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BUSINESS CASE

FOR ENERGY EFFICIENCY INVESTMENTS AND INTEGRATION OF RENEWABLE ENERGY SOURCES IN PUBLIC BUILDINGS

Disclaimer

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Main abbreviations and acronyms

BACS	Building Automation and Control System
BEMS	Building Energy Management System
DHW	Domestic Hot Water
EC	European Commission
EE	Energy Efficiency
EED	Energy Efficiency Directive
EFSI	European Fund for Strategic Investments
EIB	European Investment Bank
ELENA	European Local Energy Assistance
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Contract
ESC	Energy Service Contracting
ESCO	Energy Services Company
ESIF	European Structural and Investment Funds
EU	European Union
GHG	Greenhouse Gas
HVAC	Heating, Ventilation and Air Conditioning
NEEAP	National Energy Efficiency Action Plan
NZEB	Nearly Zero Energy Building
PA	Public Administration
PPP	Public-Private Partnership
R&D	Research & Development
RES	Renewable Energy Source
SME	Small and Medium Enterprise

Executive summary

This publication intends to provide an overview of the current situation of energy retrofit in the NEW FINANCE partner countries, as well of the available opportunities – both in technical and financial terms – for increasing the energy performance of public buildings. The overview is completed and supported by a survey of different perspectives (the owners/public authorities', the financial institutions', and the contractors/ESCOs') on financing energy efficiency projects in public buildings, highlighting the main drivers, trends, opportunities, barriers, perceived risks and benefits related to this kind of projects.

The main assumption is the crucial role assigned by EU to the building sector (accounting for nearly 40% of Europe's final energy consumption) for the implementation of the European energy efficiency policy, testified by a series of directives and regulations at EU level, among which the main ones are the Energy Performance of Buildings Directive (EPBD) and the Energy Efficiency Directive (EED). In particular, the EPBD requires Member States to ensure that all new buildings are Nearly Zero Energy Buildings (NZEB) by 31/12/2020 (public buildings by 31/12/2018), and to develop policies and take measures to stimulate the transformation of existing buildings into NZEBs. In compliance with these Directives, each country participating in the NEW FINANCE project has set its own national energy efficiency targets: half of them focused on requirements for new buildings and did not introduce different limits for existing ones, while the other half realistically introduced less stringent requirements for major renovations. Their trends to reach the 2020 targets are quite positive, and in all countries the public sector is expected to lead the process towards more energy-efficient buildings, through ad hoc public procurement and appropriate technical solutions applied to its own buildings - often with very low energy performance - thereby paving the way for other sectors to follow. However, the speed of the renovation process is still too slow, due to multiple factors, such as the lack of competences, the constantly evolving technologies and materials, and the increased costs of NZEB solutions, currently not recognized by the real estate market, notwithstanding the relatively rapid return and long-term savings generated by this kind of investments.

Since in most cases energy is lost through the building envelope, the challenge is to retrofit walls, roofs, windows, and heating & cooling systems of existing buildings in an integrated way. Depending on the available budget, plenty of options exist to reduce energy losses and gain better performance, however, as Public Authorities seldom have sufficient financial resources to make their whole building stock efficient, the selection of the building where to invest is of paramount importance. Energy Benchmarking can help identify the most profitable public buildings on which to activate energy efficiency improvements.

Another crucial issue is how to finance energy renovations. Public funding is often insufficient to ensure the implementation of energy efficiency actions, due to the scarcity of available resources and public budget constraints. EU provides grants and financial instruments for sustainable energy investments, through a wide range of programmes (Horizon 2020, Life+, etc.) and funds (including European Structural and Investment Funds and the Cohesion Fund), but this kind of support may not be sufficient. A good option is thus to use third party financing, involving private investors in Public-Private Partnership (i.e. EPC – Energy Performance Contract), so that the private actor (usually an ESCO – Energy Services Company) covers investment costs, recovering them through energy savings, while the public body gets immediate benefits from energy refurbishment actions and from the related reduction of energy consumptions.

It is important to underline that NZEB projects are usually non sustainable under normal market conditions and not attractive for private investors unless they are financially supported by public funds or incentives. This is the reason why governments and financial institutions at European and national/regional level offer diverse support schemes, including subsidies, soft loans, fiscal incentives, and Equity and Debt.

There is no optimal financing scheme, since energy efficiency projects involving public buildings usually embed different interventions with varying market attractiveness.

Public bodies must therefore assess the actual "appeal" of their projects to the market, and consequently mix different funding sources (Fund Matching) and mechanisms, with the support of an adequate technical assistance, covering administrative, technical, economic and financial aspects. For instance, the European Local Energy Assistance (ELENA) programme, managed by the European Investment Bank (EIB), provides EU regional and local authorities with financial support for the preparation and implementation of energy efficiency programmes, including feasibility studies, market analysis, programme structuring, energy audits, preparation of tender procedures.

The survey confirmed the general interested and the positive attitude of consulted actors as regards the opportunities provided by PPP (and notably by EPC) to finance energy renovation projects in public buildings. It is true that a growing number of countries are relying on the support given by the ESCOs and EPC in the public sector. Nevertheless, the use of innovative mechanisms involving third parties is not yet widespread.

Public bodies, financing institutions and ESCOs agree on the obstacles represented by public debt limitations and lack of know-how in public administrations to develop and implement innovative mechanisms, which combines with the scarce standardization of projects and contracts (however ascribed to the wide variety of available technologies, and therefore hardly avoidable) and the uncertainty and fragmentation of the national regulatory frameworks.

Notwithstanding these criticalities, banks seem willing to act as financers in loan renovation projects, proven that they can enjoy adequate guarantees by national governments and/or the EIB. From the banks' perspective, the poor technical and financial structure of most ESCOs, combined with the small dimension of most energy efficiency projects and the length of contracts, makes it difficult to access loans. Most banks have also problems to correctly evaluate projects with a high degree of technical complexity.

ESCOs consider financing and allocation of risks as the main issues affecting the successful implementation of third party investments in target countries. Other obstacles lie in a general lack of skills/ability/reliability of the companies, in the high interest rates on available loans and in the absence of multi-year programming of energy efficiency projects. An important role is also played by users' behaviours that – when incorrect – can put the success of energy renovation projects at risk.

To overcome these barriers, it is crucial to increase the level of technical knowledge of all actors involved in EE projects, as long as technological, financial and management aspects are concerned.

In particular, Public Administrations, should be enabled to assess the sustainability of their EE projects under market conditions, and consequently to choose the optimal financial scheme to adopt and to carry out the required procedures, whilst catching all available support and assistance opportunities offered at EU and national level.

However, at the moment it is also important that the EU and national Governments keep on supporting NZEB initiatives, at least until this kind of investments acquire more appeal on the market.

Introduction

The NEW FINANCE project

The NEW FINANCE project, funded under the Interreg MED Programme, has the objective to help accelerate new investment in energy efficiency and renewable energy sources in public buildings, by increasing the confidence of key decision makers from the public and private sectors (public building owners, financial institutions, and private investors) to outline and apply working strategies aimed to overcome the existing barriers in financing energy efficiency measures at local and regional level, to mobilize private funding and to better use ESI funds.

The NEW FINANCE specific objective is to support the development and implementation of innovative financial schemes that leverage ERDF and other public funds on private financial resources and lead to bankable and sustainable energy projects.

In order to reach these goals, the project will focus on effective replication of proven implementation models and smart networking activities equally involving stakeholders from public and private sector whilst capitalizing on a number of previous and ongoing similar initiatives.

The Business Case

Business case analysis (BCA) can be defined as a decision support and planning tool that foresees the likely financial results and other business and economic consequences of an action or investment.

The analysis essentially asks: "What happens if we take this or that action?" The business case provides practical guidance for managing projects, programs, and the asset life cycle. The BCA reveals critical success factors and contingencies to watch and manage in order to achieve desired energy efficiency targets. The analysis especially focuses on case studies, showing business outcomes (costs and benefits) that follow from actions.

This particular Business Case is a document based on transnational research, which

1) provides an overview of the current situation of energy renovation in the countries participating in NEW FINANCE, in terms of existing regulations, trends and available funding opportunities; and
2) considers main drivers per sector and identifies opportunities and risks by taking into account the perspective of building owners, financial institutions, and private enterprises. It also presents and promotes new finance mechanisms for energy renovation of public buildings.

In order to assess main drivers and obstacles for energy renovation, a transnational market survey was conducted to assist in creating a clear business case for energy efficiency measures.

Further information on the NEW FINANCE project can be found at https://new-finance.interreg-med.eu/.

1. Analysis of the current situation

1.1. Policies and regulations

Analysis of EU requirements

The policy and regulatory framework for the energy retrofitting of buildings in the countries participating in the NEW FINANCE project is defined at both EU and national levels. Although Bosnia and Herzegovina is not an EU Member State yet, it also has to comply with EU directives on energy efficiency due to international treaties, and it has approved a dedicated Energy Efficiency law (enacted in February 2017).

EU assigns a crucial role to the building sector for the implementation of the European energy efficiency policy, since buildings account for nearly 40% of Europe's final energy consumption.

At EU level, two directives represent the main legislation covering the reduction of energy consumption of buildings: the Directive 2010/31/EU - Energy Performance of Buildings Directive (EPBD) - and the Directive 2012/27/EU - Energy Efficiency Directive (EED). Full implementation and enforcement of new directives as well as existing energy legislation is recognised as the first priority in establishing the Energy Union.

The EPBD requires Member States, inter alia, to:

- **set minimum energy performance requirements for newly constructed buildings and existing buildings undergoing major renovations**, and for the replacement/retrofit of building elements (heating & cooling systems, HVAC, lighting, roofs, walls, etc.);
- **assure that minimum energy performance requirements for buildings are set** with a view to achieving cost-optimal levels, where the cost-optimal level is defined as "the energy performance level which leads to the lowest cost during the estimated economic lifecycle", from the financial perspective (looking at the investment at the building level) and from a macro-economic point of view (considering costs and benefits for society as a whole);
- **ensure that all new buildings are nearly zero energy buildings (NZEB) by 31/12/2020 (public buildings by 31/12/2018)**;
- **draw up lists of national financial measures** to improve the energy efficiency of buildings;
- develop policies and take measures to **stimulate the transformation of existing buildings into NZEBs**, and inform the Commission thereof of their national plans.

The EED embeds a set of binding measures to help the EU reach its 2020 20% headline target on energy efficiency[1] and pave the way for further energy efficiency improvements beyond that date.

This complements the EU's climate and energy package, which so far only included legally binding greenhouse gas and renewable energy targets.

EU Directives 2010/31/EU and 2012/27/EU have a strong focus on the energy consumption of buildings

EU countries must ensure that all public buildings are Nearly Zero Energy Buildings by 31/12/2018

[1] This target is defined as a maximum of 1.483 Mtoe primary energy or 1.086 Mtoe final energy consumption in 2020.

SIDE-BAR 1

What are NZEBs?

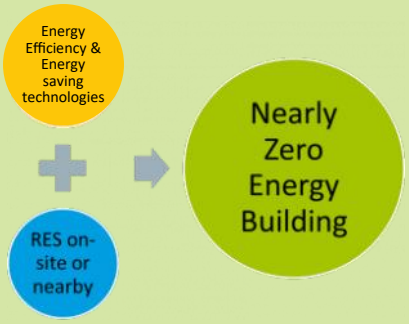
According to the EU Energy Performance of Buildings Directive (EPBD), **a NZEB — Nearly Zero-Energy Building is a building that has a very high energy performance,** determined on the basis of the calculated or actual annual energy that is consumed by the building in order to meet the different needs associated with its typical use, which include, inter alia, energy demand for heating, cooling, ventilation, hot water and lighting.

The nearly zero or very low amount of energy required should be largely covered by energy from renewable sources, also produced on-site or nearby .

EPBD sets the overall framework for the definition of NZEBs and the mandatory targets, while detailed practical applications must be defined by Member States.

The framework definition of NZEB in the EPBD does not differentiate between new and existing buildings, however the Directive requires Member States to develop policies and take measures to **stimulate the transformation of buildings undergoing refurbishments into NZEBs,** including the increase of energy from renewable sources.

The aim is therefore to increase renovation depth by setting national support policies to refurbish existing



buildings to an extent that allows to meet the energy performance requirements of a NZEB level.

The concept of NZEB reflects the fact that **renewable energy and efficiency measures work together**: when placed on-building, renewable energy will reduce net delivered energy, however in many cases, it will not be sufficient to bring energy needs close to zero without further energy efficiency measures. Therefore, higher and more demanding requirements for highly efficient NZEB will also drive an increased use of on-building renewables. The most frequently applied renewable energy systems in NZEB are on-building solar thermal and PV systems, followed by geothermal (from ground source heat pumps) and biomass.

As for energy performance requirements, the EPBD establishes a benchmarking system (**principle of 'cost-optimality'**) to guide Member States in setting and regularly reviewing them. This cost-optimality (e.g. the level of energy performance which leads to the lowest cost during the estimated lifecycle of the building) sets, indeed, the minimum level of ambition for both building renovation and new buildings. The cost-optimal methodology requires assessing and comparing different energy efficiency and renewable energy measures, both individually and in combination, as part of packages of measures to be applied to reference buildings. Accordingly, to define and meet the NZEB level, Member States can use different combinations of energy efficiency measures, inclusion of highly-efficient technical building systems and use of on-site renewable energy sources.

The evidence suggests that a combination of existing technologies related to energy savings, energy efficiency and renewable energies is sufficient to reach a suitable target for nearly zero-energy buildings.

(Source: *Commission Recommendation (EU) 2016/1318 of 29 July 2016 on guidelines for the promotion of nearly zero-energy buildings and best practices to ensure that, by 2020, all new buildings are nearly zero-energy buildings*)

Key dates for NZEBs (Source: BPIE Factsheet "Nearly Zero Energy Buildings definitions across Europe")

More specifically, EED requires Member States to:

- set their indicative national energy efficiency targets;
- energy retrofit at least 3% of buildings owned and occupied by central government
- define long-term national building renovation strategies which can be included in their National Energy Efficiency Action Plans.

In 2016 the Commission proposed an update to the EED, including a **new 30% energy efficiency target for 2030**, and measures to make sure the new target is met[2].

In compliance with the EED, **each participating country has set its own indicative national energy efficiency targets**, displayed in the table below, together with the long and short-term trend to reach the targets (data Eurostat 2016).

In order to comply with EED requirements, EU countries have also drawn up, within their National Energy Efficiency Action Plans, national strategies to show how they plan to foster investment in the renovation of residential and commercial buildings, with a view to gradually reach a NZEB level both in new and existing buildings.

EU Countries involved in NEW FINANCE have all provided their National building renovation strategies between 2014 and 2016.

NEW FINANCE Country	National 2020 energy efficiency targets		Trend to reach the 2020 target		Short-term trend	
	Primary Energy Consumption [Mtoe]	Final Energy Consumption [Mtoe]	PEC 2005-2014 trend compared to 2005-2020 trend	FEC 2005-2014 trend compared to 2005-2020 trend	Change of PEC 2014 compared to 2013	Change of FEC 2014 compared to 2013
Bosnia Herzegovina	6,10	4,21	n.a.	n.a.	n.a.	n.a.
Croatia	10.71	7.0	+	+	-4.9%	-5.0%
Italy	158.0	124.0	+	+	-6.1%	-4.3%
Malta	0.7	0.5	-	-	1.7%	3.5%
Slovenia	7.3	5.1	+	+	-3.3%	-4.0%
Spain	119.8	80.1	+	+	-1.5%	-1.9%

With regards to Bosnia and Herzegovina, the Federal government is currently adopting a national-level Energy Efficiency plan for the period 2018-2020, including targets to be reached by 2020 and building renovation targets and strategies.

It has also issued Guidelines for conducting energy audits for new and existing facilities (2009), defining minimum energy performance requirements for buildings.

The reference documents for energy retrofitting in each country are displayed in Table 1, while Table 2 shows the energy performance targets available for each country .

In particular, Table 2 shows how half of the considered countries focused on requirements for new buildings and did not introduce different limits for existing ones.

The other half realistically introduced less stringent requirements for major renovations, with the exception of Malta, that introduced very stringent deep retrofit targets for existing buildings, both residential and non-residential. This discrepancy can also be due to the co-existence of different sources, i.e. policy documents issued in different years and using different methodologies.

All countries considered higher energy requirements for non-residential buildings, which typically consume more energy for heating/cooling and lighting.

[2] See i.e. Annex 1 *Accelerating clean energy in buildings* to the Communication from the Commission *Clean Energy for all Europeans* (COM(2016)860 final).

Tab. 1—Reference documents for energy retrofitting in NEW FINANCE countries

Country	National strategies for building renovations	Documents specifically focusing on NZEBs
BIH	Energy Efficiency plan 2018-2020	Not available
HR	Long-Term Strategy for Mobilising Investment in the Renovation of the National Building Stock (2014)	National Action Plan to increase Nearly Zero Energy Buildings (December, 2014)
IT	Decree of June 26th, 2015 concerning new minimum requirements and methodology for calculating energy performance of buildings	National Action Plan to increase Nearly Zero Energy Buildings (2015)
MT	Malta's Long-Term Strategy for Mobilising Investment in the Renovation of the National Stock of Residential and Commercial Buildings (2014)	Document F "Technical Guidance - Part A: Minimum requirements on the energy performance of buildings" Nearly-Zero Energy Buildings Plan (2015)
ES	Long-Term Strategy for Energy Renovation in the Building Sector in Spain pursuant to Article 4 of Directive 2012/27/UE (2014)	Not available
SI	Long-Term Strategy for mobilising investments in the energy renovation of buildings (2015)	Action Plan for Nearly Zero-Energy Buildings up to 2020 (2015)

Tab. 2—Energy performance targets in NEW FINANCE countries

Country	Residential buildings (kWh/m2/year or Energy Class)		Non-residential buildings (kWh/m2/year or Energy Class)		Share of renewable energy sources
	New	Existing	New	Existing	
BIH (*)	95 (Class B)	n.a.	n.a.	n.a.	not available
HR	Littoral Croatia: 33 Continental Croatia: 41	n.a.	n.a.	n.a.	not available
IT (**)	Apartment buildings: 95-99 Single family houses: 99-120	Apartment buildings: 100-114 Single family houses: 113-168	115-131	145-160	Obligation to: include RES in new buildings and major renovations (covering 50% of consumption for hot water and 50% of total consumption for heating, cooling and hot water); install power from RES in new buildings (according to their surface) and existing buildings with useful floor area >1.000 m² undergoing full refurbishment.
MT (***)	Apartment buildings: 140 Terraced houses: 90 Semi-detached house: 55 Fully detached house: 55	Deep retrofit targets: with RES: 40 without RES: 80	Office buildings: 90 Buildings with offices occupying >50% of useful floor area: 350	Deep retrofit targets: 89-308	The share of RES is not detailed in available documents, however it is considered in integration with Energy Efficiency interventions.
ES	Class A	n.a.	Class A	n.a.	No values given under Spanish Regulation
SI	Apartment buildings: 45 Single family houses: 50	Apartment buildings: 70 Single family houses: 90	70	100	RES must cover 25% of the total final energy used for the building operation.

* Source: Oesterreichische Entwicklungs-Bank, Energy Efficiency Finance II - FINAL Country Report: Bosnia and Herzegovina, Vienna, June 2015

** The performance index depends on the Climatic Zone where the building is located (see National Action Plan to increase Near Zero Energy Buildings)

*** For new buildings, values are taken from Document F "Technical Guidance - Part A: Minimum requirements on the energy performance of buildings", currently in force. However, the 2015 Nearly-Zero Energy Buildings Plan for Malta sets higher targets for new apartment buildings (115 kWh/m2/year) and terraced houses (75 kWh/m2/year). For existing buildings, the source is Malta's Long-Term Strategy for Mobilising Investment in the Renovation of the National Stock of Residential and Commercial Buildings (2014); values for non-residential building vary according to the typology of building considered.

1.2. Building Stock overview

Improvements in the energy performance of government building stock are a key provision of the EED (Energy Efficiency Directive – 2012/27/EU) and EPBD (Energy Performance of Buildings Directive—2010/31/EU). Subsequent to the publication of these legislations, various measures supporting the reduction of energy consumption of buildings have been reported for the public sector in the EU countries and those participating in the NEW FINANCE project.

According to the 2016 "Assessment of the first National Energy Efficiency Action Plans under the Energy Efficiency Directive", a total of 10 countries in the EU plan to renovate 3% of their central government stock every year, in line with Article 5[3] default approach (actual refurbishment of 3% per annum of the floor area of heated and cooled buildings). The remaining countries plan to meet Article 5's requirements by using the alternative approach (based on behavioural change and soft measures), through a mixture of renovation, behavioural change and other measures.

In this section an overview of the public building stock conditions is presented, in terms of energy consumption and the initiatives promoted through the NEEAP's and the national policies to achieve energy targets in the countries involved in the New Finance project: Croatia, Italy, Malta, Spain, Slovenia and Bosnia-Herzegovina.

With regards to incentives and public investments, each country has taken up different approaches.

As a general rule, a growing number of countries are relying on the support given by the ESCOs in the public sector. ESCOs and EPC are helping to support the achievement of significant targets in energy savings in buildings owned or managed by the public administration.

SIDE-BAR 2

Energy improvement for different types of public buildings

A building energy refurbishment project promotes integrated measures on the building envelope, the thermal-technical systems, electrical systems, and water supply systems. However there are different kinds of obstacles when it comes to planning, designing and undertaking such refurbishment in the non-residential sector.

Firstly, public buildings have very different uses and a same intervention might not be applicable to all of them and/or might not lead to the same result in terms of savings performances. Therefore the approach required for the energy improvement of buildings has to be tailor-made and cost-effective.

Secondly, a challenge may arise when a building's energy requirements are high and/or extended in time. For instance, sports facilities can reach very high peak of energy demand due to the use of special equipment (e.g. stadium lighting); a hospital has to constantly maintain a specific controlled indoor climate. and so on. In these cases, an accurate project evaluation should be done in order to choose the most effective strategy to adopt.

Another frequent barrier to the adoption of energy upgrading measures is the historical importance of some buildings, which can be scheduled with different grades of architectural protection. In many cases, for example, historical constrains make it impossible to install thermal insulation or PV panels on the exterior of the building. In such cases, the intervention has to deal with the retention of architectural features and be sensible to the restoration approach. The challenge is to find possible ways to apply the new technologies without altering the existing building characteristics.

For these buildings, there is also the possibility to implement soft measures and actions aimed at inducing behavioural changes in workers and users.

[3] Article 5 of Directive 2012/27/EU of 25 October 2012 on energy efficiency ('the EED' or 'the Directive') requires Member States to ensure that, as from 1 January 2014, 3% of the total floor area of central government-owned and –occupied heated or cooled buildings is renovated each year to meet the minimum energy performance requirements that each Member State has set in application of Article 4 of the Energy Performance of Buildings Directive (2010/31/EU, also the 'EPBD'). The implementation of Article 5 therefore builds on the correct transposition of the EPBD. This requirement under the EBPD applies as of 9 January 2013 to buildings with a total useful floor area above 500 m2, and as of 9 July 2015 above 250 m2.

CROATIA

Croatia's national public buildings are estimated to be 80,196, with a total area of 13,801,902 m². Following the requirement of the EED for the public building stock, Croatia planned to renovate a total of 13.8 million square meters of usable floor area of public sector buildings. Of the aforementioned area, 43.9% is heated usable floor area.

However, according to the list of public buildings owned and used by the central government, a total of 1,325 million square meters of usable floor area were registered, which amounts to 13.8 % of the total fund of public buildings referred to in the 2nd NEEAP. The total measured final energy consumption by the central government's public buildings for all uses is 1.63 PJ per year, of which, 0.28 PJ are consumed for non-thermal uses and 1.35 PJ for thermal uses including heating, cooling, domestic hot water (DHW) preparation and cooking. The proportional share of savings which need to be achieved in central government's public buildings is therefore 13.8% of 0.53 PJ, or 0.07 PJ by 2016 and 0.14 PJ by 2020 (overall target).

The implementation of the Programme of energy renovation of public buildings owned and used by the central government included measures on the building envelope, the thermal-technical, electrical, and water supply systems. For the first period of the programme (2014–2015), planned funds for the overall cost of reconstruction at an annual level have been estimated at HRK 400 million (about EUR 52 millions). For the second period (2016–2020), the planned funds have been estimated at HRK 1 500.00 per m² and amount to HRK 0.72 billion.

This Programme is financed though the Croatian Fund for Environmental Protection and Energy Efficiency and is also implemented through energy performance contracts and ESCO companies, and other private companies are encouraged to participate in the implementation of activities.

Finally, in Croatia, the Information System for Energy Management (ISGE) is in place and has been used for monitoring the interventions and analysing the energy and water consumption of the public buildings owned by the local government (municipalities, counties and cities).

ITALY

Italy has followed the prescription of Article 5 of EED by implementing the national inventory of public buildings in 2014, with the aim to create a comprehensive baseline energy inventory and assess and promote energy upgrading of public buildings.

The 2014 inventory included data regarding 2,904 buildings occupied by central government bodies with a total gross floor area of 500 m², for a total of 13,763.975 m². Furthermore, a detailed assessment was performed on buildings having a total gross floor area between 250 and 500 m² in view of lowering the threshold to include those premises from 9 July 2015. This group includes a further 1,179 premises for a total useful area of 437.227 m².

The statistical assessment of energy consumption of buildings occupied by central government bodies, gave an estimated overall consumption of approximately 1,442 GWh/year for heating/cooling, and 717.7 GWh/year for electricity, which put together are equivalent to 0.186 Mtoe.

Considering a total useful floor area of about 14 million m² calculated by the inventory, the total share subject to the energy performance upgrading obligation in the period 2014-2020 is of more than 2.7 million m², corresponding to an overall energy consumption of about 413 GWh/year.

The Table below illustrates the types of projects envisaged, the associated percentages of floor area subject to the obligation and the calculation of the savings achievable on the basis of a cost -benefit assessment.

With regards to investments, in Italy public bodies are eligible to receive incentives under the "Conto Termico" incentive scheme.

However, participation so far is relatively low, probably because budget constraints are severely discouraging energy efficiency investments in the public sector.

Type of energy retrofit project envisaged in buildings occupied by central government bodies in Italy	Floor area concerned	Savings compared with the baseline
Energy related renovation of technical systems (heating, cooling, lighting)	85% of the area subject to the obligation each year	20-25%
Energy related renovation of technical systems and insulation of the building envelopment	13% of the area subject to the obligation each year	30-35%
Major energy-related renovation of the entire building	2% of the area subject to the obligation each year	50%

MALTA

With regards to the compliance with EED and Article 5, Malta established that the 'alternative approach' is generally preferred over the 'default approach', because it is not yet possible to establish a business case for refurbishment due to the lack of robust data.

The 'alternative approach' is also chosen for the soft measures being more flexible and adapted to any refurbishment. In addition, several of these buildings have a high historical profile and deep renovations are often difficult to carry out.

According to 2011 statistical data, Malta's public buildings are accounted to be 9,853. The total 'useful' floor area (where energy is used to condition the indoor climate) of such government buildings amounts to 158,701 m². In 2014 it was calculated that for buildings with a useful floor area of over 250 m² the minimum energy performance requirements (established at 107 kWh/m²/year by consultants who carried out the energy audits—Energy Audit Report MTS 2010) were not met.

The target savings and obligation are equivalent to 79,341 kWh per annum, equivalent to 555,390 kWh in the period 2014-2020. Preliminary energy audits have identified which measures are appropriate for which building. Works on some buildings commenced in 2016 and are expected to be completed by 2020. Some of the main measures applied include: energy efficient lighting systems; Energy Management systems (control of ACs and lighting, dimmers, etc.); replacement of ACs with inverter integrated ACs; PVs & SWH installation for own consumption; roof and wall insulation/double glazing or glass tinting.

With regards to behavioural changes, initiatives aimed to cover the information gap in certain sectors have already started or are in the process of being initiated. These include surveys targeted to all local schools, hospitality and health sectors to know their electricity consumption in the past three years. This will enable detailed policies and measures to be set up to target the decrease of energy consumption in schools, hospitals, hotels & restaurants.

A study commissioned by the Ministry for Energy and Health (MEH) to identify cost effective energy efficiency technologies aimed for the retrofitting of a hospital residence for old people is being conducted. The results of this study will enable their application in similar hospitals in Malta and Gozo.

SLOVENIA

In accordance with the "Long-Term Strategy for Mobilising Investment in the Energy Renovation of Buildings" published in 2015, as from 1 January 2014, Slovenia is obliged to ensure that 3% of the total floor area of heated and/or cooled buildings owned and occupied by central government is renovated each year to meet at least the minimum energy performance requirements set in application of Article 4 of EED. This obligation has been transposed into Slovenian law by Article 349 of the EZ-1.

The total floor area of buildings or property in the current Register of State -Owned Buildings occupied by Central Government assumed not to meet the energy performance requirements stands at 708.296 m² (figure as at 18 April 2014). By the time of the redaction of the Strategy, in 2015 Slovenia had not yet decided whether to take an alternative approach or keep the default approach, as provided by Article 5 of the EED.

The Strategy document estimates that the potential for renovation of Nearly Zero-Energy Building standard in public buildings in Slovenia in 2015 stands at 6.857 million m^2 (66% of the total floor area of public buildings). Nearly Zero-Energy Buildings account for 1%; the remaining percentage comprises buildings which, owing to various restrictions, cannot undergo complete energy renovation.

The total building renovation resulting from the implementation of the Strategy will achieve a 12% reduction in primary energy use and a 16% reduction in end-use energy. Therefore, primary energy savings from building renovation account for 42% of total savings and end-use energy savings from building renovation account for 58% of total savings.

The strategy for the energy renovation of buildings owned and occupied by central government will include the financing of projects from the new financial perspective under the OP EKP 2014–2020 and the implementation of pilot or demonstration projects.

Similar to other countries, the use of energy performance contracting (EPC) in Slovenia increases the scale of investments using less public funding for the complete energy renovation of public buildings. This contributes to achieving the annual dynamics of renovation of public buildings required under the EED, as well as giving the economy a kick start, as greater demand for energy performance contracting has contributed to the development of the market for energy services that improve energy efficiency.

SPAIN

Data on the Spanish non-residential stock and public buildings are collected in the "Long-term strategy for energy renovation in the building sector in Spain pursuant to article 4 of directive 2012/27/ UE", published in 2014. The so-called "Renovation Strategy" addresses energy renovation interventions on public buildings from an architectural and energy consumption point of view. Non-residential buildings in Spain have a very significant savings potential, since the tertiary sector—which includes public buildings—accounts for 35% of the total country's energy consumption.

Following the recommendations of the EED (transposed in the Spanish NEEAP 2017) Spain established an online energy inventory of Governmental public buildings. The database includes energy baseline inventories of those public buildings that dispose of any heating and/or cooling systems and have a total area of at least 250 m². In the same inventory it is possible to display datasheets regarding the energy rehabilitation undertaken by each building and the energy saving results achieved. The 2016 inventory includes data and reports of 2,142 buildings, with a total built area of more that 10 million m², divided among 12 Ministries. Between 2014 and 2016, a total of 937,826 m² has been renovated in Spain, reaching more than 4% of the target established by Article 5 of the EED. The assessment of energy consumption of the analysed building stock, gave an overall energy consumption of 1,038 GWh/year, of which 697 for electricity (67%), 194 for natural gas (13%) and 13 (1%) for propane. The average annual consumption rate of the total building stock is of 96 kWh/m² per annum.

With regards to public investments, the Strategy points out that energy efficiency often competes and reduces returns on other investments, such as new equipment.

Nevertheless, energy services companies (ESCOs) have begun working in the sector and private operators are taking responsibility for upgrading energy efficiency. This service, combined with energy supply and maintenance contracts, is creating an increased interest, especially due to the possibility to amortize the costs through long-term contracts.

BOSNIA-HERZEGOVINA

Bosnia-Herzegovina has signed the Energy Community Treaty and Agreement on energy community as well as the Kyoto protocol. In this way, BIH is obliged to take into consideration EU Directives in the fields of EE and RES.

Since 2006, when Agreement on energy community has entered into force, some improvements in the fields of EE and RES have been achieved, but these improvements are not enough and on par with the neighbouring countries. Following the requirements of the Directive 2006/32/EC of the European Parliament and of the Council on energy end-use efficiency and energy services (ESD), BIH has prepared the first National Energy Efficiency Action Plan (NEEAP), focusing on the period 2010-2018, providing the overall target for 2018 as well as intermediate targets for 2012 and 2015. Based on the requirement of ESD, Bosnia and Herzegovina has adopted a national indicative energy savings target of no less than 9% of the final inland energy consumption for 9 years by 2018 (a rather high rate for the existing conditions, an average 1.1% annually), which means that the country should ensure energy savings to the amount of 12,47 PJ, including 3,77 PJ energy savings for Republika Srpska and 8,33 PJ for the Federation of BIH.

Regarding the building stock, most of the buildings were built in the '70s and '80s (57% of the existing building stock) of the 20th century. In that period, there was regulation on minimal energy performance of buildings, but implementation of requirements was seldom in practice and requirements were not demanding. The first NEEAP gave a general energy baseline for the building stock of Bosnia-Herzegovina, however the existence of any public buildings inventory is not mentioned. According to the study on the energy consumption in public buildings included in the NEEAP, heating has the most significant share of energy consumption (36% of the whole energy demand) in public buildings.

A renovation of buildings need rate is provided in the NEEAP until 2018 only for private residential and commercial buildings. It predicts energy savings of about 5,25 PJ in residential buildings in the period 2012–2018, about 42% of the total energy efficiency target for that period for B&H. Assuming energy savings of 40% in comparison to the baseline consumption (about 200 kWh/m^2 per year), it means that about 40 million m^2 should be renovated for about 450,000 households. The target of energy savings for commercial buildings is of 1,62 PJ for the same period. Assuming the same improvement as for residential buildings, it is calculated that about 12 million m^2 should be renovated. The specific target for public buildings has not been expressed.

1.3. Energy, financial saving potential and associated risks

Reducing energy consumption in a public building to a "nearly zero" level is one of the priorities to improve the energy performance of the building sector. As previously said, the Directive on Energy Performance of Buildings (EPBD) sets out mandatory efficiency standards for all new buildings and deep renovations, which has resulted in significant improvement of energy performance standards for both new constructions and renovations.

The public sector has to drive the change even if its building stock often has very low energy performance, due to the type of buildings (schools, offices, hospitals, etc.) and also to the construction age. For example, in Italy, most public buildings are more than 30 years old, achieving a class G in energy performance. Therefore the public building sector—including offices, schools, social houses, sports and hospitals—has a huge potential for savings. The public sector is expected to lead by example through energy-efficient public procurement and technical solutions to reach the ambitious targets set for its own buildings, thereby paving the way for other sectors to follow.

From 2020 on, high level of energy performance will be required for both new and deeply renovated public building, to comply with the EPBD and European Union objectives. A renovation is considered "deep" if its total cost is higher than 25% of the value of the building, or if more than 25% of the surface of the building is being renovated. However, this definition varies between Member States as there are various interpretations[4].

European targets and thresholds are fixed and ambitious. For example, from 2021 onwards Spain aims for all new buildings to have energy consumption 85% lower than that of the 2006 building stock. Furthermore, 13% of existing buildings should be renovated by 2020 (Ecofys, 2013). In Italy, starting from December 31, 2018, new buildings occupied and owned by Public Authorities, including schools, have to be Nearly Zero Energy Buildings.—NZEB. From January 1, 2021, all new buildings have to be NZEB[5].

The speed of this renovation process is still to be considered too slow. The German Research Institute for Thermal Insulation (FIW), evaluates that the rate at which old buildings are being retrofitted is too slow, about 1% in the majority of Central Europe. This means that a change gear is needed to reach the goals[6].

This delay may be considered as a consequence of multiple factors: lack of competences in the management and building sector; continuous up-grading of technologies and materials; extra costs referred to the NZEB solution rather than a deep energy efficient renovation estimated at around 5% for the envelope and 30% for energy systems.

A renovation is considered "deep" if its total cost is higher than 25% of the value of the building, or if more than 25% of the surface of the building is being renovated

The deep renovation process is still too slow in the EU

[4] To counter any confusion, the ZEBRA2020 project developed a calculation method to compare national definitions, which has proved useful at European level.

[5] Source: *The Nearly Zero Energy Buildings (NZEB) Status Report in Mediterranean countries*, May 2014

[6] Source: Elizabeth Gasiorowski-Denis, *Why investing in energy-efficient buildings pays off*, 2016 (https://www.iso.org/news/2016/11/Ref2140.html)

To overcome these barriers, the first step is **energy benchmarking**.

Public Authorities do not have sufficient financial resources available to make their large building stock efficient. The selection of the priority building where to invest can have a significant impact on the quality and return of the investment, therefore public administrations need to carefully choose the buildings from which to start the energy renovation process.

Energy Benchmarking is the most effective economic comparison tool among buildings to assist in building selection. In fact, through a comparative analysis of the energy performance among the various buildings of the concerned institution (Internal Energy Benchmarking) or with similar external buildings (External Benchmarking), it is possible to identify those with the highest potential returns and to draw a list according to the kWh/m2 energy indicator (**global energy performance index**)[7]. Energy Benchmarking allows to identify the most favourable interventions in terms of potential energy savings and to select the most profitable buildings on which to activate the energy auditing procedure for identifying possible energy efficiency improvements.

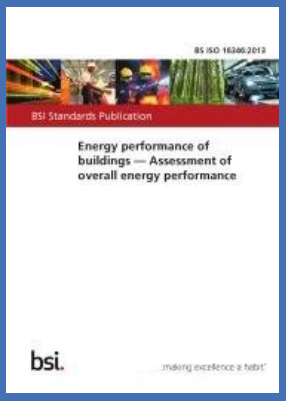
The **Energy Audit** is the procedure that assesses the status quo, analyses global performances and intervention opportunities, and defines cost-benefit optimised "packages of measures" based on efficient and quality-guaranteed technologies for the refurbishment of buildings.

According to the Intergovernmental Panel on Climate Change (IPCC), "*over the whole building stock, the largest portion of carbon savings by 2030 is in retrofitting existing buildings and replacing energy-using equipment*", and energy savings of 50% to 75%. Energy-efficient buildings already exist in many countries and there are many solutions readily available within the market. The technologies and the design know-how to cost-effectively build them are also available but the contribution that each technique and type of intervention brings to the whole energy saving process vary according to many variables, such as the regional climate, culture and building traditions, the technical solutions adopted, the type of materials and equipment, as well as policy and legal frameworks.

In most cases, energy is lost mainly through the building envelope – the boundary between the conditioned interior of the building and the outdoors. Retrofitting older buildings can significantly reduce the energy needed for heating and cooling. The existing building stock can provide a larger potential for cost-effective energy savings than new constructions. The challenge is to retrofit walls, roofs, windows, and heating and cooling systems of existing buildings to reach the highest energy performance levels in an integrated way. Depending on the available budget, plenty of options exist to reduce energy losses and gain better performance.

There are currently 35 different national and regional methodologies to calculate the energy performance of buildings, which are in line with the subsidiarity principle and flexibility allowed by the EPBD. However, this may prevent national comparisons of building performance and investments in building renovation. This might also contribute to limit the replicability of similar technologies in multiple European countries[8]. For example, the energy performance of buildings can be calculated using ISO 16346:2013, Energy performance of buildings – Assessment of overall energy performance. A harmonised energy performance calculation method is going to be introduced by ISO in 2017 (new ISO 52000 series).

Energy Benchmarking allows to identify the most favourable interventions and select the most profitable buildings to renovate



[7] Source: http://www.ecquologia.com

[8] Source: EC, *Good Practice in EE*, 2016

1.3.1. Retrofitting existing buildings

Retrofitting existing buildings and replacing energy consuming equipment are critical for improving energy efficiency in cities where building stock turnover is low. The financial and economic benefits of energy efficient building are well-researched and documented internationally.

Many energy efficiency investments have short payback periods (a few years) in terms of reduced energy costs. Due to the diversity and disaggregation of the building sector, it is, however, difficult to acquire reliable and comparable data on the buildings' energy use and the financial implications of renovation in terms of cost savings, real pay-back time and asset values.

Building envelope

The building envelope affects the amount of energy needed to heat and cool a building, and hence needs to be optimised to keep heating & cooling loads to a minimum. More than 40% of expected savings in heating & cooling energy demand under a low-carbon scenario can be directly ascribed to improvements in the building envelope.

A high-performance building envelope in a cold climate requires only 20% to 30% of the energy required to heat the current average building in the Organisation of Economic Co-operation and Development (OECD). In hot climates, the energy saving potential from reduced energy needs for cooling is estimated between 10% and 40%[9].

The technologies for building envelope retrofitting are mature, with high performance materials.

Lighting

Industrial research is pursuing very efficient targets with significant potential for energy efficiency improvements through the application of technologies to reduce the energy consumption to very low levels. Furthermore, architectural design is following more and more advanced criteria to reduce the demand for lighting in buildings, through building orientation and innovative fenestration technologies (i.e. dynamic windows).

With a better use of natural lighting and the adoption of highly efficient lighting technologies, the energy consumption for lighting could be highly reduced and the global contribution of lighting in the building efficiency process can reach around 5%[10]. Another innovation branch is the introduction of variable controls and sensors to existing lighting systems. Automatic management of light intensity and the use of presence sensors for lighting control can considerably increase the global performance and reduce energy consumption up to 50%.

Heating and cooling

Currently, space heating and cooling together with water heating are estimated to account for nearly 60% of the global energy consumption in buildings. They therefore represent the largest opportunity to reduce buildings' energy consumption. A systems approach, where equipment upgrades are co-ordinated in particular with improved building envelopes, will be key to achieving higher energy efficiency and a low-carbon heating & cooling supply. Heat pumps, solar thermal and co-generation for space heating & cooling as well as hot water are the technological solutions to gain a consistent reduction of the building energy demand. In association with equipment for air control and management with heat exchangers to recover heat from exhausted air, they can achieve the highest performances from the building system.

[9] IEA report 2013

[10] ENEA, *Ricerca di Sistema Elettrico*, 2014

Building Energy Management Systems

Systems for integrated management of the building's technological functions, called BEMS/BACS (Building Energy Management System/Building Automation and Control System), are computerized control systems using both software and hardware to monitor, regulate and control the mechanical and electrical plants with the purpose to manage the use of energy within a building.

The energy services managed by BEMS are:

- Winter and summer air-conditioning
- Mechanical and / or natural ventilation
- Domestic hot sanitary water production
- Artificial and / or natural lighting.

BEMSs are particularly important as they optimize the performance of the building-plant system during the use, ensuring conditions of comfort and quality of air within the built environment. The use of these systems results in a considerable reduction in energy consumption, with obvious economic benefits.

Technological innovation in this process can be a point of reference for the applications of those solutions integrated with renewable sources (solar cooling, photovoltaic system, solar thermal, etc.) with advanced technologies for Smart Cities (Energy Management Building System, Domotics, Smart Building, etc.) and with those for the opaque elements and glazing making up the building envelope (active envelope, active shading screens, ventilated windows fixtures etc.).

User Behaviour

In the process of reduction of the energy footprint of buildings, it is important to mention the crucial aspect linked to users' behaviour.

Feedback measures will increase end-users' awareness related to their own levels of energy consumption. Combined with emphasis on the impact of user behaviour on the energy performance of a building, feedback measures can motivate users to change their behaviour, but also to invest in energy saving technologies.

Important tools for providing feedback on energy consumption levels are, for instance, individual metering, smart metering, and informative/comparative billing.

Other measures targeting user behaviour include motivational campaigns for behavioural change, energy saving competitions, and training of building users on the energy-intelligent use of lighting, ventilation, heating, cooling, windows, and appliances.

Experiences in many countries, show that a change in behaviour can lead to energy savings in the range of 5% to 15%[11].

[11] Source: Stefan Thomas—Wuppertal Institute for Climate, Environment and Energy, *Why policy needs to assist building and appliance markets to become energy-efficient*, available at www.bigee.net/s/pri6uc

1.4. Financing energy efficiency - What is out there?

1.4.1. Public funding programmes

Energy efficiency projects usually embed different interventions with varying financial feasibility features:

- **interventions with high market attractiveness**, which can be appealing for banks and private investors (district heating, public lighting management...)
- **partially market-attractive interventions**, which can be financed through "hybrid" mechanisms combining public funds, grants, etc. (i.e. solar thermal, PV)
- **interventions with no market attractiveness**, which can only be funded through subsidies (i.e. structural works).

The European Commission considers the energy refurbishment of the building stock essential to implement EU policies for the transition towards clean energy (see the 2016 Communication "Clean Energy for All Europeans"). The "Smart Finance for Smart Buildings" initiative is especially dedicated to accelerate this transition.

EU public funding is available for sustainable energy investments: during programming period 2014-2020, Structural Funds and EU investments (ESIF) will allocate 18 billion euro to energy efficiency projects, 6 billion to renewable energy production systems (especially in buildings and for heating/ cooling), and around one billion for smart grids. Strengthening investments in energy efficiency and RES is also one of the priorities of the European Fund for Strategic Investments (EFSI). Nevertheless, since energy efficiency projects are usually implemented in private properties, it is necessary to make the energy efficiency market more mature and not so heavily dependent on public subventions. Public funds should be used only to reduce capital costs, provide longer term grants or reduce collateral requirements.

In order to foster a more efficient use of public funds, EU Commission and member states are developing innovative instruments to better integrate public and private finance. EU has issued regulations and financing programmes to help public bodies and enterprises in developing energy efficiency projects. Moreover, the latest EU Directives on energy are steering towards a **stronger involvement of private actors** (i.e. Energy Services Companies—ESCOs[12]) in energy efficiency actions, giving priority to integrated interventions.

Increased costs, currently not recognized by the real estate market, are a major obstacle to the energy retrofit of existing buildings, notwithstanding the relatively rapid return and long-term savings generated by this kind of investments. Moreover, in current market conditions, investors are not easily attracted by energy efficiency projects, also because **banks seldom take into proper account the benefits of such investments.** In order to overcome these obstacles, the EU Commission is collaborating with the Energy Efficiency Financial Institution Group (EEFIG) to develop initiatives for better informing financial institutions, investors and promoters on the advantages of investing in energy efficiency. For instance, the **De-risking Energy Efficiency Platform (DEEP)**[13] - a pan -European open source database, collecting more than 7,000 energy efficiency projects - aims to help project developers, banks and investors to better assess risks and benefits of energy efficiency investments all over Europe.

EU will allocate 18 billion euro funds to energy efficiency projects in 2014-2020

ESCOs are private companies which implement energy efficiency projects, assuming technical and financial risks and relieving public bodies from management and investment burdens. Economic savings are shared between the ESCO and the client

[12] ESCOs are private companies which implement energy efficiency projects, assuming technical and financial risks and relieving clients (usually public bodies) from management and investment burdens. Economic savings resulting from implemented actions are shared between the ESCO and the client, according to various agreements.

[13] http://eefig.eu

European funds

Subsidies (e.g. grants that must not be reimbursed) are normally used to fund projects that are not considered "bankable", e.g. likely to be lucrative and thus to be financed through bank loans.

Public Authorities often use them to finance projects proposed by Municipalities for the conversion of existing buildings into NZEBs.

The main available EU financing channels subsidizing energy retrofit, building works, design, technical assistance and communication are the following:

European Local Energy Assistance (ELENA)[14], managed by the European Investment Bank (EIB), provides EU regional and local authorities (either single or associated) with financial support for energy efficiency programmes, covering up to the 90% of technical assistance costs for their preparation and implementation, including feasibility studies, market analysis, programme structuring, energy audits, preparation of tender procedures.

HORIZON 2020[15], EU Framework Programme for research and innovation for the programming period 2014-2020, is the main financial instrument to support researchers, entrepreneurs, no-profit associations and public bodies at national, regional and local level, in the implementation of innovative projects.

The Programme co-finances up to 100% of total eligible costs for R&D projects and up to 70% for innovation projects (up to 100% for no-profit organizations).

Horizon 2020 has a strong focus on clean energy and supports actions in the building sector, contributing to increase market attractiveness of energy efficiency investments.

SIDE-BAR 3

Horizon 2020 Project Development Assistance

Project Development Assistance (PDA) is a Coordination and Support Action of the HORIZON 2020 Programme, Societal Challenge 3 (Secure, clean and efficient energy).

It aims at supporting the launch of sustainable energy investment projects, as well as the building of technical, economic and legal expertise.

Proposals (targeting existing public and private **buildings**, **industry** and **services**, urban **transport**, and existing **infrastructures** such as street lighting, district heating/cooling, etc.) can be promoted by **public and private entities,** such as public authorities or their groupings, public/private infrastructure operators, energy service companies, large property owners and services/industry.

PDA projects are operational projects, therefore the programme does not target research, studies or demonstration projects.

EU contribution ranges between EUR 0.5 and 1.5 million, for an investment portfolio size between EUR 7.5 and 50 million.

Main features of the proposals:

- They shall lead to investments launched before the end of the action (i.e. signed energy performance contracts)
- Every million Euro of H2020 support should trigger investments worth at least EUR 15 million (1:15 ratio)
- Exemplary/showcase dimension
- Deliver organisational innovation in financial engineering and/or in the mobilisation of the investment programme
- Credibility of proposed investments (sufficient project maturity and relevance, support from local stakeholders, involvement of final beneficiaries, commitment of public authorities...)
- High degree of replicability .

Eligible investments are only those directly related to or required for energy savings and/or renewable energy generation ("**energy investment costs**").

[14] http://www.eib.org/attachments/thematic/elena_en.pdf

[15] http://ec.europa.eu/programmes/horizon2020/ https://www.researchitaly.it/horizon-2020/#null

[16] http://www.interreg4c.eu/fileadmin/User_Upload/PDFs/INTERREG_EUROPE_01.pdf

INTERREG EUROPE[16] is a EU-funded Programme helping European regions to work together, sharing knowledge and experiences. Its purpose is to support economic development in general and to reduce differences among the regions in terms of wealth, incomes and opportunities, and, more specifically, to improve regional development policies and make the use of Structural Funds more efficient and effective, also targeting energy efficiency issues.

The Programme area includes 30 countries (the 28 EU member states plus Norway and Switzerland) and the beneficiaries are Public bodies and bodies under public law, with a special focus on the bodies responsible for the management of Structural Funds.

LIFE + is the EU Programme that supports projects focused on three priorities: environment and resource efficiency (including energy issues), nature and biodiversity, climate governance and information[17]. The programme budget for programming period 2014-2020 is around € 3.4 billion, and co-financing rate is of 60%. Beneficiaries are public and private bodies and institutions based in EU Member States.

LIFE financial instruments include the **Private Finance for Energy Efficiency (PF4EE),** managed by EIB and aimed at increasing private financing for energy efficiency projects. PF4EE will help intermediary banks in Member States to develop and offer specific loans for energy efficiency projects aligned with the national energy efficiency action plans, and provide support and technical assistance.

Moreover, small municipalities or other public bodies undertaking small energy efficiency investments, capable of using energy savings to repay up-front borrowing could benefit from dedicated loans. The size of loans to be provided to final beneficiaries can range between € 40,000 up to € 5 million.

Interreg Europe Programme Area

[17] http://ec.europa.eu/environment/life/about/index.htm#life2014

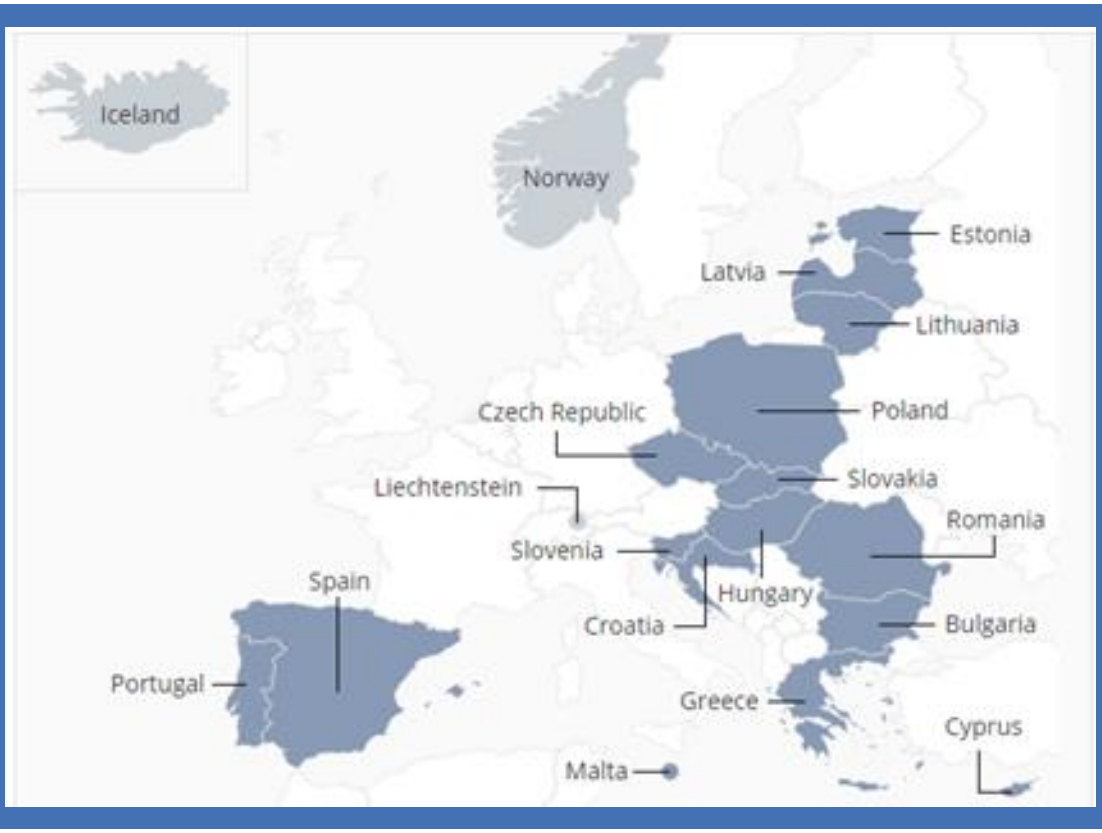
Urban Innovative Actions (UIA)[18] is an initiative of the European Commission providing European urban areas with resources to test new, high-quality, measurable and transferable solutions to tackle major urban challenges. The initiative has a total € 372 million ERDF budget for the programming period 2014-2020, and can co-finance 80% of the costs related to project activities up to a maximum of € 5 million per project. Proposals must be submitted by Municipalities or associations of Municipalities based in the 28 EU member states, with a total population of 50.000 inhabitants or more, and shall preferably involve private actors such as agencies, organizations, NGOs, and research institutions.

EEA Grants and Norway Grants foresee funding from Iceland, Liechtenstein and Norway to 16 EU countries in Central and Southern Europe and in the Baltic region, with the purpose to reduce socio-economic gaps and strengthen bilateral relationships in 32 different sectors, including energy and RES. Each beneficiary country has agreed with donor countries a set of tailored programmes based on its individual needs and priorities. The total budget for programming period 2014-2021 is of € 2.8 billion. Eligible beneficiaries include public institutions and governmental agencies. The involvement of private actors, research groups, trade organizations and NGOs is recommended. Among the NEW FINANCE partners, only Italy is not a beneficiary of the Programme.

As previously remarked, subsidies are highly appealing for building owners, but they seldom can fully support financial viability. Nevertheless, they can make energy efficiency projects more attractive for the market, stimulate immature or depressed markets, or support projects with strong innovation or demonstration aspects.

Combined with other financial instruments, i.e. bank loans, they can also provide solutions that better suit the building owners' expectations and needs, or provide the market with an attractive model that is both economically convenient, innovative and environmentally sustainable.

There are, however, some criticalities: subsidies will not be returned to the donor to be reinvested in other projects; repayment periods are usually long, and require adequate technical capacities and resources; finally, available funds are usually scarce.



Countries targeted by the EEA Grants and Norway Grants

[18] http://www.uia-initiative.eu/

Grants and fiscal incentives

National and regional authorities often support actions aimed at increasing energy efficiency by providing fiscal incentives, i.e. tax reductions or "white certificates" for energy retrofit works that improve the energy performance of buildings, or by establishing feed-in tariffs (a bonus paid by national authorities for the purchase of energy produced by individual PV panels).

These incentives are very attractive for the private actors, while they are not appropriate for public buildings.

EU provides a wide range of financial instruments, which can take the form of loans, stocks and guarantees:

- **European Structural and Investment Funds (ESIF).** ESI funds represent the larger EU budget allocation for investments on energy efficiency in buildings and SMEs. In the programming period 2014-2020, ESIF embed five EU funds: the European Development Fund (ERDF), the European Social Fund (ESF), the Cohesion Fund (CF), the European Agricultural Fund for Rural Development (EAFRD), and the European Maritime and Fisheries Fund (EMFF). Every Member State is responsible of the selection, implementation and monitoring of co-financed projects.
- **Cohesion Fund**[19] targets EU Member States with a Gross National Income (GNI) per inhabitant lower than the 90% of EU average, with the aim to reduce socio-economic inequalities and promote sustainable development. To this purpose, it promotes measures to tackle climate change, and supports investments in energy efficiency and RES, too, provided that they bring concrete environmental benefits. Beneficiaries for the programming period 2014-2020 include some NEW FINANCE partner countries: Croatia, Malta and Slovenia, along with some regions of Spain and Italy. Co-financing can cover up to the 100% of eligible costs. Financial instruments supported under the Cohesion Fund include loans (when not available on the market and/or providing better conditions than the available ones – i.e. lower interest rates, longer return periods, less guarantee requirements), guarantees (ensuring the reimbursement of the initial investment, thus facilitating the access to commercial loans also for projects considered as high-risk investments) and stocks (where the capital is invested in a share of an investment product, thus allowing the investor to share profits and participate to the management).

Fiscal incentives and feed-in tariffs have proven very attractive for building owners, while they are not appropriate for public buildings

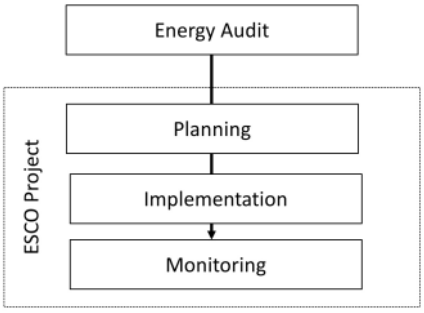
The EU Cohesion Fund supports investments in energy efficiency and RES through both co-financing and financial instruments such as loans, guarantees and stocks

[19] https://www.fi-compass.eu/sites/default/files/publications/CF-factsheet.pdf

1.4.2. Third Party Financing (ESCO, PPP)

Public funding and EU co-financing are often insufficient to ensure the implementation of decentralized energy efficiency actions, due to the scarcity of available resources. Moreover, strict budget constraints often prevent Municipalities from committing resources to the energy retrofit of public buildings.

Therefore, **a good option is to establish a Public-Private Partnership[20], in the form of a EPC – Energy Performance Contract**, so that the private actor (usually an ESCO) covers investment costs, recovering them through energy savings, while the Municipality gets immediate benefits from energy refurbishment actions and from the related reduction of energy consumptions.



However, **results achieved so far testify that NZEB projects are usually non sustainable under normal market conditions** and not attractive for private investors unless they are financially supported by public funds and/or by incentives. This is the reason why governments and financial institutions at European and national/regional level, offer diverse programmes and funds, including:

- **Subsidies**, e.g. free grants covering a percentage of total costs. They can help overcome the project's financial convenience threshold, in order to fund deep renovation projects with very long return periods, such as NZEB projects; therefore, they should be combined with other financial mechanisms such as soft loans, bank loans, or some form of PPP
- **Soft loans**, e.g. financial instruments with below-market interest rates and longer repaying periods, useful to activate co-financing and private investment. Their rotation mechanism allows funding new projects through financial flows deriving from the repayment of other loans.
- **Fiscal Incentives**, e.g. tax reductions applied by governments against the implementation of energy efficiency and RES projects. They vary from country to country and can include reduction of investment taxes, incentives to energy saving ("white certificates") and feed-in tariffs.
- **Equity and Debt** (where "debt" means regular loans or bonds bearing interest rates consistent with market standards). In case of activation of a Public-Private Partnership with Third Party Financing, the ESCO commits to provide the project with debt and own resources (equity). In PPP projects, ESCOs may obtain limited-recourse financing, or, for large projects, they may issue Project Bonds.

Considering a standard NZEB project with long pay-back times and low or null returns, it is very important for the investor, being it a Municipality or an ESCO, to reduce the cost of capital in order to make the project more attractive. Subsidized funds are good financial instruments in combination with net assets (equity) and debt, because they allow the investor to commit a lower amount of money into the project.

NZEB projects are usually not attractive for private investors unless they are financially supported by public funds and/or by incentives.

EPC is a form of creative financing for capital improvement which allows funding energy upgrades from cost reductions.

Under an EPC arrangement, an Energy Service Company (ESCO) implements an energy efficiency project and uses incomes from cost savings to repay project costs. The ESCO will not receive payment unless the project delivers the expected savings.

[20] PPP – Public-Private Partnership is a contract (usually a long-term one) and/or a legal person involving a public body and a private entity, which cooperate to implement a project/service. It is useful to optimize the value for money of public projects and services.

There is no optimal financing scheme for energy efficiency projects involving public buildings: every intervention has a different economic return period, and the return is often unsustainable for an ESCO without a specific financial support. There is therefore the need to **mix different funding sources** (Fund Matching) and to activate Public-Private Partnerships (PPP). Given a specific project, a Municipality should identify the best solution for that project among the available financial instruments. For instance, stock investments and third party investments can be preferable in terms of fewer costs and risks for the Municipality, however a NZEB project often requires a soft loan or a subsidy to be really attractive for an ESCO.

Adequate technical assistance, covering administrative, technical, economic and financial aspects, is also crucial since it can help minimize the use of public funds and maximize private co-financing, while efficiently distributing risks and setting realistic energy efficiency targets.

Monitoring is another key activity, to be performed before, during and after the intervention: effective monitoring, as well as dissemination of ex-post energy performance and assessment of ex-ante estimates, can positively influence both public bodies and potential private investors. Monitoring is also essential to correctly prepare and implement the contract among the ESCO and the Municipality, since the return of the investment depends on the energy performance achieved.

PPP and venture capital

A relevant issue affecting energy efficiency sector (mainly in Southern Europe) is the **under-capitalization of most Energy Services Companies – ESCOs**[21]. The market includes a few well-capitalized ESCOs (usually linked to large building enterprises and facility management companies) and a lot of under-capitalized SMEs, not able to participate in large-scale and complex procedures such as PPP and face many problems in activating EPC contracts.

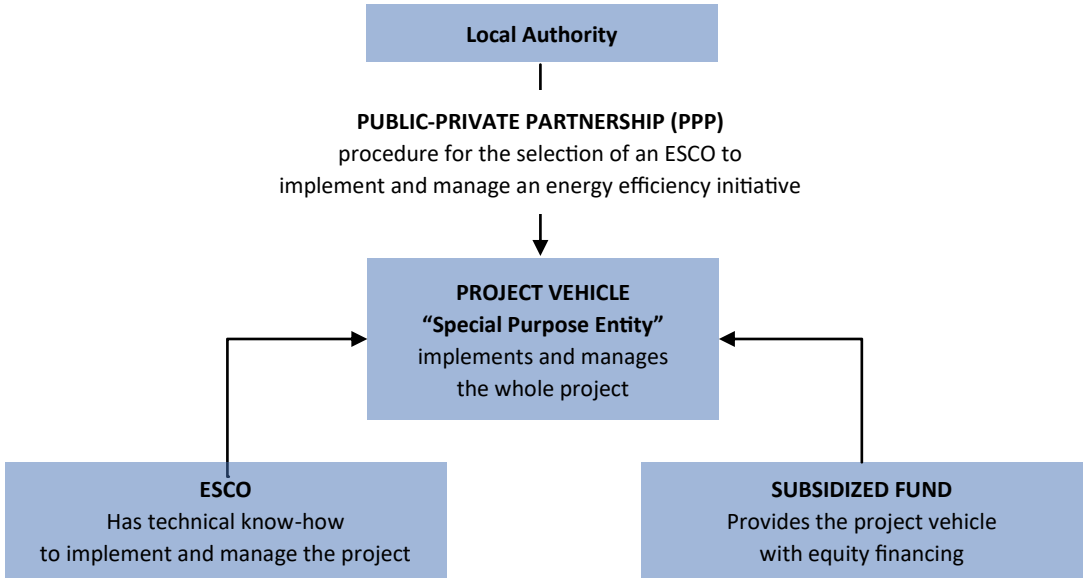
Risk monitoring tools could help promote competition among ESCOs whilst increasing the operator's capital level.

Equity participation in venture capital could solve under-capitalization problems, allowing ESCOs to jointly participate in a PPP and to have more capital to invest in energy efficiency projects.

These instruments should have "under the market" financial return expectations (i.e. Subsidized Funds backed by public entities) and they could operate in two main ways:

a. **Brownfield** – here the Subsidized Fund invests in the capital of ESCOs that have already obtained public concession, but need financing to realize interventions.

b. **Greenfield** – in this case the Subsidized Fund cooperates with the Local Authority and the Terms of Reference of the call for the selection of the Project Vehicle foresee the presence of the Subsidized Fund as equity investor, in order to avoid State Aid issues.



[21] Under-capitalization refers to any situation in which an enterprise cannot acquire the funds it needs. An under-capitalized business cannot, for instance, cope with current expenses due to a lack of capital, or is too prone to financial risk, or has not enough capital to expand and respond to the market demand.

1.4.3. Conclusions

Energy retrofit of existing buildings represents a challenge both under the technological and financial point of view. Although many dedicated financial instruments have been created, and several energy efficiency initiatives have been implemented so far (with a trend to operate at a large scale, see i.e. the programmes for the energy retrofit of schools funded by the ELENA Programme), the financing system is still in a test phase.

As previously stressed, energy efficiency projects can be not appealing for the current market. Nevertheless, interventions that are not financially sustainable can have social and environmental benefits that can justify a public commitment.

Focusing on economic and financial aspects, though, the Municipality can choose the optimal financial scheme for a project by assessing its "appeal" to the market:

- **Project fully sustainable under market conditions**: in this case, the Municipality should give priority to PPP procedures, assigning to private actors the whole responsibility for project implementation and fund raising (resources can come from private actors' own capital or bank loans)
- **Project not sustainable under market conditions**: in this case the Municipality should check whether own funds are available or not, giving way to the following alternative situations:
  1) Municipal resources are sufficient to cover the whole investment: the Municipality can directly finance the project through a public tender (traditional public procurement);
  2) Municipal resources can cover only a part of the whole investment: the Municipality should assess the availability of other financial sources on the market, able to support the project sustainability in combination with public funds. Otherwise, the Municipality should find a way to fund the whole project with its own funds.
- **Project partially sustainable under market conditions**: the Municipality should assess the availability of specific financial sources to support the project sustainability (i.e. soft loans), also considering the possibility to provide in-kind contributions. If no specific financial source is available and no other kinds of contribution are viable, the Municipality should review the whole project.

However, it is important that the EU and its Member States keep on supporting NZEB initiatives, which, though still not fully attractive for the market, are nonetheless crucial to comply with EU legislation and policies, and to foster sustainable socio-economic development in Europe.

Energy efficiency projects can be not appealing for the current market, however it is important that EU and Member States keep on supporting such initiatives through grants, subsidies, soft loans and other incentives

2. Assessment of requirements and views on energy renovation and associated financing mechanisms

One of the outputs of the NEW FINANCE project is an analysis of different perspectives on financing energy efficiency projects in public buildings, highlighting the main drivers, trends, opportunities, barriers, perceived risks and benefits related to this kind of projects, seen from the points of view of the owners/ commissioning bodies (e.g. public authorities), of financial institutions, and of contractors.

In order to produce this analysis, 91 market surveys were carried out through ad-hoc questionnaires in the six participating partner regions/countries, targeting three specific interest groups: public buildings owners and managers, banks, and third party investors (ESCOs and SMEs).

The number of surveys collected per region/country and per type of interest group is shown in the table below.

91 market surveys in six regions/ countries, targeting public buildings owners and managers, banks, and third party investors

NEW FINANCE Country	Surveys collected			
	Public buildings owners & managers	Financial institutions	Third party investors (ESCOs and SMEs)	Total
Bosnia Herzegovina	6	3	3	**12**
Croatia	8	6	8	**22**
Italy	6	3	4	**13**
Malta	21	5	N/A	**26**
Slovenia	3	3	4	**10**
Spain	3	3	2	**8**
Total	**47**	**23**	**21**	**91**

This Section presents the results of these surveys. As they were focused on small samples (maximum 14 per each NEW FINANCE partner country) and they are strictly related to the outreach/territories of the involved organizations, the surveys sample cannot be considered fully representative of the whole countries, and results may not reflect the actual overall situation of each country.

Nevertheless, the surveys helped point out some interesting issues that can serve as a basis for further analyses and developments.

2.1. Perspective I—Public buildings owners and managers

Motivational factors influencing energy renovation in public buildings

The survey focused on seven motivational factors (see Fig.1) that could act as drivers of energy renovation actions. The public building owners and managers interviewed were asked to indicate on a scale of 1 to 3 (where 1 represents the highest priority level, and 3 the lowest) the priority/importance they would assign to each factor.

The trend of the aggregated data for the six countries shows that the main issues affecting energy renovation projects in public buildings mostly relate to three factors:

- savings on energy bills resulting from reduction in energy consumption
- environmental benefits
- accessibility to financing (soft loans and grants)

In fact, from the results collected it can be noted that more than 60% of the highest priority level was allocated to these three factors, as shown in Figure 1.

Fig. 1 - Six countries-aggregated data on the factors influencing energy renovation

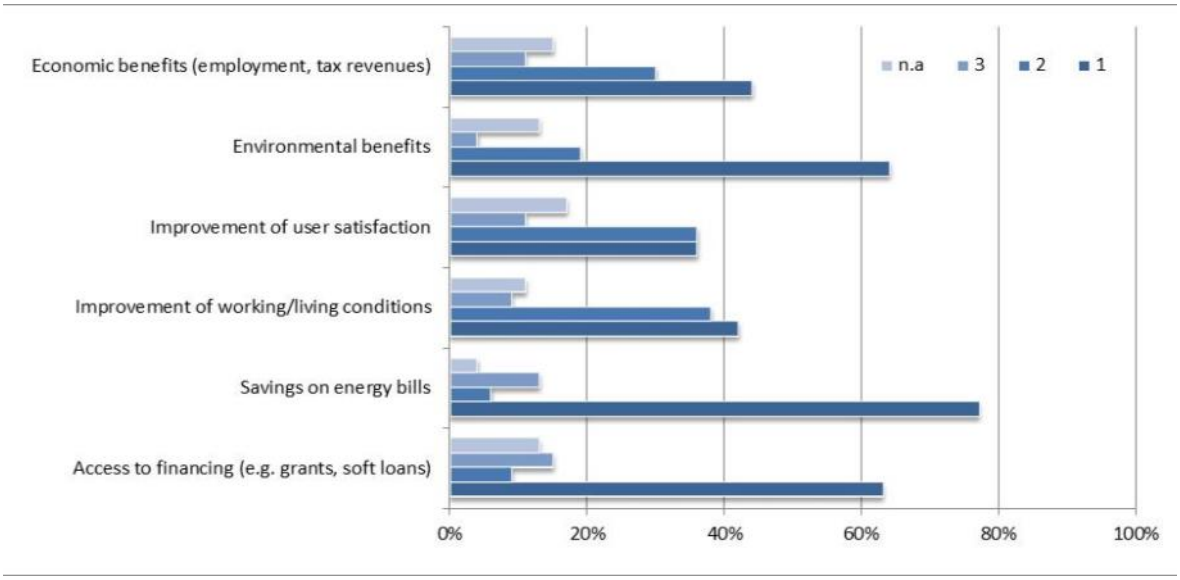


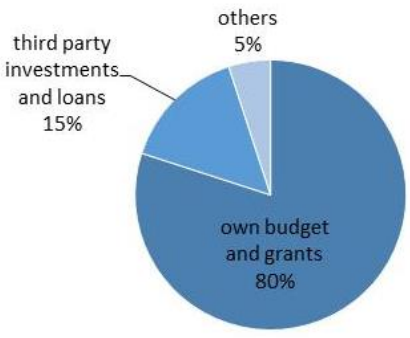
Figure 1 also shows that the survey respondents consider economic benefits (employment, tax revenues) (44% of priority level 1) as another pivotal factor influencing their decision to undertake energy renovation. These results reflect the current concerns of local authorities as regards public budget restrictions, but also highlight an attention to environmental benefits due either to an emerging awareness or to the acknowledgement of the growing importance assigned by citizens to environmental issues.

Financing mechanisms used

Public building managers were asked how the energy renovation projects recently carried out within their jurisdictions have been funded. 80% of the interviewees used their own budget and grants, while only 15% used third party investments such as EPC/PPP or loans (see Figure 2).

Apparently public building owners do not see strong opportunities of raising funds through other channels such as crowdfunding (~1%), and in the case of Malta the direct intervention of the National Government in funding building renovation projects of Local Councils was pointed out.

Fig. 2—Type of funding used for recent renovation projects



Types of investments

As for the **investments already planned**, a striking majority (nearly 83%) of the survey respondents across the partner countries have confirmed their intention to implement energy renovation projects in the next two years. Public stakeholders are mostly oriented towards investing in projects related to the implementation of energy efficiency measures (51%) or in projects that bring together EE and RES measures (44%). Only 5% of the respondents are considering projects that are only related to the introduction of renewable energy sources (5%). Results are shown in Figure 3.

The cross-country comparison deviates from the results achieved through the aggregated data. In fact, a deeper insight of the indicators provides a different interpretation of the results. For instance, only two third of the Maltese respondents are planning to do some intervention on buildings, versus a 100% response rate noticeable in all the other countries (Bosnia and Herzegovina, Croatia, Italy, Slovenia and Spain)[22].

Another aspect to be considered is the different distribution of the types of energy renovation projects in the target countries – i.e. investments for the implementation of energy efficiency measures are more apparent in Malta (93%) and in Bosnia and Herzegovina (83%), while Croatia, Italy, Slovenia and Spain show greater preferences (more than 83%) for a combination of EE and RES measures[23].

As for the **typology of buildings to be renovated**, the majority of interviewed public buildings owners showed interest in renovating administrative offices. Schools, sports & recreation facilities and health centres are also considered promising targets, while there is a striking lack of interest in the energy retrofit of social housing that could be worth further investigation (see Figure 4).

Responsibilities and decision-making

To the question "Who usually initiates energy renovation projects within your organisation?" 58% of respondents answered "head of municipality/mayor", 34% replied "head of specialized department" (for energy, environment, infrastructure, etc.), and 8% indicated "other" (see Figure 5)[24].

Fig. 3—Types of energy renovation projects foreseen by public building owners across the six countries

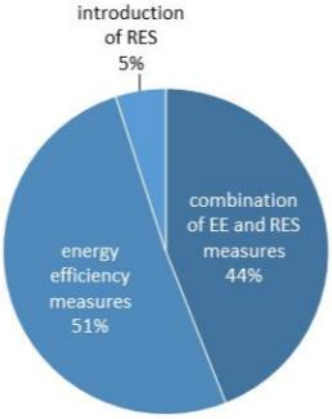
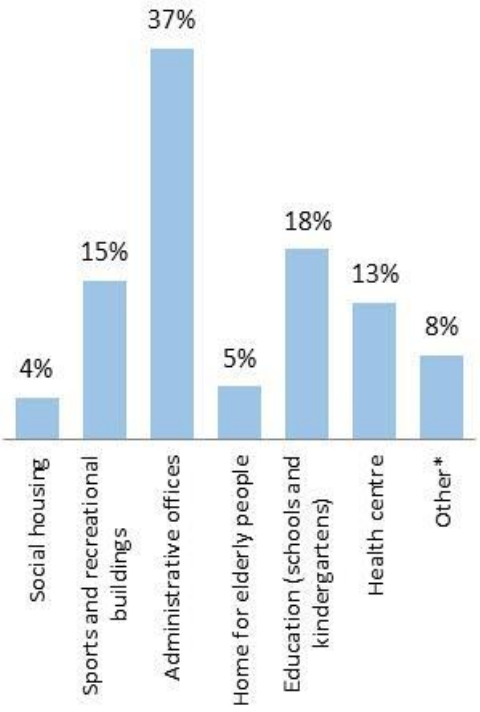


Fig. 4—Typology of public buildings to be renovated



*sometimes specified as public libraries or heritage buildings

[22] The number of surveys submitted to the Maltese local councils is significantly higher than the ones collected among the other countries. For this reason, it is more usual the probability to detect a wider odd of answers.

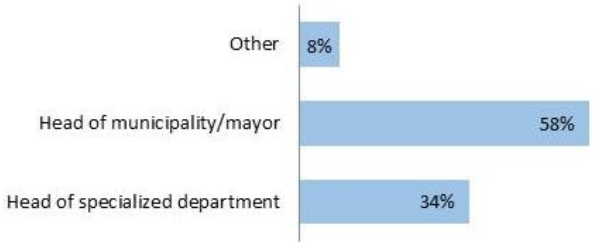
[23] Respectively 88% for Croatia, 83% for Italy, and 10% for Slovenia and Spain.

[24] For Croatia: ESCOs or Regional Energy Agencies; for Catalunya region (Spain): Presidency of Catalunya Government - specific division (energy, environment, infrastructure, maintenance area).

60% of respondents affirm to use some decision making tool for the assessment of potential energy and financial savings before deciding on energy renovation. Of the 40% who do not use any decision making tool, 72% nonetheless consider such a tool useful for making long and short term renovation.

Finally, only a half of the respondents declared to follow some methodology or protocol in order to monitor energy savings after completion of renovation projects.

Fig. 5— Initiative of energy renovation projects



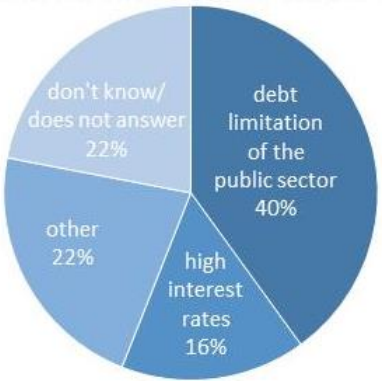
Obstacles and barriers

Dedicated loans for energy renovations

87% of respondents declare that they have not yet used dedicated loans for energy renovation, mainly due to the debt limitation of the public sector (40% of respondents) and to the high interest rates by granting national loans (16%). Among the "other obstacles" (22%), some country-specific issues have been identified, for instance:

- In Malta (where the "other" option has been chosen by the 36.5% of the interviewees), Local councils are not allowed to apply for loans to implement energy renovation and prefer to avoid additional economic burdens.
- In Bosnia and Herzegovina (where the "other" option also reached 36.5%), local authorities face insufficient budget or lack of initiative to start large investments.

Fig. 6—Obstacles to dedicated loans for energy renovation



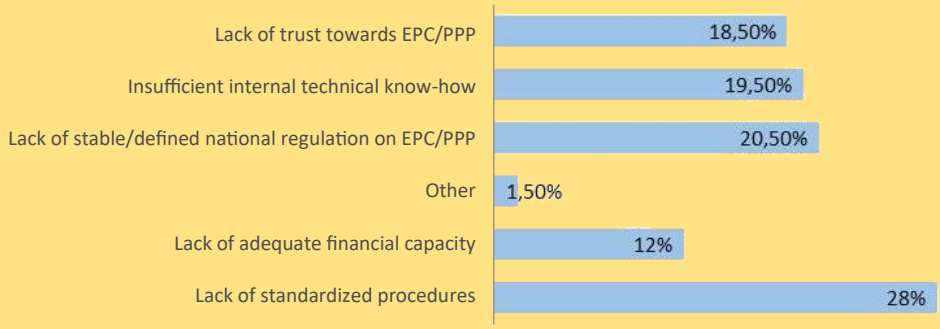
EPC/PPP contracts

Only 21% of respondents think they have sufficient internal know-how to develop and implement EPC/PPP contracts without assistance (sometimes it depends on the complexity of the intervention), while on the other hand, the majority of the answers (79%) show a lack of internal know-how.

The main barriers and challenges related to the development and implementation of EPC/PPP have been identified by public managers as below (see Fig. 10):

- The lack of standardised procedures (contracts and tendering documents for EPC/PPP) has been the most common obstacle for EPC/PPP interventions identified by the interviewees (28%).
- 60% of the survey respondents identified three other barriers: lack of stable and defined national regulation for implementation of EPC/PPP (20.5%), insufficient internal technical know-how of project developers (19.5%) and lack of trust towards EPC/PPP (18.5%).
- Lack of ESCOs and SMEs with adequate financial capacity and track record on the market was identified as a barrier by 12% of the local authorities interviewed.

Fig. 7— Main barriers and challenges related to the development and implementation of EPC/PPP



Third party investment and financing schemes: awareness and performance

The awareness of the four financing schemes is differently distributed among the respondents:

- Public-Private Partnership (PPP): 81% of respondents know the basic principles of the scheme
- Energy Service Contracting (ESC): 77% of respondents
- Energy Performance Contracting (EPC): 64% of respondents
- Crowdfunding: 45% of respondents

Regardless of this fairly high level of awareness on ESC and EPC/PPP, only 23% of the respondents stated they have already conducted similar projects so far.

In particular, only a few Local councils (17%) reported in detail the use of ESC, PPP/EPC and Crowdfunding investment schemes. Of these contracts, amounting to a total invested capital of around 67 million euros, 77% are EPC, 18% are PPP and only 5% are Crowdfunding (see Figure 8).

A cross-country comparison overview of the awareness rates for the main financing schemes is reported in Fig. 9.

Fig. 8—Percentage of contracts and project implemented using third part investment schemes

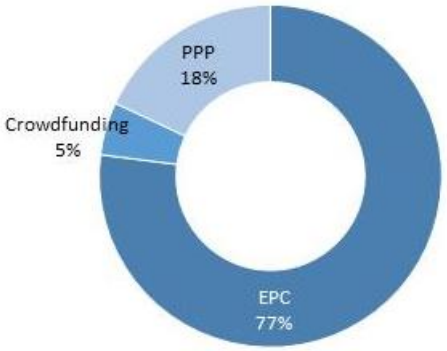


Fig. 9—Awareness of the different types of financing schemes in the different NEW FINANCE countries

Type of financing scheme	BIH	Croatia	Italy	Malta	Slovenia	Spain	Average
PPP	67%	87,5%	67%	81%	100%	100%	**81%**
ESC	67%	87,5%	83%	67%	100%	100%	**77%**
EPC	50%	37,5%	83%	62%	100%	100%	**64%**
Crowdfunding	33%	75%	33%	28%	67%	100%	**45%**

In line with the average | Above average | Below average

WHAT IS CROWDFUNDING?

Crowdfunding is an emerging way of funding new ideas or projects by borrowing funding from large numbers of people, often through an internet-based platform.

In these markets, any individual can propose an idea that requires funding, and interested people can contribute to economically support the idea. These markets have recently emerged as a viable alternative for sourcing capital to support innovative, entrepreneurial ideas and ventures.

The European Commission is exploring the possibilities and the risks of crowdfunding to identify whether European-level policy action in this field is needed. The national legal frameworks which govern crowdfunding are also being reviewed. At the moment the Commission does not intend to introduce EU laws for crowdfunding, rather it will keep reviewing developments in the sector.

The European Crowdfunding Stakeholders Forum assists the Commission in developing policies for crowdfunding.

2.2. Perspective II – Financial institutions

Trends, obstacles and opportunities for the implementation of innovative and complex financial instruments according to financial institutions in target countries

52% of the banks that participated to the survey offer dedicated loans for energy renovation projects in public buildings, as shown in Figure 1. An interesting result that has been achieved through the respondents' answer is related to the actual demand for loans for the public sector, which amounts to only 17%, as indicated in Fig.2.

The low demand of dedicated loans request by the public sector could be due to some barriers indicated by the financial institutions as follows (see also Figure 3):

- Public debt limitations seem to be the main barrier (25% of choices), followed by the complexity of the requested procedures (22%)
- Other obstacles (indicated by the 17% of respondents), such as funding from by the central national governments, or the not-compliance of dedicated loans with some banks' credit principles and policies.

Nevertheless, 87% of consulted financing institutions do offer products for project financing (regarding renewable energy projects), while the remaining 13% explain that they do no provide such loans due either to still immature market conditions, to a lack of demand (50%), or to other factors (25%) such as the scarce internal know-how or human and financial resources for setting up such products.

39% of the interviewees assert, however, that they are planning to introduce new financial products for energy efficiency and renewable energy projects. A number of banks provided further details in order to better specify their answer, which could be summarized as follows:

- Banks would be keen on introducing new financial products for RES and energy efficiency projects, subject to the provision of national or EU-funded guarantee instruments.
- Financial Institutions are currently studying new guarantee instruments (dedicated to the private sector more than to the public one) taking into consideration prototypes of projects and market requirements. Some are currently working mainly on risk sharing financial products in the climate change sector.
- Some banks have already introduced financial products which are specifically tailored to companies and aimed at the energy renovation of buildings, and are offered further to an agreement signed with EIB.

Fig. 1—Dedicated loans offered by banks for the energy renovation of public buildings

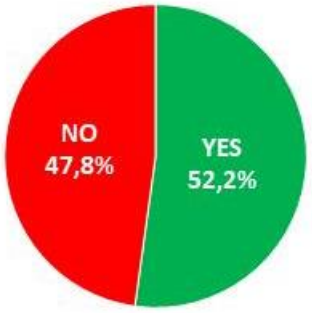


Fig. 2—Demand for energy renovation loans from public sector

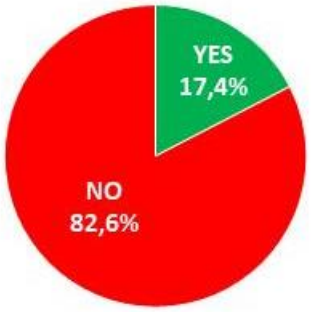
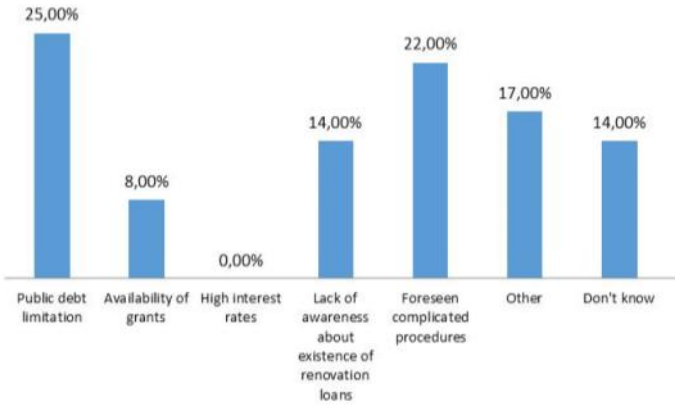


Fig. 3—Barriers of public sector investors asking for energy renovation loans according to Banks



Another question addressed to the Financial Institutions involved in the survey was aimed at identifying their willingness to actively participate as financers in loan renovation programmes initiated by the government and the European Investment Bank (EIB): as shown in Figure 4, 83% of respondents confirmed this willingness. The guarantee of the participation of the public sector and the terms/conditions of this kind of intervention seem to have a pivotal importance for the final involvement of the banks.

Number of contracts for energy efficiency and renewable energy projects concluded so far

35% of the Financial Institutions detailed number, value, type and duration of contracts for RES and energy efficiency projects implemented so far. Of 260 contracts financed, for a total value of around €186.5m, 59 have been concluded before 2016. Among these financial products, 91% (238 contracts – €17.3m) are "Standard energy renovation loans", 8% are "Project financing loans" (21 contracts – €167.2m), and 1% (1 contract – 2 billions) are "Guarantee for renovation loans", as shown in Figures 5 and 6.

In the category "Project financing loans", loans for the realization of renewable energy plants (solar, wind, biomass) have been considered, as well as projects related to water quality and recycling. The category "Standard energy renovation loans" considers loans (including leasing) for projects related with electrical facilities and lighting, but not necessarily involving energy efficiency measures or savings guarantee. In the category "Guarantee for renovation loans", loans for public lighting—such as the ESCO modality involving energy efficiency measures and savings guarantee—have been included.

Almost half of the respondents asserted they have experience with hedging, specifying interest rate risk coverage and exchange rate hedging as practice in the national contexts.

Fig. 4—Interest of banks in participating as financers in loan renovation programmes initiated by governments and the EIB

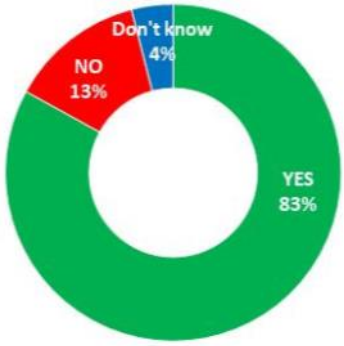


Fig. 5— Financial products for renewable and energy efficiency projects completed

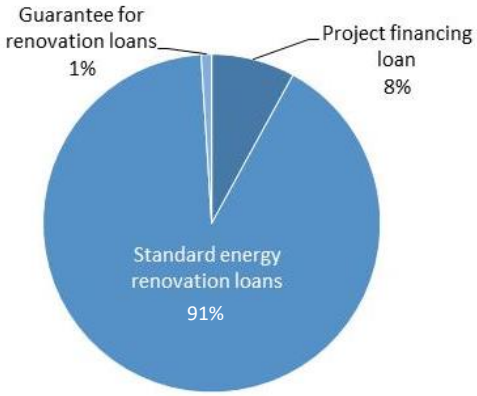


Fig. 6—Overview of granted loan contracts completed: number, value, investments, duration

Financial product	Number of contracts			Max-Min contract value (M€)	Type of investments	Max-Min duration (years)
	Before 2010	After 2016	Total			
Project financing loan	8	13	**21**	174K – 16,1	Solar self-consumption Power plants Wind farms Water quality and recycling	7 – 19
Standard energy renovation loan	51	187	**238**	16,6K – 1,8	Technology replacement Renting Buildings/Home Private/Public lighting	2 - 15
Guarantee for renovation loans	0	1	**1**	2	Public lighting (ESCOs)	14

Fixed interest rate and no currency clause

The banks involved in the survey were asked whether they would prefer to lend funds without currency clause and a fixed interest rate: 26% of them answered yes, 35% answered no and 39% didn't reply, as shown in Fig. 7. Some of them already offer short-term loans with a fixed rate, but usually not long-term loans. It is worth mentioning that banks in countries out of the Euro zone (Croatia and BIH) use to hedge the currency risk by putting a currency clause which protects them from devaluation of domestic currency. The survey shows that some banks in these countries borrow their funds in EUR and therefore prefer to issue/ disburse loans with a currency clause to final investors.

Maximum contract maturity offered for EPC

Two thirds of Financial Institutions stated that the maximum contract maturity they would be able to offer for EPC projects is between 5 and 10 years (see Figure 8).

Type of guarantees and collaterals

The survey aimed to detect the type of guarantees and collaterals (guarantee for payment of fees, guarantee for the payment of outstanding loan balance after contract termination, etc.) desired for lending a loan for EPC project. Results can be thus summarized:

- Warranties are negotiated individually for each client and depend on agreed terms, loan amount and duration.
- Collateralization is determined by the valid credit policy for each individual request and, depending on the amount of loans collateral, can consist in: 1) bills of exchange of legal and physical persons, or 2) pledge of property or pledge of money deposit. Collateralization also depends on specific projects. Most common collaterals and loan terms include: debentures and promissory notes; pledge over real estate/project; DSRA (min. 6 months principal + interest); DSCR (1,3x); etc.
- Other possible guarantees and securities could be: endorsement, mortgages, fiduciary ownership, debt bonds, guarantee for payment of fee or guarantees for loan repayment; pledge on movable properties (boilers, heat pumps...); EIF guarantees, guaranteeing for the payment of outstanding loan balances which are portfolio-based using specific guarantee and cap rates; guarantee on fixed assets and project collateral.
- When investing in the building furniture or envelope, possibilities of "land and property registry" signings (mortgages) are limited.

Fig. 7—Answers to the question "Would you prefer to lend funds without currency clause and a fixed interest rate?"

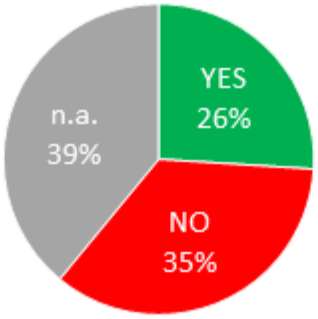
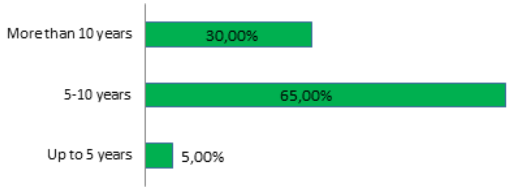


Fig. 8—Maximum contract maturity offered by banks for EPC projects



Regarding EPC, it is necessary to evaluate the creditworthiness of both the ESCOs and the customer and the technical-economic sustainability of the project. ESCOs must be certified UNI CEI 11352 and ISO 9001 (for Italy) and capable of demonstrating they have the know-how and experience needed to carry out the energy efficiency project. For example, Italian banks look for a reliable economic sustainability assessment and the transfer of the receivables, as well as some compensation in case of service fee, so that the risk is shared with the client in order to have a minimum level of guarantee on the financed investment.

Individually negotiated for each project:

1) As a guarantee for loan repayment, it is useful to make a pledge EPC contract with the following requirements:

- reasonable and achievable saving hypothesis;
- recurring and stable revenues (not dependent on energy prices) which should allow to recover investment;
- solvent counterpart and able to cope with repayment (payment of fees) of the contract;
- if actual savings are higher than the guaranteed ones, surplus should be shared between client and ESCO.

2) To guarantee the reliability of project implementation: if construction and equipment installation are not correctly carried out, expected savings might not be achieved and the required revenue will not be generated. Depending on the project and the technology used, it could be necessary to get technical endorsement during construction phase.

EUROSTAT rules acquaintance

52% of respondents declared to be aware of EUROSTAT rules on national/public debt; 39% replied no whilst 9% of respondents didn't give an answer. Three-quarters of acquainted respondents consider EUROSTAT requirements for contracts to be off-balance sheet acceptable.

Main risks for banks in EPC/PPP projects

Consulted Financing Institutions identified the main risks related to financing EPC/PPP projects as follows:

- Risk for the return on loan through operation of project
- Operational and credit risk
- Credit excess over type of project investment
- Risk of debt collection
- Double layers of risks linked to ESCO and public sector
- Default risk
- Risk of finishing projects, achieving energy efficient savings, quality of work done by builders
- National currency risk
- Delay in the payment of the fees or no payment at all
- Unplanned cash flows, which could be highly dependent on redistribution from central/local administration
- Credit worthiness of parties involved (since energy renovation projects do not create an actual cash-flow, creditworthiness of both building owners and ESCOs must always be taken into account), contract and tendering procedure and documentation
- Risk that the company will not achieve the guaranteed savings with no charge of corresponding fees, particularly for cases of projects including new technologies
- Non-recurring flows (energy fees depending on energy price, e.g. on variables that companies cannot control)
- Counterparty risk (project promoter)
- Very long term contracts
- Investments in ESCOs' balance, which could turn into excessive indebtedness and reduced funding capacity
- Little standardization of projects and contracts

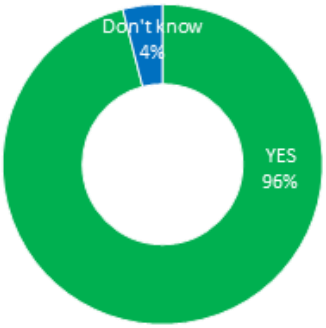
Other main issues

- Scarcity of adequately structured ESCOs (from a technical and financial point of view)
- Small dimension of energy efficiency projects (normally around € 500,000-1,000,000)
- Technical complexity of energy efficiency projects, which make them difficult for the banks to evaluate internally (some banks refer to their internal Energy Desk or to engineering firms, asking for advice and due diligence)
- Not sufficiently defined/structured access to incentive mechanisms for large projects
- Uncertainty and fragmentation of the regulatory framework, combined with the variety of possible EPC contracts, due to the wide array of available technologies
- Lack of dedicated guarantee funds. In the case of Italy, banks are waiting for the "Italian Energy Efficiency Fund" to become operational.

Standardized procedures for EPC/PPP

Nearly all respondents (96%) declared to believe that standardized procedures (contracts and tendering documentation for EPC/PPP) would result in a greater number of projects and improved implementation (see Fig. 9). However, standardization is made more difficult by the wide variety of possible EPC contracts (depending on the wide range of available technologies) and by the large number of subjects involved.

Fig. 9—Answers to the question "Do you believe that standardized procedures would result in a higher number of projects and improved implementation?"



Debt and deficit treatment of PPPs according to Eurostat

For EU Member States, the impact that a PPP has on the country's debt and deficit indicators (PPP statistical treatment) is likely to be a critical issue.

The Stability and Growth Pact and the Excessive Deficit Procedure require that the debt and deficit treatment of PPP follows the European System of Accounts (ESA). The EU Commission (through Eurostat) endeavours to guarantee the proper application of ESA: Eurostat rules on the statistical treatment of PPPs are drawn from ESA and the Manual on Government Deficit and Debt (MGDD), as well as official opinions produced by Eurostat on specific cases.

(http://www.eib.org/epec/g2g/i-project-identification/12/125/index.htm)

2.3. Perspective III – Third Party Investors

Trends, obstacles and opportunities affecting ESCO project investments

The 21 investors interviewed were asked to assign a score from a maximum of 1 to a minimum of 3[25] to five main issues/barriers considered to be affecting the implementation of third party investments in each country, with the aim of detecting which ones have to be faced or, on the contrary, are not to be considered as main issues.

Results show that ESCO companies consider financing and allocation of risks as main issues which need to be addressed (57% of respondents for each factor), followed by contract standardization (52%) and equity and guarantees (48% of choices for each factor), as shown in Figure 1.

A cross-country comparison, evaluating the maximum severity degree assigned to the obstacles influencing the ESCO dynamism on the market, depicts different internal scenarios (see Fig. 2): Croatian ESCOs, when compared to the general trend, seem to perceive the financing issue as less threatening for the implementation of their projects (37.5%), while ESCOs from Spain, Italy and BIH and on average for Slovenia[26] regard it as the major obstacle.

In addition, an inquiry on the allocation of risks factor indicates that Croatian ESCOs stress this issue as a main obstacle they have to face (to a greater extent than the other ESCOs: 87.5% vs. an average of 50% of respondents); on the contrary, Bosnia and Herzegovina ESCOs seem not to perceive this barrier in their working context.

Moreover, lack of national contract standardization is more relevant for Spanish and Croatian ESCOs[27] than for ESCOs from Slovenia (on average), Bosnia and Herzegovina and Italy (below average)[28].

Finally, the equity barrier is more threatening for Croatian ESCOs than for the ones from Bosnia and Herzegovina and Spain, while it is on average for Italian and Slovenian ESCOs.

The problem of guarantees is the main barrier for Slovenian ESCOs (75% of respondents), the last one for Croatia and BIH, and on average for Italy and Spain.

Fig. 1—Six countries-aggregated data on the main issues affecting ESCO projects

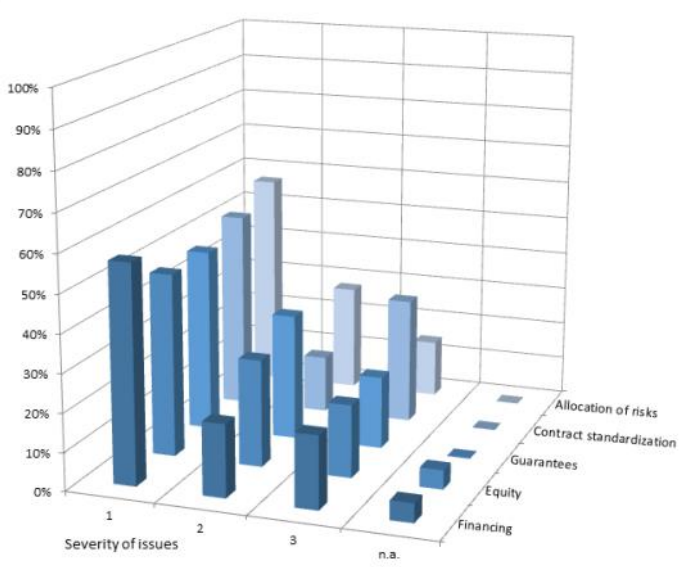
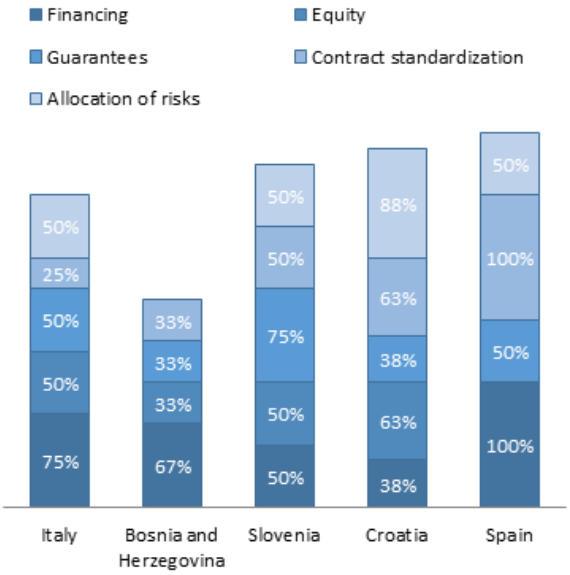


Fig. 2—Cross-country comparison: maximum severity evaluation for the main issues affecting ESCO projects



[25] Where 1: issue to be addressed; 2: neutral or do not know; 3: not a problem/barrier.

[26] Financing is the main problem verifiable in each country, except Croatia and Slovenia.

[27] All Spanish ESCOs interviewed assess as main barriers "Financing" and "Contract Standardization"; Croatian ESCOs state as main problem "Allocation of risks" followed by two other factors of the same value: "Equity" and "Contract standardization".

[28] Slovenian ESCOs assess as main problem "Guarantees", followed by an average value for all the remaining influencing factors.

The investigation on the barriers influencing the ESCOs project implementation should consider also the contribution given to this research by the companies involved in this survey. **In fact, different ESCOs, mostly from Italy and BIH, highlighted other barriers resulting by their own experience** that should be seen as complementary of the whole framework so far presented in each country.

These obstacles could be summarised as follows:

- Lack of knowledge and technical ignorance of prior energy audit (energy engineering and a detailed audit are essential before the project implementation even if it implies additional costs) and lack of skills/ability/ reliability of the ESCOs. There is the need to establish a ESCOs register and a national/local procedure to assess their efficiency (EVO protocols: evaluation plans for implementing ESCO/EPC measures; finance protocols for EPC projects), as well as a process to evaluate them.
- Lack of awareness on alternative financial modalities; high interest rates on available loans.
- Lack of dedicated resources for the implementation of EE projects in public buildings.
- Absence of multi-year programmes on energy efficiency projects and lack/inadequacy of energy efficiency plans (often not up to date to more recent technologies).
- Users sometimes cannot afford the investments that project development requires. If project development is carried out by a private partner or a company, they are also expected to manage the project implementation, which would lead to a direct conflict of interest in public procurement. There is a need for a mechanism that would take into account all aspects of the project. This could also be very helpful for a number of buildings owned by the same owner.

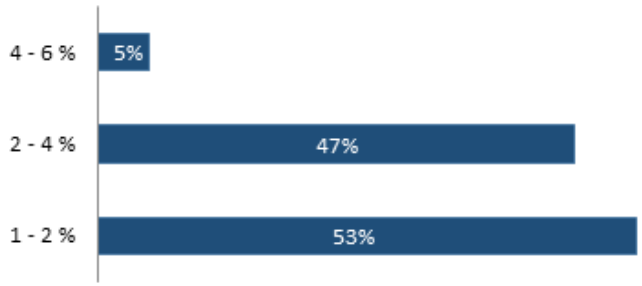
The survey also highlighted the following **opportunities:**

- Possibly, a joint participation and distribution in the implementation of EE projects.
- Quality of ESCO Contracts: EPC could/should be a must in Public Sector, as per EED 27/2012.
- ESCO qualifications/certifications have to be considered by Local Authorities (e.g. through specific award criteria included within calls/initiatives).
- For Energy managers: Public guarantees for ESCOs' EPC Projects (rotation funds or similar). In Italy, this could be addressed with "Conto Termico 2.0" incentives for public Buildings (as already provided in the Italian Decree of 16/02/2016). This provision could increment significantly the energy saving/public money ratio.
- Behavioural changes of users in energy consumption.
- EPC debt procedure has to be accepted by EUROSTAT.
- An EE investment provides a financial and environmental return that should be inserted in synergic projects with the aim to plan not only short-term actions but also efficient and long-term interventions.

Acceptable loan interest rate

According to the 53% of respondents, the most suitable and acceptable loan interest rate for EE projects is between 1-2%. Close to this result is the percentage of ESCO who would accept an interest rate between 2-4% (47% of respondents), whereas only 5% of ESCOs would consider a loan interest rate between 4-6% (see Figure3).

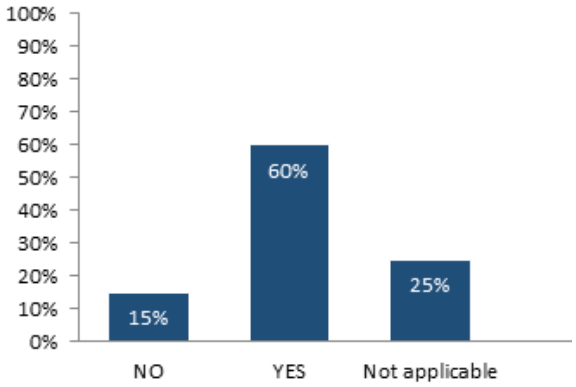
Fig. 3— Acceptable loan interest rate for EE projects



This overview substantially reflects the general situation of each country, except for Slovenian and Spanish ESCOs, which would mostly consider a loan interest rate between 2 and 4% (75% and 100% of respondents, respectively.)

In addition to this first enquiry, respondents have also been asked whether they would prefer loans without currency clause and a fixed interest rate, and 60% of them would prefer this last option (see Figure 4).

Fig. 4— Answers to the question "Would you prefer loans without currency clause and a fixed interest rate?"



Main risks in projects implemented by ESCOs

In order to classify the barriers affecting the project implementation for the ESCOs, it is possible to refer to the following scale of priority risks (see Figure 5):

1) Financial risks – 41% of interviewed ESCOs
2) User behaviour – 32%
3) Technical risks – 15%
4) Other risks – 12% (further specified as: legal issues on contracts; large/unknown financial legal risk; eventuality of missing payment from clients; variations in supply price that could compromise the conversion of saving from energy units to euros).

It is also worth to provide an overview of the situation of each country, in order to illustrate the internal scale of the perceived risks.

Results (shown in Figure 6) can be synthesized as follows:

- Spanish ESCOs indicate "Financial and Other risks" as main issues to be addressed (40% of choices for each factor), followed by "User behaviour" risk (20%), whilst no perception of Technical risks;
- Croatian ESCOs assess "Financial and User behaviour" as main risks in their working environment (38.5% of choices for each factor);
- Slovenian ESCOs highlight "Financial risk" (43%) as a main problem they have to face, followed by "Technical and User behaviour risks" with the same percentage (29%);
- Bosnia and Herzegovina ESCOs assess "Financial risks" as the main barrier (75%), followed by "User behaviour risks" (25%), whilst they have no perception of "Technical risks";
- Italian ESCOs deviate from the trend indicating as main risk "User behaviour" (40%), followed by "Financial, User behaviour and Other risks" with the same percentage (20%).

Standardization of procedures

The last question addressed to the ESCOs involved in the survey aimed to assess whether, in their opinion, having standardized procedures (contracts and tendering documentation for EPC/PPP) would improve the number of project developed and their final implementation.

90% of respondents consider this possibility an important tool to reduce contract standardization risks (see Fig. 7).

Fig. 5—Main risks affecting ESCOs' projects implementation: six-country aggregated data

Fig. 6—Main risks affecting ESCOs' projects implementation: six-country aggregated data: cross-country comparison

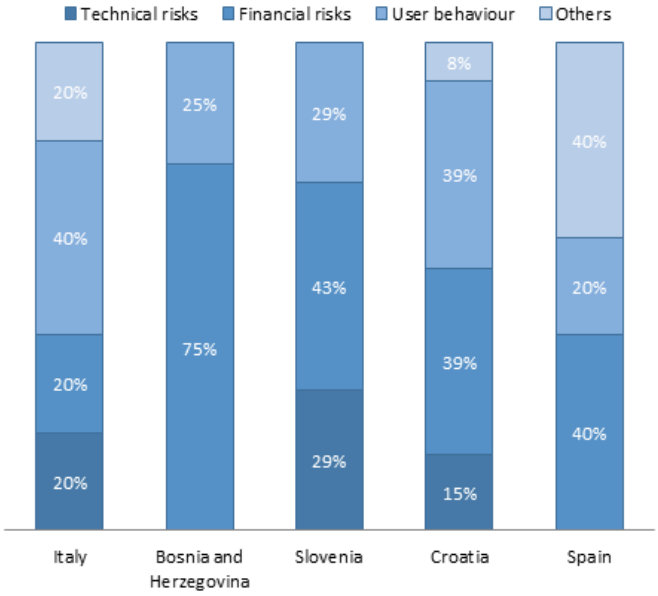
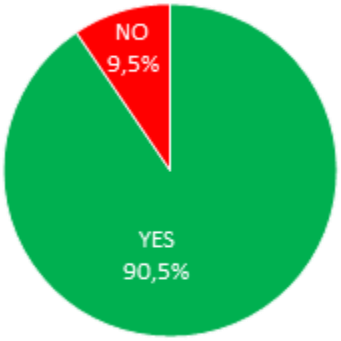


Fig. 7—Answers to the question "Do you think that standardized procedures could improve project development and implementation?"



2.4. Final remarks

Energy refurbishment of public buildings appears to be still a promising sector for public authorities in the six countries involved in the NEW FINANCE project.

Mainly guided by economic considerations (**savings in energy bills** seem to be the main driver for taking action), most of the interviewed public managers are currently planning energy renovations (mainly energy efficiency interventions, also in combination with installation of RES devices), especially addressed to **administrative offices,** and, secondarily, to **schools**. These actions are almost totally funded by public administrations through their own budget, and, though public bodies face well-known budget problems, **the use of dedicated loans and innovative mechanisms involving third parties is not yet widespread**. This is not, apparently, due to a lack of awareness on the available opportunities and their potential: the attitude towards the application of innovative financial and contracting instrument is generally positive. Nevertheless, debt limitation of the public sector hampers the use of dedicated loans for energy renovations and the use of EPC/PPP contracts is hindered mainly by lack of internal know-how to develop and implement such contracts without assistance, and of standardised procedures, while an insufficiently stable and defined national regulation for the implementation of such mechanisms also plays an important role.

The **cause-effect relationship among public debt limitations, lack of know-how in public administrations, and low demand for loans for energy renovations by the public sector** is confirmed by the financial institutions interviewed, as well as the lack of standardization of projects and contracts (however ascribed to the wide variety of available technologies, and therefore hardly avoidable) and the uncertainty and fragmentation of the regulatory framework. Standardized procedures are also a claim of the ESCOs who participated in the survey.

Notwithstanding these criticalities, banks seem willing to act as financers in loan renovation projects, proven that they are somehow "guaranteed" by national governments and/or the EIB. The **guarantees issue** is, of course, central for financial institutions, which need to carefully assess the creditworthiness of both ESCOs and public building owners – especially since energy renovation projects do not create an actual cash-flow, and energy fees strongly depend on fluctuant energy prices. From the banks' perspective, few existing ESCOs are adequately structured from a technical and financial point of view. This, combined with the small dimension of most energy efficiency projects and the length of contracts, makes it difficult to access loans. Most banks have also problems to handle the projects' technical complexity, and to evaluate them correctly.

Interviewed ESCOs consider **financing and allocation of risks** as the main issues affecting the implementation of third party investments in target countries, followed by contract standardization, equity and guarantees. Other obstacles lie in the scarce knowledge on prior energy audit and – more generally – in the lack of skills/ability/reliability of the companies; in the high interest rates on available loans and in the absence of multi-year programming of energy efficiency projects (ascribed also to inadequate energy efficiency plans). Most predictably, financial risks are considered as the main risks to be faced by ESCOs, however an important role is also played by users' behaviours that – when incorrect – can jeopardize the success of energy renovation projects.

Economic considerations seem to be the main driver of energy renovation for public buildings owners

Banks need to carefully verify the creditworthiness of ESCOs and public building owners, as well as to improve their capacities to assess technically complex energy renovation projects

Financial risks and users' behaviours are considered as the main risks ESCOs have to face

3. Selected Case Studies

This section presents a selection of case studies collected by project partners and uploaded on the NEW FINANCE platform.

CASE STUDY 1

ENERGY EFFICIENCY OF CLEAR CLAPS IN MUNICIPAL BUILDINGS

Location: Montesilvano (Italy)

Building Owner: Municipality of Montesilvano (Italy)

Duration of Contract and/or loan: 9 Years

Sector: Education

Type of intervention: EE (Active measures) including replacement of existing window frames with new ones having lower thermal transmittance than the one required by the current regulation .

Total Investment: 193.055,00 €

Simple Payback Period: 7 years

Energy Saving: 47 kWh/m2/year

Financial Model: Public-private partnership

Physical characteristics of the building:

- Building Size: < 1.000 m2

Financial Barriers:

- Limited access to public funds

Public Benefits:

- Lower GHG emissions
- Other social benefits: Reduction of public expenditure of the Municipality.

Integration in a larger implementation scheme: the project is part of an overall scheme for the replacement of windows frame in several municipal schools, and for the replacement of heat generators and instalaltions of solar thermal collectors in several scools and sport facilities.

Replication/transfer/upscale: The intervention has been implemented in different buildings of the Municipality.

CASE STUDY 2

ESCO RENOVATION MODEL OF THE HOSPITAL IN KARLOVAC

Location: Karlovac (Croatia)

Building Owner: Karlovac County

Implementation Year: 2014

Duration of Contract and/or loan: 0 Years

Sector: Health

Type of intervention: EE (Active measures) and RES, including renovation of 15.700 m2 of façade, 8.300 m2 of flat roof, and 5.000 m2 of window and door frames; installation of 6 thermal sub-stations, heat pumps, 22 solar collectors, new cooling system, 1.200 thermostatic valves and 12.500 luminaires; introduction of natural gas.

Total Investment: 8.625.947,50 €
[60% of own resources (private financing); 40% funded]

Simple Payback Period: 14 years

Energy Saving: 216 kWh/m2/year

Financial Model: Energy service agreements (EPC, ESC)

Physical characteristics of the building:

- Building Size: > 8.000 m2
- Floor area: 36.000 m2
- Year of construction: 1963
- Heating system: District heating
- Building structure's main characteristics: no thermal insulation, heat bridges, large glass surfaces with poor energy efficiency
- Energy sources used: oil and electricity
- Previous energy state: Class G

Financial Barriers:

- Procurement procedure
- Project development

Public Benefits:

- Increased employment
- Lower GHG emissions
- Increased energy security and reduced dependence on foreign imports
- Improvements to public budget
- Outreach and awareness

- Improved quality (# of people affected)
- Other social benefits: Growth of Croatian building industry; Increased value of properties; Improved energy balance of the local environment; Increased security and reliability of thermal energy supply.

Measurement, reporting & verification: throughout the contract duration, the Energy Service Provider (ESP) shall monitor and control savings.

Integration in a larger implementation scheme: the project is part of the 2014-2015 Programme of Energy Renovation of Public Sector Buildings, adopted by the Croatian Government in 2013. This Programme has generated 57 public procurement procedures for the provision of EPC, 21 signed contracts for 68 buildings (total floor area: 225.000 m2), and € 125 million of total investment, for 70 million kWh of expected energy savings.

Basic settings and characteristics of the program: the ESP provides energy services to improve the energy performance of building. It prepares project documents, carries out the energy renovation of the building (construction works, installation of equipment and materials), and monitors and maintains all building elements and installed equipment. ESP invests and takes technical and economic risk. The Client ensures payment of compensation to ESP during the contract period. Payment of services is based on verifiable savings (service charge should be less than the savings).

Replication/transfer/upscale: replicability is ensured by the Programme of Energy Renovation of Public Sector Buildings for the period 2014-2015.

CASE STUDY 3

SAVINGS PROJECT IN HIGH PERFORMANCE SPORTS COMPLEX

Location: Sant Cugat del Vallès (Spain)

Building Owner: Department of Governance (Catalan public Administration)

Implementation Year: 2013

Duration of Contract and/or loan: 10 Years

Sector: Sports

Type of intervention: EE (Active measures) and RES, including: improvement of indoor lighting, based on LED; improvement of Air Handler Units, swimming pools' pumping system and insulation in pipes and pools; replacement of R22 direct expansion equipment with one aligned with current regulation; replacement of oil boilers with gas boilers; replacement of a cooling tower; installation of new dehumidifier pump for the indoor swimming pool; replacement of a gas boiler with a solar thermal system to feed the outdoor pool; installation of a monitoring and management system (with 45 field sensors); optimization of the use of facilities; water saving actions .

Total Investment: 1.200.000,00 € (100% funded by ESCO)

Simple Payback Period: 7 years

Energy Saving: 634.435 kWh (electricity) plus 3.354.337 kWh (fuel) saved in 2016 (more than the 39% guaranteed)

Financial Model: Energy service agreements (EPC, ESC)

Physical characteristics of the building:

- Building Size: > 8.000 m2
- Floor area: 28.000 m2 (plus 94.000 m2 external)
- Year of construction/Last adaptation: 1987
- Energy sources used: fuel oil and propane

Financial Barriers:

- Procurement procedure
- Project development

Public Benefits:

- Increased employment
- Lower GHG emissions (-1.000 tons CO2/year)
- Increased energy security and reduced dependence on foreign imports
- Improvements to public budget
- Outreach and awareness
- Improved quality (# of people affected)
- Other social benefits: Increased employment; Increased value; Improved energy balance of local environment; Increased security/reliability of thermal energy supply.

Measurement reporting & verification: the ESCO has developed a M&V plan to report savings.

Integration in a larger implementation scheme: A facilitator team in ICAEN (Catalan Institute for energy) is dedicated to promote and foster EPC projects within the Catalan government's public buildings.

Basic settings and characteristics of the program: The EPC is a business model in which a site owner outsources energy services to a third party for a defined period. This means that energy is supplied and/or energy saving measures are implemented by an energy service company that takes on all of the tasks (planning, construction, financing and operational management) and the risks associated with the energy service. Energy audit was performed by a third party engineering company and that work was outsourced by ICAEN who was the facilitator.

CASE STUDY 4

EPC LIGHT PROJECT IN 12 HIGH SCHOOLS

Location: Metropolitan area of Barcelona (Spain)

Building Owner: Department of Education of Catalonia

Implementation Year: 2014

Duration of Contract and/or loan: 4 Years

Sector: Education

Type of intervention: Energy Management including Energy diagnosis, Monitoring of consumptions, Analysis of Energy Supply Contract of each centre, Optimization of star-ups of heating system, Follow up and management of energy consumptions, Training and awareness of users, Deployment of Best Practices.

Total Investment: 25.000,00 €

Energy Saving: Total savings achieved in the first year (2015): 59.255 €, which is 13,3% of baseline.

Financial Model: Energy service agreements (EPC, ESC)

Physical characteristics of the building:

- Building Size: between 4.000 and 8.000 m2
- Year of construction/Last adaptation: 1971-2001
- Floor area: average 7.000m2
- Number of floors: average 3
- Intended use: Schools
- Heating system: Boilers, central heating
- Building structure's main characteristics: Concrete lean structure, no thermal insulation, prefabricated construction elements without insulation (parapet walls), heat bridges, flat roofs, large glass surfaces with poor energy efficiency (simple double gazing)
- Energy sources used: electric energy, and natural gas

Financial Barriers:

- Project development

Public Benefits:

- Lower GHG emissions (-120 tons CO2 in 2016)
- Improvements to public budget

- Improved quality (# of people affected)
- Other social benefits: Reduction of public expenditure of the Municipality.

Measurement reporting & verification: A M&V protocol is being used in order to demonstrate savings.

Integration in a larger implementation scheme: The project was implemented under an ICAEN's (Catalan Institute for energy) initiative which has developed an Energy Plan for reducing costs in public administration of the Catalan Government. ICAEN assisted in the development of this project and in all tendering process.

Basic settings and characteristics of the program: The EPC light model is a particular case for EPC where investments are close to zero, and includes: 1) Energy monitoring of electricity, gas, water, outdoor and indoor air temperatures; 2) Establishment of Best Practices on the use and operation for each building (Summer & Winter); 3) Optimization of the utility services on energy purchase; 4) Small investments in control strategies (timers, valves, ...); 5) Training of energy managers, users, stakeholders, etc.; 6) Follow up and supervision.

Innovation: One of the first EPC light projects in Europe and the first one in Spain.

4. Conclusions & recommendations

The energy retrofitting of the existing building stock is widely considered as the action that can ensure the largest portion of carbon savings by 2030. However, the speed of the renovation process is still too slow throughout Europe, due to multiple factors: lack of competences in the management and building sectors; constantly evolving technological framework; extra costs of NZEB solutions.

Nevertheless, plenty of options exist to achieve better energy performance of existing buildings:

- Improvement of the building envelope (more efficient insulation of walls and roofs, replacement of windows…)
- Better use of natural lighting, use of innovative fenestration, high-efficiency lighting technologies, and automatic light management systems
- Improvement of heating & cooling systems, through installation of heat pumps, solar thermal and co-generation, combined with air control & management equipment and heat exchangers
- Introduction of Building Energy Management Systems and building automation devices
- Improvement of users' behaviour through specific tools (smart metering, informative/comparative billing...) or through motivational campaigns, competitions, and training.

Lack of dedicated funding is especially relevant for public administrations, whose debt limitations often hamper the energy refurbishment of non-efficient, obsolete public buildings. Notwithstanding the existence of financial instruments and funds (even at EU level) and the opportunity to activate public-private partnerships, the use of dedicated loans and innovative mechanisms involving third parties is often hindered by lack of internal know-how to develop and implement such mechanisms without assistance, of standardised procedures, and of a stable and defined national regulatory framework. Under-capitalization and lack of technical knowledge also affect most ESCOs, while banks often find it difficult to offer appealing conditions to finance energy efficiency projects, due to multiple factors (insufficient creditworthiness of ESCOs and PA, small dimension of EE interventions, length of contracts, technical complexity of the projects, etc.)

To overcome these barriers, it is crucial to increase the level of technical knowledge of all actors involved in EE projects (PA, financial institutions, enterprises, final users), as long as technological, financial and management aspects are concerned.

In particular, Public Administrations, should be enabled to assess the sustainability of their EE projects under market conditions, and consequently to choose the optimal financial scheme to adopt and to carry out the required procedures. In this sense, energy benchmarking can help them in the selection of the buildings with the highest energy renovation potential, while the Energy Audit still represents the essential tool to assess the status quo and define cost-efficient "packages of measures" for the refurbishment of buildings.

However, it is important that the EU and its Member States keep on supporting NZEB initiatives, which, though still not fully attractive for the market, are nonetheless crucial to comply with EU energy legislation and policies.

Capacities to effectively exploit existing funding schemes and management tools can "make the difference" in the implementation of NZEB models

it is crucial to increase the level of knowledge of PA, financial institutions, enterprises, and final users), as regards technological, financial and management aspects

Support from EU and national governments is still essential to finance NZEB projects

Main references

AA.VV., *Guidance on Energy Efficiency In Public Buildings – EPEC European PPP Expertise Centre,* 2012 - http://www.eib.org/epec/resources/epec_guidance_ee_public_buildings_en.pdf

AA.VV., *Linee guida alla presentazione dei progetti per il Programma per la Riqualificazione Energetica degli edifici della Pubblica Amministrazione Centrale PREPAC (D.M. 16 Settembre 2016)*, ENEA-GSE, 2017

BPIE, *Financing Energy Efficiency (EE) in Buildings - Background Paper*, 2010 - www.bpie.eu

BPIE, *Setting The 3% Target For Public Buildings Renovation - Factsheet*, 2014 - www.bpie.eu

BPIE, *Nearly Zero Energy Buildings definitions across Europe—Factsheet* - www.bpie.eu

ENEA, *RAEE Rapporto Annuale sull'Efficienza Energetica*, 2016

ENEA, *Ricerca di Sistema Elettrico: Sviluppo della metodologia di indagine. Realizzazione di schede tecniche moduli per la formazione del personale SOTACARBO per la creazione di un primo data base degli edifici pubblici insistenti sul territorio del Sulcis*, 2014

ESMAP, *Improving Energy Efficiency in Buildings. Mayoral guidance notes #3,* Knowledge Series 019, 2014 - www.esmap.org/Energy_Efficient_Cities

European Commission, *Good practice in energy efficiency for a sustainable, safer and more competitive Europe*, 2016 - https://ec.europa.eu/energy/sites/ener/files/documents/good_practice_in_ee_-web.pdf

European Commission, *Report from the Commission to the European Parliamenti and the Council: 2016 assessment of the progress made by Member States in 2014 towards the national energy efficiency targets for 2020 and towards the implementation of the Energy Efficiency Directive 2012/27/EU,* Brussels, 1 February 2017 (COM(2017) 56 final)

European Commission, *Recommendation (EU) 2016/1318 of 29 July 2016 on guidelines for the promotion of nearly zero-energy buildings and best practices to ensure that, by 2020, all new buildings are nearly zero-energy buildings*

G. Fasano, *L'efficienza energetica nel settore civile*, Quaderno ENEA, 2011

E. Gasiorowski-Denis ,*Why investing in energy-efficient buildings pays off*, 7 November 2016 - https://www.iso.org/news/2016/11/Ref2140.html

IEA, *Transition to Sustainable Buildings Strategies and Opportunities to 2050,* FIRE - Federazione Italiana per l'uso Razionale dell'Energia - https://www.fire-italia.org

RePublic_ZEB (IEE Project) - Refurbishment of the public building stock towards NZEB: http://www.republiczeb.org/index.jsp

S. Thomas, *Energy efficiency policies for buildings*, Wuppertal Institute, 2015 - www.bigee.org

ZEMEDS (IEE Project) - Promoting renovation of schools in a Mediterranean climate up to Nearly Zero-Energy Buildings: http://www.zemeds.eu/case-studies

http://eedguidebook.energycoalition.eu/images/PDF/EED.pdf

http://www.epbd-ca.eu/outcomes/2011-2015/CA3-BOOK-2016-A-web.pdf

https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/synthesis-report-assessment-member-states-building-renovation-strategies)

https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings

Project Partners

North-West Croatia Regional Energy Agency (HR)
Lead Partner

Catalan Institute for Energy (ES)
Project Partner

Abruzzo Regional Energy Agency (IT)
Project Partner

Energy Agency of Savinjska, Šaleška and Koroška Region (SI)
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Malta Intelligent Energy Management Agency (MT)
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Development Agency of the Una-Sana Canton (BIH)
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