PROJECT

PRO-ENERGY

Work Package:	**3 Joint Regional Analysis, Strategy and Framework**
Activity:	**3.6.4** Joint criteria for selecting pilot public buildings
Activity Leader:	**National Agency of Natural Resources**
Deliverable:	**3.6.4**

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Editor:	**Roalb Studio Shpk** 		

DISCLAIMER:

The common challenge of PRO-ENERGY is to improve energy efficiency of public buildings (municipal/provincial/regional buildings, schools, universities, health centers, hospitals, museums, sports facilities etc.). This is a common problem faced by the territories participating in the project characterized by old facilities, outdated/degraded building façades, materials & equipment (insulation, electrical appliances, cooling/heating systems etc.), low energy consciousness & awareness, lack of skilled civil servants, etc. leading to high-energy consumption & CO2 emissions.

IDENTIFICATION SHEET

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INTRODUCTION

WP3(Joint Regional Analysis, Strategy& Framework) aims at formulating a Joint Strategy& Action Plan for the whole Balkan Med area regarding energy efficiency through behavioural change based on the analysis of the existing situation regarding energy efficiency in participating territories incorporating mapping of policies, initiatives& interventions & the selection of good practices& benchmarking of participating authorities, at building know-how which will be used in trainings of WP4& at establishing the framework for the pilot actions of WP5 through the establishment of joint criteria for selecting pilot public buildings, the identification/selection of pilot buildings from all territories& the implementation of energy audits (smart metering) in these buildings.

Based on the above, Work Package 3 (WP 3) "Joint Regional Analysis, Strategy and Framework" aims at sustainability of project results is also self-evident since PRO-ENERGY involves activities that directly impact & reduce energy consumption in public buildings leading to the coverage of an apparent need of project partners & stakeholders to keep applying & trying to extend the applicability of these activities.

More specifically, Activity WP3 Del. 3.6.4 "Capacity Joint criteria for selecting pilot public buildings**." aims to:**

1. Joint Strategy & Action Plan contributing to developing effective energy efficiency policies & measures & to defining pilot actions for the reduction of energy spending in public buildings.
2. Joint Cost-Benefit Analysis Modeller (open to all) supporting decision-making for retrofits, renovations etc. which lead to increased energy efficiency.
3. Energy Performance Contracts through open-tendering procedures to finance energy upgrades from cost reductions & contribute in this way to increased energy savings & increased energy efficiency.
4. Framework for energy-related interventions in public buildings which includes the implementation of Energy Audits in selected public buildings enabling through smart sensor systems the recording of energy consumption & the measurement of the impact of behavioural change measures.

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1 ACTIVITY REPORT AND PROGRESS ACHIEVED

1.1 Project Objectives

The common challenge of PRO-ENERGY is to improve energy efficiency of diverse public buildings (schools, museums, innovation centres etc). Participating territories face the common problems of old facilities, outdated/degradated building façades, materials& equipment (insulation, appliances, cooling/heating systems etc), low energy consciousness&awareness, lack of skilled civil servants, leading to high energy consumption&CO2 emissions. Combined with the fact that participating territories are dependent on energy imports, it is more than evident that there is room for improvements in energy consumption&more efficient use of energy. More importantly, the exemplary role of the public sector should be promoted by increasing energy savings in public buildings.

With focus on behavioural energy efficiency, PRO-ENERGY aims to address all issues by developing& implementing joint strategies& action plans, increasing competences of public buildings owners& operators, developing& applying technologies& tools for reducing energy consumption in public buildings& promoting good practices& results generated by the project to other local/regional/national entities in the area. The project addresses the policy& institutional level (Joint Strategy&Action Plan), human resources level (Capacity Building for Energy Managers)&the managerial systems level (open-source ICT Platform&CBA Modeller&Energy Performance Contracting-EPC). The novel energy saving technologies promoted by PRO-ENERGY refer The Program's purpose is to contribute to an improvement/extension of energy supply offered, strengthened grid stability, reduced system losses. This shall contribute to the protection of the climate and the environment by way of environmentally friendly and efficient generation and use of energy.

to Behaviour-based Energy Efficiency. Behavioural efficiency programs&strategies introduce a cost-effective way to reduce energy consumption, as literature&practice suggests. Clean Energy initiatives are twofold processes which produce energy by means of renewable energy sources (RES) or by finding ways to make efficient use of existing energy at hand. Deployment of RES requires heavy investment, takes time to pay-back&entails the existence of a solid/effective legislative framework. On the other hand, energy-dependent regions&countries are struggling to find ways to become less dependent, even at the slightest possible scale.

A modern&proven approach is the concept of "Behavioural Energy Efficiency", a set of tools that trigger, sensitise, advise&finally drive individual users towards practical& measurable actions for their personal&everyday use of energy resources. Studies reveal that a 3-4,5% reduction in energy consumption may be achieved through simple rules ("switch off the lights when leaving the room", "maintain a steady temperature on the thermostat") that may reach 15% when rules are driven/supported by a consistent information system at the hands of the energy user. Based upon the universal fact "You may not improve unless you measure first" the project foresees actual&precise energy readings from different energy sources within Public Buildings which may come available near real-time through the engagement of an ICT interactive platform, whilst a set of proposed actions through the platform aiming to improve these readings, will drive the so called "Behavioural Energy Efficiency" on the buildings.

Alongside, data analytics techniques (open to all) imposed through the ICT platform & the design of a cost–benefit analysis (CBA) tool (open to all) will produce a hands-on modeller for measuring net present value of energy efficiency interventions. Also, EPC represents a proven&effective form of 'creative financing' for capital improvement allowing funding energy upgrades from cost reductions. PRO-ENERGY suggests improvements on energy consumption actual levels via pilot actions assessed with the CBA tool & monitored throught the ICT system.

Target groups/stakeholders include local/national/regional public authorities,sectoral agencies & regulators,infrastructure& service providers, interest groups& NGOs, higher education& research institutes, training centres& schools, business support organisation& enterprises in the areas of the project. They will be involved in the formulation of the Joint Strategy& Action Plan through public consultations& other formal/informal meetings& events. The aim is to integrate their feedback, insights, proposals& ideas in the document to be formulated, to reach the maximum possible consensus& increase intensity of participation& thus local ownership. Target-groups will benefit from the increased energy efficiency, the use of innovative tools& the improved energy-related& management skills.

The EE Consultant, established through the Program, will:

- promote EE potentials,
- assist potential investors in defining EE investment projects taking into consideration technical, environmental, social, socio-economic and financial aspects,
- establish various project documents, assist in the procurement, supervision and acceptance of different EE constructions and/or installations.
- assist the National Agency of Natural Resources(AKBN) in building up a pipeline of EE projects and
- consult and train AKBN and other institutions' personnel for assessment of investments and operation of them.

1.2 Project Progress and Results

1.2.1 Overview of activities and results

The project's progress is according to the plan. The actual commencement date was the January 9th, 2022.

Table 2.1 presents the project planned project activities against the performed ones.

The key targets for the first project period have been met:

- Project office and facilities have been established and project staff has been mobilised
- Contacts and collaborations with key- Albanian organisations have been developed.
- Extensive field work for identification of project pipeline, including energy audits, has been performed
- The general requirements for project implementation, as well as project concepts have been elaborated and submitted with this report
- Pre-feasibility studies for promising potential EE investments in advanced progress.

During the initial project period, know-how transfer was provided through discussions, provision of information and collaboration during the site visits. Assistance during project implementation did not started as there are no projects implemented yet.

Table 2.1: - Planned and performed activities (Jan - May 2022)

Task	Task Description	Plan	Current status	Remarks
Task 0	***Project Management***	*To establish office; mobilise staff. etc.*	*Completed*	
Task 1	***Assistance in the preparation of EE projects***			
Task 1.1	Contacting and interviewing institutions/companies, where energy efficiency measures could be conducted, in cooperation with AKBN	completed	Completed	This activity will continue, as new projects may be identified
Task 1.2	Elaboration of general requirements and of a pipeline of potential EE investments	completed	Completed	Remark as above
Task 1.3	Project preparation on pre-feasibility level and elaboration of project proposals	completed	Completed	
Task 1.4	Approval of the project concepts before submission to the AKBN and Roalb Studio	completed	Completed	Proposals are submitted with this report
Task 2	***Assistance during project implementation***			
Task 2.1	Assistance in the implementation of EE projects	completed	Completed	Information provided during visits and energy audits
Task 2.2	Periodic supervision of the implementation of measures	To start	Not stared	
Task 3	***Know-how transfer***			
Task 3.1	On-the-job training of participating institutions/companies for operation	completed	Completed	Know-how transfer during visits and energy audits
Task 3.2	Assistance and know-how transfer to the AKBN regarding technical, financial and economic assessment of investments	Started	Started	Close collaboration with AKBN established; extensive know-how transfer activities not performed due to limited AKBN's staff.

Task	Task Description	Plan	Current status	Remarks
Task 4	***Assistance to AKBN and regular progress reports to the AKBN and Roalb Studio***	Started	Started	*The consultant is ready to provide further assistance on AKBN's request*

The progress towards achieving the project Results as per ToR is summarised in Table 2.2.

Table 2.2: Lot 4 - Planned and achieved Results (Sept-Dec 2021)

Task	Task Description	Planned	Progress
Result 4	***Visible and cost effective projects are realised***		
	Identification of project proposals for EE measures	completed	Done
	Preparation of feasibility studies and energy audits	completed	Done
	Measures are implemented/ Equipment is installed	In progress	
	Supervision of the implementation and acceptance by the Consultant	Later stage	
Result 5	***Institutions, where EE measures are implemented, are capable of their operation***		
	If necessary: instructions through suppliers	completed	
	Training in operation measures	completed	

1.2.2 Description of activities undertaken

Task 0: Project Management

Following the initial discussions with the Programme Executing Agency (AKBN) and the kick-off meeting of 12/01/2022, the Consultant concentrated its initial efforts on the following tasks:

- to mobilize the local and international experts
- to set-up office infrastructure and facility
- to establish communication with key organizations and
- to perform a survey for identification of potential projects.

The team of experts included in our proposal have been mobilized, responsibilities have been allocated and the experts work as planned. The Consultant interviewed additional local experts and will submit his proposals to enhance the team.

The Consultant developed close collaboration with the National Agency of Energy (NAE) and established contacts with banks to investigate the project financing conditions and key Albanian organisations that would support the Program. The meetings with the Contracted Company be particularly mentioned.

The activities of the Consultant, along with the initial findings until February 10th, 2022 were reported in two informal "Briefings – Activity Reports".

Task 1: Assistance in the preparation of EE projects

The main efforts during the reporting period focused on:

- Contacting and interviewing institutions/companies, where energy efficiency measures could be conducted, in cooperation with AKBN (Task 1.1)
- Elaboration of general requirements and of a pipeline of potential EE investments(Task 1.2) and
- Project preparation on pre-feasibility level and elaboration of project proposals (Task 1.3)

Tasks 1.1. and 1.2 are considered completed, although additional projects may be added in the pipeline in the course of the project duration. Task 1.3 is in progress. In fact the Team has to prepare entirely the projects, rather than assist the beneficiaries in project preparation. This is particularly true for most EE projects in the public sector as the technical capacity of the organisations is very limited.

The project team, based on the recommendations in the kick-off meeting, focused on two areas for identification of potential EE projects:

- EE projects in the broader public sector that will be almost fully financed by the grant as “demonstration projects”, and
- EE projects in industry/ private sector where the terms of financing have to be identified.

The team, based on the initial findings from their contacts and initial visits to candidate project sites, worked intensively to establish a list of promising EE projects in facilities of the Public sector. In addition the team initiated contacts with State officials and market actors for disseminating the purposes of the Program to the private sector.

The team sent a letter with an attached questionnaire in Albanian language to many possible participants including hospitals, rehabilitation centres, orphanage houses, schools, university dormitories etc. as well to industrial enterprises - to collect information regarding their heating and cooling loads and consumption and their monthly electricity consumption as well as drawings and other information.

The letter to potential participants and the questionnaires for buildings are presented in ***Appendix 1.***

An initial list of potential project sites was drawn, mainly hospitals, rehabilitation centres, orphanage houses and university dormitories etc. as well as industrial sites. The list of sites was compiled in collaboration with AKBN.

Following the initial contacts and site visits a number of 28 sites of public sector facilities

Team members visited, for a ‘walk-through’ audit most of the above mentioned facilities, to obtain a direct view of the existing situation.

The first screening of the projects was done using qualitative criteria such as the scope of EE interventions, the attitude of the facility management towards the project etc. In promising cases the team visited the sites several times to collect additional information and conduct energy audits. The team is currently working to collect missing information from certain sites. In parallel pre-feasibility studies are under completion for all promising cases. The perfectibility studies will provide the required information for project selection under the criteria proposed in following chapter of this report.

This project pipeline developed should not be considered “fixed and closed”. New sites may be added during the course of the Project.

<u>Task 2: Assistance during project implementation</u>

According to the original plan some activities under Task 2 would start by mid February assuming that certain EE projects, especially in the industrial sector, would be mature for implementation. This was not the case. During the site visits implementation issues were discussed with the management and staff of the sites visited.

<u>Task 3: Know-how transfer</u>

The Team developed close collaboration with AKBN. In this frame, techno-economic and other information with regards to EE was exchanged. Extensive know-how transfer activities were not performed due to limited AKBN's staff. We expect that additional staff will become available from AKBN to the project in order to realise this Task.

Concerning know-how transfer to participating institutions/companies this was performed mainly through the discussion during the visits and energy audits.

Task 4: Assistance to AKBN and regular progress reports to the AKBN and Roalb Studio

This report includes information that would facilitate reporting of the AKBN to Roalb Studio. The Consultant is ready to provide further assistance on AKBN's request

1.2.3 Resources utilisation

The human resources utilisation is reasonable and according to the plan. Local experts worked intensively to identify sites and collect information that will be indispensable for preparation of studies. It is evident that the limited technical capacity of most public organizations, as well as the limited resources allocated from AKBN to the projects increase the workload of local experts.

2 EE PROJECT PIPELINE

2.1 EE projects in Public Sector Facilities

During the first project period the main effort of the Consultant was to identify projects and prepare draft project concepts for facilities of the broader public sector, as most organisations do not have the expertise and capacity to identify and propose projects by their own means. The geographical distribution of sites visited and potential EE projects is presented in the following map.

The site visits and short audits identified that many public buildings are in bad condition from efficiency point of view, and with inadequate and poorly designed and maintained energy installations i.e. lack of proper heating system, no wall/roof insulation, single-glass windows with extensive air draughts, unacceptable thermal comfort conditions, extensive use of electricity for heating, steam leaks, boiler poor efficiencies etc.

It became obvious that in certain cases the interventions will improve the comfort level rather than reduce actual energy consumption. In this respect, the comfort level should be taken into account in our cost and benefit calculations.

Appendix 3 presents in tabular format a **"Summary of finding and potential EE projects in public facilities"** .

Some sites were excluded from further investigations due to lack of interest from their site or because there was no scope for energy efficiency interventions.

The Team performed a first screening of potential projects on the basis of information obtained and the results of site visits.

The **<u>criteria for the first screening</u>** of projects included:

1. **Scope for EE interventions**: (Significant/ Reasonable/ Limited or no scope) There are sites recently renovated where there is no or limited scope for EE interventions.
2. **Acceptance / Implementation risk**: (High/ Medium/ Low) As this pre-screening stage implementation risk is evaluated mainly by the acceptance and willingness of the site Management to participate in the project and undertake responsibilities, as well as on an overall assessment of other possible factors that could impose risk to implementation.
3. **Replicability and demonstration effect** (Significant/Medium/Limited): Many of the visited sites, such as schools were built before 1990 and are of similar architectural design. Implementation of energy efficient projects in some of those will develop conditions for massive replication.
4. **Social sensitivity related to the investment**: (High/Medium/Neutral) For Albania this is a particularly important criterion. Projects improving significantly living and working conditions, in terms of indoor comfort, for handicap children, pupils and other vulnerable groups should be considered provided that pure EE and other criteria are also met.

The ranking of sites was done on the basis on the above mentioned four qualitative criteria. Quantification was performed using the simple approach of weighted average based on the importance given to each criterion. The weights used are the following:

- Scope for EE interventions (40 points)
- Acceptance / Implementation risk (10 points)
- Reliability/demonstration effect (20 points)
- Social sensitivity (30 points)

Given the circumstances in Albania, apart from the scope for EE interventions, social sensitivity related to the investment was considered significant. Energy Efficiency and the profile of the Programme are better promoted by investing in socially sensitive sites.

At the present stage acceptance and implementation risk are weighted rather low, as when there is a real project proposal, the attitude of the management may change. Obviously, implementation risk will be a significant factor during final evaluation of projects.

Table 4.1 presents the 28 identified candidate project sites with their evaluation according to the pre-screening criteria. Detailed analysis is presented in the ***Appendix 5.***

Table 4.1: Pre-screening of sites and potential projects

	Name of the Building	Points (Max100)
1	**School of Koto Hoxhi, Gjirokaster**	**93**
2	**Kindergarten - Kamza City**	**92**
3	**Kindergarten – Kavaja**	**90.5**
4	**Elbasan Hospital –Elbasan**	**89.1**
5	**Mother Teresa Hospital, Tirana**	**88**
6	**School of Drenova-Korce**	**85.5**
7	**School of Beden – Kavaje**	**84.2**
8	**School of Ceta – Kavaje**	**81.5**
9	**Shkodra Hospital – Shkodra**	**81**
10	**School of Vreshtas-Korce**	**80**
11	**Korca Hospital – Korca**	**74**
12	**Student Campus, Tirana**	**72.5**
13	**Kindergarten – Korca**	**72.5**
14	**Student campus for Civil Engineering Faculty of Polytechnic University – Tirana**	**72**
15	School of Cipan –Korce	63
16	School of Synej – Kavaje	62
17	Sanatorium-Tirana	59
18	School of Mollaj – Korce	54
19	Elementary School –Kamez	53
20	Orphanage House – Tirana	52
21	Student city of Medical Faculty – Tirana	50
22	Student city Agricultural University – Tirana	50
23	School of Shushica –Elbasan	40
24	Durres Hospital – Durres	37
25	Maternity Hospital-Tirana	33
26	“Aleksander Xhuvani” University and Dormitories – Elbasan	31
27	“Luigj Gurakuqi” University and Dormitories – Shkoder	27
28	“Aleksander Moisiu” University Durres	24

According to the previous ranking further study should be conduced for the top 10 sites.

The Team has already started preparing prefeasibility studies for the most promising cases.

The Consultant proposes to start project preparation and implementation with School of Koto Hoxhi, Gjirokaster situated in the centre of Gjirokaster, which is the first in the classification, and in the same time is relatively easy in its implementation, monitoring and commissioning. The Consultant expects to finalise the pre-feasibility study for this building in the first two weeks of February 2022 and will present results to Participant and AKBN.

3 PROPOSALS FOR EE PROJECT IMPLEMENTATION

It is considered indispensable that AKBN appoints a co-ordinator to follow closely the project progress and at least one dedicated technical expert to work with the Team and trained on-the job.

3.1 Disbursement of funds for EE

Roalb Studio disburses Funds for account of the Authorized Party directly to the contractors of goods and services to be financed by Roalb Studio through Balkan Med programe.

Irrespectively of the Disbursement scheme, the role of the Consultant is to participate in project evaluation, progress monitoring and acceptance Committees and provide his independent expert opinion to AKBN and Roalb Studio concerning disbursement of funds. In addition the Consultant will assist AKBN in preparing the documents required.

3.2 Procedures for EE Projects in the broader public sector

3.2.1 Proposed Financing Scheme

It is proposed that EE projects in the broader public sector (i.e. for State and Local Authority institutions) are financed as a grant on investment up to about 85% (exact threshold to be defined).

They are implemented by contractors following an open tender procedure. Contacts are awarded by AKBN.

APPENDIX 1: LETTER TO POTENTIAL PARTICIPANTS WITH QUESTIONNAIRE

Questionnaire for energy consumed by Public/Private Buildings

Interviewer:		**Date of interview:**	

The indicator of the respond: ❒ responded; ❒ refused; ❒ without contact

I. GENERAL INFORMATION	
1.: What is the sector of your organisation? ❒ Hospital/Poliklinic ❒ Hotel ❒ School ❒ Tourist Centre ❒ University ❒ Business Centre ❒ Dormitories ❒ Private School ❒ Orphanage /Kindergarten / Nursery ❒ Private University ❒ Old people's house ❒ Private Kindergarten / Nursery ❒ Public Administration ❒ Other activities not included above	
2.: Activity duration in months for 2019 and 2020	2019 ❒❒ 2020 ❒❒
3.: The activity of your buildings is:	❒ continuous ❒ seasonal
4.: Are your buildings active in 2020?	**Yes** ❒ **No** ❒
5.: Which is the number of the administrative staff and patient/children/student/client ?	
6.: How many hours per day the building operates?	
7. What are the total floor area of your buildings?	
8. What is the number of your buildings?	
9. What is average height of each floor for your buildings?	
10. What is the total volume of your buildings?	

II. ENERGY CONSUMED BY SOURCE													
11.1: Energy sources consumed in physical units (commercial) for the year 2019													
	Units	Jan	Fe	Ma	April	May	June	Jul	Aug	Sep	Oct	No	Dec
Electricity	kWh												
Diesel	Liter												
Gasoline	Liter												
Heavy fuel oil	Ton												
LPG	Kg												
Lignite (domes.)	Ton												
Fire wood	m^3 st												
11.2: Energy sources consumed in physical units (commercial) for the year 2020													
Electricity	kWh												
Diesel	Liter												
Gasoline	Liter												
Heavy fuel oil	Ton												
LPG	Kg												
Lignite (domes.)	Ton												
Fire wood	m^3 st												

III.: ENERGY CAPACITIES
13. Does exist a central heating system in your buildings or you are using electrical individual heaters for each room? ❒ Yes ❒ No ❒ electrical radiator ❒ conditioner ❒ individual stoves with wood ❒ individual stoves with LPG
14. Does exist a central water system in your buildings or you are using individual electrical boiler? ❒ Yes ❒ No ❒ electrical boilers

15. Does exist a central air conditioning system in your buildings or you are using individual split systems for each room? ❒ Yes ❒ No ❒ **individual split systems for each room**	
16. What king of lighting bulbs are you using in your building? ❒ incadeshent bulbs ❒ flouroshente bulbs	
17.: What is the total installed engine power of the electro-motors in your buildings?	
18.: How many electro-motors do you have in the buildings?	
IV.: THE CAPACITIES OF THE BOILERS WHICH CONSUME ENERGY	
19.: Please give the number of the boilers in your Enterprise	
20: What kind of fuel do they use? ❒ Electricity ❒ LPG ❒ Lignite Coal (domestic) ❒ Diesel ❒ Heavy fuel oil ❒ Fire wood	
21.: Please give type of the boiler : ❒ pulverized ❒ skare ❒ pressure pulverised bed	
22.: What do the boilers produce? ❒ steam ❒ hot water	
V.: CAPACITIES OF MELTING AND BAKING OVENS, WHICH CONSUME ENERGY SOURCES	
23.: How many Ovens have you in buildings?	
24.: What kind of energy source do they use? ❒ Electricity ❒ LPG ❒ Fire wood ❒ Diesel	
25.: Which are the average capacities of ovens (kW $_{thermal}$)	
VI.: STATIONARY INTERNAL COMBUSTION ENGINE GROUP - ELECTRO GENERATOR	
26.: Have you stationary internal combustion engine group - electro generator in your buildings? ❒ Yes ❒ No	
27. Have many stationary internal combustion engine group - electro generator are in your buildings?	
28.: What is the installed power of the stationary internal combustion engine group - electro generator [kW]?	
29. In what percentage are the installed capacities used in average?	
30.: How many hours per day (averages) is the stationary internal combustion engine group - electro generator in full loaded?	
31.: How many working days has the stationary internal combustion engine group - electro generator realized in 1998?	
32.: What is the installed power of the stationary internal combustion engine group - electro generator	

APPENDIX 2: LIST OF SITE VISITS AND AUDITS

Table II.1: Education Institutions Visited/Contacted

	Potential site	Visiting/contacting dates
1	**School of Drenova - Korce**	Sept 02,21 Oct. 19,21
2	**School of Vreshtas - Korce**	Sept 02,21 Oct. 19,21
3	**School of Cipan – Korce**	Sept 02,21 Oct.19,21
4	**School of Beden – Kavaje**	Nov 10,21 Sept 17,21 Oct. 14,21 Oct. 28,21
5	**School of Synej – Kavaje**	Nov 10,21 Sept 17,21 Oct. 14,21 Oct. 28,21
6	**School of Ceta – Kavaje**	Nov 03,21 Sept 10,21 Sept 24,21 Oct. 21,21
7	**Kindergarten of Kavaja**	Nov 03,21 Sept 10,21 Sept 24,21 Oct. 21,21
8	**Kindergarten of Kamza City**	Oct. 21,21 Oct. 27,21
9	**Elementary School of Kamez**	Oct. 21,21 Oct. 27,21
10	**School of Mollaj Korce**	Sept 02,21 Oct. 19,21
11	**Kindergarten in Korca**	Sept 02,21 Oct. 19,21
13	**“Luigj Gurakuqi” University and Dormitories-Shkoder**	Nov,05,21 Nov 28,21
14	**“Aleksander Xhuvani” University and Dormitories-Elbasan**	Nov 19,21 Sept 20,21
15	**School of Shushica –Elbasan**	Sept 20,21 Oct. 28,21
16	**“Aleksander Moisiu” University-Durres**	Nov 19,21 Sept 23,21
17	**Student city of Medical faculty-Tirana**	Nov 16,21 Sept 24,21
18	**Student city of Agricultural University**	Nov 21,21 Sept 28,21

19	**School of Koto Hoxhi, Gjirokaster**	Dec16,21 Nov 12, 21 Oct. 23,21 Oct. 25, 21

APPENDIX 3: PRE-SCREENING OF POTENTIAL PROJECTS IN THE PUBLIC SECTOR

Pre-screening criteria

Scope for EE interventions (40 points)		Implementation risk (10 points)		Replicability/demonstration effect (20 points)		Social sensitivity (30 points)	
Significant	**100**	High	**10**	Significant	**100**	High	**100**
Reasonable	**50**	Medium	**50**	Medium	**50**	Medium	**50**
Limited or no scope	**10**	Low	**100**	Limited	**10**	Low	**10**

Pre-screening results

	Site	Scope for EE interventions	Implementation risk	Replicability/ demonstration effect	Social sensitivity	Overall assessment (100 points)
1	Shkolla Koto Hoxhi, Gjirokaster	90	90	90	100	**93**
2	Elbasan Hospital –Elbasan	84	90	90	95	**89**
3	Kindergarten – Kavaja	90	95	90	90	**91**
4	Mother Teresa Hospital, Tirana	85	90	90	90	**88**
5	Kindergarten - Kamza City	90	95	90	95	**92**
6	School of Drenova-Korce	90	80	80	85	**86**
7	School of Beden – Kavaje	88	90	80	80	**84**
8	School of Ceta – Kavaje	80	80	80	85	**82**
9	School of Vreshtas-Korce	80	80	80	80	**80**

	Site	Scope for EE interventions	Implementation risk	Replicability/ demonstration effect	Social sensitivity	Overall assessment (100 points)
10	School of Mollaj – Korce	50	40	60	60	**54**
11	Korca Hospital – Korca	60	90	85	80	**74**
12	Shkodra Hospital – Shkodra	85	60	85	80	**81**
13	Student Campus, Tirana	80	55	70	70	**72,5**
14	Student campus for Civil Engineering Faculty of Polytechnic University – Tirana	80	50	70	70	**72**
15	School of Cipan – Korce	50	80	70	70	**63**
16	Sanatorium-Tirana	40	50	85	70	**59**
17	Kindergarten – Korca	60	85	80	80	**73**
18	School of Synej – Kavaje	50	50	80	70	**62**
19	Orphanage House – Tirana	50	10	50	70	**52**
20	Elementary School –Kamez	50	50	50	60	**53**

APPENDIX 4: Methodology

Executive summary

Energy efficiency is "an energy source in its own right"[1]. By 2030 more energy will be saved than the amount of oil-based energy then[2], thus energy efficiency is expected to actually become the “first fuel”.

Policy context

Today, buildings account for 40% of Europe's total energy consumption. Around 75% of the building stock is energy inefficient. At the current 1% annual renovation rate it would take around a century to decarbonise the building stock to modern, low-carbon levels.

To realise the sustainable energy potential in buildings, a number of social, financial,technical barriers or administrative challenges need to be overcome. In this context, the European Commission launched the “Smart Finance for Smart Buildings” initiative in November 2016 to unlock private financing for energy efficiency investments in buildings. Animportant objective of this initiative is to “de-risk” investments. Fundamentals such as the lower probability of default in the case of energy saving loans or an increased value of assetsdue to higher energy performance need to be progressively recognised by banks andreflected in the pricing of their financing products.

Content

This report supports “de-risking” activities by evaluating existing literature about the impact of energy efficiency improvements on the value of buildings by increasing its actual valueand through the impact on operational costs. The specific impacts of labels and certificatesto create “green premium” and “brown discount” are analysed.

The report also looks at the impact of energy efficiency on the payment default risk. The analysis shows that higher energy efficiency is clearly linked to lower default risk, which should be reflected in financial products.

Main findings

As a rule of thumb an increase of 3-8% in the price of residential assets as a result of energy efficiency improvements, and an increase of around 3-5% in residential rents compared to similar properties can be observed. For commercial buildings, the premium seems to be higher, over 10%, and in some studies even over 20% of sales price increase compared to similar properties has been reported. Rental prices of commercial buildings have also been positively affected by 2-5%. Differences across regions and countries, as wellas different property types (e.g. apartments vs. houses) are shown. A change over time is also seen, because the labels and schemes become more well-known and understood. It is shown that higher energy performance is becoming the norm, therefore higher values are associated with better performance in latter times.

Energy efficiency upgrades change the basic characteristics of the buildings affected and thus have an impact on other value drivers: comfort, safety, maintenance, etc. Not only the energy performance, but rather the connotated features can influence the value of aproperty. Current demand for housing and location are still the main drivers to a building’s appraisal value and for a tenant’s selection of housing, however energy performance is becoming increasingly important across all reviewed countries.

Related and future

The JRC has been deeply involved in the technical and scientific support of EU energy efficiency policies and in particular policies related to financing energy efficiency investments and creating a market for energy efficiency. Several reports have been published on the topic by the JRC and are available on the E3P Platform. The JRC will further investigate the One-stop Shop concept, the values of non-energy benefits in valuating energy efficiency projects and the latest development in the energy services markets.

Quick guide

The current report is a stepping stone in the journey towards establishing more information, data and evidence, as well as to identify knowledge gaps in two critical aspects related to energy efficiency investments.

Firstly, it evaluates existing literature that discuss the impact of energy efficiency improvements on the value of buildings, the methodology that can be applied to quantify theincrease or decrease of property value linked to the energy performance and sustainability components.

Secondly, it demonstrates the impact of energy efficiency on the payment default risk namely the link between energy efficiency investment and ability of borrowers to repay their loans.

1 Introduction

Energy efficiency improvement means using less energy to deliver the same service. Putting energy efficiency first can be an underlying direct or indirect driver of a number of key European targets, when energy efficiency is acknowledged as "an energy source in its own right", or otherwise put, the “first fuel” considering that more energy will be saved by 2030 than the amount of oil-based energy then (Saheb & Ossenbrink, Securing Energy Efficiency to Secure the Energy Union: How Energy Efficiency meets the EU Climate and Energy Goals, 2015).

In particular, the European building sector still offers large savings potentials, which have been only superficially tapped. The sector accounts for 40% of Europe's total final energy consumption and is the main contributor to GHG emissions[3]. Around 75% of the building stock is energy inefficient, and at the current 1% annual renovation rate it would take around a century to decarbonise the building stock to modern, low-carbon levels.

Accordingly, investing in an increased renovation rate of the European buildings and homes offers various benefits for citizens, for the society, as well as for different segments of the economy. To realise the sustainable energy potential in buildings, a number of social, financial, technical barriers or administrative challenges need to be overcome. Even more financing energy demand side projects is seen more challenging compared to financing energy supply projects, according to EEFIG (2017), for reasons including:

a. benefits are in the form of savings rather than revenues
b. savings can be hard to measure, and Measurement and Verification protocolsare complicated and expensive
c. projects are generally small and fragmented when compared to supply sideprojects
d. projects can be embedded into wider projects with other purposes e.g. building modernization, which may jeopardize the economic benefits
e. the split incentive in commercial or residential property whereby the tenantbenefits from energy savings whereas the landlord makes the investment.

Therefore; the EU has increased efforts on several fronts to contribute to a more sustainable building stock. Notably, a package of various legislative pieces has been under review with direct benefit for the building sector (including the Energy Performance of Buildings Directive (2010/31/EU) and the Energy Efficiency Directive (2012/27/EU)), the amount of public funds has been increased and tailored for direct investments[4], for research and market preparation, etc.

Specifically, for energy efficiency financing for buildings, the European Commission launched the “Smart Finance for Smart Buildings” initiative in November 2016 to unlock private financing for energy efficiency investments in buildings.

An important objective of this initiative is to “de-risk” investments. This means that investors and financiers need to better understand the real risks and benefits of sustainable energy building investments based on market evidence and performance track record. Fundamentals such as the lower probability of default in the case of energy saving loans or an increased value of assets due to higher energy performance need to be progressively recognised by banks and reflected in the pricing of their financing products.

3. The impact of energy efficiency improvements on the valueof buildings

Properties and buildings are sold, marketed, rented, and renovated. Along these processes, their values are estimated. How much a property is worth depends on a large number of factors, some of them are intrinsic and others are external or even incidental.

The value of the property will essentially depend on both these characteristics and on the type of valuation that is being carried out. Out of these one characteristic to be taken into account can be the property’s energy efficiency level or energy performance per se, but more importantly several other characteristics that are directly related to energy performance. For example, renovating the lighting system usually also contributes to higher fire security, and when using CFLs or LED lighting the lower lighting temperature reduces both the risk of fire and the need for excessive cooling.

3.1. Valuation methods for buildings and properties

Hartenberger et al. (2017) provide an excellent overview of valuation definitions and practices that have to be considered when understanding the link between energy efficiency characteristics and the value of buildings in theory. Building on their assessment, the following context should be considered.

Valuation of a building or property occurs at many stages and for many purposes, and can actually take an official, or more “home-made techniques”. Even properties in the same neighbourhood and with similar characteristics are different enough and the market varies from day to day, making it impossible to come up with a hard and fast formula for determining a price for a property. Residential property owners typically look at property values in two ways. Either compare their home to similar ones on offer, - or if data allows – those sold recently, or they will calculate the invested costs (the land and the construction costs) to try to estimate the current value of their properties.

Official valuation techniques are based on data and evidence-based methods, are replicable and are officially validated. Since valuation is widely used by banks for lending, by financial markets for inclusion in financial statements, for regulatory compliance, for taxing purposes, for individual transactions, for hereditary decisions, etc., the reliability and replicability of the methods is of outmost importance. The following regulations and guidance books are most widely accepted:

— The International Valuation Standards (IVS) are standards for undertaking valuation assignments using generally recognised concepts and principles that promote transparency and consistency in valuation practice.

— The RICS[5] publishes the “Red Book” (latest in 2017: Global Red Book) to provide the mandatory requirements and advisory Valuation Practice Guidance Applications (VGPAs) that should be followed by valuers to remain consistent with IVSC international standards.

— TEGoVA[6] publishes the European Valuation Standards (focused on 5 topics) since the early 1980s as part of the European Valuation Standards (EVS), i.e. the “Blue Book”.

Overall, three key definitions of “value” should be differentiated:

— Transaction value (TV): is the amount for which the property actually exchanges owner or that is rented, which is based on both personal and non-personal factors. Such a valueis influenced not only by the persons involved, but also by the status of the market, by other markets (especially relevant here is the energy market), and by the moment of the transaction.

— Market Value (MV): “the estimated amount for which an asset or liability should exchange on the valuation date between a willing buyer and a willing seller in an arm’s length transaction, after proper marketing and where the parties had each acted knowledgeably, prudently and without compulsion.”[7]

The MV is not the actual transaction price, which may be highly influenced by a number of personal factors (e.g. emotional bond both from the buyer and the seller’s point of view, the need for a quicker transaction or conversely the time that the seller can wait until a “better offer” arrives, etc.)

The MV assumes that each participant is knowledgeable, has all important information, and they are not under other pressures.

As Hartenberger et al. (2017) have put it, the MV is a “moment in time” value, as it can change through time.

— Mortgage Lending Value (MLV) is defined as “the value of immovable property as determined by a prudent assessment of the future marketability of the property taking into account long-term sustainable aspects of the property, the normal and local market conditions, the current use and alternative appropriate uses of the property.”[8]

As opposed to MV, the MLV involves the analysis of risks or future perspective from the lender (bank) perspective.

The methodologies for valuation can be categorized into “market approach”, “income approach”, and “cost approach”. They are all based on the economic principles of price equilibrium, anticipation of benefits or substitution. The choice of approach for any given asset depends on the particular circumstances, and none of them is applicable in every possible situation. The choice should be influenced by (a) the appropriate bases of value, determined by the terms and purpose of the valuation assignment, (b) the respective strengths and weaknesses of the possible valuation approaches and methods, (c) thereliable information needed to apply the method(s) (IVSC, 2016). The following categories are defined in (IVSC, 2016):

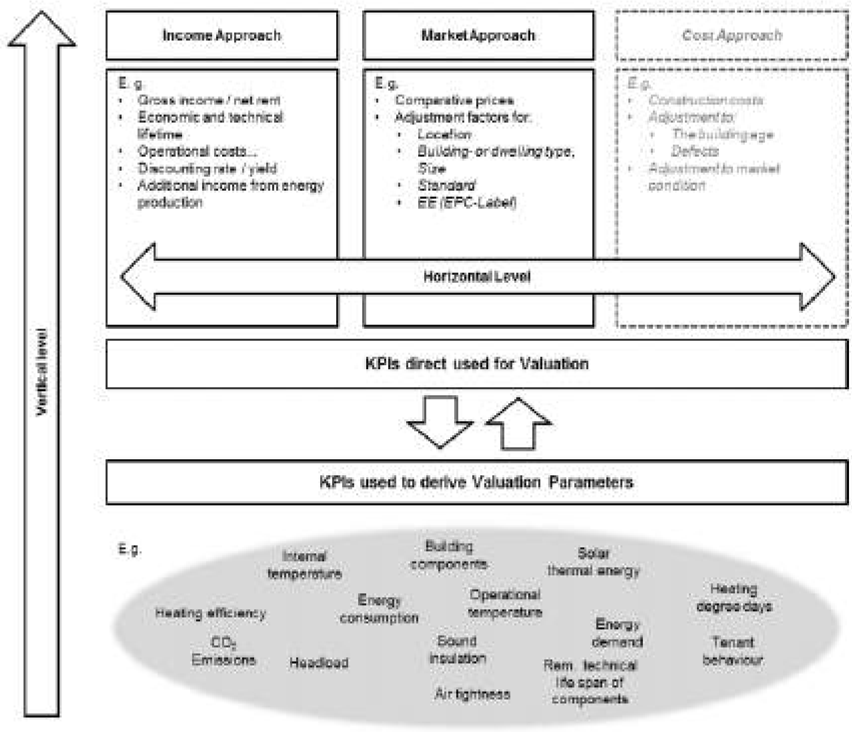
1. The **market approach** provides an indication of value by comparing the asset with identical or comparable (that is similar) assets for which price information is available. When reliable, verifiable and relevant market information is available, the market approach is the preferred valuation approach.
    (a) The **comparable transactions method**, also known as the guideline transactions method, utilises information on transactions involving assets that are the same or similar to the subject asset to arrive at an indication of value.
    (b) The **guideline publicly-traded method** utilises information on publicly-traded comparables that are the same or similar to the subject asset to arrive at an indication of value.
    (c) **Other market approaches**, such as Anecdotal or “rule-of-thumb” valuation benchmarks are sometimes used as a short-cut market approach, however should be avoided as much as possible.
2. The **income approach** provides an indication of value by converting future cash flow toa single current value. Under the income approach, the value of an asset is determinedby reference to the value of income, cash flow or cost savings generated by the asset. There are many ways to implement the income approach, all methods under the income approach are effectively based on discounting future amounts of cash flow to present value.
3. The **cost approach** provides an indication of value using the economic principle that a buyer will pay no more for an asset than the cost to obtain an asset of equal utility, whether by purchase or by construction, unless undue time, inconvenience, risk or other

    factors are involved. The approach provides an indication of value by calculating the current replacement or reproduction cost of an asset and making deductions for physical deterioration and all other relevant forms of obsolescence.
    (a) **replacement cost method**: a method that indicates value by calculating the cost of a similar asset offering equivalent utility,
    (b) **reproduction cost method**: a method under the cost that indicates value by calculating the cost to recreating a replica of an asset, and
    (c) **summation method**: a method that calculates the value of an asset by the addition of the separate values of its component parts.

Adjustments can be made “manually” to adjust for differences between the subject asset and the guideline transactions or publicly traded securities. These can be different premiums, such as the topic of the current report: “green premium”.

The Revalue project has summarized the Key Performance Indicators that are relevant in the above three valuation approaches (Reuter & Spaeh, 2017):

Figure 1. The three key valuation approaches and the valuation parameters



2.1 "Green value" and "brown discount"

Appraisers will be able to produce better results, and a more realistic valuation, if they consider green features of the property, such as energy efficiency, or the indoor air quality, existing, conventional buildings will become obsolete, and experience the so-called "brown discount". Due to increasing stringency of regulatory requirements and standards, these latter buildings and properties fall below standards and become less attractive due to increasing level of necessary economic input for upgrading. On the other hand, properties

that achieve or rather overpass the sustainability requirements or other green features (suchas solar panels, low-flow water faucets, energy-efficient lighting, automation) can experience a "green premium", which is a higher value assigned by potential buyers or renters related to their lower operational costs or the better living conditions they offer. An example of market development in the US was reported by Green Energy Money blog (2016)(see Figure 2).

Figure 2. The future trend of green buildings taking over the market because of non-sustainablebuildings going obsolete (US market situation)

The concept of "green value" or "green premium" was introduced in 2005 by RICS and was used more widely in the real estate business from 2010 (Hartenberger, Lorenz, Sayce, & Toth, 2017). While in the US, "Green Value" is used to refer to a variety of sustainability and environmental properties (including water and waste efficiency and resilience to flooding, even for social aspects), in Europe the term refers mostly only to energy efficiency and low carbon features. It has been long and often discussed whether more sustainable buildings are valued somewhat higher as a direct result of their better performance.

2.1 Calculation options of the "Green value"

According to EPBD 2010/31/EU, the energy efficiency recommendations included in the energy performance certificate can provide an estimate for the range of payback periods or cost-benefits over its economic lifecycle (European Commission, 2010). Article 5 points out that a new comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements is needed (D'Agostino & Parker, 2017). To accomplish the task, experts had to answer several questions such as: "Should a future higher sale or rent value for a more energy efficient building be taken into account already in the global cost calculation and if so, what should that value be?" (European Commission, 2011). Popescu et al. (2012) studied the opportunityof including a future higher sale value due to energy performance into economic calculations.The analysis provides information on how and when it is appropriate to take the added valuedue to energy performance into consideration in such methodologies focussing on various energy efficiency measures such as: thermal insulation of the walls, floor and attic, the replacement of old windows with energy efficient ones, natural efficient lighting, better HVACequipment, the integration of renewable energy systems, demand driven control, passive design BEMS[9], etc. Classic energy audit methodologies are based on the calculation of thenet present value of the costs of energy savings compared to the price of investments for energy efficiency measures.

Nonetheless, the result presented by this study Popescu suggests that energy efficiency measures produce two main financial benefits:

— firstly, they reduce the operation expenses and

— secondly, they increase the value of the building.

In this case, part of the investments in energy efficiency measures pay off immediately, due to the increased value of the property and only the rest has to be recovered by savings on energy expenses. As a result of this, the investments for energy efficiency measures (I) are considered profitable if they are lower than the net present value of the cost of energy savings (NPV) plus the added value of the building due to energy performance (ΔV),

$I < NPV + \Delta V$

The added value due to energy performance (ΔV) represents the net additional valueobtainable on the real-estate market after applying energy efficiency measures.

$\Delta V = P_2 - P_1$

Where P1 represents the transaction price of the property before retrofitting, and P2 is the transaction price after retrofitting. To include this in the energy audit methodology, the quantification of the added value due to energy performance (ΔV) is needed. So far, few markets have been studied from this point of view and generalizing their results is not possible since real estate markets are different and evaluated in different ways (Popescu, Bienert, Schützenhofer, & Boazu, 2012).

2.1.1 Methods to calculate the added value of energy performance

Three main procedures can be identified for calculating the added value due to energy performance (Popescu, Bienert, Schützenhofer, & Boazu, 2012), (Lorenz, Trück, & Lützkendorf, 2007) (Jim & Chen, 2006): the hedonic pricing model, the method based on the direct comparison between transaction prices and the method based on the willingnessto payback investments in energy efficiency measures . In addition to these, a classical method to calculate the net present value of costs of energy savings will be discussedhere[10]. Although it seems logical that consumers should be prepared to pay a higher pricefor energy efficient buildings compared to less efficient buildings that are below current energy performance standards, in reality this is more complex and evidence is needed in each studied market.

2.1.2 The hedonic pricing method

In the real-estate economic theory, the building is considered a good value for its characteristics. A hedonic price function describes how the quantity and quality of these characteristics determine the building's price in a particular market. Such method can derivethe quantitative impact of the energy performance on the value of the property. Lorentz et al. (2007) used hedonic analysis to explore the relationship between the sustainability features and the market value of residential properties from Stuttgart. The hedonic pricing model was also applied by Jim and Chen (2006) to study the impact of crucial environmentalelements on real estate transaction prices. Brounen et al. (2009) investigated the economic value of the European energy performance certificates by using the energy labels, as inputs. Other studies (Sayce, Sundberg, & Clements, 2010), (Leopoldberger, Bienert, Brunauer, Bobsin, & Schutzenhofer, 2010) had quantified the added value due to energy performance of a wide range of numerous buildings.

However, according to Popescu (2012), the use of hedonic pricing methods is complex. It requires large databases holding detailed features of buildings and it requires corresponding information on realistic prices, which limits the analysis to develop a completely transparent picture of the property markets. Further issues are that transaction data expires fast due to the volatility of prices and results of the hedonic pricing model applied to data collected from specific real estate markets, cannot be extrapolated for other markets or other periods. Due to the increased interest on ‘‘green value’’, ‘‘sustainability’’ or ‘‘energy efficiency’’, real estate experts and national property valuation bodies are supposed to provide information obtainedby the hedonic pricing model in the near future. It can be argued that when such informationwill be available, based on the known value of the buildings, the added value due to energy performance could be calculated.

2.1.3 The method based on the direct comparison between transactionprices

Following the research by Popescu et al, the method based on the direct comparison between transaction prices needs a link between the energy auditor and an appraiser, because it includes valuation techniques specific to the sales comparison approach (see above in section 2.1.). The sales comparison approach is based on the theory that same properties should have the same prices. It uses transaction prices of highly comparable properties that have been recently sold or currently for sale. The price of a property is affected by various characteristics and the effect of each feature on the value, must be analysed separately. There are national valuation organizations that have potentials on how to take into consideration the main characteristics of the building, for adjusting the value accordingly. Following this methodology (Popescu, Bienert, Schützenhofer, & Boazu, 2012) two databases should be created; one containing information on buildings that had undergone energy efficiency measures and the other one including information on non- retrofitted buildings. The impact of location on transaction prices is significant and therefore data must be grouped by location, in each one. Besides transaction prices, for each building,the databases must contain a description in terms of age, location, size, floor area, neighbourhoods, view, facilities, existence of an elevator, etc. Finally, adjustments of valuein accordance with specific differences (age, floor area, etc.), except location, are applied to the sale price of each comparable property. The meaning of the final adjusted value of each property would be the transaction price of the subject property if it was sold in the same district, where the comparable property is built. The added value of a retrofitted property is the difference between its value after retrofitting and the value before retrofitting.

The added value due to energy performance can also be calculated as a percent for each retrofitted property, to extrapolate the results, an average added value for energy performance must be calculated in each location. The result is the average rate for all the retrofitted properties located in the specific location. When the financial analysis of investments in energy efficiency measures has to be done for a property which has to be retrofitted, only the value of the property before retrofitting is known. By applying the transaction coefficient on the value of the property before retrofitting, the added value dueto energy performance can be calculated.

2.1.4 Method based on the willingness to payback investments in energy efficiency measures

This procedure uses a scoring model to quantify the willingness to payback investments in energy efficiency measures. It is very simple and once the main criteria of the scoring modelare defined, the energy auditor can apply it for different scenarios. A technique that could be considered to be a scoring model based on the sustainable characteristics and their future development, was used in the calculation of the Swiss Economic Sustainability Indicator (ESI) (Meins & Burkhard, 2009) (Meins, Wallbaum, Hardziewski, & Feige, 2010). In this paper a scoring model based on how the energy efficiency affects the buyer's willingness to pay back investments in energy efficiency measures is presented. In this model, the main political, social and psychological factors that can affect the willingness to pay more for energy efficiency are the following: energy efficiency is promoted by mass media, energy expenses represent an important part of household income; the market reflects higherprices for energy efficient buildings, sellers/buyers/tenants focus on energy efficiency aspects during transactions, operating expenses and energy costs are high compared to the rent/price for the property, energy prices increase fast and significantly, energy efficient buildings are rare and represent unique selling propositions, monetary penalties/restrictions are applied for non-energy-efficient properties, the studied building achieves passive houses standards. It may be noticed that if in the studied country/region such conditions are met and well-known, the market coefficient (β) might be significant, β = [0.75, 1]. If not, the impact of energy efficiency on transaction prices is low β= [0, 0.25]. Whether investments inenergy efficiency measures are completely neglected if the property is sold, $\beta = 0$. Once the analysis by the scoring method is done, the market coefficient (β) is settled and the added value due to energy performance can be calculated by the equation:

$$\Delta V^{\beta} = \beta * I$$

where I represents the cost of investments in energy efficiency measures. The way the scoring model is established may vary from country to country and from period to period.

2.1.5 Calculation of the net present value of costs of energy savings

The calculation of the potential costs of energy savings is typically the only parameter taken into consideration in the analysis of investments in energy efficiency measures. A high number of energy audit methodologies use a simple formula, like the following:

$$NPV = \sum_{j=1}^{J} \left((ES)_j \cdot (CE)_j \cdot \sum_{n=0}^{tR} \left(\frac{1}{1+i} \right)^n \right)$$

where ES represent the annual energy savings, j represents the type of energy (e.g. j = 1for gas, j = 2 for electricity, j = 3 for district heating, etc.), CE is the actual cost of energy, iis the discount rate, tR is the lifetime (in years) of the retrofitting. The annual energy savings ES represents the difference between the energy demand of the building before retrofitting ED1 and the energy demand after retrofitting ED2:

$ES= ED_1- ED_2$

The calculation of the net present value of costs of energy savings should theoretically include the forecast of energy prices. However, in practice this is difficult to predict since energy prices fluctuate at unexpected rate. According to the Popescu study, the best way to study the impact of the volatility of energy prices is to use the real option approach, basedon data from reliable sources, such as well-known energy agencies. For research studies thisis the recommended procedure, but energy auditors will not necessarily apply the same (Popescu, Bienert, Schützenhofer, & Boazu, 2012). Methods for calculating the net present value of costs of energy savings (NPV) depend on national energy assessment procedures that might include fluctuations of energy prices.

2.1.6 Calculation of the net present value of investment

The calculation of the NPV of investment is also an important factor taken into account during feasibility studies before investing in energy efficiency measures. This is a very basic, though still relevant, metric that influences the investor's choice to invest in a project. A commonly used methodology to calculate the NPV of investment uses a simple formula similar to the following:

$$NPV\ \mathrm{I} = F - \sum_{t=1 \ldots n} \mathrm{I}_t\ (1+\mathrm{i})^t$$

Where:

NPV I = net present value of the

investmentIt = investment at

year t

F =

financial

savingsi

=

discounte

d rate

t = years of investment or years of

financial saving n = life expectancy of

investment or financial saving

If the Net Present Value (NPV) is greater than 0, then the energy efficiency measure provides a better return than the alternative investment. The NPV is calculated by adding up all the benefits of the efficiency measure over its life and subtracting the costs. Benefits and costs are "discounted" to account for the time-value of money (the ability of money to earn interest).

The Net Present Value is a better measure to use than Internal Rate of Return when comparing a number of possible efficiency measures that are "mutually exclusive", meaning only *one* can be implemented. For example, NPV is a good measure to use when trying to determine what level of insulation to add to an attic. Only one level of insulation can be chosen, i.e. they are mutually exclusive.

The Net Present Value method requires that you enter a discount rate for your money (%/year.) The higher the risk of your project, the higher the discount rate you should use. Lighting projects for instance usually should not be very risky, so a rate of 7% /year couldbe applied.

A study conducted by JRC on the renovation of buildings (Saheb et al. (2015)) summarises the main financial and economic parameters influencing the cost-effectiveness of energy efficiency (Box 1 and Box 2).

Box 1. Financial and economic parameters of cost-effectiveness of energy efficiency

Financial parameters influencing the cost-effectiveness of EE investment:

The **discount rate (DR)** is the main financial parameter influencing investors' choices; it takes two forms the financial discount rate (FDR) and the social discount rate (SDR).

The **financial discount rate** is the opportunity cost of capital. We decide to use capital for one project and sacrifice another. The loss of income from the sacrificed project has an implicit cost.

There are three main ways of determining the FDR:
- estimating the actual weighted average cost of capital;
- establishing a maximum limit value for the FDR; and
- considering the cut-off as a planning parameter.

The **social discount rate (SDR)** reflects society's view as to how future benefits and costs should be evaluated as compared with the present. The SDR takes into account market failures in financial markets.

There are various ways of determining the SDR:
- expecting marginal public investment to have the same return as private investment;
- using estimates based on the predicted long-term growth of the economy; and
- using variable rates over time.

Economic parameters influencing the cost-effectiveness of EE investment:

The performance indicator used to assess the project is the main economic parameter that will influence the decision-maker. For EE investments, one of the following indicators is generally used
- internal rate of return (IRR);
- pay-back time (PBT);
- net present value (NPV); or
- benefit/cost ratio (B/C).

Net present value (NPV) is the sum of the discounted net flows of a project; it represents the present net benefits flow generated by the investment. NPV is calculated using the following formula:

$$NPV = \sum_{t=0}^{n} a_t S_t$$

where: S_t is the balance of cash flow at time t, a_t is the discount rate chosen for discounting over time t

The choice of discount rate and time horizon are crucial for determining the NPV of a project. A positive NPV means that the project generates a net benefit, which is what investors look for. However, the balance is usually negative in the first few years of the project.

Internal rate of return (IRR) expresses the relative efficiency of an investment. It is the discount rate that zeroes out the NPV value of flows of costs and benefits of an investment, as given by the formula below:

$$NPV\ (S) = \sum \frac{S_t}{1 + IRR^t} = 0$$

IRR is independent of the size of the project, while very sensitive to the economic conditions and the timing of benefits. IRR cannot be applied where time-varying discount rates are used, so the NPV is usually preferred. When details of the investors' capital costs are not available, IRR can be used as indicative.

Payback time (PBT) is the period required to recover the cost of an investment. It is calculated as a ratio of the cost of the project to annualised cash flows. Typically, longer PBTs are not desirable for investors.

$$Payback\ time = \frac{Cost\ of\ the\ project}{Annualised\ cash\ flows}$$

PBT does not measure profitability, as it ignores the benefits that accrue after the payback period. It also ignores the time value of money.

Benefit/cost ratio (B/C) is the present value of project benefits divided by the present value of project costs or investments.

$$\frac{B}{C} = {PV\ (I)}/{PV\ (O)}$$

where '*I*' is the inflows and *O* the outflows.

If *B/C* >1, the benefits measured by the present value of the total inflows are greater than the costs, measured by the present value of total outflows. The project is therefore suitable for investors.

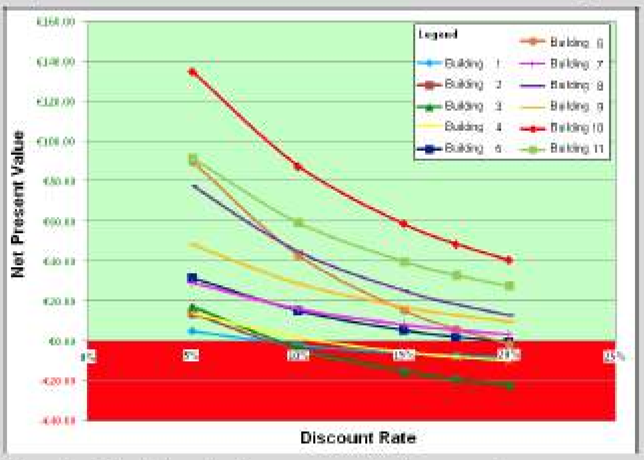
Like IRR, B/C is independent of the size of the investment. It rewards low-cost projects and is not appropriate for mutually exclusive projects, as it does not take account of the total amount of net benefits.

Box 2. Impact of discount rate choices on the cost-effectiveness of EE investment

To illustrate the impact of the discount rate on the attractiveness of energy renovation, we calculated the NPV for the renovation of 11 buildings using discount rates of 5%, 10%, 15% and 20%.

The attractiveness of the projects for investors is very sensitive to the discount rate chosen (Figure 4.2). With a discount rate of 5%, the 11 projects would have a positive NPV, making them all attractive to investors. However, with a rate of 10%, five of the 11 projects would have a negative NPV and would not be attractive to investors.

Impact of discount rate choices on the cost-effectiveness of energy renovation



Key point: The higher the discount rate, the less attractive energy renovation is to investors.

The higher the discount rate, the less attractive energy renovation would be for investors. When competing with alternative investment opportunities close to 20% (e.g. other energy investments), less than half of the projects would be attractive to investors. To make the 11 projects attractive, the capital cost should be 5%, which is close to the social discount rate.

2.1 Valuing energy efficiency by the market

The value of a property is expected to be affected when improving its energy performance, because it is associated by lower operating costs, and therefore higher cash flow of the owner, as well as because there are numerous co-benefits associated with buildings that are more energy efficient, which are seen to provide a greater level of services (Urge-Vorsatz, Novikova, & Sharmina, 2009). Therefore, actors expect the energy performance of buildings to affect the value of buildings as it saves money and is also in line with changing social norms vis-à-vis the environment.

On the other hand, barriers, such as the split incentive have been shown to undermine the theoretical potential that information provision can be expected to assure. According to Kok and Jennen (2012) part of the return to energy efficiency improvements consists of relatively predictable energy savings, but under lease contracts and in multi-tenant buildings, these savings typically flow to the occupants.[11] For investors, the return is thus uncertain, consisting of better marketability of properties (*e.g.*, lower risk of vacancy, higherrents, shorter rent-free periods) and higher valuations (*e.g.*, less depreciation). In this context, the implementation of energy performance certificates can improve thetransparency of energy consumption in buildings, enabling private and corporate occupiersto take energy efficiency into account when making housing decisions. Recent evidence shows that the EU energy label is effective as a signalling device in the residential housing market (Brounen & Kok, 2011). Information provision through certificates or energy performance labelling can help render the differences between otherwise comparable properties more readable, enabling market actors to act on this information when they perceive it to be salient to them (Mudgal, Lyons, Cohen, Lyons, & Fedrigo-Fazio, 2013).

2.1.7 Claimed value, willingness to pay

Banfi et al. (2008) analysed the willingness to pay for different energy saving measures in the context of the Swiss residential buildings sector. In this case, the willingness to pay for energy efficiency attributes was 3% of the standard price for having an enhanced insulated façade, 13% more for energy-efficient windows and 8% of the standard price for having a ventilation system.

Sayce et al. (2010) concluded there have been a number of studies that showed a positive relationship between willingness to pay and "green premium", however the impact on the observed, actually realized transaction price is considered to be a better indicator.

2.1.8 Impacts observed at the property markets

There has been a wealth of studies that assessed the impact of improved energy efficiency and or other sustainability attributes, mostly through the assessment of the energy labels and/or certification schemes. These have been collected and compared in meta- assessments, which are summarized below in Table 1 for the commercial and public sector and in Table 2 for the residential sector (references are indicated in the tables).

Mudgal et. al. (2013) reviewed 22 papers in which hedonic regression had been applied to determine the relationship between energy performance certificates and the exchange value of both residential and commercial real estate (both rental and sales value), in a period from1995 to 2012. In 19 of the 22 papers, a positive relationship on either rental and/or sales value was identified: the labelled buildings (e.g. Energy Star or LEED) have an increased price compared to non-labelled objects. In the residential market they found that transaction prices are central, but findings are overall conflicting. Some studies showed evidence that a positive relationship exists between energy efficiency labels and transaction prices. However, these studies did not investigate occupancy premiums and only three studies investigated rental premiums. Regarding these factors and the effect on time to sale the existing literature is thin. All studies in Europe show price premiums for energy efficient buildings, though some are unquantified.

There seem to be more studies available for the commercial and service segment than forthe residential sector. Of the studies examining the impact on sales value, 90% found that the presence of energy/environmental labelling had a positive impact on the sales value (European Commission, 2016).

The REVALUE project (Pelizzon & Riedel, 2017) also provided an overview of past literature and the impacts found that green value had a positive impact on either the prices or other selling/renting attributes, such as transaction time. The commercial sector was found to seea lot of benefits, although not always quantifiable (e.g. through soft impacts). As seen from Table 1 and Table 2 above, the increase of both the sale price and of the renting rate and both for non-residential and residential (respectively) buildings has been observed in the large majority of the reviewed studies. Only rarely a negative impact has been seen, or some cases could not indicate an impact. In more recent studies (probably due to more detailed assessments) varied types of impacts were found, e.g. impact depended on the location or on the availability of properties in the neighbourhood.

The ranges across countries are difficult to compare, because of the different methodologies and because of the different market structures and label/certification information.

As a rule of thumb from the above meta-studies, an increase of 3-8% in the price of residential assets, and an increase of around 3-5% in residential rents compared to similar properties can be observed. Some studies also proved brown discount, e.g. the French national study based on notaries' database could compare premium and discount both amongst houses and amongst apartments. They found -6% to -17% brown discount and + 6% to + 13% premium for houses (depending on the region), and -6% to -10% brown discount and + 3% to + 19% premium for apartments.

For commercial buildings, the premium seems to be higher, over 10%, and in some studies even over 20% of sales price increase compared to similar properties has been reported. Rental prices have also been positively affected by 2-5%.

2.2 Summary and conclusion: the impact of EE on the building value

Implementing energy efficiency measures in buildings have important benefits for the developer/owner, the tenants, the society and the environment. They can reduce operation costs, improve the image and reputation; they have low impact on the environment andmost importantly, they cut the use of primary resources. All these qualities have a theoretical basis for increasing building value and worth, advantages in tendering processes and increased marketability.

According to the literature reviewed energy efficiency and energy certification produce tangible benefits. They have been expressed in a number of studies through willingness of pay. Since reliable proof exist, market driven reasons such as higher prices for energy performance buildings can be included in the impact assessment of energy policies (Popescu,Bienert, Schützenhofer, & Boazu, 2012). Recommendation to incorporate the sale value information in the financial analysis of investments in energy efficiency measures should be done, with caution, only when and where there are reliable proofs that the studied real- estate market reacts to energy performance.

As a rule of thumb an increase of 3-8% in the price of residential assets as a result of energy efficiency improvements, and an increase of around 3-5% in residential rents compared to similar properties can be observed. For commercial buildings, the premium seems to be higher, over 10%, and in some studies even over 20% of sales price increase compared to similar properties has been reported. Rental prices have also been positively affected by 2-5%. Differences across regions and countries, as well as different property types (e.g. apartments vs. houses) are shown. The change over time is also seen, because the labels and schemes become more well-known and understood. It is shown that higher energy performance is becoming the norm; therefore higher values are associated with better performance recently.

2 The role of energy efficiency in payment default risk

Credit risk or payment default risk[15] is the probability of loss of the lender due to late or non-payment. From the other perspective, at the individual level, the payment default risk isthe potential of a borrower or another counterparty to fail to meet its payment obligations intime, i.e. in accordance with contractually agreed terms (Basel Committee, 2000).

A theoretical argument why owners and tenants of more sustainable (more energy efficient/green/better performing) buildings are less prone to default in their payments has been established by Pelizzon and Riedel (2017) within the EeMAP project[16] building on recentliterature. Hereby, a summary and extension of their argumentation is given.

On one hand, the financial status of the borrower will be affected:

1.1. As has been shown in this report, the operational costs (energy bill) of an energy efficient building are lower, therefore the cashflow and the disposable income of the borrower are higher (EEFIG, 2017), which remains available for errands and unexpected events, etc.

1.2. The financial stability is also underpinned by the fact that the costs are morepredictable according to Burt et al. (2010).

1.3. Furthermore, energy price fluctuations do not affect the operational costs of the building as much as those of the standard buildings.

1.4. The Green Mortgages project[17] in Romania further established an indirect link between the financial stability of the borrower and his/her reduced health related costs due to healthier homes.

On the other hand, energy efficiency improvement investments have a positive impact onthe value of the property (see Section 2 of this report), which is used as an equity.

2.1. The attractiveness of the building is increased or even ensured as opposed tostandard buildings. First, more sustainable buildings may be valued higher by potential buyers/renters.

2.2. Second, following current regulatory trends, low energy performing buildings may fallbelow standards for a next transaction.

However, only very little evidence is available to prove especially the first point above in practice (Pelizzon & Riedel, 2017). According to Pelizzon and Riedel (2017), only three studies have tried to measure the direct impact of energy efficiency on mortgage defaultrisk, and only one of them was targeted at the residential sector, while all studies originate from the USA. Nevertheless, these studies did find evidence.

Data of a national sample of 71,000 ENERGY STAR rated and non-ENERGY STAR homes in the USA were analysed by Quercia and colleagues (Quercia, Sahadi, Stellberg, Kaza, & Tian, 2013) to determine whether residential energy efficiency was associated with lower default and prepayment risks. Two key messages are drawn:

1) “The study finds that default risks are on average 32 percent lower in energy-efficienthomes, controlling for other loan determinants. This finding is robust, significant, andconsistent across several model specifications.”

2) “Within ENERGY STAR-rated homes, default risk is lower for more energy-efficient homes.”

The impact of energy efficiency and environmental performance at the corporate building level has been shown, for instance, by Iichholtz et al. (2012), who documented that Real Estate Investment Trust (REITs) owning a larger fraction of energy performance and environmentally certified buildings demonstrate enhanced operating performance measured by return on assets (ROA), return on equity (ROE). In addition to these, certified buildings are associated with a significantly lower systematic risk. The analysis (Iichholtz, Holtermans, Kok, & Yonder, 2012) demonstrated the existence of a negative relationship between environmental performance and risk, i.e.

environmentally certified real estate assets tended to have higher and more stable occupancy rates that are easier to sell and have lower systematic risk.

The impact of the existence of a certification/label as opposed to a building with the same characteristics, including energy performance but without a certificate has not been studied to the knowledge of the authors of this report. This could also be an interesting research question, in order to determine whether the main causal relationship between avoiding payment default is with the higher financial stability (lower actual operational costs), or it is also with the information (and thus probably higher market value).

It is evident that much more research and data collection are needed in this field, and especially studies focused on the European Member States would be critical, becausepayment default functions can vary widely between localities due to cultural, behavioural, and economic aspects. We need to understand three critical issues:

- What is the function between the borrower's default risk and energy efficiency investments, and/or the value of the equity as compensation and energy efficiency investment?

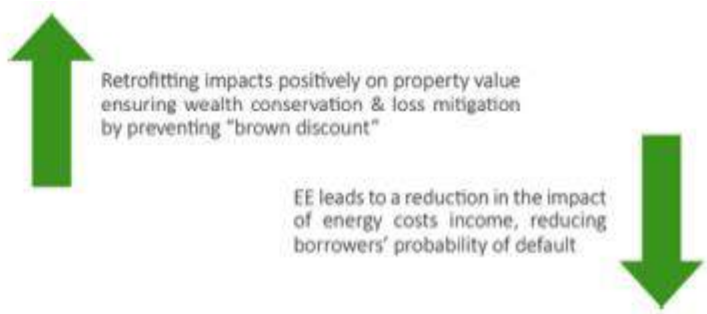
- Are there (or is there any interest from) banks or financial institutions that value a higher rating in energy efficiency performance, and is this linked to the fact of being more energy efficient or to the existence of a certification about it?

- What additional mechanisms exist to decrease the default risk in relation to energy efficiency investments?

The second and third points are discussed in the next two sections below.

In recent years more and more open source databases and platforms appear that are able to substantiate financial decisions, or economic valuations of building projects. None has been found to deal with the payment default *per se*, but they can be used as examples for the establishment for one. The DEEP (DE-RISKING Energy Efficiency Platform),[18] monitors and benchmarks energy efficiency performance in the building and industry sector to evidencethe actual performance and payback-time of energy efficiency investments and financial risks.

Figure 5. Double impact of energy efficiency on the value of the building.



While research is very scarce on the topic so far, a promising European project has been identified (and quoted above). The EeMAP (Energy Efficient Mortgages Action Plan) is a market-led initiative focused on the design and delivery of an "energy efficient mortgage", which is intended to incentivise and channel private capital into energy efficiency investments. The initiative is based on the assumption that energy efficiency has a risk

3.1 Energy efficiency to hedge against energy price risk

Energy consuming assets represent a "short" position in the energy markets. A "short" position is the risk terminology that implies a relationship between future energy prices and price risks. Modern energy supply markets allow energy producers and end users to protect against volatility by using financial instruments known as hedges. Hedges are effectively insurance instruments where a market participant can pay a relatively small amount to reduce the uncertainty in future prices (Bertoldi & Kromer, 2006). In this context, energy efficiency has significant well-documented economic environmental benefits, especially in regions with a history of high energy prices and high energy intensity. Companies' energy costs are often as large as or even higher than profits. This indicates the significant financial benefits that can result from reducing energy costs by improving efficiency. Up to now less attention has been paid to how these benefits can flow through to financial institutions as a result of reducing the default risk of borrowers. Reducing energy consumption lowers the exposure of companies to volatile energy prices, making their profits more secure and lowering the risk of their defaulting on loans (Blyth & Savage, 2011), see also Figure 6.

Figure 6. Multifaceted benefits of improved energy performance

The attractiveness of energy efficiency as an investment proposition depends on a variety of factors including the policy environment, the energy market structure and the existence of suitable supply chains for energy efficiency projects.[21] According to Blyth and Savage(2011), "Perhaps most fundamentally, the investment case depends on energy prices". As prices rise, the payback on energy efficiency investment becomes more attractive. However,project finances depend not only on the absolute level of energy prices but also on their volatility. Price volatility creates systemic risks to companies and to the wider economy. Energy efficiency can help to offset some of these risks, giving companies that invest in energy efficiency a different risk profile from their competitors.

According to the literature review collected for this analysis (Blyth & Savage, 2011) (Bertoldi& Kromer, 2006) energy efficiency can also be important to hedge against energy pricerisks. Though separate energy efficiency projects can be financially attractive, banks generally make decisions not on the basis of project cash flow but rather on the strength of the host company's balance sheet because of the need for collateral. Companies with tight margins are exposed to significant financial risk from the increase and volatile energy prices and other commodities. Because energy markets show a high degree of volatility and uncertainty, going forward, companies with significant energy costs will be exposed to significant financial risk and energy efficiency can help reducing this exposure (Blyth & Savage, 2011). For instance, a company that can bring the energy cost down below those ofits competitors may find that its returns have a reverse correlation with energy price movements: if the market price of goods rises in response to energy price rises, energy efficient companies stand to gain more than their competitors, and profits may increase in line with energy prices. Reducing volatility in the asset value therefore reduces a company's risk of default and should also reduce the company's cost of capital. Banks and other investors seeking to hedge themselves against energy price risk should therefore see energyefficiency as an attractive investment class.

3.2 Mechanisms to further decrease payment default risk

As shown above, a higher energy performance of a building is already an indicator for lowered payment default risk. This credit risk can be further decreased by payment policy mechanisms.

On-bill recovery (OBR) (EEFIG, 2017) is used in several states of the USA for residential energy efficiency loans[22]. The clients repay their loans - taken for energy efficiency investments - directly linked to their electricity bill. This has a number of benefits related to the reliability of repayment. Usually, the OBR component is set in an amount that is less than the cost saving, in order to leave the client with a positive cash flow, and encouragethe use. The OBR is billed together with electricity; therefore, it makes the payments easy tohandle for both the client and the bank. Billing with the electricity is also informative at the decision phase, as credit risk can be linked to bill default rates. There are additional benefits for the financial institutions, such as reduction of overhead (using an existing billing and marketing route), access to a larger customer base, more reliable repayment, and transferability. Finally, linking the repayment with the electricity bill means also transferability in case of sale or renting. On the other hand, with the liberal market, where customers can choose their electricity suppliers, transferability becomes difficult and clarifiedregulations would be needed on how these obligations can and have to be handled in case ofsale or rent and in case of supplier switch.

The design of the OBR programme is critical (as always). The most well-known example of the UK Green Deal, which was launched in 2013 and ended in 2015, generated a number of important lessons for the European markets. The mechanism should be tested carefully before launch, the list of eligible measures should be representative of the market needs and drives, interest rates should be competitive, the transaction costs/time shall be limited, and the marketing message should be tailored to the stakeholders (for example, the financial benefits were overemphasized for the UK Green Deal, while clients were found later to be more attracted by warmer homes) (EEFIG, 2017).

Another real example of repayment mechanisms is also found in the USA[23]. PropertyAssessed Clean Energy (PACE) loans are repaid as an additional payment on a property's regular local property tax. Naturally, a prerequisite is that there is local property tax, and that linking it with a commercial loan is regulated by the local or municipal legislative level,in order to ensure that the loan repayment can be collected and enforced in the same wayas the linked tax (EEFIG, 2017).

3 Conclusions

This overview of literature on the impact of energy efficiency improvements on the value of buildings provides an indication that energy efficiency and sustainability matters in the rentaland real estate markets. Rental growth in efficient and less efficient buildings differsnoticeably. Sustainability has a direct impact on the evaluation of "non green" and more efficient buildings.

However, a more systematic and comparable evidence is missing on what the exact level of impact is, and how this could be integrated into investment and financing decisions to consider the rental and sale price increase as a co-benefit of energy efficiency improvements. More academic evidence would be helpful to confirm how investments in energy performance really translate into economic value, because investors remain reluctantto invest in energy efficiency measures and retrofitting of existing properties.

Real estate appraisers should integrate the most important elements of sustainability (energy efficiency, carbon emission reduction) in the evaluation of properties, for instance less sustainable implies lower income (and quite possible higher risk). Banks and other real estate financiers can exploit the measurable elements of sustainability in the evaluation of existing and future lending agreements. For less efficient office properties that are not adequately improved, the credit risk faced by banks may be affected through lower cash flows and also maybe by the lower values of the financed properties leading to a higher loan compared to the value of the property.

Notably this overview offers insights into the profit opportunities of building retrofits as well. Sustainability is a key element for real estate investors. Innovative financing mechanisms such as "retrofit funds" "on bill financing through utility companies", "ESCOs" enable large scale inflows of private capital to invest in energy efficiency (Kok & Jennen, 2011). Using Third Party capital, real estate investors can improve the quality of their real estate portfolio,profit from lower operational costs, benefit from an improvement in the marketability of the properties and ultimately they are hedged against the market and macroeconomic trends that will affect the value of their property portfolio.

At the European level, the volume of outstanding mortgage loans was €7 trillion at the endof 2016, representing 30% of total assets in the EU banking sector (€23.6 trillion in 2016) and equalling 47% of EU GDP (Pelizzon & Riedel, 2017). The decisions and methods the financing sector, in particular banks employ have a significant impact on the construction sector, and in particular on the energy efficiency sector, and may be among the key game- changers in relation to the EU's energy savings targets.

This and many quoted reports have shown clear evidence for the economics of energy efficiency investments in buildings to reduce credit risk when pricing loans, through the increased creditworthiness of the client/the asset owner and also due to the increased value of the buildings, assets.

International Financial Institutions (IFIs) could and should intervene through provision ofrisk guarantees priced against the 'real' as opposed to the 'perceived' risk profile of such investments. Such guarantees could help catalyse a scaling up of energy efficiency financing.Initially, guarantees would encourage banks to explore default risk beyond their current conservative horizons with respect to energy efficiency lending. The banks would then gain from the reduced risks, and in the long run this should lead to a greater willingness to lendto energy efficiency and more favourable lending terms, stimulating greater demand for loans without the need for guarantees.

Regarding the impact of energy performance certification on commercial mortgages this overview demonstrates that energy efficiency plays a crucial role. Lower risk associated with energy efficiency should be taken into account when underwriting mortgage risks. As a result, efficient homes should have lower default risks than less efficient homes because the former are associated with lower energy costs, which in theory should leave more money to pay the mortgage.

2.1 Project team competencies

The selection criteria have been specified to encompass the range of competencies and expertise that would be required to deliver an environmentally improved office building. These reflect the need for experience in specific technical areas as well as in the successful management of technical innovation in this field.

The first two proposed criteria are focussing on the project manager and the design team, who have a critical role to play in selecting, modelling, specifying and integrating solutions to meet environmental criteria. Working alongside the design team, the role of the project manager was identified by stakeholders as being significant in managing technical innovation, so it is specifically highlighted. Given the increasing prevalence of building environmental assessment schemes, experience and expertise in applying them to projects is also judged to be of value in managing a design teams' response to a range of environmental criteria.

The next two criteria are focussing on the main building contractor and possible specialist contractors, as well as potential Design, Build and Operate (DBO) contractors and property developers. The need to make thedistinction between these two broad types of contractors was highlighted by stakeholders because of the difference in the contractual relationships and competencies required. Depending on the nature of the project, it may also be necessary to procure the services of specialist contractors. These could include, for example, the demolition of buildings already on a site or an Energy Service Company (ESCo) providing building renovations

and/or low or zero carbon energy supply technologies.

Stakeholder feedback received during the final written consultation

It was commented that the roles of the project manager and the design team should be separated. They are distinct competencies and the project managers may be separately contracted from the design team. Thesame should also apply to the competencies of the main contractor and property developers, which should be distinguished.

With reference to the overall management of energy use, the potential to refer to ISO 50001 was highlighted by one stakeholder. This is a standard that specifies the elements of an energy management system.

Moreover, a stakeholder also commented that the criteria should include reference to experience in the design/construction of buildings with the same procured scale/budget.

These comments are addressed in the above-given background discussion and rationale.

<table>
<tr><th>Core criteria</th><th>Comprehensive criteria</th></tr>
<tr><td colspan="2">SELECTION CRITERIA</td></tr>
<tr><td colspan="2">These criteria may form part of a pre-selection procedure where the services of a project manager and/or a design team are procured by the contracting authority. The number and size of executed projects to prove the experience should be proportionate to the tendered project. Design competitions may be used to encourage new companies with less experience to bid, although to balance the risk it could be requested that the design team contains experienced supporting expertise.</td></tr>
<tr><td>A1. Competencies of the project manager

The project manager shall have relevant competencies and experience in each of the following areas for which they would be responsible under the contract (select as relevant to the specific contract):

- The project management of building contracts that have met or exceeded the environmental performance requirements set by clients;

- The successful identification and management of the delivery of a range of environmental technologies and design innovations required to deliver improved environmental performance and quality;

- Involvement in the financial appraisal of environmental technologies and design innovations as part of the delivery of projects.

Verification:

Evidence in the form of information and references related to relevant contracts in the previous 5 years in which the above elements have been carried out. This shall be supported by CVs for personnel who will work on the project.</td><td>A1. Competencies of the project manager

The project manager shall have relevant competencies and experience in each of the following areas for which they would be responsible under the contract (select as relevant to the specific contract):

- The project management of building contracts that have met or exceeded the environmental performance requirements set by clients;

- The successful identification and management of the delivery of a range of environmental technologies and design innovations required to deliver improved environmental performance and quality;

- Involvement in the financial appraisal of environmental technologies and design innovations as part of the delivery of projects;

- Projects that included the assessment of building environmental performance using multi-criteria building assessment, reporting and certification schemes;

- The use of holistic assessment tools in the design, appraisal and specification of environmentally improved buildings, including LCC and LCA.

Verification:

Evidence in the form of information and references related to relevant contracts in the previous 5 years in which the above elements have been carried out. This shall be supported by CVs for personnel who will work on the project.</td></tr>
<tr><td>A2. Competencies of the design team

The architect, consultant and/or design team consortium shall have relevant competencies and experience in each of the following areas for which they would be responsible under the contract (select as relevant to the specific contract):

- The management of building contracts that have delivered improved environmental performance that goes beyond minimum building-code requirements (specify if national, regional, local or other) regarding the following aspects (to be completed with elements deemed important by the contracting authority and not covered below);

- Energy efficient building fabric and services design for new-build or renovation projects (select as appropriate), including if available measured energy performance data per m^2 from completed projects including heating, cooling, lighting, hot water and auxiliary equipment;

- Installation of Building Energy Monitoring Systems (BEMS), communication of how they work to building managers and their use to diagnose energy use patterns in</td><td>A2. Competencies of the design team

The architect, consultant and/or design team consortium shall have relevant competencies and experience in each of the following areas for which they would be responsible under the contract (select as relevant to the specific contract):

- The management of building contracts that have delivered improved environmental performance that goes beyond minimum building-code requirements (specify if national, regional, local or other) regarding the following aspects (to be completed with elements deemed important by the contracting authority and not covered below);

- Energy efficient building fabric and services design for new-build and/or renovation projects (select as appropriate), including if available measured energy performance data per m^2 from completed projects including heating, cooling, lighting, hot water and auxiliary equipment;

- The specification and design of renewable and/or high</td></tr>
</table>

buildings; - Water efficient services design, including measured water demand per employee from completed projects; - The specification, procurement and installation of low environmental impact construction materials. To include reference to EPDs in compliance with ISO 14025 or EN 15804; - The development and implementation of staff travel plans, including infrastructure for low emission vehicles and bicycles. Project experience and Continuous Professional Development (CPD) of relevance to these areas shall be highlighted. *The contracting authority may require a minimum number of contracts according to the nature of the project.* **Verification:** Evidence in the form of information and references related to relevant contracts in the previous 5 years in which the above elements have been carried out. This shall be supported by CVs of personnel who will work on the project.	efficiency energy generation equipment; - Installation of Building Energy Monitoring Systems (BEMS), communication of how they can be used to building occupiers and their use to diagnose energy use patterns in buildings; - Water efficient services design, including measured water demand per employee from completed projects; - Bioclimatic architecture and passive design to good thermal and optical comfort, natural air purification etc; - Assessment of building environmental performance using multi-criteria building assessment and certification schemes, - The specification, procurement and installation of low environmental impact construction materials. To include reference to EPDs in compliance with ISO 14025 or EN 15804. - The use of holistic assessment tools in the design and specification of environmentally improved buildings including LCC and LCA. Comparative studies in compliance with ISO 14040/14044 or EN 15978. - Design, specification and monitoring to address daylighting and glare, thermal comfort and indoor air quality - The development and implementation of staff travel plans, including infrastructure for low emission vehicles and bicycles. Project experience and Continuous Professional Development (CPD) of relevance to these areas shall be highlighted. *The contracting authority may require a minimum number of contracts according to the nature of the project.* **Verification:** Evidence in the form of information and references related to relevant contracts in the previous 5 years in which the above elements have been carried out. This shall be supported by CVs of personnel who will work on the project.

Selection criteria on the competencies of the lead construction contractor, specialist contractors and/orproperty developers

Core criteria	**Comprehensive criteria**
SELECTION CRITERIA	

A3. Competencies of the main construction contractor and specialist contractors. *These criteria may form part of a pre-selection procedure for the main contractor or where specialist contractors are to be procured e.g. demolition, ESCOs.* The construction contractor shall have relevant competencies and experience in the completion of building contracts that have been shown to have delivered improved environmental performance.	**A3. Competencies of the main construction contractor and specialist contractors.** *These criteria may form part of a pre-selection procedure for the main contractor or where specialist contractors are to be procured e.g. demolition, ESCOs.* The construction contractor shall have relevant competencies and experience in the completion of building contracts that have been shown to have delivered improved environmental performance.

In the case of design and build contracts, criterion A1 will also be relevant to the design team employed. Relevant areas of experience shall include (as appropriate to the project and the selected GPP criteria): - Energy efficient building fabric and services design for new-build or renovation projects (*select as appropriate)*, including if available measured energy demand per m^2 from completed projects including heating, cooling, lighting, hot water and auxiliary equipment. This will have been applied in the context of new-build and/or renovation projects (select as appropriate); - The installation of Building Energy Monitoring Systems (BEMS) and communication of how they work to building managers; - The installation of water efficient services, including if available measured water demand per employee from completed projects; - The procurement, installation and verification of low environmental impact construction materials. - The successful implementation of demolition and site waste management plans in order to minimise waste arisings. Selection and knowledge of off-site treatment options. **Verification:** Evidence in the form of information and references related to relevant contracts in the last 5 years in which the above elements have been carried out. This shall also be supported by CVs for personnel who will work on the project and their relevant project experience.	In the case of design and build contracts criteria A1 will also be relevant to the design team employed. Relevant areas of experience shall include (as appropriate to the project and the selected GPP criteria): - Energy efficient building fabric and services design, including if available measured energy demand per m^2 from completed projects including heating, cooling, lighting, hot water and auxiliary equipment. This will have been applied in the context of new-build and/or renovation projects (select as appropriate); - The installation, commissioning and (as relevant) ongoing operation/maintenance of renewable and/or high efficiency energy generation equipment; - The installation of Building Energy Monitoring Systems (BEMS) and communication of how they work to building managers; - The installation of water efficient services, including if available measured water demand per employee from completed projects; - Functioning passive design features to achieve low energy use and good thermal and optical comfort, etc; as evidenced by post-occupancy studies; - The procurement, installation and verification of low environmental impact construction materials. Supply chain management to ensure compliance with building assessment and certification systems and in order to support modelled resource efficiency strategies; - The successful implementation of demolition site waste management plans in order to minimise waste arisings. Selection and knowledge of off-site treatment options. - The installation of features to address daylighting and glare, thermal comfort and indoor air quality **Verification:** Evidence in the form of information and references related to previous contracts in the last 5 years in which the above elements have been carried out. This shall be supported by evidence and data from: • Third party auditing, • Post-occupancy auditing, • LCA/LCC analysis and/or • Data collection from monitoring This shall also be supported by CVs for personnel who will work on the project and their relevant project experience.
A4. Competencies of DBO contractors and property developers *These criteria may form part of a pre-selection procedure for the DBO contractor or property developer that will operate the building.* *The contractor shall have relevant competencies and experience in managing the construction and operation of office buildings that have been shown to have delivered improved environmental performance. Criterion A1 will also be relevant to the design team employed.*	**A4. Competencies of DBO contractors and property developers** *These criteria may form part of a pre-selection procedure for the DBO contractor or property developer that will operate the building.* *The contractor shall have relevant competencies and experience in managing the construction and operation of office buildings that have been shown to have delivered improved environmental performance. Criterion A1 will also be relevant to the design team employed.*

Relevant areas of experience shall include (as appropriate to the project and the selected GPP criteria): - The management of design teams to achieve the permitting and construction of office buildings that met client performance requirements, including under DBO arrangements; - The management of main contractors for the construction of office buildings that have environmentally improved performance, including under DBO arrangements; - Ongoing facilities management in order to optimise the performance of office buildings, including the use of systems such as BEMS, the contracting of energy managers and the ongoing monitoring/reporting on performance; **Verification:** Evidence in the form of information and references related to previous projects and contracts in the last 5 years in which the above elements have been carried out. This shall also be supported by CVs for personnel who will work on the project and their relevant project experience.	Relevant areas of experience shall include (as appropriate to the project and the selected GPP criteria): - The management of design teams to achieve the permitting and construction of office buildings that met client performance requirements, including under DBO arrangements; - The management of main contractors for the construction of office buildings that have environmentally improved performance, including under DBO arrangements.; - The management of design teams and/or main contractors to obtain ratings according to multi-criteria building assessment and certification schemes; - Ongoing facilities management in order to optimise the performance of office buildings, including the use of systems such as BEMS, the contracting of energy managers and the ongoing monitoring/reporting on performance; **Verification:** Evidence in the form of information and references related to previous projects and contracts in the last 5 years in which the above elements have been carried out. This shall also be supported by CVs for personnel who will work on the project and their relevant project experience.
A5. Energy Management System *These criteria may form part of a pre-selection procedure for a developer/operator of the office building.* The DBO contractor or property developer who will operate the building shall be able to demonstrate experience in implementing energy management systems for sites, such as ISO 50001 or equivalent, as part of facilities management arrangements. **Verification:** The DBO contractor or property developer shall provide management system certifications for sites they operate or have operated over the last three years.	**A5. Energy Management System** *These criteria may form part of a pre-selection procedure for a developer/operator of the office building.* The DBO contractor or property developer who will operate the building shall be able to demonstrate experience in implementing energy management systems for sites, such as ISO 50001 or equivalent, as part of facilities management arrangements. **Verification:** The DBO contractor or property developer shall provide management system certifications for sites they operate or have operated over the last three years..