



EBENTO

D2.1 Preliminary Business models and market analysis

Part 1 - Preliminary market outlook and business modelling analysis and planning
Part 2 - Legal and contractual aspects of the energy performance contracting in the target countries.

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Author(s)	Organization
Clemens Mayer	Joanneum Research
Andreas Türk	Joanneum Research
David Blättner	Joanneum Research
Shima Ebrahimi	IIECP
Dimitris Athanasiou	IIECP
Dimitra Tzani	IIECP
Elena Leal Lorente	ETRA
Edin Lakić	UL
Katarina Kern	UL
Domen Bančič	IRI UL
Sara Arko	IRI UL
Jure Vetršek	IRI UL
Gloria Calleja Rodriguez	Cemosa

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ABSTRACT

This deliverable provides a general overview on the current status of the market development of Energy Performance Contracts (EnPCs) in the European Union and in particular in the pilot countries of the EBENTO project. Furthermore, it describes the most common business models and the legislative framework for EnPCs in the EU and the pilot countries. The results that are presented in this report were obtained through an extensive literature research and in-depth interviews with key stakeholders relevant to EnPCs (e.g., policy makers, ESCOs, representatives of Ministries, etc.). The basic EnPC business model finances energy efficiency investments with guaranteed energy savings generated through the contract. New innovative business models also include demand response services in the contract and thereby improve the profitability and reduce the duration of the contract. The analysis in this report also reveals that there are still major barriers for the large scale adoption of EnPCs in Europe. Moreover, the report investigates the legal and contractual aspects of EnPC within the EU and specific target countries, including Spain, the UK, Greece, and Estonia. The analysis highlights the influence of EU policies like the European Green Deal and its implementation 'Fit for 55' package on energy efficiency and building renovation. The Energy Efficiency Directive (EED) and the Energy Performance of Buildings Directive (EPBD) are presented as instrumental legislative instruments driving energy retrofit efforts. The EED outlines EnPC, one-stop shops (OSSs), information dissemination, energy flexibility, and digital tools as innovative approaches to accelerate renovation rates while the EPBD emphasizes the adoption of innovative financial mechanisms, accessible advisory tools, and digital platforms for monitoring building performance

KEYWORDS

Energy Performance Contracting, EnPC, Energy Supply Companies, ESCO, Business Model, Shared savings model, Guaranteed savings model, Market development, Legal framework, Energy savings, Energy efficiency.

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EXECUTIVE SUMMARY

The objective of the Horizon Europe EBENTO project is to enhance energy efficiency in buildings by developing an integrated one-stop-shop platform for all actors involved in building and renovation sector in order to better coordinate and manage Energy Performance Contracting (EnPC). EnPCs are contracts between building owners and Energy Service Companies (ESCOs) that target to facilitate energy efficiency improvements in buildings that are financed from guaranteed energy savings. The target of this report is to provide a general overview on the status of the market development and business models of EnPCs as well as the main barriers and drivers, and the legislative framework for EnPCs in the European Union, particularly in the pilot countries of the EBENTO project.

The methodological basis for the elaborations in this report is a literature research and analysis combined with expert in-depth interviews with national key stakeholders relevant to EnPC. Interviews were conducted in six EU Member States, as outlined in the methodology description of chapter 2. The business model analysis outlines the well-established basic EnPC business model with its main characteristics as well as EnPC categories and the most common financing schemes. Furthermore it reveals that new innovative business model approaches focus on the integration of demand response and flexibility services and revenues in the EnPC business model. The analysis of the current market situation showed that an initial EnPC market development took place in all European countries but there is only a slight market growth. The main barriers that were identified in the analysis are a lack of awareness and understanding, lack of trust, high complexity, high payback periods and contract durations as well as high transaction costs and the split incentive dilemma. The most relevant drivers of EnPCs in residential sector are increasing energy costs, supportive schemes and the availability of competent facilitators or support services (e.g., one-stop-shops).

A comprehensive analysis is conducted on the legal and contractual aspects of EnPC within the context of the European Union (EU) level and four specific target countries: Spain, the United Kingdom, Greece, and Estonia. The objective is to identify essential legal and contractual prerequisites for the successful implementation of the proposed business models within the EBENTO project.

At the European Union (EU) level, the energy services sector, including ESCOs and EnPCs, operates within a comprehensive regulatory framework. This framework defines key provisions to support energy service contracts, financial instruments, certified service providers, and monitoring and verification methods. The primary driver of this framework is the Energy Efficiency Directive (EED), which mandates Member States to take actions that bolster the energy services market.

Over the past decades, the EU's focus on energy services, driven by the EED and other supportive legislation, has led to increased interest in the sector. As a result, the average ESCO market across EU Member States has witnessed steady growth. Most Member States have introduced relevant national legislation to establish their energy services markets, including provisions for ESCOs and EnPCs. However, the actual implementation of this legislative framework and the functioning of these markets vary widely. Some provisions are yet to be fully incorporated into national legislation, and in certain Member States, the energy services market remains in its infancy.



(EnPCs have found use in the public sector, partly due to revised Eurostat rules regarding public debt and deficit. These changes have made it easier for public authorities to renovate their buildings using private sector investments.

Despite the sector's potential, the widespread adoption of EnPCs, even in developed markets, remains below expectations. Legislative barriers often hinder progress, suggesting that a more standardised approach could facilitate market growth, streamline transactions, and reduce costs. Improving information dissemination and raising awareness are crucial steps forward. Lists of ESCOs prove highly valuable for customers seeking to understand the market. Facilitators specialising in EnPCs and energy agencies have pivotal roles to play, particularly within the public sector.

Addressing complaints effectively within the energy service market is another critical area for attention. Some Member States have successfully implemented ombudsman services or dispute resolution mechanisms with minimal costs and rapid, fixed response times.

Financial support and incentives, such as tax incentives, continue to be essential, particularly in countries with less mature markets. Member States are encouraged to utilise European Funds effectively, employing a smart mix of financial schemes that promote EnPCs and ESCOs. Furthermore, sharing best practices at the national and regional levels, along with lessons learned from EU-funded projects, can enhance collaboration among Member States.

The ongoing revision of national legislative frameworks, notably in response to the revised EED and the EPBD as part of the 'Fit-for-55' package, presents a unique opportunity. This revision can address existing legal barriers and provide the necessary incentives to promote the energy service market and facilitate the broader application of EnPCs.

The legal and contractual aspects of EnPC in the pilot countries of the EBENTO project are also explored in this report. The analysis shows that Greece's EnPC sector is in its initial phases, primarily concentrating on public lighting projects. Challenges encompass regulatory ambiguities, financial limitations, technical intricacies, and a scarcity of precedents. To stimulate expansion, Greece should streamline procedures, enhance awareness, and cultivate trust in EnPC, thereby promoting a more robust and vibrant EnPC landscape.

Estonia is in the early stages of EnPC market development, exemplified by its first project in 2019 through the EFFECT4buildings initiative (1). While ESCO solutions are gaining ground in commercial and industrial sectors, progress is slower in smaller enterprises, the public sector, and residential areas. Insights from interviews reveal that ESCOs are drawn to non-residential projects due to lower costs and quicker paybacks. Clients, on the other hand, prioritise aesthetics and are motivated by government support for energy-efficient renovations. The Estonian government recognises ESCOs' potential and has proactively explored enhanced support to overcome barriers. Refining ESCO offerings and establishing a national register could further drive adoption and project financing.

Spain's EnPC sector has transitioned from an initial stage to a mature one, emerging as a significant player in the public sector contracting landscape. Facilitators activate the market, and providers' availability and satisfactory provision levels indicate strong support. Regulations like the Sustainable Economy Law (Royal Decree Law 6/2010) promote the ESCO market in line with EU energy efficiency



goals. Initiatives such as the Spanish Energy Saving and Efficiency Action Plan (2008-2012) and Royal Decree 853/2021 underscore Spain's energy efficiency commitment. Despite progress, challenges persist. Regulatory complexity, technical issues like energy savings control, limited market access, funding difficulties, and social awareness gaps are barriers. Drivers include energy districts, sustainability awareness, financial grants, third-party financing credibility, participatory approaches, and transparency's role in building trust.

The ESCO market in the UK remains small, with limited participation from local authorities. The use of public sector frameworks like RE:FIT and CEF (2) has been vital in boosting EnPC despite the absence of ESCO-specific regulations. Barriers hindering EnPC's growth encompass regulatory uncertainty, split incentives, technical complexities, and resistance to innovative models. Technical challenges include the lack of shared energy data, skill gaps, data privacy concerns, and the need for standardized criteria. Market and financial obstacles range from resistance to pay-for-performance schemes and monopolistic energy models to insurance limitations and cost-effectiveness concerns. Social barriers arise from issues of trust, limited emphasis on energy efficiency, awareness gaps, and complications in ownership structures. However, drivers are emerging. The Energy Company Obligation (ECO) policy, evolving through ECO4, introduces the 'pay for performance' approach, enhancing accuracy and support for energy efficiency projects. Mortgage companies recognizing the importance of financing energy-efficient upgrades stimulate growth in the market for secured lending products. Challenges persist in the UK's energy efficiency landscape, but evolving policies and market recognition are gradually facilitating greater adoption of energy performance contracting and improved energy efficiency measures.



1 Introduction

1.1 Policy Context

The European building stock is currently responsible for 36% of all energy related CO₂ emissions in the EU. The entire building stock will need to be highly energy efficient and carbon-neutral by 2050 to achieve the EU's climate objective. In 2020, EU commission has published the Renovation Wave (3) , initiative aiming to double annual energy renovation rates in the next ten years and renovate 35 million buildings in Europe by 2030. (3) Together with a very ambitious decarbonisation of heating this should enable to cut direct building sector greenhouse-gas emissions by 60% until 2030 (based on 2015 levels) as laid down in the Climate Target Plan 2030 (CTP). The current EPBD is an essential element of the EU renovation strategy. It upgrades the existing regulatory framework to reflect higher ambitions and more pressing needs in climate and social action. If implemented by Member States it will change the way renovation is carried out, providing a range of new requirements but also new opportunities for energy supply companies carrying out renovation activities. A deep renovation for energy performance purposes is seen as a prime opportunity to address other aspects such as indoor environmental quality, living conditions of vulnerable households, sufficiency and circularity, increasing climate resilience, improving environmental and health standards. Member States shall require the installation of measuring and control devices for the monitoring and regulation of environmental quality at relevant unit level and, where technically and economically feasible, in all non-residential buildings undergoing major renovation. The upcoming revision of the EPBD encourages district renovation solutions. This may offer new opportunities for energy communities to acts as ESCOs.

Energy Performance Contracting (EnPC) is one promising option to boost renovation rates and achieve the ambitious EU targets outlined above. EnPC is a financial and technical mechanism that enables organizations to implement energy efficiency measures and renewable energy projects without upfront capital investment. It is a contractual agreement between an energy service company (ESCO) and a client, typically a commercial or public sector entity, to improve energy efficiency and reduce energy costs. The latest revision of the EED foresees to promote the energy services market and the access to it. Member States shall promote and ensure the use of EnPCs for renovation of large buildings.

1.2 Purpose of the document

The purpose of this report is to provide an overview on the current market status, business models and legislative frameworks, barriers and drivers for EnPCs in the EU and especially in the pilot countries of the EBENTO project. The main target of the Horizon Europe project EBENTO is to enhance energy efficiency in buildings by developing an integrated one-stop-shop platform for all actors involved in building and renovation sector. This one-stop-shop should improve the coordination and management of EnPC projects by bringing together the needs from all actors involved in enhancing the building stock. This report will be basis for the later work in this project.



1.3 Scope and structure of the document

Deliverable 2.1 is created within Work Package 2 (Performance-based business models) and it is one of the first deliverables of the EBENTO project. It sets the groundwork for many other tasks of the project by giving a general overview on the status of the market development, business models as well as the main barriers and drivers and the legislative framework for EnPCs in the EU and in particular in the pilot countries of the EBENTO project. The business models described in this report, together with the use cases from T2.3, provide the groundwork for the definition of new innovative business models which will be elaborated and applied to the pilot cases within task T2.4. The methodological basis for the elaborations in this report is a literature research, interactions with the demo sites and in-depth interviews with national stakeholders in six EU Member States.

Chapter 2 describes the methodology used for the two principal research methods included on this report i) literature review and ii) in-depth interviews with key experts. In chapter 3 the basic concept of EnPC is described. This contains a description of the main elements of EnPCs, the most common categorizations methods as well as the key components and characteristics of EnPCs. This is followed by a description of the standard EnPC business model and an elaboration of new innovative business model approaches in chapter 4. Chapter 5 provides a general overview on the current market status of EnPCs in the EU. It starts with current market developments and is followed by an elaboration of the main barriers and drivers for EnPCs. The legal and regulatory framework of EnPCs in Europe and in the pilot countries as well as county specific barriers and drivers are outlined in chapter 6. Chapter 7 derives some final conclusions out of the analysis.



2 Methodology

Two principal research methods were employed in T2.1 and T2.2, resulting in the outcomes of this report. Namely, in-depth interviews with the key stakeholders relevant to energy performance contracting and literature review and analysis.

2.1 Literature review

By conducting a thorough literature review, we uncover new business models, examine the existing market status, and dive into the legal and contractual aspects of energy contracting within the target countries. The literature analysis used the method of thematic saturation that proposes to continue with the identification of new literature until no new topics emerge anymore (and the research is saturated) (4). The results from the literature review were compared and merged with the results from the in-depth interviews. The literature review also provided some quantitative data to supplement the qualitative insights gathered through the interviews. The results are included in the chapters 3,4, and 5.

2.2 In-depth interviews

In EBENTO, we conducted a set of semi-structured in-depth interviews. An in-depth interview is a qualitative data collection technique that enables the capture of detailed, descriptive information on existing practices, attitudes, values and perceptions. Typically, qualitative in-depth interviews are conducted face-to-face, allowing for the establishment of rapport with respondents. This facilitates a deeper level of understanding, as body language cues can enhance the interpretation of responses. Rather than opting for more rigid question-and-answer research methods (e.g., questionnaires, surveys), semi-structured interview were selected as a preferred qualitative data-gathering method, which allows for a more of a guided conversation through open-ended questions, fostering a more natural and interactive exchange between the researcher and the research participant(s).

Detailed interviewing guidelines were prepared by the research partner (IRI UL), who provided a framework for the interviewing in terms of the concept behind the interviews, as well as tools to guide and support the EBENTO partners through the four phases of the process: selection of interview participants, definition of research topics, implementation of the interviews, and reporting. The guidelines therefore included a definition of the scope and purpose of the interviews, guidelines for identification and engagement of stakeholders, a selection of key research topics and questions, practical methodological tips for carrying out semi-structured interviews, instructions for reporting (incl. reporting templates), as well as guidelines on ethical research conduct and protection of personal data (incl. informed consent template).

Purpose and framework

The EBENTO interviewing process focused on investigating the feasibility of performance-based business models in combination with innovative solutions for improving energy efficiency and comfort



in residential buildings. In the interviews with identified key stakeholders in each of the participating countries, we focused on examining the existing models of energy performance contracts (EnPCs), the roles and experiences of key stakeholders (including processes, costs, benefits, and risks), as well as their interests and potential for participating in such business models (including motivations, barriers, and enablers). In addition, we concentrated on the legal and contractual aspects of EnPC business models in EBENTO pilot countries (and, from a comparative perspective, other participating countries), to identify a legal and contractual framework for implementing innovative business models. The goal of the interviewing processes was therefore to explore the relevant aspects of EnPCs in more detail, as well as to initiate or strengthen the ties with the key stakeholders with the aim of nurturing their support and participation in the project’s forthcoming activities.

Scope of Interviewing

Interviews were carried out in all participating countries (AT, EE, GR, ES, SI, UK). In total, 31 in-depth interviews were conducted (Austria – 3, Estonia – 6, Greece – 7, Spain – 4, Slovenia – 5, United Kingdom – 6).

A variety of key stakeholder groups along the EnPC business model value chain (decision-makers, contractors, beneficiaries, etc.) were engaged. The following table provides a list of stakeholders engaged in research, contingent upon the context of an individual pilot, or the regional or national ecosystem. It provides an overview of the stakeholder groups whose representatives participated in EBENTO as research participants.

Table 1 - List of stakeholder groups engaged in the EBENTO research.

STAKEHOLDER GROUP	STAKEHOLDER	EXAMPLE
POLICY-MAKERS and REGULATORS	LOCAL GOVERNANCE ORGANISATION	<ul style="list-style-type: none"> • municipalities • public sector organisations
	REGIONAL and/or NATIONAL GOVERNMENT ORGANISATIONS	<ul style="list-style-type: none"> • ministries • regional authorities • (public) funding organisations • financing organizations
RESEARCHERS	RESEARCH ORGANISATIONS	<ul style="list-style-type: none"> • researchers
PROVIDERS	ENERGY (SERVICE) COMPANIES	<ul style="list-style-type: none"> • ESCOs • Facilitators (energy renovation advisors) • Energy providers, energy agencies • Construction developers focusing on energy facilities
	OSS	<ul style="list-style-type: none"> • existing owners/providers of One-Stop-Shops
BENEFICIARIES	PROPERTY OWNERS	<ul style="list-style-type: none"> • public property owners • private property owners • real estate investors
OTHER RELEVANT PROFILES		<ul style="list-style-type: none"> • building managers • housing associations



As the interviews aimed to explore in more detail the experiences and perceptions of each key stakeholder, the research aimed for detailed interviews and more fine-grained data collection, rather than quantitative insights. Using the templates provided in the interviewing guidelines, the participating partners provided comprehensive reports for each individual interview and an overall analysis of the national ecosystem and key findings related to EnPC models. The latter are included in section 9 (Annex 1) of this deliverable, while the formers are stored by the consortium for potential further reference and not made public due to any potentially sensitive data.



3 Concept of Energy Performance Contracting

3.1 General Concept

This chapter outlines the basic concept of Energy Performance Contracting (EnPC). It describes the main content of EnPCs, common categorization options and the main characteristics and features of EnPCs.

EnPCs are contracts between building owners and a contractor (usually energy service companies – ESCOs) that aims at facilitating energy efficiency improvements in buildings that are financed from guaranteed energy savings. ESCOs have the necessary know-how to provide turnkey services and solutions that achieve significant reductions of energy costs. ESCOs can handle projects, manage or mobilize financial resources, undertake installation and maintenance work as well as collaborate with other market players. EnPCs transfer the economic and technical risk associated with an investment in the improvement of energy efficiency in buildings from the building owner to the ESCO which also have the financial resources as well as the technical capacities and experience to implement the investment and to ensure the verification of guaranteed energy savings (5), (6).

EnPC contracts usually define (7):

- Specification of the building (size, type of use, operation mode, ...).
- Detailed description of the measures and services implemented by the ESCO.
- Scope of the services during the planning, implementation and operation phase of the project.
- Responsibilities and liabilities of ESCOs for the design and implementation of agreed measures.
- Baseline energy consumption of the building in the reference year.
- Guaranteed energy savings.
- Definition of measurement and monitoring process.
- Method of the calculation of energy savings compared to the baseline.
- Method for the calculation of EnPC fees based on the achievement of guaranteed energy savings.
- Procedures for billing of EnPC fees and payment.
- Procedures for the transfer of the installed energy saving measures to the ownership of the building owner.
- Contract duration.

3.2 EnPC categorization

The ways ESCOs operate and subsequently also their offers are very heterogeneous. Some authors see the main difference in the ESCOs financing strategy (8). Sorrell (2007; 2016) observes that EnPC arrangements differ in terms of scope, depth, and financing method (9), (10):

- **Scope:** ESCOs could be distinguished by the number of useful energy streams and/or final energy services that are wholly or partially under the control of the contractor. Also technologies and



systems that are included in the contract (e.g., boilers, CHP, lighting, building and controls) may differ.

- **Depth:** Another way to draw a distinction is to look at the extent to which ESCOs are involved. More precisely, the factor of depth thus may address the number of organizational activities required to deliver the flows or services that are under the control of the contractor (e.g. who is responsible for planning and engineering; financing; procurement, installation, commissioning and maintenance of equipment, etc.).
- **Finance:** The third factor, which, as mentioned above, is also considered crucial by other authors, examines the source of funds for new investments. Different funding options here might include, working capital provided by customers or by the ESCO, loans from financial institutions, or equity from venture investors as well as subsidies.

Another very common categorization of EnPCs is the differentiation between shared-savings model and guaranteed-savings model. The following subsections will outline the basic components of those two models and the differences between the models.

Shared savings model

In the EnPC shared savings model, the ESCO is undertaking the investment, as well as the project planning and implementation as shown in **¡Error! No se encuentra el origen de la referencia..** The energy savings are shared between the ESCO and the customer. The investment is paid back by the part of the energy savings that are obtained from the ESCO. In the shared savings model, the ESCO has the **technical risk** of achieving the agreed savings and the **credit risk** as the ESCO is responsible for investment. (11) This means that in the shared savings model, the only financial commitment the client will have to bear is to pay back the investments made by the ESCO through the savings achieved, **at a pre-determined rate or proportion and over a certain period of time** (12). **The performance risk (i.e., the uncertainty of future energy consumption) can therefore be regarded as being shared between contractor and client.** (13) (14).



Figure 1 Shared savings model (11)

Guaranteed savings model:

In the EnPC guaranteed savings model, the **ESCO guarantees a certain amount of savings** to the customer. The ESCO only takes the **technical risk of achieving the agreed savings**. The customer obtains a bank loan or uses its own equity to pay contractually determined fees to the ESCO and the bank. Therefore, **the customer has the credit risk** in the guaranteed savings model. In other words, the customer is required to provide the necessary financial resources and therefore the contractor



assumes the entire performance risk (12), (13), (14). Figure 2 graphically shows the concept of the guaranteed savings model (11).

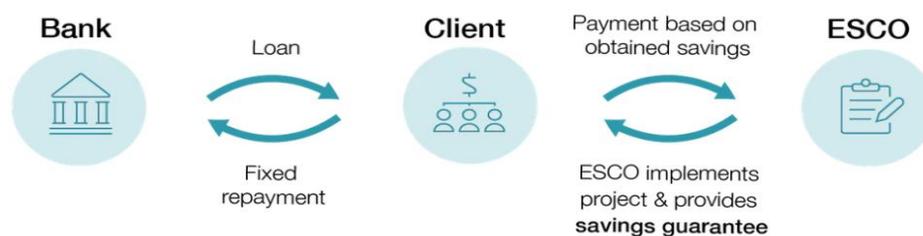


Figure 2: Guaranteed savings model (11)

The main differences between shared savings model and guaranteed savings model are outlined in Table 2.

Table 2: Differences between shared savings and guaranteed savings model (12)

	Shared savings contract (SSC)	Guaranteed savings contract (GSC)
Principle	Performance is related to the percentage of energy cost savings. Cost savings split for a pre-determined time in accordance with a prearranged percentage, based on the cost of the project, the length of the contract and the risks taken by the ESCO and the client.	Performance is related to the level of energy saved. The value of energy saved is guaranteed to cover the client's annual debt obligations.
Financing	ESCO Financing and/or TPF (through ESCO)	Client Financing and/or TPF (through the client)
Risk taking - Business	Client	Client
Risk taking - Performance	ESCO (and client)	ESCO
Risk taking - Credit	ESCO and/or financial institution	Client and/or financial institution
Advantages	Good introductory model in developing ESCO markets. The customer has no financial risks and is only obliged to pay a percentage of the actual savings to ESCO over a specified time period. This obligation is not considered a debt and does not appear on the customer's balance sheet.	Fosters the growth and viability of newly established ESCOs that have limited resources and a credit history.
Disadvantages	ESCOs may become overly indebted, and may have difficulties in obtaining financing at a reasonable price and in contracting additional debt for subsequent projects.	It is challenging to function properly in countries with an undeveloped banking structure, insufficient technical expertise and a poor understanding of EE projects.



4 EnPC Business Model

This chapter includes the description of the standard EnPC business model in a schematic manner in order to understand where it is possible to innovate. An elaboration of new innovative business model approaches is included considering the main characteristics of the EnPC business models.

4.1 Standard EnPC business model

The basic idea of the EnPC business model is that the ESCO will be remunerated based on the energy savings generated through the contract. The basic EnPC business model is described in Figure 3. It shows that the baseline energy consumptions gets reduced through the implementation of energy efficiency measures. The energy savings are used to pay back the investment costs. After the contract duration, the customer receives all savings.

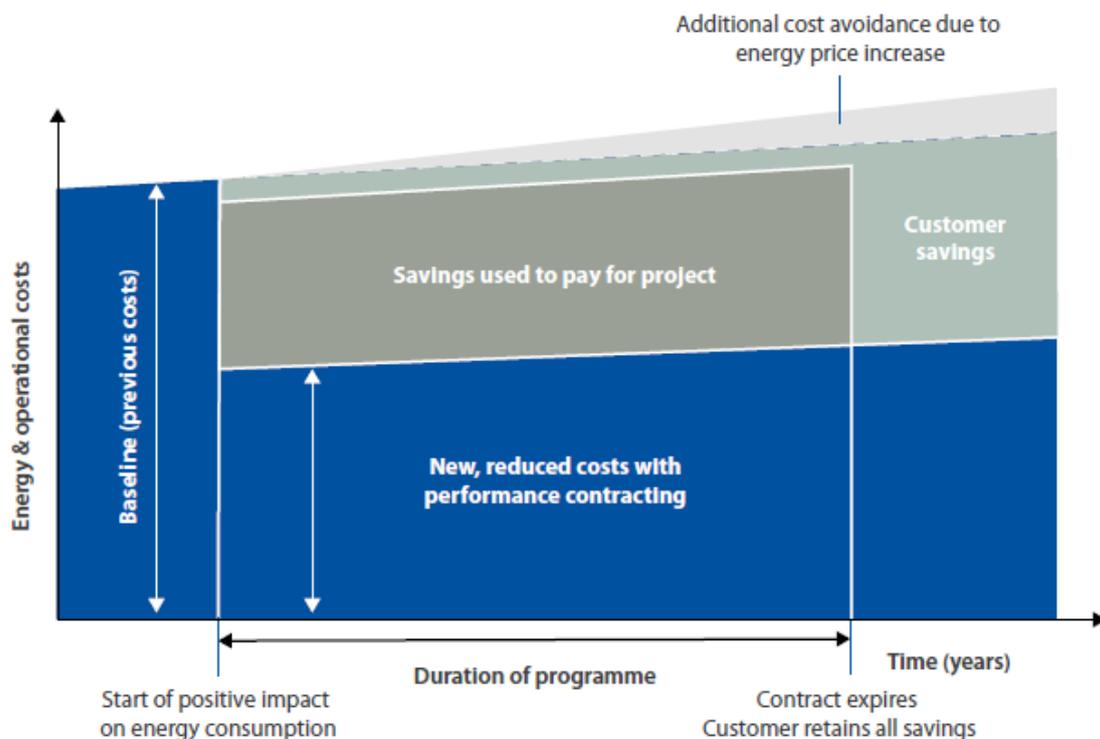


Figure 3: Basic concept of EnPC (15)

Some specific characteristics of the EnPC business models are:

- EnPCs focus on buildings with energy systems that are outdated and inefficient or on building where a deep renovation of is needed for energy efficiency enhancement.
- The EnPC project is usually designed and planned by the building owner or a facilitator in combination with contracted architects.
- The installation and operation of equipment and technical facilities is done by the ESCO.



The technical improvements of the building can include deep renovation of building structures (e.g., building envelope, roof, basement, interior, facilities like elevators, ...) as well as the replacement or new construction of in-house energy supply and consumption systems (e.g. energy efficient heating, ventilation, air condition, lighting, ...). Often it also includes the utilization of renewable energies and the installation of heat pumps. The ownership of all equipment and facilities installed is usually transferred to the building owner at the date of hand over as defined in the contract. The contract usually also includes services such as energy accounting and management as well as the measurement of actual energy consumption and the third-party verification of the achieved energy savings. Other services can be granting applications and approval procedures. Furthermore, operation services such as optimization of operation and maintenance of installed facilities and the auditing and certification procedures, can be additional services that are defined in the EnPC contract (6).

4.2 Phases of an EnPC

There are three different phases in an EnPC:

Pre-contracting phase: The first phase is called pre-contracting phase. It involves the collection and analysis of energy data and the benchmarking of all significant consumptions through an energy audit. After that, a technical feasibility assessment is carried out to check the requirements and conditions for the implementation of energy saving measures. Furthermore, an economic and social analysis (only if public) is performed to develop an initial preliminary cost estimation and to estimate the expected savings.

Contracting phase: The second phase is important to EnPC projects since it determines the main calculations and quantifications on the terms of the contract (duration, energy savings guarantee, baseline, measurement and verification methodology). The appropriateness and accuracy of the terminology stated here will help to reduce risks for the ESCO and improve performance gain for the client. After the design of the contract and the definition of the engineering projects required for the implementation of the EnPC, the selected energy measures are carried out.

Performance phase: The last phase is called performance phase. It starts after all energy efficiency measures are implemented and all equipment is installed. It contains the monitoring of energy consumptions and the implementation of an active control process. Furthermore, a regular measurement (according to the IPMVP) procedure is done to define the energy and cost savings.

4.3 EnPC financing mechanism

The funding vehicle or financing scheme is one central element of an EnPC. It can be structured through various mechanisms. The most common financing options for EnPCs can be summarized as following:

Third party financing via financial institutions: In this model, the customer makes use of external financing solutions (financial institutions, utility funds, bank loan ...) for financing the project. This means that the renovation works are funded by the customer that pays the ESCO directly at the time of their completion. The ESCO implements the energy efficiency measures, and the client repays the financing entity through a portion of the energy savings over a defined term. The financing entity



assumes the financial risk associated with the project, while the client receives immediate energy cost savings. Third party financing is understood as a type of debt financing (for example through banks or grants). (15)

Own funds of client: The customer uses its own equity to finance the project and pays the ESCO after renovation measures are completed. The financing could be paid back by the energy savings that were guaranteed by the ESCO in the EnPC contract (guaranteed savings model). (16)

Investment fund: In this model a public, public-private or public-citizens fund is set-up to provide total or partial project financing.

On-Bill financing/repayment: This financing mechanism involves a partnership between the utility company and the ESCO. The utility company provides the upfront capital for the energy efficiency project, and the client repays the investment through a monthly charge on their utility bill. The utility company collects the repayment on behalf of the ESCO, making it a convenient and streamlined payment method for the client. This means that on-bill repayment can be seen as financing scheme in which a third-party lender supplies capital to a customer to fund energy efficiency upgrades and is repaid through regular payments on an existing utility bill (the utility acts as repayment service provider) (17), (18).

Green Bonds: Green bonds are fixed-income financial instruments that raise capital for environmentally friendly projects. The ESCO can issue green bonds (applicable only for large ones) to finance the implementation of energy efficiency measures or renewable energy projects under an EnPC. Investors purchase these bonds, and the ESCO repays the investment using a portion of the energy savings generated. This means that the issuer of the bonds agrees to pay the borrowed capital to the investor back within a fixed term and with fix or variable interest. Green bonds offer an attractive financing option for EnPCs, as they tap into the growing market for sustainable investments.

ESCO financing: In this model, the ESCO is responsible for the investment and provides the upfront capital required for implementing energy efficiency measures. The ESCO either uses its own equity or a bank loan. The ESCO recovers its investment through a share of the energy savings achieved over a specified period. The client benefits from reduced energy costs without making any upfront capital investment. The ESCO takes on the financial risk of the project. Figure 4 graphically depicts the financing of EnPCs through bank loans of the ESCO (16).



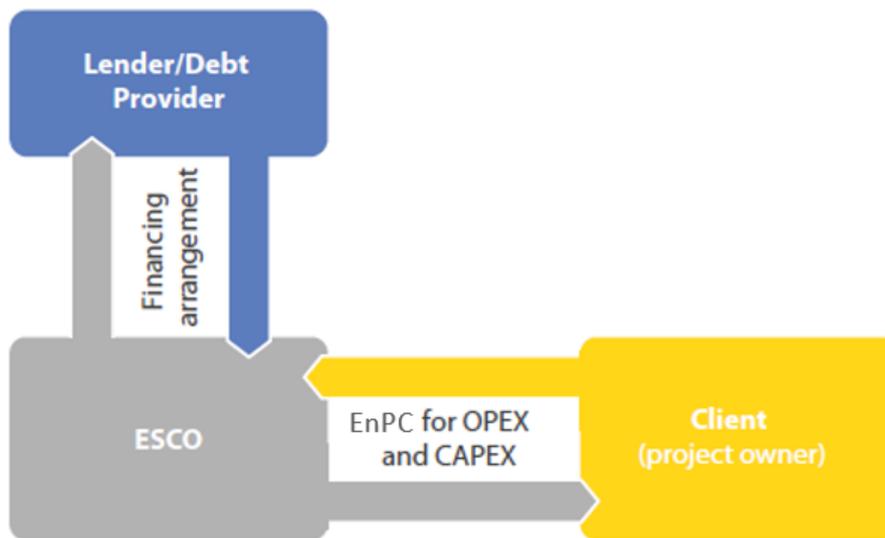


Figure 4: EnPC financing through ESCO (either own equity or bank loan) (15)

Forfaiting: Forfaiting is an innovative financing mechanism for EnPC. Financial institutions can act as forfeiter (financial intermediary) that buy the rights to the future revenues that a seller (ESCO) will receive from the EnPC customer. The EnPC forfaiting relates only to the part of the EnPC fee that covers the capital expenditure (CAPEX) for the implementation of the agreed renovation measures. The selling price is usually defined by the net present value of the sum of the future CAPEX related receivables less the interest rate cost and the cost of EnPC customer credit risk. EnPC forfaiting can be an important part of the long-term financing scheme and therefore will be negotiated between EnPC provider and the forfeiter already in the contract development phase. EnPC forfaiting can help ESCOs to finance their EnPC projects and increase their capabilities. (19) The concept of forfaiting is outlined in Figure 5.

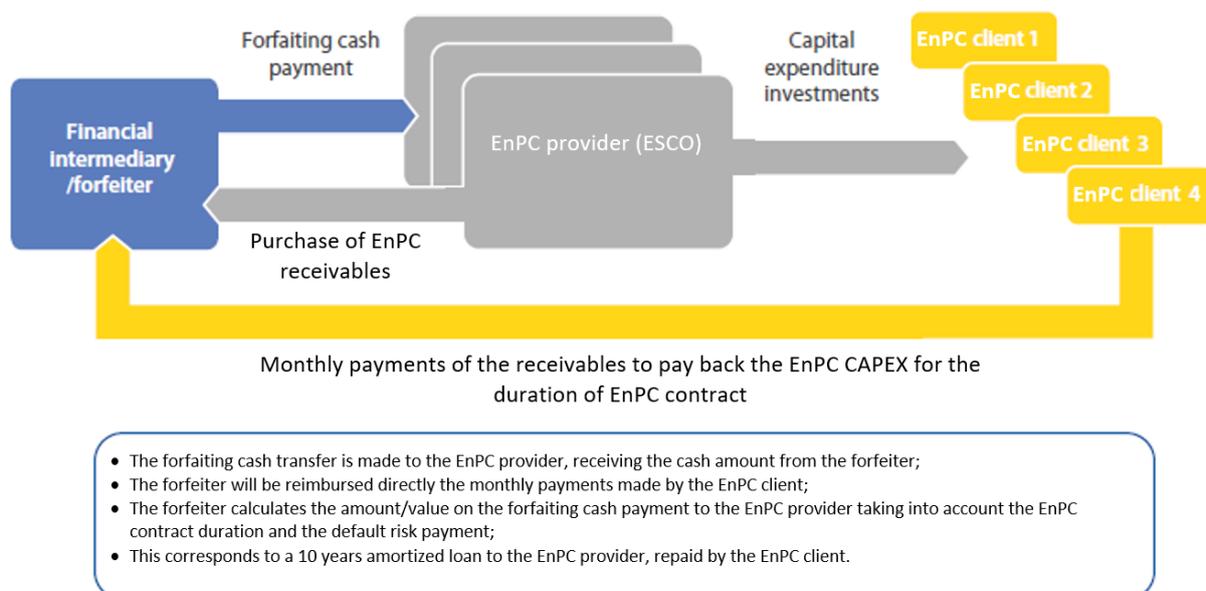


Figure 5: Concept of forfaiting (15)



4.4 Innovative EnPC business models

This subsection outlines potential new innovative business models that are further elaborated in the EBENTO project and applied to the pilot sites.

EnPC enhancement with Demand Response services

The enhancement of EnPCs with demand response services is one of the innovative EnPC business models. The main idea of such a business model is about the addition of demand response services (DR) to the basic EnPC business model in order to deploy the available flexibility of buildings and thereby improve the profitability of EnPCs. Demand response services target to encourage the consumer to use less energy during peak hours, or to move the time of energy use to off-peak times such as nighttime and weekends. These modifications on the demand side could result in energy savings and cost savings. (20) Horizon2020 project “Ambience” (21) named this concept Active Building Energy Performance Contract (AEnPC) and defined it as following:

“The Active building EnPC (AEnPC) Concept is an enhanced modular and performance-based delivery mechanism, using the financing mechanism for the energetic renovation and optimization of existing and new buildings, tapping into all passive and active energy and cost saving measures, while leveraging a comprehensive set of technical, operational, usage, behavioral and dynamic energy or CO₂ pricing parameters. The AEnPC concept is an enhancement of the basic EnPC concept, through a strong focus on the electrification (also of the local heat supply and including mobility) and the addition of Active Control measures.” (20)

In the AEnPC model, ESCOs deliver guaranteed energy cost savings based on energy efficiency, renewable energy supply and active control of flexibility. Flexibility or demand response services are treated as a new energy service that can bring new value streams to an EnPC. A market aggregator has to be involved, acting as a third party and trade the prosumers’ flexibility on the markets. By integrating Demand response services in the contract, ESCOs can assume a more active role acting either as an actuator or as an aggregator.

Figure 6 shows the main difference between the basic EnPC business model and the AEnPC, which are the additional revenues from demand response services. The consideration of this additional value stream could improve the profitability of the EnPC and thereby shorten the contract duration.

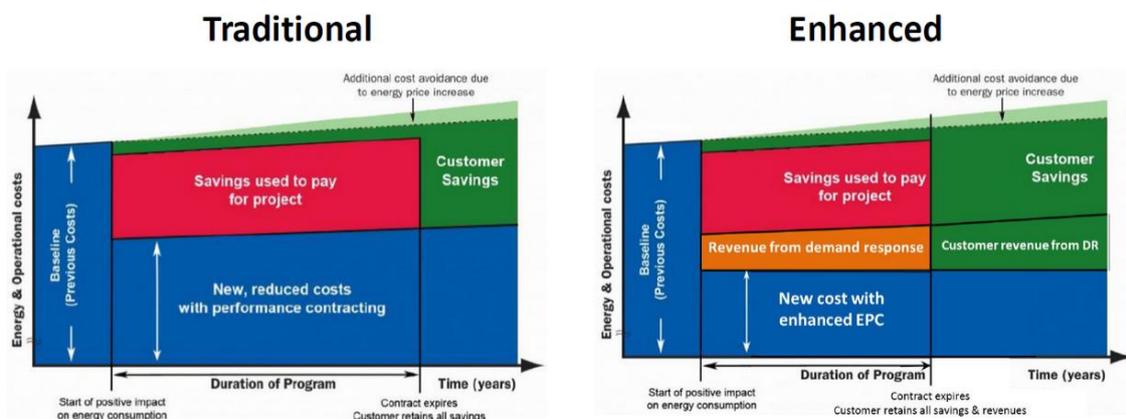


Figure 6: Difference between traditional EnPC and Enhanced EnPC

EnPC tailored to rented buildings.

The split-incentive dilemma represents one major barrier for the implementation of EnPCs. The problem is that the building owner is the contracting party of the EnPC and therefore bears all risks and responsibilities but the tenants are usually those who profit from the energy savings of the EnPC, if they pay for energy separately to the rent. The target of the SmartSPIN HorizonEurope project (22) is to define new EnPCs that also take tenants into account.

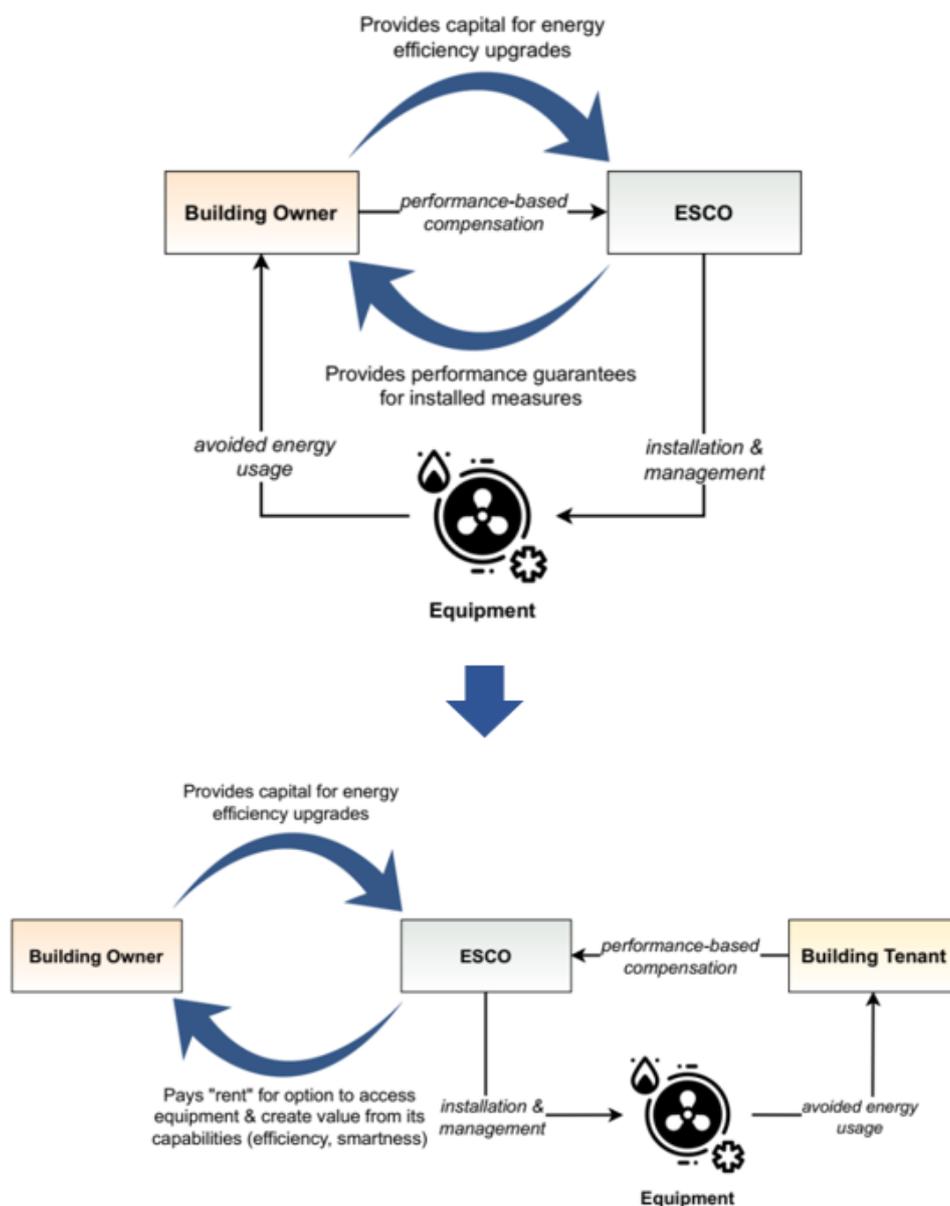


Figure 7: EnPC tailored to rented buildings (17)

Figure 7 shows the traditional model and the new EnPC model that is tailored to rented buildings as it also considers tenants in the contract. It shows a conceptual extension of the EnPC model to include



tenants as shown in the lower part of the picture. The central ideas behind this approach are the financial transactions between ESCOs and tenants are dictated by the energy savings and/or efficiency gains. A contract between tenants and ESCOs can incentivize systematic fine-tuning of the equipment operations and the exploitation of additional revenues such as demand response and additional benefits such as improved indoor air quality due to ventilation (17).

This approach leads to some risks. The involvement of tenants in this scheme requires an agreement from their side. If tenants leave the building, a new contract has to be created with the new tenants. A source of risk for the building owners is that both the building owners and the ESCOs are compensated by the tenants. If tenants move out, no cash flows can be generated (17).

In general it can be said that an involvement of tenants in an EnPC can be a solution towards the split-incentive dilemma. However, the complexity of the contracts, long contract duration and the reliability and liability of tenants is a strong barrier in this concept. At the moment this new concept is only a conceptual idea but there are no best-practice examples available yet. Further research on model contracts and pilot projects has to be done to clarify the details and boost this concept.

Energy as a service (EaaS)

EaaS contracts may include (i) building retrofitting and investments for the installation of smart equipment (metering, sensing, actuating), together with extended offerings for the installation of distributed generation (PV) and storage (batteries) units; (ii) energy efficiency services, spanning behavioral transformation and targeted guidance towards energy savings along with more advanced concepts for net metering/self-consumption maximization through smart automation; (iii) flexibility services (with the introduction of storage and electric vehicles as means for enhancing flexibility); and (iv) non-energy services (e.g. comfort preservation, indoor air quality, security, etc.). Those bundles are complemented by appropriately drafted business models (for ESCOs and Aggregators) that focus on the establishment of highly profitable business cases for all involved actors by properly extending traditional P4P business offerings. Such new business models aim at allowing ESCOs and Aggregators to individually or jointly provide energy efficiency services combined with flexibility services to the energy system under hybrid service contracts and legal arrangements that ensure attractive payback periods for any investments associated with the services (23). Future EaaS business models could likely involve energy management through software or ownership of electric devices, like cars or water heaters. Such approaches could save consumers money while providing societal benefits by better matching of electricity demand with supply, integrating renewables, and reducing emissions (24).

EnPCs including comfort and sustainability

Another innovative approach highlighted in the interviews is to consider comfort as a fundamental element of EnPCs (“comfort as a service”) and embracing sustainability criteria as an opportunity for a more holistic and people-centered renovation projects that enhance not only energy efficiency and financial savings but also the overall wellbeing and satisfaction of building occupants. This approach also aligns with the Renovation Wave and the EPBD, which aims to integrate sustainability criteria into the renovation process, ensuring that the overall improvements encompass multiple dimensions, including functionality, financial viability, and occupant wellbeing. Furthermore, one



interviewee mentioned the LEVEL(S) (framework for sustainability performance of buildings) (25). Although it may take some time for this to become part of the regulatory framework, it represents a step towards integrating comprehensive criteria for evaluating the performance and comfort of buildings.

4.5 Other ESCO concepts

This subsection provides an overview on other concepts related to EnPC business models that are of interest for investigation in order to perform new business models linked with EnPCs. Although most of them are not EnPCs, according to the main features outlined above but as they share some basic aspects with EnPCs, they are often mentioned in literature in the context of EnPCs and can be used as a base for investigating new possible more suitable business models for residential users. The most common concepts are explained in the following enumeration:

Energy supply contract (ESC): An energy supply contract (ESC), is a contract in which the ESCO takes over the planning and construction of energy production and distribution systems or systems for measurement and control technology. In this contracting type, ESCOs overtake the responsibility for financing the project as well as for the operation and maintenance of equipment's and guarantee of supply. The building owner buys the output (useful energy) to the ESCO. Typical examples are photovoltaics (PV), combined heat and power (CHP) or biomass heat supply installations. For example, in the case of heating, this includes planning and installation of equipment, energy distribution, operation and maintenance of the production facilities or procurement of fuel (26).

Pay-for-performance contract (P4P): P4P has been described as a scheme that aims to achieve more than persistent energy savings over time by offsetting energy efficiency resources, i.e., by comparing measured energy consumption and actual energy consumption in the absence of energy efficiency measures. P4P programs have existed for more than 20 years, in different forms, primarily targeting the commercial and industrial building sectors, mainly due to wide smart metering penetration in these sectors and have already been implemented for several years in the United States (27).

Chauffage model: The chauffage model is also known as "Comfort Contracting". It is a contract that focuses on the management and optimization of a buildings' operational conditions. The chauffage model can be part of a more diverse scheme where ESCOs are responsible for the efficient day-to-day operation of a building's technical system. (28) Chauffage contracts do not include comprehensive retrofitting measures or equipment substitutions and therefore this concept is not in the focus of the EBENTO project.



5 Status of EnPCs in the European Union

5.1 Current market development of EnPCs in the EU

In the majority of the EU countries there has been a low but steady growth in the EnPC market over the last years. However, there are differences between countries regarding development, sectors and type of contracts. Compared to the US, the market is much smaller and the potential for EnPCs in Europe has not been used so far.

According to the European Commission’s Staff Working Document ‘Analysis of the national long-term renovation strategies’ (29) in recent years, there has been an increased interest in the provision of energy services to achieve energy and environmental goals. The average ESCO market of the European Union has been on a steady rise for the last decades, and the growth and maturity has continued or even increased slightly between 2015 and 2018. Traditionally, energy services markets in Europe included a variety of contract types, many types of contractors (suppliers) and a few types of clients (mainly industry and public sector). There are a number of traditionally well-developed markets in Europe, such as Germany, Italy, France, and some parts of Austria, and Czech Republic for a few decades. However, the ESCO markets have matured in other countries, both in terms of volume and in complexity, and ESCOs play today an important role in energy efficiency. Figure 8 provides an overview on the ESCO market development across the EU Member States (30).

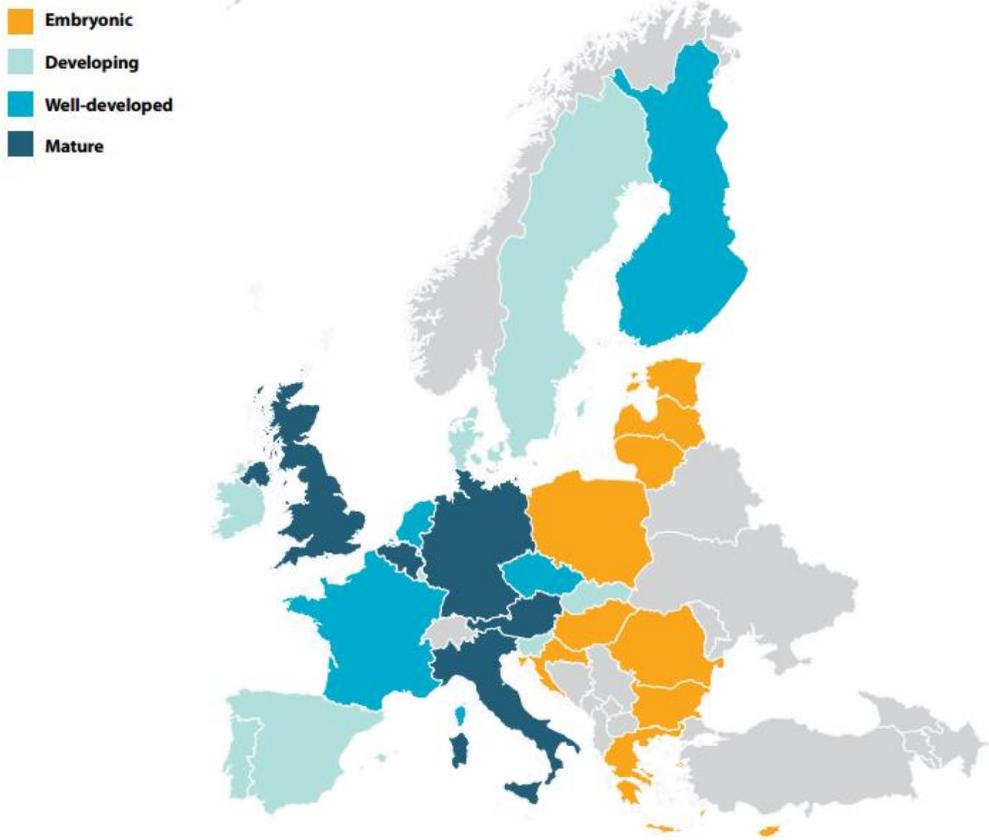


Figure 8: ESCO market development across the EU in 2020 (30)



Approximately 80% of the ESCO market is concentrated in public buildings, mainly targeting energy contracting offerings to large customers like education and healthcare facilities as well as municipal and regional buildings (partly explained by the large transaction costs) (23), (31). The European market for residential energy services is currently very limited and represents only a very small part of the ESCO market in the European Union. Although the economic energy savings potential in the private building sector is very large in the EU for ESCOs, the market there is less developed than in other sectors (32). This sector thus seems to be out of the scope of ESCOs to a large extent at the moment (23). The reason is that there are still many barriers to overcome as outlined in the next section.

The most comprehensive analysis of the ESCO and EnPC market is done on a regular basis by the Joint Research Centre (33). The latest report revealed that the ESCO market development in almost all European Member States has been either stable or growing. The specific reasons for the ESCO market development vary from country to country. According to the latest analysis, the market status of EnPC in the EU Member States can be summarized in six groups (33):

- Mature and developing in Croatia, Czechia, Slovenia, Slovakia – in Belgium the market is developing and in Wallonia it is mature.
- Mature but static in Austria, Germany, Denmark and the Netherlands – in Sweden a relatively small market has become stagnant.
- Sizeable and developing markets in Italy, Spain and Portugal (especially in public lighting).
- Small but developing markets in Bulgaria (slow development), Ireland, Lithuania, and Poland.
- Preliminary markets in Latvia, Estonia, Finland (static), France (static due to legal issues), and Greece (activity in public lighting corresponds to a vague conception of EnPC).
- Non-existent markets in Romania, Cyprus, Luxemburg, Malta and Hungary.

5.2 Main barriers for EnPC

While energy performance contracts (EnPCs) offer numerous benefits, there are several barriers that can hinder their implementation and adoption. This section outlines the most common barriers associated with energy performance contracting in the residential sector based on literature and interviews in Austria, Greece, Spain, Slovenia, the UK and Estonia. A country specific analysis of barriers and drivers is done section 6.

(a) Financial barriers

Upfront Investment and Financial Constraints: Implementing energy efficiency measures typically requires upfront investment, which can be a significant barrier for clients with limited capital or tight budgets. Securing financing for EnPC projects can be challenging, especially for organizations or clients that are already financially constrained (31), (34).

Transaction costs: High transaction costs for project development can be a reason, why the residential sector often is not attractive enough for ESCOs. Building units and project size are often too small to be profitable if the transaction costs are taken into account. Small scale projects in residential sector therefore are not compatible with energy performance contracting (31).



Long payback periods: Energy efficiency measures require long payback periods to ensure profitability and full compensation of the investment via energy savings. Therefore the contract duration quite long which impose a major barrier for private investors (10), (32).

(b) Technical barriers

Uncertainty in Energy Savings: Estimating and guaranteeing energy savings can be challenging, especially in complex and diverse building portfolios. Organizations may be hesitant to engage in EnPCs due to concerns about the accuracy of energy savings projections and the financial implications of potential shortfalls.

Technical Complexity: Energy efficiency projects often require technical expertise to identify suitable measures, assess feasibility, and oversee implementation. The high complexity of energy performance planning and contracting, regarding project development, technical implementation, life cycle assessment, legal implementation etc. requires a lot of knowledge and competences. The lack of technical knowledge and handling of technical risks are issues faced by many countries. (31). Also there number of different typologies of residential buildings, which often require planning on a case-by-case basis (i.e., time and effort).

Risk Aversion: Risk aversion can be a significant barrier to EnPC adoption. Organizations may be reluctant to enter into long-term agreements or invest in energy efficiency measures due to uncertainties regarding project performance, maintenance, and technology obsolescence.

Asymmetric baseline knowledge: Stakeholders identified the barrier of extensive knowledge and expertise that is required for participation in such partnerships (PPP EnPCs), where especially the public partner often lacks the needed resources or know-how, but also in relation to residential buildings. In both cases, lack of sufficient knowledge on the side of the client tends to lead to complications and slower progress in project development due to additional workload caused by “a million unnecessary questions”. E.g.: lack of action on the side of municipalities due to lack of own internal capacities (experts) for understanding both technical and administrative side of EnPC related projects.

(c) Legal and contractual barriers

Lengthy and Complex Procurement Processes: The procurement process for EnPC projects can be time-consuming and complex. Organizations may face challenges in developing and implementing a competitive procurement process that ensures transparency, fairness, and value for money.

Contractual and Legal Considerations: EnPC agreements involve complex contracts and legal frameworks, which can pose barriers to implementation. Lacking political and regulatory supporting schemes hinder the successful Implementation of EnPCs. In many countries non supportive legal frameworks are a limiting factor. The legal complexity is very high. Especially the tertiary and the residential sector are affected in terms of rental housing (33); (35).

(d) Market and social barriers

Lack of ESCOs: Throughout Europe, there is a lack of big ESCOs that have enough capacity to realize large-scale deep renovations of residential buildings.



Lack of awareness and understanding: Many potential customers, particularly small and medium-sized enterprises (SMEs), may have limited awareness and understanding of EnPCs. They may not be familiar with the concept, potential benefits, or how to initiate an EnPC project. There is also a lack of awareness about fitting business models. There are different business models and contract types and there is not often no knowledge about the best fitting business models. (10) (36).

Lack of trust in EnPCs, and related actors: A lack of trust in the EnPC concept and the ESCO industry as a whole is also often reported as major barrier for the adoption of EnPCs. There are many potential reasons for this lack of trust. The most common reasons are missing best practice examples, inhomogeneous offers, lack of competition and a lack of standardized measurements and verifications. (36). The lack of trust may also relate towards the integrity of housing manager, or legitimacy of the manager's relation and arrangements with various service providers. As the interview revealed the lack of trust may manifest itself as protest or lack of cooperation, which can happen at various stages of the project development and implementation process. In addition, there is a level of distrust also among the client and investor, as exemplified by the need for additional supervision and other clear mechanisms of control on the part of the public partner.

Lack of robust business model for the residential sector: There is currently no universally applicable business model designed specifically for residential building renovation. The lack of such a thorough framework emphasizes how complicated and multifaceted residential building renovations are. The shared savings model, in the renovation of apartment buildings may not be economically feasible and viable, interviewed ESCOs mentioned. However, principles, processes, methods, and tools could be implemented without the contractual terms.

Split-Incentives: Split incentives occur when the party responsible for making energy efficiency investments (e.g., building owner) does not directly benefit from the resulting energy savings (e.g., tenants paying the utility bills). This misalignment of incentives can discourage EnPC implementation, particularly in leased or multi-tenant buildings. (10).

Agreeing on the indoor climate parameters: Agreeing on the indoor climate parameters (temperature, CO₂, brightness in the case of light installations, lighting level, and uniformity) is a long and expensive process because they have a lot of subjectivity. What is suitable for one is not for another. It is difficult to control how the user will use the building later. It can also happen that usage changes significantly for whatever reasons (for example, business needs change).

Renovation of (residential) buildings as social process: ESCOs and building managers note that renovation is not only a technical challenge or a business transaction, and it involves not only management of materials, systems and administrative processes, but also management of social relations and various interests. In fact, from the point of view of viability of EnPC business model for residential building renovations, one might even argue the latter is the most relevant of all. Also it is difficult to control how the user will use the building later. It can also happen that usage changes significantly for whatever reasons (for example, business needs change).

Ownership and control as important factors

The focus of communication should be on highlighting the collective and individual aspects of ownership of the benefits generated by the projects, such as ownership/participation in long-term



energy/money savings, improvement of the quality of buildings (comfort, IEQ), aesthetic appearance and the elevated social status of the owners/occupants of the buildings etc.

Fragmented decision-making processes: The number of actors involved in the process (property owners, housing managers, ESCOs, public partners, construction companies etc.) impacts the decision-making process throughout the PPP EnPC project. People or organisations involved at various stages of the building renovation process often have conflicting interests and/or incompatible expectations. In cases of distrust, ESCOs may end up in an ungrateful role of mediator, as the third party in the triangle of relations with the community of property owners and the housing managers, or even between individual property owners. These demands time and efforts to resolve, rendering the project less cost-effective.

To overcome these barriers, it is important to address knowledge gaps, provide financial incentives and support, streamline procurement processes, offer standardized contract templates, establish clear energy savings measurement and verification protocols, and provide technical assistance to organizations interested in implementing energy performance contracts.

A platform with all the key factors of the contract (energy performance, financial issues, etc) would be seen as very useful for the ESCO and for the client. The platform will be an important asset to increase the attention and interest of the potential client, having all the necessary key aspects (consumption, financial, etc.) in just one tool.

5.3 Main drivers and opportunities for EnPC

The drivers of energy performance contracting are the factors that incentivize businesses and institutions to adopt this approach. This section outlines the most common drivers associated with energy performance in the residential sector. These drivers are the most common drivers that were identified and reported across all analyzed countries. A country specific analysis of barriers and drivers is done in section 6.

(a) Technical drivers

Energy Efficiency Targets: European countries were committed to meeting energy efficiency targets set by the European Union. Many governments and organizations have set ambitious energy efficiency goals to reduce carbon emissions and promote sustainable practices. EnPCs provide a structured approach to achieving these goals by facilitating the implementation of energy-saving measures and monitoring the resulting energy savings.

Quality labels: Labels and quality assurance systems can be a strong driver of EnPCs as they reduce mistrust and ensure high quality of the services and projects. (37)

Building automation and Data collection

Interviews revealed the need for gathering comprehensive and improved data that will enable accurate building segmentation, which, in turn, facilitates the identification of optimal renovation strategies – i.e., targeted renovation / prioritization of buildings for renovation, including the use of EnPCs. Building automation and commissioning systems are an upcoming way to control building energy use. The collection and analysis, through artificial intelligence, of all the data gathered from their different installations, in order to keep improving them and maximising the results and savings achieved.



(b) Financial drivers

Energy Cost savings: One of the main drivers for EnPCs is the potential for significant cost savings. By implementing energy efficiency measures, organizations can reduce their energy consumption and lower utility bills. The cost savings realized from these measures are used to finance the project, allowing organizations to upgrade their facilities without upfront capital investment. Ongoing enormous increase of energy costs definitely has the potential to increase the attractiveness of EnPCs (38)

Financial Mechanisms and Incentives: Various financial mechanisms, subsidies, and incentives were available in different European countries to support ENPC projects. These measures made it more attractive for organizations to invest in energy efficiency upgrades. High-quality financing products, such as revolving funds or forfaiting to enhance credit up-take and liquidity can be a strong driver for EnPC development.

Monetization of comfort and climate footprint: Monetization of new concepts such as comfort and climate footprint can enhance the profitability of Energy Performance Contracts (EnPCs). In EBENTO we would analyse the best way to include this concept on contracts and how the verification of conditions can be done. It is necessary to use eco-friendly and low-impact construction materials. Promoting collaboration with manufacturers committed to sustainability and offering innovative and energy-efficient solutions is essential. Selecting suppliers that follow sustainable production practices and provide environmentally certified products contributes to ensuring the quality and efficiency of materials used in rehabilitation.

(c) Market and social drivers

Bundling of EnPCs: In Public Private Partnership EnPCs, there are usually several buildings renovated in a cluster as part of an individual EnPC project. This is relevant in terms of scale and potential savings, while it also allows for the inclusion of specific buildings (e.g., listed cultural heritage buildings), where the renovation might not yield substantial savings individually, but the potential for higher overall savings increases when these buildings are part of a “package”.

Facilitators/Advisors: Facilitators such as consulting companies can help to overcome the complexity barrier. Furthermore, they can uptake the burden of promoting and informing potential clients, organise networking opportunities and arrange financing, thus also work with the financial sector. (37). Such facilitates and advisors should possess expertise in technical, legal, economic, and social aspects, enabling them to cover areas such as data analysis, legal compliance, financial evaluations, and stakeholder communication.

Individuals: In cases of multiple occupants and multiple ownership, the role of individuals who drive the social mobilisation required for successful development of an energy-efficiency focused renovation/investment process, cannot be overstated. Such “local heroes” are often the key (f)actors, particularly in the preparation phase of a project, as well as to increase the level of trust of building occupants towards other actors in the partnership.



Diversification of ESCO activities: Some ESCOs are moving away from deep renovations or are diversifying. While some ESCOs still prioritize energy renovation initiatives, they are actively diversifying its endeavours by increasingly focusing on e.g., the installation of PV power plants as our interviews confirmed.

Apartment block neighbourhoods as a potential for EnPC renovation projects: In line with the identified barrier of diverse typologies of residential buildings, certain apartment block neighbourhoods could present an opportunity, since in these, the multi-apartment buildings are often of similar typology. Also public buildings and residential building could be included in the same EnPCs increasing scope and efficiency.

Other relevant drivers:

- Supportive policy framework for energy efficiency
- Long term commitment by governments
- Dedicated ESCO legislation which removes regulative barriers, certification of ESCOs.
- Standardization, model contracts and handbooks to overcome complexity barriers.
- Quality assurance mechanisms (e.g., list of qualified/certified suppliers)
- National support schemes (e.g., green loans, subsidies for initial analysis, ...)



6 Legal and Contractual Aspects of Energy Performance Contracting: EU Level and the Target Countries

Section 6 outlines the legislative framework about EnPCs and ESCOs and the contractual dimensions of EnPCs, examining both the European Union (EU) level and four specific target countries: Greece, Estonia, Spain, and the United Kingdom. The primary aim of this analysis is to identify the critical legal and contractual prerequisites essential for successfully implementing the envisioned business models within the project's scope.

6.1 European Energy Performance Contracting Regulations: A Comprehensive Overview

Within the EU, energy policies have increasingly focused on promoting energy efficiency, renewable energy, and carbon neutrality. Innovative approaches to financing energy efficiency investments are at the centre of the EU energy efficiency policy, legislation and funding. Energy performance contracting is a promising financing and services model, strongly supported by European energy efficiency policy and legislation. The Energy Efficiency Directive (EED) and Energy Performance of Buildings Directive (EPBD) are crucial legislative instruments driving energy retrofit. They set the rules and obligations to meet the energy efficiency and building stock decarbonisation targets for 2030 and 2050. Several provisions of the Energy Efficiency Directive (EED) have direct or indirect impact on the market uptake of EnPCs. The provisions on energy services directly contribute to EnPCs services development, while the provisions on the exemplary role of the public sector, as well as the provisions establishing energy savings obligations have an indirect triggering effect on the demand for EnPCs. The EPBD and other related legislation play a vital role in guiding member states towards adopting and implementing EnPCs.

The EBENTO business model focuses on innovative approaches to accelerate renovation rates. This subsection outlines the EED regulations pertaining to these innovative approaches, including EnPCs, one-stop-shops (OSSs), information dissemination, energy flexibility, digital tools, and considering multiple stakeholders' perspectives.

Relevant EU Policies and standards

The Energy Efficiency Directive (EED)

The EED (2012/27) set binding measures to help the EU reach its 20% energy efficiency target by 2020. In 2018, the 'Clean energy for all Europeans package' introduced the amending Directive on Energy Efficiency (2018/2002) to update the policy framework to 2030 and beyond. The central feature was the establishment of a prominent energy efficiency target for 2030, set at a minimum of 32.5% improvement compared to the 2007 projections for the same timeframe. In 2023, the EED was amended again (formally adopted on 13 September 2023), as part of the package "Delivering on the European Green Deal", including the need to further enhance ambition and decrease the EU's dependency on fossil fuel imports from Russia, following the energy crisis by the invasion of Russia to



Ukraine and the European Commission's REPowerEU plan (of May 2022). The revised EED establishes 'energy efficiency first' as a fundamental principle of EU energy policy, recognising its vital role in practical policy applications and investment decision-making. The 2023 amending directive raises the level of ambition of the EU energy efficiency target, making it binding for EU countries to collectively ensure an additional 11.7% reduction of energy consumption by 2030, compared to the 2020 reference scenario projections.

The EED is the principal EU legislation, which sets explicit requirements to promote the market of energy services and EnPCs. Article 2 of the EED provides the necessary definitions:

- **Energy service (Art 2.11)** as *the physical benefit, utility or good derived from a combination of energy with energy-efficient technology or with action, which may include the operations, maintenance and control necessary to deliver the service, which is delivered on the basis of a contract and in normal circumstances has proven to result in verifiable and measurable or estimable energy efficiency improvement or primary energy savings.*
- **Energy service provider (Art 2.29)** as *a natural or legal person who delivers energy services or other energy efficiency improvement measures in a final customer's facility or premises.*
- **Energy performance contracting (Art 2.33)** as *a contractual arrangement between the beneficiary and the provider of an energy efficiency improvement measure, verified and monitored during the whole term of the contract, where investments (work, supply or service) in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement or other agreed energy performance criterion, such as financial savings.*

The definition of Energy Performance Contracts establishes prerequisites for verification, monitoring, and agreed-upon levels of energy improvement/financial savings.

Article 29 is a significant provision concerning energy services and energy service companies. It mandates Member States to promote energy services contracts, dedicated financial instruments, certified and qualified energy services providers, and monitoring and verification methodologies. The EED calls Member States to take actions to strengthen the energy services market, including:

- dissemination of information about available energy service contracts and clauses as well as financial measures supporting energy efficiency service projects
- publishing of EnPC model contracts and list of available energy service providers
- encouraging the development of quality labels
- disseminating information on best practices for EnPCs
- providing a qualitative review of the current and future development of the market
- identifying and publicising contact points for final customers
- putting in place an independent mechanism for handling complaints and disputes.
- enabling independent market intermediaries, i.e., facilitators.

Member States have the responsibility to put in place a supportive regulatory and enabling framework for the creation of a well-functioning energy service market at the national level, providing for example, providing clear and easily accessible information on available energy service contracts and on the financial instruments that can be used in support of these.



Article 22 encourages the **establishment of one-stop shops (OSSs)** to provide technical, administrative, and financial advice on energy efficiency and renewable energy uptake, particularly for households and small non-household users.

Another key element of the EED is the introduction of a specific mandate for the **public sector** to achieve an annual energy consumption reduction of 1.9% (Article 5). This measure aims to enhance the exemplary role of the public sector across a wide range of activities including buildings, transportation, water management, and street lighting. Additionally, EU countries are obligated to **annually renovate at least 3% of the total floor area of heated/cooled buildings owned by all levels of public administration** (Article 6). Public bodies are also required to consistently consider energy efficiency **requirements when procuring products**, services, buildings, and infrastructure projects (Article 7). The EED emphasizes the use of EnPCs for renovations in the public building sector due to fewer financial, informational, and technical barriers for public bodies compared to private building owners.

Additionally, **Article 7** obliges Member States to establish legal and regulatory provisions for public purchasing and budgeting, ensuring that public bodies are encouraged to invest in energy efficiency and use EnPC and third-party financing mechanisms.

“Member States shall establish legal and regulatory provisions, and administrative practices, regarding public purchasing and annual budgeting and accounting, necessary to ensure that individual contracting authorities are not deterred from making investments in improving energy efficiency and from using energy performance contracting and 3rd financing mechanisms on a long-term contractual basis.”

The EED proposes the importance of creating an inventory of Energy Performance Contracts (EnPCs) for public buildings, which can be utilized by private actors like energy service companies to propose renovation solutions (Article 29). The EED acknowledges barriers in national legislations related to EnPCs and suggests investigating the rules and regulations in target countries to identify potential solutions for overcoming these barriers.

Article 29 recommends Member States to promote the use of EnPCs combined with expanded energy services, including demand response and storage, for renovations of large non-residential buildings.

“Member States shall encourage public bodies to use EnPC for renovations of large buildings. For renovations of large non-residential buildings with a useful floor area above 1000 m², Member States shall ensure that public bodies assess the feasibility of using EnPC. Member States may encourage public bodies to combine EnPC with expanded energy services including demand response and storage.”

The Energy Performance of Buildings Directive (EPBD)

The EPBD is currently the main legislative instrument to reduce the energy consumption of buildings. Most of the requirements under this Directive can also contribute to the increase of the ESCO market through promoting an energy efficient building stock and related public measures. The directive covers a broad range of policies and support measures that will help national EU governments boost energy performance of buildings and improve the existing building stock:



- EU countries must establish strong long-term renovation strategies, aiming at decarbonising the national building stocks by 2050, with indicative milestones for 2030, 2040 and 2050.
- EU countries must set cost-optimal minimum energy performance requirements for new buildings, for existing buildings undergoing major renovation, and for the replacement or retrofit of building elements like heating and cooling systems, roofs and walls.
- As of 2021, all new buildings must be nearly zero-energy buildings (NZEB) and since 2019, all new public buildings should be NZEB.
- When a building is sold or rented, energy performance certificates must be issued and inspection schemes for heating and air conditioning systems must be established.
- Support for electro-mobility by introducing minimum requirements for car parks over a certain size and other minimum infrastructure for smaller buildings.
- An optional European scheme for rating the smart readiness of buildings and smart technologies are promoted.
- Requirements are introduced on the installation of building automation and control systems, and on devices that regulate temperature at room level.

In 2018 the EPBD was amended, as part of the 'Clean energy for all Europeans' package (2018/844/EU) introducing new elements aiming to modernise the buildings sector in light of technological improvements and to increase building renovations. In 2021, the European Commission proposed a revision of the directive to reflect higher ambitions and more pressing needs in climate and social action in line with the European Green Deal towards a zero-emission and fully decarbonised building stock by 2050. The proposed measures will increase the rate of renovation, particularly for the worst-performing buildings in each country. The revised directive will modernise the building stock, making it more resilient and accessible. It will also support better air quality, the digitalisation of energy systems for buildings and the roll-out of infrastructure for sustainable mobility. Crucially, the revised directive facilitates more targeted financing to investments in the building sector, complementing other EU instruments supporting vulnerable consumers and fighting energy poverty. The Commission's new proposal aims to contribute to reaching the target of at least -60% emission reductions by 2030 in the building sector in comparison to 2015 and achieve climate neutrality by 2050. The main measures in the new proposal are:

- the gradual introduction of minimum energy performance standards to trigger renovation of the worst performing buildings.
- a new standard for new buildings and a more ambitious vision for buildings to be zero-emission.
- enhanced long-term renovation strategies, to be renamed national Building Renovation Plans.
- increased reliability, quality and digitalisation of Energy Performance Certificates; with energy performance classes to be based on common criteria.
- a definition of deep renovation and the introduction of building renovation passports
- modernisation of buildings and their systems, and better energy system integration (for heating, cooling, ventilation, charging of electric vehicles, renewable energy)
- The proposed revision of the directive is now being considered by the Council and the European Parliament.



The most relevant part of the EPBD relates to Energy Performance Certificates, which is an important driver of ESCO contracts, by showing building owners a list of measures to be implemented to improve their buildings, thus increasing a demand for energy efficiency measures, while reducing transaction costs through mandating energy consumption information collection.

The proposal to revise the EPBD highlights the importance of technical support through one-stop-shops (OSSs) and integrated financing mechanisms to achieve the Minimum Energy Performance Standards (MEPS). Additionally, removing non-technical barriers and involving all actors, including homeowners, are emphasized for successful energy-saving measures. In particular it focuses on enabling funding and financial tools, such as energy efficiency loans, mortgages for building renovation, energy performance contracting, fiscal incentives, on-tax schemes, on-bill schemes, guarantee funds, funds for deep renovations, and funds with minimum threshold of targeted energy savings. Notably, the use of innovative financial mechanisms, like pay-as-you-save schemes, is highlighted. Furthermore, complementing mechanisms for successful renovations include providing information on available funding and financial tools, removing non-economic barriers, and monitoring the availability of skilled professionals. Figure 10 outlines the main pillars of the proposal to revise the EPBD, illustrating a comprehensive and effective financial support system for Member States.

- “Member States shall support compliance with MEPS by all the following measures providing technical assistance through OSSs; designing integrated financing schemes; removing non-economic barriers, etc.”

- “Member States shall ensure the establishment of technical assistance facilities, including through OSSs, targeting all actors involved in building renovations, including homeowners and administrative, financial and economic actors, including small- and medium-sized enterprises.”

- “OSSs for EE in buildings shall be **independent** public entities, **cross-sectorial** and **interdisciplinary** and shall provide their service **free of charge** for the users. They shall provide **tailor made advice** to different target groups on EE in buildings and may accompany **integrated district renovation programs**. OSSs may cooperate with private actors that provide and promote services relevant for ER, such as financing solutions and the execution of ERs and, where appropriate, that connect potential projects, in particular smaller-scale projects, with market actors.”

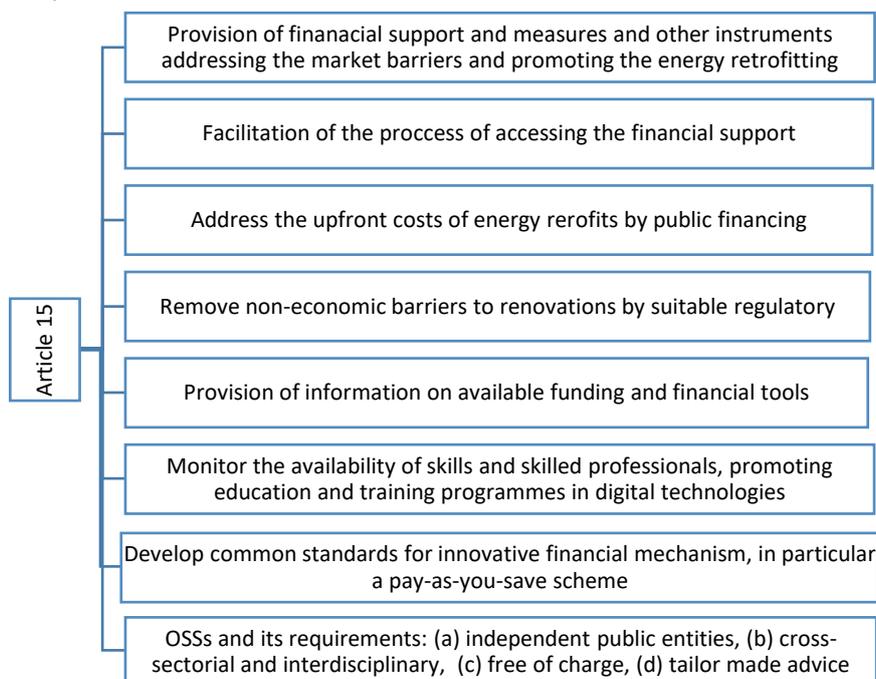


Figure 9 – Main pillars of EPBD Article 15



Finally, the proposal to revise the EPBD emphasizes the importance of providing information on cost-effective measures, financial instruments, and OSSs for renovation advice. Additionally, the significance of digital tools for monitoring building performance, both before and after renovation, is highlighted. These tools allow for the evaluation of energy efficiency renovations' effectiveness, with data being connected to the EU Building Stock Observatory.

Renovation wave strategy

In 2020, the EU Commission unveiled its ambitious Renovation Wave Strategy, aiming to spearhead a transformative clean energy transition by renovating the existing building stock. Over the next decade, the strategy sets out to double the annual energy renovation rate, targeting 35 million buildings to be renovated by 2030. The Renovation Wave Communication proposes to expand the use of ESCOs and energy performance contracts, which proved to work well in some Member States to make renovation affordable for all households, including those with a limited ability to cover costs upfront.

The Renovation Wave Strategy focuses on several key objectives:

- (a) The strategy strives to provide public, private owners, and tenants with comprehensive information, legal clarity, and enticing incentives to drive energy retrofitting efforts.
- (b) A crucial aspect is to guarantee sufficient and well-directed funding, creating the necessary financial support for building renovations.
- (c) Leveraging cutting-edge technologies, the strategy promotes the integration of all building-related data from forthcoming Building Renovation Passports, Smart Readiness Indicators, Level(s), and EnPCs, with the aim of accelerating deep renovation.
- (d) The strategy aims to enhance technical assistance to national and local authorities and invest in training and skill development for workers, empowering them to contribute significantly to sustainability efforts.
- (e) A novel approach involves developing neighbourhood-focused initiatives and empowering consumers to become "prosumers," enabling them to sell energy back to the grid.

Recovery and Resilience Facility and REPowerEU

As a reaction to the Covid-19 pandemic crisis, the **Recovery and Resilience Facility**, makes available EUR 723.8 billion in loans (EUR 385.8 billion) and grants (EUR 338 billion), including for renovation investment and energy efficiency related reforms across Member States. At least 37% of the funding is targeted at climate-related expenditure.

In tandem with the ambitious "Fit for 55" and "Renovation Wave Strategy," the EU has launched the ground-breaking "**REPowerEU**" initiative, a comprehensive plan due to the current energy crisis, prompting EU countries to seek ways to decrease their reliance on Russian fossil fuels. In response, Member States are encouraged to address the energy crisis swiftly and efficiently, ultimately reducing energy costs for their citizens. To achieve this, the "REPowerEU" initiative focuses on two key aspects:

- (a) **Doubling Solar Photovoltaic Capacity:** Recognizing the immense potential of solar energy, the EU is determined to double its solar photovoltaic (PV) capacity. By investing in large-scale solar



projects and incentivizing rooftop solar installations, the EU aims to significantly increase the share of solar energy in its energy mix.

- (b) **Accelerating Heat Pump Deployment:** Heat pumps have emerged as a highly efficient and eco-friendly alternative for heating and cooling. To harness their full potential, the EU is dedicated to doubling the rate of heat pump deployment across member states, encouraging households and businesses to adopt this clean technology.

One-Stop Shops: To simplify the process of building renovations, "REPowerEU" advocates for the establishment of one-stop shops. These shops serve as centralized points of contact, providing comprehensive information, technical support, and financial guidance for energy-efficient renovations. By streamlining the process and reducing administrative burdens, one-stop shops aim to encourage more building owners to embark on energy-saving measures.

building owners and the environment.

Despite these ambitious targets, challenges persist in the installation and scaling of energy-efficient renovation solutions. To overcome these obstacles, the "REPowerEU" initiative emphasizes the adoption of energy performance contracts and the establishment of one-stop shops, all operating in accordance with EU regulatory frameworks.

Energy Taxation Directive

The Energy Taxation Directive (ETD) establishes rules within the European Union for the taxation of energy products and electricity. Its relevance lies in its ability to impact consumer behaviour and incentivise energy efficiency. However, the current framework requires revision to align taxation with energy and climate policies, supporting the implementation of pay-for-performance (P4P) schemes and demand response initiatives. Well-designed taxes under the ETD can send price signals and provide incentives for consumers to adopt sustainable practices and invest in more efficient appliances. Addressing the lack of environmental distinctions between different energy sources is also crucial, as the current focus on consumption quantity rather than environmental impact falls short.

- The ETD establishes EU rules on taxation of energy products and electricity, which can impact consumer behaviour and incentivize energy efficiency.
- The ETD requires revision to align taxation with energy and climate policies, supporting the roll-out of pay-for-performance (P4P) schemes and demand response initiatives.
- Well-designed taxes under the ETD can send price signals and provide incentives for consumers to adopt sustainable practices and invest in more efficient appliances.
- The current taxation framework lacks distinctions based on the environmental consequences of different energy sources, focusing more on consumption quantity rather than environmental impact.

The European strategy for data

The European strategy for data aims to create a single market for data, ensuring Europe's competitiveness and data sovereignty. Within the context of energy, data collection and sharing have



relevance to the innovative energy performance contracting schemes, such as EBENTO. These initiatives enable the energy diagnosis of buildings, identification of priority interventions, and support aggregators, building owners, and energy providers in offering energy-saving portfolios and identifying valuable business opportunities. Furthermore, the utilisation of big data can facilitate accurate measurement of energy savings, enable flexible consumption, and uncover potential business prospects within the energy sector.

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European standard EN 15900:2010

The European standard EN 15900:2010 Energy efficiency services adopted in 2010 specifies the definitions and minimum requirements for an energy efficiency service. It defines energy efficiency services (EES) as an agreed task or tasks designed to lead to an energy efficiency improvement and other agreed performance criteria. According to EN 15900:2010 Energy efficiency services shall include an energy audit (identification and selection of actions) as well as the implementation of actions and the measurement and verification of energy savings. A documented description of the proposed or agreed framework for the actions and the follow-up procedure shall be provided. The improvement of energy efficiency shall be measured and verified over a contractually defined period of time through contractually agreed methods. A core element of each Energy efficiency services is thus an energy efficiency improvement (EEI) action, which is any action that directly leads to a reduction in energy consumption. EEI actions may be the substitution of technology, improvement of technology, better use of technology, and behavioural change.

Legislative considerations for the development of energy service and EnPC markets in Member States

In the framework of the Concerted Action EED, Member States presented the current status of the legislation (39) and the energy service market in compliance with the EED requirements. Some interesting takeouts verify that the **implementation of the EED is very patchy**. There are large number of provisions that are not (yet) properly transferred in national legislation. The Concerted Action EED published a report about administrative barriers in regard to energy services and ESCOs, energy auditing. Below some conclusions are presented for the actual implementation in EU Member States:

Removing the legal and regulatory barriers

“Member States shall remove any regulatory or non-regulatory barriers to energy efficiency, in particular as regards legal and regulatory provisions, and administrative practices, regarding public purchasing and annual budgeting and accounting, with a view to ensuring that individual public bodies are not deterred from making investments in improving energy efficiency and minimising expected



lifecycle costs and from using EnPC and other third-party financing mechanisms on a long-term contractual basis.”

Article 19 of the EED requires Member States to take **appropriate measures to remove regulatory and non-regulatory barriers** to energy efficiency, including those that prevent public bodies from using EnPCs and other third-party financing mechanisms on a long-term contractual basis. Some countries have put in place measures to overcome regulatory barriers by creating **intermediaries (for example, public ESCOs, public funds, utilities ESCOs)** who work with government agencies to organise auctions for **local ESCO companies** with the aim of carrying out energy efficiency projects. As independent entities, these intermediaries can take over procurement functions, because they are not subject to public procurement regulations and can use alternative procurement methods, for example based on the highest net present value, instead of contracts based on the lowest price and on deliverables, saved energy. They can also use public funding for projects (as a solution to the low value of local ESCOs), can be a ‘neutral intermediary’ between the public agency and the local ESCOs, can resolve potential disputes on energy savings achieved, etc.

Provision of information

Member States must support the energy service market by providing information, removing barriers, and promoting advisory services and market intermediaries like one-stop-shops (OSSs). **Information provision** is typically done **bottom-up, mostly by the ESCOs themselves**, or by intermediaries where these exist. Information dissemination is reported as successful in Austria, Belgium, Czech Republic, France, Germany, the Netherlands, Poland, Slovenia, Spain. Dissemination by companies is very common, especially in small and emerging markets (Hungary, Croatia, Portugal, etc.). Information on financial instruments is successful in Bulgaria, Belgium, Czech Republic, Germany, the Netherlands, Slovenia. Information on best practices is successful in Austria, Belgium, Czech Republic, France, the Netherlands, Spain and Slovenia. Provision of information about current ESCO market and future expectations is considered successful by market actors in Croatia, Germany and Poland.

Model contract

The **establishment of a model contract** at national level for energy performance contracting in the public sector has been initiated in half of Member States, of which two thirds were initiated before the obligation in the framework of the EED was introduced. However, at regional/local level it has been much less developed. The same is true of the establishment of contract guidelines at national level for energy performance contracting, which 10 Member States established before the EED came into force, and 5 established under its compulsion. Both model contracts and contract guidelines are present in 13 Member States, in 9 of them they were introduced before the EED came into force.

As in any market, when dealing with financial issues a more standardised approach can help in growing the market, simplifying transactions and lowering their costs. The main reasons for the development of model contracts and contract guidelines have been the growing EnPC market and the **need for standardised guidelines or minimum criteria to be covered by the ESCO contracts**, thus encouraging the use of ESCO and EnPC concepts in large building situations, where procurement rules and



competition makes ESCO tendering more challenging. Where established, the contracts are either part of regulations or published independently without obligation for use.

Facilitators and energy agencies

Facilitators for EnPC have an important role to play in the public sector (and not only). Facilitators are crucial to the market at all stages, but sometimes their availability or qualification is not enough to meet the market needs. Qualification/ certification of facilitators (and energy experts) should be considered. Facilitators can have a role in dispute resolution, having specific knowledge in contract and technical issues and skills to facilitate an agreement between the parties. The facilitator can be the one involved in the early phase of the contract - thus knowing the project - if both parties agree, or another facilitator maybe chosen by a third party.

The EnPC Facilitator provides the necessary know-how and experience to support the building manager with the successful implementation of an EnPC project. The EnPC Facilitator acts as a mediator between client and ESCO to build up a sustainable relationship and to create trust between the future contract partners. Tasks of the EnPC Facilitator usually include:

- Initial assessment of project suitability for EnPC.
- Initial assessment of potential energy savings and investment required.
- Initial technical analyses.
- Support client during procurement process.
- Provide advice throughout the project.

List of providers

Lists of providers are generally considered very helpful to customers as they can use them to understand what the market offers and who the appropriate providers to get in touch with are for services from energy analysis/audit to design, implementation, management and maintenance of energy efficiency measures, and eventually also performance contracts and/or third-party financing. Moreover, lists usually guarantee that these actors have a track record and/or are qualified and/or certified. In fact, in the majority of Member States, lists and/ or labels are publicly available for providers of various energy related services. Lists are an important communication/marketing channel to end-users/customers for the listed professionals and/or providers, so it is very important to consider their accessibility and usability. Lists build trust in the market, make it more transparent and in some cases set a quality standard. The signing of a code of conduct to join the list can help to build trust and facilitate marketing, especially if a qualification/ certification/quality control scheme are not present.

Lists are widely used among Member States, mostly for providers of building energy performance certificates but also for energy audit providers and energy service providers. 'Service providers' has a quite broad definition, often gathering energy related professionals and providers of different kind of services. Some Member States consider ESCOs only as service providers offering energy performance contracts, while others have a broader definition.

Experience/references have a major role in market-based lists and in general are considered very important for all lists. Market-based certifications, qualifications and labels also have the issue of a



potential conflict of interest where the organisation issuing and controlling the certification, labels, etc., is also paid to monitor by the monitored.

Handling of complaints

Complaints in the energy service market need first of all a quick and accessible mechanism as it is usually in the interest of both parties **not** to interrupt the service. The experience of some Member States on the **use of an ombudsman or other form of dispute resolution**, with no or low costs and short, fixed response times, is working for complaints of citizens/small users with energy suppliers and providers of energy services. Usually, these mechanisms have limitations on the maximum monetary amount of the dispute which makes them not generally applicable to service providers or to the typical size of performance contracts. The energy service contracts themselves also regulate the handling of complaints, although dedicated clauses are usually quite standard and concise, not addressing the specificity of an energy service contract with or without performance guarantee(s). In contracts with major interests, more extensive provisions for dispute resolution should be included.

Good practices on legal set up

Below some **good practices** from the national long-term renovation strategies (40) and other sources as (41):

- **Austria** will set up an **energy-saving contracting platform** for small- and medium-sized enterprises (SMEs). Its goal will be to record the energy-saving measures that were identified in the context of the supported energy and environmental consultations, but not implemented for various reasons, in a central database, with the consent of the undertakings involved. Contractors and external energy service providers should have access to this database to access information on unimplemented projects and actively contribute to the implementation of upcoming projects. In addition, the platform itself can identify projects from these data according to certain criteria.
- In **Belgium, the Brussels Capital Region** authorities plan to set up a **market facilitator** that will support the establishment of ESCOs and EnPCs, with a view to creating the conditions for the emergence of ESCOs. This facilitating body will also **play the role of aggregator** of applications in order to limit the expenditure of ESCOs in research and project planning. This measure will be accompanied by the **removal of administrative and legal disincentives** and the provision of **standard procurements and contracts**. Furthermore, a **specific public legal vehicle** will be created to **support the managers of public building applicants** in the preparation of the financing solution, and to offer tax and accounting advice for the renovation programme. In the **Flanders Region**, the Flemish Energy Company (VEB) **facilitates energy performance contracts between ESCOs and public institutions**. This is to **remove the burden on public institutions** as far as possible: the VEB provides knowledge and experience at technical, legal and project levels so that the ESCO process can be successfully completed.
- In **Finland**, the Finnish Real Estate Federation invested in the **implementation of new contract forms** in 2017 and 2018. The investments resulted in **new document templates** that are compliant with the shared contractual practices of the real estate and construction industries. They are available in digital format at www.sopimuslomake.net.



- The 'Adjudication Committee' is a mechanism in the **Netherlands** used to **solve complaints** applicable to energy service sector up to certain thresholds (€5,000 for consumers and €50,000 for businesses).
- The **model contract** for the public sector in **Ireland** has provisions to **manage complaints**, in specific cases (e.g., measurement and verification of savings) with three different levels of complaint resolution, starting internally with a meeting of a senior member of each of the parties trying to solve the complaint with good faith efforts within a couple of weeks. At the second level, a mediator mutually agreed or appointed by a technical third party is used before (third level) an arbiter is involved – chosen in the same way - which is a binding process. There is also an expert determination for specific circumstances (e.g., measurement and verification of savings, etc.) after the meeting of the senior members.
- **Croatia** has a specific mechanism set up to **solve disputes** in a programme for the energy renovation of public sector buildings. A third party can be asked to check the project savings by project documentation and can also check if the works were done according to the project specifications.
- In the **Netherlands** the www.qbisnl.nl website has all the lists except the one of ESCOs, which is based on the signature of the Transparency code of conduct. Government support is provided mostly by giving visibility. The list is hosted by an association of service providers.
- **Germany** illustrated two lists, one of service providers - free, based on self-declaration and with around 3,000 registered providers - and the efficiency expert list - for which there is a fee as well as entrance and periodic checks with almost 14,000 professionals listed. This second list is more popular since it is linked to various support schemes.
- In **Germany** the website of the Federal Energy Efficiency Agency provides information on contracting model contracts and guidelines on energy-saving contracting available free of charge. This includes offers specifically aimed at public properties or local authorities. As part of the advisory programme 'Energy advice for non-residential buildings of local authorities/non-profit organisations', a 'contracting cheque' (up to 80% of the net consultancy fee, with a maximum of EUR 2,000) is provided for local authorities and non-profit organisations. A qualified energy consultant examines whether and how the measures proposed in a previous energy audit (also supported), or consultation (refurbishment roadmap) can be implemented using an appropriate contracting model. The aim is to draw the attention of local authorities to the often-unfamiliar possibilities of different contracting models, encouraging greater use of energy-saving contracting in particular. The Federal Government/federal state dialogue on energy-saving contracting will provide a platform for intensive exchanges on energy-saving contracting between representatives of the Federal Government and the federal states. The project aims to remove barriers to the implementation of energy-saving contracting and to build up regional expertise in this area. This will be done through annual plenary meetings and workshops, as well as a mentoring programme, the exchange of examples of good practice and the practical implementation of around 10-15 energy-saving contracting model projects in representative properties in local authorities and at federal state level, with the aim of providing a model for the potential of contracting and thus prompting the establishment of a functioning ESC market in Germany.



European financial support

The multi-annual Financial Framework (41) serves as a significant funding source for implementing EnPC policies and measures. These funds have been and will continue to be allocated for the purpose of attracting private investment, particularly for ESCO markets. In various countries, the **Structural and Cohesion Funds** have been utilized to support energy efficiency and ESCO projects. However, accessing these funds directly proves challenging for ESCOs, as they are not the ultimate beneficiaries.

In order to stimulate the creation of viable project pipelines, the EU has established diverse **Project Development Assistance (PDA) programs** aimed at assisting project initiators in transforming their concepts into tangible investment initiatives on the ground. Among these EU PDA initiatives, **ELENA** is managed by the European Investment Bank and has been operational since 2009. It extends support to public project initiators like local and regional authorities to formulate and launch substantial bankable sustainable energy ventures, including those involving sustainable transportation.

While the primary purpose of the PDA initiatives revolves around project development, the **European Energy Efficiency Fund (EEE-F)** holds a central position as a funding source for ESCO projects. It can be utilized for both project development and investments, offering options such as loans, guarantees, and equity participation in endeavours led by public authorities, governmental bodies, or ESCOs involved in public contracts. Operational oversight of the fund is managed by Deutsche Bank.

Recently, the **European Investment Bank** has been actively engaged in supporting ESCO projects through the **provision of guarantees**. The presence of accessible and readily available financial guarantees proves to be of greater significance than purely providing financial grants for EnPC/ESCO projects. This is due to the fact that a guarantee fund has the capability to stimulate investments from the market, thereby leveraging private funding. Importantly, it complements ESCO investments, engendering greater trust and ensuring the security of projects.

JESSICA, established in 2006 by the European Investment Bank, serves as a financial mechanism. It permits Member States to harness grants from European Structural Funds for the purpose of capitalizing funds specifically designated for urban development investments. Alternately, returns and proceeds generated from investments can be conserved or redirected back to managing authorities for reinvestment in other urban regeneration undertakings. JESSICA Funds are versatile and can function as equity, debt, or guarantee investments.

6.2 Contractual issues to be considered.

There are several factors affecting the successful delivery of EnPCs, including economic, contextual, technology, operation, and measurement and verification (M&V) risks (43). Some key areas to be considered when developing an EnPC include the following:

- **Energy Audit:** The scope and level of detail of the energy audit can be a big driver in costs. Establishing criteria for cost-effectiveness prior to conducting the audit can help limit the scope to pursuing only viable projects.
- **Expected energy savings:** degradation rate of system performance, quality of system operation and maintenance (O&M), environmental conditions (e.g., change in weather



pattern), accuracy in estimating expected savings. **Operational** issues should be addressed in the M&V plan as they are fundamental in calculating energy use and realizing the energy savings. Changes in equipment **operating hours** and load can show up as increases or decreases in savings.

- **Equipment performance** is also critical to energy use calculations and savings determinations. The contract may need to demonstrate that the improvements meet expected performance levels including specified equipment capacity, standards of service, and efficiency. Preventative maintenance activities can impact performance and life of equipment.
- **Equipment, construction, M&V and other costs:** any new additional costs related to expanded operations and maintenance/repair activities should be considered into the financial plan.
- **Interest Rates:** Interest rates have a huge impact on the overall cost-effectiveness and viability of a performance contract project, as interest rates can add substantial expense over the term of a project. Higher interest rates will increase the project's cost and term. Weather: Use of typical weather data is one approach to mitigate risks from weather.
- **Duration of contract**
- **Delays:** delays can add cost to the project (e.g., construction interest, remobilization).
- **Changes** (from initial assessment), of energy source, supplier, etc.; price change (namely under liberalized market) and dynamic pricing (it can also be a form of savings, namely financial ones); change of ownership; base scenario change: i.e., machinery, higher consumption.
- **Authorizations** (passive or active management): that could be in the form of a mandate to act on behalf of the final client, for example, to negotiate energy supply contracts.
- **Controls and minimum services:** what are the minimum services, for example in case of interruption of services (not related to energy supply), time to reestablish services, penalties, etc.).
- **Breach of contract** (remedies), early termination (of the contract)
- **Other duties:** as confidentially (may follow into "sensitive data" category, if you are dealing with households and using consumption profiles).
- **Typical Events of Default:** failure to make payments; failure to maintain credit support; breach of reps and warranties (usually subject to materiality); breach of transfer/change of control restrictions.
- **Typical remedies:** actual damages, termination of contract, termination of payment, Step-In-Rights for lenders in case of a default event, and verification of savings with e.g IPVMP (EVO) (44).

These factors should be addressed in the contract, M&V plan or both. Stipulating certain parameters in the contract can align responsibilities but can also transfer risk. The M&V plan should state roles and responsibilities for initial and long-term performance, including who is responsible for replacing failed components or equipment throughout the term of the contract. The M&V plan should also clarify how performance will be verified, and what will be done if performance does not meet expectations or if inadequate preventive maintenance impacts performance.

6.3 Case study: Greece



Current status of EnPC market in Greece

Based on the expert interviews, the current Greek market remains immature despite efforts by the Ministry of Energy and Environment. with only 29 ESCOs registered in the official registry with an EnPC (although still the legislation is quite flexible with what can be considered as EnPC). Big construction companies, involved in public works, have not yet decided to invest in the ESCO market. Building owners (including for public buildings) and investors still hesitate to apply EnPCs given the immature market, technical and administrative knowledge is limited, there are many risks and better business opportunities. Financial institutions are not really engaged so far (due to low market demand). EnPC projects are notably limited, but some municipalities have started adopting EnPCs for streetlighting projects.

According to the JRC report in 2021, it is anticipated that Greece will transition from projects focused on lighting with loose performance guarantee enforcement to initiatives encompassing technology upgrades and substantial building renovations.

The market scale for Greece pertains specifically to Energy Performance Contracting agreements focused on lighting. In the context of Greek contracts, these agreements encompass both the supply and maintenance aspects. Within these agreements, a noteworthy detail is that 30% of the payment allocated to contractors is spread out over the span of a 10-year contract duration. This disbursement is contingent upon the contractor's performance, thereby creating challenges in asserting performance assurances. Additionally, this approach diminishes the motivation for service providers to actively pursue ambitious enhancements (45).

Table 3 Greece's status related to energy performance contracts of public lighting.

	2016	2019
Greece	Insignificant, at a pilot stage, limited to the public sector only	Initial (Substantial engagement in public lighting, aligns with a vague EnPC understanding)

In November 2016, Greece implemented a pilot EnPC project in the public building sector, specifically at the premises of the Centre for Renewable Energy Sources (CRES)¹. The project focused on upgrading the internal lighting system of CRES's office building, utilizing a guaranteed energy saving contracting with a three-year duration and guaranteed savings of at least 67%. Unfortunately, apart from this small-scale example, no large-scale EnPC projects were implemented in the public building sector until the development of the PRODESA project [2].

Legal framework

The legal framework for Energy Performance Contracting (EnPC) in Greece has been set with the transposition of Directive 2006/32/EC on energy end-use efficiency and energy services, into national legislation under Law 3855/2010 (Government Gazette No 95, Series I, 23-06-2010), as well as with the

¹ CRES is the Greek national entity for the promotion of renewable energy sources, rational use of energy and energy conservation



transposition of Directive 2012/27/EU on energy efficiency, under Law 4342/2015 (Government Gazette No 143, 09-11-2015) which replaced Law 3855/2010. In these two Laws among other things, the definition of EnPC, ESCOs, Energy Service Providers (ESP) and Energy Services are set.

Deriving from the first Law, a Ministerial Decision came into force in 2011 (D6/13280/07.06.2011, Government Gazette, Series II, No 228) setting the requirements on Operation, Register, Code of Conduct and related provisions for energy service providers. Thus, this Ministerial Decision foresaw the operation of an ESCO registry, where companies willing to act as ESCOs are registered, given that they fulfil certain criteria of former experience in energy projects. When the registry was created, because the market was on an early stage, the criteria for entering the ESCO registry were not strict, and it was foreseen that after a period of time the criteria would be readjusted.

A new Ministerial Decision came into force in 2018 (DEPEA/G/oik. 176381/06.07.2018, Government Gazette, Series II, No 2672) that set new criteria for entering the Registry. More specifically, for entering the higher category of the registry, which is category A, one should have experience of performing at least one EnPC in the past. For entering the lower category, which is category B, one should have former experience in providing energy services. The companies already registered had one year to satisfy the new criteria otherwise they would be removed from the registry. The ESCO Registry website (<http://www.escoregistry.gr>) where the ESCO Registry is currently hosted accounts today² 132 companies registered as ESCOs, where 29 of them are registered in category A (meaning they have performed an EnPC project). Most of the companies of category A, have former experience with EnPC in the street-lighting sector, while only a handful of them have experience of EnPC in small private building projects with replacement of lighting fixtures. Thus, it is understood that the ESCO market in Greece is still in an early stage, where the implementation of EnPCs, in the building sector has not yet been widely deployed [4].

Besides the above-mentioned Laws introducing EnPC in the national legislation, an EnPC project procured in the public sector should be treated as a Public Procurement and therefore should be typically subject to the national rule on public procurement, which is Law 4412/2016 (transposition of Directive 2014/24/EC on public procurement). Unfortunately, there is no reference of EnPC in the public procurement legislative framework, and this creates ambiguity to Contracting Authorities of how EnPC should be actually procured and implemented in practice. This lack of guidelines and standardization is also one of the identified administrative barriers for implementing EnPC in the public sector. However, although the legislation does not have any specific reference to Energy Performance Contracting it foresees mixed contracts that can describe the case of EnPCs.

The Directorate for Energy Policy and Energy Efficiency of the Ministry of Energy and Environment has updated the Ministry's webpage with all available information:

- Website: <https://ypen.gov.gr/energeia/energeiaki-exoikonomisi/mitroo-eef/>
- Existing legislation
- Process to register as an ESCO

² Last update of the registry September 2023



- two model Energy Performance Contracts (EnPC): (a) Energy Performance Contract Guaranteed Savings model, (b) Energy Performance Contract Shared Savings model. Moreover,
- the ESCO Register website (<http://www.escoregistry.gr/>) provides information material that include:
 - available EnPC and clauses that should be included in such contracts to guarantee energy savings and final customers' rights;
 - financial instruments, incentives, grants and loans to support energy efficiency service projects.
 - best practices for EnPC, mainly for building renovations, which include a cost-benefit analysis using a lifecycle approach

The PRODESA project in a nutshell

In the PRODESA initiative, seven municipalities in the Athens Metropolitan area joined forces with the common goal of reducing their carbon footprint through energy efficiency renovations and locally available renewable energy generation. To achieve this objective, PRODESA focused on consolidating fragmented municipal projects and exploring financing options, leveraging private funds through energy performance contracting. Aligned with its aims, PRODESA successfully launched exemplary energy efficiency and renewable projects, including:

- Energy efficiency renovations in 96 municipal buildings across Alimos, Ag. Dimitrios, Vari Voula Vouliagmeni, and Ag. Anargiri Kamatero, resulting in primary energy savings of 2.7 GWh per year.
- Street lighting energy efficiency projects yielding primary energy savings of 25.3 GWh per year.
- Photovoltaics integrated into municipal buildings, generating 1.9 GWh of electricity per year, with additional photovoltaic projects in the pipeline to produce 3.6 GWh per year.
- Signed contracts for investments worth 7.8 million EUR, tendered contracts of 9.05 million EUR, and a pipeline of 4.2 million EUR to be tendered.
- Throughout its duration (2017-2022), PRODESA encountered the challenges of an early-stage Greek EnPC market. Overcoming these obstacles, such as municipalities and contractors hesitating to proceed with contracts due to perceived risks, PRODESA developed four distinct types of Guaranteed Savings EnPC, showcasing practical project examples and facilitating dialogue between stakeholders. The initiative also conducted targeted capacity-building activities for municipalities and other stakeholders nationwide, contributing to the removal of such barriers.

Ultimately, PRODESA aimed to serve as a best practice model, surpassing existing barriers and paving the way for replication in the majority of public buildings [3].

Barriers to EnPCs in Greece: exploring regulative, administrative, technical, market, financial, and social challenges



In the context of the PRODESA project, an “ESCO dialogue” was performed to establish a communication line between different market actors and the PRODESA project in order to help understand the views and difficulties faced by both sides (ESCOs and Contracting Authorities) in the implementation of an EnPC project and also help remove the lack of confidence that is prevailing today. The actors involved in the dialogue included municipalities, ESCO companies, financial institutions and the Directorate of Energy Policy and Energy Efficiency of the Ministry of Environment & Energy (YPEN), which is the regulating authority of the Energy Service market. Through the dialogue barriers, as well as the guarantees and perceived risks of EnPC in the public sector were identified.

As mentioned in the methodology section, within the EBENTO project, 6 interviews have been conducted, mostly with policy makers officers, to collect data on the barriers and drivers for the energy performance contracting. In addition to the results of the interviews, the results of a questionnaire survey are used to investigate the influencing factors of energy performance contracting in Greece. The survey was conducted from June 2018 until August 2018 as part of the dialogue among companies either already registered in the ESCO registry or not yet registered but willing to act as ESCOs. In total 17 companies replied to this survey which covers all topics of the ESCO Dialogue.

According to the survey, legislative and regulatory barriers are seen as the main hindering factors (29%) regarding EnPC implementation in the public sector. Market and financial barriers follow with a percentage of 20%, information and awareness barriers rank at 18% and finally technical barriers score the lowest percentage of 12%.

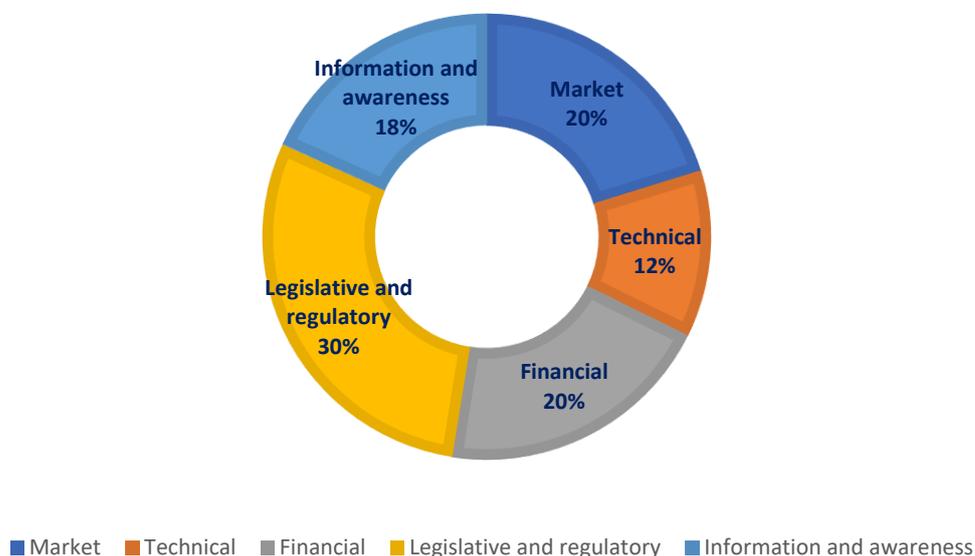


Figure 10: Categories of barriers for implementing EnPC in the public sector.

Table 4 presents a comprehensive overview of various barriers encountered in the implementation of Energy Performance Contracts (EnPC) in the context of Greece. These barriers are categorized into four main areas: financial, regulative/administrative, technical, and market/social barriers.



Financial barriers encompass challenges related to securing funds for energy efficiency projects, including limited access to financing, high-risk perceptions by financial institutions, and a lack of experience and awareness among financial institutions. Additionally, uncertainties surrounding payback periods and Return on Investment (RoI) contribute to these financial hurdles. Table 4 highlights the hesitation of municipalities to engage in EnPCs due to perceived risks.

Regulative/administrative barriers underscore the need for standardized procurement procedures and clear budgeting and accounting rules for EnPCs in the public sector. Ambiguities in characterizing EnPC contracts and doubts regarding their suitability under existing legal frameworks are significant challenges. The table emphasizes the importance of standardizing documents and procedures to instill confidence among stakeholders. Legislative revisions are also mentioned as part of efforts to promote EnPCs.

Technical barriers include issues such as a lack of historical energy consumption data, limited experience in setting energy baselines, absence of energy managers in public buildings, and non-standardized Measuring & Verification (M&V) procedures. Complex monitoring and verification plans for the EnPC Shared Savings model are mentioned as a concern. The table highlights the necessity of awareness, training, and experience in the implementation and monitoring of EnPCs.

Market and social barriers encompass challenges related to the broader market and external factors. These include the need for proper ESCO certification, uncertainty about future energy prices, a lack of best practice examples and mistrust from end-users. Table 4 also notes uncertainties related to achieving energy savings and a lack of experience among public authorities.

Table 4 Barriers to the energy performance contracting in Greece.

Barriers	Description
Financial barriers	<p>In respect to the financial barriers that hinder the implementation of EnPC projects, the ones highlighted are:</p> <ul style="list-style-type: none"> • Limited access to available funds to finance energy efficiency projects through EnPC contracts (survey and interviews). • Financial institutions treat EnPC as high-risk investments, resulting in high guarantees and high interest rates on returns of capital (survey and interviews). • Financial institutions don't treat EnPC as project financing but provide loans to ESCOs based on their own creditworthiness. • Lack of experience, low awareness and low interest of financial institutions with energy efficiency projects. • Uncertainty for payback period and RoI (interviews in EBENTO). • Difficulty to determine unitary cost (wide range) (interviews in EBENTO). • Municipalities in Greece cannot cover the funding needed in case energy savings are not achieved. Despite the amendments in the EUROSTAT accounting system, Municipalities still hesitate to implement EnPCs as they find the venture too risky (interviews in EBENTO). <p>It has to be mentioned that new funding programmes for the renovation of public programmes are designed providing specific incentives if an EnPC or an ESCO is involved. The ESCO has to be registered in the ESCO registry. For example the ELEKTRA project, which is a funding programme for the public sector, provides an additional 10% bonus</p>



	<p>if the project is implemented via EnPC. It also provides guarantees. Similarly, the Attika Regional Programme implements EnPC for public buildings.</p>
<p>Regulative/ administrative barriers</p>	<p>For the implementation of EnPC in the public sector two of the main legislative & regulatory barriers highlighted by the survey and interviews are:</p> <ul style="list-style-type: none"> • Lack of standardized procurement procedures for EnPCs in the public sector (survey). • Unclear budget and accounting rules (survey). • High uncertainty regarding future development in terms of energy prices, regulatory framework (interviews) <p>As already mentioned, Law 4412/2016 on Public Contracts does not have any particular reference for EnPC contracts, thus there is uncertainty among public authorities how to procure EnPC projects. Basic questions such as: how the contract should be characterized: as a Public Work contract, as a Supply contract or as a Service contract or what is the suitable award criteria to be used, still exist. There is also doubt whether a Public Work contract, with its specific requirements, could serve an EnPC project. Also, particular emphasis should be placed on the existing legislative framework for the financing of energy-saving projects through Public-Private Partnerships (PPPs). All PPP projects' operation parameters should be considered and analysed, and if the PPP model for the implementation of energy efficiency improvement projects is deemed effective, this model should also be a guide for implementing similar projects to improve energy efficiency energy efficiency through EnPCs. Thus, standardization of documents and procedures should be done to provide procedural transparency that will create confidence to both parties.</p> <p>The second barrier, which has to do with budget and accounting rules, is also underlined in the 2017 ESCO report of the JRC. In specific, in this report it is stated that the administration of ESCO projects contracted by the public sector as part of the public debt is a major, probably the largest and most distributed barrier that arose in recent years, and drastically limits the markets.</p> <p>It has to be mentioned that the current legislative framework will be revised setting stricter requirements for companies to be registered in the ESCO registry and clarifying what can be considered as EnPC. The Ministry plans to review the legislation as part of the harmonization of the revised Energy Efficiency Directive (EED), which includes new provisions to promote EnPCs (e.g. exclusion from the obligation of energy audits if an EnPC has been in force), aiming to enhance the ESCO market.</p>
<p>Technical barriers</p>	<ul style="list-style-type: none"> • Some of the technical barriers that the survey and interviews highlighted are: • Lack of official historic data of energy consumption. • Lack of experience in setting energy baselines. • No energy manager in all public buildings. • Lack of standardized Measuring & Verification (M&V) procedures. It is very important to develop a standardized method of M&V for the energy savings, as this is a field for disputes between the implicated parties (ESCO and public authority). • High uncertainty regarding future development in terms of technology. • Complex monitoring and verification plan, which must be implemented for the case of the EnPC Shared Savings model (interviews). • The vast majority of the energy efficiency projects are small scale, while the potential aggregation is difficult to be achieved (interviews). • Lack of awareness/training/experiences for the implementation and monitoring the energy performance contracting (survey and interviews). <p>Energy performance contracting poses significant complexity and risk for companies, making clear framework conditions and well-defined user behaviour</p>



crucial for successful repayment. Minimizing the influence of unpredictable user behaviour is imperative, emphasizing the need for awareness raising and training among building occupants and operators in matters of Energy Efficiency. Conversely, there is also a notable lack of confidence in ESCO services, largely due to the absence of prior successful project implementations as references. In light of this, promoting pilot projects becomes paramount. Such initiatives can play a pivotal role in dispelling market scepticism and addressing doubts, both from the market's perspective and among clients, particularly in the public sector, regarding the effective execution of Energy Performance Contracts (EnPCs)

Market and social barriers

Some of the market or external barriers that the survey and interviews highlighted are:

- Lack of proper ESCO certification. As already mentioned there is an ESCO registry already in place, but the criteria for entering were very loose, trying to help the emerging energy service market, but these criteria should be stricter now [5].
- High uncertainty regarding future development in terms of energy prices.
- Lack of best practice examples/implemented projects.
- Mistrust from the end-users (interviews).
- Uncertainty for energy savings to be achieved (interviews).
- No experience from the public authorities.

The responses to the question “*What type of guarantees would you like to have in order to enter into an EnPC with a Public Authority?*” reveals that 47% of the answers concerned financial guarantees, 21% concerned insurance and contractual issues, 18% behavioural issues and awareness raising of the employees, while 14% establishing baseline and M&V issues (Figure 11).

Figures related to the market and external barriers.

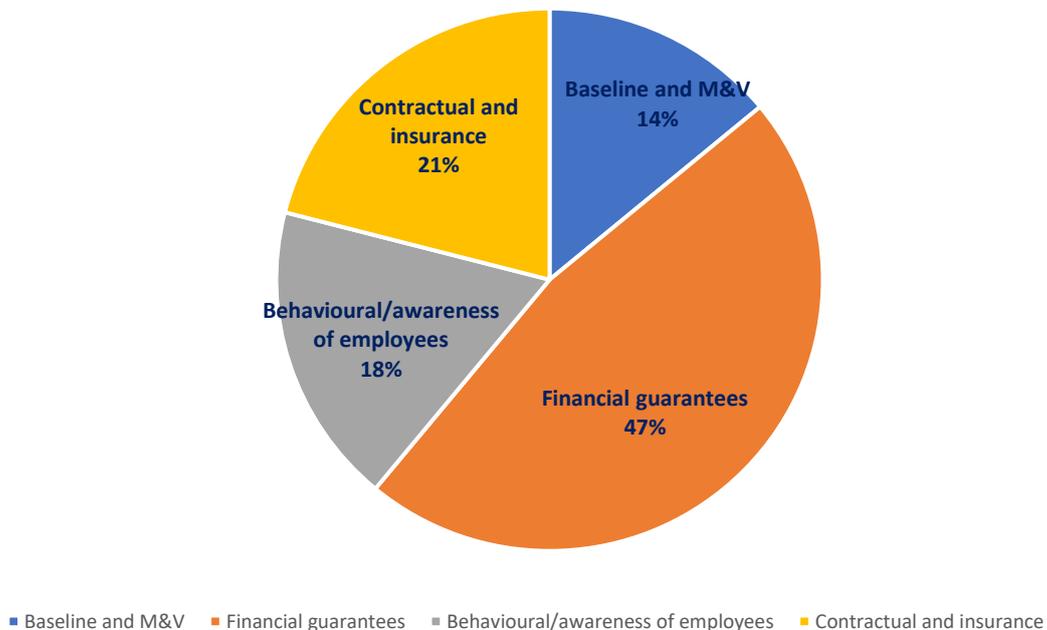


Figure 11 Type of guarantees for entering in an EnPC in the public sector.



The perceived risks when implementing EnPC in the public sector in descending order are the following:

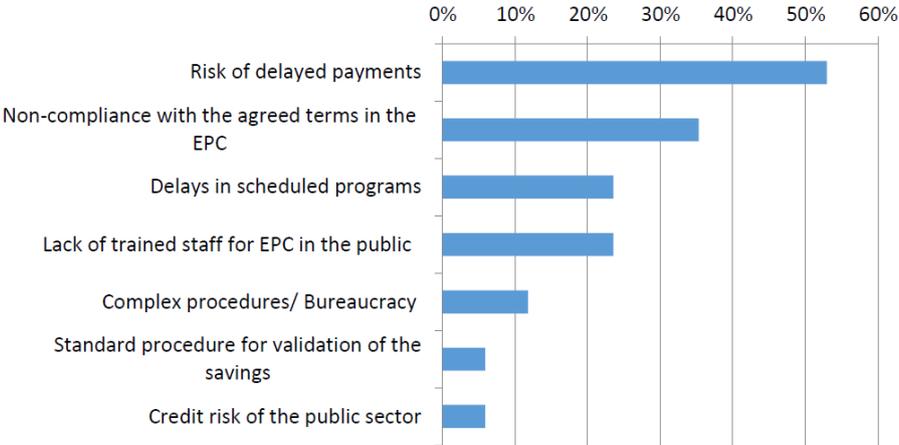


Figure 12 The perceived risks when implementing EnPC in the public sector.

6.4 Case study: Estonia

Current status of EnPC regulations in Estonia

Estonia is situated in the early stages of Energy Performance Contracting (EnPC) market development, as evidenced by its inaugural project in 2019 within the EFFECT4buildings (46) initiative. This status is rooted in the still-nascent nature of the energy service company market within the country. Notably, ESCO solutions have gained significant traction primarily among substantial commercial and industrial energy consumers, particularly in the food production sector. However, the adoption of ESCO services has been slower within the realms of small-scale commercial enterprises, the public sector, and residential areas.

Insights from interviews with Estonian stakeholders shed light on perspectives from both ESCOs and clients. ESCOs view residential building investments as less appealing due to the substantial retrofitting and insulation costs associated with existing structures. These investments often entail payback periods extending over 25 years, while ESCOs are more inclined towards projects with shorter payback spans, typically capped at 5 to 6 years. Consequently, their focus predominantly centres on non-residential buildings and high-benefit building services.

From the standpoint of clients, including building associations and residents, energy-saving motivation is hindered by various factors. Their interests tend to gravitate towards the aesthetic transformation of buildings, especially among elderly residents, who are concerned about the additional monthly costs. Typically, building associations and residents are motivated to meet minimum energy efficiency requisites when government-backed renovation support is accessible or when obligations dictate such actions.

To catalyse change, the Estonian government has proactively sought to leverage the manifold advantages ESCOs offer in unlocking the country's energy efficiency potential. In 2018, the Ministry of Economic Affairs and Communications orchestrated a roundtable to explore enhanced government



support for this emergent sector and identify barriers requiring surmounting. Given Estonia's status as a relatively small market, the conventional ESCO business model might face challenges in sustainability. However, with adept governmental backing, the prospects for making the ESCO concept compelling expand considerably.

A strategic approach lies in refining ESCO offerings to precisely match the unique needs of different sectors, thereby unlocking significant energy-saving potential across industrial processes, industrial buildings, and the residential sphere. Additionally, establishing a comprehensive register of accredited companies on a national scale will streamline the adoption of ESCO solutions. A flourishing ESCO market would also extend new avenues for project financing within these diverse sectors [6].

Legal framework and market standing

In accordance with the Estonian National Energy Efficiency Action Plan (NEEAP) [7], Estonia has taken progressive steps to bolster energy services in alignment with the EED Article 18. The following measures have been executed:

- **Professional qualifications system:** Estonia has established and put into action a comprehensive professional qualifications framework. The objective is to cultivate a network of proficient specialists capable of delivering energy services throughout the country.
- **Stimulating energy services market:** The country has proactively supported energy audits for apartment buildings. Specific conditions governing this support have been outlined in a regulation issued by the Minister for Economic Affairs and Communications³. Funding for this initiative has been provided by SA KredEx, a government created financing institution.
- **Enabling Enhanced Solutions:** A series of analyses and projects have been undertaken to facilitate the integration of more effective energy service provisions across Estonia (47).

The future focus lies in the NEEAP's aspiration to transpose the requirements stipulated in Article 18 of the Directive. Estonia is determined to foster project-based energy services and amplify energy service reliability from a consumer's perspective. In terms of accessible data, the register of economic activities serves as a repository for information concerning various enterprises' operations. Enterprises are required to notify their economic activities, or information about licensed enterprises is circulated within this register. Enterprises operating as energy service providers and financial service providers must possess a financial institution license for their operations.

In the context of energy service companies (ESCOs), it's important to note that they remain a relatively modest market segment. A study conducted by SA Keskkonnainvesteeringute keskus (the Environmental Investment Centre) in 2013, titled 'An analysis of the possibilities for creating a market of energy service enterprises', highlighted that without supportive measures, the ESCO business model might face sustainability challenges in Estonia. However, the study indicated that, with the right support, the ESCO concept could indeed be implemented.

Critical insights from this study confirm that only a handful of companies in Estonia identify as energy service enterprises. These companies don't operate as energy service providers in the traditional

³ Regulation No 48 of the Minister for Economic Affairs and Communications of 12 June 2008, entitled 'Conditions and rules for conducting energy audits and expert assessments of buildings and for supporting the preparation of design documentation



sense, where payment is linked to future savings. Instead, purchasers primarily pay for investments, and in cases where energy savings surpass expectations, the resulting savings are shared between clients and energy service providers. Examining the current scenario through a segmented lens:

- **Housing Market:** Estonia's housing landscape is characterised by individually owned dwellings, with apartment properties having distinct owners. While the rental market constitutes a modest 15% of the total housing market, most apartment buildings have an apartment association formed by property owners. Despite favourable conditions for energy service operations in the housing market, ESCOs have shown greater interest in other sectors.
- **Commercial and Public Sector Buildings:** Private ownership defines the commercial sector's buildings, creating a conducive environment for energy service undertakings. In the public sector, buildings are owned by the state, local governments, or private entities established by them. Although the potential for energy savings projects exists, legal constraints and factors such as building condition influence their implementation. The rental sector's energy consumption is often determined by renters, making building owners less inclined to invest in energy efficiency. However, evolving real estate conditions have led to the integration of energy efficiency clauses into long-term rental contracts, indicating a positive trajectory for energy services.

Barriers to EnPCs in Estonia: exploring regulative, administrative, technical, market, financial, and social challenges.

When it comes to energy contracting, several hurdles emerge in various areas in Estonia as identified in the interviews with stakeholders. These hurdles can be grouped into four categories: rules and regulations, technical issues, financial barriers, and social factors.

- (a) Rules and regulations: Challenges include navigating public investment limitations and legal complexities. Inexperience in procurement processes adds to the complications. The absence of continuous energy-saving monitoring after renovations and the lack of strict rules to prove savings hinder progress.
- (b) Technical issues: Clients' lack of technical understanding and uncertainty about the future create difficulties. Technical details of energy contracts can be puzzling, and discrepancies between expected and actual building operation hours pose challenges. Ownership complexities in apartment buildings make decision-making tricky, and incomplete energy use measurement complicates the picture.
- (c) Financial barriers: Low awareness about energy savings, limited financing options for energy projects, and banks' unfamiliarity with energy services slow progress. Substantial upfront capital requirements hinder the adoption of Energy Performance Contracts (EnPCs), while lengthy payback periods deter investment.
- (d) Social factors: Lack of examples and limited awareness hinder adoption. The division of responsibility for energy-efficient outcomes complicates matters, and the unpredictability of post-renovation building use affects energy savings. Energy contracts are effective, but only under consistent usage conditions.



Table 5 Barriers to the energy performance contracting in Estonia.

Barriers	Description
Regulative/ administrative barriers	<ul style="list-style-type: none"> Limited public sector investment capacity and legal complexities: The constraint to make investments in the public sector, coupled with legal intricacies surrounding off balance sheet investments, acts as a significant barrier to implementing energy efficiency projects. The absence of sufficient experience in procurement processes presents a notable hindrance, impeding the smooth execution of energy efficiency initiatives. The absence of a requirement for continuous monitoring and verification of energy savings in buildings that have undergone energy efficiency renovations leads to a failure in achieving the intended energy conservation outcomes. The lack of stringent requirements to showcase energy savings contributes to reduced interest and motivation among building associations and residents, as they do not prioritise this aspect as a result (interview).
Technical barriers	<ul style="list-style-type: none"> Clients do not feel like equal partners; above all, they lack technical knowledge and understanding (interview source). Clients' uncertainty about the future Technical Complexities of Energy Service Contracts The disparity between the calculated operational hours of a building and its real operational hours undermines accurate energy efficiency evaluations (interview source). Apartment buildings characterised by complex ownership structures, where each apartment has a separate owner, create difficulties in planning and making energy performance contract (EnPC) and renovation-related decisions. Legal processes necessitate unanimous consent for transactions. Incomplete measurement of consumption components within buildings makes it challenging to differentiate sources of consumption and establish a proper baseline model. For example, heating and electricity measurements are at the building level rather than at more specific levels like zones or apartments (interview source). Conflicts between ESCOs and clients can emerge when energy efficiency savings and outcomes are not met. Often, these conflicts result not only from technical issues but also from changes in user behaviour, such as altered usage hours, number of users, and usage patterns (interview source).
Market and financial barriers	<ul style="list-style-type: none"> Awareness in the realm of energy saving is generally low. Energy service enterprises face challenges in financing projects. The concept of energy services is relatively new for Estonian banks and financial institutions. Clients' distrust towards energy services primarily relates to concerns about financial guarantees and associated risks. The need for substantial initial capital presents a major obstacle in EnPC contract implementation. ESCOs struggle to secure funds at favourable terms without guarantees. Banks may say that the guarantees no longer cover the loan balance as the risk becomes too great for them and they cannot give more loans (interview source). The extended payback period for insulating structures, often exceeding 25 years, doesn't align well with the business models of ESCOs and EnPC contracts (interview source).
Social barriers	<ul style="list-style-type: none"> The absence of demonstrated best practice examples and the limited understanding among potential clients regarding the economic potential of energy savings remain obstacles, hampering the adoption of energy contracting projects [7,8] On one side, the responsibility for achieving energy efficiency in renovation projects rests with technical consultants, contractors, and owner's supervisors due to clients' lack of expertise. On the other side, the post-renovation use of the building is hard to control and can greatly affect the attainment of energy savings. Energy Performance Contracts (EnPCs) can set the stage



for energy conservation but are subject to specific usage conditions. Actual savings depend on the building's usage patterns and aren't guaranteed if usage changes (interview source).

Drivers to EnPCs

In the pursuit of advancing energy efficiency and sustainable practices within the realm of building renovations, a careful examination of various drivers comes to the forefront. This table highlights a spectrum of potential drivers that could significantly influence the adoption and successful implementation of Energy Performance Contracts (EnPCs). EnPCs represent a strategic approach to enhancing energy efficiency by aligning incentives with results. The drivers outlined below encompass a range of technical, awareness-focused, market-oriented, and procedural aspects that collectively contribute to the viability and efficacy of EnPCs.

Table 6 Potential drivers to energy performance contracting in Estonia.

Potential drivers to EnPC	Description
Technical requirements	<ul style="list-style-type: none"> • The measured energy certificate should be calculated annually or 3 years after the building renovation. Annual calculations would enable comparing results and identification of further energy saving improvements in those 3 years. <ul style="list-style-type: none"> • Building associations should be required to guarantee and prove energy savings after renovation to keep energy renovation grants. • A share of the grant money should go towards post-renovation monitoring and follow-up works. • Heating should be measured at the apartment level to promote more sustainable behaviour of residents. • Conducting systematic checks to verify and equalize the competence and qualification of technical consultants.
Increasing awareness and consciousness about sustainability	Raising awareness and fostering consciousness regarding sustainability are integral elements in the EnPC landscape. By enhancing the informativeness of monthly utility bills, residents can gain insights into their energy consumption patterns and compare them against baseline apartments. This approach not only promotes informed decision-making but also acts as a catalyst for motivating renovations aimed at energy efficiency. Leveraging existing communication channels, such as energy bills, stands to amplify residents' comprehension of energy consumption and subsequently elevate their motivation for energy-saving measures.
Market approach	There is a need for a paradigm change to support ESCO and EnPC implementation in the public domain. Energy volume and energy unit costs should not be directly related. That is, monthly or annual costs on energy and energy savings should be a lump sum, which would motivate ESCO on the EnPC contract to improve energy performance further. Otherwise, if consumption is reduced and, thus, the budget is reduced, it would not motivate parties to save energy.
Monitoring and verification processes	<p>Increased measurement and specialized monitoring systems for energy purposes. Necessary for understanding energy savings potential, human behaviour, detecting anomalies, capturing as-is situations.</p> <p>To better manage the building, set up systems, and understand the energy consumption, the building needs to be equipped with energy meters. Also KredEx could develop a renovation monitoring system. Some portion of the money received from KredEx could be left for post-monitoring at the end of the renovation period.</p>
Standard documents and procedures	The realization of energy efficiency should be the responsibility of an entire team of technical consultants, designers, energy specialists, contractor, owner's supervisor. Moreover, checklists



	would greatly simplify the work of the owner's supervision and commissioning, while BIM technology would facilitate to properly document construction processes.
Automation systems	Implementing EnPC for building automation systems and lighting has the most significant potential. Focusing more on building automation and understand its importance especially for the case of non-residential buildings could enhance the uptake of EnPCs.

6.5 Case Study: Spain

Current status of EnPC regulations in Spain

Spain is categorized as having a relatively sizeable market for EnPC in the public sector contracting. The market has shown remarkable recovery and fast development, transitioning from an initial stage to a more mature one. Spain's EnPC market development is notable, though to a certain extent. The public EnPC market in Spain leads the respective ESCO market in the country, contributing to its growth within the broader European landscape. Spain concluded a total of 59 contracts in the field of EnPC, making it one of the countries with a substantial number of contracts. Spain holds a notable position in EnPC within the public sector contracting landscape. Spain is among the countries where facilitators play a role in activating the EnPC market. The availability of providers is relatively high in Spain, and there is a satisfactory level of provision, indicating that the EnPC market is adequately supported. (45)

Table 7 Market status of EnPC in the public sector in Spain - 2016 and 2019

	2016	2019
Spain	Slowly emerging. Private sector lead, public projects available.	Sizeable, developing (esp. lighting)

The estimation of the number of contracts and the overall market size for Spain's expertise in EnPC was based on expert estimates collected through a questionnaire by JRC. (45) These estimates were critically reviewed to ensure accuracy. The absolute values presented for Spain were compared to various factors such as the number of employees in the public sector and the area of public buildings. It's noted that for Spain, as well as other countries like Greece, the estimation of public sector size is influenced by the significant presence of public lighting, making the assessment of market size complex yet facilitating a more comprehensive comparison (45).

Table 8 Number and size of contracts

	Number of contracts	Overall size (m€)	Public employment (x1000)	Market/ public sector (€/employee)	Public buildings (Mm2)	Market/ public sector (€/m2 x1000)
Spain	59	60	2479	24	135	444

Table 9 shows the main regulations related to EnPC. The "Sustainable Economy Law," Royal Decree Law 6/2010 is the main piece of legislation addressing the Spanish energy services (ESCO) market and includes a section assigned to promoting the ESCO market and outlining measures following the European Energy Services Directive, ESD, 2006/32/ EC.

Article 1 of the royal decree establishes the purpose and provides definitions for key terms used within the regulatory framework for energy efficiency. The main objective of the decree is to promote actions



that enhance energy efficiency, energy savings, and reduction of greenhouse gas emissions, aligning with the energy efficiency goals of the European Union. Article 1 further provides definitions for energy performance contracting and energy service providers. The following are the defined terms:

- "Energy performance contract": Any contractual agreement between the beneficiary and the provider of an energy efficiency improvement measure, verified and supervised during the term of the contract, in which the investments (works, supplies or services) in such measure are paid as a result of a contractually agreed level of energy efficiency improvement or other agreed energy performance criteria, such as financial savings or contractual savings guarantee.
- "Energy service provider": Any natural or legal person that provides energy services or applies other measures to improve energy efficiency in the installation or premises of an end customer, in accordance with current regulations.

Article 19 (48) is assigned for the measures related to the ESCO, such as facilitating the knowledge of energy service companies and providing a list of qualified companies and their voluntary services. To promote the procurement of energy efficiency services, the government has approved the 2008–2012 Spanish Energy Saving and Efficiency Action Plan, which includes energy service companies as possible beneficiaries.

Contracts by public administration. As a result of the publication of new law 9/2017, of Nov 8, on public sector contracts⁴ and changes in the regulatory framework, IDAE⁵ adjusted the specifications of contracting between public administration and energy service companies under the typology of the mixed supply and services contract. Among the benefits that EnPCs provide for the public sector is that investments to increase energy efficiency are financed for entirely or in part with savings, and that the private sector takes the risk of the required works and installations and guarantees energy savings, utilising its experience to help achieve the best technical solutions. The legal regime and jurisdiction for two cases (without energy supply and with energy supply), conditions for the applicant ESCo, contract award procedure (based on technical and social assessment criteria, grants and subsidies for the successful bidder, etc. are specified in the template provided by IDEA to conduct this type of contracts between the ESCo and public parties. There is no specific regulation for residential EnPCs in Spain and specifically there is no regulation for residential EnPCs making difficult to perform them.

National program for OSSs. The Royal Decree 853/2021 (49) contains national program on supporting the citizens through provision of services by OSS. Chapter 3 of this document addresses the financial supports including the grants and subsidies for the OSSs. The national program aims to give subsidies for the provision of services facilitating the implementation and integral management of energy renovation projects in the residential sector for the citizens, homeowner associations, companies and contractors in general. Articles 21-29 contain different aspects, such as the target groups of the

⁴ Public party is involved in Spanish pilot and therefore, the legislations related to the public party and energy service company is needed to be considered.

⁵ The Institute for Diversification and Saving of Energy (IDAE) is an agency of the Ministry of Industry, Energy and Tourism through the Ministry of Energy, contributing to the targets of the energy efficiency, renewable energy and other low carbon technologies in Spain.



subsidies, the supported activities by the program, the amount and procedures for the grants and subsidies, etc.

Table 9 – regulations related to EnPC in Spain

Law, legislation, and regulations related to ENPC	Objectives
Sustainable Economy Law, Royal Decree Law 6/2010	(a) Promoting the ESCO market and defining measures consistent with the Energy Service Directive, ESD, 2006/32/EC (b) Facilitating the activities of energy service companies as a result of energy saving and energy efficiency action plan (2008-2012)
The law 9/2017	<ul style="list-style-type: none"> • Including rules for contracting between public body and ESCo
The new Directive 944/2019 [8]	<ul style="list-style-type: none"> • Concerning common rules for the internal market in electricity
The new Regulation 943/2019 [126]	<ul style="list-style-type: none"> • Concerning the internal market in electricity
Royal Decree 853/2021	<ul style="list-style-type: none"> • Setting a national program on the provision of subsidies and grants for the establishment of OSS supporting the energy retrofitting in the building sector

Barriers to EnPCs in Spain: exploring regulative, administrative, technical, market, financial, and social challenges.

The most important barriers identified to the provision of energy services in Spain, are the following:

(a) Regulative and administrative barriers

Table 10 highlights the regulatory and administrative barriers that impede the successful implementation of energy efficiency projects and energy performance contracting (EnPC). These barriers pose challenges to both public and private sectors, hindering the adoption of sustainable energy practices and impeding progress towards energy efficiency goals. This section critically examines the key barriers identified in the table, shedding light on their impacts and suggesting potential solutions to overcome them.

Table 10 Regulatory and administrative barriers of energy efficiency projects and energy performance contracting

Regulatory and administrative barriers	Description
The long-term duration of contracts can cause concern.	EnPCs often have long-term durations, which can raise concerns among community members. Committing to a long-term contract may create uncertainty or hesitation. To address these concerns, it is essential to effectively communicate the sustained benefits that can be achieved through the contract. This includes emphasizing the long-term energy cost savings that residents can enjoy, as well as the positive environmental impacts, such as reduced carbon emissions and increased sustainability. (interview).
The complex administrative process	The existing legal framework in Spain treats medium and large-scale energy generators, similarly, imposing the same legal requirements and administrative processes on both. This complex administrative process can be a significant hurdle for medium and large generators (interview and JRC report, 2020).
Lack of regulation for payments in kind and the	In the public sector, contracts involving large sums of money must undergo a public tendering process. However, there are challenges in implementing EnPCs due to the lack of regulation



energy trading market for EnPC	for payments in kind and the energy trading market. Negotiating joint supply agreements for similar buildings also poses difficulties, and the fixed budget in public tenders makes EnPC implementation challenging (interview).
Lack of regulations and incentives such as subsidies and tax benefits	There is a lack of detailed regulation and legislation regarding EnPCs. The private sector desires more regulations and incentives such as subsidies and tax benefits (interview).
Lack of flexibility regulations	The absence of comprehensive regulations on demand response and asset aggregations in Spain inhibits the development of EnPCs. This limitation hinders the integration of demand-side resources into electricity markets, restricting explicit demand response opportunities. To overcome this barrier, it is crucial for regulatory frameworks to evolve and provide flexibility that encourages the participation of various stakeholders in energy markets (ambience).
Lack of requirements for guaranteeing savings and leveraging private investment	Without clear requirements for guaranteeing energy savings and facilitating private investment, the adoption of EnPCs can be hindered. Establishing robust mechanisms for verifying and ensuring energy savings will instil confidence among investors and facilitate greater participation in energy efficiency projects (ambience).
Procurement bottlenecks and problematic procedures	Lengthy and complex procurement processes can pose challenges to implementing EnPCs. Slow decision-making processes, administrative burdens, and restrictive requirements can discourage potential participants. Additionally, the lack of regulation in Spanish legislation regarding payments in kind, such as energy savings, may complicate the formation and execution of EnPCs, as it leaves a significant aspect of such contracts ambiguous and potentially unreliable, potentially adding another layer of complexity and discouragement for parties interested in pursuing such agreements in Spain.

(b) Technical barriers

The implementation of energy efficiency projects and energy performance contracting (EnPC) encounters specific technical barriers that need to be addressed for successful outcomes. This table presents insights gathered from interviews conducted to explore the technical challenges associated with EnPCs. The challenges include energy savings control, the significance of the contract verification process in shaping new types of EnPCs, issues related to connecting the energy system to the grid, limited data accessibility, and the complexity of the measurement and verification process. Overcoming these technical barriers is essential to ensure the smooth operation and effectiveness of EnPCs, enabling optimal energy savings and enhancing the overall efficiency of energy efficiency projects.

Table 11 Technical barriers of energy efficiency projects and energy performance contracting

Technical barrier	Description
Energy savings control is a significant hurdle.	In an energy performance contract, the contracted company assumes the role of the energy manager for the property. They establish consumption limits, both upper (ceiling) and lower (floor) limits, and implement various measures to optimize energy usage, maximize savings, and minimize costs. This level of complexity and control over energy consumption may create reluctance among users or residents who may be unfamiliar with the intricacies of energy management. It requires clear communication and education to address concerns and ensure users understand the benefits and potential energy savings that can be achieved through the contract (interview).
Contract verification process	The contract verification process is an important factor in shaping new types of EnPCs. Exploring new business models requires clarity to ensure transparency and security. Addressing issues such



	as the aggregation of homes can optimize costs for companies involved in renovation and residential improvement (interview).
Challenges related to the connection of the energy system to the grid	One technical challenge relates to the connection of the energy system to the grid. The Distribution System Operator (DSO) is hesitant to provide connection points for EnPC systems due to concerns about potential overloads on the grid.
Lack of full data accessibility	Access to data is a problem as companies offering service improvements based on consumption do not provide full data accessibility. They only offer limited on-demand services based on their conditions. Building owners own the consumption data, but accessing it requires independent setup of storage and access structures to maintain control over the data under desired conditions (interview).
Complexity in measurement and verification process	EnPCs are technically complex, requiring better methodologies or services to simplify measurement and verification processes, particularly for small and medium ESCOs.

(c) Market and financial barriers

- Limited access to flexibility markets: Distributed Energy Resources (DER) cannot enter the DR market or the balancing markets.
- Lack of explicit support programmes for promoting DER penetration in the markets.
- Market concentration with high entry costs.
- Absence of a market party (known as an "independent aggregator") in charge of aggregation.
- Lack of in-house capacity to engage with energy performance interventions (JRC, 2020)
- Lack of suppliers willing to participate in tenders.
- Access to funding for providers to participate in EnPC under public sector contracts can be problematic, especially for off-balance sheet contracts (JRC, 2020)
- The private funding of EnPC providers is at a disadvantage because to the preferential governmental financing of municipalities.

EnPCs are not suitable for all situations but are most effective in cases where significant savings can be achieved. They are complex and require additional costs, including the resources needed to explain the model to homeowners without technical backgrounds. Therefore, EnPCs should be applied where they can have a substantial impact, such as industries, large tertiary buildings, or neighbourhood-scale renovations, where there is a high quantity of targeted houses, equipment, and energy consumption.

(d) Social barriers

The successful implementation of energy efficiency projects and energy performance contracting (EnPC) is influenced by various social barriers that need to be addressed. Table 12 highlights insights obtained from interviews conducted regarding the social barriers specific to EnPCs. The interviews were conducted in an undisclosed location, shedding light on challenges such as the difficulty for end users to understand certain aspects of EnPCs, the long-term commitment required from clients, the complexity of engaging with building owners in the residential sector, and the lack of awareness among community members.



Table 12 Social barriers of energy efficiency projects and energy performance contracting

Social barrier	Description
Difficulty in processing different aspects of EnPC by the end users	the average residential user finds it challenging to comprehend certain aspects of energy performance contracts. Factors such as energy price fluctuations and climatic conditions make decision-making difficult, emphasizing the importance of conducting cost-benefit analysis (interviews in Ebento). The lack of understanding and trust in the model and measurement methodologies by building owners and homeowners can be a significant obstacle to the widespread adoption of EnPCs.
Require long term commitment of the client	One of the barriers is the cautious attitude of clients towards entering into long-term contracts. EnPC contracts in Spain typically last around 10 years, which requires a significant commitment from the client. As a result, not all clients are willing to engage in this type of agreement (interviews in EBENTO).
Complexity of having contract with the building owners of the residential sector	EnPCs and PPAs primarily target industrial clients and municipalities, as they often face difficulties in reaching agreements with residential building owners. In Spain, residential buildings are typically owned by multiple families, making it more challenging to reach a consensus with various stakeholders. Moreover, the financial analysis of individual clients in residential buildings may be less accurate, further complicating the financial discussions (interviews in EBENTO).
Lack of awareness among community members	Lack of awareness among community members about energy performance contracts can hinder their adoption. Many residents may not be familiar with the concept or the potential benefits. However, the availability of incentives and grants for housing renovation has generated interest in these contracts. These incentives provide financial support and serve as incentives for community members to consider energy performance contracts. Additionally, the active support and involvement of community leaders are crucial for successful project execution. Community leaders can help raise awareness, educate residents about the benefits, and garner support for implementing energy performance contracts

Drivers to the EnPCs in Spain

EnPCs are gaining traction as a means to promote sustainable energy consumption and reduce reliance on fossil fuel-based sources. This table presents insights gathered from interviews with experts in Valencia, Spain, regarding the drivers and potential drivers influencing the adoption of EnPCs in the region. Understanding these factors is crucial for stakeholders involved in the implementation and promotion of EnPCs, as they contribute to the overall success and impact of such initiatives in Valencia and potentially other areas as well. The expert interviews shed light on the importance of energy districts, increased awareness of sustainability, financial support, third-party financing, participatory approaches, and the role of transparency and information in enhancing project ambition and trust within the local context.

Table 13 Drivers and potential drivers to energy performance contracting in Spain.

Drivers and potential drivers to EnPC	Description
Energy districts	Energy districts refer to the concept of harnessing renewable energy sources within a specific geographical area or district. By implementing renewable energy systems such as solar panels or



	<p>wind turbines within the district, energy generation can be decentralized and localized. This approach allows for efficient utilization of renewable energy resources, reducing energy losses during transmission and distribution. As a result, individual residential properties within the energy district can benefit from improved energy consumption efficiency, lower energy costs, and reduced reliance on fossil fuel-based energy sources.</p> <p>Including district and city-level solutions is crucial to the evolution of the entire ecosystem surrounding individual homes. Local governments play a vital role in providing assistance and support, while residents' engagement promotes community awareness and a higher quality of life, integrating with the city.</p>
Increasing awareness and consciousness about sustainability	<p>While profitability and cost remain crucial factors for users and investors, there is an increasing awareness and consciousness about sustainability, influencing decision-making. Private investors are showing growing interest in projects that promote sustainability, reflecting concerns for environmental and social impact.</p>
Financial support	<p>Grants play a vital role in the viability and profitability of energy performance contracts. However, interviews suggested decreasing housing taxes for buildings that are renovated and that prove (through EnPCs) their energy improvements and savings.</p>
Third party financing	<p>While financing is not a primary focus for EnPCs, it adds credibility to the project's impact. Homeowners are free to seek financing from third parties, ESCO ensures the projected impact and savings. Collaboration with banks offering favourable financing products for renovation projects helps increase trust, as banks consider ESCO's technical expertise beneficial in reducing risks.</p>
Participatory approach	<p>The involvement of municipalities and public administrations is crucial to building trust and credibility among homeowners. Municipal support is especially important in the residential sector, as the technical complexity of EnPCs may be a barrier that public administrations can help overcome.</p>
Providing transparency and information	<p>EnPCs enhance project ambition and trust among all stakeholders involved. By providing transparency and information about various alternatives, EnPCs instil trust and enable owners and Energy Service Companies (ESCOs) to be more ambitious in project definition and implementation. When there is clarity regarding costs and anticipated impacts, stakeholders are more likely to pursue ambitious goals compared to situations where information and transparency are lacking</p>

6.6 Case Study: United Kingdom

Current status of EnPC in the UK

In the dynamic environment of the UK's Energy Performance Contracting (EnPC) sector, at least 30⁶ active companies navigate diverse industries, often leveraging EnPCs to augment their core operations. These firms range from specialist energy service companies (ESCOs) to technology providers and facilities management services, embodying a spectrum of specialties within the energy realm (50). This diversification in the sector is particularly evident when looking at the evolution of contractual clarity and flexibility in the UK between 2010 and 2013.

This period marked significant progress in the enhancement of contracts, driven by the development and dissemination of standardized contract models and new definitions, like those found under the

⁶ Latest data in 2018



UK's RE:FIT programme. The emergence of these elements has paved the way for more adaptable contracting processes, enabling a level of flexibility not observed in earlier years (Bertoldi, 2017) (51). The enhancement in contract clarity and adaptability has had repercussions on the preferred types of contracts in the public sector.

Despite the availability of a model contract for ESCOs, contracts under public sector frameworks, such as the Retrofit Accelerator (RE:FIT) and The Carbon & Energy Fund (CEF), are more prevalent. These specialized frameworks have been fundamental in bolstering the usage of energy performance contracts in the public sector, focusing sharply on energy renovation. However, the intricacies involved in revising each contract case-by-case could potentially pose challenges and may risk impairing the mutual trust between the involved parties (52).

Integrating smoothly with this contractual landscape are EnPC facilitators—organizations offering essential support in various aspects of the EnPC, without being either the client or provider. Entities like Turner & Townsend and Ecovate have been crucial in public procurement frameworks, contributing services in project development and energy consultancy, and managing project development units as necessary. The involvement of these facilitators intertwines with the broader push for formal recognition and accreditation of ESCOs.

The absence of a formal accreditation procedure for ESCOs in many countries, including the UK, raises challenges in assuring potential clients about the capability of ESCOs to deliver the requested services. To mitigate this, the Energy Services and Technology Association (ESTA) in the UK is spearheading efforts with its draft accreditation scheme (52), which aligns with the global focus on the implementation of effective energy audit regulations.

These energy audit regulations are instrumental in shaping ESCO activities worldwide, determining the obligatory demand for ESCO-related services from public and private entities (52). The UK demonstrates a proactive stance in this regard, fostering an environment conducive to energy flexibility services and implementing progressive policies such as the “Smart Systems and Flexibility Plan.” This innovative initiative is a significant step towards removing barriers to smart technologies and fostering markets that reward energy flexibility, thus allowing specialized companies to access equitable financial returns (Erwin, 2020) (53).

[Barriers to EnPCs in the UK: exploring regulative, administrative, technical, market, financial, and social challenges.](#)

(a) Regulative and administrative barriers

Table 14 highlights the regulatory and administrative barriers that pose challenges to energy efficiency projects and energy performance contracting. These barriers include regulatory uncertainty and insufficient rewards, lack of comprehensive support for financial schemes, and the absence of supportive rules for innovative business models like Energy Performance Contracting.



Overcoming these barriers is crucial for promoting energy efficiency and driving sustainable improvements in the energy sector.

Based on the recent report by UN, there is not many barriers due to existing ESCO-specific regulation of the following types:

- Contract format is not without drawbacks but have been the base for strong growth in EnPC.
- No public super ESCO, but public frameworks exist that act as super.
- Access to the government funding.

Table 14 – Regulative and administrative barriers of energy efficiency projects and energy performance contracting

Regulative and administrative barrier	Description
Regulatory uncertainty and insufficient rewards	In the UK, aggregators participate in the energy system more actively than in other countries. According to UK customer surveys, the primary barriers to participating in demand services through an aggregator are regulatory uncertainty and insufficient rewards. The main motivation is to generate income from existing assets like backup generators, CHP, or renewable generation (Erwin, 2020).
Lack of supports for promoting the financial schemes	To effectively promote retrofitting, financial schemes must be accompanied by additional support. Simply providing financing is not enough to drive upgrades in buildings. Large governmental grant schemes often go unutilized unless they are complemented by factors such as information dissemination and the availability of innovative finance products (from the interview).
Lack of supportive rules for innovative business model of energy performance contracting	According to one of the interviews, a few years ago, the council made an attempt to utilize the Energies prong approach for upgrading its residential housing. They have continued to collaborate with Energies prong in implementing retrofit projects, and as a result, over 100 buildings have been upgraded under this initiative. However, one significant barrier they faced was their inability to incorporate Energy Performance Contracts (EnPCs) as a means to finance these projects. The main challenge stemmed from the council's inability to justify linking the procurement of services to the rent of the properties. The idea was to reflect the payment for energy improvement upgrades through higher rental fees for those properties. However, the council's procurement rules prevented them from justifying such a significant investment, which was essentially viewed as advanced maintenance costs, and then recovering these expenses through rent increases. As a result, this barrier hindered the council from effectively utilizing EnPCs as a funding mechanism for the retrofit projects, despite their ongoing partnership with Energies prong (from the interview with a property owner – social housing provider).

(b) Technical barriers

The following table highlights several technical barriers identified in the context of energy efficiency projects and performance measurement. These barriers were discussed in interviews with experts and stakeholders involved in the UK. The table provides a concise description of each barrier, shedding light on the challenges faced in areas such as data sharing, professional skills, data privacy, government support, tampering risks, and standardisation. By understanding these barriers, it becomes possible to identify key areas for improvement and develop strategies to overcome these challenges to promote effective energy efficiency initiatives and achieve desired outcomes.



Table 15 Technical barriers of energy efficiency projects and energy performance contracting

Technical barrier	Description
The lack of shared energy data poses a barrier to measuring performance	In the interview with a UK expert working on the SHDF, it was mentioned that the government wants to measure thermal performance using smart meter data. However, a major problem is that the smart meter data is private and not shared, which makes it difficult to achieve this goal.
Lack of professional skills on energy efficiency	Due to their lack of knowledge and focus on immediate profits, ESCos may fail to create new business models for emerging technology. The expense of switching to a net-zero network using traditional DH serves to highlight this. When using gas boilers, the cost of heat in Glasgow, for instance, could increase from about 4p/kWh to 12-15p/kWh (Angelidis, 2023).
Lack of skills have limited the learning from projects	In the context of the UK case being discussed, it was mentioned by an interviewee that the SHDF team had a limited background or lack of experience in retrofitting. As a result, they were unfamiliar with the right set of questions to ask and how to effectively analyse the data they received related to retrofitting projects. Additionally, the interviewee mentioned their involvement in a demonstrator project where the responsibility for providing feedback on the project's progress and outcomes rested with the sustainability manager. This meant that the sustainability manager was responsible for assessing the project's sustainability and making recommendations for improvement. However, this arrangement had certain limitations. It placed constraints on the team's expertise and capacity, which means they may have faced challenges in fully understanding and extracting valuable insights from the data collected. These limitations could have potentially hindered their ability to derive meaningful learnings and make informed decisions regarding the project.
Data privacy is a likely barrier to innovative energy performance contracting such as P4P	Data privacy presents a potential obstacle to the implementation of pay-for-performance (P4P) schemes. Companies express concerns about the collection of data due to the burden of privacy implications and the requirements for data management and analysis (from the interview).
Metered energy savings is under discussion but not supported by the government yet.	The concept of metered energy savings is currently being discussed but has not yet received government support. It is included in the PAS2035 standard, and projects like Carbon Co-op's Retrometer are exploring this approach. Ofgem, the energy regulator, advocates for the use of metered energy savings, but the government has not made it a requirement yet (from the interview).
Tampering with and sabotaging monitoring equipment pose significant challenges.	Providing accurate and reliable information to residents is crucial to mitigate the risks associated with tampering (from the interview).
Need open and common standards in the sector for EnPCs	In order to effectively use EnPCs, it is crucial to quantify energy savings and establish open and standardized criteria. These standards should define the calculation methodology, allowing for independent verification of measures and the possibility of arbitration, thereby preventing confusion and ensuring that expectations align with reality.
The cost-effectiveness of the energy saving measure	In EnPC, it is important to prioritize practicality. Initially, the plan was to replace gas boilers with heat pumps. However, after evaluating the building fabric and other measures, it was discovered that gas usage was already very low. Consequently, in cases where boilers were in good working order, they were not replaced due to insignificant emissions savings and the ability to allocate financial resources more effectively to improve other properties. This highlights the need for thorough assessments in energy performance contracting to optimize outcomes (from the interview with a property owner – social housing provider).

(c) Market and financial barriers



Table 16 explores various market and financial barriers that hinder the progress of energy retrofit projects. These barriers have been identified through interviews and reports, providing insights into the challenges faced in the market. Each barrier is described concisely, covering important aspects such as resistance to "pay for performance" schemes, issues related to incentives and mandates, the impact of a monopolistic energy model, the complexity of pay-as-you-save schemes, insurance limitations, the gap between building owners' expectations and EnPC, lack of support for financial schemes, performance uncertainty, and high financing costs. By understanding and addressing these barriers, it becomes possible to devise strategies that promote market growth, encourage financial support, improve customer satisfaction, mitigate uncertainties, and facilitate cost-effective financing options for energy retrofit projects.

Table 16 Market and financial barriers of energy efficiency projects and energy performance contracting

Market and financial barriers	Description
The sector is resisting 'pay for performance'	Some major companies in the sector are opposing the adoption of 'pay for performance' due to their vested interest in the simplicity and advantages of using predetermined or estimated energy savings.
Split incentives⁷ and illustration of mandates.	The UK's ESTA reports that split incentives and responsibilities are mentioned in their jurisdictions and that they do not promote the use of ESCOs because the building's user - or the party responsible for paying the bills - obtains the benefits through lower energy use and emissions (UN, 2022).
Monopolistic energy model	Shifting from the current monopolistic energy model in which huge Energy Supply Companies (ESCOs) sell heat to consumers to a more open access market (from consumers to prosumers), providing energy as a service, essentially selling comfort (Angelidis, 2023).
The complexity of pay-as-you-save schemes	The complexity of pay-as-you-save schemes can hinder their success. While such schemes have been attempted, overly complicated designs are bound to fail. Government schemes that do not align with real-world needs are swiftly rejected. Detailed service design and a streamlined end-to-end process are crucial for effectiveness. Simplifying the process as much as possible is vital to ensure ease of use for participants.
Insurance is a fundamental barrier to retrofit in the UK - from failed projects and separation from the EU.	The interviewee mentioned that the poor retrofit practices have led to catastrophic failures, such as fires, in some cases. As a result of the Grenfell incident, insurance companies no longer provide coverage for foam-based materials used in retrofitting. One potential solution to this issue is government intervention to assume liability and provide insurance coverage. This intervention could have a significant impact.
The gap between the building owners' expectation and the EnPC	Homeowners have expressed dissatisfaction with the results of specific energy retrofits, as their expectations were not met. An example involves a homeowner who aimed for a warmer house but encountered damp issues instead. To tackle this problem, one possible solution is to utilize an Energy Performance Certificate (ENPC) to explicitly outline the contractual responsibilities, potentially mitigating such issues (from the interview).
The issue of performance uncertainty	The issue of performance uncertainty, encompassing the effectiveness of retrofit measures and the quality of the work undertaken, has a substantial impact on the

⁷ In the ESCO market, split incentives refer to situations where the benefits and costs of energy efficiency improvements are divided between different parties, creating a barrier to the adoption of ESCO projects. This occurs when the entity responsible for implementing the energy efficiency measures (ESCO) is not the same entity that directly benefits from the resulting energy savings (e.g., the building owner or tenant). The misalignment of incentives can make it challenging to reach agreements and hinder the widespread implementation of ESCO projects.



	financing of such measures. It raises important questions about the actual performance and workmanship, which in turn lead to considerations of liability for either the homeowner or the lender. These uncertainties directly affect insurance coverage and create obstacles that prevent lenders from expanding their offerings and participating more extensively in scaling up retrofit projects (from the interview).
High costs of financing energy retrofits	Finance poses a significant challenge when it comes to achieving substantial changes in domestic retrofit. High costs of finance, elevated interest rates, and the disparity between guarantees and savings models create hurdles in this regard. It is crucial to differentiate between households based on their financial capabilities and interest in home improvements. Currently, savings models predominantly drive domestic retrofit efforts, but they fail to install sufficient confidence for low-cost financing. Enhancing confidence could be achieved by increasing the utilization of guarantees. Energy Performance Certificates (EnPCs) are not suitable for lending purposes, highlighting the need for regulatory measures to enhance data collection and address this issue (Provider OSS).

(d) Social barriers

Table 17 presents several social barriers that hinder the progress of energy efficiency initiatives in the UK market. These barriers are influenced by factors such as lack of trust, low priority for energy efficiency, limited awareness among clients, and complexities in ownership structures. Understanding and addressing these social barriers is crucial for promoting effective energy efficiency measures and achieving sustainable outcomes.

Table 17 Social barriers of energy efficiency projects and energy performance contracting

Social barrier	Description
Lack of trust	Customers and ESCOs alike expressed concern about the quality of the ESCOs providing services in the UK market. In the ESCO market, trust is a key concern. Poor quality ESCOs that make overly ambitious claims about technical capability or fall short of deadlines that are too optimistic have hurt trust. Customers expressed concern that ESCOs favour the easiest projects, which was related to their mistrust. The technical validity of contracts for energy services has also been harmed by a terrible mismatch between the skills of energy auditors and the specialised processes used by clients.
Low priority for energy retrofit	In the UK, energy retrofitting is often overshadowed by immediate, short-term concerns and more visible initiatives. Economic constraints, perceived inconvenience, and underestimated benefits lead to its deprioritization despite the understood long-term gains in efficiency and environmental impacts.
Lack of awareness amongst clients and develop new routes to access service companies	There's a notable lack of awareness in the UK about the benefits of energy services and the availability of service companies specializing in energy retrofitting. This knowledge gap results in missed collaboration opportunities for enhancing energy efficiency
Comfort takeback: A Barrier to Performance-Based Returns in Low-Income Households	Comfort takeback refers to a situation where low-income households, after receiving energy-efficient upgrades, may unintentionally increase their energy consumption due to the improved comfort levels. This phenomenon could pose a challenge when implementing performance-based returns, as a focus solely on energy savings may not accurately reflect the actual energy usage and overall performance.
Complexity in the ownership	Implementing Energy Performance Contracts (EnPCs) in domestic properties is a more intricate process compared to municipal or commercial buildings. The participant has had



successful experiences utilizing EnPCs in commercial projects, but unfortunately, they encountered failures when applying them to domestic buildings. A significant contributing factor to these failures was the stark contrast between the ownership structures. Commercial projects typically involve single or few owners, whereas domestic buildings often have numerous owners with diverse motivations and interests. This complex ownership dynamic posed challenges for the implementation of EnPCs in domestic properties (from the interview with a property owner – social housing provider and provider of OSS).

Drivers to the EnPCs in the UK

Policy driver. ECO is a well-established policy that has already played a significant role in improving the warmth of homes and reducing emissions. With ECO4, there will be a growing emphasis on providing support to owner-occupied households, aligning with other policies aimed at decarbonizing the housing stock.

Under ECO4, a new approach called 'pay for performance' will be introduced. The government aims to obtain more precise performance data and, therefore, ECO4 will incorporate the requirement for pay for performance. This approach will help secure funding and provide additional support for projects. Currently, we are awaiting the publication of guidance on how pay for performance will be implemented under ECO4.

Market driver. According to one of the interviewees, mortgage companies have become increasingly aware of the significance of providing financial products to enhance the energy efficiency of buildings. Remarkably, even in the absence of policy incentives and relatively low demand, the market for secured lending products that facilitate energy-efficient building upgrades has witnessed substantial growth.



7 Conclusion

The entire building stock will need to be highly energy efficient and carbon-neutral by 2050 to achieve the EU's climate objective. In order to achieve these ambitious targets, different strategies and potentials have to be explored. Energy Performance Contracting (ENPC) is one promising option to boost renovation rates and achieve the ambitious EU targets. The target of the analysis in this report was to provide a general overview on the status of the market development and business models of EnPCs as well as the main barriers and drivers and the legislative framework for EnPCs in the European Union and particularly in the pilot countries of the EBENTO project. The methodological basis for the elaborations in this report is a literature research and analysis and expert in-depth interviews with national key stakeholders relevant to EnPC. There are hardly any ESCO project in the residential sector. There are a number of challenges, which contribute to this, including: lower expected savings due to the inability to effectively control the energy-related behaviour of individual residents, dispersed ownership of residential units, non-standardised residential buildings, the time and effort that would be required to coordinate such a project with individual homeowners.

The business model analysis outlines and describes the well-established basic EnPC business models where the investment costs of energy efficiency and RES measures are played back through the gained energy savings. The analysis also outlined the main characteristics of EnPCs as well as the most common EnPC categories such as the shared savings model and the guaranteed savings model and the most common financing schemes. Furthermore, the analysis reveals that new innovative business model approaches focus on the integration of demand response and flexibility services and revenues in the EnPC business model. The analysis of the current market situation showed that an initial EnPC market development took place in all European countries but there is only a slight market growth. Especially in the residential sector, EnPCs mainly involve only smaller, technological measures, rather than deep renovation. There are several barriers that hinder a broader market growth. One central barrier are the long payback periods of more than 20 years in many cases. This leads to long contract durations which are not reasonable for many clients, especially in the residential sector. The lack of trust in the EnPC concept and the ESCO industry is another major barrier that was mentioned in the interviews and in the literature review. Reasons for this mistrust are missing best practice examples, inhomogeneous offers, lack of competition and a lack of standardized measurements and verification processes. Other barriers that were identified in the analysis are a lack of awareness and understanding, high complexity of EnPC as well as high transaction costs, the split incentive dilemma and insufficient energy efficiency targets. The most relevant drivers of EnPCs in residential sector are increasing energy costs, supportive schemes and the availability of competent facilitators or support services (e.g. one-stop-shops). Higher energy costs increase the profitability of energy efficiency measures and therefore reduce payback time and contract duration of EnPCs. Facilitators can support in the planning and contracting phase and thereby help to overcome the barriers regarding complexity and mistrust against EnPC and ESCOs.

D2.1 also explored the legal and contractual requirements for the EBENTO pilot cases. Greece's EnPC sector is in its early stages, mostly focused on public lighting. The market is valued at €100 million, with key initiatives like the PRODESA project aiming to set a best practice model. Estonia's EnPC market is



at a budding stage, marked by its first project in 2019 via the EFFECT4buildings initiative. ESCO solutions flourish among commercial and industrial sectors, notably in food production. However, smaller businesses, the public sector, and residences show slower progress. ESCOs hesitate to invest in residential structures due to high retrofitting costs and extended payback periods. Spain's EnPC market has progressed from its initial stages to a mature state, marked by 59 contracts and an estimated €60 million market size. While regulatory hurdles, technical complexities, and awareness gaps persist, facilitators and providers play a pivotal role in its advancement. In the UK, the ESCO market is modest, with limited local authority participation. Improved contract clarity and the use of public sector frameworks like RE:FIT and CEF have bolstered energy performance contracting. Public frameworks act as super ESCOs, offering government funding despite lacking ESCO-specific regulations. Barriers to EnPC growth include regulatory uncertainty, split incentives, technical challenges, and resistance to innovation.

The analysis of the legal framework showed that at EU level, ESCOs and EnPCs rely on a comprehensive regulatory framework, which provides the appropriate definitions and other provisions to promote energy services contracts, dedicated financial instruments, certified and qualified energy services providers, and monitoring and verification methodologies. The Energy Efficiency Directive (EED) is the main regulatory instrument calling Member States to take actions to strengthen the energy services market. Due to the EED and other supportive legislation, in the last decades there has been an increased interest in energy services and the average ESCO market in the EU has been steadily risen. Most of the Member States have introduced appropriate legislation in the national regime for the establishment of energy services market, including for energy service providers and EnPCs. However, the actual implementation of the legislative framework and operation of the market is very inconsistent. There are large number of provisions that are not (yet) properly transferred in national legislation, while in some Member States the market is still immature. EnPCs are used in the public sector. The revised treatment of the Eurostat rules on public debt and deficit now allows public authorities to renovate their buildings with investment that originates from the private sector more easily.

The diffusion of EnPCs is still far from its potential, even in developed markets. In many cases the main barriers are legislative. A more standardized approach can help in growing the market, simplifying transactions and lowering their costs. Information and awareness raising should be significantly improved. Lists of providers (ESCOs) are generally considered very helpful to customers as they can use them to understand what the market offers. Facilitators for EnPC and energy agencies have an important role to play, especially in the public sector. Handling of complaints in the energy service market is another area that requires special attention. The experience of some Member States on the use of an ombudsman or other form of dispute resolution, with no or low costs and short, fixed response times, is working for complaints of citizens/small users with energy suppliers and providers of energy services.

Financial support and incentive (e.g., tax motivations) are still needed, especially in countries with immature market. Member States should also use effectively European Funds with a smart mix of finance schemes, promoting the use of EnPCs and ESCOs. In addition, good practices at national/regional level and lessons learned from EU Funded projects should be better communicated



among Member States. The revision of the national legislative framework, especially with regards to the revised EED and EPBD as part of the 'Fit-for-55' package, offers a unique opportunity to resolve any legal barrier and provide the appropriate incentives for the promotion of the energy service market and the wide-spread application of the EnPCs.



8 References

1. Effect4buildings. <https://www.effect4buildings.se/>. [Online]
2. RE:FIT. <https://www.refitproject.eu/>. [Online]
3. European Commission. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS. *A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives {SWD(2020) 550 final}*. 2020b.
4. Lowe, A, et al. Quantifying Thematic Saturation in Qualitative Data Analysis. *Field Methods*, 30(3). 2018.
5. Bertoldi, Paolo, Rezessy, Silvia und Vine, Edward. Energy Service Companies in European Countries: Current Status and a Strategy to Foster their Development. *Energy Policy* 34. 2006.
6. Csaszar, Catalin, et al. Adapted Business Models for Energy Performance Contracting in the Public Sector. *D2.1 EPC-INTRANS Capacity Building on Energy Performance Contracting in European Markets in Transition*. 2015.
7. Vanstraelen, Lieven, Marchand, Jean-Francois und Casas, Miguel. Increasing capacities in Cities for innovating financing in energy efficiency. *CITYNVEST*. 2015.
8. Taylor, R.P., et al. *Financing energy efficiency: lessons from Brazil, China, India, and beyond*. s.l. : World Bank Publications, 2008.
9. Sorell, S. The economics of energy service contracts. *Energy Policy*. 2007, Bd. 35, S. 507-521.
10. Nolden, C. und Sorell, S. The UK market for energy service contracts in 2014–2015. *Energy Efficiency*. 2016, Bd. 9, S. 1405–1420.
11. IEA. Energy Service Companies (ESCOS). <https://www.iea.org/reports/energy-service-companies-escos-2>. 2018.
12. Pätäri, S. und Sinkkonen, K. Energy Service Companies and Energy Performance Contracting: is there a need to renew the business model? Insights from a Delphi study. *Journal of Cleaner Production*. 2014, Bd. 66, S. 264-271.
13. Bertoldi, P., Rezessy, S. und Vine, E. Energy service companies in European countries: Current status and a strategy to foster their development. *Energy Policy*. 2006, Bd. 34, 14.
14. Winther, T. und Gurigard, K. Energy performance contracting (EPC): a suitable mechanism for achieving energy savings in housing cooperatives? Results from a Norwegian pilot project. *Energy Efficiency*. 2017, Bd. 10, S. 577–596.
15. fiCompass. European Structural and Investment Funds (ESIF) and Energy Performance Contracting (EPC). 2017.
16. Economidou, Marina, Todeschi, Valeria und Bertoldi, Paolo. Accelerating Energy Renovation Investments in Buildings. *JRC Science for Policy Report*. 2019.
17. SmartSPIN. D2.1 Review of Existing Business Models for Smart Energy Services. *SmartSPIN*. 2022.
18. Bianco, V., et al. Business models for supporting energy renovation in residential buildings. The case of the on-bill programs. *Energy Reports*. 2022, Bd. 8, S. 2496–2507.



19. Moles-Grueso, Sergi, Bertoldi, Paolo und Boza-Kiss, Benigna. Energy Performance Contracting in the Public Sector of the EU - 2020. *JRC Science for Policy Report*. 2021.
20. Neyestani, Nilufar. D2.1 Active Building Energy Performance Contract concept and methodology. *Ambience project*. 2020.
21. AMBIENCE. <https://ambience-project.eu/>. [Online]
22. SmartSPIN. <https://www.smartspin.eu/>. [Online]
23. Aranda, J., et al. Innovative Data-Driven Energy Services and Business Models in the Domestic Building Sector. *Sustainability*. 2023, Bd. 15, S. 3742.
24. EaaS. <https://www.rff.org/publications/issue-briefs/energy-service-business-model-expanding-deployment-low-carbon-technologies/>. [Online]
25. Level(s). https://environment.ec.europa.eu/topics/circular-economy/levels_en. [Online]
26. Mayer, A., et al. Energy performance contracting in the European Union: creating common "model" definitions, processes and contracts. *Institute for Building Efficiency*. 2010.
27. NEON. D2.2 multi-actor energy performance contracting. *NEON - Next Generation Integrated Energy Services for Citizen Energy Communities*. 2022.
28. ClimACT. E2.7.1 - Easy Guide on EPC Business Models. *CLIMACT - Acting for the transition to a low carbon economy in schools - Development of support tools*. 2017.
29. Commission, European. Analysis of the national long-term renovation strategies. [Online] 2022. SWD-Analysis-of-2020-LTRS.PDF (europa.eu).
30. Buildings Performance Institute Europe (BPIE). *ENERGY SERVICES AND THE RENOVATION WAVE*. 2020.
31. Bleyl, J. [Befragte Person] Joanneum Research. *Current market situation, barriers and drivers of EPC in the residential Sector*. Graz, 26. 04 2023.
32. Suhonen, N. und Okkonen, L. The Energy Services Company (ESCO) as business model for heat entrepreneurship-A case study of North Karelia, Finland. *Energy Policy*. 2013, Bd. 61, S. 783–787.
33. Moles-Grueso, S., Bertoldi, P. und Boza-Kiss, B. *Energy Performance Contracting in the Public Sector of the EU – 2020*. European Commission. Luxembourg : Publications Office of the European Union, 2021. Policy Report. EUR 30614 EN.
34. Polzin, F., von Flotow, P. und Nolden, C. What encourages local authorities to engage with energy performance contracting for retrofitting? Evidence from German municipalities. *Energy Policy*. 2016, Bd. 94, S. 317-330.
35. Frangou, M., et al. Renewable energy performance contracting in the tertiary sector Standardization to overcome barriers in Greece. *Renewable Energy*. 2018, Bd. 125, S. 829-839.
36. Bertoldi, P. und Boza-Kiss, B. Analysis of barriers and drivers for the development of the ESCO markets in Europe. *Energy Policy*. 2017, Bd. 107, S. 345-355.
37. Boza-Kiss, B., Toleikyte, A. und Bertoldi, P. Energy Service Market in the EU: Status review and recommendations . *JRC Science for Policy Report*. 2019.
38. Ewald, J., et al. Saving energy in residential buildings: the role of energy pricing. *Climatic Change*. 2021, Bd. 167, 18.



39. Joint Research Center. JRC Visitors'Centre: May – Nov 2015. [Online] 2015. https://s3platform.jrc.ec.europa.eu/documents/20125/282807/Presentation%20BCN%20-%204%20May%202017_Fabrizio%20Guzzo.pptx/1228140c-060f-2014-e52a-81fe1a426d50?version=1.1&t=1619525887308.
40. [Online] Long-term renovation strategies (europa.eu) .
41. [Online] SWD-Analysis-of-2020-LTRS.PDF (europa.eu) .
42. JRC. Energy Service Companies in the EU: Status review and recommendations for further market development with a focus on Energy Performance Contracting. [Online] <https://publications.jrc.ec.europa.eu/repository/handle/JRC106624>.
43. Pacific Northwest National Laboratory Richland, Washington 99352. A Guide to Performance Contracting with ESCOs. [Online] 2017. PNNL-20939.pdf.
44. [Online] <https://evo-world.org/en/>.
45. [Online] <https://publications.jrc.ec.europa.eu/repository/handle/JRC123985>.
46. [Online] <https://europeanenergyinnovation.eu/Latest-Research/Spring-2020/EFFECT4buildings-Project-Risk-management-for-energy-efficiency-investments>.
47. *Perioodi 2014–2020 ühtekuuluvuspoliitika vahenditest kavandatavate rahastamisvahendite eelhindamine*.
48. [Online] <https://www.global-regulation.com/translation/spain/1440591/royal-decree-law-6-2010-of-9-april-on-measures-to-boost-economic-recovery-and-employment.html>.
49. Ministerio de Transportes, Movilidad y Agenda Urbana. [Online] <https://www.boe.es/buscar/act.php?id=BOE-A-2021-16233>.
50. UK REPORT ON THE ENERGY EFFICIENCY SERVICES MARKET AND QUALITY. [Online] <https://qualitee.eu/gb/publications/market-research-report/>.
51. Paolo Bertoldi a, Benigna Boza-Kiss. Analysis of barriers and drivers for the development of the ESCO markets in Europe. [Online] 2017. <https://www.sciencedirect.com/science/article/abs/pii/S0301421517302483>.
52. The global ESCO network. *Regulatory Barriers for Energy Service Companies - Perspectives Based on Feedback from National ESCO Associations*. 2022.
53. Erwin Mlecnik a, James Parker b, Zheng Ma c, Cristina Corchero d, Armin Knotzer e, Roberta Perneti f. *Policy challenges for the development of energy flexibility services*. 2020.
54. ALFRESCO. [Online] <https://www.alfresco.com>.
55. Taylor, Robert, et al. Financing Energy Efficiency: Lessons from Brazil, China, India and Beyond. *World Bank*. 2008.
56. Bianco, Vincenzo. Overview of On-Bill Building Energy Renovation Schemes. *D2.1 RenOnBill*. 2020.
57. Daniele Forni, , ENEA/FIRE. *Energy services and ESCOs, energy auditing, solving administrative barriers*. 2017.
58. PRODESA. <https://www.prodesa.eu/news-events/?lang=en>. [Online]



9 Annex 1 Interviews report per country

9.1 Annex 1.1: Interview Summary Greece

NATIONAL OR REGIONAL ECOSYSTEM OVERVIEW

<p>Key stakeholders in the ecosystem</p>	<p>The interviews were mostly focused in the public sector (policy officers). The market is still immature with only 29 ESCOs registered in the official registry with an EnPC (although still the legislation is quite flexible with what can be considered as EnPC). Big construction companies, involved in public works, have not yet decided to invest in the ESCO market. Building owners (including for public buildings) and investors still hesitate to apply EnPCs as the market is still immature, technical and administrative knowledge is limited, there are many risks and better business opportunities. Financial institutions are not really engaged so far (due to low market demand).</p>
<p>EnPC projects identified</p>	<ul style="list-style-type: none"> • Most projects refer to streetlighting. • In PRODESA project seven municipalities in the Athens Metropolitan area joined forces with the common goal of reducing their carbon footprint through energy efficiency renovations and locally available renewable energy generation. PRODESA developed four distinct types of Guaranteed Savings EnPCs, showcasing practical project examples and facilitating dialogue between stakeholders. • ELEKTRA is a funding programme for the public sector. which provides an additional 10% bonus if the project is implemented via EnPC. It also provides guarantees. • The Attika Regional Programme implements EnPC for public buildings. • CRES (Centre for RES and EE, attached to the MoEE) implemented a pilot project in CRES premises.

NATIONAL OR REGIONAL ECOSYSTEM CHARACTERISATION

<p>The current Greek market remains immature with limited EnPC projects. In the public sector not many projects have been implemented so far (some pilots in the framework of EU funded projects, such as PRODESA) and there are still too many obstacles to be overcome. Some Municipalities have started adopting EnPCs for streetlighting projects. In the private sector some projects are spotted mostly in the industry and tertiary sector and less in the residential one. It is expected that the market gradually will evolve despite the existing barriers. The market potential is huge.</p>
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KEY OVERALL INSIGHTS

The following table compile all the information related with the EnPCs and framework in Greece mostly based on the findings from specific stakeholders during the interview process in the context of WP2.

ALL FINDINGS	
<p>Insights</p>	<p>Regulation: The current legislation mostly concerns the requirements for companies for the registration in the national ESCOs registry. The current legislative framework will be revised setting stricter requirements for registration in the ESCO registry and clarifying what can be considered as EnPC. The Ministry plans to review the legislation as part of the harmonization of the revised Energy Efficiency Directive (EED) in the national framework.</p>



<p>Barriers</p>	<p>Financial:</p> <ul style="list-style-type: none"> • Limited access to available funds to finance. Financial institutions treat EnPC as high-risk investments, resulting in high guarantees and high interest rates. • Uncertainty fo • r payback period. • Municipalities cannot cover the additional funding needed in case energy savings are not achieved. • Despite the amendments in the EUROSTAT accounting system, Municipalities still hesitate to implement EnPCs as they find the venture too risky. • High uncertainty regarding future development in terms of energy prices. <p>Legal:</p> <ul style="list-style-type: none"> • Lack of standardized procurement procedures for EnPCs in the public sector. • The Law on Public Contracts does not have any particular reference for EnPCs, thus there is uncertainty among public authorities how to procure EnPC projects. • The requirements for companies to be registered are very loose. <p>Technical:</p> <ul style="list-style-type: none"> • Lack of experience in EnPCs contract (including in setting energy baselines, M&V, technologies, monitoring). • Lack of awareness among all actors (building owners, public authorities at all levels, construction companies).
<p>Opportunities</p>	<p>Contracts:</p> <ul style="list-style-type: none"> • Framework contracts need to be developed comprising the entire procedure (procurement, conducting the baseline, contracting, funding mechanism, verification and monitoring, operations and maintenance, etc.). • Templates and procurement norms are needed. • Central monitoring of MRV • Implementation of large-scale pilot projects (e.g., aggregation). Central government should lead these projects and then share experience and recommendations. • Create a framework for independent organisations to implement M&V procedures. <p>Technical</p> <ul style="list-style-type: none"> • Target specific technologies with certified energy performance, ensuring energy savings. <p>Social</p> <ul style="list-style-type: none"> • Need to communicate the benefits of the concept to make it more attractive: huge market potential. • Exchange of good practices among different EU countries could facilitate the market at this early stage. <p>Legal Framework</p> <ul style="list-style-type: none"> • Revise the legal framework, both for ESCOs registration requirements and public procurement • Certification for ESCOs



9.2 Annex 1.2: Interview Summary Estonia

RESEARCH BACKGROUND

National/regional system explored in WP2 research	In Estonia, the following stakeholders per WP2 were interviewed: <ul style="list-style-type: none"> REGIONAL and/or NATIONAL GOVERNMENT ORGANISATIONS: Public Renovation Funding Organisations ESCO: Two ESCOs, one has finished business and another operating for more than 10 years in Estonia. PROPERTY OWNERS: public and private property owners (one general PPP contractor) OTHER RELEVANT PROFILES: technical renovation consultants; renovation advisors; financier (bank)
EBENTO partner organisations involved in the research	Tallinn University of Technology
Stakeholder organisations or stakeholder group representatives involved in the research	ESCO-s focused on non-residential buildings. PPP Contractor with Guaranteed Energy Savings for Office Buildings Technical Renovation Consultants Renovation Advisor Financier (Estonian largest bank) National Funding Agency Supporting Renovations

NATIONAL OR REGIONAL ECOSYSTEM OVERVIEW

Key stakeholders in the ecosystem <i>(list and brief description, a few words)</i>	Residents and Building Associations Technical Consultants Renovation Advisors Financiers National Funding Agency for Renovation Designers and Engineers General Contractors for Renovation Manufacturers and Installers Building Managers
EnPC projects identified. <i>(add links to available further information)</i>	Ministry Building in the Tallinn City Centre PPP Company Owned Office Buildings Warehouse by ESCO company Kindergarten by ESCO company Schools by ESCO company
Relevant tools / services related to EnPCs already in place <i>(add links, if relevant)</i>	https://evo-world.org/en/
<i>(add more items, if relevant)</i>	

NATIONAL OR REGIONAL ECOSYSTEM CHARACTERISATION

In Estonia, the ESCO services and EnPC are not implemented in the context of residential buildings. From the supplier (ESCO) perspective, investing into residential buildings is not attractive because it would



require substantial investment into retrofitting and insulating existing structures, for which, the payback period is 25+ years. Most ESCOs only want to deal with projects where the payback period is maximum 5 to 6 years. This is why these companies have mostly focused on non-residential buildings and on building services, where the benefits are the highest.

From the client (building associations and residents) perspective, people have little or lack of motivation to save energy for many different reasons. They are interested more in the new planned outlook of the building, and, especially elderly residents, what will be the monthly extra cost for them. Building associations and residents are interested to fulfil minimum energy efficiency requirements when renovation support is received from the government or they are obligated any other reason.

Despite that implementing the EnPC in the traditional sense is not possible in Estonia, in this pilot, it is believed that the EnPC principles, processes and methodologies could and should be implemented, nevertheless. In this pilot, we focus on quality management of renovation and commissioning of residential buildings.

KEY OVERALL INSIGHTS

ENVIRONMENT AND LEGAL FRAMEWORK	
Insights	<ul style="list-style-type: none"> • The post-renovation measured energy consumption and certificate should be calculated annually up to two-three years after renovation to enable better comparability. • Increase building associations and residents' motivation by introducing clear requirements to prove and demonstrate energy savings after renovation. • Introduce clear post-renovation monitoring and maintenance requirements for energy efficient renovation grants. • The calculated and measured energy consumptions do not match. • No systematic post-renovation monitoring of effects and results. • Often reasons for not meeting the expected energy savings are related to users. • Sometimes there may be external reasons why owners and user may not want to save. For example, departments in local municipalities do not want to save because their budget will be reduced accordingly; building residents are not interested in saving energy because costs are calculated per m². • The key incentive for banks to give out "green loans" is the ESG policy that requires them to save energy and be environmentally sustainable. • For banks, the building associations are very good clients because they are very reliable customers.
Barriers	<ul style="list-style-type: none"> • Calculating the measured energy certificate one year after renovation is not enough time as it does not allow for proper comparison before and after renovation situation. • Buildings that have received the energy efficiency renovation grants do not need to monitor and verify energy savings over longer period of time, resulting in not achieving energy savings. • Because of a lack in these requirements to demonstrate energy savings, building associations and residents lack interest to make it their utmost priority. • Building operational hours used in calculations do not correspond to the real operational hours of a building.



	<ul style="list-style-type: none"> • Complex ownership structure (every apartment is owned by separate person) in apartment buildings makes it difficult to plan and make EnPC and renovation related decisions; e.g., all notarial transactions require everyone's signatures. • The competence and qualification of technical consultants (required by Kredex to get funding support) varies significantly.
Opportunities	<ul style="list-style-type: none"> • The measured energy certificate should be calculated annually or 3 years after the building renovation. Annual calculations would enable comparing results and identification of further energy saving improvements in those 3 years. • Building associations should be required to guarantee and prove energy savings after renovation to keep energy renovation grants. • A share of the grant money should go towards post-renovation monitoring and follow-up works. • Heating should be measured at the apartment level to promote more sustainable behaviour of residents. • Conducting systematic checks to verify and equalize the competence and qualification of technical consultants.
EnPC and ESCO	
Insights	<ul style="list-style-type: none"> • Phases (timeline) for implementing EnPC: 1) set objectives; 2) establish baseline model; 3) develop a model for measures and estimate the impact; 4) implement selected measures; 5) verify results. • EnPC business model needs to be robust and reliable in rough terms and not at the precision of decimal places. • Generally, the customer has a vision/project and they ask for energy efficiency calculations. Calculations are requested for two reasons: either out of obligation - to obtain a building permit or to find out whether the desired energy class is achieved, and if not, suggestions for achieving a better result are also expected.
Barriers	<ul style="list-style-type: none"> • EnPC is a cash flow business, meaning ESCOs providing EnPC services must be very well capitalized at the beginning. As a result, it takes a long time before ESCO starts to earn money. • Energy is inexpensive (for various reasons, e.g., government subsidies), which means investment payback times are very long especially for residential buildings and investments into insulation. • Energy savings are sometimes achieved at the expense of indoor climate quality. But, for example, employees cannot work in offices with an indoor temperature of 16 degrees. • Minor errors in design, small errors in construction, small errors in commissioning, and significant errors in management all result in no energy saved and poor energy efficiency. • Not all consumption components in the building are measured separately, so it may be impossible to distinguish sources for consumption and establish the baseline model properly. For example, heating and electricity are measured at the building level and not at the level of zones, apartments, consumption types, etc.
Opportunities	<ul style="list-style-type: none"> • Make monthly utility bills/invoices more informative for residents and inform them on their energy-related consumption and behaviour when compared to similar baseline apartments.



	<ul style="list-style-type: none"> Existing channels (such as energy bills) could be used to increase the residents’ understanding of energy consumption and could increase motivation for renovation. EnPC and ESCO services are helpful for local municipalities as they do not need to take a loan and pay instead for service to finance the energy savings, supply and security services.
EnPC PROJECT PREPARATION	
Insights	<ul style="list-style-type: none"> Establishing the baseline model and estimating the impact of measures is the critical first step in the EnPC business model so that we can assess the potential for implementing the EnPC. There is a lot of subjectivity in selecting the indoor climate parameters - what is suitable for one is not for another. Building automation and commissioning systems (BACS) are the only way to control energy use in building operations phase. You can make any building as efficient as you want, but if you do not have automation, you will never achieve the desired target. Poor initial design briefs result in poor design solutions that are not thought through, and too many assumptions are made. For example, the investment in automation is often reduced or left out, leading to overconsumption in buildings.
Barriers	<ul style="list-style-type: none"> Agreeing on the indoor climate parameters (temperature, CO2, brightness in the case of light installations, lighting level, and uniformity) is a long and expensive process. Design briefs and initial tasks on building automation, heating, ventilation, cooling, and lighting are often very poorly prepared. Investments made are often not profitable, or those that would be profitable are left out. In the absence of good input, expected savings are often estimated based on experience (residential buildings).
Opportunities	<ul style="list-style-type: none"> Increased measurement and specialized monitoring systems for energy purposes. Necessary for understanding energy savings potential, human behaviour, detecting anomalies, capturing as-is situations. Focus more on building automation and understand its importance. This is especially true in the case of non-residential buildings.
EnPC CONTRACT and ESCO MODELS	
Insights	<ul style="list-style-type: none"> Three main types of EnPC: (1) shared savings (shared risk, both parties motivated), (2) full-risk contract (client not motivated, supplier risk); and (3) fixed fee/subscription (client risk, supplier responsible for a piece of work). In Estonia, EnPC is primarily used in public buildings and focused on indoor climate (building services: lighting, heating, cooling, etc.). Two main types of ESCO: (1) ordinary ESCO (either energy-saving or energy-securing service); and (2) super-ESCO (both services). EnPC measures are implemented only in service systems and related non-building structural investments with a payback period of 5-6 years. In office building example using PPP (Private-Public-Partnerships), the contract defines the maximum allowed energy consumption as X kW/m2 per year. The ESCO does not get anything from the savings, but the excess cost must be paid according to the current price.



	<ul style="list-style-type: none"> • In one project case, initially 70% of the cost was paid out; the remaining 30% was paid when efficiency was achieved. ESCO profited afterward. • Challenging to implement EnPC due to financial circumstances, e.g., long payback times and difficulty to obtain loans. • In residential buildings, banks tend to prefer loan applications that have already been approved for a grant by Kredex. That means more professional parties have advised and approved the renovation project, and it's thoroughly thought-out.
Barriers	<ul style="list-style-type: none"> • Clients are often sceptical of the fixed fee/subscription model because there is no guarantee of delivering energy savings. • The need for initial capital is very high when implementing EnPC contracts and it is difficult for an ESCO to raise funds on reasonable terms without a guarantee. Banks may say that the guarantees no longer cover the loan balance as the risk becomes too great for them and they cannot give more loans. • The payback period for insulating structures is typically 25+ years, which is too long for ESCO and EnPC business models.
Opportunities	<ul style="list-style-type: none"> • There is a need for a paradigm change to support ESCO and EnPC implementation in the public domain. Energy volume and energy unit costs should not be directly related. That is, monthly or annual costs on energy and energy savings should be a lump sum, which would motivate ESCO on the EnPC contract to improve energy performance further. Otherwise, if consumption is reduced and, thus, the budget is reduced, it would not motivate parties to save energy.
IMPLEMENTATION OF MEASURES	
Insights	<ul style="list-style-type: none"> • Building services (lighting, automation, ventilation, cooling, etc.) have the largest potential for implementing the EnPC model as the payback is between 1 to 6 years.
Barriers	<ul style="list-style-type: none"> • In one project case, in the first few years EnPC measures worked well, and then the energy saving goals were accomplished. However, after a few years, users did not want to save energy and, instead, they increased the room temperature in the winter up to 24 degrees. • Conflicts between ESCO and client can arise when energy efficiency savings and outcomes are not met. However, in addition to technical problems, often the reason is that user behaviour has changed: usage hours, number of users, use types etc.
Opportunities	<ul style="list-style-type: none"> • Implementing EnPC for building automation systems and lighting has the most significant potential. • To make it clear to the client, it should be proven before the renovation how the savings will be achieved and then after the renovation it should be assessed whether they were achieved.
COMMISSIONING	
Insights	<ul style="list-style-type: none"> • It is unclear who should be responsible for the results and realization of energy efficiency in renovation projects. • Today the technical consultant and the owner's supervisor do not want to be involved after the renovation activities, i.e., the client will be left alone with the builder, but client and builder are not at the same level of expertise and competencies.



	<ul style="list-style-type: none"> • Making general contractor responsible for monitoring and assuring energy performance after the renovation would motivate the builder to achieve energy savings. • EnPC requires considerable investments in monitoring solutions.
Barriers	<ul style="list-style-type: none"> • On one hand, the technical consultant or the contractor and the owner's supervisor should be responsible for the realization of energy efficiency in renovation projects. The client does not have knowledge or ability for it. On the other hand, it is difficult to control how the client will be using the building after renovation and it may significantly alter the achievement of energy savings. EnPC can only create conditions and opportunities for saving energy under certain conditions. But savings will be achieved if a building is used in a certain way and not guaranteed if usage changes. • The building or facility manager often lacks the necessary knowledge to maximize energy savings in operational buildings.
Opportunities	<ul style="list-style-type: none"> • The realization of energy efficiency should be the responsibility of an entire team of technical consultants, designers, energy specialists, contractor, owner's supervisor. • Checklists would greatly simplify the work of the owner's supervision and commissioning. • BIM technology to properly document construction processes and results could be used. • Educating and involving more renovation specialists genuinely interested in achieving energy consumption goals.
CONTRACTUAL PHASE	
Insights	<ul style="list-style-type: none"> • The shared savings and fixed fee/subscription types enable the development of additional emerging ideas during project delivery. • In the big picture, people are often satisfied with the renovation.
Barriers	<ul style="list-style-type: none"> • Residents are not interested in the energy efficiency and certificate calculations but in how much more or less they will have to pay monthly.
Opportunities	<ul style="list-style-type: none"> • To better manage the building, set up systems, and understand the energy consumption, the building needs to be equipped with energy meters.



9.3 Annex 1.3: Interview Summary Spain

NATIONAL OR REGIONAL ECOSYSTEM OVERVIEW

Key stakeholders in the ecosystem <i>(list and brief description, a few words)</i>	Based on research and the interviews performed the most involved stakeholders in the ecosystem are ESCOS, construction developers linked with energy facilities and property owner. In addition to that there are other interesting stakeholders that participate in the EnPC ecosystem. They are specific organization and building manager. Although less involve on the EnPC process they also have a real a good vision of the barriers and needs of the framework.
EnPC projects identified <i>(add links to available further information)</i>	Some of the project identify during the investigation, and specifically during the interviews were: <ul style="list-style-type: none"> • The rehabilitation of an emblematic residential building in Valladolid (Spain) Press Release ES • Public building at the University of Málaga
Relevant tools / services related to EnPCs already in place <i>(add links, if relevant)</i>	For this type of contracts the most used tools are monitoring ones in terms of evaluate the savings and check the contract clauses. Additionally the buildings are usually equipped with a range of sensors, transmitters, and have specific technical personnel to manage all the services.
<i>(add more items, if relevant)</i>	

NATIONAL OR REGIONAL ECOSYSTEM CHARACTERISATION

<p>To understand the ecosystem of Spain the most important item to keep in mind is that industrial clients and public buildings are the most used to be involved on EnPCs. For residential user there is no specific legislation to apply meaning that in most of the cases the same type of contracts and requirements are apply to residential buildings making hard for homeowners to understand their possibilities and benefits. Additionally, although the main 3 partners involver on the EnPC (Client, Technical Player and Financial Player) not all are aware of the same needs or want the same benefits so the coordination on the contracts and execution of projects is costly and not always successfully.</p>

KEY OVERALL INSIGHTS

The following table compile all the information related with the EnPCs and framework in Spain mostly based on the findings from specific stakeholders during the interview process in the context of WP2 There are fining in different fields, the following table compile all the findings.

ALL FINDINGS	
Insights	Regulation: There is no specific regulation for residential EnPCs in Spain and specifically there is no regulation for residential EnPCs making difficult to perform them.



	<p>Contract management: It is key for the company performing the EnPC to be in charge of the whole project lifetime.</p>
<p>Barriers</p>	<p>Social:</p> <ul style="list-style-type: none"> • Lack of knowledge among community members • Lack of trust in the simulation and the energy estimations (too much fluctuation on energy prices the last years in Spain). • Lack of confidence on the part of the end customer and the applicator due to lack of knowledge of the procedure on both sides <p>Contracts:</p> <ul style="list-style-type: none"> • Clients are cautious about this kind of contracts due to the long duration (10 years is the average of the contract) • The problem with residential buildings is about the difficulty of reach an agreement between the owners of the building. • Payments in kind (such as energy savings) are not regulated in Spanish legislation. <p>TECHNICAL</p> <ul style="list-style-type: none"> • technical complexity. Need for a verification and measurement protocol. Solution: simplify and automate the methodology. • Lack of knowledge of who applies it. ESCOs think that more internal control is not beneficial, they increase the requirements to be fulfilled and do not see the advantages of it.
<p>Opportunities</p>	<p>Contracts:</p> <ul style="list-style-type: none"> • Include the EnPCs in the context of energy districts: this opportunity would be interesting to be analysed in future projects. The idea would be to join public buildings and residential building in the same EnPCs considering the energy district as a common point to make more efficient. • Monetization of new concepts such as comfort and climate footprint can enhance the profitability of Energy Performance Contracts (EnPCs). In EBENTO we would analyse the best way to include this concept on contracts and how the verification of conditions can be done. • Simple models and methodologies to apply EnPCs to small users. <p>Technical:</p> <ul style="list-style-type: none"> • To conduct a comparison with data from previous years to evaluate the effectiveness of the energy performance contract and its impact on energy savings. • The collection and analysis, through artificial intelligence, of all the data gathered from their different installations, in order to keep improving them and maximising the results and savings achieved. EBENTO will use NILM for some of the pilots, specifically for the Spanish one, using these new technologies to provide better advice to homeowners. • Professionalize the sector. • More internal control allowing allows companies to know themselves better. It allows you to know your real costs, what your savings capabilities are. <p>Social:</p>



	<ul style="list-style-type: none">• Effectively communicate the long-term benefits derived from these contracts. EBENTO is running workshops with specific actors and homeowners to develop tools according to their needs.• Measuring energy savings provide users with valuable information that can also be used to recommend them better energy habits.• More transparency generates trust and the end user will understand it as natural, he will not think a priori "they are cheating me". <p>Legal Framework</p> <ul style="list-style-type: none">• Municipalities must support the projects directly.• Decreasing housing taxes for buildings that are renovated and that prove (through EnPCs) their energy improvements and savings.
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9.4 Annex 1.4: Interview Summary UK

RESEARCH BACKGROUND

National/regional system explored in WP2 research	UK
EBENTO partner organisations involved in the research	Carbon Co-op
Stakeholder organisations or stakeholder group representatives involved in the research	<p>Carbon Co-op - OSS provider and research organisation</p> <p>Green Finance Institute - finance provider</p> <p>A council - social housing provider</p> <p>Housing Associations’ Charitable Trust (HACT) - policy-makers and regulators: public sector organisation.</p> <p>DESNZ - Policy makers and regulators - national government organisation.</p> <p>Local Partnerships LLP - Provider OSS</p>

NATIONAL OR REGIONAL ECOSYSTEM OVERVIEW

Key stakeholders in the ecosystem (list and brief description, a few words)	<p>Department for Energy Security and Net Zero (formerly BEIS) - responsible for policy making to meet carbon reduction targets.</p> <p>Community organisations informing and advising the public on opportunities and the benefits of measures financially, for health and carbon reduction such as Community Energy England.</p> <p>Local authorities and social housing providers own or manage the buildings or facilities where energy efficiency measures are implemented. Examples include the Greater London Authority and Manchester City Council.</p> <p>Finance providers and innovative finance developers such as the Green Finance Initiative.</p>
EnPC projects identified (add links to available further information)	<p>Re:fit is an EnPCo based framework for improving public sector building performance in the UK. Since 2009 over 250 organisations have been engaged; £180m of works procured so far and 1,000 public sector buildings retrofitted (Re:fit 4 business caseguide)</p> <p>Energiesprong has been used by some local authorities for improving their social housing stock with limited success. As far as we know the EnPCo aspect of Energiesprong has not been successfully applied to domestic retrofit in the UK. Sutton Housing case study</p> <p>Like Re:fit, the Carbon and Energy Fund (CEF) framework in the UK supports public sector organisations implementing energy efficiency and carbon reduction projects. It provides a procurement process, access to pre-qualified energy services providers and funding options for energy performance contracts. Its goal is to accelerate the adoption of energy efficiency measures to reduce carbon emissions, and achieve cost savings.</p>



	<p>CEF's Contract and Performance Assurance</p> <p>ESCO's in the UK that use EnPCo's include: Schneider Electric, Siemens, Johnson Controls, ENGIE, Veolia, Bouygues Energies & Services, E.ON Energy Solutions, SSE</p>
<p>Relevant tools / services related to EnPCs already in place</p> <p>(add links, if relevant)</p>	<p>Re:Fit and Carbon and Energy Fund frameworks (see above)</p> <p>Department for Levelling Up, Housing & Communities - Energy Performance of Buildings Data: England and Wales</p> <p>Access to Energy Performance Certificates and Display Energy Certificates data for buildings in England and Wales. Searchable, browsable and downloadable individually or in bulk.</p>
<p>Additional information</p>	<p>Government's guidance on Energy Performance Contracts (dated - 2015)</p>

NATIONAL OR REGIONAL ECOSYSTEM CHARACTERISATION

<p>Energy performance contracts are used primarily in the public sector but also in the private sector for building energy improvements in the UK.</p> <p>There have been examples of the attempted use of EnPCs in the domestic sector but, as far as the investigators are concerned, there are no successful examples to be found.</p> <p>The most successful example seems to be with the Re:fit, in the public sector.</p> <p>Several energy supply companies in the UK have EnPC based offerings</p>
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KEY OVERALL INSIGHTS

LEGAL FRAMEWORK	
<p>Insights</p>	<p>Proprietary data from smart meters is not shared, creating a barrier to creating a measure of thermal performance using this data.</p> <p>The government is aiming for more accurate performance data and to introduce pay for performance requirements through ECO4.</p> <p>Companies are concerned about the burden of data collection, privacy implications, and data management requirements.</p> <p>Metered energy savings are recommended in PAS2035, but the government has not yet made it a requirement.</p>
	<p>These insights highlight the challenges and considerations related to data sharing and privacy, financial incentives, and the need for reform and standardisation in the legal framework for energy performance contracts.</p>



<p>Barriers</p>	<p>Lack of Data Sharing - the proprietary nature of smart meter data and the resistance to sharing it pose a barrier to gathering accurate performance data for EnPCs.</p> <p>Expertise and Knowledge Gap - the lack of background knowledge and expertise in retrofitting inhibits organisations' ability to effectively analyse and utilise the available data.</p> <p>Resistance to Change - some large companies are resisting moving away from deemed savings, which are simpler but don't necessarily accurately reflect energy performance. This hampers the adoption of more accurate performance-based approaches.</p> <p>Complex and Ineffective Schemes - overly complex pay as you save or cashback schemes that do not align with the real world and lack detailed service design can fail to deliver the desired outcomes.</p> <p>Lack of Standardization and Reform - Energy Performance Certificates (EnPCs) need to be reformed and standardised to avoid confusion, ensure independent verification and enable funding measures based on performance indicators.</p> <p>Bad retrofit practices have resulted in works that have caused, in some cases catastrophic failures, through for example fire. Since Grenfell it has not been possible to insure foam based materials for retrofit. Government intervention to underwrite liabilities could make a major difference here.</p>
<p>Opportunities</p>	<p>The introduction of pay for performance requirements in the ECO4 scheme, would provide an opportunity to secure funding for energy efficiency projects based on actual performance outcomes in social housing over coming years.</p> <p>EnPCs are recognised as not being fit for purpose. This is increasing the call for improved energy performance data which could in turn be leveraged for energy performance contracting.</p>
<p>EnPC PROJECT INCEPTION</p>	
<p>Insights</p>	<p>Ensure that the team involved in the EnPC project has the necessary background and expertise in retrofitting and energy performance. This includes knowing the right questions to ask and how to effectively interrogate the data collected.</p> <p>Defining clear contractual responsibilities can help alleviate potential issues and disappointments. This includes ensuring that expectations are properly defined and communicated to the householder to avoid any mismatch between what is delivered and what is expected.</p> <p>To avoid confusion and ensure accurate measurement and verification of energy savings, it is essential to establish open and common standards. These standards should define the calculation methodology for energy savings, allowing for independent verification and arbitration if needed.</p>
<p>EnPC PROJECT PREPARATION</p>	
<p>Insights</p>	<p>National incentive schemes need to accommodate the needs for the incorporation of EnPCs: The government's Social Housing Retrofit Accelerator would be likely to be the best place to incorporate the Re:fit framework into the domestic housing sector. So far though the timescales for procurement under the scheme have been too tight in order to carry out the assessment and competition required for Re:fit.</p>



9.5 Annex 1.5: Interview Summary Slovenia

RESEARCH BACKGROUND

National/regional system explored in WP2 research	Slovenia
EBENTO partner organisations involved in the research	IRI UL (Institute for Innovation and Development of University of Ljubljana) FE UL (Laboratory of Energy Policy, Faculty of Electrical Engineering, University of Ljubljana)
Stakeholder organisations or stakeholder group representatives involved in the research	<ul style="list-style-type: none"> • Ministry of the Environment, Climate and Energy (policy-makers, national governance) • City of Ljubljana (municipality, local governance) • Expert for EnPC contracting (ESCO manager) • INTERENERGO (ESCO company) • SPL - Stanovanjsko podjetje Ljubljana (building management company)

NATIONAL OR REGIONAL ECOSYSTEM OVERVIEW

Key stakeholders in the ecosystem (list and brief description, a few words)	<ul style="list-style-type: none"> • Ministry of the Environment, Climate and Energy – governance and policy-making; responsible for the key legislative acts that pertain to Energy Performance Contracts (EnPCs), have influence on EnPC financial incentives (subsidies), potential for exploitation of EBENTO results. There is also a project office within the ministry dedicated to energy renovation of public buildings. • ESCO companies with experience in EnPCs, such as Petrol, Interenergo, Resalta that represent a vast majority of Slovenian ESCO market. • Local governance – municipalities; those that already have considerable experience with EnPCs (in particular Ljubljana, also Kranj, etc.), municipalities which have experience with guaranteed energy supply (e.g., investment in biomass boiler, provision of heat for a certain period of time), as well as those that may benefit from the good practice examples; own a considerable (public) building stock, including residential buildings, which has the potential for mass renovation and energy savings. • Research institutions such as Institut Jozef Stefan (IJS Energy Efficiency Centre), ZRMK (Building and Civil Engineering Institute) – important for transfer of knowledge, training and educational initiatives • Building management companies, such as SPL and other regional housing management entities; manage large quantities of residential housing, have access to residents and can play a role of an intermediary. • Local energy agencies (e.g., GOLEA, KSENA) • LIFE Project Care4Climate
EnPC projects identified (add links to available further information)	<p>A number of EnPC projects implemented in Slovenian municipalities as a PPP using the model of EnPCs (Ljubljana, Maribor, Kranj...), as well as by some other public institutions (e.g., the University of Maribor). We focussed primarily on the largest one, carried out by the municipality of Ljubljana.</p> <p>EOL – Energetska obnova Ljubljane / Energy Retrofit of Buildings in Ljubljana The "Energy Retrofit of Buildings in Ljubljana" (EOL – <i>Energetska obnova Ljubljane</i>) project stands out as Slovenia's largest public-private partnership in terms of Energy Performance Contracts (EnPCs) and is regarded as one of the most successful projects of its kind in Europe. The EOL projects encompass the energy retrofitting and</p>



	<p>rehabilitation of more than 100 public buildings, with an estimated investment value of approximately EUR 60 million. The majority of funding is derived from private partners, supplemented by EU cohesion funds, and a small proportion is contributed by COL. The renovation works are being executed in four phases, currently in the final phase.</p> <ul style="list-style-type: none"> - https://www.ljubljana.si/en/news/energy-advanced-energy-renovations-of-buildings-under-the-ownership-of-the-city-of-ljubljana/ - https://www.ljubljana.si/sl/moja-ljubljana/varstvo-okolja/proti-plasticnim-vreckam-v-ljubljani/seznam-trgovcev-in-gostincev/energy-retrofit-of-public-buildings-in-the-city-of-ljubljana/ - https://www.ljubljana.si/assets/Uploads/MOL-2022-Energetske-stavbe-Brosura-A4-ANG-2022-web.pdf - https://www.ljubljana.si/assets/Uploads/MOL-2021-Energetske-stavbe-Brosura-A4-ENG-2021-08-31-web-compressed.pdf <p>New pilot incentive (Care4Climate LIFE IP) – recently initiated: A recent initiative, which could be of interest to EBENTO. Within the Care4Climate (LIFE integrated project), a pilot project of multi-apartment building deep energy renovation is being implemented by using new financial instruments. The activity addresses the implementation aspects of the new financial instruments designed in the project, a combination of public and private collaboration using the EnPC model. As a part of this initiative, a pilot subsidy program was initiated, with a call open at the end of 2022 through EKO SKLAD (Slovenian environmental public fund, offering loans and subsidies).</p>
<p>Relevant tools / services related to EnPCs already in place (add links, if relevant)</p>	<ul style="list-style-type: none"> • Portal Energetika – Government portal gathering all information related to energy issues in one place (including legislative acts and other links related to EnPC, a list of ESCOs etc.). Within it: Project office for energy renovation of buildings. • Local energy agencies are available for support (e.g. GOLEA, KSEENA) to municipalities in terms of preparing various projects, including EnPCs. • EnSvet – Part of the EKO SKLAD, a network of 59 regional/local EnSvet offices offer free and independent energy consultation, as well as informational, educational and awareness-raising activities to citizens in the local area.
<p>Legal framework – key documents</p>	<ul style="list-style-type: none"> • https://www.energetika-portal.si/fileadmin/dokumenti/podrocja/energetika/javne_stavbe/smernice_za_energetsko_pogodbenistvo-web.pdf (Guidelines for the implementation of energy efficiency improvement measures in public sector buildings through EnPC) • PURES (Rules on efficient use of energy in buildings) • Dolgoročna strategija energetske prenove stavb do leta 2050 (energetika-portal.si) (Long-term strategy for the energy renovation of buildings up to 2050) • 2022-01-0874-2014-01-0538-npb9.pdf (EZ - 1 Energy Act) • Zakon o spodbujanju rabe obnovljivih virov energije (ZSROVE) (pisrs.si) (Act to increase the use of renewable energy sources) • Zakon o učinkoviti rabi energije (ZURE) (pisrs.si) (Energy Efficiency Act) • Zakon o urejanju prostora (pisrs.si) (ZUreP-1) Regional Planning Act • Zakon o javno-zasebnem partnerstvu (ZJZP) (pisrs.si) (Public-Private Partnership Act) • IJZP (pppforum.si) (Public Private Partnership Institute) • Stanovanjski zakon (pisrs.si) (Housing Act (SZ-1)) • Pravilnik o upravljanju večstanovanjskih stavb (pisrs.si) (Management regulations for residential buildings) • Pogodbeno zagotavljanje energije Portal Trajnostna energija (Contractual energy supply)



In Slovenia, energy performance contracting is moderately well-developed - there is a specific EnPC model being implemented with particular success, namely EnPC in the form of a public-private partnership (PPP). In practice, this means that public partners (such as local governance organisations) contract ESCOs to carry out partial or deep energy renovations of their building stock. The majority of the facilities part of EnPC projects include educational facilities (kindergartens, schools) and sports facilities (public indoor swimming pools etc.). The financing for these projects is often combined: in addition to the private partner’s investment, the public partner usually acquires funding from e.g., cohesion fund, and partially invests from own budget. The extent of these projects is likewise usually a combination of partial renovations and deep renovations (including the building envelope, static rehabilitation etc.). One of the key challenges faced is a lack of ESCOs on the national level – there are currently eight ESCOs listed in the national register, whereby some of these are smaller companies with limited capacity for large-scale renovation. Nevertheless, there have been a number of EnPC projects implemented successfully in several Slovenian municipalities. Ljubljana’s EOL project stands out as particularly successful and is currently running its fourth and final phase.

EnPC model is, however, not used for renovation of residential buildings in Slovenia. There are a number of challenges, which contribute to this, including: lower expected savings due to the inability to effectively control the energy-related behaviour of individual residents, dispersed ownership of residential units, non-standardised residential buildings, the time and effort that would be required to coordinate such a project with individual homeowners. Only minor investments are carried out in multi-residential buildings in the form of EnPCs, e.g., boiler room.

Nevertheless, there is a certain sense of urgency on the level of the Government of Slovenia in terms of reaching the energy use reduction and renovation targets (where Slovenia is lagging behind) and it is assessed that it would be beneficial to develop EnPC models, which could be used for renovating residential buildings as well. Likewise, there is in principle an expressed interest from intermediary organisations (e.g., building management companies) to support such initiatives in the future.

KEY OVERALL INSIGHTS

GENERAL INSIGHTS	
Insights	<p>The current state of energy performance contracts (EnPCs) in Slovenia varies across different segments of the building stock.</p> <ul style="list-style-type: none"> • Narrowly considered public sector: This sector comprises approximately 500-600 buildings, and EnPCs are deemed suitable for a portion of them. • Wider public sector: EnPCs are functioning well in this sector, with Ljubljana's EOL project and other municipalities serving as successful examples. • Residential buildings: In this segment, it is crucial to carefully consider how to effectively stimulate renovation in collaboration with external partners. <p>Renovation of (residential) buildings is inherently a social process.</p> <p>ESCOs and building managers note that renovation is not only a technical challenge or a business transaction, and it involves not only management of materials, systems and administrative processes, but also management of social relations and various interests. In fact, from the point of view of viability of EnPC business model for residential building renovations, one might even argue the latter is the most relevant of all.</p> <p>Role of housing management companies</p>



	<p>Housing management companies have few experiences with EnPCs. These are related to renovation of central heating systems (boilers) and are not (primarily) associated with energy savings.</p> <p>Notions of ownership and control as an important factor</p> <p>With regard to EnPC or any other projects managed or financed by an “external” entity, housing management note that people like to be “in control” of the developments and investments. They described their past experiences with promoting EE projects as if property owners are deterred from engaging by default as soon as the notion of external ownership is mentioned.</p>
<p>Barriers</p>	<p>Asymmetric baseline knowledge</p> <p>Stakeholders identified the barrier of extensive knowledge and expertise that is required for participation in such partnerships (PPP EnPCs), where especially the public partner often lacks the needed resources or know-how, but also in relation to residential buildings. In both cases, lack of sufficient knowledge on the side of the client tends to lead to complications and slower progress in project development due to additional workload caused by “a million unnecessary questions”. E.g.: lack of action on the side of municipalities due to lack of own internal capacities (experts) for understanding both technical and administrative side of EnPC related projects.</p> <p>Coordination and management of all the involved stakeholders</p> <p>This was highlighted as one of the most challenging aspects of EnPC projects, indicating that the network is complex and that managerial and social aspects are an essential part of such initiatives, which require effort and specific knowledge.</p> <p>Distrust or lack of trust among the parties involved.</p> <p>Most often this can be observed as a degree of distrust by the community of property owners towards the integrity of their housing manager, or legitimacy of the manager’s relation and arrangements with various service providers (speculation of corruption or favouritism often implied). More concretely, the lack of trust may manifest itself as protest or lack of cooperation, which can happen at various stages of the project development and implementation process. In addition, there is a level of distrust also among the client and investor, as exemplified by the need for additional supervision and other clear mechanisms of control on the part of the public partner.</p> <p>Fragmented authority for decision-making</p> <p>The number of actors involved in the process (property owners, housing managers, ESCOs, public partners, construction companies etc.) impacts the decision-making process throughout the PPP EnPC project.</p> <p>Conflicting interests of the involved actors</p> <p>People or organisations involved at various stages of the building renovation process often have conflicting interests and/or incompatible expectations. In cases of distrust, ESCOs may end up in an ungrateful role of mediator, as the third party in the triangle of relations with the community of property owners and the housing managers, or even</p>



	<p>between individual property owners. These demands time and efforts to resolve, rendering the project less cost-effective.</p> <p>Barriers to involvement of housing management companies & multi-apartment buildings in EnPC projects</p> <p>There are a number of barriers identified by the different stakeholders, some of these include:</p> <ul style="list-style-type: none"> • Existing negative experience (or arguments based on anecdotal evidence) with EnPC projects, stressing the contrast between promised/projected benefits and the actual (lower) benefits experienced during and after the end of the project. • Lack of knowledge and awareness on how EnPC model(s) can be beneficial for the parties involved. • Lower expected savings due to the inability to effectively control the energy-related behaviour of individual residents. • Dispersed ownership of residential units impacting the time and effort that would be required to coordinate such a project with individual homeowners. • A number of different typologies of residential buildings in Slovenian context, which often require planning on a case-by-case basis (i.e., time and effort).
<p>Opportunities</p>	<p>Data collection and building segmentation play a crucial role in supporting targeted renovations.</p> <p>The policymakers emphasized the need for gathering comprehensive and improved data that will enable accurate building segmentation, which, in turn, facilitates the identification of optimal renovation strategies – i.e., targeted renovation / prioritization of buildings for renovation, including the use of EnPCs.</p> <p>Advisory role to be fulfilled</p> <p>COL’s advice for other (in particular smaller) municipalities was to seek the guidance of advisors if they lack suitable personnel who can handle the various aspects of EnPC projects. These advisors should possess expertise in technical, legal, economic, and social aspects, enabling them to cover areas such as data analysis, legal compliance, financial evaluations, and stakeholder communication.</p> <p>Similarly, an ESCO noted that it would be extremely beneficial to encourage collaboration among a diverse range of experts from various technical and interdisciplinary backgrounds. As end-users’ behaviour has a significant impact on the results of energy renovation, such a collective engagement would include people who have valuable insights into their perspectives.</p> <p>Comfort as a key aspect of EnPCs (“comfort as a service”)</p> <p>Considering comfort as a fundamental element of EnPCs and embracing sustainability criteria as an opportunity for a more holistic and people-centred renovation projects that enhance not only energy efficiency and financial savings but also the overall wellbeing and satisfaction of building occupants. This approach also aligns with the new directive (EPBD), which aims to integrate sustainability criteria into the renovation process, ensuring that the overall improvements encompass multiple dimensions, including functionality, financial viability, and occupant wellbeing. Furthermore, one interviewee mentions the forthcoming LEVEL(S) (framework for sustainability performance of buildings). Although it may take some time for this to become part of</p>



	<p>the regulatory framework, it represents a step towards integrating comprehensive criteria for evaluating the performance and comfort of buildings.</p> <p>Opportunities for a one-stop-shop</p> <p>The interviewee (policy-making) agreed that there is a potential for developing a one-stop-shop (OSS) dedicated to EnPCs. They suggest focusing on a specific aspect of EnPCs within the beta version of the OSS being developed in the EBENTO project.</p> <p>For example, the upcoming directive may specify that <u>certain types of buildings</u>, for example buildings with energy class F, need to undergo renovation. An OSS could concentrate on addressing the renovation of these specific buildings. However, it's important to recognize that each country may have its own specific circumstances. For instance, in England, houses in a neighbourhood may be quite similar, while in Slovenia, there are numerous typologies. Additionally, the dispersed ownership of buildings in Slovenia also poses a specific challenge.</p> <p>Another opportunity for an OSS is <u>addressing energy poverty through EnPCs</u>. The Ministry is currently preparing an action plan to tackle this issue. The idea is to pilot the renovation of an entire vulnerable neighbourhood or community. In Slovenia, there are already financial instruments in place to support energy-vulnerable households, with subsidies available for up to 100% financing and definition of energy poverty is put in legislation. However, many targeted households may not be aware of these options or lack the knowledge and ability to apply for such funding. An OSS could help support the renovation of vulnerable communities in this sense.</p> <p>Notions of ownership and control as important factors</p> <p>The focus of communication should perhaps be on highlighting the collective and individual aspects of ownership of the benefits generated by the projects, such as ownership/participation in long-term energy/money savings, improvement of the quality of buildings (comfort, IEQ), aesthetic appearance and the elevated social status of the owners/occupants of the buildings etc.</p> <p>Apartment block neighbourhoods as a potential for EnPC renovation projects</p> <p>In line with the identified barrier of diverse typologies of residential buildings, certain apartment block neighbourhoods could present an opportunity, since in these, the multi-apartment buildings are often of similar typology.</p>
LEGAL FRAMEWORK	
<p>Insights</p>	<p><u>Guidelines for implementation of EPC projects</u></p> <p>The first guidelines were available in 2014 in Slovenia, which allowed for the first EnPC projects to initiate in the form of PPPs (e.g., the first call for EOL project was out in 2015).</p> <p>Forthcoming revised Energy Performance of Buildings Directive (EPBD)</p> <p>EPBD is likely to significantly impact the renovation efforts, including EnPCs. Significant changes include: a substantial increase in the integration of renewable energy sources (RES); introducing the concept of zero-emission buildings, smart readiness indicators (SRI), the concept of Building Passports, as well as new energy performance certificates, which will differ significantly from the existing certification system currently in place.</p>



	<p>Substantial efforts required to meet the ambitious renovation targets set for 2050</p> <p>In Slovenia, the building sector is close to 1% mark in terms of renovation efforts annually. Renovation activities will need to double, if not triple, in order to align with the desired objectives. This means that it is likely that there will be new initiatives, support systems, and incentives designed on policy level to support renovation activities.</p>
<p>Barriers</p>	<p>Legislation is unfavourable in terms of EnPC for renovation of residential buildings.</p> <p>For ESCOs, the Housing Act (Stanovanjski zakon) is problematic when it comes to the potential renovation of residential buildings, in Slovenia by-and-large implying multiple ownership. The biggest barrier is presented by Article 29, concerning transactions that go beyond the framework of regular building management, namely:</p> <ul style="list-style-type: none"> • (1) the requirement that for any transactions that go beyond the framework of regular building management a consent of 75 % or more of property owners has to be acquired (according to their relative share of the total size of the property). • (2) the requirement that for taking and repaying any loans to the charge of the building's reserve fund a <i>full</i> (100 %) consent of property owners has to be acquired (disregarding owners' relative share of the total size of the property). <p>Practice shows that for ESCOs, these two requirements make the process of planning renovation projects <u>effort and time intensive</u>, involving a significant number of consultations and negotiations between the actors involved in the decision-making process. In financial terms, this implies <u>high costs as well as potential business-related risks</u>, which renders the idea of EnPC for renovation of residential buildings in Slovenia less interesting for ESCOs.</p> <p>Calls for subsidies do not enable or include support for projects using EnPC form of contracting.</p> <p>Without subsidies, it tends to be much harder to create a viable business model for the individual EnPC projects.</p> <p>Local energy directives have a significant influence on the content of the projects.</p> <p>Housing management company notes that in the case of Ljubljana municipality, the nature of EE projects was largely determined by a Directive on priority energy use, which limited the types of investments that go against the long-term municipal energy strategy (this has recently been remedied, in case the heat source is RES).</p>
<p>Opportunities</p>	<p>The need for expert support in PPP projects with municipalities (practice shows municipalities do not have the necessary internal knowledge capacity, which hinders development of projects).</p> <p>On policy-making level, a need for a comprehensive long-term renovation strategy is recognised, which would address both various stakeholders and different possibilities for financial flows. These elements were identified as missing from the current renovation strategy.</p> <p>The stakeholders identified the need for subsidies in the area of waste heat recovery.</p>
<p style="text-align: center;">EnPC PROJECT INCEPTION</p>	



<p>Insights</p>	<p>In Slovenia, EPC projects are by-and-large implemented in line with the model of public-private partnerships, where local governance organisations initiate renovation of their own public building stock (educational, sports facilities etc.) with a private contractor and in combination with other external funding (EU Cohesion Fund).</p> <p>EPCs in residential buildings mainly involve smaller, technological measures, rather than deep renovation.</p> <p>There are a number of barriers contributing (described in the dedicated section below), but primarily relating to lower expected savings due to the inability to effectively control the energy-related behaviour of individual residents, dispersed ownership of residential units, non-standardised residential buildings, the time and effort that would be required to coordinate such a project with individual homeowners.</p> <p>In PPP EPCs, there are usually several buildings renovated in a cluster as part of an individual EPC project. This is relevant in terms of scale and potential savings, while it also allows for the inclusion of specific buildings (e.g., listed cultural heritage buildings), where the renovation might not yield substantial savings individually, but the potential for higher overall savings increases when these buildings are part of a “package”.</p> <p>EPCs may not be suitable for all buildings.</p> <p>Numerous factors collectively have a significant impact on the decision-making process regarding building renovation. It is therefore crucial to consider these factors comprehensively to determine the most appropriate strategies.</p> <ul style="list-style-type: none"> - Primarily, the financial viability of a project plays a significant role in determining priority. Buildings that offer a favourable investment-savings ratio are those that would be given precedence. - The segmentation of buildings is crucial, extending beyond the simple categorization of public versus private sector buildings. While renovating public buildings through EPC projects may be relatively easier, it is not always feasible or practical. - Certain types of buildings, such as those protected due to their cultural heritage value, may not be suitable for EPC renovation due to strict preservation regulations. <p>The role of motivated individuals (local heroes)</p> <p>In cases of multiple occupants and multiple ownership, the role of individuals who drive the social mobilisation required for successful development of an energy-efficiency focused renovation/investment process, cannot be overstated. Such “local heroes” are often the key (f)actors, particularly in the preparation phase of a project, as well as to increase the level of trust of building occupants towards other actors in the partnership.</p> <p>Some ESCOs are moving away from deep renovations or are diversifying.</p> <p>While some ESCOs still prioritize energy renovation initiatives, they are actively diversifying its endeavours by increasingly focusing on e.g., the installation of PV power plants.</p>
<p>Barriers</p>	<p>Barriers towards including residential buildings into EPC renovations.</p>



For some ESCOs, EPC for residential building renovations is not interesting for several reasons. Most of them ultimately boil down to non-profitability or, alternatively, high financial costs for the investor. Costs and profitability of projects are directly related with complexity and length of work-related processes, which can vary substantially depending on a number of factors.

- There isn't currently a universally applicable business model designed specifically for residential building renovation. The lack of such a thorough framework emphasizes how complicated and multifaceted residential building renovations are.
- Complexity and effort are estimated through all key project phases, i.e., before closing (signing) the contract, during the project realisation phase (renovation, installation, etc.), and after the end of the realisation, also referred to as operational phase (monitoring, upkeep etc.).
- Multiple ownership – many properties are cases of multiple ownership, sometimes also of mixed ownership (private and public) and mixed purpose (residential and commercial). Building managers' experiences with promoting any kind of projects, processes of decision-making and formalisation tend to be time and energy consuming.
- Investors have no (or little) control over behavioural patterns of building users – this is particularly valid for residential buildings, while the situation is different in e.g., schools (centralised control of building systems).
- In ESCOs view, EPCs for residential buildings would necessitate extensive efforts in engaging and persuading tenants to undertake renovations or undergo re-education. However, due to time and personnel constraints, such endeavours are often not feasible for ESCOs.

Limited number of ESCOs / private partners to participate in PPP EPCs

One of the key challenges faced in EPC ecosystem is a lack of ESCOs on the national level – there are currently eight ESCOs listed in the national register, while some of these are smaller companies with limited capacity for large-scale renovations, and at least one of them is likely to phase out EPC projects from their portfolio in the near future.

Previous negative experience affects trust.

ESCOs note that negative experience with past EPC projects can still have a negative impact on public perception of ESCO companies, where people tend to associate investment projects in the construction sector with corruption and favouritism. Likewise, housing management companies note that the discourse related to professional housing management is often tainted with speculation of various forms and degrees of corruption or favouritism, implying that housing managers illegitimately earn a percentage of the investment by favouring certain service provider over another. This belief, which can also be a legitimate concern, can have a strong enough impact to either render a renovation project outright impossible or to mobilise the community of property owners to bypass the housing manager altogether, and orchestrate a building renovation on their own.

It is, however, important to note the argument voiced by some housing managers, that management of housing renovation is not part of their job description, and that they should be entitled to a certain financial compensation for the additional work they do for management of the renovation project. To a degree, this argument is based on the fact that retrofitting the building is considered a “transactions that go beyond the framework of regular building management”.



	<p>Lack of willingness and trust in stakeholders</p> <p>In the experience of building management company, the residents are often not willing to engage in EE interventions identified and proposed by the company (which systematically analyses the building stock they manage). The lack of willingness is primarily due to lack of trust in the integrity and capabilities of external stakeholders. It is often based on arguments related to both anecdotal or indirect negative experience with various, sometimes even incomparably different cases of ill-fated investment projects, often alluding to elements of corruption, incompetent project management, or poor realisation (poorly installed systems, poorly realised construction details etc.).</p> <p>Convincing key decision-makers within municipality as a challenge</p> <p>In terms of PPP EPCs, the biggest challenge for investors (private partners) is convincing municipalities to renovate their buildings. Many municipalities find themselves burdened with substantial debt, making it crucial for them to explore avenues, such as EPCs, to facilitate the renovation process. Convincing the key decision-makers within the municipality often hinges upon effectively presenting the guaranteed savings associated with the proposed renovations.</p> <p>EPCs pose a logistic challenge for the narrow public sector</p> <p>There is a perceived lack of temporary accommodation for employees during renovations. For instance, as one of the interviewees explained, while EU institutions in Brussels can relocate occupants to other office buildings, the scarcity of office space in Ljubljana presents a major obstacle, potentially requiring employees to relocate outside the city.</p>
<p>Opportunities</p>	<p>Identifying most suitable (types of) buildings for EPC projects</p> <p>Based on the experience of actors involved in EPCs, there are types of buildings that are most suitable for EPC renovation projects from an economic perspective, including:</p> <ul style="list-style-type: none"> • <u>sports facilities</u> which tend to be large energy consumers, presenting significant opportunities for energy efficiency improvements. • <u>public buildings</u> in general due to their size, opportunity for renovating them in clusters, thereby offering a greater savings potential, as well as inclusion of less profitable or more demanding buildings (e.g., cultural heritage buildings). In addition, in public facilities, such as elementary schools, the heating and cooling systems are uniformly managed by the building's caretaker to maximize energy efficiency. • <u>industry-related projects</u> as they are simple from a managerial point of view (few actors with decision-making authority involved, most of whom are performance focused and often have a relevant knowledge background), often large in scale, and also do not involve complexities associated with management of residential housing renovations. <p><i>The perspective of selecting buildings appropriate for EPC according to their feasibility in economic terms (investment vs savings), primarily aligns with the interests of investors. It might be beneficial for EBENTO to consider the broader benefits and costs, adopting a life-cycle cost (LCC) approach. This approach, as advocated by frameworks like LEVEL(S) and DNSH, considers the overall costs and benefits over the entire life cycle of the building.</i></p> <p>Partial renovations as an alternative</p>



	<p>In situations where financial constraints limit the municipality's resources, partial renovations may be undertaken as an alternative. These partial renovations typically involve refurbishing the building façade and replacing windows, resulting in reduced energy consumption. However, it is important to acknowledge that such partial measures may not generate significant savings when compared to deep energy renovations.</p> <p>Accelerating EPCs for residential buildings</p> <p>While there will be an enhanced need to renovate residential buildings, driven also by the rising energy prices, the interviewees pointed out several aspects, which could support making EPCs a more viable model for their renovation:</p> <ul style="list-style-type: none"> • <u>identifying stakeholders and establishing the project's duration are critical aspects</u>, as a one-size-fits-all approach cannot be applied to all projects. • <u>educating building managers</u> about building renovation and EPCs. • exploring <u>innovative models</u>, such as constructing an additional floor in a building to generate funds for the renovation of the rest of the structure, can be beneficial. <p>Management of public perception, opinion and understanding of certain technologies and business models (PPP, EPC) and dealing with the collective memory (and popular beliefs)</p> <p>On the basis of the interviews, these aspects seem to be important for the future of EPC projects. One of the viable ways is to increase the visibility of positive results delivered by either ESCOs or building managers. Such recognition would build trust in their clients, but also motivate the employees to continue working towards having a positive impact on the lives of owners and occupants.</p>
<p>EPC PROJECT PREPARATION</p>	
<p>Insights</p>	<p>The preparatory phase is time- and effort-intensive.</p> <p>COL (municipality) releases the tender on the public tenders' portal, and it is also published on the EU portal. External applicants from outside Slovenia are welcome to apply. Then they begin with competitive dialogue & concession contracts - in the first round of EOL projects, it took from 2015, when the call was published, until 2017 to finalize and sign the concession contracts.</p> <p>Similarly, in another example offered by an ESCO, one of their last EPC projects which involved installation of a new heating system took 3 years only to reach the necessary consensus between all of the involved parties, and to sign the contract.</p> <p>Time and effort invested into planning and realisation of an EPC project is clearly relevant, impacting the financial viability of the individual EPC projects, or more generally, of the EPC business model as such (in particular for ESCOs).</p> <p>Mechanisms to accommodate unforeseen events and challenges that may arise.</p> <p>In an EPC project, the interviewees underlined, it is essential to have a series of mechanisms in place to accommodate unforeseen events and challenges that may arise during the long-term process. These mechanisms should allow for necessary adjustments to be made, considering factors such as market dynamics, price fluctuations, and delays.</p> <p>Communication with end-users</p>



	<p>In COL’s EPC projects, end-users are not directly involved in the competitive dialogue process. The communication is, however, part of the process in later stages and is primarily related to their specific needs and requirements, such as the presence of radiators in boxes for kindergartens or identifying weak points in the building, not so much on concrete energy measures. When facility tours are conducted, it is likewise a practice to have maintenance staff present.</p> <p>The difference between preparing a project with experienced or less experienced municipalities.</p> <p>In ESCOs experience, negotiations in larger municipalities are quite distinct, more detailed and demanding, due to their extensive previous experience. Smaller municipalities are nimbler in their renovation efforts and more ambitious in their renovation endeavours.</p> <p>Inclusion of PV in EPC projects</p> <p>According to the policymaker, it is essential to consider smart readiness, the integration of renewable energy sources (RES), and the implementation of energy storage solutions, such as batteries, in conjunction with building renovation efforts. However, there is very little experience in practice. In the case of EOL 3, COL introduced an amendment to the decree to include photovoltaic (PV) systems in the renovation projects, yet there was limited interest from contractors at that time – the interviewee speculated that this could be attributed to the longer payback periods associated with PV installations. They also noted that while EPC projects primarily focus on generating savings, PV systems involve energy generation and serve as a replacement for energy production methods and sources. To address this situation, the municipality decided instead to pursue its own power purchase agreement (PPA) for PV installations.</p>
<p>Barriers</p>	<p>Fragmented decision-making authority</p> <p>This can be problematic at all stages of an EPC project, but especially in the <i>before</i> phase of the project, when key decisions regarding the contract and the project details are being shaped and ultimately taken. This relates to costs of time and effort, as one of the main reasons why they have both few experiences as well as little interest and motivation for EPC in the sector of residential building renovations.</p> <p>Conflicting political interests</p> <p>ESCOs observe that PPP EPC projects are time- and effort-intensive, but also because of conflicting political interests within the municipal structures. As stated by our interlocutors, <i>“With PPP project, approximately 20 % is technical related, everything else is politics”</i>.</p>
<p>Opportunities</p>	<p>Scenarios to address the uncertainties, unforeseen events and challenges.</p> <p>In COL’s EPC projects, a number of scenarios are prepared in advance. These consider various potential issues, such as boiler failures on weekends, bankruptcy of private investors, or COL deciding to sell a particular building. By having predefined procedures and plans in place, the project can more effectively respond to unexpected events and mitigate their impact on the project's progress and success.</p>



	<p>Incentives and EPC models for inclusion of residential buildings in the renovation process</p> <p>These are recognised as needed, building management companies are interested and in principle willing to act as intermediaries.</p>
CONTRACT	
Insights	<p>Specific contracts for deep retrofits and partial renovations</p> <p>The COL's EPC within the EOL projects usually encompass both types of renovations, while the city employs two types of contracts: contracts A for deep/comprehensive renovations and contracts B for technological measures. According to the interviewee's experience, it is logical to incorporate technological measures into a project as they offer a shorter payback period and help sustain the overall project. However, the interviewee notes an increasing trend in the proportion of technological measures due to worsening economics in terms of the investment-to-savings ratio.</p> <p>Contractor selection supervision</p> <p>While the investor chooses the construction contractors, COL retains the right to supervise the selection process. This oversight ensures that appropriate contractors are chosen to carry out the works.</p>
IMPLEMENTATION OF MEASURES	
Insights	<p>The benefit of combining both building envelope retrofits and technological measures (partial renovations) in an EPC project</p> <p>This is the prevalent approach in Slovenian municipalities, and also understood as one of the key factors contributing to the advanced development of PPP EPCs in Slovenia in comparison to some other EU countries, where EPCs primarily focus on partial measures, such as boiler rooms, heat pumps, lighting, and thermostat valves.</p> <p>COL experience – duration of design and implementation phase</p> <p>In COL's PPP EPC projects, private partners take on the role of designing the project, while COL establishes stringent requirements, such as ensuring fire safety in the building envelope, including the exclusion of materials like Styrofoam. This design phase generally lasts around two-three months, but it may experience delays. Then, a timeframe of six months is typically allotted for completing the renovation. Failure to meet this deadline can result in significant penalties as stipulated in the contract.</p> <p>Two types of EPC project, which should both lead to deep renovation.</p> <p>In the policymaker's view, there should be two main types of EPCs: deep (comprehensive) renovation and gradual deep renovation.</p> <p>The gradual deep renovation refers to a step-by-step approach to renovating a building over time. For example, the renovation process could begin with window replacements, followed by subsequent stages of renovation over the years. The aim is to progressively transform the building into a zero-emission or nearly zero-emission structure by completing the renovation measures in a phased manner. The choice between these approaches may depend on factors such as the building's condition, budgetary constraints, and the specific objectives of the renovation project.</p>



	<p>Supervision by the public partner in PPP EPCs</p> <p>COL carries out its own supervision during the implementation phase of the project, even though it is not a legal requirement. This supervision aims to ensure the high-quality execution of the works and adherence to project specifications.</p>
<p>Barriers</p>	<p>EPCs are also a social process.</p> <p>EPCs are demanding in terms of having multiple stakeholders. An EPC project encompasses multiple stakeholders, including construction companies, the investor aiming to maximize savings, and various stakeholders within the public partner, such as energy and architectural professionals. To effectively manage this diverse group in COL's projects, weekly coordination meetings are held at the construction site. This also signifies that renovation processes are not only technical issues, but they are essentially also social processes that require dealing with diverse organisational and individual interests, which are time and effort intensive and therefore require specific expertise.</p>
<p>CONTRACTUAL PHASE</p>	
<p>Insights</p>	<p>Management and operational phase</p> <p>During this phase, the investor can begin utilizing the energy savings achieved from the retrofit. In COL's EPC projects, the investor (ESCO) is also obliged to provide annual reports on the progress and actions undertaken.</p> <p>COL's EPC financial model</p> <ul style="list-style-type: none"> • 51% always the private investor • Large projects: 40% cohesion funds, 9% COL • Partial renovation: 49% COL • COL also has the obligation to pay out the savings. <p>Duration of the contract in COL's PPP EPCs</p> <p>The contract between COL and the private partner has a duration of 15 years. During this period, the savings generated from the energy retrofit are charged for 14.5 years, accounting for the six-month implementation phase. The calculation of potential savings is based on the previous years' energy usage data. The savings are disbursed to the private partner on a monthly basis, with 1/12th of the annual savings paid each month. Bonuses, if applicable, are shared between COL and the private partner either in a 50-50 or 60-40 ratio. If the achieved savings fall below 50% of the promised savings, the bonus is allocated to COL.</p> <p>The measures financed by the public partner.</p> <p>Savings calculations are done separately for individual measures such as window replacements and façade insulation. If COL is the investor for the windows, the known saving potential from window replacements is subtracted from the overall savings calculation.</p> <p>Supervision and control mechanisms</p> <p>Supervision is employed by the public partner (COL) in all phases of the project. Despite the collaborative nature of EPC projects (in principle: trust), the interviewee emphasized the importance of control mechanisms to promote transparency and provide the public partner with tools to ensure quality:</p>



	<p><u>Supervision during facility handover</u>: When the renovated facility is handed over to the users, the contractors first conduct their own supervision in compliance with the Building Act. Subsequently, COL carries out its own supervision to ensure the quality of the completed works.</p> <p><u>Documentation and proof</u>: The control process is supported by extensive documentation, which includes proof of the facility's reliability, maintenance guidelines, and other relevant information.</p> <p><u>Annual reports</u>: Private partners are obligated to provide annual reports on the activities and progress during the management phase. These reports serve as a means of accountability and allow for monitoring of the project's ongoing performance.</p> <p>Communication with end-users</p> <p>In COL projects, when the renovated building is handed over to the end-users, contact information is exchanged, and a dedicated service department is made available to the building users 24/7. This service department acts as a point of contact for the end-users and assists them in addressing any minor issues or concerns that may arise during the management phase. In terms of communication, there is active engagement between the investor and the end-users, particularly employees at the management level and janitors. Additionally, COL, as the contract administrator, may also become involved in the communication process when necessary.</p> <p>Educational efforts are a key component.</p> <p>COL's EPC projects include different provisions for educating the building users:</p> <p><u>Allocation of savings for educational purposes</u>: An agreement is in place where a portion of the savings, retained by COL, is dedicated to educational initiatives on environmental topics.</p> <p><u>Training for personnel</u>: Contractors are required to provide training to personnel such as directors and technical staff. However, there are no strict provisions regarding the frequency or number of training sessions. The interviewee believes that there should be more of these activities, as higher savings are in the contractors' interest. Limited availability of personnel within the contractors may be a contributing factor.</p> <p><u>Educational campaigns</u>: Some EOL projects have included educational campaigns. Contractors have prepared playful stickers that were placed in the renovated public buildings, such as schools and kindergartens, designed to engage building occupants and raise awareness about energy efficiency and sustainable practices.</p> <p><u>Provision of instructional documents</u>: Contractors are obligated to prepare various documents, such as guidelines on how to use thermostat valves and lights. These documents are provided to the management of the renovated buildings, ensuring that they have the necessary information to effectively utilize the energy-efficient features and technologies.</p>
<p>Barriers</p>	<p>Problem of asymmetric knowledge of involved parties</p> <p>ESCOs mention e.g., calls and questions by building dwellers regarding issues with radiators (which is a technical issue that concerns the housing manager, meaning there is lack of understanding who is responsible for what).</p> <p>ESCOs have very little control over patterns of building use.</p>



	<p>It is therefore very difficult for them to guarantee (i.e., promise) energy savings since they have no control over how people will be using the building in any given period after the end of renovation. This is in particular a barrier to EPC projects in residential buildings.</p>
<p>Opportunities</p>	<p>Mechanisms to improve educational efforts and training of end-users and key staff.</p> <p>The need for increasing these efforts was identified by both the public partners, as well as ESCOs, who noted that even though they have little control over patterns of building use, behavioural interventions are possible, highlighting an award-winning project they carried out with the School centre Kranj in which they not only renovated the building but also educated students about practices of energy use.</p> <p>Clear pathways of divided responsibility in EPC projects</p> <p>There is a need for establishing clear protocols or pathways, so that end-users and/or other stakeholders are clear on who is responsible for what.</p>



9.6 Annex 1.6: Interview Summary Austria

RESEARCH BACKGROUND

National/regional system explored in WP2 research	Austria
EBENTO partner organisations involved in the research	Joanneum Research
Stakeholder organisations or stakeholder group representatives involved in the research	Facilitator Energy Agency ESCO ESCO umbrella association

NATIONAL OR REGIONAL ECOSYSTEM CHARACTERISATION

The following explains the current market status in Austria, including barriers and drivers.

The market for EPC, especially in the residential sector, is hardly growing, but rather stagnating. An initial market development has taken place so far. The Austrian market for residential energy services is currently very limited. Although the economic energy savings potential in the private building sector is very large in Austria for energy service companies (ESCOs), the market there is less developed than in other sectors such as industrial or service buildings. This sector thus seems to be out of the scope of ESCOs to a large extent at the moment.

There are much more energy supply projects than energy performance contracts in Austria. Only “Bundesimmobiliengesellschaft” BIG is mentioning the concept of EPCs explicitly in public tenders.

Barriers

- According to one of the interviewed experts, the very much supply driven market itself might be one of the reasons for the stagnation: Market developments can only be analysed and influenced by a better understanding of the demand side, which is currently not considered enough. Without exploring the customers’ needs, EPC cannot be a “pain reliver”.
- Regarding that point it seems logical that often cited problem is the limited awareness of and trust (on client side) in EPC, as well as their missing knowledge about the function of the model.
- The high complexity of energy performance planning and contracting, regarding project development, technical implementation, life cycle assessment, legal implementation etc. requires a lot of knowledge and competences.
- Regarding this, a lack of experience and specialized knowledge on the market could be stated. Additionally the inconsistent strategies may result in low clarity and attractiveness of EPC models on the market. Thus, the availability and quality of providers, intermediaries and personnel could be insufficient. Bad experiences might create an obstacle here.



- Also lacking political and regulatory supporting schemes hinder the successful Implementation of EPC: In many countries, non-supportive legal frameworks are a limiting factor. The legal complexity is very high. Especially the tertiary and the residential sector are affected in terms of rental housing.
- An expert stated EPC should not be considered a goal in itself, but a delivery mechanism for energy efficiency. Without top-down energy savings targets (top down), the system will not work because the incentives are not strong enough.
- Another barrier is the split incentive dilemma in rented facilities: The main beneficiary of energy saving measures is the tenant, while the owners responsibility is the energy efficiency investment.
- Also the huge financial resources, mostly connected to high transaction costs, that are necessary to implement large scale retrofitting programs, pose a potential problem
- High transaction costs also are the reason, why the residential sector often is not attractive enough for ESCOs, because building units are too small to be profitable.
- Additionally the long payback periods (short ones are preferred) derived from low energy savings rates and/or the high required investments, together with insecurity over long-term contracts and the other mentioned arguments, scare off private investors

Some of these Barriers are the reasons, why Energy Performance Contracting (EPC) providers have been most active in the services and the public building sector. Approximately 80 % of the ESCO market is concentrated in public buildings, mainly targeting energy contracting offerings to large customers like education and healthcare facilities as well as municipal and regional buildings (partly explained by the large transaction costs).

Drivers

- One of the main drivers is the energy price. Ongoing enormous increases of energy costs definitely has the potential to increase the attractiveness of EPC models in every perspective:
 - Customers have the ability to prevent upcoming costs, while the provider of the contract might be paid back faster
 - From a regulatory perspective, the limited budgets in the public sector automatically cause the need to increase efforts to include the residential and private sector as investors.
 - Having an interest in energy savings and cost savings (and therefore growing flexibility), while at the same time fostering national value creation, policy makers will also try to support the development of the EPC market by removing regulatory barriers and setting the right conditions for growth.
- Regarding the financial side the opportunity costs are an important driver: lost benefits or savings are often not included in the calculation of costs and are not mentioned much in the literature but could be regarded as a major argument.



- Another driver would be if the concept of EPC would be a central requirement of public tenders,
- Also ESCOs are able to remove a number of the serious barriers for customers by taking the technical, administrative, financing, construction quality, financial and credit risks, a private person would face in energy efficiency projects
- Apartment owners highly value the improved safety, indoor comfort and appearance of the building being safeguarded by a long-term energy performance agreement.
- Another added value is the extended lifetime of building envelope and technical systems

Regarding the mentioned drivers, a lot of barriers can be overcome, if the right conditions are set. Due to the described complexity of energy performance planning and contracting, researchers and experts highlight the importance of an external facilitator in order to successfully implement projects, especially in the residential sector.

Financing

- Big ESCOs (eg Energie Steiermark) use own equity for financing
- Forfeiting is a very promising concept; EU-Taxonomy can boost the concept of forfeiting as EPC can be easily declared as sustainable => high demand of banks; Forfeiting not relevant for Energie Steiermark as they have enough equity resources;

BUSINESS MODELS

Payback time is very different. For old buildings with bad energy performance and bad building energy management system, payback times of 10-15 years are possible; For others it can be possible that payback times are more than 30 years which is too much for EPC.

PV is most profitable.

Change of heating system and integration of BEMS is also profitable with payback times <20years;

Deep renovation is very expensive and less profitable than other measures; Payback time is between 20-40 years and strongly depends on the specific case.

Water and mobility can be included in the contract to improve profitability;

KEY OVERALL INSIGHTS

LEGAL FRAMEWORK	
Insights	In general, the interview confirms our current view on the market status of EPCs in Austria. The market is stagnating. EPCs are too complex, and the payback-time and contract duration is too long and therefore there is no strong need from demand side. Advantage of EPCs is not the financing but the resources and competences in energy performance of buildings. This advantage should be more emphasized. Boost in renovation through binding targets or regulations would also increase demand for EPCs;



10 Annex 2: Interview guidelines



EBENTO

WP2

INTERVIEWING GUIDELINES FOR T2.1 AND T2.2



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2 Introduction

2.1 PURPOSE OF THE DOCUMENT

This internal document provides guidance to EBENTO partners on conducting interviews with stakeholders in participating countries within the scope of WP2. WP2 focuses on analysing and defining performance-based business models to enhance energy performance contracts (EPCs) and guarantees. Interviews with key stakeholders on existing EPC models are envisioned as part of the analysis process in T2.1 and T2.2.

2.2 SCOPE OF THE DOCUMENT

The document provides a framework for the interviewing in terms of the concept behind the interviews, as well as tools to guide and support the EBENTO partners through the four phases of the process: selection of interview participants, definition of research topics, implementation of the interviews, and reporting.

2.3 STRUCTURE OF THE DOCUMENT

Chapter 3 sets the stage for the interviewing process by conceptualizing the task at hand (defining the scope and purpose of the interviews). Chapter 4 provides guidelines related to interview participants (identification and engagement of stakeholders). Chapter 5 provides a selection of key research topics and questions. Chapter 6 focuses on the implementation of the interviews (practical methodological tips for carrying out semi-structured interviews), while chapter 7 includes guidelines for reporting, including a reporting template. Finally, chapter 8 offers a step-by-step overview of activities to be implemented by EBENTO partner organisations.



3 Purpose and scope of the WP2 interviews

3.1 PURPOSE AND FRAMEWORK OF INTERVIEWING

3.1.1 What?

WP2 investigates the viability of performance-based business models in combination with innovative solutions for improving energy efficiency and comfort in residential buildings. Interviewing the key stakeholders is part of the research process in two WP2 tasks.

- **T2.1 (lead partner: JR)** focuses on scanning the existing models of energy performance contracts (EPCs), the roles and experiences of key stakeholders (process, costs, benefits, risks), as well as their interest and potential for participating in such business models (motivations, barriers, enablers).
- **T2.2 (lead partner: IEECP)**, on the other hand, focuses on the legal and contractual aspects of EPC business models in EBENTO pilot countries (and, in comparative perspective, other relevant countries), to identify a legal and contractual framework for implementing innovative business models.

3.1.2 Why?

The interviews carried out with stakeholders will provide relevant **inputs to both WP2 tasks**, supporting the desk research and analysis of the business model aspects in focus. In addition, the interviewing process provides an opportunity to **engage the key stakeholders into the project activities from the outset**.

3.1.3 How?

WP2 envisages **in-depth interviews** with key stakeholders, which means that we strive for quality and fine-grained qualitative data on EPC business models and guarantees, rather than sheer quantity. Chapter 6 provides guidelines on carrying them out.

3.1.4 When?

Both T2.1 and T2.2 conclude in M12. Taking into account the analysis process and integrating the data into the overall research conducted as part of these tasks, the partners are expected to provide interview reports by end of **M8 (31 May 2023)**.



3.2 SCOPE OF INTERVIEWING

3.2.1 EBENTO partners' engagement

Interviews will be carried out in all participating countries (AT, EE, EL, ES, NL, SI, UK), with a specific focus on pilot countries (EE, EL, ES, UK) to explore the relevant aspects of EPCs in more detail and to initiate or strengthen the ties with the key stakeholders with the aim of nurturing their support and participation in the project's forthcoming activities.

→ We suggest that in countries with more than one partner organisation, the workload is sensibly shared between them based on the principles of 1) access to a particular stakeholder (vicinity, prior relationship etc.), 2) importance of establishing contact between a particular partner and the individual stakeholder organization (future collaboration required etc.).

3.2.2 Number of interviews to be carried out

As the goal of WP2 interviews is to explore the experiences and perceptions of individual key stakeholders in more detail, this calls for longer conversations, good quality of data gathered, and comprehensive reports, rather than numerous superficial responses.

Therefore, the exact number of interviews to be implemented in each participating country may vary to a degree. In principle, we suggest the following approach:

- 6-8 interviews per pilot country;
- 3-5 interviews in other participating countries.



4 Interview participants

4.1 LIST OF KEY STAKEHOLDER GROUPS

We aim to engage a variety of key stakeholder groups along the EPC business model value chain (decision-makers, contractors, beneficiaries etc.). The table below provides a “catalogue” of stakeholders that may be engaged in WP2 research, depending on the context of an individual pilot, or the regional or national ecosystem. In relation to EBENTO pilot countries, the stakeholders interviewed might be directly involved in the pilot, but not necessarily (i.e., other models and examples of EPCs could likewise be explored). The list should be considered as non-exhaustive, which means that additional stakeholder organisations might also be relevant.

→ Identify known examples of energy performance contracting and guarantees in place or being prepared, then identify the parties involved, using the list as guidance to prepare a country-level selection of organisations and/or individuals who could potentially play the role of research participants.

STAKEHOLDER GROUP	STAKEHOLDER	EXAMPLE
POLICY-MAKERS and REGULATORS	LOCAL GOVERNANCE ORGANISATION	<ul style="list-style-type: none"> • municipalities • public sector organisations
	REGIONAL and/or NATIONAL GOVERNMENT ORGANISATIONS	<ul style="list-style-type: none"> • ministries • regional authorities • public funding organisations
RESEARCHERS	RESEARCH and DEVELOPMENT ORGANISATIONS	<ul style="list-style-type: none"> • researchers at universities and research organisations • regional development organisations
PROVIDERS	ESCOs	
	OSS	<ul style="list-style-type: none"> • existing owners/providers of One-Stop-Shops
BENEFICIARIES	PROPERTY OWNERS	<ul style="list-style-type: none"> • public property owners • private property owners • social housing providers
	OTHER RELEVANT PROFILES	<ul style="list-style-type: none"> • facility managers • building managers • building users/owners (associations)



4.2 ENGAGING STAKEHOLDERS

As the WP2 interviews might be EBENTO's first contact with the stakeholder organisations and a kick-off of the projects' continuous collaboration throughout its duration, establishing the first contact is an important steppingstone. Before embarking on the interviewing process, take the following guidelines into consideration:

#1 Use the Informed consent template (Annex A) – each research participant should consent to participating in the research by signing the form. The form provides key information on the project, as well as guarantees that the information and data being collected will be treated responsibly (project's do no harm policy). If needed, the template may be adjusted and translated to the language used by the interview participants.

#2 Start with existing (trusted) contacts from the key stakeholder groups. You may either recruit them as research participants, if appropriate, or ask them to help with identifying potential participants with the necessary knowledge, experience, role or position.

#3 When contacting the potential research participants, be prepared to send some **key project and interview information** via e-mail (with new contacts, it may sometimes be easier to start with an e-mail and follow-up with a phone call).

#4 When you have arranged for an interview, you may also want to **ask them to think in advance** (gather information, documents etc.) about their experiences and knowledge related to EBENTO research questions.

#5 Use a "snowball sampling technique" – once you have kicked-off your research, you can ask your initial research participants to help you identify and contact other individuals or organisations who might be relevant to the research.

#6 Think about how EBENTO or your organisation could benefit the interviewee and how the stakeholder organisation could be further involved in the project. **What do you bring to the table?**

#7 Be clear, professional, and humble - your top priority should be making your informants realize that you are a researcher, not an "inspector" of some sort. Make it clear that their partaking in the research is both highly appreciated and crucial for the success of EBENTO.



5 Key research topics and questions

Below, we provide an overview of the key research topics and a list of several sub-questions to support the interviewing process. The topics listed follow the logic of an EPC project process, i.e., from policy and legal framework, inception, through commissioning, to contractual phase, and consider elements such as involvement of different stakeholders, decision-making process, perceived risks, barriers, benefits etc.

→ Keep in mind that the relevance of individual questions may differ between individual stakeholders and that it may not be possible to explore all of the aspects and not in a single interview. For instance, if a public authority is currently in the commissioning phase of an EPC-supported project, they will naturally not be in a position to reflect on the challenges faced in the contractual phase. Nevertheless, their experience and perceptions on the initial phases are relevant. Likewise, if the interviewee is a representative of a policy-making organisation, the interview will focus strongly on legislative and policy aspects. It is required to review and adapt the questions (or add additional ones) prior to each interview according to the interviewee's background, granularity of knowledge, role etc.

PARTICIPANT'S PROFILE

- Capture the participant's background, incl. e.g., their background, role and position, experience with EPCs.

LEGAL FRAMEWORK

- How would you describe the current market status of EPCs in your country?
- What kind of formal rules, regulations and procedures do the energy service companies (ESCOs) need to follow in the target country?
- What kind of policies, rules, and regulations can support the efficient operation of ESCOs in the target country?
- Which types of the best legislative practices are you aware of in the target country that support and offer the best environment for the ESCO performance?
- What are the barriers in the current rules, regulations, and legislations for the current ESCO operators in the target country?
- What do you think are the essential rules, regulations, and legislations for the effective performance of the one stop shop, such as the EBENTO platform in the target country?

INCEPTION

- What was your role in the EPC-financed project(s)?
- What were the reasons to implement the project(s) through an EPC model?
- Why and how were the particular buildings selected for financing through an EPC model?



- Who participated in the decision-making process throughout the EPC-financed project(s) inception phase?
- What was (is) the timeline of the process?
- Who was involved in the consultation – were users of the buildings (residents, employees etc.) part of the process and how?
- Who were the actors involved (consultants...) and what did they provide?
- What kind of information was required to conceive the project(s) and where/how was it obtained (knowledge on the building stock, feasibility etc.)?
- Were there any doubts or barriers that your organisation met with in this phase? What kind and how were they resolved?
- What risks were identified?
- Were there any particular organisations, tools etc., that were crucial in supporting the decision-making process in this phase?
- Which other market players facilitate the performance of the ESCOs? Which types of support do they provide?
- What do you perceive as the benefits of integration of services in one platform, such as EPC and financial support for renovations?

PREPARATION

- What were the required steps in the preparation phase, how was the process initiated?
- Who were the stakeholders that had to be involved in this phase?
- How were the user requirements defined (e.g., indoor environment requirements)? Were the building users part of this process?
- How were the providers selected (tender, negotiations...)?
- How was the tender prepared and what were the special requirements included in it?
- How were performance measurement and verification protocols set?
- How was the allocation of savings decided (%)?
- Were there any challenges faced in this phase by your organisation? What were they and how were they resolved?

CONTRACT

- What types of EPC are you aware of and are prevailing in the residential sector of the target country?
- How was the contract prepared and who participated in the process?
- What were the key elements of the contract?
- Which energy efficiency or renovation measures were defined in the EPC contract?
- How was the EPC project financed? Were there any grants, subsidies, funds or other financing methods (e.g., forfeiting) used?



- Which annual energy savings were guaranteed by the ESCO? (in percent of base year)
- How was the ESCO remunerated for the investment?
- Were there any legal barriers, restrictions that impacted the contract preparation? What were they and how were they resolved?

IMPLEMENTATION OF MEASURES

- What kind of measures were implemented once the contract was signed?
- Were there any measures implemented, which were not part of the contract and how was this handled?
- Were there any challenges/conflicts faced during the implementation phase? What were they and how were they resolved?

COMMISSIONING

- How was the technical review implemented and who was involved?
- Were there any difficulties and how were they resolved?

CONTRACTUAL PHASE

- What was the timeline of the contract?
- How were the benefits measured (savings and indoor environment requirements)?
- How were the benefits perceived by the users? Were their perception and experiences measured and how?
- Were there any issues of trust among the contracting parties, or the users? How were these resolved?
- What is the general perception of the process and experiences?

CONCLUDING QUESTIONS

- Conclude the interview by asking the interview participant for an overall reflection, based on their experience and insight, for example:
 - What are the main gaps and barriers?
 - What are the main benefits and advantages of EPC models?
 - What are their key lessons learned through experience?



6 Methodology guidelines

In EBENTO WP2, we are conducting **semi-structured interviews**. This means that we have a selection of specific topics and questions that we are interested in, however, these are used to guide the conversation in an open-ended fashion and are not followed strictly (in contrast to surveys). The list of questions that guide the interviews with EBENTO stakeholders can be seen as a check-list of topics, which can be covered in the conversation, while the key is to also remain flexible and responsive to the topics brought up by the interviewees. Act on your knowledge of the participant, your observation and instinct during the interview to modify the attention you will allow for a specific topic or question.

PREPARING FOR INTERVIEWS	
Schedule your time	The entire interview process (from recruiting participants, to preparing for the interview, carrying it out, potential travel to and from the interview location, reporting) can take between 6-8 hours. Make sure you plan sufficient time and effort, by sharing responsibilities and efforts among the team members (if applicable).
Select location	Be flexible about the location. It may not be possible or appropriate to hold all meetings in official locations - interviews sometimes work better in informal settings, where people tend to be more relaxed. Meeting at the stakeholder organisation’s offices may on the other hand provide opportunity for them to access documents, tools in place etc. Suggest and discuss the interview location when you approach a candidate to make the appointment.
Prepare materials	<p>Customise research topics and questions according to the individual participant’s specifics (background, role, organisation). You may keep more (sub)questions on your list, but be aware that you probably won’t have the time to go through all of them. Print the questions and bring it with you for the interview as a “back up” reference (e.g., to glance over them if the discussion comes to a stall).</p> <p>Also print out consent forms and bring any other materials such as brochures and visuals, if available. Visuals are usually a great tool for sparking up discussion.</p>

INTERVIEW INTRO	
Introduce EBENTO and yourself	It is helpful if you can work in pairs. Explain that you are in the role of researchers, hoping to learn from their experience and knowledge, and to understand their (personal/organisational) perspective. Very briefly explain the aims of EBENTO and indicate how EBENTO relates meaningfully to the background and work of the person you are talking to. Highlight why their participation is important (even invaluable) for the project.
Explain aims of the interview	Explain why it is valuable to record the session (in written and/or audio format): to be able to represent their explanation properly and analyse with due diligence, while all records will be treated according to GDPR and personal data protection protocols. The aim is to understand, not to harm.
Ice-breaker	To break the ice, ask your informant some simple questions that they will feel comfortable with. For example, regarding their professional background: How did they end up here – in



WP2 Interviewing guidelines

	the job/position where they are now? What is their favourite part of doing what they do? What are they passionate about and what gives them purpose in the context of their profession?
Clarify the key notions and establish the topical field	Explore differences and similarities in your understanding of core EBENTO concepts (energy performance contracts, guarantees etc.) and establish common ground for later discussion.

COLLECT EXPERIENCES AND PERSPECTIVES	
Interviewing process	Think of your interlocutors (from either stakeholder group) more as your co-workers rather than simply informants from which you wish to “extract” information. If prompted to do so, do not hesitate to “give” in return during the interview (e.g., information).
	It is usually best to begin with open ended questions (broad and simple), which require the participant to describe events, or a process (e.g. how do you understand... ? What is your experience of... ?). Steer the conversation with more specific questions that relate to the initial question and answers given by your interlocutors; e.g. “What exactly did you mean by ...? Can you tell me more about... ?; Why was this so important/relevant/interesting for you?”
	Do not rush from one question to another. Allowing interviewees to explain in detail will help to understand their context, as well as identify aspects which we have not considered in our list of questions.
	As often as possible, ask your interlocutor to show you the things or activities you are discussing (virtually or physically). Ask them to show you any photos or other materials that are relevant to them in the context of what you are discussing.

RECORDING DATA	
Make notes	Limit note-taking to briefly capturing the content of discussion (not word-by-word), your observations and thoughts, or new questions that arise. Otherwise, focus on the activity and your interlocutor as much as possible (eye contact, attention). Working in pairs can help here, as one of the researchers can focus on the note-taking process. Take additional notes immediately after the activity concludes, when your memory is still fresh.
Audio recording	The interviews may also be audio recorded, if preferred and if consent is given by the interview participant. Reassure your interlocutor(s) that the recording will not be shared or published, and will be stored securely solely for the purpose of research analysis. Be aware that note-taking from audio records will take additional time, while it can also make the interviewee feel less comfortable to discuss freely.
Record visual material	Take photos or videos, whenever needed, appropriate and if you have explicit consent. Visual material is a helpful tool for later analysis and representation. You can also document secondary material (e.g., make photos of documents shown etc.)



7 Analysis and reporting guidelines

The analysis and reporting process will progress through three steps:

- STEP 1 – analysis of individual interviews (partners carrying out interviews);
- STEP 2 – brief overall analysis and report at the national/regional ecosystem level (partners carrying out interviews);
- STEP 3 – comparative analysis and integration into T2.1 and T2.2 outputs (T2.1 and T2.2 team).

Guidelines and templates for reporting are provided in this document, however, T2.1 and T2.2 teams will be available for any required clarification and support in the analysis process.

7.1 INDIVIDUAL INTERVIEW ANALYSIS AND REPORTING

Each interview will be first analysed and reported on separately. This is done by the partner(s) who carry out the interview. The goal of this first step in the analysis process is to comb through the raw data collected, i.e., the notes and/or transcriptions you made during or after the interviews and capture them in a brief report. A template for noting down the most relevant data and insights is provided in **Annex B**.

These reports will provide a baseline for further interpretation and analysis in steps 2 and 3. Note that the interview notes will remain internal documents and will not be published in project deliverables as such. Also note that some interviews may be “richer” in terms of content than others – the amount and type of insights you collect in the report may therefore differ between individual interviews. Below are some recommendations to support the reporting process.

INTERVIEW REPORTING	
Timing	<ul style="list-style-type: none"> • Start with organising your notes as soon as possible after an individual interview is completed (ideas and impressions tend to fade away!).
Prepare materials	<ul style="list-style-type: none"> • Notes made during or after the interview (read through, fill in gaps). • If available: audio recordings and transcription of key statements. • Visual materials and any other artefacts (documents etc.).
Write the interview report	<ul style="list-style-type: none"> • Use the Interview notes template with examples (Annex B). • In the central part of the template (Key topics and insights – Context), organise the data gathered in the interview into individual insights. Then briefly explain them in more detail in the second column (provide context, further information etc.). • Include verbatim statements (quotes) where relevant, otherwise capture the content in your own words. • Consult WP2 team, if further support is needed.
Eliminate any blind spots	<ul style="list-style-type: none"> • Avoid assuming in your analysis – if you realise some aspect or important detail of the conversation is unclear to you, it is better to reconnect with the research participant and ask for additional explanation or information, or make a note in the analysis that there is unclarity or need for further confirmation.
Submit	<ul style="list-style-type: none"> • Upload the report to the WP 2 folder at EBENTO’s Alfresco platform.



7.2 OVERALL ANALYSIS AND REPORTING

Once all the interviews in an **individual national or regional ecosystem** have been conducted and separately analysed, an overall analysis of the research insights will help T2.1 and T2.2 leaders to integrate the findings into the data from the other tasks’ actions. This part of the analysis process is likewise delivered by the partners who were engaged in the interviewing process, as they have a more complete insight into the national context and data gathered through the interviews and the research. A draft template is provided in **Annex C** to guide the reporting; however, partners are free to add other points they consider relevant for this research, as these may be specific to their national ecosystem.

NATIONAL/REGIONAL-LEVEL ANALYSIS	
Timing	<ul style="list-style-type: none"> Start drafting the overall report when all the planned interviews have been concluded and individually analysed.
Prepare materials	<ul style="list-style-type: none"> Interview reports. Relevant documents or analyses, which might provide relevant additional data or be used as references.
Write the overall report	<ul style="list-style-type: none"> Use the Overall report template with instructions (Annex C). Synthesise the data gathered in individual interviews and formulate insights (learnings) on a broader (regional or national) perspective. Consider the topics, following the logic of the research questions: from legal framework to the individual phases of an EPC process (inception, commissioning...). Adapt the template, if required (e.g., add a new topic in the insights section etc.) – make it work for your specific context. However, try to stick to defining the barriers and opportunities, as these will be relevant for the ongoing WP2 work. Try to contextualise the insights you have gathered through the interviews by explaining the relevant national specifics, referring to e.g., external resources that support your claims. You may still include verbatim statements (quotes) from the interviews where relevant, especially when they are particularly insightful, or capture the content most vividly. Contact WP2 team if further support is needed.
Eliminate any blind spots	<ul style="list-style-type: none"> As in the individual interview analysis, double check the data where you feel uncertain of the validity and accuracy.
Submit	<ul style="list-style-type: none"> Upload the report to the WP 2 folder at EBENTO’s Alfresco platform by end of M9 (June 2023).

7.3 COMPARATIVE ANALYSIS AND INTEGRATION INTO WP2 OUTPUTS

The national/regional reports will form the baseline for a comparative analysis, backed by individual interview reports for reference. The insights will be integrated with other data gathered in T2.1 and T2.2 to investigate the viability of innovative performance-based business models including a legal and



contractual framework, based on the experiences, motivations, and the barriers and enablers met by the key stakeholder groups involved in the research. This will be done by the WP2 team, with the support of the partners who conducted the interviews, if required (e.g., reviewing, feedback, clarifications).



8 Checklist

- Decide on the sharing of responsibilities between partner organisations in the participating countries.
- Identify examples of energy performance contracting and guarantees in place or being prepared, then – using the table in chapter 3 as a reference – draw up a catalogue of local/regional/national stakeholders, who could potentially participate in the research as interviewees. Finally, set up a priority list.
- Allocate responsibilities between partners locally and decide on internal deadlines.
- Contact the stakeholders and set up the interviews.
- Before each interview, customise the list of key interview topics and questions, based on the specific stakeholder's context (background, knowledge, experience, field of expertise etc.).
- Carry out the interviews, keeping in mind the guidelines and 'tips and tricks' for a successful interviewing practice (note-taking, recording, etc.).
- Fill in the reporting template (Annex B) for each individual interview and upload them to the WP2 folder in EBENTO's Alfresco platform.
- Once all interviews are complete, write up a brief overall analysis (template Annex C) and upload it to the WP2 folder by 31. 5. 2023.



Annex A – EBENTO Informed consent (TEMPLATE)

You are invited to be part of the EBENTO project’s research. Before you agree to participate in the interview, it is important that you understand the purpose, the nature, and the content of the research. Please read the following information carefully. In case you find any information unclear, or if you would like more details, please do not hesitate to ask one of our project representatives for clarifications; contact details are provided below.

Purpose, aims and goals

EBENTO, which stands for “Energy efficiency building enhancement through performance guarantee tools”, is a Horizon Europe project, which aims at developing an integrated platform for all actors involved in building and renovation sector to provide a one-stop-shop platform to better coordinate and manage Energy Performance Contracting (EPC), bringing together the needs from all actors involved in enhancing the building stock. The project will validate new business models for optimizing the financial resources available, explore financing and collaboration schemes to set up energy services, in order to increase the amount of energy efficiency projects in the city/region.

The purpose of EBENTO interviews is to investigate the viability of performance-based business models in combination with innovative solutions for improving energy efficiency and comfort in residential buildings. By engaging different stakeholders (incl. regulators and policy-makers, providers, beneficiaries, and others), we aim towards a better understanding of their experiences in existing projects involving energy performance contracting.

The methods

EBENTO uses semi-structured interviews to engage with the relevant stakeholders in the national and regional ecosystems, recording the discussion in written notes and/or audio, with your consent. Likewise, with your explicit consent, and when appropriate, we will take photos during the research activities. Collected materials will be used for research and/or promotional purposes in the context of EBENTO. Any personal data gathered as part of this research will be treated in accordance with EU’s General Data Protection Regulation (GDPR). Details of how to exercise your rights under GDPR are available at <https://gdpr-info.eu/>.

Voluntary participation

Participation in this research is entirely voluntary. You can decide whether and to what extent you want to participate. If you agree, you will be asked to sign this consent form. You can withdraw from participation in the project at any time during the project duration without providing a reason. You can do so by contacting one of the project representatives listed below. In that case, any information and data you have shared with EBENTO researchers will be excluded from the study and all records will be securely destroyed.

Project representatives at XXX insert institution XXX:

YYYY name YYYY
Email: xxx@yyyy.zzz
Ph.: 010 2030 40506

YYYY name YYYY
Email: xxx@yyyy.zzz
Ph.: 010 2030 40506

Thank you for considering contributing to the EBENTO project.

Kind regards,

XXX insert institution XXX



PARTICIPANT CONSENT FORM

Name

Please tick the box(es) to confirm the following statements.

I agree to take part in the EBENTO research.

I confirm that I have read and understood the EBENTO research information sheet.

I understand that my participation is voluntary and that I am free to withdraw from participating in the project at any time for the duration of the project without giving any reason.

I consent to the interview being recorded. YES NO

I understand that the data collected from the EBENTO study may be used by the researcher(s) for this project.

I consent to quotations from the research activities being used (select preference):

A) With reference to my true identity and the identity of the organisation/institution I represent.

B) Strictly anonymously.

I consent that images or videos taken during the research can be used in project reports and for dissemination purposes.

Name of Participant

Signature

Date

To be filled in by the responsible EBENTO researcher.

I, _____, declare that the research participant signed above has been adequately informed about the study.

Signature

Date



Annex B – Interview analysis (TEMPLATE)

Location & date of activity	<i>e.g., Ljubljana, IRI UL headquarters</i>	17. 3. 2023
Participant(s)	<i>Pseudonym or full name if explicit consent was given.</i>	
Organisation	<i>If applicable and if explicit consent was given.</i>	
Stakeholder group	<i>e.g., ESCO, policy-makers ...</i>	
Interviewee’s background (brief)	<i>An approximate description of the interviewee’s context, e.g., role at the organization, experiences relevant to EBENTO. Avoid using identifiable references in case information provided could potentially harm the participant.</i>	
Researcher(s) present		

Key topics and insights (add lines for each new insight as needed)	Context
<p><i>These might be different from one interview to another. Focus on the experiences, needs, barriers, and opportunities identified through the interview. Try to phrase your insights in a conceptually condensed, and comprehensive manner.</i></p> <p>E.g.: There is a lack of best practice examples, which stalls the initiation of energy performance contract projects in the region.</p>	<p><i>Describe the individual insight in more detail, providing more context to support, explaining the topics raised, backing the claims with further information. Use direct quotes from the interview, where appropriate.</i></p> <p>E.g.: The participant is aware of only one such project. Project XYZ involved a local school and PV installation. However, the project was dealing with numerous challenges, most notably a), b), c)...</p> <p>“I personally am not inclined to take part in another such project any time soon”, the participant seemed determined.</p> <p>Based on the interviewees experience, it would seem that an accessible portfolio of best practice examples from other regions, for instance, could help instil more trust ...</p>

Reflection
<p><i>Write a very brief reflection on the research activity – for example, your most important takeaway, your impression, what went well (what didn’t), or if there is any follow-up required. Here you can be entirely subjective.</i></p> <p>E.g.: Even though the participant was adamant the project was in general a failure, the available data shows that it is functioning with significant success – it might be valuable to explore the experience of other stakeholders who were involved in this particular project.</p>

Visual or other gathered material (documents etc.)
<p>Photo 1: Mr Municipality Officer pointing out the PV installation on the school roof.</p> <p>Document 1: The School project publicly available report.</p>



Annex C – Overall analysis and report (TEMPLATE)

RESEARCH BACKGROUND

National/regional system explored in WP2 research	
EBENTO partner organisations involved in the research	
Stakeholder organisations or stakeholder group representatives involved in the research	

NATIONAL OR REGIONAL ECOSYSTEM OVERVIEW

Key stakeholders in the ecosystem <i>(list and brief description, a few words)</i>	
EPC projects identified <i>(add links to available further information)</i>	
Relevant tools / services related to EPCs already in place <i>(add links, if relevant)</i>	
<i>(add more items, if relevant)</i>	

NATIONAL OR REGIONAL ECOSYSTEM CHARACTERISATION

<i>Briefly characterise the ecosystem studied (approx. 300 words) – think of this as an introductory paragraph to the state of EPCs in your country/region. Include information on the maturity of the ecosystem, etc.</i>
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KEY OVERALL INSIGHTS

LEGAL FRAMEWORK	
Insights	<i>Describe the key findings related to the EPCs legal framework in your national or regional ecosystem.</i>
Barriers	<i>List and briefly describe the key barriers related to the legal framework, identified through your research.</i>
Opportunities	<i>List and briefly describe any identified opportunities, which could help overcome or mitigate the barriers, and could potentially be explored further by EBENTO.</i>



EPC PROJECT INCEPTION	
Insights	
Barriers	
Opportunities	

EPC PROJECT PREPARATION	
Insights	
Barriers	
Opportunities	

CONTRACT	
Insights	
Barriers	
Opportunities	

IMPLEMENTATION OF MEASURES	
Insights	
Barriers	
Opportunities	

COMMISSIONING	
Insights	
Barriers	
Opportunities	

CONTRACTUAL PHASE	
Insights	
Barriers	
Opportunities	

<i>Copy table and add items, if needed</i>	
Insights	
Barriers	
Opportunities	

