iBRoad2EPC

TRAINING MODULE FOR CONSTRUCTION PROFESSIONALS

4 –Explain the project proposal to the different specialties/ stakeholders

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

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ULO No	Autonomy and Responsibility	Skills	Knowledge
4	Take responsibility for explaining the work to be performed, the connections between the different measures and steps and the time schedule to each involved professional	Communicate properly the specific project designs and plans Explain the advantages and specific challenges of step-by-step renovation Explain the economic efficiency of the different energy efficiency measures within a life-cycle assessment Explain the benefits of renovating to ambitious energy efficiency standards	Advantages of renovation and in particular step-by-step renovation Economic efficiency, lifecycle analysis Additional benefits of deep energy efficiency renovations

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Single-step or Step-by-step

	Single step	Step by step
Definition	Only major renovation (including whole building envelope)	Renovation measures performed according to trigger points
Time dimension	At once	Over the years (or decades)
Main risks	If not done right, mistakes take a long time (even decades) to be corrected (lock-in effects)	Avoid missed opportunities and lock-in effects, if the different steps are not carried out correctly
Barriers	Disruption and/or affordability	Lower barrier for single measures
Cost	At once – possibility that loans and policy-related incentives are available	Cost-shifting – further measure costs can be partially anticipated and/or postponed

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Advantages and specific challenges of step-by-step renovation

Advantages

- Create a holistic view of your building renovation project.
- Interdependency of the steps.
- Reduce your up-front budget without compromising on your long-term plan. By breaking your renovation into smaller projects, you are able to lower your initial costs and spread your investment over a longer period of time.
- Construction time will be shorter for each project and will also allow for a break between projects to allow you to regroup and recharge before you take on another project.
- Coordinate timing that fits best with your needs or schedule.
- It allows better final and long-term results due to the overall plan and coordination of measures (no lock-in effects).
- Predictability of the costs and effects of each step.

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Advantages and specific challenges of step-by-step renovation

Specific challenges

- Risk of lock-in effects.
- Exploiting the full energy savings potential from the beginning.
- Calculating the optimum timing to perform each step (or package of measures) taking into account budget restrictions, material ageing processes, and interdependency of the steps.

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Specific project designs and plans

- It is necessary that the step-by-step renovation plan is drawn up by a qualified specialist who could propose different combinations of measures that allow both optimal technical and economic benefits, as well as allowing to upgrade the effect with the next steps.
- It is necessary for the technical projects and drawings to be in accordance with the measures and their technological sequence, not allowing lock-in effects for further upgrading.
- The project should be designed to maximise the energy saving potential.

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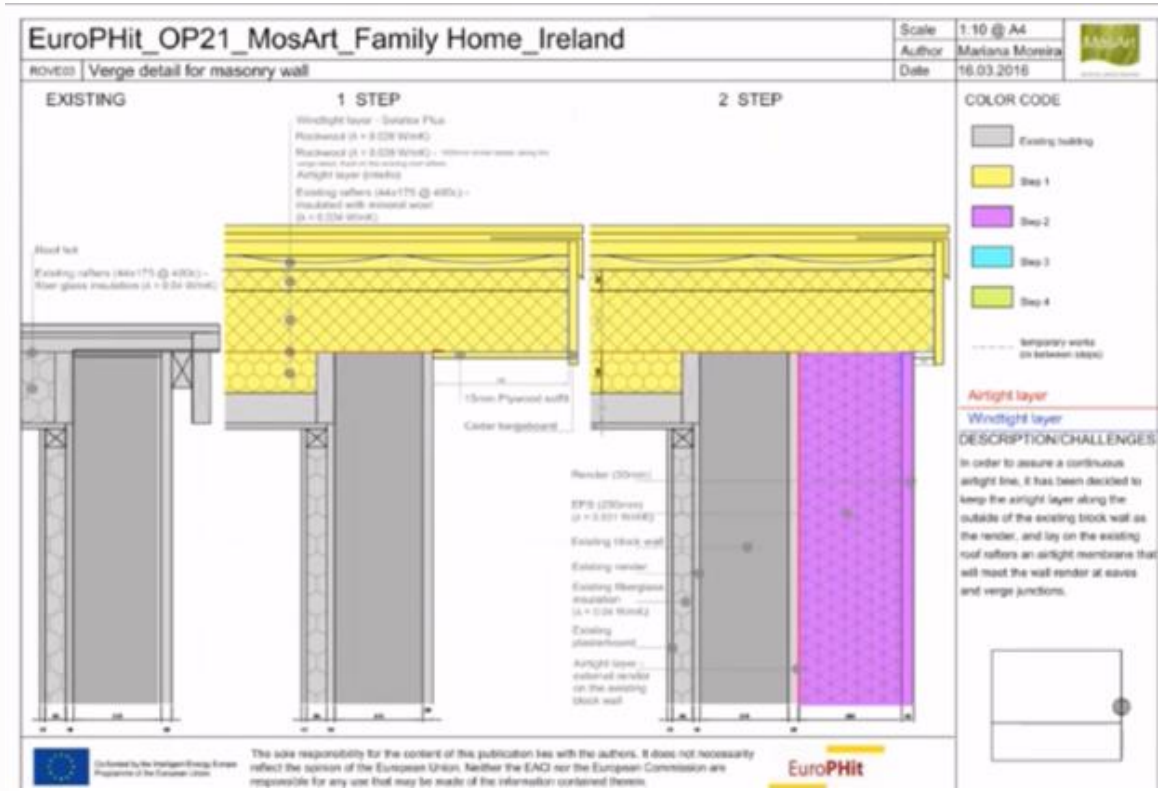
Specific project designs and plans

- To ensure proper implementation, the project must be accompanied by relevant implementation details.



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Specific project designs and plans

EXAMPLES OF TYPICAL RENOVATION DETAILS TO PAY ATTENTION TO

In case of insulating the roof, take into account ...

... with regard to a later outer wall insulation
Extension of the roof overhang: The roof overhang must be built in a way that the future wall insulation is sufficiently covered (thickness of the insulation and sufficient overhang). In some cases, it may become necessary to extend the rafters. Also, gutters need to be adjusted.

... with regard to the existing heating boiler
Adjustment of the heating system: Due to the insulation of the roof, the heat demand of the building reduces. Consequently, the heating system needs to be adjusted: the heating curve should be set to lower flow temperatures, a proper hydraulic balancing of the heating circuits needs to be performed, and the performance of the heating circuit pump can possibly be reduced.

... with regard to a later installation of a solar thermal system
The pipe ducts through the roof seal for the future thermal solar system should be provided. Potentially, solar pipelines could be preliminarily laid in the roof insulation.

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Specific project designs and plans

EXAMPLES OF TYPICAL RENOVATION DETAILS TO PAY ATTENTION TO

In case of insulating the walls, take into account ...

... with regard to a later pitched roof insulation
The low thermal bridge connection to the later sloping roof insulation is to be prepared. Existing panels on the eaves must be opened and the insulation should be installed to a defined height, e.g., to top edge rafters. At the verge, the insulation is to be led up to the upper edge of the gable wall. For this purpose, the roof overhang usually has to be rebuilt and extended.

... window replacement
It is to prepare a later low-heat window installation / door installation. Check that the window stops / door stops are removed so that windows / doors can be set against the front edge of the masonry in the future. The existing roller shutter boxes can be removed, and new roller shutters integrated into the ETICS. Instead of the old shutters insulating parts are used. If the windows / doors are to be installed at a later date in the same installation level, then the reveal insulation must be connected to the existing windows in a weather-proof and impact- proof manner with a diffusion-open joint.

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Specific project designs and plans

EXAMPLES OF TYPICAL RENOVATION DETAILS TO PAY ATTENTION TO

In case of a replacement of windows or doors, take into account ...

... with regard to an outer wall insulation
The thermal bridges and connections to the soffit, parapet and lintel shall also be designed for the intermediate state up to the insulation of the external walls so that the minimum thermal protection and moisture protection are maintained

... with regard to an internal insulation
The thermal bridges and connections to reveal, balustrade and camber are thus for the intermediate state to the inner insulation airtight and taking into account the minimum thermal protection and moisture protection.

... with regard to heating optimisation
The heating circuit temperatures can be lowered. In principle, after insulation measures, it should be checked whether the performance of the individual radiators matches the reduced room heating loads

... with regard to a perimeter insulation
The thermal bridges and connections to the soffit, parapet and lintel shall also be designed for the intermediate state up to the installation of the perimeter insulation so that the minimum thermal protection and moisture protection is maintained

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Specific project designs and plans

- During a building's life cycle, maintenance and operation activities constantly need to occur to avoid first stages of degradation and failure of the building material.
- Simultaneously, regular maintenance activities and/or material replacement provide an opportunity for increasing the building's energy efficiency, and, consequently, improving the building's energy performance. These activities may be initiated by unpredictable damages such as breaks, leakages and cracks, or predictable parameters, such as a material's durability that is defined by the material's lifetime.

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Specific project designs and plans

Building material / Heating system technology	Lifetime
• Windows	30
• Cement external wall	100
• Gas and coal boiler	30
• Sloped roof	60
• XPS insulation material	30
• Heat pump	20
• Electric heater	25

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Economic efficiency and benefits

Cases studied building data, Source: iBRoad-project, 2019

ID	Country	Year of construction	Net floor area [m^2]	Year of heating system replacement	Heating System
1	PT	1937	74	1937	Electric heater
2	PL	1975	218	1975	Gas boiler
3	PL	1975	368	2004	Gas boiler
4	PL	1981	285	1981	Coal boiler
5	BG	1994	160	1999	Air heat pump

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Economic efficiency and benefits

Step-by-step roadmaps and model input data per step: building 1, Source: iBRoad-project, 2019

ID	Step	Measure/Package of measures	Primary energy demand [kWh/m²]	Useful energy demand [kWh/m²]	Carbon emission [kg/m²a]	Investment cost [Euro]	Main energy source
1	**0**	**Status quo**	**600**	**327**	**100**		**electricity**
1	1	Thermal insulation on exterior walls - application on the inside with light coating; thermal insulation with sloped roof - application on the slopes on the resistant structure of the sloped roof; Replacement of existing frames with energy class A windows	249	99	36	14,500	electricity
1	2	Add a biomass boiler	51	112	7	3,000	wood
1	3	Installation of individual inclined solar thermal system	27	87	4	2,000	wood

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Economic efficiency and benefits

Step-by-step roadmaps and model input data per step: building 2, Source: iBRoad-project, 2019

ID	Step	Measure/Package of measures	Primary energy demand [kWh/m²]	Useful energy demand [kWh/m²]	Carbon emission [kg/m²a]	Investment cost [Euro]	Main energy source
2	0	**Status quo**	**474**	427	86		Natural gas
2	1	Pipe insulation; Installation of a thermal solar system for domestic hot water	343	317	63	2,222	natural gas
2	2	External Wall insulation;Roof insulation; Substitution of the old doors	163	154	30	17,384	natural gas
2	3	Substitution of the old windows	134	127	25	9,160	natural gas

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Economic efficiency and benefits

Step-by-step roadmaps and model input data per step: building 3, Source: iBRoad-project, 2019

ID	Step	Measure/Package of measures	Primary energy demand [kWh/m²]	Useful energy demand [kWh/m²]	Carbon emission [kg/m²a]	Investment cost [Euro]	Main energy source
3	**0**	**Status quo**	**382**	**344**	**70**		**natural gas**
3	1	External Wall insulation;Substitution of the heating system by a condensing gas boiler; Add a thermal solar system	234	214	43	15,151	natural gas
3	2	Roof insulation	153	140	28	5,210	natural gas
3	3	Substitution of the old windows; Substitution of the old doors	123	113	23	10,536	natural gas

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Economic efficiency and benefits

Step-by-step roadmaps and model input data per step: building 4, Source: iBRoad-project, 2019

ID	Step	Measure/Package of measures	Primary energy demand [kWh/m²]	Useful energy demand [kWh/m²]	Carbon emission [kg/m²a]	Investment cost [Euro]	Main energy source
4	**0**	**Status quo**	**435**	**396**	**100**		**hard coal**
4	1	Substitution of the old doors	431	392	99	2,597	hard coal
4	2	Insulation external walls	235	214	99	29,616	hard coal
4	3	Insulation of ceiling	185	168	56	43,257	hard coal

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Economic efficiency and benefits

Step-by-step roadmaps and model input data per step: building 5, Source: iBRoad-project, 2019

ID	Step	Measure/Package of measures	Primary energy demand [kWh/m²]	Useful energy demand [kWh/m²]	Carbon emission [kg/m²a]	Investment cost [Euro]	Main energy source
5	**0**	**Status quo**	**504**	**168**	**100**		**electricity**
5	1	External Wall insulation; Roof Insulation; Change glazing with energy saving glazing	300	100	13	9,537	electricity
5	2	Installation of a thermal solar system for domestic hot water	227	92	12	2,550	electricity
5	3	Substitution of the heating system by a heating pump	176	59	8	6,120	electricity

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Economic efficiency and benefits

Cumulated energy savings per renovation approach (single-step and step-by-step) - building 1 to 5.

Cumulated energy savings [%a]

ID	Single-step	Step-by-step
1	16.3	18.3
2	13.3	15.9
3	13.1	16.8
4	2.3	9.6
5	15.0	17.3

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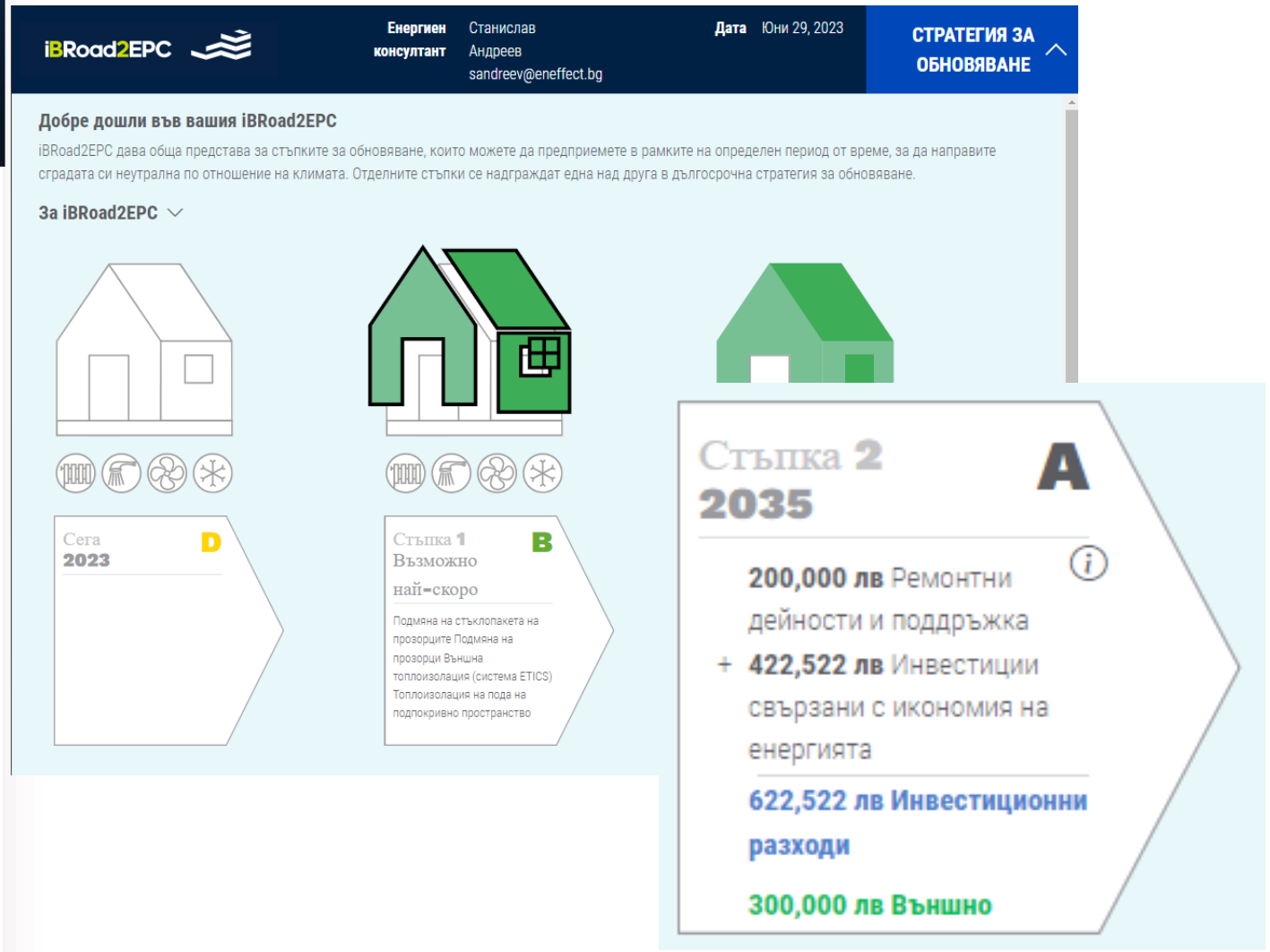
Economic efficiency and benefits



The investment cost module allows the display of renovation costs in iBRoad2EPC.
The following types of costs can be presented:

- Total investment costs
- Repair and maintenance costs
- Investments related to energy saving
- External funding

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Economic efficiency and benefits

In general, the single-step approach provides faster achievement of energy savings. Ideally, renovations should be performed as early as possible to guarantee high cumulated energy savings.

However, in real life, due to building owner's (or property manager) financial or time barriers, renovations may be postponed or delayed. With the step-by-step renovation, on the other hand, the **energy savings increase** gradually and are performed according to building owner's affordability.
In real-life, the chosen renovation approach is directly linked to the building owner's budget restriction. The present results reinforce the importance of including accurate building owner's budget restrictions in building renovation models.

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Test Questions

1. Which statement is not related to the specific challenges of step-by-step renovation?
   a) The risk of lock-in effects;
   b) Exploiting the full energy saving potentials from the beginning;
   c) Need to secure all investments at the beginning of the project

1. Which renovation approach achieves greater cumulated energy savings?
   a) Single step
   b) Step By Step

3. Which of the listed materials has the longest lifetime?
   a) XPS insulation material
   b) Cement external wall
   c) Windows

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Test Questions

4. In case of insulating the roof, we should take into account the following:
    a) Extension of the roof overhang;
    b) The pipe ducts through the roof seal for the future thermal solar system;
    c) Need to secure all investments at the beginning of the project

5. What is the definition of the step-by-step approach?
    a) Only major renovation (including whole building envelope)
    b) Retrofit measures performed according to trigger points
    c) Renovating only the windows

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Thank you for your time and collaboration

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