iBRoad2EPC

Training module for construction professionals

1 - Opportunities for energy savings

Name of presenter, affiliation

Occasion of presentation (event details)

This project has received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement No 101033781

Training module for construction professionals
1 – Opportunities for energy savings

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ULO No	Autonomy and Responsibility	Skills	Knowledge
1	Understand national regulations for energy certification of buildings	Understand and explain the requirements for buildings certification	National building certification requirements, minimum energy requirements, validity, content, certification process
	Understanding the benefits of deep renovation, including comfort, health, and safety requirements in buildings	Explain how building renovation influence the indoor environmental quality (IEQ)	Improvement of IEQ through building renovation, benefits for the occupants from different energy efficiency measures. How building envelop and building systems influence IEQ.
	Identify opportunities for energy savings	Explain the difficulties that are typically encountered during renovation of existing buildings which are striving for ambitious energy performance	Common opportunities for energy savings in renovation Energy saving potential of building envelope insulation, airtightness, thermal bridges, changing heating, cooling, ventilation systems, DHW and others.

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“Energy efficiency first” principle

Energy efficiency is a pillar of the EU energy union. The energy efficiency first principle is embedded in the Regulation on Governance of the Energy Union and Climate Action (2018/1999) and in the Energy Efficiency Directive (2018/2002). With the on-going recast of the directive, proposed in the European Green Deal package in July 2021, the Commission intends to provide a stronger and wider legal basis for the application of the principle.

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“Energy efficiency first” principle

The “energy efficiency first” principle means taking utmost account of cost-efficient energy efficiency measures in shaping energy policy and making relevant investment decisions.

The principle aims to treat energy efficiency as a source of energy in its own right in which the public and the private sector can invest ahead of other more complex or costly energy sources. This includes giving priority to demand-side solutions whenever they are more cost-effective than investments in energy infrastructure to meet policy objectives.

Beyond contributing to reducing fossil fuels consumption and increasing independence and security of supply, this principle also emphasises the importance of reducing energy production. Reduced energy demand can help control the level of investment needed for the transition towards renewables. Moreover, it supports a more sustainable approach to the use of limited resources and increases the resilience of the EU's energy system.

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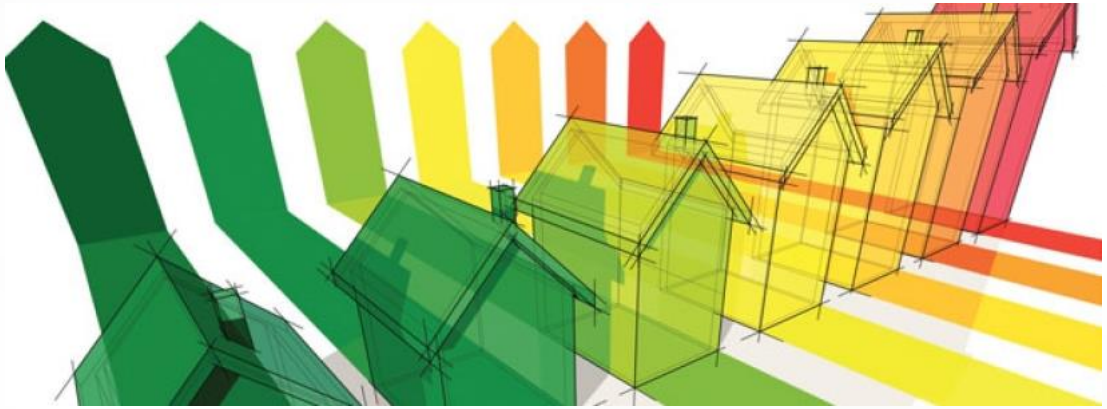
Facts and figures



In 2050, 9 out of 10 existing buildings will still be in use.

Buildings are responsible for approximately:

- 40% of EU energy consumption
- 36% of the energy-related greenhouse gas emissions
- Buildings are therefore the single largest energy consumer in Europe. Heating, cooling and domestic hot water account for 80% of the energy that we, citizens, consume.
- At present, about 35% of the EU's buildings are over 50 years old and almost 75% of the building stock is energy inefficient. At the same time, only about 1% of the building stock is renovated each year.

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What are Minimum Energy Performance Standards and to which buildings will they apply?

The EU Minimum Energy Performance Standards (MEPS) are a system to require the renovation of the worst performing buildings; those in Energy Performance Certificate (EPC) classes G or F.

In particular, public and non-residential buildings will have to be renovated and improved to at least energy performance level F at the latest by 2027, and to at least level E by 2030 at the latest.

Residential buildings should be renovated from G to at least F by 2030, and to at least E by 2033.

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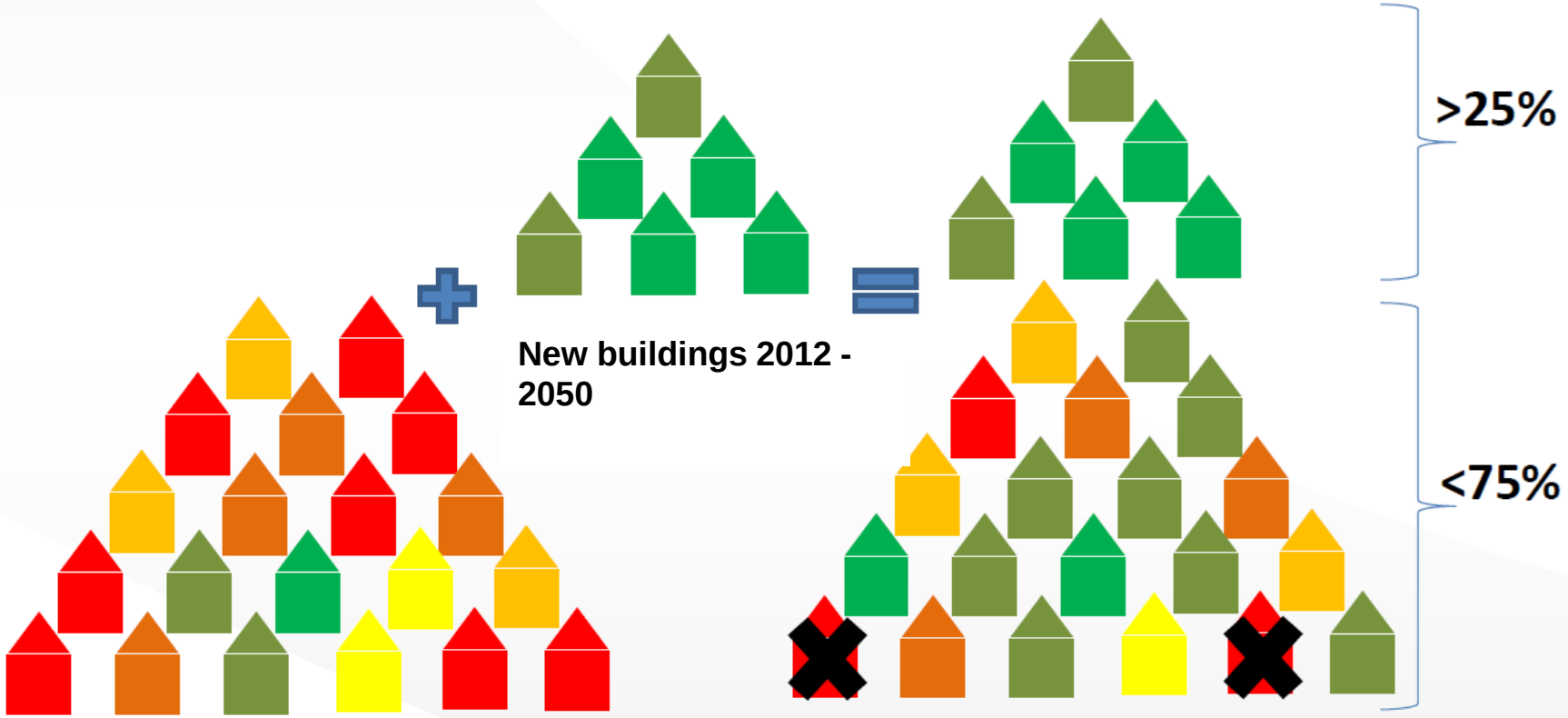
EU Building Renovation Policy



Source : Bogdan Atanasiu, *Challenges and Principles for nearly Zero-Energy Buildings*, presentation of BPIE for ENTRANZE project, 2012)

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EU Building Renovation Policy

Roughly 75% of European buildings are considered inefficient energy-wise, while up to 97% have a significant potential for further improvement. The European Commission has published the **Renovation Wave Strategy** to boost building renovation for climate neutrality and recovery. The objective is to at least **double the annual energy renovation rate** of buildings by 2030 and to foster deep energy renovations.

Source: BPIE – The Buildings Performance Institute Europe

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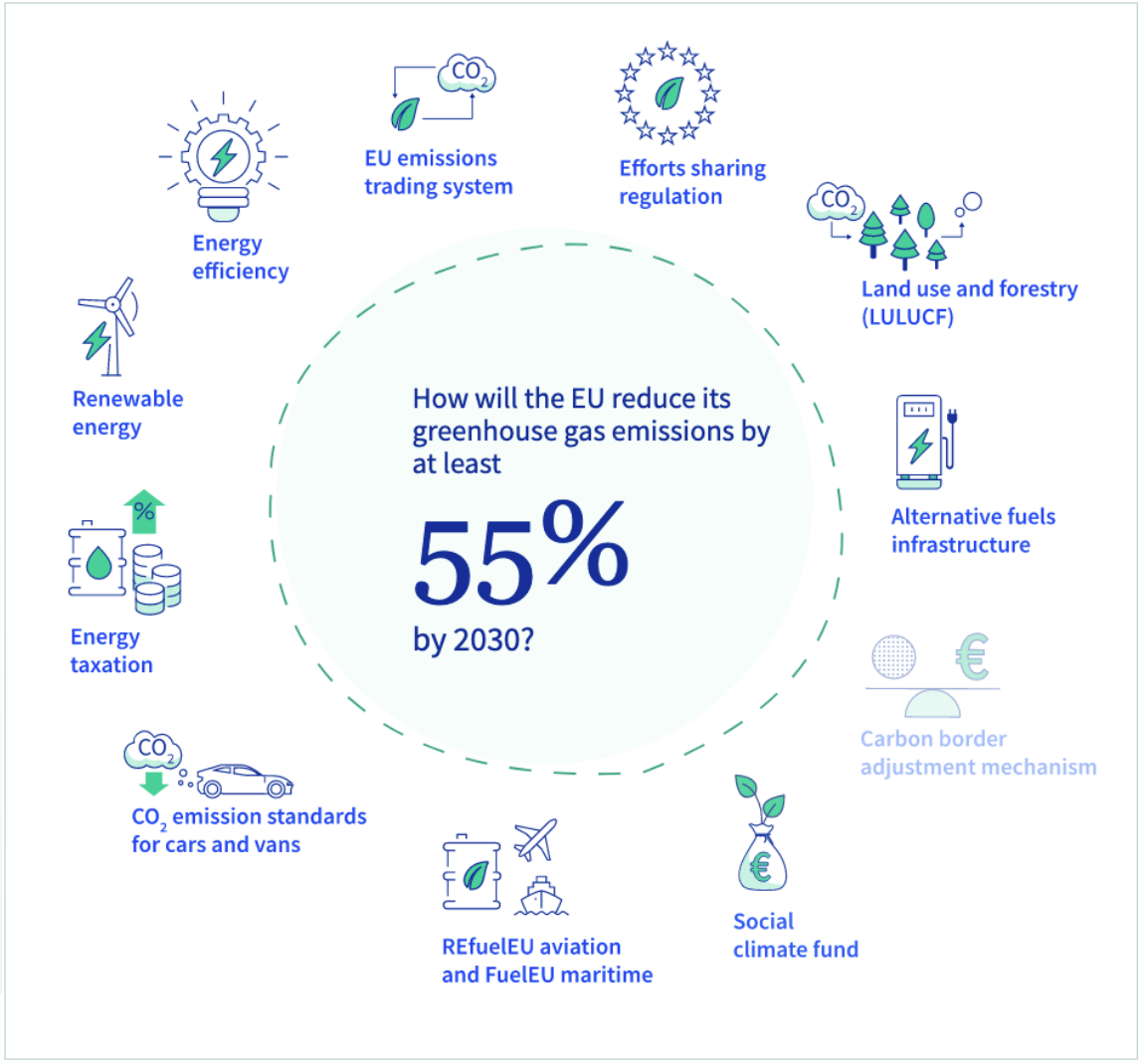
Fit for 55: how the EU will become more energy-efficient?

- The Fit for 55 package is a set of proposals to revise and update EU legislation and to put in place new initiatives with the aim of ensuring that EU policies are in line with the climate goals agreed by the Council and the European Parliament.

- Why 'Fit for 55'?

Fit for 55 refers to the EU's target of reducing net greenhouse gas emissions by at least 55% by 2030. The proposed package aims to bring EU legislation in line with the 2030 goal.



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Energy Performance of Buildings Directive (EPBD recast Dec 2021)

EPBD

As of 2030 all new buildings must be zero-emission; new public buildings must be zero emission already by 2027.

The worst-performing 15% of the EU building stock will have to be upgraded from Energy Performance Certificate (EPC) label G to at least label F by 2030, public and non-residential buildings leading the way by 2027.

Residential buildings should be renovated from G to at least F by 2030, and to at least E by 2033

The obligation to have an energy performance certificate is extended to buildings undergoing major renovation, buildings for which a rental contract is renewed and all public buildings.

Requirement to roll out charging infrastructure for electric vehicles in residential and commercial buildings and to promote dedicated parking space for bicycles

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Energy Performance of Buildings Directive (EPBD recast Dec 2021)

EPBD

Buildings or building units which are offered for sale or rent must have an energy performance certificate, and the energy performance class and indicator should be stated in all advertisements

National Building Renovation Plans will be fully integrated into National Energy and Climat Plans to ensure comparability and tracking of progress – they will need to include roadmap for phasing out fossil fuels in heating and cooling by 2040 at the latest.

A Building 'Renovation passport' will give access to information and lower costs for consumers to facilitate their planning and a step-by-step renovation towards zero-emission level.

Member States are invited to include renovation considerations in public and private financing rules and to establish appropriate instruments, in particular for low-income households.

An expiration clause is introduced for financial incentives to use fossil fuels in buildings: no financial incentives should be given for the installation of boilers powered by fossil fuels as of 2027 and Member State are given the legal possibility to ban fossil fuel use in buildings.

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Deep Energy Renovations

With a view to achieving the long-term vision for buildings, **deep renovation** should be defined as a renovation that transforms buildings into **zero-emission buildings**; in a first step, as a renovation that transforms buildings into nearly zero-energy buildings.

Source: https://ibroad2epc.eu/#

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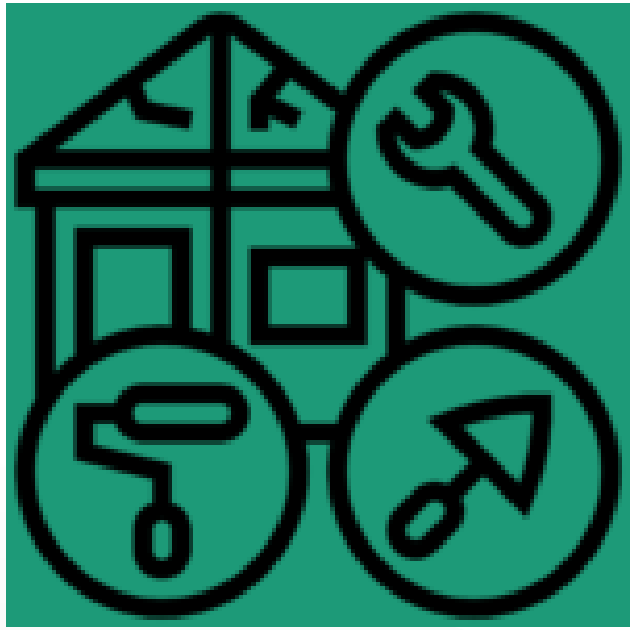
Deep Energy Renovations

In more details '**deep renovation**' means a renovation in line with the energy efficiency first principle and efforts to reduce whole life-cycle greenhouse gas emissions generated during the renovation, which focuses on essential building items, such as wall insulation, roof insulation, low floor insulation, replacement of external joinery, ventilation and heating or heating systems and treatment of thermal bridges, to ensure the necessary comfort of the occupants in summer and winter or a renovation resulting in a reduction of at least 60 % primary energy demand for worst-performing buildings for which it is technically and economically not feasible to achieve a zero-emission building standard.



Source: https://ibroad2epc.eu/#

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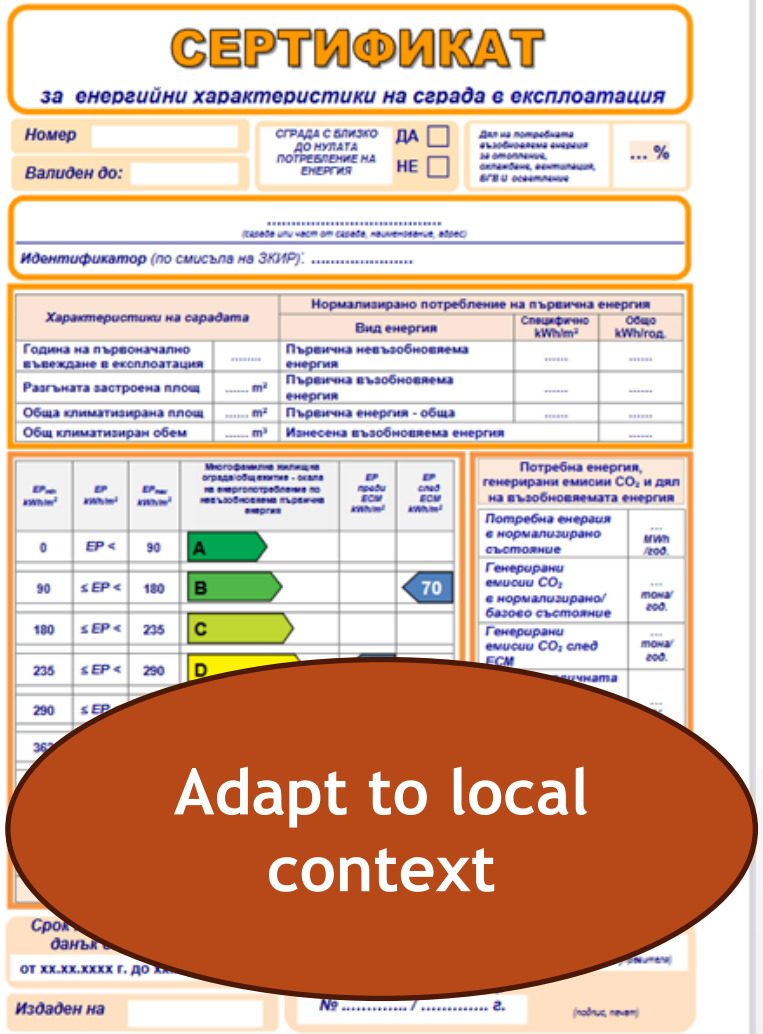
Energy Performance Certificate (EPC)

Energy performance certificates (EPCs) are a rating scheme to summaries the energy efficiency of buildings.

In the European Union, EPCs are regulated by the European Directive on the Energy Performance of Buildings.



Adapt to local context

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Building Renovation Passports

Building Renovation Passports (BRPs)

Building Renovation Passports support deep renovation through comprehensive assessment and identification of effective measures.

Stepwise deep renovation of an existing building is possible, but a plan –such as that presented in a BRP– is needed to ensure the full potential is reached.

Building Renovation Passports are becoming an integral part of the renovation action around Europe, being one of the direct results of the new legislative developments within the Fit-for-55 legislative package and the national-level adaptation of policy and financial instruments, supporting the increasing EU energy and climate targets.

Source: https://ibroad2epc.eu/#

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Building Renovation Passports

In this regard, the integration of the Building Renovation Passport in the Energy Performance Certificate, as advocated by the iBRoad2EPC project, provides an excellent opportunity for practical implementation of the policy action, given the fact that it uses an already established service at a key moment of the investment project, minimising costs and involving appropriate expertise in the design and planning of the renovation process

Source: https://ibroad2epc.eu/#

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Benefits of iBRod2EPC approach

iBRoad2EPC	Each country has different requirements for building performance certificates, which have been taken into account
	Through this approach, the possibility of allowing a lock-in effect or inefficient investments is significantly limited
	A simplified auditing model

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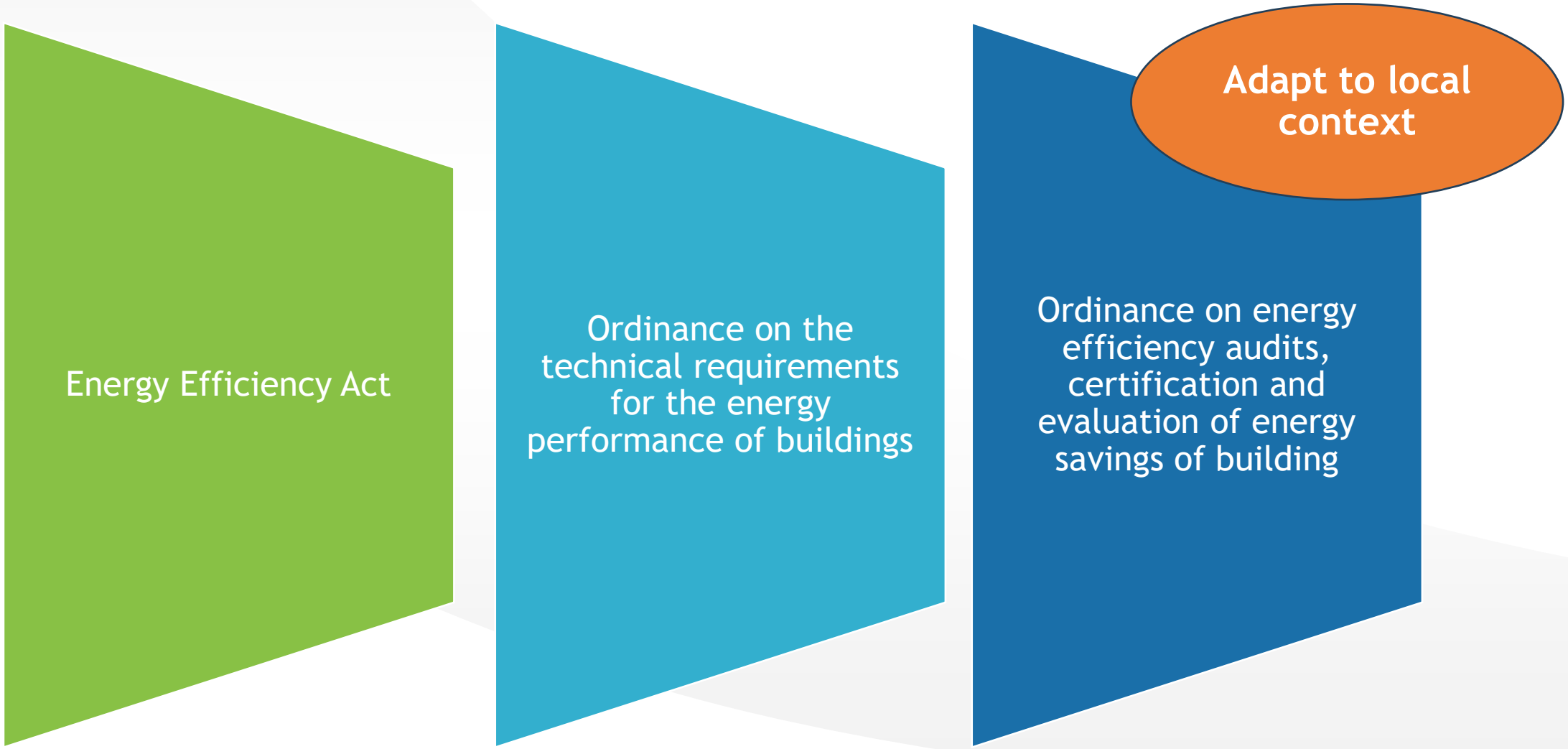
National legislation in the field of Energy Efficiency



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National legislation – Energy Efficiency Act

Art. 31. Energy efficiency requirements apply to each investment project for:

- ✓ construction of a **new building**;
- ✓ **reconstruction of a building**, which changes its energy characteristics;
- ✓ reconstruction, renovation or deep renovation of a building, when **covering more than 25 percent of the area of the external envelop structures and elements of the building** and changing its energy characteristics.

Art. 32. (1) The energy performance of a **new building** are certified with a **certificate for the energy performance of a new building.**

Art. 36. (1) The energy performance of **buildings in exploitation** are established with an **energy efficiency audit**.
(2) The energy efficiency audit of buildings in exploitation aims to establish the level of energy consumption, determine the specific possibilities for its reduction and recommend measures to increase energy efficiency.
(3) The inspection ends with a **report and with the issuance of a certificate for the energy performance of the building.**

Adapt to local context

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National legislation –Technical requirements for the energy performance of buildings

The energy consumption classes are expressed in a 7-level scale with fixed numerical limits of the primary energy EPmin and EPmax, from the lowest class "G" - corresponding to the worst energy efficiency, to the highest class "A" - corresponding to best energy efficiency.

The belonging of the building to the relevant class of energy consumption is established by comparing the value of the total (integrated) energy performance of the building with the numerical values of the class limits according to the condition:

$EPmin \leq EP < EPmax$,

where: EPmin and EPmax are respectively the minimum and maximum numerical values of the limits for the respective energy consumption class.

Adapt to local context

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National legislation –Technical requirements for the energy performance of buildings

class	Expression of achieved energy efficiency	$EP_{min} \leq EP < EP_{max}$
A	Very good energy efficiency - a building with very good energy performance	$EP < 0,5.R_{r,ref}$
B	A building with good energy performance - good energy efficiency	$0,5.R_{r,ref} \leq EP < R_{r,ref}$
C	Average (by level) energy efficiency – a building with satisfactory energy performance	$R_{r,ref} \leq EP < 0,5.\ (R_{r,ref} + R_{s,ref})$
D	Improved energy efficiency – a building with unsatisfactory energy performance	$0,5.(R_{r,ref} + R_{s,ref}) \leq EP < R_{s,ref}$
E	Poor energy efficiency – a building with poor energy performance	$R_{s,ref} \leq EP < 1,25.R_{s,ref}$
F	Worst energy efficiency – a building with the worst energy performance	$1,25.R_{s,ref} \leq EP < 1,5.R_{s,ref}$
G		$1,5.R_{s},ref \leq EP$

Adapt to local context

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National legislation –Technical requirements for the energy performance of buildings

Different scales for energy consumption classes apply to different types of buildings, as follows:

- ✓ multi-family residential buildings (apartment blocks)
- ✓ single-family residential buildings (single-family houses)
- ✓ administrative buildings (offices)
- ✓ Schools
- ✓ Universities
- ✓ kindergartens and nurseries
- ✓ buildings in the field of health care: medical facilities for inpatient care (all types of hospitals), medical facilities for outpatient care, medical centers
- ✓ buildings in the field of hotels, restaurants and catering
- ✓ commercial buildings
- ✓ sports buildings
- ✓ buildings in the field of culture and arts

Adapt to local context

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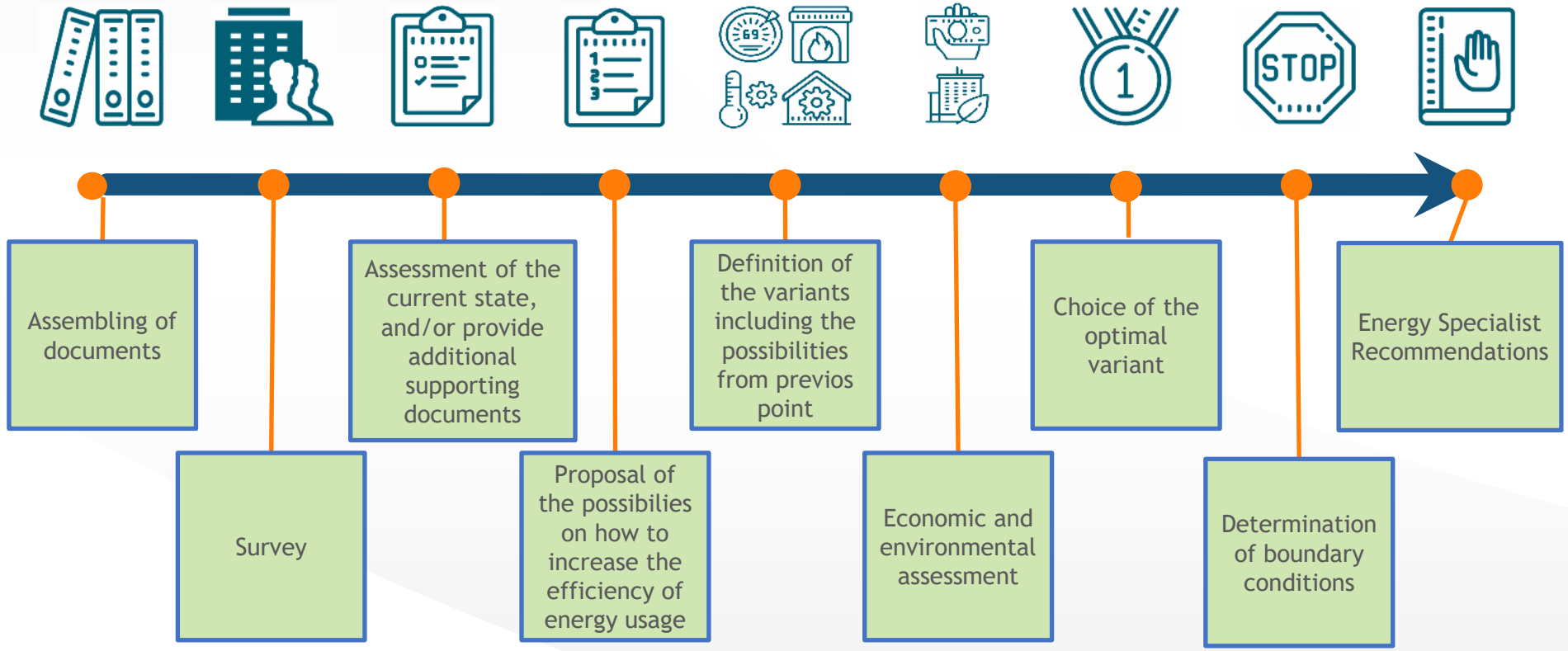
Energy Audit Procedure



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Deep Energy Renovation – Why is it important?

Energy efficiency in buildings has a synergistic impact, leading to a range of environmental, economic and social benefits.

In cooperation with: ROCKWOOL

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Deep Energy Renovation – Why is it important?

before

290 kWh m^2 .y.

Energy savings
Bills reduction
Reduced maintenance costs
Extended building life

after

94% savings

17 kWh/m^2y

In deep renovation of existing buildings energy savings are >60%

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Deep Energy Renovation – Why is it important?

Local example

Example:

Measures	Investment	Life	Energy savings			Cost savings					Payback period
			Electricity	Central heating	RES	Electricity	Central Heating	RES	Operation and maintenance	Общо	
	BGN.		kWh/a	kWh/a	kWh/a	BGN./a	BGN/a	BGN/a	BGN/a	BGN/a	years
ESM B1. Wall thermal insulation	207 530	25		183295		0	18 175	0	0	18 175	11,4
ESM B2.1. Windows replacement	248 160	25		123315		0	12 228	0	0	12 228	20,3
ESM B2.2. Replacement of glass units	21 840	25		39513		0	3 918	0	0	3 918	5,6
ESM B3. Roof thermal insulation	51 055	25		83417		0	8 271	0	0	8 271	6,2
ESM B4. Floor thermal insulation	54 696	25		44984		0	4 461	0	0	4 461	12,3
ESM C1. Solar pannels	540 000	20	123980			24 534	0	0	-800	23 734	22,8
	1 123 281	20	123 980	474 525	0	24 534	47 053	0	-800	70 787	15,9

Energy savings
Bills reduction
Reduced maintenance costs
Extended building life

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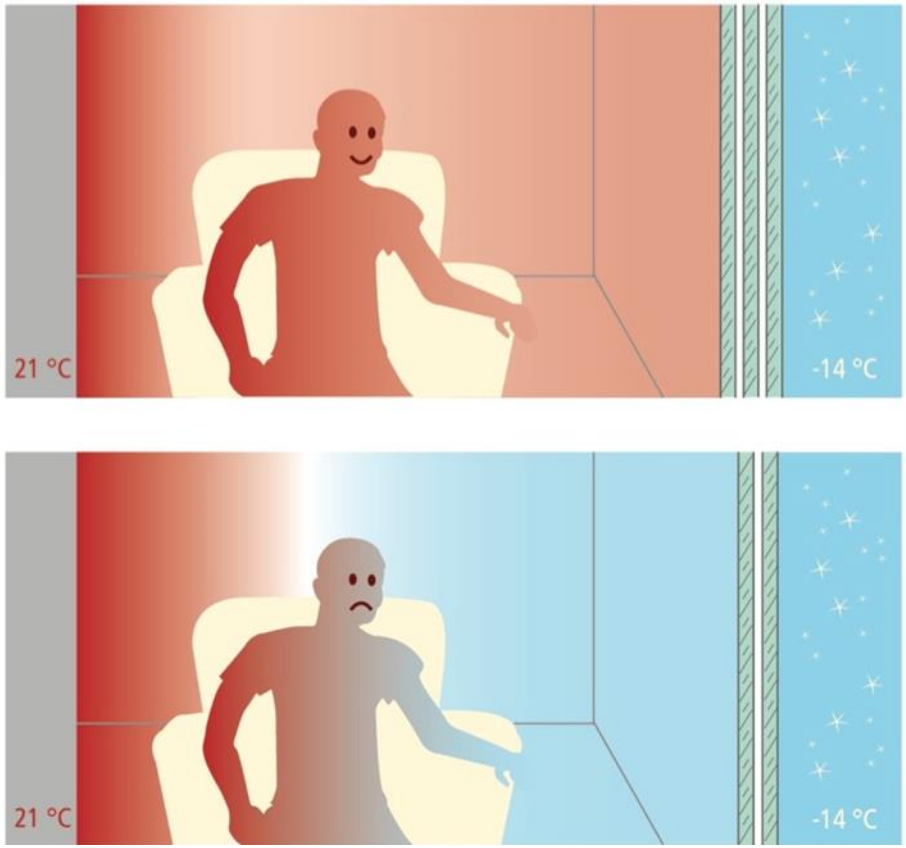
Deep Energy Renovation – Why is it important?



Provides optimal thermal comfort

- ✓ Warm surrounding surfaces
- ✓ No cold pocket in the legs
- ✓ Better thermal insulation and air tightness provide better sound insulation of the building
- ✓ Optimal solar gains in winter and summer

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Deep Energy Renovation – Why is it important?

Improves indoor air quality in buildings

- ✓ Sufficient oxygen and healthy CO2 levels
- ✓ No external contaminants
- ✓ Removing indoor pollutants at the source
- ✓ Regulated air humidity
- ✓ Prevents mold growth

Reduction of respiratory diseases
Better concentration and better sleep

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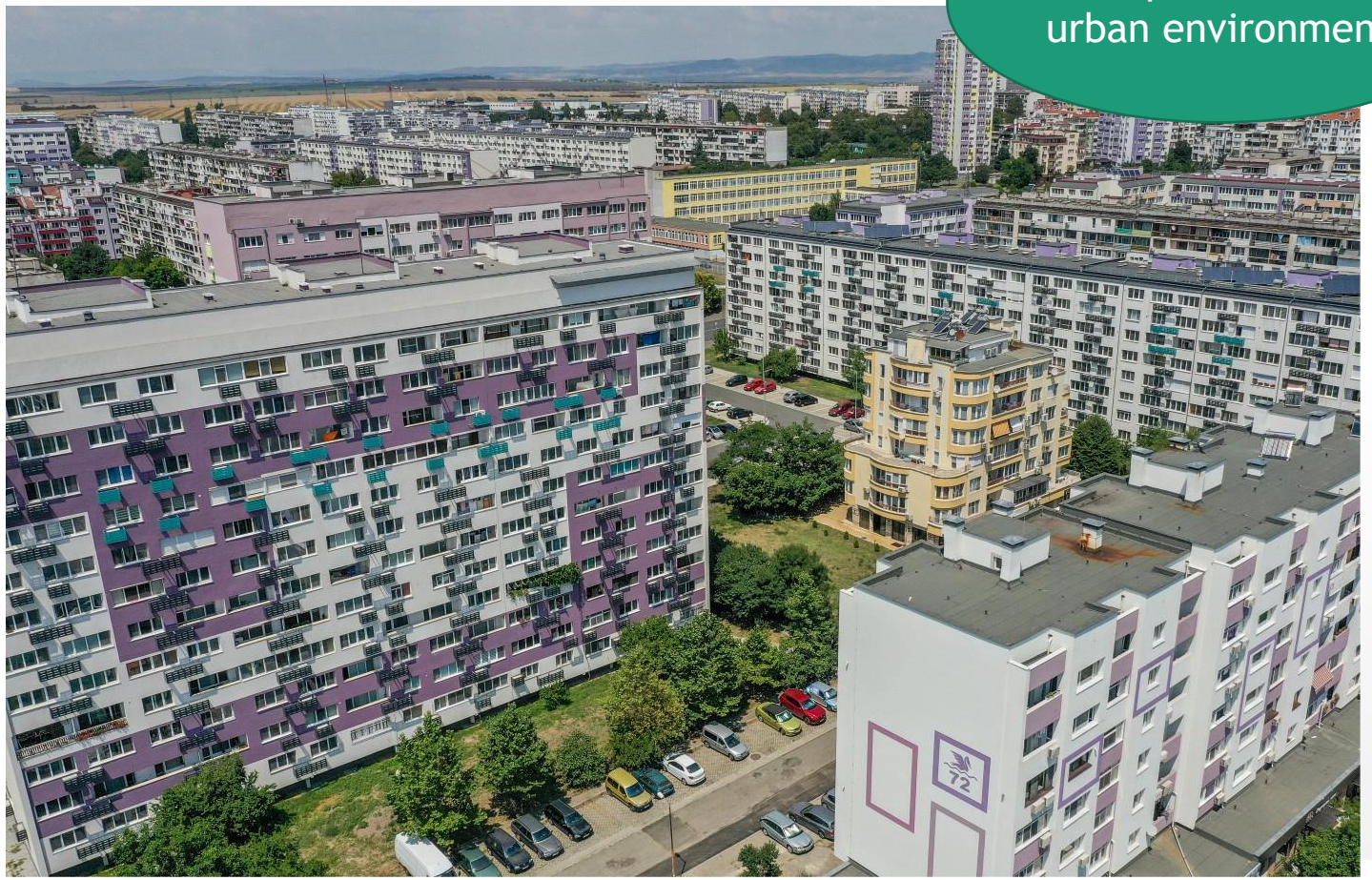
Deep Energy Renovation – Why is it important?

Improves the urban environment



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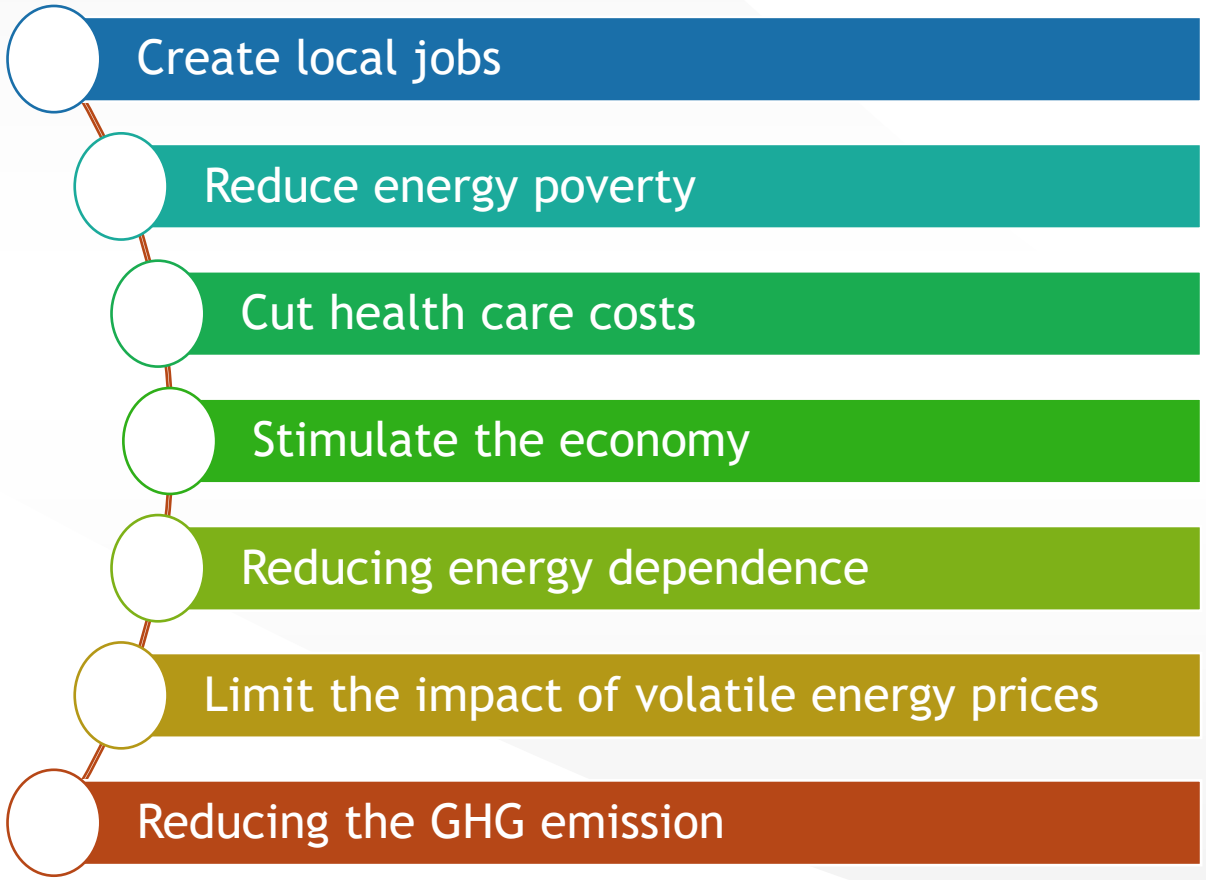
Deep Energy Renovation – Why is it important?



Every 1 mil. 1 euro invested in deep renovation of buildings creates an average of **18 jobs** in the EU. (more than 40 in Bulgaria). These are local, long-term jobs that stimulate economic activity.

Reduce the average length stay in hospital by 11%
Medication cost could be reduced by up to 19%

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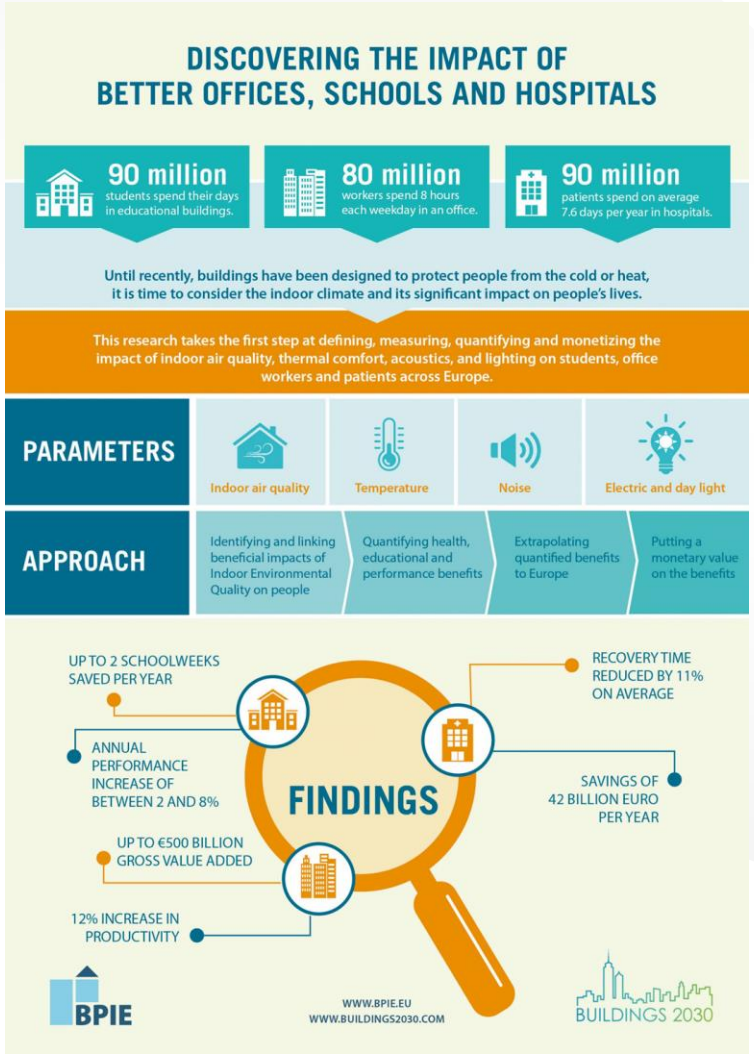
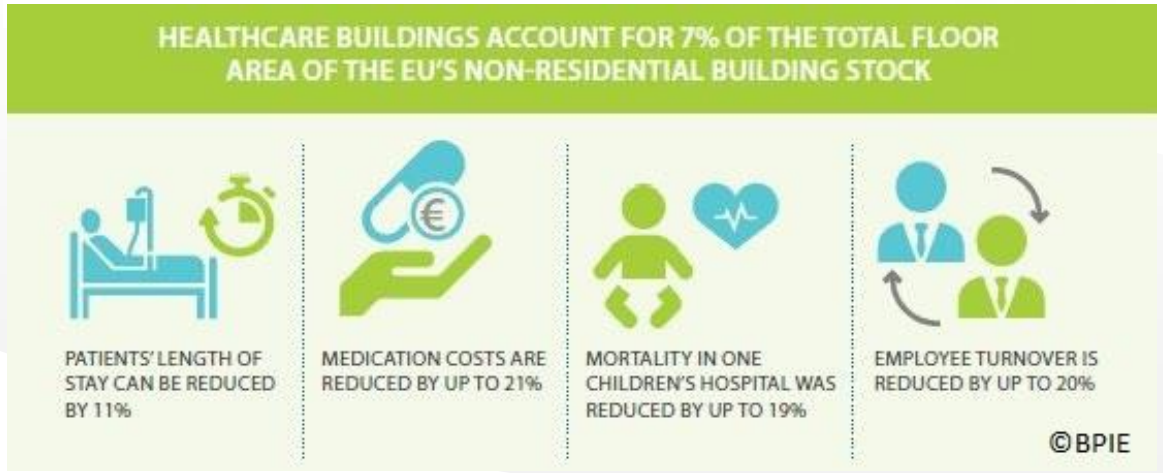
Benefits of Deep energy renovation in numbers





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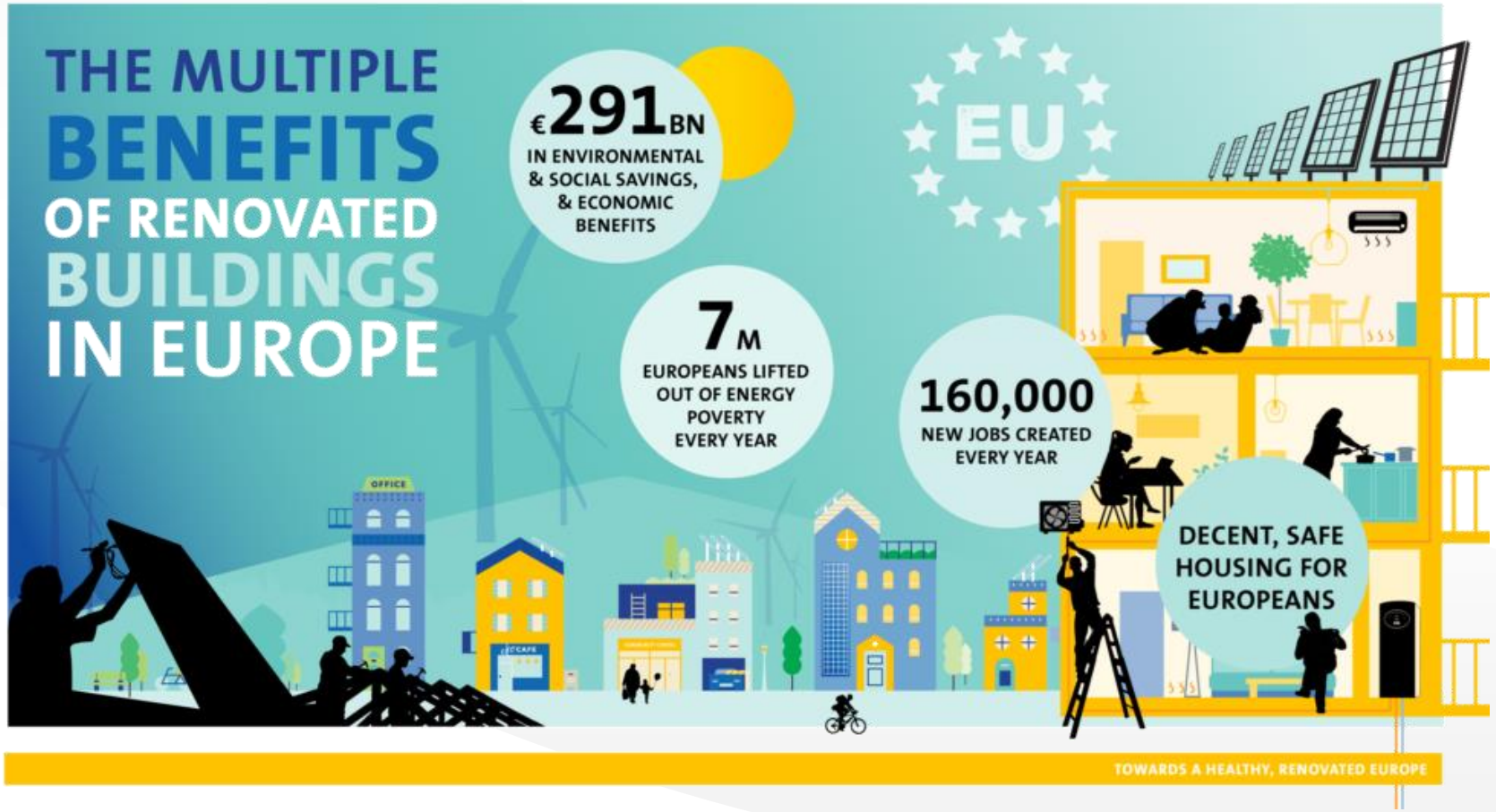
Benefits of Deep energy renovation in numbers



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Opportunities for energy savings

Significant energy savings of between 75 and 90 % can be achieved even in existing buildings, for which the following measures have proved to be particularly effective:

- improved thermal insulation (based on the principle: if it has to be done, do it right)
- reduction of thermal bridges
- considerably improved airtightness
- use of high quality windows
- ventilation with highly efficient heat recovery
- efficient heat generation
- use of renewable energy sources on site

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Difficulties that are typically encountered during renovation of existing buildings

At planning phase

- When it comes to the energy renovation of a building, the corresponding measures prescribed in the energy audit of the building must be designed in this phase. This phase is extremely important, because any gap in the project documentation at this stage is a prerequisite for poor implementation of the activities. In addition, it is the results of this phase that are the main documents on which the conditions for the tendering procedures for implementation are formed.

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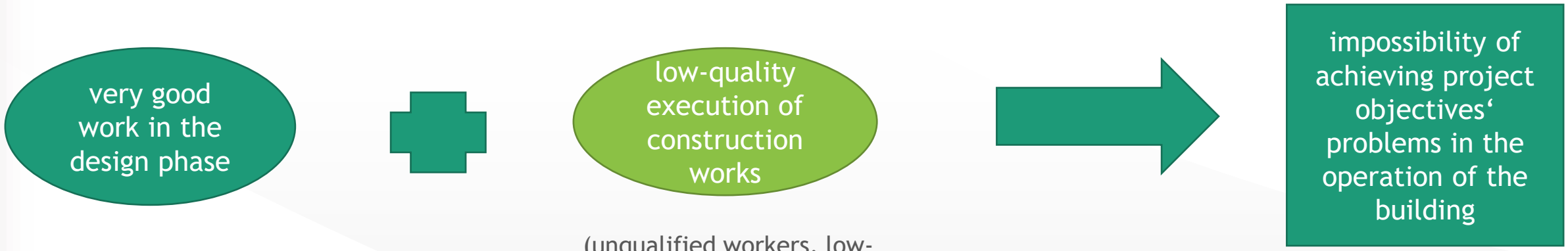
Difficulties that are typically encountered during renovation of existing buildings

At construction phase:

Correct execution and good quality monitoring during the construction phase of each project is of decisive importance for the quality of the final product.



(unqualified workers, low-quality materials, non-compliance with work details, lack of adequate control, etc.)

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Difficulties that are typically encountered during renovation of existing buildings

Quality assurance in renovation process covers:

- ✓ Materials used: Are they of the right standard, size, shape and material?
- ✓ Equipment: Will it work in the environment and is it safe?
- ✓ Agreed ways of measuring quality: What does ‘good’ look like?
- ✓ Project management: Timeframes, fair bidding processes, agreed budgets, etc.
- ✓ Certificates and skills: Do your people have the right skills for the job?

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Difficulties that are typically encountered during renovation of existing buildings

Verification and certification

Very often, detailed inspections of projects that have just been "successfully" completed find that the previously set results have not been achieved, and this can be due to a number of factors (poor construction, wrong equipment settings, inappropriate user behavior, and even incorrect assumptions in the energy audit). For many of these factors, immediate corrective action can be taken, but only if the causes are identified in time and possibly tied to the final payment of contractors.

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Difficulties that are typically encountered during renovation of existing buildings

Purposes of a Blower Door test

- ✓ Document the relative airtightness of houses (are they leaky - tight - or somewhere in between).
- ✓ Help find air leaks by inducing air to move through all leaks at the same time (chemical smoke, IR camera, feeling with you hand, zonal pressures).
- ✓ Determine the effectiveness of air sealing activities (compare before and after measurements).
- ✓ Investigate duct leakage problems.
- ✓ Help estimate the need for mechanical ventilation.

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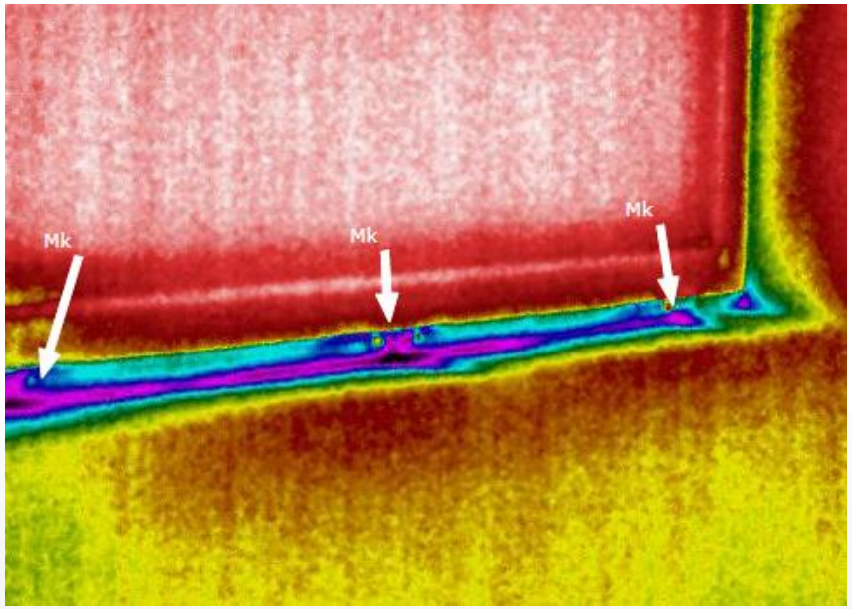
Difficulties that are typically encountered during renovation of existing buildings

Thermal camera inspection



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iBRoad2EPC

Test Questions

1. EP means
   a. The total (integrated) energy performance - "specific annual energy consumption" (kWh/m2.year) of the building.
   b. The maximum amount of energy that a building can consume in order to be in class D
   c. A rating scheme to summaries the energy efficiency of buildings.

2. Which of those is the European document on the basis of which the European countries make up their regulatory framework in the field of energy efficiency?
   a. EPBD
   b. Energy audit
   c. EPC
   d. Energy Efficiency act

3. Why is deep renovation important (mark all correct answers)?
   a. Because in 2050 only 25 % of all buildings will be buildings constructed after 2012
   b. There are several additional benefits for residents, such as improving air quality in buildings, living comfort and others
   c. There are several additional benefits for the societies, such as reducing the medical costs and stay in hospitals, establishing energy independence, and others

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iBRoad2EPC

Test Questions

4. Which checks can be carried out immediately before acceptance of construction works, and even during their implementation?

   a. Blower Door test

   b. Thermal camera inspection

   c. Verification of achievement of design energy performance

5. Which of the below are not among the measures proven to be particularly effective for significant energy savings?

   a. Reduction of thermal bridges

   b. Considerably improved airtightness

   c. ventilation with highly efficient heat recovery

   d. Use of mineral plaster for the facades

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Find us on Social Media

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Thank you for your time and collaboration

Name
email

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