending on the severity/repetitiveness of the non-compliance	up to EUR 50,000
Additional supporting measures	guide about reporting	Slovak Sustainable Energy Finance Facility supports energy efficiency projects. Upon approval of the application, industrial companies must carry out an energy audit to confirm that the most appropriate energy saving measures have been chosen. The implemented savings must be verified later on by a third party.	guideline and test scheme for classification as small or medium sized enterprises by Federal Office of Economics and Export Control

Table 1.3.3: Energy audits in Hungary, Slovakia and Germany

Based on: A Study on Energy Efficiency in Enterprises: Energy Audits and Energy Management System, EC, 2016

1.3.3 REFERENCES

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