EEnvest

Risk reduction for Building Energy Efficiency investments

Energy Efficiency Business Models

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Executive summary

The objective of the present public deliverable D4.2. Energy Efficiency Business Models is threefold:

1. To guide building owners of a commercial building through the selection of an appropriate business model and financing source for their EE project of its commercial building, based on a decision-making flow methodology.
2. To apply the decision-making flow methodology on a set of business cases
3. To provide a market uptake potential analysis of the main EE business models in the pilot countries Spain and Italy, with specific focus on the most appropriate business model observing the EEnvest's risk reduction approach

After the **Introduction chapter,** setting the business model background and providing more insight in the three objectives, **Chapter 1** describes the business models that are usually at the basis of Energy Efficiency services. These business models can be divided in two main business models: the Separate Contracting Based (SCB) business model and the Energy Performance Contracting (EPC) business model. The chapter firstly introduces the service delivery models and the main stakeholders in the Energy Efficiency value chain. It then analyses and discusses specifically the SCB business model and the EPC model with its main variants. The chapter finally discusses the relevancy of integrating Multiple Benefits (MB) in the business case analysis of energy efficiency projects and evaluates how the inclusion of Multiple Benefits in the energy efficiency value chain influences the business models for energy efficiency.

The implications in terms of risk allocation and risk management applicable to the different Business Models and how the risks can be allocated to different stakeholders/actors such as the building owner, the tenant, the designer and/or the contractor(s) or ESCO are being described in **Chapter 2**. This chapter further discusses the impact of the different risk allocations on the financial results of the EE project based on the probability distribution of these relevant results (i.e., financial KPI) based on the following four main risks: energy performance gap, damage, climate risk and energy price risk.

Chapter 3 guides the project or building owner through the selection of an appropriate business model and financing scheme for the envisaged energy renovation project of its commercial building. This chapter firstly discusses briefly the relationship between financing instruments and financing products. It then analyses 11 available financing instruments for commercial building renovation and further briefly discusses the sources of public support for building renovation in the form of grants, tax reductions or credits and subsidized loans in the pilot countries Italy and Spain. The chapter then proposes a decision-making flow methodology based on six defined selection criteria. Finally, a practical decision-making flow is presented based on three defined criteria: Risk aversion, leverage and project magnitude or size.

The analysis of business cases using the Discounted Cash Flow model is discussed in **Chapter 4**. It adopts a practical approach and explains how the DCF works, touching upon the main inputs and outputs of the model. It specifically discusses the business model-specific parameters, depending on the business model chosen, and the financial instrument-specific parameters, depending on the availability of specific financial instruments and the country specific parameters.

In order to provide some examples on the potential business models and financial instruments that are suitable for different energy efficiency investments, **Chapter 5** analyses a set of thirteen business cases, based on actual data from building renovations and applies the decision-making flow methodology to point towards a possible business model and specific financial instruments. The first part of the chapter describes the results of the EEnvest technical and financial evaluation of the thirteen energy efficiency renovation projects, considering several Key Performance Indicators (KPI) complemented by additional

information on multiple-benefit KPIs that are relevant for building owners, as they refer to the impact on building occupants. The second part of the chapter applies the practical decision-making flow to these thirteen business cases, hence pointing towards the Separate Contracting Based Model or the Energy Performance Contracting Model and providing suitable financing solutions.

Chapter 6 discusses the market uptake potential of the Energy Efficiency Business Models described in Chapter 2, and particularly the Energy Performance Contracting (EPC) model. Firstly, it describes the status of the SCB business models and the possibility of project certification as an enabler of their uptake. Then it provides the status of EPC in the two pilot countries, Spain and Italy. Finally, the chapter discusses current tendencies in the energy efficiency market and provides insights in the join efforts needed to pave the way for EPC models.

The conclusions of this report are being provided in **Chapter 7.** This chapter highlights how the three objectives of this report have been addressed.

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List of abbreviations and acronyms

aaS	As-a-Service
AEPC	Active building Energy Performance Contracting
CaaS	Comfort-as-a-Service
CHP	Combined Heat and Power
CR-EPC	Comprehensive Refurbishment Energy Performance Contracting
DER	Deep Energy Retrofit
EE	Energy Efficiency
EPC	Energy Performance Contracting
ESA	European System of Accounts
ESC	Energy Supply Contracting
ESCO	Energy Services Company
IEC	Integrated Energy Contracting
LaaS	Light-as-a-Service
M-EPC	Maintenance & Energy Performance Contracting
PPA	Power Purchase Agreement
QAI	Quality Assurance Instruments
SCB	Separate Contracting Based
smartEPC	Smart Energy Performance Contracting
TCO	Total Cost of Ownership

INTRODUCTION

Before deciding to implement their energy efficiency (EE) project building owners normally will have to address the following questions, among other:

- Which Energy Conservation Measures (ECM) will be or can be implemented?
- How much energy and cost savings will be or can be achieved?
- How are these ECM going to be implemented?
- Who will be implementing, operating and monitoring the ECM?
- How to address the risks surrounding the envisaged energy efficiency project?
- How to finance the investment in the ECM?

To which extent these questions can be addressed depends on the stakeholders and actors involved in the EE project, on the service delivery model provided, on the value created (monetary and multiple-benefits) by the EE project, on the financing needs of the building owner and, when necessary, on the available or addressable financing sources.

The way an EE project is set-up, with the stakeholders and actors involved in the project, to create value by delivering and sourcing services to the building owner (the service delivery model) refers in fact to the business model. Hence, depending on the business model the above-mentioned questions, and per definition the value creation and the risk associated with the EE project, will be addressed differently or in a different way. The building owner has thus a vested interest in understanding the business models that are commonly used to deliver EE and energy renovation projects. This understanding allows the building owner to choose the business model that best fits his risk profile and value creation ambitions.

This document has three objectives:

1. To guide the building owner through the selection of an appropriate business model and financing source for the envisaged EE project of its commercial building, based on a decision-making flow methodology.
2. To apply the decision-making flow methodology on a set of business cases, based on actual data from building renovations.
3. To provide a market uptake potential analysis of the main EE business models in the pilot countries Spain and Italy, with specific focus on the most appropriate business model observing the EEnvest's de-risking approach.

In order to address the **first objective** this document introduces business model concepts such as stakeholders, service delivery model and financing and presents the two main business models that are commonly used for the delivery of EE services: the **Separate Contracting Based (SCB) business model** and the **Energy Performance Contracting (EPC) business model**, including its main variants. The emphasis here is on how services and solutions are delivered to the building owner and how the different stakeholders (e.g., subcontractors, engineering companies, financiers, facilitators) are involved in the project delivery and financing, how value is created and captured to generate a profitable business for all parties involved and finally, how risk is being dealt with among the stakeholders. The analysis also shows which input and output parameters are applicable (e.g., investment, operation & maintenance costs, energy savings, financing costs…) and how monetary exchanges flow among these different parties, with specific focus on how Multiple Benefits create value and how that value is captured, recognizing that some value of MBs will not be able to be quantified and/or captured. The implications in terms of risk allocation and risk management of each business model and how the risks can be allocated to the different stakeholders is then presented. The **EEnvest financial risk evaluation model** will be proposed as a method to calculate the impact of the different risk allocations on the financial results of the EE investment. This calculation is based on the probability distribution of relevant financial KPI based on four main risks: **Energy performance gap**, **damage**, **climate risk** and **energy price risk**.

After analysis of eleven available financing instruments for commercial building renovation and sources of public support in the pilot countries Italy and Spain a **decision-making flow methodology** is proposed. This methodology is based on six defined selection criteria. It intends to guide the building owner through the selection of an appropriate business model and financing scheme. The proposed methodology is not aimed at choosing one specific solution, rather the most suitable set of solutions. Given the complexity of the decision-making flow, when all defined criteria are being applied, a practical decision-making flow is proposed based on three defined criteria: **Risk aversion** (criterion 1), **leverage** (criterion 2) and **project magnitude or size** (criterion 3).

To give substance to the **second objective** a set of thirteen business cases, based on actual data from building renovations are being introduced and analyzed. For these business cases relevant KPI, resulting from the application of the EEnvest technical and financial evaluation approach and from application of the DCF-methodology, which is also discussed in this document, are being presented and benchmarked. The analysis of the KPI is complemented by additional information on multiple-benefit KPIs relevant for building owners, as they refer to the impact on building occupants. The proposed practical decision-making flow is applied to these thirteen business cases, hence allowing to point for each business case, firstly, towards a suitable business model, either to the **SCB Model** for those business cases qualifying as low risk or to the **EPC Model** for the business cases qualifying as higher risk and, secondly, to **suitable financing solutions**.

As part of the **third objective** this document presents the status of the SCB business model and links the potential for uptake of SCB energy efficiency investments to the possibility of project certification. Project certification, such as IREE (Investor Ready Energy Efficiency), is a means to increase investors' confidence EE projects and could thus be an enabler of the SCB uptake. The status of the EPC business model in the pilot countries Spain and Italy is then presented, based on research and interviews conducted with experts. For Spain current barriers are being discussed, as well as initiatives and proposed contracts to overcome those barriers. The current ESCO market is presented for Italy as well as the commonly proposed EPC variants and a status is being given of the current business volumes. For both countries the current tendencies in the energy efficiency market are being highlighted. To overcome the existing barriers joint efforts to pave the way for EPC models are required. This document looks at some EU projects and highlights how they deal with these barriers.

1. Business Models for Energy Efficiency investments

Business Models are key to any economic activity, whether it is product or services based. This is not different for Energy Efficiency (EE) services or investments delivered by a variety of market actors in the Energy Efficiency value chain.

Although in the past EE business models were often based on the delivery of technology or products, with some level of additional services, in recent years there is an important trend to provide EE as a Service. Energy Performance contracting (EPC) and Energy Supply Contracting (ESC) are good examples, but different other types of "as-a-Service" models are being offered, e.g., Light-as-a- Service, Comfort-as-a-Service, EE Equipment–as-a-Services, etc. The difficulty for end-customers is often to understand clearly what is being offered and to what extent performance guarantees are being offered.

A key driver for performance-based models for energy efficiency or energy renovation of buildings is the fact that the customer faces a significant risk of underperformance in the traditional way they are designed and implemented. None of the stakeholders in the value chain of traditional EE projects (e.g., engineering companies, installers, contractors...) cover the non-negligeable risk of such underperformance. As investment levels increase, so does the impact of underperformance. Customers are thus turning to models where Energy Services Companies (ESCOs) cover the risk and provide performance guarantees. They will include penalties in case of underperformance and bonusses in case of overperformance.

A specific element of EE investments business models is the fact that that these are based on the promise of a monetary return on investment, i.e., most energy efficiency investments are made to achieve energy and cost savings. The project will often be evaluated based on those cost savings that are directly related to the ambition level and thus level of investment. This makes EE projects often very variable and the level of ambition is often a key driver in the investment decision. To step away from this financial logic business models can bring multiple benefits (i.e., increased comfort, increase Indoor Air Quality, increased well-being...) of energy efficiency renovations to the foreground as these are benefits that originate in addition to energy and cost savings. As with other business models the goal of the party that is delivering the services is of course to build a profitable business model and generate sufficient margin on the activity. In energy efficiency, unlike what some people might think, profit margins are mainly taken on the investment part and to some extent on other services like maintenance. The financing part is rarely the activity on which EE services providers try to take margins. This is also driven by the fact that customers are often looking for transparency on financing rates and costs.

A key element of the EE investments business model from the point of view of the EE providers is the risk for underperformance, to some extent balanced by the opportunity of overperformance. This has led to the development of service models like EPC, where the so-called Energy Service Company or ESCO takes on a significant level of financial performance risks by offering guarantees on the energy and cost savings. This performance guarantee becomes a key element of the business model in which all eyes are set on the objectives and the way to measure meeting them, rather than on the means to get there. This then has a huge impact on how projects and tenders are organized and on the increased scalability of the business model.

1.1. DEFINITION OF A BUSINESS MODEL

There are several definitions of what a Business Model is, but in the context of the EEnvest project we will use the following one:

"A business model is a description of how an organization's activity is set-up with partners and/or stakeholders to create value by delivering and sourcing service or product offerings to customers, while identifying financial flows between parties."

The advantage of this definition is that it is sufficiently generic to cover different variations in the context of energy efficiency renovations and that it focuses on the key relations between stakeholders, which allows it to zoom in on value creation and associated risks. Value creation in energy efficiency business models is not only limited to monetary value as a result of kWh savings, but includes also Multiple Benefits that, as being described in the EEnvest Evaluation Methodology for Energy Efficiency Investments, are created as a result of the energy efficiency renovation but are not always monetised, quantified or captured by the different stakeholders of the business model. Particularly, in case of rented homes, social housing or office building, value may be created through energy savings and multiple benefits by the owner of the building (as the latter normally bears the investments in the energy efficiency renovation), but may not be captured by him because of the owner/tenant split incentive. These Multiple Benefits are however often captured by the tenant.

1.2. INTRODUCTION TO THE DELIVERY MODELS, STAKEHOLDERS AND BUSINESS MODELS

In the case of an energy efficiency project or energy renovation of buildings, the main beneficiary of the value that is being created when implementing the business model is the building owner (or project owner). Nevertheless, other stakeholders are involved, and some are even necessary to make this business model work. The building owner will make an investment (i.e., a Capital Expenditure, CAPEX) in energy saving measures and reckons to get some level of return on investment from the financial savings that result from the kWh savings. He will likely also need to spend some amount of money on maintenance or other operational services (Operational Expenditures, OPEX). In many cases the energy efficiency project involves also the addition of local renewable energy production, PV solar being the most common one. In addition to energy and cost savings, he will likely benefit from a number of multiple or non-energy related benefits, like for example an increased level of comfort or an increase in the building asset value.

To deliver the energy savings, the basic delivery model is the one that is already being used for decades. It is based on a fragmented value chain, in which various market actors intervene at various stages of a project. These are typically energy auditors, engineering companies and a variety of general and specialized contractors. Specific technical solutions or services may be provided by even more specialized services or technology providers.

One of the key stakeholders that will have a major interest in the business model of energy efficiency in buildings is of course the company (or companies) that is executing the renovation works. These are typically contractors, either a general contractor or most often multiple separate contractors per type of work or energy measure. They will often deliver the equipment or material and perform the installation or works. They may provide some level of maintenance, although it is common to outsource maintenance to a dedicated maintenance company or to manage maintenance in-house. This model is sometimes referred to as the Separate Contracting Based (SCB) model[1].

In some cases, the project owner prefers to finance the investment in its building with own funds. In case the owner cannot or prefers not to deploy own funds, he may look for an external financier, typically a financial institution. In this case, this financier clearly has an important role to play in the Business Model and will look at creating value in his own right. Some contractors may provide financing themselves, typically some kind of supplier credit financing product whereby payment is deferred or vendor financing whereby the supplier lends the money to the project owner. These contractors will

[1] http://citynvest.eu/sites/default/files/library-documents/20151202_WP2_Final_Report-V1.5.PDF

mostly have some kind of back-to-back arrangement with a financial institution to provide this type of financing offer, as financing is never their core business.

In other cases, the financing may be provided by some other 3rd party financier, or a combination of 3rd party financiers, like a private investment fund or a public investment fund at the local, regional, national or European level. The latter may provide low or even zero-interest loans.

One part of the financing may not come from a loan or similar financing that needs to be reimbursed, but from grants or subsidies that can be obtained from local, regional, national or European authorities. In that case the obtained grants or subsidies will lower the amount that would need to be financed externally or with own funds.

Often financing will be obtained from both public sources (e.g., grants or loans) and private sources (e.g., private equity, loans or ESCO financing). This type of blended financing is quite common in large projects, projects that aim to achieve SDG goals or in projects were private financing is required to achieve ESA neutrality (off-balance).

Other stakeholders that are involved in the Business Model are organizations providing the necessary advisory services to the building owner, e.g., architects, consultants, engineering companies, etc. In some cases, not only investments can be subsidized, but also “technical assistance”, which allows for hiring or paying in-house staff or for paying such outsourced advisory services, technical studies or project facilitation services.

In case the building owner wants to mitigate the risk for underperformance in terms of energy savings - which is very real in a classical approach of energy efficiency - he may want to engage into an Energy Performance Contract (EPC). In this case energy savings are designed, built, maintained and guaranteed by a single party, an Energy Service Company (ESCO), acting as a single point-of-contact (contact and contract) and sole responsible party for the whole energy efficiency renovation project. The ESCO will pay a penalty in case of underperformance, typically equivalent to the non-realized though guaranteed cost savings. On the other hand, the ESCO can typically earn a bonus in case of overperformance, often corresponding to up to 50% of these excess energy cost savings. These guaranteed energy savings, that constitute a stable and predictable cashflow, are used in this specific EPC business model to pay for the investments, that can be prefinanced by the ESCO or an external third-party investor (bank or financial institution, investment fund, etc.).

1.3. BUSINESS MODELS FOR ENERGY EFFICIENCY

Based on the above discussed elements, two main Business Models can be identified:

- Separate Contracting Based (SCB) Business Model
- Energy Performance Contracting (EPC) Business Model

The following graph shows the basic scheme of the **SEPARATE CONTRACTING BASED (SCB)** business model for an owner occupier of the building.

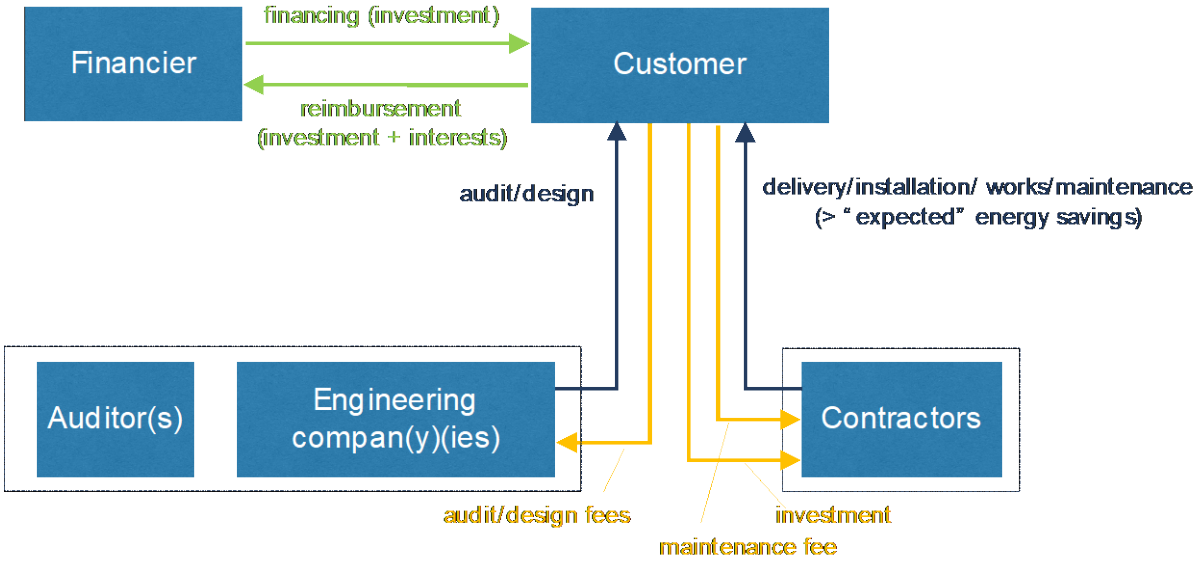


Figure 1. Separate Contracting Based (SCB) Business Model for Energy Efficiency

The graph shows the direct relation between the customer and the different contractors and other service providers. In some projects the number of contractors can be important. As the value chain of the delivery of energy efficiency measures is disintegrated at each stage of the process, none of the actors involved in the audit, design and implementation will take responsibility for the final performance. Energy savings are estimated and may even differ from one stage to the other. Estimated savings (and not guaranteed savings) will be the basis for the reimbursement of part or the whole of the investment, but the performance risk, i.e., the risk of not achieving the savings, remains with the customer. Financing can come from the customer's own funds or from an external financier.

The SBC model is not very scalable and transaction costs (technical assistance, studies, technical specs, tendering costs, etc.) will grow almost linearly with the number of buildings and measures.

The following graph shows the **BUSINESS MODEL FOR ENERGY PERFORMANCE CONTRACTING (EPC)** for a building owner occupier.

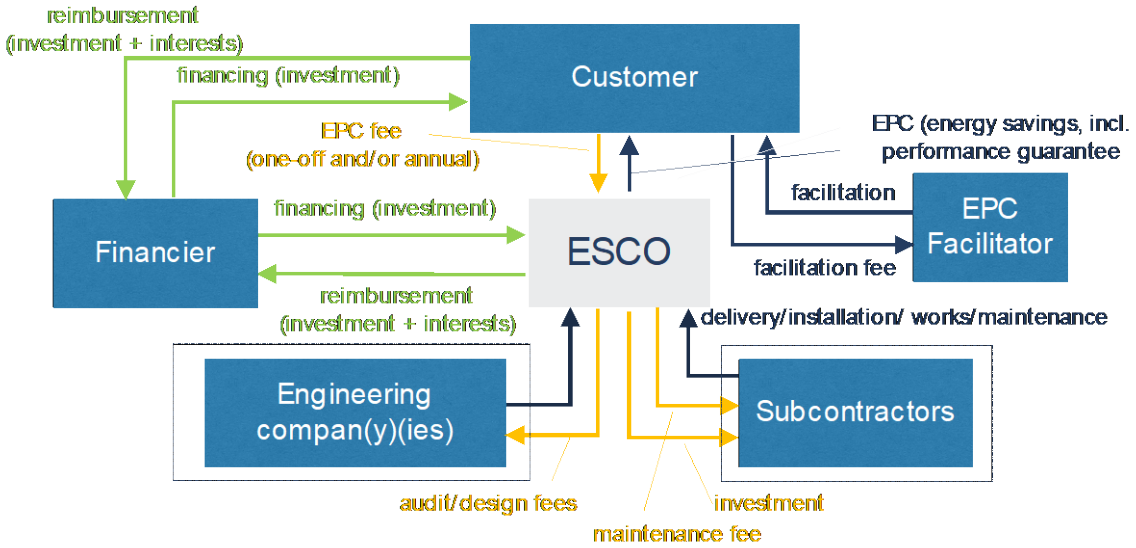


Figure 2. Energy Performance Contracting (EPC) Business Model for energy efficiency

In this case, the ESCO acts as a Single Point of Contract for the delivery of the energy efficiency measures to the Customers. He may incorporate all competencies necessary to design, implement and manage the measures, or decide to subcontract certain activities to external subcontractors and act as an integrator of the end-to-end service to the project owner. Subcontractors will typically include technology providers or installers. In case of building envelope measures, they may include building contractors, unless this is a key competence that the ESCO can provide. Sometimes the ESCO may subcontract maintenance and other operational services. Core competencies that will probably be done in-house often relate to (energy) auditing and design. Engineering is typically performed in-house or outsourced to trusted partners.

The ESCO delivers the energy efficiency measures through an EPC contract and offers a performance guarantee to the customer. In other words, the customer shifts the performance risk to the ESCO who needs to be capable of managing that risk. This is being done by either executing or tightly controlling the whole energy efficiency renovation process from the audit, over the design and the engineering, to the implementation, the follow-up and the operation of the energy efficiency measures. This full integration of the value chain is key to being able to guarantee performance and avoid penalties. Risk management is a core competence of any ESCO that takes its business seriously.

The capability of offering guaranteed energy savings, provides the customer with stable and predictable cashflows in terms of cost savings, thus creating smoother conditions for external financing. As a building owner occupier, the customer is the sole beneficiary of the savings.

Financing is a key component of any energy efficiency model and of EPC in particular. In some countries, ESCOs are even defined or perceived as companies that prefinance energy efficiency measures. This approach is very common in the Anglo-Saxon world. In most EU countries the emphasis is on the performance guarantee delivered by the EPC contract and ESCO financing is more seen as an option, rather than as standard or mandatory feature of the ESCO offering.

Basically 3 options exist for financing the investments:

- Customer's own funds
  In this case the customer finances the investments himself and the ESCO is being paid for the investments at the beginning of the EPC contract, usually at the end of the implementation period of the energy efficiency measures.

- FI Financing
  In this case, a Financial Institution (e.g., a bank) acts as financier and prefinances the investment. The customer typically takes on a loan, that is reimbursed over the duration of the contract, including any financing costs (incl. interests). Several types of loans exist, but they all have in common that the investment and the corresponding debt are on the balance sheet of the customer. Such financing can also be obtained from an investment fund.
- ESCO Financing
  In this case, the ESCO prefinances the investment and charges a periodical (typical annual) fee to the Customer, that includes the part of the investment and financing costs (incl. interests). Financing is not the core business of most ESCOs and they will thus typically refinance themselves through a financial institution, as is shown in the graph. As they will often try not to carry the investment and corresponding debt on their balance sheet, they may engage into a forfaiting or factoring arrangement with the financial institution. This arrangement typically takes the investment off their balance sheet and allows the ESCO to build a larger portfolio of financed projects.

Obviously, the financing can also be a blend of these three options.

From the point of view of the customer, the EPC model provides a number of advantages. As the contract is focused on the performance, the contract will typically include key performance indicators for energy savings, but also for comfort and possibly for maintenance and other services. Thus, the consequential performance risk for these key performance indicators or services is also shifted to the ESCO. This "output-driven" approach, i.e., defining output key performance indicators and not technical specifications, allows for functional and performance-based tendering. This makes the model highly scalable for the customer, as upscaling the project to include more buildings or more measures does not require "input-driven" technical specifications and tendering. There might be some increase in transaction costs, but that is far from being linear as is the case with the SCB model.

In the public sector, EPC tendering is usually done via two stage public tendering procedures. In stage one a limited number of ESCOs is selected, based on selection criteria. In stage two, these shortlisted ESCOs will be asked to perform an Investment Grade Audit that is the basis of their offer. They often have a high degree of freedom to propose the measures that give the best return on investment to the customers. Offers are typically compared based on Total Cost of Ownership (TCO) calculation and other qualitative award criteria. Often several rounds of negotiation will take place to select the ESCO to whom the contract is awarded.

In the private sector, a similar competition may be organized by the customer, but the customer can decide to directly engage with one ESCO with whom the EPC contract is signed.

In any case, if competition is included into the procurement process, that competition is on the overall performance of the project (costs & benefits, quality, etc.), not only on price or not only on references.

Depending on the ambition level of the customer and the complexity of the project, ESCOs may take on the form of a consortium of different parties, e.g., the combination of an ESCO that is specialized in HVAC systems and a building contractor that provides the skills to execute the building insulation works. In that case, parties need to agree on risk and award sharing, which may be complex, as risks are arising for various techniques and at various stages of the process: audit, design, implementation and operation. This is the reason why some ESCOs (and customers) prefer the model of a SPOC, possibly with subcontractors, with a clear risk allocation.

The EPC model can also be applied to the case of a customer who owns the building but does not occupy it. In that case, there is typically a "split incentive" situation, as the building owner who invests in the energy efficiency measures is not the beneficiary of the energy savings. The tenant is. In this case both parties should look for ways of dealing with this split incentive depending on who is the primary

investor. This could be done for instance, by having the tenant or owner pay a fee equivalent to a percentage of the guaranteed savings, by negotiating an increase or decrease in the monthly rental fee or simply by co-investing. The feasibility of such an agreement between the building owner and the tenant will depend on the remaining length of the building lease or the building owner's ability to increase the rent when leasing to a new tenant.

The following figure shows this variation of the **EPC Business Model in case of an owner-tenant relation.** The split incentive and the possible ways of solving this split incentive are sufficiently different to show this as a variation of the basic EPC model.

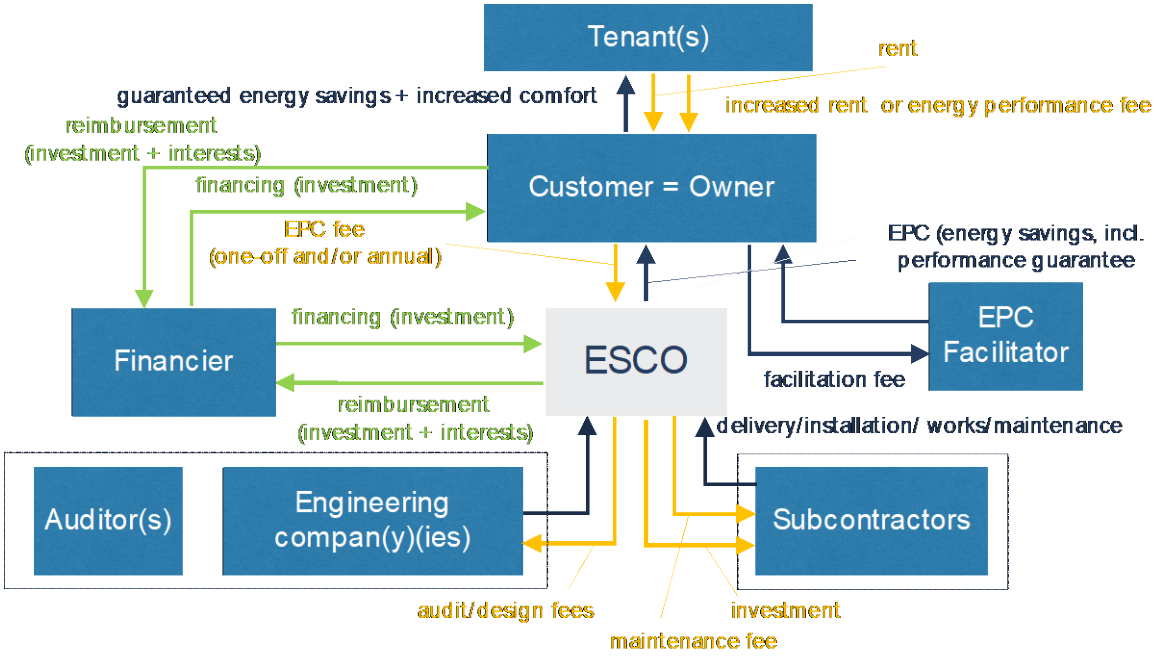


Figure 3. EPC Business Model with Split Incentive

The following figure represents the Financial Approach to the EPC Business Model, in particular for the case including **ESCO financing**, showing how the savings on the energy costs (or baseline) are used to reimburse the ESCO for prefinancing the investment and pay for delivering the other services to the customer. The graph shows the case of budget neutrality, this is the case when the total costs during the contract, i.e., the reimbursement of the capital expenditure and the operation & maintenance costs (O&M), are equal to the energy costs before the contract. There are no net savings during the contract period.

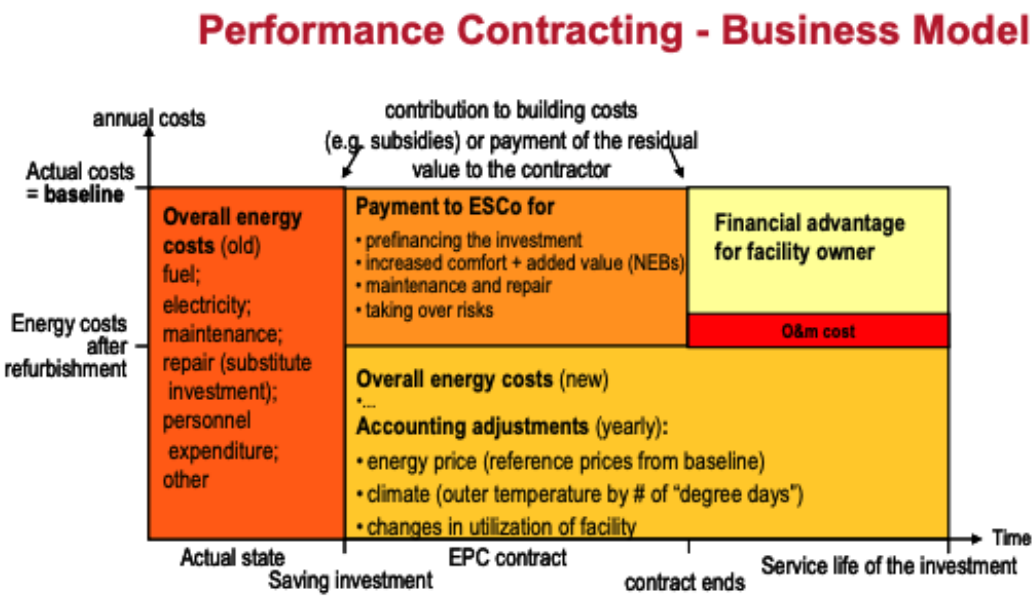


Figure 4. Business model of Energy Performance Contracting (Graz Energy Agency et al., 2008)

In order to maintain the savings at the contractually agreed level, the ESCO will need to operate, maintain and repair the energy efficiency assets (installations and equipment) and from time-to-time will need to replace obsolete or malfunctioning assets. The additional expenses related to these activities are known as Operation & Maintenance (O&M) costs and are normally a fundamental part or the EPC. Net savings for the customer typically come only after the contract, after the investment has been reimbursed with the achieved savings.

At the end of the EPC contract period, the customer can engage into a new EPC contract, possibly with new investments to further lower the energy consumption and energy bill or he could envisage an extended O&M period with the ESCO or any other party in order to safeguard as much as possible the achieved energy savings during the EPC period.

In some cases, the customer may decide not to allocate all of the energy savings to the reimbursement of the initial investment amount and the remuneration of the ESCO services, but to keep some net savings during the contract. As less savings are being used to remunerate the ESCO for the investment and the services this might imply not retaining some of the measures with a higher payback or alternatively extending the duration of the contract.

In case of deep energy renovation or **Comprehensive Refurbishment (CR-EPC),** or when the customer has additional own funding, he may choose to increase the expenses (reimbursement of the investment and the ESCO services) during the contract period beyond the baseline (or beyond the energy savings), Figure 5.

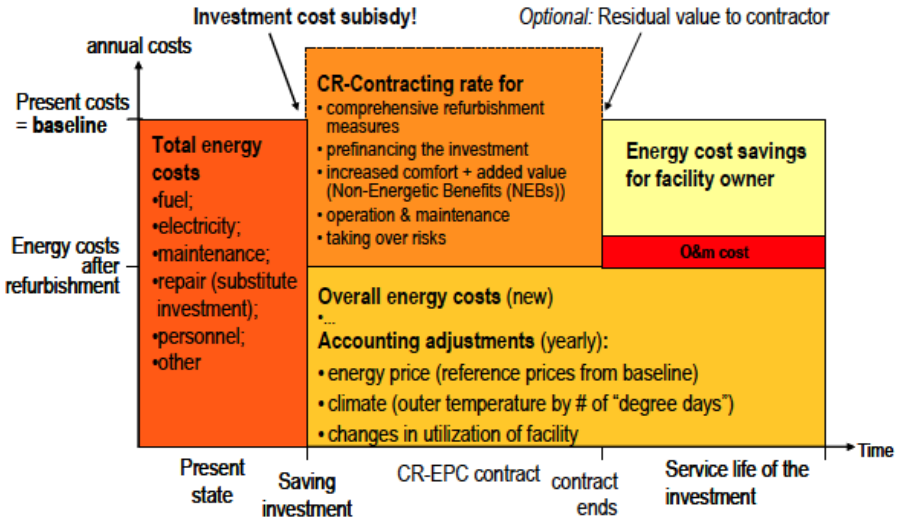


Figure 5. Comprehensive Refurbishment EPC (CR-EPC) Business Model

There are 3 different types of the CR-EPC model, depending on how the project is organized either via a General Contractor or via a General Planner approach and on the weight of the investments in the building envelope as percentage of the total energy efficiency investment. They are:

- General Contractor CR-EPC
- General Planner CR-EPC
- CR-EPC Light

The 3 different types are not covered in detail here, as they are less relevant for the required level of understanding and application in the EEnvest project. For additional details on these 3 variations of the CR-EPC model, interested readers are referred to the IEA DSM Task 16 guide on Comprehensive Refurbishment of Buildings through Energy Performance Contracting[2].

1.4. VARIATIONS OF THE EPC BUSINESS MODEL

The EPC business model is a very modular model that comes in various shapes and forms, depending on 1.) how the performance risks are allocated, 2.) at what level savings are determined and guaranteed or 3.) what the scope of the services is. The major variations based on these 3 possibilities are described in Annex 1.

1.5. MULTIPLE BENEFITS IN RELATION TO THE BUSINESS MODELS FOR ENERGY EFFICIENCY

Multiple benefits (MBs), also referred to as Non-Energy Benefits (NEB), are being dealt with extensively in the EEnvest project, specifically in the EEnvest Evaluation Methodology for Energy Efficiency Investments. The methodology allows to define what these MBs are, which ones are the most important to consider according to the methodology, which quantitative KPI's are relevant for stakeholders and how they can be included in and potentially improve a business case.

[2] https://userstcp.org/wp-content/uploads/2019/11/IEAdsm-TaskXVI_Bleyl-Schinnerl_Comprehensive-Refurbishment-of-Buildings-through-EPC_081118_vers2.pdf

In fact, DER investments are very often not attractive from a financial point of view only (i.e., IRR, NPV and Payback Period) as in most cases the achieved energy savings do not cover the required upfront investments. Therefore, Multiple Benefits bring to the foreground those benefits that originate in addition to energy savings and financial indicators. Hence, Multiple Benefits are relevant and valuable decision-making indicators for different stakeholders, e.g.: project promoters/building owners, building occupants/tenants but also external investors.

Whilst MBs for investors, which are out of the scope of the purpose of this deliverable, are related to environmental, social and economic impacts such as CO2 emission reduction, numbers of jobs created and link to the Sustainable Development Goals. While the following six MBs can be most relevant to the business case of project promotors/building owners and/or building occupants/tenants:

1. Thermal Comfort
2. Acoustic Comfort
3. Visual Comfort
4. Air Quality
5. Perceived Physical/Mental Health
6. Productivity per employee

Other MB KPIs such as reduced CO2-emissions, environmental benefits or increased asset value (and thus increased sales or rental price) are neither considered in this report as they will be assessed in a separate upcoming deliverable. However, it's important to make the distinction between the type of MBs.

In this section we want to evaluate how the inclusion of Multiple Benefits can influence the Business Model(s) for energy efficiency.

To do so, we remind that the Business Model deals with how stakeholders interact to create value, and this reflects itself in how the energy service is delivered and which monetary flows are exchanged between the stakeholders. It does not say anything about the specific amounts of money being exchanged (e.g., investments, operational costs, financing, reimbursement) and how viable that is for an investor. This kind of analysis, i.e., financial impact and risk is part of the business case analysis performed on a set of business cases and presented in Chapter 5 of this document. The Business Model will of course influence the way the business case is done in general, and thus also as far as Multiple Benefits are included.

The inclusion of Multiple Benefits in the Business Model will potentially have an influence in several areas:

- The appearance of new stakeholders, that may be interested in these multiple benefits
- The value creation:
    - An increase in the value proposition being offered to the customer (i.e., building owner)
    - An increase in the value proposition being offered to the external investors, who seeks environmental impacts such as CO2 emission reduction
    - An increase in the competitive advantage for the service provider (ESCO, contractor…)
    - An increase in the value for other stakeholders
- The potential to create new service offerings or improve existing ones
- The appearance of new monetary flows, e.g., revenue or cost saving streams for the customer, service provider or other stakeholders, that could potentially improve the business case

For each of the enumerated MBs above, we assessed the influence as shown on the following Table 1. Influence of Multiple Benefits (own elaboration).

Multiple Benefit: Increase of	New or impacted stakeholders	Value creation			New or improved service offerings	New (N) or modified (M) monetary flows
		Customer	Service Provider	Other Stakeholders		
1. Thermal Comfort	Occupants	Employee/ tenant wellbeing	Boundary condition for energy performance	-	Comfort-as-a-Service	-
2. Acoustic comfort	Occupants	Employee/ tenant wellbeing	-	-		-
3. Visual comfort	Occupants	Employee/ tenant wellbeing	-	-	Comfort-as-a-Service	-
4. Air quality	Occupants/Society	Employee/ tenant wellbeing	Boundary condition for energy performance	Reduced risk for spread of viruses (e.g., Corona)		-
5. Improved Health	Government Health sector	Wellbeing/Reduced absence	-	Reduced health costs	-	-
6. Productivity per employee	Building owner/Occupants/Society	Productivity increase	-	Increased competitiveness (for companies)	-	Improved bottom line (N)

Table 1. Influence of Multiple Benefits (own elaboration)

In some cases, the advantage of the MB to one stakeholder can represent a disadvantage to another stakeholder. This is the case for:

- Reduced maintenance costs for the customer, that represent a potential loss of revenues for the service provider. On the other hand, the potential increase of business generated by an EE project will probably outweigh this potential loss.
- An increase in the sales or rental price of the building in favor of the customer will represent an extra expense for the tenant or future buyer. This expense is however often compensated totally or partially by the reduced energy bill.

In other cases, the increased revenues or profitability for the customer, may not have a direct influence for the service provider, but may indirectly improve the customer's business case. This may motivate him to extend the size, scope or ambition level of the project, increasing indirectly the attractiveness for the service provider(s).

Based on this analysis we can update the Business Model(s) previously described.

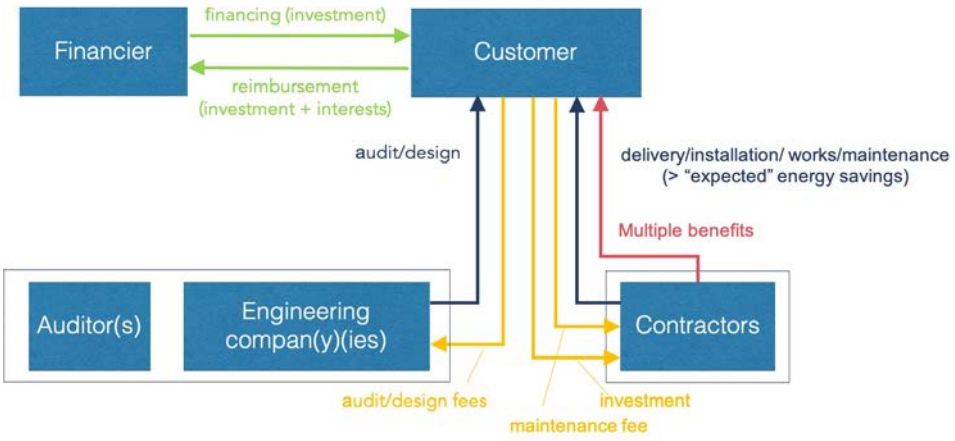


Figure 6. Separate Contracting Based (SCB) Business Model taking into account Multiple Benefits

In the SCB case, Multiple Benefits will exist, but in analogy with the energy savings they are somewhat uncertain and more difficult to quantify.

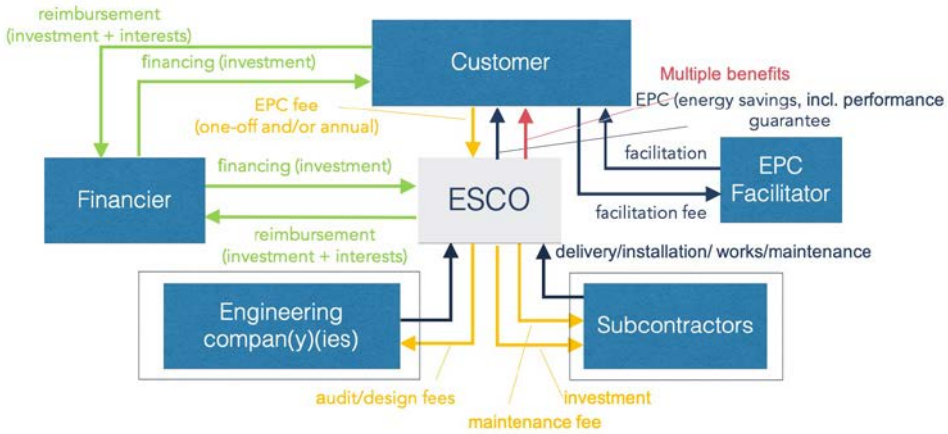


Figure 7. Energy Performance Contracting (EPC) Business Model taking into account Multiple Benefits

In the case of EPC, there are not only multiple benefits, but the fact that there are potentially more underlying energy savings and that these are guaranteed by the ESCO also increases the value of MBs and reduces the risk of not being able to benefit from them in full. In some cases the MBs may even be part of the KPIs that are being guaranteed, which is often the case for thermal comfort or air quality. These guarantees increase the capability to quantify these MBs and to use them as part of the business case.

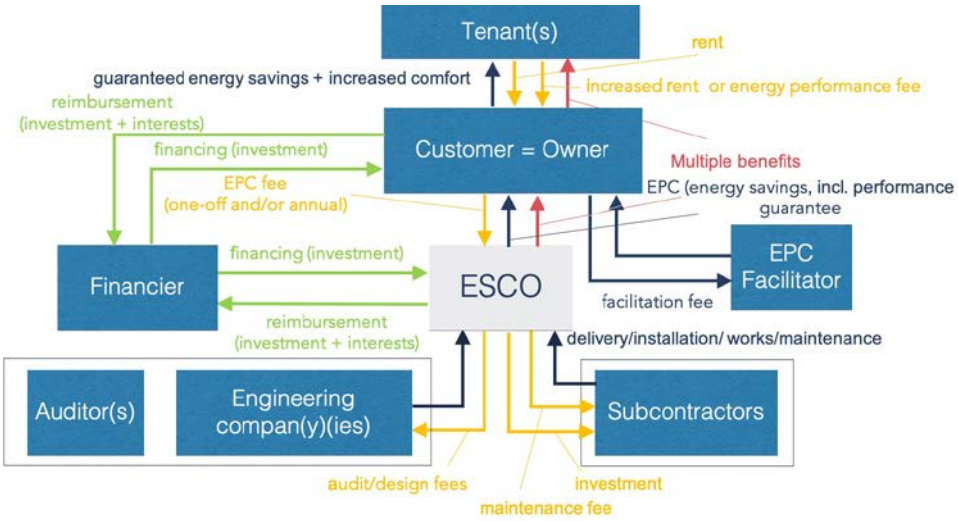


Figure 8. EPC Business Model with Split Incentive taking into account Multiple Benefits

In case of split incentive, primary benefits (e.g., energy cost savings) and MBs may still be generated but may not be captured by the customer (building owner) who does the investment. Effectively in that case someone else, mostly the occupant, is benefiting from the energy savings and thus from the MBs that are associated with these energy saving investments, like comfort improvements. Nevertheless, as the occupant will be the one who captures these primary benefits and MBs, this creates an opportunity to engage in negotiations between owners and occupants to find win-win-solutions, e.g., based on sharing costs and thus share benefits between owner and occupant.

The above adjusted Business Models show that Multiple Benefits are an integral part of any Energy Efficiency Business Model. Multiple benefits go beyond mere energy savings and financial performance and can provide specific value, quantitative and/or qualitative, to different stakeholders and hence should be integrated or seriously considered in their business case analysis.

2. Performance Risk allocation and management

Each Business Model for energy efficiency has a specific implication on the allocation of risks among the parties involved in the project. In some cases, such as for public buildings in the context of public-private partnerships, a correct risk allocation is required by law and mandatory for the public subject in order to benefit, for instance, from the off-balance statistical treatment of the project in the National Accounts in line with ESA 2010 (European System of Accounts) rules.

Following the analysis carried out in technical and financial risk analysis, this paragraph describes the implications in terms of risk allocation and management for the different Business Models.

The analysis will focus in general on the "performance risk", meaning the risk that the renovation measures don't perform as expected in the project, implying, from a technical point of view, a lower energy saving and/or increased operational expenses. From the financial point of view, lower actual energy savings and/or increased operational expenses means lower economic savings, implying longer payback of the investment and a lower return.

According to the type of Business Model adopted for the energy efficiency renovation project, this risk could be allocated to different actors such as the building owner, the tenant, the designer and/or the ESCO.

2.1. DO-IT-YOURSELF MANAGEMENT (APPLICABLE TO SMALL PROJECTS)

The standard case of an energy efficiency renovation project, generally applicable to small buildings with low expected investment, is when the property owner, or the tenant of a building (the Project Owner), decides to directly carry out renovation works, without a proper ex-ante assessment, due diligence, or detailed energy analysis, either with own funds or borrowing cash from a financier. In this case, the property owner will likely hire a contractor based on the best quality/price ratio of several price quotations. These quotations could include a rough estimate of the achievable energy saving but cannot include a guarantee of performance since no detailed energy analysis is carried out.

Once the works are assigned, the awardee contractor starts implementing the renovation measures as agreed upon in the contract. Once the works are implemented, a test is carried out to verify that all renovation measures are installed and are working as agreed. If the test is successful, the contractor gets paid and the contract comes to an end.

Typically, in this case, the contractor only provides the legal warranty on the installed equipment and renovation works, thus only being responsible for breakdowns or malfunctioning in general.

Performance risk, meaning the risk that the renovation measure performs less than expected, is entirely borne by the customer.

2.2. RISK ALLOCATION IN SEPARATE CONTRACTING BASED MODELS

SCB models are those where the design/engineering and the construction works are assigned to different subjects. This is, most often, the traditional procurement scheme for Public Administrations (non-PPP), where the design/engineering must be carried out by a different entity than the constructor.

This scheme has some advantages, as the Project Owner (building owner or tenant) can rely on qualified external experts to study the state of the art and define the feasible investment measures. The customer

can thus choose the type of renovation measures to be applied to the building, according to its budget and the expected results. Once the project is fully designed, the selection of the contractor is done mainly on the basis of the offered price, since most of the technical aspects are already defined.

The main disadvantage of this scheme is that there is no clear allocation of responsibilities for underperformance among the different actors. In fact, while the designer can estimate the amount of energy savings achievable through a renovation measure, the contractor cannot assume responsibility for the calculations provided by a third party, thus cannot guarantee a performance. This would mean, in case of underperformance, the start of a possible dispute between the designer/engineering/contractor/owner/tenants about who is responsible for the underperformance.

In the end, this means that the performance risk remains in the hand of the Project Owner.

2.3. RISK ALLOCATION IN ENERGY PERFORMANCE CONTRACTING MODELS

The main feature of Energy Performance Contracts (EPCs), and the main reason why they are spreading into the market, is that the performance risk is transferred to the ESCO and is guaranteed by a contractual clause.

This means that, from a technical point of view, the ESCO is responsible for any underperformance of the energy renovation measures affecting the achievement of the expected energy savings. Thus, if the guaranteed energy saving is not met, the payment to the ESCO gets reduced proportionally or more than proportionally, according to the contract clauses.

In the case of EPCs, the Customer will still bear the following risks, that cannot be allocated to the ESCO:

- Variation of energy prices;
- Variation of external climate conditions (degree-days);
- Variation of use of the building (occupancy rate, heating hours, etc.).

EPCs should thus foresee a mechanism to normalize the actual energy consumption to standard external conditions and events outside the control of the ESCO. This normalisation is usually being carried out based on a pre-defined Measurement and Verification (M&V) process, ideally following an accepted M&V-norm such as the International Performance Measurement and Verification (IPMVP) protocol or the ISO50015 Energy Management Systems standard.

2.4. IMPACT OF DIFFERENT RISK ALLOCATION ON FINANCIAL RESULTS

As a consequence of the different risk allocation of each Business Model, the calculation of expected financial results of an energy efficiency investment needs to be calculated considering the actual exposure of the party to the risk.

The EEnvest financial risk evaluation model will calculate the financial risk related to an energy efficiency investment by providing a probability distribution of the relevant indicators (IRR, payback time, NPV, etc.). This probability distribution is based on 4 main risks:

- **“Energy performance gap”**, or underperformance: it is the risk connected to the lower performance than expected of the renovation measures implemented, affecting the energy and economic savings;

- **"Damage"**: the risk of failure/breakage of the installed renovation measures, causing the need for additional investments to replace or repair the installed renovation measures;
- **Climate risk**: the risk that external temperatures during the heating season (degree days) are different than standard conditions, causing a higher or lower energy demand of the building;
- **Energy price risk**: the risk that energy prices vary from historical prices, making the investment more or less convenient from an economic point of view.

As stated in the previous Paragraphs, in the case of energy renovation directly carried out by the building owner/tenant (do-it-yourself) or in the case of Separate Contracting Based Models, all these risks are borne by the Project Owner. This means that the expected financial result of a project under this condition are affected by all the main risks, causing a wider variability in the probability distribution.

In the case of Energy Performance Contracts, instead, "Energy performance gap" and "Damage" risks are completely transferred to the ESCO, while the Customer will still bear Climate and Energy price risks. By transferring those risks to a third party, the probability distribution of expected financial results is expected to be narrower.

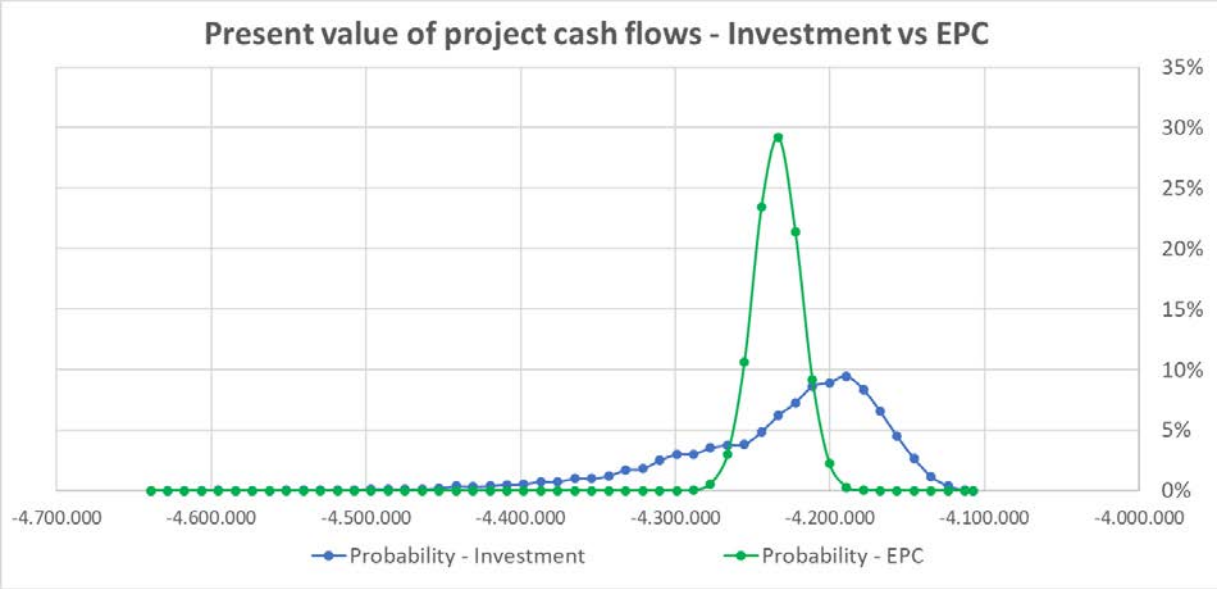


Figure 9. Present value of project cash flow – investment versus EPC

On the other side, the EEnvest financial risk model will also allow to calculate the financial results of the investment for the ESCO, which is only affected by the two above-mentioned performance risks. This is another important feature as one of the main scopes of the EEnvest platform is to assess the financial risk of an energy efficiency investment from the point of view of a third-party financier. In the case of EPCs, a third-party financier would in fact provide finance to the ESCO, not to the customer, thus he/she will only be interested in evaluating the financial returns and risks of the investment from the point of view of the ESCO.

In any case, also according to the feedback received from the banks that were interviewed during the project, this assessment will not overcome the classic credit-worthiness analysis they perform before lending money for an investment project. That creditworthiness analysis will still be the main driver for the evaluation.

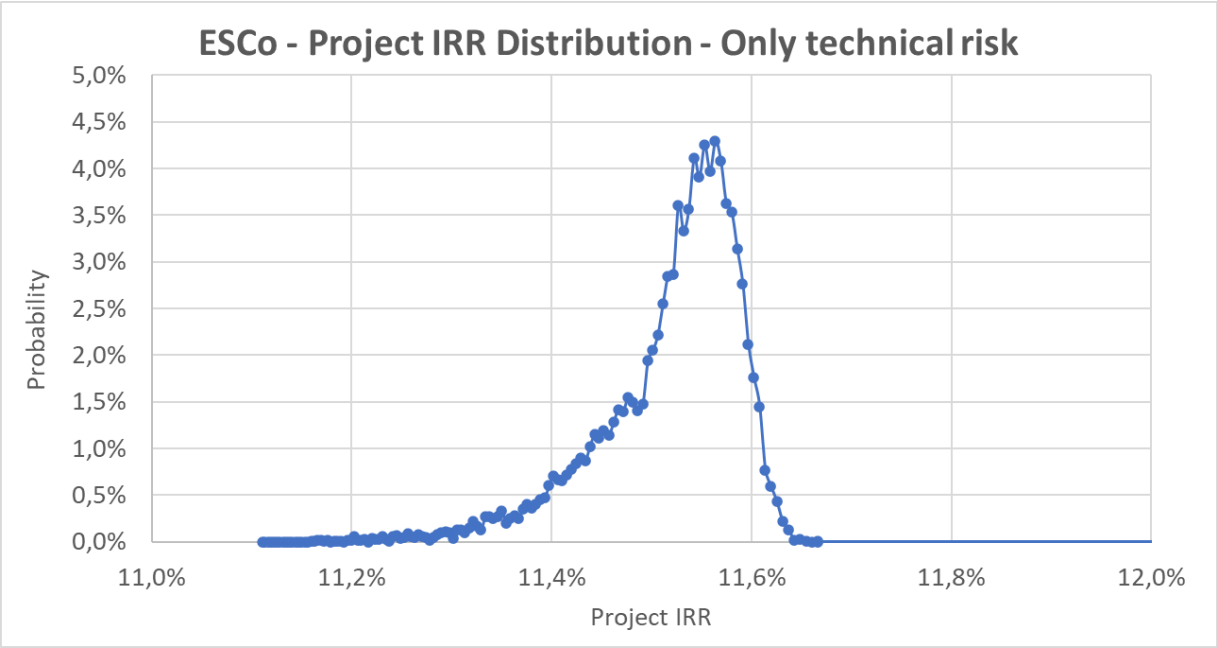


Figure 10. Project IRR distribution

3. Methodology for the selection of an appropriate business model and financing scheme

The present section has the objective of guiding the building owner or project promoter to select the most suitable business model and financing scheme for the renovation project. To achieve this quest, three main workstreams are proposed.

First, to define, differentiate and bridge financial instruments and financing products. Second, to present the most suitable financing instruments for deep energy renovations (DER) for commercial buildings. Third, to construct the EEnvest Decision Making Flow Methodology, based on the SCB and EPC Business Models described and discussed in the previous Chapters, and specific criteria.

In order the fulfill the task at hand, strong desk-research guided the definition of financing instruments and financing products as well as the selection of the most suitable financing instruments for EEnvest's purposes. Then, several Consortium-Level discussions took place in virtual format to design the EEnvest Decision Making Flow Methodology. The most challenging activity was to define the set of criteria that would help to navigate through the decision flow.

Ought to be remarked that there's no such a thing as a unique silver bullet for choosing one financial instrument for a specific project. This rationale is backed-up by the fact that the ultimate decision for choosing one or another financing source relies on the point of view of the building owner as well as the external investor.

For the case of the building owner, the decision relies on his or her (i) risk profile and preferences when seeking financing and (ii) the unique characteristics of the renovation project. Whereas for the investor, the decision about whether to finance a DER investment or not depends on the (i) credit-worthiness of the customer, (ii) guarantees given by the customer and lastly, the (iii) financial and impact metrics of the investment.

3.1. FINANCING INSTRUMENTS AND FINANCING PRODUCTS DEFINITION

As first stop, a distinction between financing instrument and financing product is presented.

Financing instrument alludes to a tailor-made financial structure that occasionally undertakes standardized procedures and operations. Financing instruments are often referred as high-level structures that respond to market failures and specific country-level needs. In the case of innovative financial instruments, a change in local legislation may be required (for example On-Tax Financing). As such, financing instruments are highly dependent on the existing legal framework and in some cases, to accounting legislation at country level.

In other words, financing instruments are a means to enable intermediates, such as retail banks, to deploy frictionless financing products to clients. For the case of energy efficiency investments, financing instruments are essential to stimulate financing suppliers to improve their conditions and develop tailor-made energy efficiency financing products. Therefore, the demand side (i.e., building owner or project promoter) rarely interacts with the financing instruments and instead, they perceive and interact with the financing product being offered by the supplier.

Financing product refers to a standardized and publicly available product in the market. It's often related to a specific financial institution such as retail banks. As a matter of example, Santander Energy Efficiency EIB Loan[1]. In this sense, financing products are often linked to a specific local context

(I.e., geographic conditions: Spain) and its financing conditions are subjected to the financing entity issuing the product and, of course, the creditworthiness of the client. Last, from the customer point of view, the financing product is the mean to finance the project.

Once these two definitions are set, it's plausible to analyze the European Commission's standpoint on the matter. In 2011 the European Commission issued an official communication –COM (2011) 662[3] "*A Framework for the next generation of innovative financial instruments*" – where a new definition is proposed. The communication defined **innovative financial instruments (IFIs)** as instruments which provide equity/risk capital, or debt instruments (such as loans or guarantees) to intermediaries that provide financing to a large number of **final recipients who have difficulties in accessing finance**, or risk sharing with financial institutions in order to increase the volume of finance and hence the impact resulting from the EU budget intervention".

The aforementioned communication is key to understand that there's a larger portion of the society and business owners that cannot access financing products due to their risk profiles. Therefore, there's a clear market need to develop innovative financing instruments that, on the one hand, enhance the creditworthiness of clients and, on the other hand, stimulate retail banks to develop and deploy financing products for DER projects. This rationale is also embodied by the European Commission's Renovation Wave, as it must leave no one behind.

Given the fact that typically DER projects are often not attractive to financial institutions (i.e. investors), the EEnvest Project promotes the financing structure of mixing two or more financing products (or when possible, instruments) such as grants, subsidies and tax deductions to decrease the total investment cost to then include a layer of private financing such as bank loans. This mix of financing sources - public and private - are also known as blended finance.

It's therefore concluded that given the nature of deep energy investments, as emphasized in D4.1, in most cases it's highly recommended to finance the initial tranche of the investment cost with public financing and incentives and thus finance the remaining part of the investment with third party financing (i.e. private financing).

However, in most cases this financing solution is simply not enough due to the long payback period of DER investments and thus short repayment terms of available loans. For instance, 3-8 years for the previously cited Santander Energy Efficiency EIB Loan. Thus, it's highlighted the urgent need of implementing innovative financial instruments that are tailor-made for DER investments: long term tenor and competitive interest rates. The Consortium expects a strong development in the upcoming years on the matter and encourages all investors to constantly monitor these developments in order to improve their financing products and hence promote the sorely needed uptake of DER projects.

The following figures will describe the existing financing instruments that are relevant for the scope of the EEnvest Project.

[3]For further reference, see:
https://www.europarl.europa.eu/meetdocs/2009_2014/documents/com/com_com(2011)0662_/com_com(2011)0662_en.pdf

3.2. FINANCING INSTRUMENTS FOR RENOVATION PROJECTS OF COMMERCIAL BUILDING

This section has the objective of presenting the available financing instruments for commercial building renovation. The outcome of this section will feed the basis of the EEnvest Decision Making Flow Methodology.

Acknowledging the fact that the EEnvest Project is focused on commercial buildings, as first stop, it's imperative to select those financial instruments that are more relevant for this type of infrastructure. In this quest, the desk research task force leverages on a 2015 EEFIG Study [4] plus our own expertise on the matter to select a specific set of financial instruments for further analysis.

Figure below pinpoints the most relevant financial instrument for our work.

Mature Financial Instruments	Commercial	Public	Public Rental	Private Rental	Owner Occupied
Dedicated Credit Lines	3	2	3	3	3
Energy Performance Contracting (Undertaken by Private Sector)	3	3	3	1	1
Risk-Sharing Facilities	2	1	2	2	2
Direct and Equity Investments in Real Estate and Infrastructure Funds	2	1	1	2	0
Subordinated Loan	1	1	1	1	1
Covered Bonds	1	1	1	0	0
Leasing	0	1	0	0	0

Figure 11. Source: EEFIG 2015

Emerging Financial Instruments	Commercial	Public	Public Rental	Private Rental	Owner Occupied
On-Bill Repayment	2	1	2	3	3
On-Tax Finance (PACE)	2	1	1	2	3
Energy Efficiency Investment Funds	3	2	2	1	1
Energy Services Agreement	3	3	2	1	1
Public ESCOS for Deep Renovation of Housing	0	0	3	2	2
Factoring Fund for Energy Performance Contracts	2	2	1	1	0
Public ESCOS for Deep Renovation of Public Buildings	0	3	3	0	0
Green Bonds	2	1	0	0	0
Citizens Financing	0	0	0	1	2

Figure 12. Source: EEFIG 2015

The figures above share a common purpose which is to rank the 16 identified (in 2015) financial instruments suitable of energy efficiency investments. Under this frame, an exhaustive survey was conducted by the EEFIG to better determine the applicability to support the investment flows towards EE retrofits endeavors. The following scores were set by the EEFIG:

- Score 0 if instrument is "not applicable" (Mature) or has "zero potential" (Emerging)
- Score 1 if instrument is "marginally useful" (Mature) or has "some potential" (Emerging)
- Score 2 if instrument is "useful" (Mature) or has "potential" (Emerging)

[4] For further reference, see: https://ec.europa.eu/energy/sites/ener/files/documents/Final%20Report%20EEFIG%20v%209.1%2024022015%20clean%20FINAL%20sent.pdf

- Score 3 if instrument is "very useful" (Mature) or has “strong potential” (Emerging)

As result, emerging and mature financial instruments were ranked. Considering the EEnvest Project’s scope of work and partners’ expertise, a more in-depth description will be providing in the financial instrument with the highest rank on the commercial building category. These are:

a) Dedicated Credit Lines (Mature, 3)
b) Energy Performance Contracting (Mature, 3)
c) Energy Efficiency Investment Funds (Emerging, 3)
d) Energy Services Agreement (Emerging, 3)
e) Direct and Equity Investments in Real Estate and Infrastructure Funds (Mature, 2)
f) Risk-Sharing Facilities (Mature, 2)
g) Factoring Fund for Energy Performance Contracts (Emerging, 2)
h) On-Tax Finance -PACE- (Emerging, 2)
i) On-Bill Repayment (Emerging, 2)
j) Green Bonds (Emerging, 2)
k) Citizens Financing (Emerging, 0)

Ought to be remarked that the EEFIG ranking was developed in 2015. Therefore, the it’s decided to include a 11th financing instrument: Citizens Financing, as nowadays this instrument is gaining more tractions as it’s a means of collective financing that promotes awareness amongst home and building owners whilst it’s an effective source of financing.

The rest of the financial instruments are out of scope as the Consortium considers that further analysis on these instruments will not contribute to the development of the current task.

The following paragraphs provide a brief snapshot of the aforementioned financing instrument whilst Annex 2 presents the long-listed instruments considering their main characteristics, advantages, weaknesses, obstacles and requirements for a full roll-out of the instrument.

The principle for presenting the standard definition of the financing instrument in the Annex is that there’s sufficient literature that describes these mechanisms and thus the added value of this section of the report is the decision-making flow and not the definition of the instruments.

Additionally, the key papers that guided the analysis of the shortlisted FIs were selected based on their scope of work at EU-Level, and exhaustiveness of the report. These are:

- Accelerating energy renovations investments in buildings (2019) – JRC Science for Policy Report (2019)
- Financing building energy renovations – JRC Science and Policy Reports (2014)
- Energy Efficiency – the first fuel for the EU economy: How to drive new finance for energy efficiency investments (2015)

These papers are presented as a means to settle a standardized and agreed definition of each financial instrument to be further complemented with the Consortium’s expertise.

3.2.1. DEDICATED CREDIT LINES (MATURE)

Also known as soft loans, this is one of the most known financial instruments. Dedicated credit lines are extended to financial institutions (i.e., retail banks) as a low interest loan by a government or by a donor (such as development/multilateral development bank). Then, the recipient institution issues a tailored loan (i.e., financing product) with more attractive conditions to borrowers aiming to finance a renovation project. In some cases, soft loans may also offer additional features such as extended tenor or grace

periods and interest holidays and it can be combined with subsidies and grants. For further detail refer to Annex 9.2.

3.2.2. ENERGY PERFORMANCE CONTRACTING (ESCO FINANCING) (MATURE)

It's important to distinguish between the EPC Business Model, as described in Section 1.3, and the EPC as a form of financing instrument. In specific, the scope of the EPC Financing instrument refers to ESCO Financing.

Basically, this instrument refers to the type of financing that the ESCO provides to the building owner. In some cases, the ESCO Financing may not offer the best conditions to the beneficiary as financing is not the core business of the ESCO. In fact, if the ESCO decides to offer financing, it may get financing first from a different source such as retail banks through dedicated credit lines. Therefore, the ESCO may perform the role of a lead generator for financial institutions rather than offering direct financing to building owners. For further detail refer to Annex 9.2.

3.2.3. ENERGY EFFICIENCY INVESTMENT FUNDS (EMERGING)

EE investment funds are specific investment vehicles targeting energy efficiency projects. In some cases, these funds pursue a return based on energy savings achieved. The nature of this mechanism is usually linked with Socially Responsible Investments (SRI) ventures as well as sustainable financing and ESG criteria[5]. As such, these funds typically excel at raising capital from impact investors as well as monitoring the use of funds due to the narrow approach (i.e. EE projects).

Given the nature of DER projects – in most cases capital extensive - it's expected that Energy Efficiency Investment Funds increase their participation in the market. This is mainly for two reasons. First, these types of funds are specialized in energy efficiency investments and therefore have the know-how that other financial institutions lack. Second, their specialized structure enables them to quickly deploy contracts, partnerships, and agreements with third parties such as ESCOs or Technology Providers. The latter is especially burdensome for those financial institutions whose core business is not energy efficiency investments nor technology solutions. For further detail refer to Annex 9.2

3.2.4. ENERGY SERVICES AGREEMENT (EMERGING)

The Energy Services Agreement (ESA) can be perceived as a sort of the energy efficiency version of the PPA Model. It is also known as a "pay-for-performance" service contract. It typically involves a third-part investor and an asset owner (i.e., building owner) to deliver energy savings in the form of a service -hence the name of the instrument.

The typical tenor of the ESA contract is 10 years where the building owner agrees to pay their historical utility bills to the third party involved in the contract. In some cases, an upfront access fee or an ongoing utility bill discount might be paid to the building owner as incentive. ESAs are a good avenue for those business owners that are risk adverse and seeks for a third-party to manage the project and deals with the risk of underperformance. Also, it's a good scheme for business owners that want to avoid upfront capital expenditures. Plus, the ESA scheme is designed as an off-balance sheet solution and thus the ESA payments can be recorded as operating expenses, being particularly interesting for business owners. For further detail refer to Annex 2.

[5] ESG and SDG criteria will analyzed and presented in D4.3.

3.2.5. DIRECT AND EQUITY INVESTMENTS IN REAL ESTATE AND INFRASTRUCTURE FUND (MATURE)

The importance of these funds in respect of EE investments lies on which portion of the fund is solely dedicated to energy efficiency investments. Although in some cases it may be difficult to accurately estimate its contribution to EE endeavors, it's acknowledged that it occurs during a fund's investment life cycle. Some of the most common investment streams are renovation, planned and preventive maintenance, new developments and active building management.

It's expected that these types of funds provide more weight to their share in deep energy retrofits projects as a result of the European Commission's efforts on the Renovation Wave and the strong relation between DER investments and ESG metrics. For further detail refer to Annex 2.

3.2.6. FACTORING FUND FOR ENERGY PERFORMANCE CONTRACTS (EMERGING)

Factoring is commonly referred as a financial transaction in which an entity sells its accounts receivable (typically invoices) to a third party – called factor – at a discount. Under the context of EE, Factoring Funds for EPCs would buy funded EPCs from their originators - typically ESCOs - at a discount (i.e., purchase of future receivables at a discount). In turn, such process liberates the balance sheet of the ESCO which results in higher capacity to aggregate new EPCs and thus expanding their business. Therefore, this instrument provides an off-balance sheet financing solution. Ought to mention that Factoring does not limit to specific funds, as for instance private firms can also perform this activity.

Given the characteristics of these funds, they are perceived as a means to propel the market uptake of small and medium ESCOs willing to increase their market share. This is the ultimate result of the instrument, as ESCOs will be able to generate more EPCs without breaking through their balance sheets covenants. As result, in most cases this instrument secures refinancing for ESCOs.

Given the objective of these funds, socially responsible investors and impact investors may be eager to invest in these endeavors as it's a means to obtain returns whilst enabling ESCOs to propel their businesses and therefore enact more projects.

Ought to remark that for the scope of the EEnvest Project, there's no need to deepen on the difference between factoring and forfeiting agreements as these terms are being used in parallel in the energy efficiency literature and also in practice. Here we propose a simplified terminology of the practice of selling receivables.

Further, as previously indicated, this financing instrument is often linked with the involvement of an ESCO. Thus, it's concluded that this instrument is better fit for financing the ESCO rather than the building owner. For further detail refer to Annex 2.

3.2.7. ON-TAX FINANCE -PACE- (EMERGING)

This instrument is based on the U.S. Property Assessed Clean Energy (or 'PACE') tool and allows for the attachment of a renovation loan to a property and the subsequent repayment of the loan through taxes. Another characteristic of this mechanism is that upon the sale of the property, the remaining loan amount can be repaid or the repayment duty can be simply passed on to the next owner as he or she will enjoy the benefits of the renovation project.

The core characteristic of this mechanism is that the loan repayments are integrated in local taxes. For the U.S. case, it automatically enhances creditworthiness as taxes have near-to-zero non-payment rates in the country and they are senior to any other debt. For the case of Europe, a more detailed study must be emplaced as the implementation of this instrument is subjected to local regulations.

In respect of financing, it can be provided either by private funds/financial institutions or by the local authority. The role of each party is determined by the finance provider or the service company willing to promote a renovation program in a specific location. For instance, if financing is provided by a private fund, the public sector must excel at securing the reimbursement of the loan by integrating it in tax collection whilst the financing provider may focus on generating market traction and closing contracts. For further detail refer to Annex 9.2.

3.2.8. ON-BILL REPAYMENT (EMERGING)

The On-Bill Repayment instrument is aimed at improving the creditworthiness of EE investments by tying the post-implementation repayment of the investment to subsequent utility bills which are recollected through the existing utility infrastructure.

The instrument leverages on the existing payment relationship between the customer and the utility company and this connection provides a sound snapshot of the "credit history" of the property owner to better determine the risk of loan default (as customer payment histories with both utilities and tax payments are long and exhibit low default rates compared to other consumer finance).

For an On-Bill structure to prove successful, the achieved energy savings need to be sufficiently substantial, so as to ensure that monthly utility costs have effectively decreased and the difference achieved can be used to cover repayment installments. Therefore, this instrument may be fit to specific weather conditions and energy efficiency measures that secures strong energy savings. For further detail refer to Annex 2.

3.2.9. GREEN BONDS

Green bonds are a fixed-income financial instrument which the proceeds are exclusively applied to green projects. This type of project encompasses initiatives that promote climate or environmental outcomes. Nowadays this type of impact can be also classified as ESG, SDG or Impact Investing. All in all, this instrument is tailored to projects with a positive and measurable impact as well as large renovation projects (i.e., on hospitals) or even a portfolio of projects.

It's widely acknowledged that energy efficiency investments are long term ventures and rather stable. In this context, debt financing is common and therefore the "new market" of green bonds is a logical step in the market. This comes amidst the trend on green investments[6], and it's expected that the impact of the project being financed for Green Bonds is reported at corporate level.

Green bonds can be issued by corporations, through banks or even through governments (i.e., sovereign issuers). In fact, Poland became the first sovereign to issue a Green Bond in December 2016. As of 2021,

[6] For an exhaustive review on the investors' trend towards Green and sustainable investments, refer to D4.1.

16 countries have issued this type of instrument ranging from Germany, France, Belgium, Ireland, Chile, Ecuador, Indonesia, Guatemala and more. For more details on sovereign bonds visit here[7] and here[8].

The trend on Green Bonds will most probably increase at corporate, bank and country level. This tendency will be beneficial for the energy efficiency renovation market as these types of projects are starting to be assessed not only from the financial standpoint, but also from the optic of social, environmental and governance impact. For further detail refer to Annex 9.2.

3.2.10. CITIZENS FINANCING

This type of financing instrument can be identified as a bottom-up mechanism[9]. This is due to the fact that – as the names implies – citizens pool their financial resources to fund projects of their interest and of common good. Citizen financing can be broadly split in two categories: Community Energy Financing and Crowdfunding.

Community Energy Finance are typically local energy communities using a co-operative structure. Furthermore, the group of investors are indeed part of the community where the project takes place and, therefore, they enjoy the benefits of undertaking the project. The classic example are solar projects where the community enjoys cheaper energy or, in some cases, energy free of charge.

Crowdfunding consists in the aggregation of a number of investors that does not necessarily relate to the project nor have a tight link with the endeavor. This scheme is mainly offered through a dedicated platform which in some cases the company setting up the website manages two businesses. On the one end, to attract interesting projects and conduct the investment analysis (i.e., Project Developers) and, on the other hand, attract investors through attractive returns and positive impact. In fact, one member of the EEnvest Consortium is Ecrowd! and they actively connect investors with project with positive impact.

The Consortium's sense of the market is that this type of instrument will gain solid traction due to two main reasons. First, citizens are becoming more aware of climate change and therefore are more prone to take action. In this case it refers to investing in a project with positive impact. Second, energy communities are increasing its relevance and more projects -including European H2020 Projects- are targeting this niche. For further detail refer to Annex 2.

3.2.11. RISK SHARING FACILITIES

Risk-sharing facilities are aimed at reducing the risks for banks and equity investors by covering a part of the risk of default of a loan or portfolio of loans. This can be also defined as a guarantee funds or a first-loss absorption mechanism. The main rationale is that this instrument aim at enabling banks and investors to issue loans with favorable conditions to clients. In some cases, these clients are classified as high-risk clients with low creditworthiness.

Risk-sharing facilities deserve a special mention. One of the core values of the Renovation Wave is that it leaves no-one behind. This means that deep energy efficiency renovation must be rolled-out in all types of buildings and most importantly, in all types of socioeconomic conditions. From a purely credit risk standpoint, financial institutions -i.e. banks- have a set threshold in terms of how much risk they

[7] For further information, refer to: https://insights.nordea.com/en/sustainability/sovereign-green-bonds/

[8] For further information, refer to: https://www.oecd.org/coronavirus/en/data-insights/growing-momentum-for-sovereign-green-bonds

[9] For further information on the matter, the Consortium suggest referring to the H2020 Prospect Project: https://www.h2020prospect.eu/images/Booklets/Citizen_finance_-_Handbook.pdf

can bear plus the credit risk profile of their clients. In practice, these criteria determine to which client the bank lends money and to which they do not.

Therefore, from a raw financial optic, vulnerable sectors are not capable of obtaining loans. Under this frame, risk-sharing facilities comes to place as they decrease the risk of default of this type of profile and therefore it enhances banks to lend money to these people and if needed, they will absorb the losses. For further detail refer to Annex 2.

The description of each FIs, supported by Annex 2, showcases their advantages, weaknesses and main obstacles to the roll-out at large scale of the instruments provides a solid understanding of the available mechanism that on the one hand, investors can leverage on to invest in DER projects and on the other hand, project promoters and business owners can comprehend and be informed about.

In order to develop a criteria or method that provides project promoters and building owners guidance when accessing to financing, a practical standpoint is embodied by the Consortium.

From this optic, it's clear that some of these instruments are not ready to be fully implemented in the market yet due to mainly a high level of dependency on the legal framework as the case for On-tax financing, On-bill Repayment and the Energy Service Agreement. In addition, Green Bonds are rather tailored to investors and financial institutions rather than project promoters and business owners. In fact, Green Bonds are aimed rather at portfolio level than single projects. As result, these four instruments are discarded for further analysis.

With the objective of making DER investments accessible to both, investors and project promoters, it's imperative to take explore what are the available public funding opportunities to make the project more accessible. As previously mentioned, this specific form of financing refers blended financing and this method is acknowledged as key to upscale EE investments.

Under this frame, the next paragraphs provide an overview of the available subsidies and public sources of funding for EE projects in commercial buildings in Italy and Spain.

3.3. EXISTING SUBSIDIES AND PUBLIC INCENTIVES FOR EE RETROFITS IN ITALY AND SPAIN

Private financing may not be sufficient to motivate the uptake of energy efficiency projects across Europe. As response, the public sector often contributes with different sort of incentives which vary from one country to another. This type of public funding and mechanisms are aimed at covering the first layer of financing and thus are not large enough to cover the full investment cost. However, they play a crucial role in incentivizing the building owner to join the renovation journey.

The next paragraphs provide an overview of the public source of funding for EE projects in commercial buildings in both Italy and Spain.

3.3.1. ITALY – PUBLIC FUNDING FOR EE PROJECTS LANDSCAPE

In Italy there are several supporting mechanisms for investments in energy efficiency in the form of grants, tax deduction or subsidized loans. Everybody (physic persons, companies, organizations, Public Administrations, etc.) can rely on at least one supporting mechanism to renovate the buildings they own or rent. Commercial buildings are also eligible for several form of public incentives, but some remarks are needed:

- Incentives cannot be cumulated for the same renovation measure, so applying for one incentive prevents from the possibility of applying to another one;
- Incentives can be combined if they are applied to different renovation measure (i.e., it's possible to apply for the "Conto Termico" for the replacement of the heating system and, at the same time, for White Certificates for the replacement of old lamps with new LED;
- No incentive is always "better" than another, since the convenience of each inventive depends on the type of building, on the type of renovation measure and other project-specific factor.

Thus, the calculation of the correct amount of incentive and the evaluation of the best option requires a deep technical assessment of the project.

The detail of the major existing supporting mechanisms[10] and main feature is detailed in the following Table 2.

Table 2. Italian Public funding.

Ecobonus, and Superbonus	The Italian Government established in 2007 a national program of tax incentives for investments in energy efficiency of buildings. Since then, the program has been continuously updated and relaunched every year with minor or major changes to the type of investment and nature of beneficiaries that can benefit from the tax incentives up to its latest version published in July 2020. The incentive consists of a tax credit equal to a percentage of the investment (from 50% up to 110%) that the beneficiary can use either: • As a tax reduction over 10 years; • As a transferable tax credit, that can be sold to the executor of works or to a bank or a financial intermediary. The Ecobonus is one of the most widely used and effective incentives for the activation of energy efficiency investments in Italy, especially in the residential sector. In 2019, this mechanism allowed the implementation of about 318 thousand projects with investments for about 3.4 billion Euros. Commercial buildings can benefit from the Ecobonus (at the moment, available up to the end of 2021) for: - Replacement of old boiler with new ones (50% to 60%, max €30.000); - Global energy renovation of a single building (65%, max €100.000); - Building envelope, in case of multi-unit building (70% to 75%, max €40.000 per each unit);
Conto Termico	The Conto Termico is a public incentive program first established in 2012, then updated and expanded in 2016, in order to facilitate investments in energy efficiency. The Conto Termico provides incentives to increase energy efficiency of buildings and the production of renewable energy from small-sized plants. Private beneficiaries can obtain these incentives for investments in heat pumps, biomass boilers, solar thermal plants and hybrid heat pump systems. Public administration can instead obtain incentives also for the thermal insulation of buildings, also through an ESCO in an EPC contract. The Program provides 700 mln Euros per year as grant for private beneficiaries and 200 mln Euros for Public Administrations to cover up to 65% of the investment cost, according to a series of technical requirements defined by the Decree.

[10] https://www.mise.gov.it/index.php/it/energia/efficienza-energetica/incentivi

	Even though the total amount of available resources and the percentage covered by the grant is very attractive, the Conto Termico is still very underused (in 2019 only 30% of total cap was assigned to the private sector and only 26% to the public sector). Anyway, the yearly amounts of assigned incentives has been constantly increasing since the beginning of the program. Up to July 2020, a total of 335.113 incentives requests have been worked out by the GSE. Commercial buildings can benefit from the Conto Termico primarily for the replacement of old HVAC systems with new heat pumps, the installation of new biomass heating systems and solar thermal panels. Source: https://www.gse.it/servizi-per-te/efficienza-energetica/conto-termico
Fondo nazionale efficienza energetica National Energy Efficiency Fund	The Fund supports energy efficiency measures carried out by companies, including ESCOs, and by the public administration on buildings, plants and production processes. More specifically, the measures supported must concern: - the reduction of energy consumption in industrial processes - the construction and extension of district heating networks - improving the efficiency of public services and infrastructure, including public lighting - energy requalification of buildings. Source: https://www.mise.gov.it/index.php/it/energia/efficienza-energetica/fondo-nazionale-efficienza-energetica Further information at: https://www.invitalia.it/cosa-facciamo/rafforziamo-le-imprese/fnee
Titoli di efficienza energetica White certificates	Titoli di Efficienza Energetica (TEE or White Certificates) are tradeable titles issued by the Manager of Energy Markets (GME - Gestore dei Mercati Energetici) to the subjects that achieved a certified amount of final energy saving in terms of Tons of Oil Equivalent (TOE). Beneficiaries of the White Certificates can be: - "Obliged parties": a) electricity distributors who, at the date of 31 December of two years prior to the considered year of obligation have more than 50,000 final customers connected to their distribution network; b) natural gas distributors who, at the date of 31 December of two years prior to considered year of obligation have more than 50,000 final customers connected to their distribution network; - companies controlled by obliged parties or controlling obliged parties, pursuant to art. 1, paragraph 34, of Law no. 239 of 2004 and subsequent amendments; - electricity and natural gas distribution companies not subject to the obligation; - public and private parties who/which, during the established period, are in possession of a certification in accordance with UNI CEI 11352, or have appointed a certified energy management expert in accordance with UNI CEI 11339 or are in possession of a certified energy management system in accordance with ISO 50001.

	Once obtained, White Certificates can be sold either through the GME market platform or through bilateral contracts. Average market price for 1 TEE in the first semester of 2020 was about 260 Euros. White Certificates are the main incentivization program for energy efficiency in the industrial, infrastructure, services and transport sector, but can also apply to investments in other civil sectors. In 2019, the GME issued 2.9 million of TEE, equal to about 1 million TOE of energy savings. Renovation of commercial buildings is eligible for white certificates according to the overall amount of primary energy saved. Usually, white certificates are used for energy efficiency of lighting (internal and external), since none of the other incentives are applicable to this renovation measures and do not overlap. More information: https://www.mise.gov.it/index.php/it/component/organigram/?view=structure&id=563

3.3.2. SPAIN – PUBLIC FUNDING FOR EE PROJECTS LANDSCAPE

In Spain, there are several sources of public support for building renovation in the form of subsidized loans, tax reduction and grants.

Given the fact that Spain is divided in Autonomous Communities, the available mechanisms for public funding are issued and distributed by the Spanish Government (i.e., national level) and then, administered by the respective Autonomous Community Government (i.e. regional level). Plus, in a more specific scenarios, there are also public incentives at city level that are managed and deployed by the local municipality.

The criteria to deploy public incentives from national level to regional level are mainly two: total number of dwellings and total number of population. The overarching criteria in Spain is that all building stock built before 1980 (or in some cases, 1970) may be prone to renovation.

The vast majority of incentives in Spain are focused on energy retrofits at residential level rather than commercial buildings. Prior to describing the available mechanisms for deep energy retrofits in commercial buildings, some remarks are needed:

- Incentives cannot be cumulated for the same renovation measure, so applying for one incentive prevents from the possibility of applying to another one;
- Incentives can be combined if they are applied to different renovation measures but each measure must be defined as an eligible investment or eligible measure;
- In Spain, it's possible to combine incentives that are provided by the Regional Government and the Municipality;
- There's no golden rule in the sense that one incentive is more convenient than another. Hence, it's always subjected to the specific renovation project and energy conservation measures.

Considering these four remarks, it's plausible to conclude that the selection of the best combination of public funding depends on the specific and unique conditions of the renovation project and, in most cases, it requires technical support to choose the best public funding options. Nevertheless, as previously mentioned, the available incentives for commercial building renovation are anything but promising. Table below presents the National Program for Energy Efficiency Renovation of Buildings in Spain.

Table 3. National Program for Energy Efficiency Renovation of Buildings in Spain

PREE – National level (Programa Rehabilitación Energética de Edificios)	A recently launched program for Building Energy Rehabilitation by IDAE, the Institute for the Energy Diversification and Saving, operating from beginning until mid-2021. It has a total budget of 300 mln euros which is then divided by each Autonomous Community. For instance, almost 44 mln were assigned to the Catalunya Region. The distribution factor is set by the total number of primary dwellings in the respective region. The main objective of the PREE is to boost the sustainability the existing building stock through actions that range from renovating or changing the thermal envelope to the installation of renewable sources of energy such as biomass, solar thermal, heat pumps, etc. The PREE is also aimed at promoting actions carried out by renewable energy communities or citizen energy communities. However, it places strong emphasis on vulnerable collectives and thus energy poverty alleviation. In respect of the target group, there's no strong restriction and thus it's aimed at different profiles such as individual homeowners, ESCOS, small companies, city councils and community of owners. A basic aid under the program, for actions in full buildings, will be of 35% of the eligible costs for all types of actions, except in the case that the EE measure are changing the lighting systems-where the aid is 15% of the total eligible cost. In the event that works are for homes or single-family apartments, this percentage will be 25% and 15%, respectively, and may have different additional aid depending on the use of the building and, If the energy efficiency criteria, social criteria or integrated action criteria are met. Ought to remark that the total aid will be limited by the maximum amount resulting from the application of the State aid regulation.

Benchmarking both countries, it's clear to conclude that public incentives are more developed in Italy that in Spain which may not come as a surprise considering the Ecobonus and Superbonus initiatives. This is indeed attractive for all sort of building owners and project promoters in Italy and it serves as an example for other European countries.

For the Spanish demo case, it's acknowledged that in order to obtain public incentives to finance the first tranche of the investment cost, an in-depth analysis of the local context that emanates from the location of the building must take place. This is classified as out of the scope of the EEnvest Project and no further research will be enacted on this topic.

Considering the aforementioned financial instruments and overview of the public funding landscape for DER projects in Italy and Spain, from now onwards an analytical approach will be carried out. The ultimate objective of this approach is to construct the EEnvest Decision Making Flow that guides the building owner through the most suitable (I) business model and (ii) financial instrument according to a specific set of criteria.

3.4. BUSINESS MODEL AND FINANCING INSTRUMENT DECISION MAKING FLOW

In the light of guiding the building owner to choose a suitable business model and source of financing for the DER project, a decision-making flow methodology is proposed.

It's important to note that there's no one-for-all solution when it comes to business model and financing instrument election because the ultimate decision relies on the building owner profile, preferences and specific project and local conditions. In fact, in most cases a dedicated technical third party is recommended to conduct such an assessment.

However, the proposed methodology is a necessary first step to standardize the decision-making process and hence upscaling the demand for DER projects for commercial buildings. As such, the proposed methodology is not aimed at choosing one specific solution, but rather at pointing to the most suitable set of solutions (i.e., 2-3) for each specific project and thus it's aimed to help building owners and project promoters navigate through uncertainty.

The Decision-Making Flow is built upon the previously described and short-listed business models and financing instruments. These are summarized below.

BUSINESS MODELS	Energy Performance Contracting (EPC)
	Separate Contracting Based (SCB)
FINANCING INSTRUMENTS	EPC Financing (ESCO Financing)
	Dedicated Credit Lines
	Direct Equity Investments in RE Investment Funds
	EE Investment Funds
	Factoring Funds for EPC
	Citizen Financing

Once the foundations of the methodology are defined, the second step is to define the criteria that will help navigate through the business model and financing instruments options. The criteria definition is a most complex process and it involved several partners-level discussions, brainstorming sessions and internal expert consultation. The result of these efforts resulted in a list of criteria and these are presented in table below

Table 4. List of criteria

CRITERIA	DESCRIPTION	IMPLICATION
Risk-Aversion	Reluctancy to bear with the risk of performance of the renovation project (i.e., energy savings).	Binary decision between the EPC and SCB Business Models. Low risk-aversion: SCB Business Model

	A building owner with low risk-aversion is prone to deal with more risk than a building owner with high risk-aversion.	High risk-aversion: EPC Business Model
Leverage	Inclination to cover a portion or the full investment cost with third-party financing	Binary decision between full equity and third-party financing. Yes: 3rd party financing No: Own funds- full equity
Project Size	It refers specifically to the total investment value of the renovation project.	Binary decision when considering a specific threshold. For the scope of EEnvest, three thresholds are set: Threshold 1: Project size < 600.000 euros Threshold 2: 600.000 euros <= Project size < 2.500.000 euros Threshold 3 Project size > 2.500.000 euros Yes/No In some cases, EE Investment Funds and Real Estate Investment Funds may be only interested in large projects or even, a portfolio of small projects. Hence the rationale of incorporating the threshold of 2,5M euros to the Decision-Making Flow.
On/off balance sheet financing	Disposition to include a liability on building owners' balance sheet (on-balance sheet) or not (off-balance sheet).	Binary decision between on and off-balance sheet financing. Typically, on-balance sheet financing implies lower interest rates than off-balance sheet financing. As result, on-balance sheet may be more accessible. However, on-balance sheet financing impacts directly the company's debt ratios such as the debt-to-equity ratio. This effect is significant when considering that DER investments are often capital intensive. Off-balance sheet financing is strongly subjected to local accounting rules and in most cases, a fiscal expert is needed for assessing such a source of financing. Plus, not all financing instruments offer this solution.

Accessibility	Refers to the degree of accessibility of the financing instrument in terms of administrative processes and documentation.	Binary decision. High accessibility: administrative processes/paper work are relatively easy to comply with. Low accessibility: administrative processes/paper work are rather a hustle and could discourage applicants to pursue this path. Although this criterion is difficult to apply, it could be concluded that from high accessibility to low accessibility the order is the following: (1) Dedicated credit line (2) Citizen Financing (3) EPC Financing (ESCO Financing) (4) EE Investment Funds (5) RE Investment Funds From the point of view of the ESCO, Factoring Funds for EPCs are highly accessible.
Tenor requirements	Defined as the duration of the financial contract. Evidently, the investment tenor will be shorter that the useful life of the investment.	Highly dependent on the specific case and in some cases, to the specific source of financing (i.e., financing entity). Thus, it's difficult to define a threshold to guide the decision-making flow. However, it could be concluded that from high to low tenor requirements the order is the following: (1) Dedicated credit line (2) Citizen Financing (3) EPC Financing (ESCO Financing) (4) EE Investment Funds (5) RE Investment Funds Factoring Funds for EPC are out of scope for this category as this instrument is only relevant for ESCOs.

Depending on the specific characteristics of an energy efficiency project it could be the case that all mentioned criteria are mandatory to be able to recommend the most suitable financing instruments for the project under analysis. Thus, it could be concluded that providing a one-in-all formula that leads to the one best option taking into consideration all relevant criteria is a most complicated decision-making process. However, the described criteria help to understand the important angles that must be considered when selecting the source of finance for the EE project under assessment.

In the light of providing a practical decision-making flow for building owners, three criteria are selected. These are:

- Criteria 1: Risk aversion
- Criteria 2: Leverage

- Criteria 3: Project Size

The rationale of discarding the tenor requirement, accessibility and on/off-balance sheet criteria is because very often these criteria are highly dependent on the local context (i.e., local regulations, building locations and project-unique characteristics). Moreover, it requires an in-depth technical assessment that in most of the cases is outsourced to consultants or senior advisors. Lastly, acknowledging the distinction of financing instrument and financing product, at the end of the day what the building promoters perceive is rather a financing product (i.e., EE credit loan from a retail bank) rather than the financing instrument as such.

Taking all these elements into consideration, the next paragraphs depict the EEnvest Decision-Making Flow. In order to provide more clarity on the usage of the tool, it has been divided in three figures.

The first step of the business model and financial instruments decision-making flow consists in guiding the building owner to select either the Separated Contracting Based Business Model (SCB) or the EPC Business Model. If the building owner is willing to deal with the risk of the project himself, it means that his level of risk-aversion is low. However, if the building owner is not willing to bear with the risks of the project at all or just in a very limited way, then it means that his or her level of risk aversion is high. This leads to a binary decision and works as follows:

- High Risk-Aversion à EPC Business Model. The building owner does not want to deal or bear with the risk of the project.
- Low Risk-Aversion à SCB Business Model. The building owner wants to bear with the risk of the project.

Once the building owner decides which business model is most suitable for the specific project in analysis, then the next strep relates to the decision on how to finance the project. The first criterion in the next step is rather straightforward and it refers to the willingness to finance the project with leverage or not. It works as follows:

- Yes, the building owner wants to leverage the financing à building owner needs a third-party financing.
- No, the building owner does not want to leverage the financing à building owner will finance the project with own funds (i.e., full equity).

The flow of both decisions is better showcased in Figure 13 below.

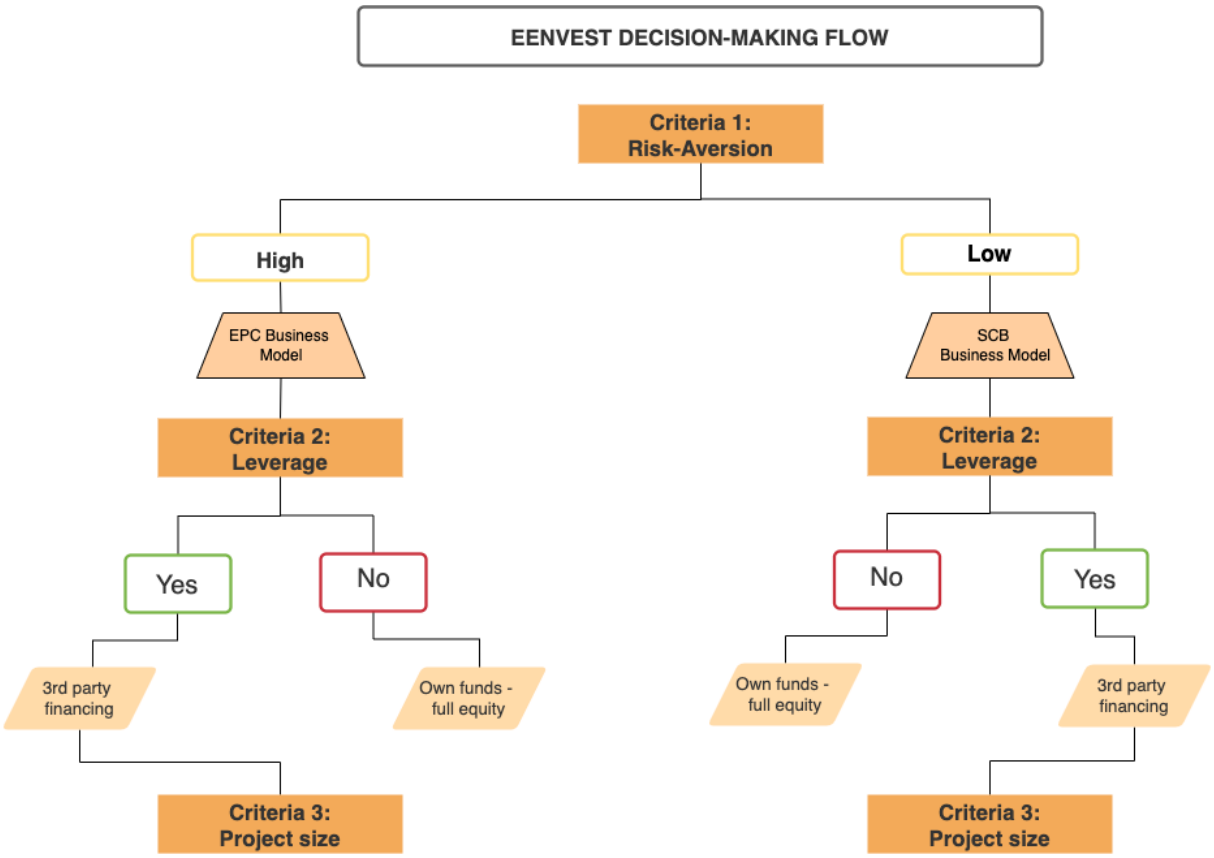


Figure 13. EEnvest Decision-Making Flow - Business Models & Leverage Case

Own elaboration

Evidently, if the building owner decides on financing the project with own funds, then the decision-making flow finalizes. However, if the building owner aims to leverage on financing, then the decision-making flow continues with the purpose of walking the building owner towards the most suitable set of financing instruments for the renovation works under analysis.

To guide the building owner towards specific financing instruments, the project size criteria is defined. Project size criteria is also referred as the third criteria or criteria 3. In brief, project size (i.e., total investment cost) may lead to different financing instruments as some of them are tailored to smaller investments amounts whereas others, such as EE Investment Funds, are usually fit for larger projects. In the light of guiding the building owners towards the most suitable options, three thresholds are set. These are:

- Threshold 1: Project size < 600.000 euros
- Threshold 2: 600.000 euros <= Project size < 2.500.000 euros
- Threshold 3: Project size > 2.500.000 euros

Each threshold will point to a different set of financing instruments. The suggested financing instruments are related to the specific business model selected in criteria 1 of the decision-making flow. Figure 14 below depicts the case for a building owner with high propensity to risk and that's willing to leverage financing for the project.

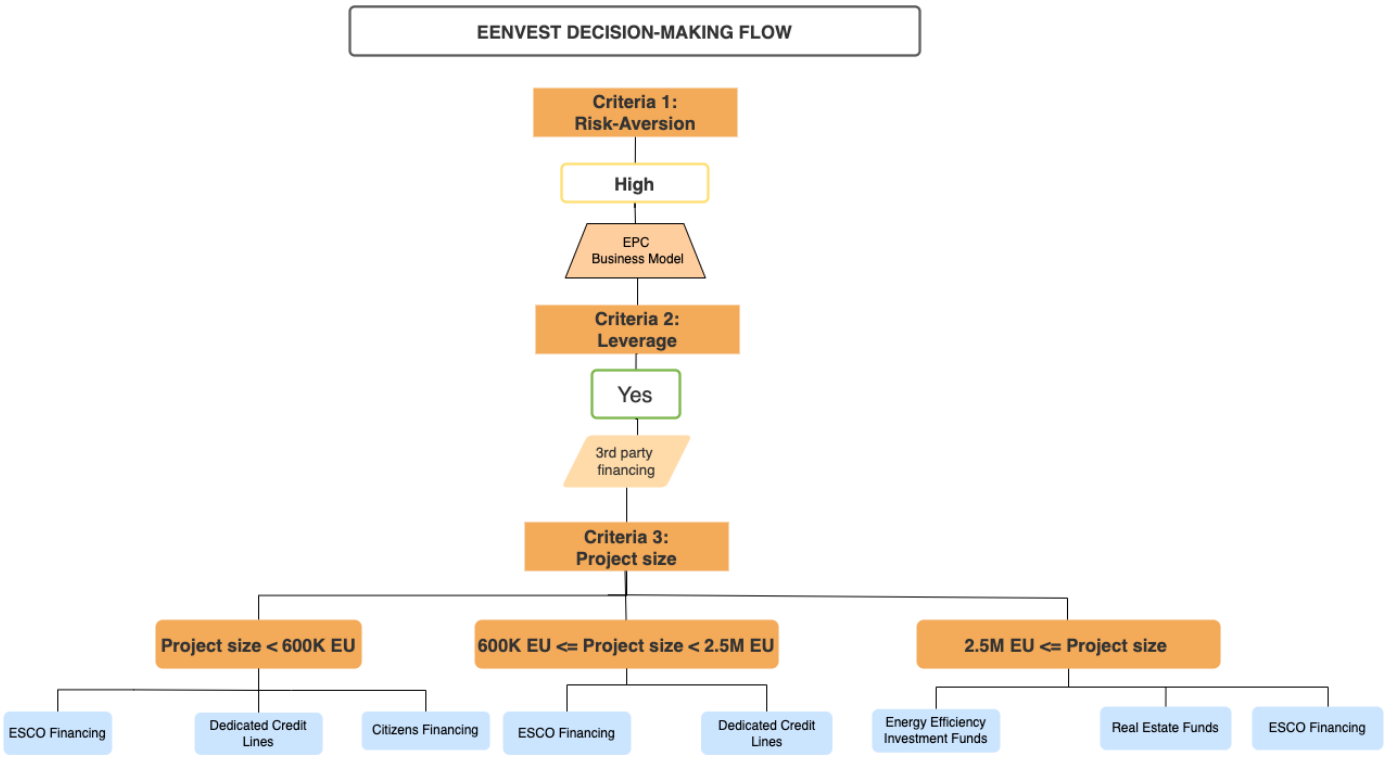


Figure 14. EEnvest Decision Making Flow - High Risk Aversion & Leverage Case

Own elaboration

The case presented in Figure 14 above is fit for those building owners with high risk aversion and therefore are willing to transfer most of the project risks towards a third party. As explained in Chapter 1, the EPC Business Models involves an ESCO, which in most cases offers guaranteed performance and/or financing. An important note is that ESCOs typically offer “attractive” financing conditions to building owners by using (i) their own funds, (ii) dedicated credit lines and (iii) EPC Factoring Funds.

However, there may also be the case of building owners with low risk aversion and thus can bear with some, if not all, of the project risks. Figure 15 below presents the case of low risk aversion and leverage financing.

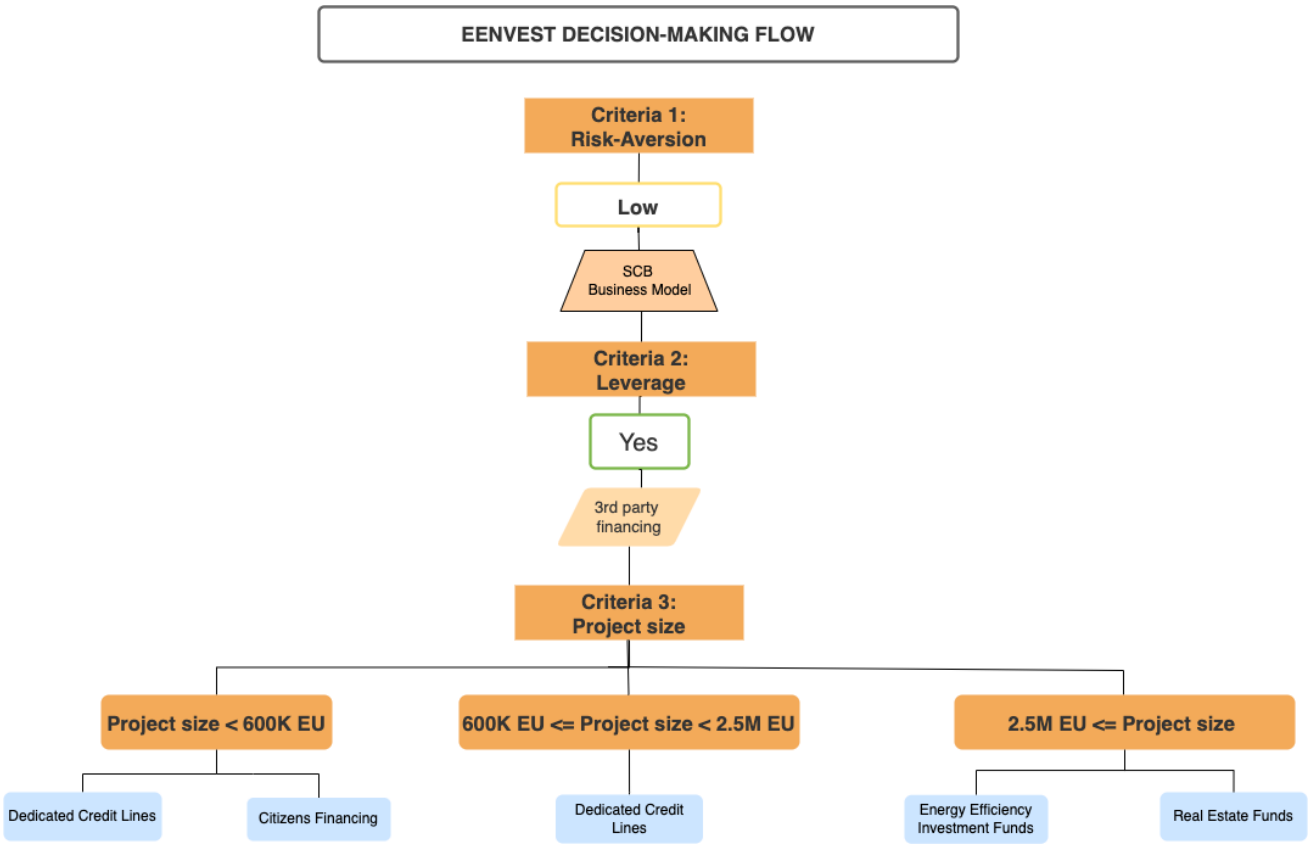


Figure 15. EEnvest Decision Making Flow - Low Risk Aversion & Leverage Case

Own elaboration

It's observable that for this specific case, Dedicated Credit Lines gains relevance. Ought to remark that this financing instrument is delivered to the market through retail banks. Evidently, the selection of the bank with the most suitable financing conditions to the project at hand is strongly subjected to the specific case, market conditions as well as geographical location and credit worthiness of the building owner.

The EEnvest Decision-Making flow is presented as a standard methodology that any building owner can access and apply. It's a useful first step to provide guidance to building owners that are entering the renovation process and needs clarity on the most suitable available options of business models and financing instruments. Ought to be remarked that when the building owners reach the third level of options (i.e., Financing Instrument, blue boxes on Figures above) an in-depth analysis should be carried out by the building owner to ultimately select the most suitable financing product or the type of investor that is more fit for his or her renovation project.

In the light of providing further guidance to building owners seeking to get the renovation project done, the next paragraphs will discuss how the other criteria presented in Table 4 above may guide the decision-making flow towards specific financing instruments and business models.

For the case of off-balance sheet requirement criterium, it must be noted that it can only be applied when the renovation qualifies as a service (e.g., Energy as a service). At project level this can only be achieved through the ESCO (EPC or ESC) or when a (ESCO) Special Purpose Vehicle is being set up. Consequently, the FI could be ESCO Financing or the appropriate FI behind the financing of the ESCO or the SPV as such (Forfaiting/Factoring Fund, Equity fund, EE fund (equity or debt) or dedicated credit lines). Whereas for an on-balance sheet solution both business models are eligible and thus the key point to decide one of the two business model lies on the risk-aversion of the building owner.

The accessibility criterium was not incorporated in the decision-making flow as a fixed criteria as it's strongly subjected to local context as some financing instruments may be more developed in some countries than others. For instance, the Italian market for ESCOs is considered as mature whereas the Spanish market is considered to be in development. This can indicate that in Italy it may be easier to obtain an ESCO Financing in comparison with Spain. The same occurs for Dedicated Credit Lines, these being more accessible in some specific countries than others. In fact, some retail banks may require opening a bank account to access their financing. This may be a hurdle for some building owners and thus it required an in-depth analysis considering the local market context.

In regards of tenor criteria, it may be applicable from two angles. For instance, short tenor requirements may lead to dedicated credit lines, citizen financing whereas long tenor requirements will lead to energy efficiency investment funds and real estate funds. In most cases this specific criterium is strongly linked with the project size criteria.

As final remark, it could be concluded that if the decision-making flow is applied in one specific project, as a tailored consultancy service, the accessibility and tenor criterion can be applied right after the project size criteria to select the most suitable financing instrument for that specific project.

The next chapters will adopt a practical fashion and will elaborate further on business cases and will apply the EEnvest Decision-Making Flow.

4. Analysis of Business Cases using the Discounted Cash Flow model

As already stated, no one business model is always better than another and the decision about which business model should be pursued is project-specific. This decision, in particular, depends also on the financial KPIs of the investments, such as payback time, IRR, NPV, etc. In order to provide some examples about the potential business models that are suitable for different energy efficiency investments, Chapter 6 analyses a set of business cases, based on actual data from building renovations.

However, in order to assess the business cases from a financial performance point of view, it is fundamental to define a standard methodology for the calculation of the financial KPIs. This methodology consists of applying the Discounted Cash Flow (DCF) model.

The DCF model that is being used at the EEnvest Project obeys the main principles of any DCF. These are:

1. It is used for projecting the expected cash flows of the project, discounted to the present value in order to take into consideration the time value of money, and thus it is a tool to assess the viability of an investment opportunity which, in the case of EEnvest, relates to an energy efficiency project.

2. The tool works in an input-output dynamic, meaning that the more reliable the input, the more reliable the output of the model.

3. The output of the model is used for decision-making purposes and therefore, project evaluation.

Considering that the scope of EEnvest is to assess energy efficiency projects, the inputs required to run the tool are related to the expected energy savings to be achieved as an effect of the renovation project. In some cases, if any relative change in the O&M costs is expected due to the EE project, these may also be included. Energy savings can be indirectly considered as a positive cash flow, representing the effect of the reduction of future expenditure for energy supply. So, in the DCF model, the negative cash flows deriving from the investment cost is offset by the positive cash flows generated by the renovation itself.

The rationale of choosing the DCF as one of the EEnvest tools is that this is a very simple though exhaustive model to calculate and describe the project financial performance. Moreover, it's also suitable to embed the variability coming from the technical risks analysis to define the variability of the financial KPIs. Thus, this paragraph adopts a practical approach and explains how the DCF works, touching upon the main parameters of the model (i.e., inputs and outputs)

Inputs

- **Investment cost** [€]: It refers to the total amount to be invested for undertaking the energy efficiency project. It's expressed as a single value and it's highly dependent on the type of renovation measures (i.e., solution set) under analysis. As the DCF tool is used to analyse the financial performance of the project, the investment cost is a mandatory input that must be provided by the user. Ought to remark that the investment cost, for the purpose of the DCF methodology chosen at EEnvest, is conceived in time 0 (base time), meaning that once the investment is done, the project starts and thus the analysis of the cash flows of the project.

- **Thermal Energy Savings [kWh]:** It alludes to the expected or predicted energy savings that are obtained from a thermal energy source. Typically, this input is highly dependent on the specific set of measures and thus as well as external factors such as weather conditions. In the light of a DCF valuation of an energy efficiency project, the thermal energy savings are indeed one of the revenue streams (positive cash flows) of the model.

- **Thermal energy price [€/kWh]**: It refers to the price of thermal energy, depending on the fuel source used (e.g., natural gas, gasoil, etc.). It depends on the geographic location of the building as well as on the tariffs applied by the energy supplier.

· **Electric energy savings [kWh]:** The same rationale of thermal energy savings governs the definition of electric energy savings. The only difference is the type of energy and the consumption of this source of energy, based on building usage, equipment's quality and external factors as well. Anyway, electric energy savings is an input that depends on the renovation solution set and thus it is provided by the user.

· **Electric energy price [€/kWh]**: It refers to the price of electric energy, based on the specific conditions of the user.

These inputs are crucial for computing the revenues of the DCF model, representing the economic (monetary) value of energy savings. In particular, revenues are computed by simply multiplying the expected energy savings by their respective energy price. This is the method to monetize energy savings as, from the renovation project, these are usually expressed in kWh and not in Euro.

Then, for a more detailed investment analysis, more parameters can be taken into consideration in order to calculate its sustainability, profitability and bankability. These parameters are the following:

- **Inflation rate [%]:** is the rate to which revenues (energy savings) and costs can be indexed over time. Adding an inflation rate helps assessing the nominal value of the main outputs, such as the Internal Rate of Return (i.e., IRR);
- **Leverage factor [%]:** it's the share of the investment covered by debt (bank loan). A leverage factor of, for example, 70% means that the 70% of the investment cost is covered by bank loan while the remaining 30% is covered by equity (own resources) of the investor;
- **Interest rate [%]:** is the interest rate applied to the applicable 3rd party financing source, meaning the cost of debt;
- **Loan duration [years]:** it's the duration of the debt (tenor), meaning the number of years the debt is supposed to be paid back;
- **Cost of capital [%]:** is the opportunity-cost of the risk capital (equity) invested in the project. In finance, it represents the expected yield on a generic investment on the market with similar riskiness of the one under evaluation. This parameter is used to check whether the investment is economically convenient for the investor, as it's used as discount rate for the equity cash flows to calculate the Net Present Value;
- **Weighted Average Cost of Capital (WACC) [%]:** is a discount rate calculated as the weighted average between the cost of debt (the interest rate on the loan) and the cost of capital, where the weighting is the leverage factor. It is used as discount rate for the project cash flows to calculate the project NPV.

These parameters are entered into the DCF model in order to calculate the main financial output, meaning the indicators that can support the assessment of the economic convenience and profitability of the project, supporting the decision-making process of the investor. The main outputs are defined as follows:

1 **Project NPV [Euro]:** represents the economic value created (if positive) or destroyed (if negative) by the investment. As it's not affected by the financial structure, it is calculated as the sum of the present value of all cash flows over the defined time horizon, using the WACC as discount rate.
2 **Equity NPV [Euro]:** represents the economic value created (if positive) or destroyed (if negative) by the risk capital invested. As it is affected by the financial structure, it is calculated as the sum of the present value of the cash flows related to the capital invested over the defined time horizon, using the cost of capital as discount rate.
3 **Project IRR [%]:** represents the yield on the investment over a defined time horizon, without considering the financial structure. Mathematically, it is calculated as that discount rate that sets the Project NPV equal to zero.
4 **Equity IRR [%]:** represents the yield on the risk capital invested over a defined time horizon, without considering the financial structure. Mathematically, it is calculated as that discount rate that sets the Equity NPV equal to zero.

These parameters may vary according to the business model that is chosen and, secondarily, also according to the Country where the building is located, as explained in the following paragraphs.

4.1. BUSINESS MODEL-SPECIFIC PARAMETERS

Depending on the Business Model that is chosen to implement the investment, some financial parameters to be used in the DCF model may vary, influencing the financial outputs. Inputs varies also according to whose point of view is considered: the ESCO or the Customer. In each case, the DCF model should reflect the contractual clauses that have been agreed upon in the contract.

In particular, focusing on the Energy Performance Contracting model:

- From the **Project** point of view: the DCF model considers 3 main inputs: the up-front investment cost; the contractual fee to be paid by the Customer (as revenue, linked to the energy saving[11]); the operating and maintenance costs. Other financial parameters may also be considered, such as the financial structure. Indexing and prices, instead, depend on the contractual agreement;
- From the **Customer** point of view: the DCF model should only consider the actual economic savings after the renovation (indirectly, as a "revenue") and the costs related to the annual fee to be paid to the ESCO. In this case, no up-front investment and no financial structure is considered (unless an initial contribution is agreed upon with the ESCO or the EPC investment is financed by the Customer).

So, for each business model that is planned to be implemented, the investor should draft the DCF model that is most suitable for a proper assessment of the energy efficiency investment.

4.2. FINANCIAL INSTRUMENT-SPECIFIC PARAMETERS

The availability of specific financial instruments to face the up-front investment cost may affect the financial leverage and parameters of the project, causing an impact on the financial outputs (specifically on the outputs related to the invested equity).

In the case grant capital (subsidies) is available, coming from specific national or regional programs for the incentivization of energy efficiency, the actual financial need to undertake the investment project becomes lower. The reduction of the up-front cost means a lower need of resources to obtain the same result in terms of energy and economic savings. Thus, the project becomes obviously more convenient from a financial point of view, whatever the financial leverage is that is put in place to cover the remaining part of the investment need.

On the other hand, dedicated credit lines, or other specific debt financing lines with particularly favorable conditions and dedicated to energy efficiency, positively affect the parameters related to the leverage factors. Lowering the interest rate on debt, or extending the duration of the financing, allows more cash flows generated by the project to be dedicated to the remuneration of the equity invested. In more technical terms, a lower interest rate on debt reduces the WACC, positively affecting the NPV of the project cash flows.

Finally, in the case of large projects or a portfolio containing several projects, also the possibility to attract energy efficiency investment funds could be considered and evaluated. These funds can in fact provide equity (risk capital) or financing (debt capital, in various forms such as senior loan, factoring, etc.) at favorable conditions.

[11] Typically, EPCs foresee a shared-saving clause, where a small portion of the economic savings (5% or more) is left to the Client. The majority of the savings is due to the ESCO as "service fee", needed to payback the up-front investment.

For a proper evaluation of an investment in an energy efficiency project, all these aspects must be correctly assessed in order to find out the most suitable and convenient financing structure to optimize the return. In particular, in case of availability of several alternative financing instruments, the investor should evaluate which one is more convenient for its project and is able to bring more added value. In many cases, a blending between grants and dedicated credit lines (or other specific financing instruments) could be the solution to increase the economic convenience and profitability of an energy efficiency project, often being fundamental for the go or no-go decision.

4.3. COUNTRY-SPECIFIC PARAMETERS

Depending on the country where the building (and the investor) is located, specific parameters should be taken into consideration for a proper assessment of the investment, also from the financial point of view. Besides considering the availability of different financing sources, as explained in previous Paragraph 5.2, the location of the building/investor may affect the parameters to be considered in the evaluation. In particular:

- Since the **Cost of Capital**, according to the Capital Asset Pricing Model (CAPM), which quantifies risk and translates that risk into expected return, is affected by the country risk, the evaluation of an investment must take this also into consideration. Thus, investing in a country with a higher default risk (e.g., with lower rating or with higher spread versus the risk-free rate) implies a higher opportunity cost of capital. This means that an investor in a low-risk country will accept a return on the investment that is lower than the required return in a high-risk country;
- Expected **inflation rate** may be different from country to country. At EU level, in particular for the Euro area, the long-term expectation of price increase is the same, but some country-specific factor could be considered, particularly if the dynamics of energy price is concerned.

In the following Paragraph, a sensitivity analysis will be performed in order to assess the actual impact of the geographical location of the building on the financial inputs to be used in the DCF model and on the expected outputs.

5. Analysed Business cases

The first part of this chapter shows thirteen case studies, all renovated commercial office buildings, analysed with the EEnvest framework for evaluating financial impacts of technical risks related to energy-efficient renovation projects[12]. The renovation projects, with the relative energy performance measures adopted and mitigation measures implemented, address the impact results of technical and financial risk calculation and multi-benefits analysis.

In the second part of the chapter, it is shown how the business cases vary. Such results are very helpful to face, within a wide range of possibility, the best business model or financing instrument in relation to the investor and/or building's owner expectations.

5.1. THE EENVEST TECHNICAL AND FINANCIAL EVALUATION ON A SET OF PROJECTS

This part describes the results of the EEnvest technical and financial evaluation of 13 energy efficiency renovation projects, collected within the EEnvest project and used to identify possible business models considering several indicators (KPIs).). On top of this, additional information regarding the multiple-benefit KPIs that are relevant for building owners, as they refer to the impact on building occupants, is provided.

Currently, the buildings (or energy efficiency renovation projects) collected in the EEnvest database are 13 (see Table 5), two of them are the demo-case buildings of the EEnvest project (n.11 and n.13).

Table 5 exhibits main information on:

- Generic building information, such as position and dimensions;
- Renovation strategy, grouping the energy renovation measures in two groups: (i) envelope, such as insulation of the walls, roof, or basement, windows and doors replacement, and new shading system installation, and (ii) technical systems, such as heating, cooling, ventilation, and lighting system, etc. and Renewable Energy Sources (RES) such as Photovoltaic system (PV) or solar thermal panels.
- Mitigation measures, such as certification protocols, operations procedures, monitoring and measurement & verification methods of the energy consumption, and maintenance program.

Table 5. Business cases analysed

	Building name	City	Net heating area	Net heating volume	Renovation Strategy			
					Envelope	Technical System	RES	Mitigation measures
			m2	m3	(wall, roofs,windows)	(heating, cooling, ventilation, electric)		
1	Office 1	Bozen, IT	7.809	23.429	Roof	Heating generator system	-	-
2	Office 2	Bozen, IT	9.225	27.675		Heating generator system	-	-
3	Office 3	Bozen, IT	3.193	9.579	Roof, walls, windows	Heating generator system	-	-

[12] https://www.mdpi.com/2673-4931/11/1/32

4	Office 4	Bozen, IT	1.718	5.156		Heating generator system	-	-
5	Office 5	Bozen, IT	6.335	19.005	Roof, walls, windows	Heating generator system	-	-
6	Office 6	Bozen, IT	4.061	12.184	Roof, windows	Heating generator system	-	-
7	Office 7	Bozen, IT	2.669	8.008	Roof	Heating generator system	-	-
8	Office 8	Bozen, IT	3.364	10.093		Heating generator system	-	-
9	Office 10	Bozen, IT	4.648	13.944	Roof, walls, windows	Heating generator system	-	-
10	Office 11	Bozen, IT	3.003	1.804	All the envelopes. Building enlargement.	All the technical system		Passive House and KlimaHouse Certification
11	IFAD	Roma, IT	24.470	97.048		All the technical system		LEED certification
12	Milan 1	Milan, IT	645	1.935	Wall insulation, new windows	Lighting system	-	Monitoring of energy consumption
13	Fem Nucli	Olot, SP	347	1.101	All the envelope	All the technical system	PV	-

The renovation strategies proposed for buildings n.2, 4, 8 and 11 (highlighted with the blue color) are mainly based on the renovation of the technical systems only, without any renovation at the building envelope. It can be assumed that in such buildings the renovation of the envelope is not needed or appropriate: for example, in building n.11, the Italian pilot, the condition of the envelope is quite good (built in 2015) whereas the technical systems need to be renovated. Buildings n.10, 11 and 12 include mitigation measures, such as implementation of standardized energy certification procedures and monitoring of energy consumption.

Table 6**.** shows the main energy related parameters of the renovation strategy, such as:

- Thermal and electric energy consumption, before and after the renovation. Values before the renovation are actual values while after the renovation these are estimated. The values are expressed in kWh/year.
- Energy costs before (actual consumption) and after (estimated demand) the renovation**.** The first one is the real consumption, calculated as the sum of the annual average cost of the energy bills of the last three years, and the second one is the energy demand, an estimation of the energy costs of thermal and electric consumption for heating, cooling, ventilation, lighting, and appliances. Both are expressed in Euro (€) currency.
- Energy savings due to the building renovation, calculated as the difference between the energy cost before and after the renovation. Energy savings are expressed in both terms of costs saving and percentage of energy consumption.

Table 6. Energy consumption of the business cases collected

	Actual energy consumption before the renovation		Estimated energy demand after the renovation		Energy price			Cost of energy consumption before the renovation	Cost of planned energy demand after the renovation	Energy savings	
					Thermal		Electric				
	Thermal	Electric	Thermal	Electric	Pre	Post		(thermal and electric)	(thermal and electric)	Value	Percentage
	kWh/a	kWh/a	kWh/a	kWh/a	€/kWh	€/kWh	€/kWh	€	€	€	%
1	758.973	46.821	492.066	46.821	0,07	0,07	0,21	64.687	45.352	19.335	30%
2	941.671	58.092	711.924	58.092	0,07	0,07	0,21	80.259	63.615	16.643	21%
3	301.608	134.200	96.509	134.200	0,07	0,07	0,21	49.667	34.809	14.858	30%
4	197.602	12.190	146.288	12.190	0,07	0,07	0,21	16.841	13.124	3.717	22%

5	343.110	192.275	132.915	192.275	0,07	0,07	0,21	64.711	49.484	15.227	24%
6	495.435	268.263	298.824	268.263	0,07	0,07	0,21	91.497	77.254	14.243	16%
7	593.198	297.067	426.411	297.067	0,07	0,07	0,21	104.550	92.468	12.082	12%
8	700.981	161.616	524.487	161.616	0,07	0,07	0,21	84.281	71.496	12.785	15%
9	354.204	72.236	23.767	72.236	0,07	0,07	0,21	40.633	16.695	23.938	59%
10	565.765	104.804	32.000	97.297	0,10	0,03	0,21	77.949	21.100	56.849	73%
11	1.468.243	3.286.000	1.890.243	1.806.000	0,03	0,03	0,13	470.528	295.436	175.092	37%
12	118.680	19.500	48.375	19.500	0,08	0,08	0,17	12.809	7.185	5.624	44%
13		79.117	-	2.559	-	-	0,16	12.658	409	12.249	97%

It was decided to present the buildings energy performance using the costs of energy, both before and after (estimated demand) the renovation, as it allows to sum up electric and thermal consumption (independently to the energy vector used to produce such energy). In several buildings (from 1 to 9), the electric consumption and the electric demand, pre and post the renovation, are the same. This means that no energy renovation measures to the lightings, appliances or other electrical parts are foreseen.

In the previous Table 6 the "Energy savings" are presented both as value and percentage, with a minimum percentage value of 12% achieved in the building n.7, and a maximum of 97% in building n.13.

The results of some technical-financial KPI (investment cost, damage, energy performance gap and payback time) of the renovation strategies evaluated by EEnvest methodology are reported in Table 7.

Table 7. Renovation strategies: some KPI compared.

ID	Investment	Damage		Energy Performance Gap		Payback time	
		(Increase of investment)		(Increase of energy consumption)		without technical risks	with technical risks
	€	€	%	€	%	year	year
1	*404.253* *	3.754	0,93%	1.070	2,36%	20,91	23,15
2	*110.000* *	162	0,15%	1.362	2,14%	6,61	6,76
3	*638.361* *	4.353	0,68%	282	0,81%	42,96	58,70
4	*24.067* *	50	0,21%	286	2,18%	6,47	6,63
5	*684.088* *	3.766	0,55%	387	0,78%	44,93	58,70
6	*748.788* *	1.767	0,24%	640	0,83%	52,57	61,64
7	*165.340* *	1.487	0,90%	848	0,92%	13,68	14,99
8	*80.000* *	43	0,05%	760	1,06%	6,26	6,29
9	*1.742.890* *	4.256	0,24%	104	0,62%	72,81	85,32
10	4.800.000	8.793	0,18%	1.105	5,24%	84,43	104,60
11	1.306.000	3.983	0,30%	3.074	1,04%	7,46	7,57
12	201.850	1.609	0,80%	11	0,16%	35,89	40,08
13	250.000	950	0,38%	132	32,33%	20,41	21,96

**Investment with the reduction of Italian public incentives available in the year 2020*

The **investment cost** is the total amount of the capital expenditure needed for the energy renovation project, calculated as the total cost of investment, including all design and construction costs, excluding the VAT.

The **payback time** is an economic indicator expressing how much time (years) it takes for the project to produce enough net positive cash flows to repay the initial investment. It gives an idea, through a simple and easy to understand number, of how many years are needed before the project breaks even and possibly becomes profitable. In the model, payback time can be calculated including or not including technical risks. For example, in building n.2 there is only one energy renovation measure implemented (the replacement of the heating system), that alone allows the reduction of the energy costs by 30%. The simple *payback* without considering technical risk is estimated in 6.61 years, and it increases to 6.76 years when technical risks are included.

A visible difference in the result of different renovation scenarios is due to the typologies of the renovation measures adopted. Analyzing the results of the payback time indicator, it is possible to affirm that there are two kinds of renovation strategies: (1) the renovation strategies that renovate the building envelope and the technical system, and (2) the renovation strategies that renovate mainly the technical system. This last category has more interesting results, at least based on the chosen financial indicators, characterized by higher level of cost-benefit, also described by the lower payback time indicators but obviously has, on average, lower energy savings ambitions.

The renovation of the building envelope, or part of it, results, in economic terms, in a higher investment outlay compared to the energy improvement of the building system. However, from multiple benefits point of views, such investment could still be considered very interesting for increasing the indoor comfort.

As an example, *payback* indicators of buildings n.9 and 10, although this last one reaches the passive house standard, are very high, respectively 72 and 84 years. The investment of the renovation of the building n.9 is about 2 million €, of which the substitution of the windows alone amounts to ca. 1.5 million € (including a reduction of 100.000 € thanks to Italian government incentives), weighting about 77% of the investment. Investment for building n.10, instead, is very high as the project foresees a building extension and the investment costs include the renovation of all the building elements, including interior finishing, pavement, wall, lighting, etc.., without any government incentives. The payback indicator for this building would definitely decrease if the building enlargement and the investments not generating any energy savings (finishing, pavement, walls…) would be excluded from the calculations.

EEnvest assessment: technical-financial risk evaluation

The EEnvest calculation approach estimates the risk associated to the energy renovation measures, combining a set of pre-identified risks. It evaluates the technical risk, financial performance and the multi benefits based on an energy renovation project of office buildings, by several indicators listed in Table 8. The results of each renovation scenario will be different from another energy renovation strategy proposed, addressing and weighting the energy renovation measures implemented and the related mitigation measures adopted. In any case, it should be considered that technical risks are referred to the renovation measures only, while potential risks coming from non-renovated parts or systems are not considered in the KPIs.

Table 8. Technical risk, financial performance and the multi benefits performance.

TECHNICAL RISK INDICATORS Evaluated by two independent economic indicators presented to the user as cost incrementation in euro (€). The first one related to the planned energy consumption and the second one to the renovation investment.	**DAMAGE** is a technical risk indicator of the energy renovation of office buildings. **It is indicated as a percentage increase of the investment.** The damage indicator is calculated on the renovation measures adopted, this means that all the building elements or technical system that are not included in the renovation are not considered in the technical risk evaluation.	T_O.1
	ENERGY PERFORMANCE GAP is a technical risk indicator of energy renovation of office buildings. **It is indicated as a percentage increase of planned energy consumption (thermal and electric energy demand) after the renovation**. The energy performance gap indicator is calculated on the renovation measures adopted, this means that all the building elements or technical system that are not included in the renovation are not considered in the technical risk evaluation.	T_O.2

FINANCIAL PERFORMANCE INDICATORS	**PAYBACK TIME** The payback period refers to the amount of time an investment takes to recover the initial investment outlay, when the length of an investment time reaches a breakeven point.	F_O.1
	MATURITY The total duration of the project	F_O.2
	INTERNAL RATE OF RETURN The Internal Rate of Return (IRR) is the discount rate that makes the net present value (NPV) of a specific project equal to zero.	F_O.3
	NET PRESENT VALUE ON INVESTMENT The Net Present Value (NPV) is the value of all future cash flows (positive and negative) over the entire life of an investment discounted to the present. The Net Present Value on Investment (NPV/INV) is the ratio between the Net Present Value (NPV) and the Investment (INV). It gives a measure of profitability of the project.	F_O.4
	DEBT-SERVICE COVERAGE RATIO Debt-Service Coverage Ratio (DSCR) is an indicator of the project's ability to repay a debt. It's calculated as the ratio between the operative cash flows generated by the project and the cash flows for debt, lease or other obligation (debt service, both for interests and principal payment) due in one year.	F_O.5
MULTIPLE BENEFITS INDICATORS	**THERMAL COMFORT** assesses whether the room temperature is safe and well-balanced. Thermal comfort must first of all protect the health of the building users during the cold and hot seasons and it helps creating an optimal living and working environment. The suggested equipment to compute Thermal Comfort are smart sensors.	M_O.1
	VISUAL COMFORT assesses the illuminance inside compared to outside illuminance of buildings. The visual comfort is calculated according to the Daylight Autonomy (DA) that quantifies the local availability of a sufficient day lighting level in the considered reference period. It's measured by using a luxmeter or colorimeter.	M_O.2
	ACOUSTIC COMFORT assesses noise pollution as this is a major environmental problem. Noise problems in building envelopes can be the result of impact noise or airborne noise, both need to be properly taken into account. Acoustic Comfort is, in the best-case scenario, measured through impact noise (Hz) and Airborne noise (db(A)). The professional equipment to compute this KPIs is a sound level meter. Phone apps can be also used for measuring this indicator but the result may not be as accurate.	M_O.3
	PERCEIVED PHYSICAL AND MENTAL HEALTH is assessed via questionnaire screeners. The proposed methodology consists on doing a WHO[13] survey on ex-ante basis (i.e., the baseline) and then, doing the same survey ex-post to then compare the improvement on the health status of the building occupant.	M_O.4
	INDOOR AIR QUALITY Air Quality (IAQ) relies upon having an installed an efficient heating ventilation and air conditioning (HVAC) and is an environmental KPI that is gaining importance in the midst of the COVID pandemic. Although Air Quality can be considered an environmental factor, it affects health and productivity of building users. It's measured with smart sensors.	M_O.5
	PRODUCTIVITY is accrued to three dimensions. • **Increase productivity value** is computed as the product of number of employees, average salary cost per employee and the increased productivity per employee. • **Turnover employee reduction,** refers to the difference between the number of employees before and after the DER project, weighted by the total of employees in a defined period of time. **Reduced Number of sick days claimed by the employee.** The typical value that can be found in literature is an increment of 4.5 active work days per employee, as results of the DER project.	M_O.6

EEnvest technical-financial risk impacts have been estimated based on the input data of the renovation strategy for each energy renovation project (Table 5). The multiple benefit KPIs shown in the table above are indicators to assess the positive impact of the DER project in the overall wellbeing of building occupants. The multiple benefits deserve a special mention, multiple-benefits KPIs require specific input to be computed. Further, the EEnvest Project classified an additional set of multiple-benefits that are relevant for external investor or financiers of the renovation projects, and these accrue to environmental, societal and economic impact. These multiple-benefits are assessed from the angle of KPIs that will be presented in ulterior work (i.e. out of the scope of this report).

In relation to their different interest in technical and financial parameters results investors can choose to finance the most interesting "renovation scenario". Each renovation strategy has been evaluated by the EEnvest technical and financial risks assessment approach. The technical and financial results are presented in two different ways able to contain all the parameters: in a table (Table 9) as well as through

[13] Find the questionnaire here: https://www.who.int/mental_health/who_qol_field_trial_1995.pdf

a spider graph (Figure 16). For each parameter five different levels of impacts have been identified, ranging from 1 (lower performance – red) to 5 (higher performance - green). For example, a damage lower than 0,5% of the investment cost shown as level 5 – green colour and as external point in the spider graph) is considered a good investment, on the contrary the level 1 (coloured in red in the table, and close to the centre on the spider graph) indicates a renovation scenario with a damage deviation higher than 3% of the investment cost, and thus pointing to more risk surrounding the investment cost. It is important to mention that the set of KPIs should be considered and contextualized to the specific project type and size, and that a low value for some of them should not lead to unworthiness towards investment.

Table 9. Results of technical-financial risk evaluation assessment of the cases collected.

		Serie 1	Serie 2	Serie 3	Serie 4	Serie 5	Serie 6	Serie 7	Serie 8	Serie 9	Serie 10	Serie 11	Serie 12	Serie 13
Damage	1. D > 3% 2. 2% < D < 3% 3. 1% < D < 2% 4. 0,5% < D < 1% 5. D < 0,5%	4	5	4	5	4	5	4	5	5	5	5	4	5
Energy Performance Gap	1. EG > 40% 2. 30% < EG < 40% 3. 20% < EG < 30% 4. 10% < EG < 20% 5. EG < 10%	3	3	5	3	5	5	5	4	5	2	4	5	1
Payback time	1. PT > 12y 2. 10y < PT < 12y 3. 7y < PT < 10y 4. 5y < PT < 7y 5. PT < 5y	1	4	1	4	1	1	1	4	1	1	3	1	1
Maturity	1. M > 25y 2. 20y < M < 25y 3. 15y < M < 20y 4. 10y < M < 15y 5. M < 10y	2	2	2	2	2	2	2	2	2	2	2	2	2
Internal Rate of Return	1. IRR < 2% 2. 2% < IRR < 4% 3. 4% < IRR < 6% 4. 6% < IRR < 10% 5. IRR > 10%	5	5	5	5	5	5	2	5	5	5	5	5	5
Net Present Value on Investment	1. NPV < 10% 2. 10% < NPV < 20% 3. 20% < NPV < 30% 4. 30% < NPV < 40% 5. NPV > 40%	1	5	1	5	1	1	1	5	1	1	5	1	1
Debt-Service Coverage Ratio (DSCR)	1. DSCR < 1,1 2. 1,1 < DSCR < 1,2 3. 1,2 < DSCR < 1,3 4. 1,3 < DSCR < 1,4 5. DSCR > 1,4"Nee	1	5	1	5	1	1	2	5	1	1	5	1	1

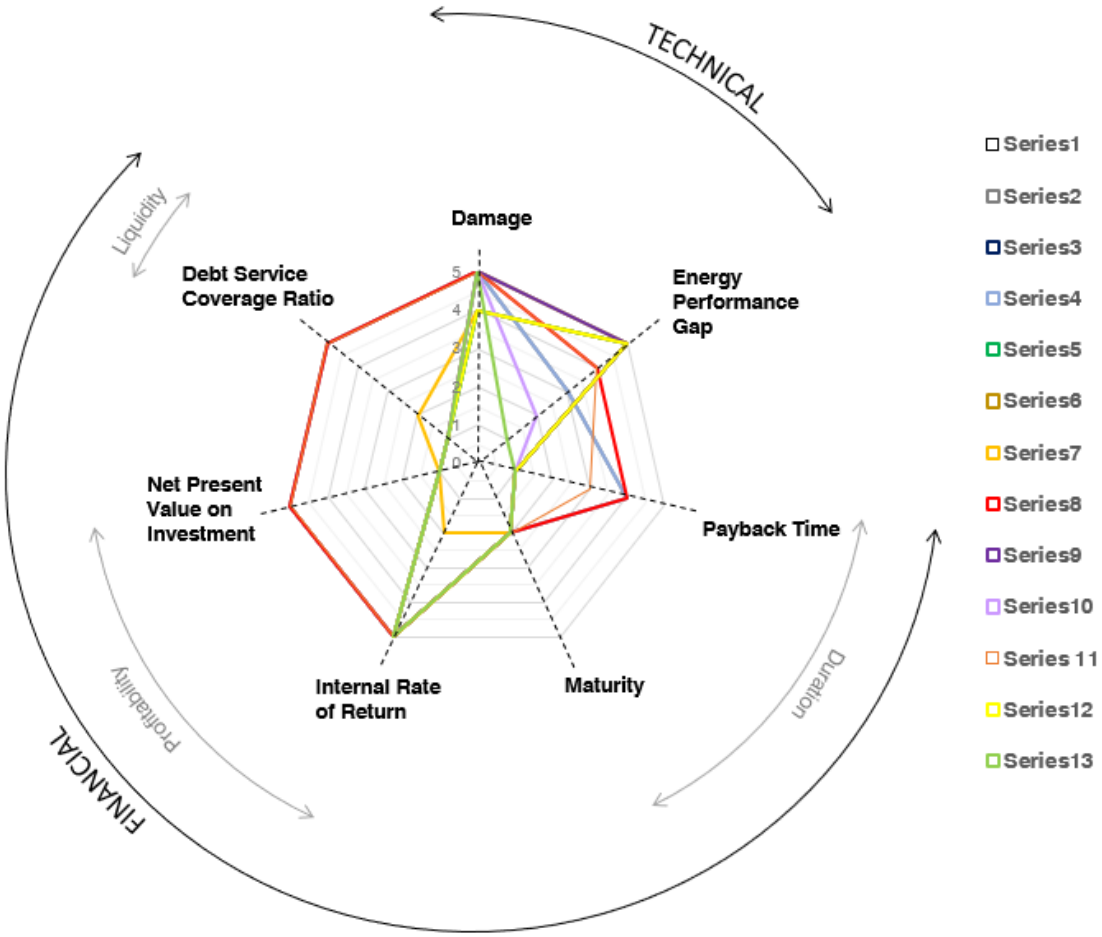
Looking at the results of different case studies (series 1-13) it is possible to identify case studies that achieve positive results in several indicators, such as series 8, 4, 2, and case studies characterized by different results (low and high values) in relation to the indicators, as for example series 10 and 13. Such results are visible in Table 9 and in Figure 16. Results of technical-financial risk evaluation assessment of the cases collected..

Series 2,4,8 can be considered very positive investments, because they achieve very good level of performance in payback time indicator, the investment can be repaid in less of 7 years. The energy consumption of these buildings (before the renovation) results very high, and only with a low budget renovation measure (as substitution of the heating system) the energy performance of such systems can be increased a lot reducing the energy consumption (and relative fuel-costs), making such interventions very attractive from an investment point of view.

Series 8 is considered a typical trend of positive results: in Table 9 it is highlighted mainly by the green color while in the spider graph (Figure 16) it has a regular form due to the high values achieved by each indicator.

On the other hand, series 13 shows the opposite: in Table 9 it is highlighted mainly by a red color (low value for each indicator) while in the spider graph (Figure 16) it has an irregular form due to the variety of low and high values achieved by each indicator.

Figure 16. Results of technical-financial risk evaluation assessment of the cases collected.



In these practical examples discussed above, multiple-benefits could play a crucial role to uplift the business case from two angles.

For the building owner or project promoter, the six multiple-benefits previously presented are key to develop a compelling value proposition to the building owner who is in charge of making the decision to join the renovation journey. From the external investor's point of view, multiple benefits bring light to the overall impact of the investment and can be also referred as environmental, social, and economic impacts. These impact dimensions are relevant for corporate reporting purposes as well as sustainable image and compliance with the EU-Taxonomy.

Given the fact that any sort of renovation project, regardless of its size, will improve the multiple-benefit performance from the building occupants' point of view, an interval of possible values on the multiple-benefits (in the table below referred to as non-energy benefits) that are subjected to energy savings has been established. This approach emphasizes the link between energy savings and multiple-benefits and thus improves the business case.

KPI	NEB Values Range relative to Energy Savings
Thermal Comfort	[1% , 51%]
Acoustic Comfort	[5%, 35%]
Visual Comfort	[1% , 44%]
Air Quality (Environmental)	[5% , 50%]
Perceived Physical/ Mental Health	[2% , 47%]
Productivity per employee	[5% , 33%]

Table 10. NEB Values Range relative to Energy Savings, GNE Finance, 2020

Despite that the intervals shown in the table above are rather wide, it is strongly suggested to consider the lower band rather than the upper band of improvement. In fact, from a building owner's point of view, it is observable that all KPIs are relevant as it directly impacts the building occupants (i.e., personnel) which, at the very bottom line, might improve productivity and therefore a company's competitive advantage.

Ought to remark that for the case of the business cases previously presented, it was not feasible to measure the multiple-benefits for project promoters as the renovation works already took place and therefore it was not possible to compute the multiple benefits on an ex-ante basis. However, the Consortium elaborated a step-by-step procedure to help building owners and project promoters to compute these multiple-benefits and will also elaborate a methodology to assess the environmental, social and economic impact of the project in order to provide a full assessment of the multiple-benefits[14] implication on the project impact assessment. It is expected that this development will be accessible on the EEnvest Platform.

5.2. BUSINESS MODELS AND FINANCING INSTRUMENTS SUITABLE FOR THE BUSINESS CASES

The business cases shown in this Chapter vary a lot in terms of size, type of foreseen energy renovation measure and KPIs. In order to implement the renovation project, the owners of those buildings face a wide range of business models and financing instruments and their combinations. As the business cases are well defined and the relevant KPIs are calculated, the selection of the most suitable business models and financing instruments could be done applying the Decision-Making Flow presented in Paragraph 3.3.

[14] For the interested reader wanting to take a deep-dive into multiple-benefits for building owners, refer to D4.1. For the interested reader, ideally a project promoter, that seeks to measure the multiple benefits, refer to D6.1. Last, for the interested reader, with the profile of external investor, refer to D4.3.

The first step of the Decision-Making flow is related to the risk-aversion. In the EEnvest model, this could be addressed through the technical risk KPIs, namely the "energy performance gap" and the "damage". According to the results shown in the Likert scale in Table 9, all business cases are performing well (4-5) on the "damage" side, while on the "energy performance gap" side three cases (n. 1, 2 and 4) have a score of 3, one case has a score of 2 (n. 10) and one case has a score of 1 (n. 13). The weighting between the scores of "energy performance gap" and the "damage" are, of course, subjective but, as an assumption and for the only purpose of theoretically applying the flow, projects with an average score equal or higher than 4.50 are considered "lower risk" while the others can be considered "higher risk". Indeed, the selection of the score threshold that separates low-risk and risky projects strictly depends on the personal risk-aversion of the project owner.

According to the methodology, riskier projects should better be undertaken through Energy Performance Contracts, so that the technical risks are transferred to the ESCO. For low-risk investments, instead, the project owner could also apply the Separate Contracting Business Model (SCB). Since risk-aversion is a strictly personal assessment, a less risk-averse investor could possibly qualify as "low-risk" also a project with higher risk rates and vice-versa, so the threshold to define if the EPC is more suitable than the SCB varies accordingly. For the only purpose of this exercise, as stated above, the threshold of an average risk indicator of 4,5 is considered to divide between low-risk and higher-risk projects.

Low-risk project	Higher-risk project
n. 3 – 5 – 6 – 7 – 8 – 9 – 11 – 12	n. 1 – 2 – 4 – 10 – 13
Separate-Contracting Business Model	Energy Performance Contract

The second step of the flow is related to the financing sources for the investments, where the project owner has to decide whether to invest own money or to borrow money from a third party. Of course, this is exclusively a subjective decision of the project owner, depending on many different factors such as: the budget constraints; the willingness to invest own money; the availability of interesting financing opportunities on the market, etc. For the purpose of this exercise, in order to show the different possibilities in terms of financing instruments, the assumption is that the project is financed through leverage.

The following step is to decide which kind of financing solution is most suitable for the project. According to the methodology, the type of suitability of the different available financing solution depends mostly on the project size. Projects with capex below €600,000 can be financed through simpler instruments, such as dedicated credit lines from retail banks or even crowdfunding. Medium-sized projects, with capex between €600,000 and €2,500,000 may instead be more attractive for other types of financiers, such as investment banks and, if part of a larger portfolio of a group of investments, also real estate or energy efficiency investment funds. Large projects, with capex over €2,500,000, will instead be attractive for large financing institutions also as stand-alone investments.

According to the results shown in Table 9, seven projects can be defined as "Small" (namely n. 1, 2, 3, 5, 6, 12 and 13) and six projects as "Large" (namely n. 3, 5, 6, 9, 10 and 11).

Results of the application of the methodology are shown in the following Table 11:

Table 11. Riskiness, size and Financing options of the analysed business cases

Building n.	Riskiness		Size	Financing
1	Higher	EPC	Small	ESCO Financing
2	Higher	EPC	Small	ESCO Financing
3	Low	SBC	Medium	Investment banks – Investment Funds (only within a portfolio of investments)

4	Higher	EPC	Small	ESCO Financing
5	Low	SBC	Medium	Investment banks – Investment Funds (only within a portfolio of investments)
6	Low	SBC	Medium	Investment banks – Investment Funds (only within a portfolio of investments)
7	Low	SBC	Small	Dedicated credit lines – Crowdfunding
8	Low	SBC	Small	Dedicated credit lines – Crowdfunding
9	Low	SBC	Medium	Investment banks – Investment Funds (only within a portfolio of investments)
10	Higher	EPC	Large	ESCO Financing
11	Low	SBC	Medium	Investment banks – Investment Funds (only within a portfolio of investments)
12	Low	SBC	Small	Dedicated credit lines – Crowdfunding
13	Higher	EPC	Small	ESCO Financing

In general terms, EPC and ESCO financing is the most suitable solution for the de-risking of the investment. Whenever the riskiness of the project is perceived as “higher” by the project owner, the EPC will ensure the mitigation of the technical risks of the investment and guarantee the results in terms of energy savings.

In this perspective, the project owner should, in fact, evaluate the overall convenience of the EPC contract not only according to its financial cost, which is usually higher than SBC, but also considering the economic value of the risks transferred to the ESCO. If a project owner is not willing to bear the risks related to the technical performance of the investment, then EPC is the best solution to be considered

6. Market uptake potential analysis

EEnvest is about de-risking Energy Efficiency Investment (EEI) characterising the EE projects by innovative technical and financial KPIs. What has been developed in the previous paragraphs demonstrates that the EPC business model carries less risk, hence we want to investigate the market status and uptake potential of EPC, particularly in Italy and Spain were the EEnvest pilots are located.

At the scale of the EU, the building sector is responsible for 40% of the EU's energy consumption and 36% of the EU CO2 emissions. The heated floorspace is split between the private and public sectors, respectively, 88% and 12%. The policy makers have clear in mind the levers that need to be activated to unlock the energy efficiency market. Therefore, important efforts are made to develop tailored solutions (i.e., financing, contracting, partnerships…) adapted to the different contexts of all potential energy efficiency projects. Supporting the development of innovative business models through EU projects such as "ICP", "AmBIENce", "Citynvest" and many more allows the EU to bring the needed tools to the market. In 2018, in Europe, the EPC business model represented only 10%[15] of the global total EPC market which was seen as under-developed.

6.1. INTRODUCTION TO BUSINESS MODEL UPTAKE

There are two main sections in this deliverable. First, a series of more theoretical chapters presenting the main business models applied to Energy Efficiency projects (i.e., the SCB and EPC) including, for the EPC, a series of contract variants, which are sometime specific to certain context or countries (Chapter 1). The report then focuses on the way risks are allocated and managed depending on the business model considered and on the numerous financial instruments associated with Energy Efficiency projects that are defined and benchmarked (Chapter 3). This section ends with a theoretical DCF discussing the main components and levers of value creation (Chapter 4). The second section of the deliverable steps into the practical application of the models. It shows and analyses practical business cases based on real EE projects design for existing buildings and financed by real investors (Chapter 5). Titled "Market uptake potential analysis", this last Chapter of the report aims to give feedback from experts of the Energy Efficiency Investment (EEI) sector and share their vision of the market potential for Energy Efficiency Business Models with particular focus on Energy Performance Contracting (EPC). To stick to the EEnvest exploitation plan, we will focus on Spain and Italy. We will discuss both public and private sectors.

6.2. SEPARATE CONTRACTING BASED AND PROJECT CERTIFICATION

Until the beginning of the 21st century, SCB was the traditional way to deal with EE business. This SCB is described in Chapter 1. The SCB implies that the project owner develops a commercial relationship with different contractors to carry out the EE project. The weakness of SCB is that the project risks are assumed by the project owner. If the project owner needs to finance the project, he looks for investors and the investors have no easy way to assess if the project design follows or doesn't follow best practises. The lack of confidence among the investors created interest in the market for project certification and several projects were funded in order to develop and increase investor confidence in Energy efficiency projects. Today, SCB still represent more than 80% of the global European EE contracts, and EE project certification is one of the solutions developed to increase investors' confidence in projects and project owners.

In 2013, the Energy Efficiency Financial Institutions Group (EEFIG) was created by the European Commission Directorate-General for Energy. The EEFIG members are public and private financial

[15] https://www.iea.org/reports/energy-service-companies-ESCOs-2

institutions, industry representatives and sector experts. One of the priorities of the EEFIG was to support the development of a tool to increase investor confidence in energy efficiency investments and standardisation of the development process. This priority was stressed in the EEFIG report and the Investor Confidence Project, which was only operating in the United States at that time, was highlighted as "a relevant model initiative and "an EU "Investor Confidence Project" (ICP) was recommended.

The IREE[16] (Investor Ready Energy Efficiency™) certification for Energy Efficiency projects was developed by the ICP[17] project. It aims to increase the confidence of investors and project owners in engineering fundamentals and financial returns.

We conducted 2 interviews to obtain information regarding the IREE process and today's reality regarding its business volume in Europe and more specifically in Spain and Italy. The first interviewee was Jorge Rodrigues de Almeida, co-founder of ICP in Europe and also manager of the ICP in Portugal for years. He informed us about the background, the intention and spirit of the IREE certification. The second interviewee was Matt Golden from the Green Business Certification Inc. (GBCI). He updated us on the actual status and development plans foreseen for the IREE certification.

Today, the Green Business Certification Incorporated (GBCI) is the certification authority for ICP IREE projects and leads the operations in the EU. The concept of the IREE Certification comes from the United States of America and was transposed and adapted to the European context during the years of the ICP project. ICP is primarily delivering certified projects in the US market, where most current volume is coming through PG&E's commercial on-bill financing program, PG&E is an American investor-owned utility (IOU) with publicly traded stock, which are loans free of any interest and fees, pre-payment penalties, or other charges. In the US, this program will provide over $100M in loans in 2021 and 95% of those are being certified as ICP. Canada is expected to be a territory for replication in the short term. Quite logically, the GBCI does not actively look for more business volume. In fact, it would create a conflict of interest to both acquire customers and certify projects. GBCI must be neutral to the transaction. The number of certified projects is a function of the market. Most projects are on private buildings but there is no rule or limitation, and the potential exists for both private and public buildings.

The IREE Certification scheme (categories and fees) corresponds to the one of the LEED Certification (Leadership in Energy and Environmental) managed by the GBCI and is available online. Even in the US, where most commercial EE projects are actually relatively small in general, ICP has seen a number of very large deep retrofits. On a per-project basis, the greatest volume is represented by efficiency measures on lighting / controls / variable speed drives, etc. The project size is generally in the $30K - $100K range, equivalent to 25K to 80K euros. Smaller projects do not request certification mostly because the cost is a showstopper. Indeed, the certification cost can easily represent 1% (250 euros) of the total project cost and small projects (<25K euros) are mostly financed through standard loans and are not seen as major project investment. Note that aggregation of projects could be an option to join financial forces.

To get an IREE certification, for all Countries in the EU the process is similar. The projects should be originated using the EU ICP protocols, checked by a credentialed QA provider, and submitted for certification to GBCI. Interviewees emphasize on the fact that in the EU, there is more a lack of projects than a lack of investors. This observation steers EEnvest market towards the investor side and investors might be more willing to pay an extra cost than project-owners to get access to project data, so probably quality certification will be seen as a plus.

In practice, the interviewees recommendations are the following:

[16] http://www.eeperformance.org/iree-certification.html

[17] http://www.eeperformance.org/project-framework.html

- Use simple language
- Propose assistance to fill out the forms
- Concentrate on 5 to max 10 key metrics and information relevant to the investors
- Make projects comparable
- Do not benchmark too much with database filled with selected (good) project (i.e., DEEP)

6.3. STATUS OF THE EPC IN SPAIN AND ITALY

At the scale of the EU, the drivers and barriers of the EPC deployment have been well identified and are reported in several documents (BPIE, EEFIG, JRC). Hereafter are two tables extracted from the Energy Services and the Renovation Wave report of the BPIE published in August 2020 that synthesizes EPC market strengths and weaknesses:

Energy savings guarantee	**66%**
Pressure to recude cost	40%
External expertise/ turnkey services	40%
Increasing energy prices	40%
Limited budgets in public sector	38%
Financing provided by service provider	34%
Government policy	32%
customer demand	25%
Availability of affordable finance	19%
Public subsidy	13%

Complexity of the concept/ lack of information	**55%**
Lack of trust in the ESCO system	42%
Administrative barriers in the public sector	42%
High costs of project development and procurement	39%
Customer demand	37%
Low energy prices	36%
Subsidy / policy uncertainty	35%
Lack of support from the governement	32%
Raising affordable finance	29%

Figure 17. Main drivers and barriers of the EPC Market – QualitEE Survey of 15 EU member countries

On one hand, what always comes out of the reports is that the main driver of the EPC is by far the idea that the energy saving is guaranteed by the contract. This guarantee is very appealing and comfortable for project owners. On the other hand, what always appears as main barriers is the complexity of the concept and the lack of information. The difficulty and doubts of the customer are crystallised around the concept of the energy baseline definition.

Across the EU, many parameters such as policies, perception of risk, incentives and more support limit the ESCO market development in the different countries. The following map from one of the last BPIE reports shows 4 groups of countries sharing the same level of ESCO market development.

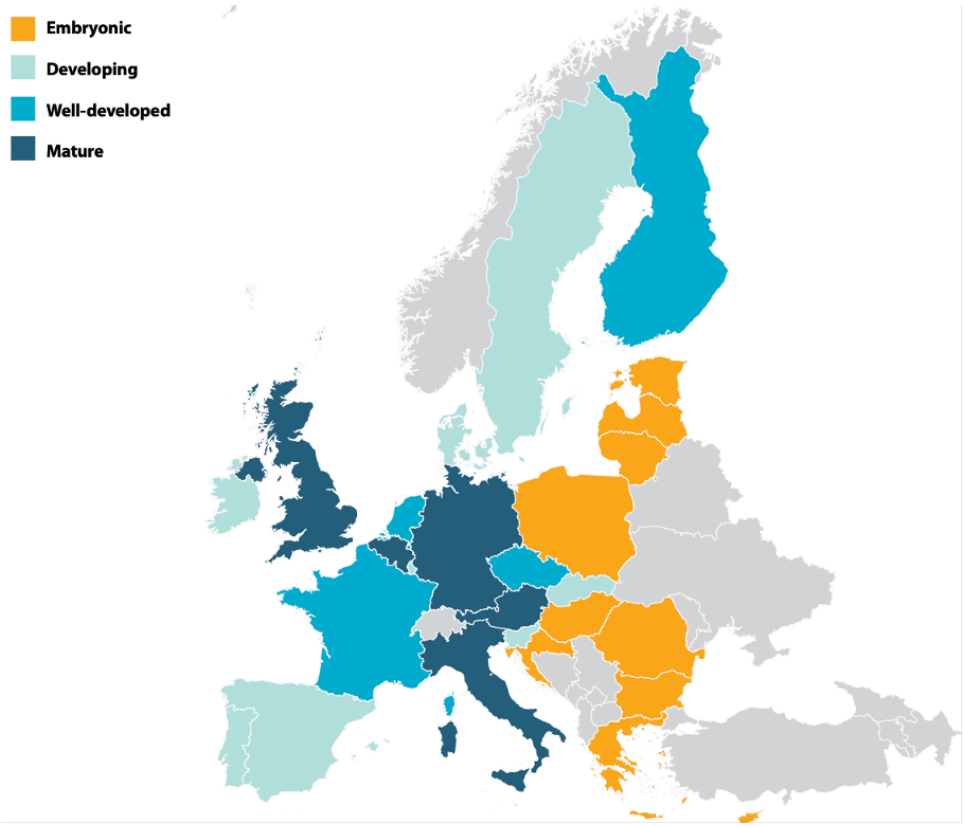


Figure 18. ESCO market development across the EU (BPIE – adapted from JRC 2019)

One can notice that Italy and Spain are not colored the same, Italy is considered as having a mature ESCO market while the ESCO market in Spain is classified as in development.

More particularly, in the public sector the energy performance contracting is driven by projects related to re-lamping, which represent a high potential of energy savings of the sector. In Italy, Spain and Portugal the EPC markets of the public sector are described as sizeable and in development. The public sector appreciates the fact that the EPC transfers the technical and financial risk to the private sector via ESCOs.

At the end of 2020, the AmBIENCe[18] EU Project published online very concise and informative fact sheets giving key KPIs, drivers and barriers of this market in Italy and Spain among other countries. The situation of the EPC model in Spain and Italy seems to be very different. Spain has been slower than Italy to kick off the policies deployment needed to establish the legal framework of the EPC market. Italy continues to be ahead of Spain regarding the level of EPC market uptake.

Italy's first definition of ESCOs was given by the Legislative Decree 115/2008 while the primary legislation addressing the Spanish energy services (ESCO) market was the 'Sustainable Economy Law', Royal Decree Law 6/2010, so published two years after the Italian Decree. Lately, encouraged by the European Renovation Wave Strategy, recent decrees tend to support an acceleration of EPC and ESCO model deployment to improve the energy performance of buildings in both countries.

[18] https://ambience-project.eu

6.3.1.SPAIN

Spain seems to clearly face significant and diverse barriers limiting the pace of the EPC deployment. AmBIENCe lists the following main barriers:

- Administrative and financial barriers
- Lack of knowledge and trust
- Lack of standard and enforced measurement and verification (M&V) protocols
- Lack of a neutral third-party institution that certifies the accountability of a particular ESCO
- Duration of contracts perceived as too long to the potential clients

Spain will need to improve those aspects to become a well-developed ESCO market.

In its last report, the BPIE emphasizes on the fact that, in Spain, the two main factors breaking the ESCO's market development are (1) the falling energy price and (2) setbacks related to instable government changing political priorities. This report is rather optimistic regarding the tools available to support the development of the ESCO market considering that Spain has comprehensive national examples of model contracts available, that the information is clearly disseminated through the main EPC associations (i.e., ANESE, IDAE…) and that Spanish stakeholder focus on removing regulatory barriers identified and reported these last years.

In 2020, the ANESE published a new volume of its guide "Technology Guide for Energy Saving and Efficiency" ("Guia de Tecnologías para el Ahorro y la Eficiencia Energética"), which shows 22 real cases of EPC implementation in order to impulse confidence and encourage project owners to adopt the EPC business model. The last part of the guide lists 23 recent technologies that have been implemented in the real cases. With this guide, ANESE is tackling the perception of lack of knowledge and trust the ESCOs suffer. Advertising success stories is indeed an efficient way to demonstrate the competency and competitivity of the ESCOs as well as spreading information regarding the latest technologies available to improve energy efficiency. The results of each case are quantified and shared, showing rather impactful numbers ranging from 15% to 80% energy saving depending on the new technology chosen and installed.

In Spain, so far, real cases show numerous projects in public and industrial buildings while private office buildings represent a high volume of future prospects for the ESCOs.

An exchange with Javier Martinez, working as 'responsible for sustainable financing' at ANESE, confirmed that the EPC market is mostly applied to the non-residential sector and split into two main groups of customers: the public and the industrial/private sectors. He indicated that there are 2 main contracts on the market. Particularly appreciated by the public sector, the EPC 5Ps, also named "integral energy contract", was created in 2007 by the IDAE. The 5 services it includes are the following: (1) Energy management, (2) Maintenance, (3) Total equipment warranty, (4) Improvement works and (5) Improved energy efficiency. The performance is a fulfilment of the project, but the contract is not energy performance based, and the energy savings are not shared between the parties. In the 5Ps contract, the company that provides the energy service (ESCO) faces the investment, the payment of the energy and the operation and maintenance of the facilities. The company receives a fixed remuneration for this. This model is relatively simple to propose because it does not require complex contractual adjustment mechanisms. For that reason, it has been well received in the maturing phase of the market, helping its development.

In the industrial sector, in Spain EPCs offering energy performance guarantee are most commonly signed. This sector seems to feel confident regarding the M&V (Measurement and Verification) protocols based on the International Performance Measurement and Verification Protocol (IPMVP) in place to calculate the energy saving and govern its repartition.

In terms of project size, Mr Martinez provides the following average numbers: public projects commonly reached 800 Keuros, industrial projects involved about 600 Keuros and multi-residential projects, quite smaller than the two previous categories, would require investments of about 200 Keuros.

Very interestingly, in 2019, Mr Martinez was involved in the Enerinvest[19] EU project and is now involved in the FPI[20] EU project. On the Cordis portal, the description of the Enerinvest project has similarities with the EEnvest platform. Although Enerinvest was specifically developed for Spain and englobed a wider spectrum of sustainable energy projects financing, very similarly to EEnvest, the aim of the Enerinvest platform was to cover the gap existing between the financial sector (i.e., investors) and the sustainable energy sector (i.e., project owners), hence, promoting a higher and more efficient investment in sustainable energy projects. While the Enerinvest platform itself did not reach TRL9, part of the results of this project are used in the FPI EU project, which aims to promote and speed up the development of private investments in energy efficiency, sustainable mobility and self-consumption. Mr. Martinez insisted in the need of support requested by the project owners when entering the data into the platform. The EEnvest consortium will keep in mind this remark and will think about how to tackle this barrier. That could be by setting up a helpdesk to provide assistance to project owners or by proposing an online webinar training to support project owners encountering difficulties during the step of project data upload.

6.3.2.ITALY

Italy first defined ESCOs in 2004. At the beginning, the ESCO market developed a lot via the sales of energy efficiency certificates and thanks to the support of powerful independent associations as AssoEsco and FederEsco. Today, the Ambience project report states that in Italy the ESCOs propose 3 main complementary services which are distributed as follows:

- Energy efficiency and consulting projects, 42%
- Energy performance contract (EPC) services, 35%
- Sales of energy efficiency certificates, 23%

In the private sector, considering the level of EEI and the share of this EEI coming through EPC, there is room for EPC market growth. In 2018, only 12% of the total EEI was achieved through EPC and most of this market was coming from tertiary buildings. There is a lot of market share to conquer in the residential sector, which represent 82% of EEI according to Ambience estimations.

For the Italian public sector of EEI, Ambiences reports a higher share of 35% EPC in 2018. In all of Europe, public non-residential projects in government buildings, schools and hospitals support the ESCO's market development.

Because Italy is recognized as a country with highly qualified ESCOs able to manage bureaucracy, regulated energy audits and existing incentives for the customers, Ambience sees Italy as one of the key European playgrounds for the deployment of more sophisticated versions of EPC.

To enrich this section with recent feedback from an Italian ESCOs, Ms Giulia Carbonari was interviewed, as she is working as Facility Management Expert and Project Manager at R2M Solution ESCO in Milan. She reports that although EPC is getting more frequent year after year, it still remains in Italy a tool not widely used compared to classical interventions, in particular in the public sector. To explain its limited adoption by the public sector, Ms Carbonari states that it is due mainly to three causes:

[19] https://www2.deloitte.com/es/es/pages/energy-and-resources/articles/-que-es-enerinvest.html

[20] https://www.fpih2020.eu

(1) the hybrid nature of the contract, (2) the complexity of the tool and (3) the legal framework still uncertain. Indeed, the EPC contract is perceived as a mix of a procurement contract and a public private partnership contract (PPP). This puts the Public Administration in the difficulty of qualifying the contract and identifying the right selective type of contractor, generating uncertainty in public operators regarding the regulation of its essential elements, the application of the most efficient award procedures, and the correct allocation of expenditures in the budgets of the public body.

Globally, in Italy the business distribution is tilted towards SCB rather than EPC, Ms Carbonari confirms and indicates that out of the 14,000 energy companies in Italy (mixed profiles), only 10% are offering EPC, the Ambience project reports 1045 ESCO compagnies in Italy managing at least one EPC.

Regarding the common contracts proposed by the Italian ESCOs to their public and private customers, Ms Carbonari reports that there are two main types of contracts, namely "first out" and "shared saving". In a "first out" contract, the ESCO provides the capital and the energy savings achieved are entirely used to repay the financing of the intervention and remunerate the activities of the ESCO; in this way the customer is protected from any performance risk. In a "Shared saving" contract, the ESCO provides the capital but the savings are divided according to a predetermined percentage between the customer and the ESCO.

When trying to put the Italian energy efficiency business in numbers, Ms Carbonari advised to check the EEI categories and business volume reported in the RiESCO[21] 2020 report. It makes clear that energy efficiency in Italy is divided into 2 macro markets:

(1) **1st Macro market: approximately € 20-24 billion, in which the return on investments is guaranteed only by 'energy savings'.** This market based on energy saving is split in 2 as follows:

First, the photovoltaic for companies; indeed, the GSE SpA (Gestore dei Servizi Energetici) claims that in 2019, photovoltaic systems were installed for a power of 20,800,000 kW, at an average price of 800-1,000 € / kW. Therefore, the photovoltaic market is worth approx. € 17-20 billion.

Second, public lighting consists of approximately 10 million light points. At current pace, the transition to LED is estimated to take about 10 years. Considering a unit price of approx. 500-700 € / PL, the annual market could reach about €500 to €700 million. Also, it is to be noted that the private lighting market is approximately 5 to 7 times the public. In total this market is valued at about € 4.0 billion (incentivized with White Certificates in a few cases).

(2) **2nd Macro market: approximately € 30 billion, in which the return on investments is possible thanks to 'energy savings and incentives',** e.g., Air conditioning of buildings. In fact, from the 2019 reports of GSE SpA and ENEA[22] (the National Agency for New Technologies, Energy and Sustainable Economic), it is noted that national incentives are paid every year for energy efficiency renovation and renewable energy plants respectively equal to: € 14.8 billion and € 3.4 billion. To these have to be added regional incentives estimated at € 1.5 billion for a total of € 19.7 billion. At the end, these national and regional incentives cover about 65% of the investments, the total investments are ca. € 30 billion.

6.4. MARKET TENDENCIES

Whatever market you study, at the beginning of 2021, it will be influenced by the Covid-19 crisis which started at the beginning of 2020. The crisis has created new consumer habits that may last for years and

[21] https://www.ri-esco.it/wpcontent/uploads/2020/09/RiESCo_BP.2020_200915_Sito.pdf

[22] https://www.enea.it/it/seguici/pubblicazioni/pdf-volumi/2020/raee-2020.pdf

have impacts for decades. For instance, transferring the workplace from commercial buildings to residential buildings has immediately impacted several aspects of the energy sector in buildings such as the energy distribution and intensity. The middle and long-term effects of widespread new routines as homeworking may influence the energy related contracts.

Already in May 2020, the IEA's World Energy Investment 2020 report planned a global decrease of about 18% in energy investment due to an economic contraction related to the impossibility of forecasting what will happen in the coming months and years. The global contraction of energy efficiency spending was first estimated to 12% then decreased to 9% in October 2020. In December 2020, the IEA published a study regarding energy efficiency. It quantifies how much energy was transferred from office and commercial buildings to residential buildings. Depending on the equipment of the home and the need of heating and cooling, the daily impact on energy consumption of a day of work from home ranges from +7% to +23% compared with a classical day at the office.

In the public sector, despite too optimistic expectations expressed few years ago regarding the EPC growth over the period going from 2017 to 2019, and considering the EU countries are evolving at different pace due to local conjectures, at EU global scale, the EPC market is expected to accelerate its growth in 2020-2023. Two major milestones are about to be reached: the implementation of Eurostat rules on public energy efficiency projects[23] and the publication of the EIB Guide[24] , both address major barriers reported in 2017.

In Spain, according to ANESE, in 2019 ESCOs revenues were about €1,170M[25]. When asking about the current mindset of the EE community, Mr. Martinez from ANESE confirms that in the building sector there is a lot of interest and willingness to implement projects aiming at improving energy efficiency. The residential building sector seems to concentrate on the renovation of boilers and improvement of the thermal insulation while the office building sector seems to be slower in growing its business volume, maybe because of the relation between the level of investment required and the long-term payback observed, which is a classical barrier reported. Mr. Martinez also points out that the Covid-19 crisis has impacted the market, lots of business have slowed down, some others are in stand-by, project start-ups are postponed. The economic uncertainties related to the crisis have placed many projects on-hold. Also, the projects owners are now studying how to capture part of the European and national budgets announced to relaunch the post-crisis economy.

In Italy, according to R2M Solution ESCO, the framework is being setup by the government to use the energy transition and the EEI as a lever to create post Covid-19 crisis jobs and growth. Introduced in Chapter 6.3.2ITALY, Ms Carbonari evocated the Ecobonus 2020 created as part of the new measures adopted by the Italian government, included into the "Decreto Rilancio" (Decree n.34/2020) to promote the recovery of the country after the crisis caused by Covid-19. This Ecobonus 2020 introduces a tax deduction equal to 110% of the expenses related to specific energy efficiency measures and anti-seismic measures on buildings. She thinks that this new Ecobonus will be an important push for the development of EPC contracting in the country, in particular with private users.

The Covid crisis has also impacted the perception people may have of the indoor air quality. The fear for the presence of biological contaminants floating in the indoor air has increased exponentially together with the confused mediatic coverage of the pandemic. Today, the perspective of sharing an open-space office, entering in a train saturated with commuters or shopping in a crowded mall creates anxiety. To get people back into public transportation and offices, the asset managers will have to demonstrate the high quality of the indoor air of those spaces. The air quality is an environmental

[23] https://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_saving_statistics

[24] https://www.eib.org/attachments/epec/epec_guidance_on_energy_efficiency_in_public_buildings_en.pdf

[25] Spanish ESCO Association. 2016 survey including 59 ESCOs

Multiple benefit KPI, a good air quality is recognized as basic to ensure occupants health and wellbeing. The main indoor pollutants monitored are PM2.5 (fine particle matter), Volatile Organic Compounds (VOC), Carbon monoxide (CO), Radon and Carbon dioxide (CO2). Biological agents in the air are not listed here yet, but considering the magnitude of the COVID crisis it is no surprising to see a sudden but strong interest in sampling and detection methods for viruses. Based on recent publications from the World Health Organization[26], there is little doubt about the fact that air quality monitoring will soon include biological agent monitoring. Preparing for the return of the building occupants, all asset managers might be soon looking for a mean to guarantee indoor air quality which is dependent upon good HVAC equipment. Many asset managers may need to go through the acquisition of new equipment to improve or complement their installations. Recent European policies pushing for energy efficiency will make that the renovation of those HVAC systems will be done with the concern of energy efficiency. This context creates interest for an EPC contract including multi-benefit guarantees, which would include, but not only, the level of biological contamination risk. Many papers are currently being published to review and propose improvements to the sampling and detection of corona viruses in air (Rahmani et al, 2020).

6.5. JOINT EFFORTS TO PAVE THE WAY TO EPC MODELS

Owing to the fact that EPC combines the concept of included guarantee and a high flexibility allowing to tailor solutions adapted to all customer needs, the EPC-type business model will continue to gain stake in the EEI market. Efforts need to focus on adapting the process for EPC projects to the customer targeted. Based on what we observe in Spain and Italy, to set up at national scale, the EPC business model must be adapted to local needs and legislation must create space for its implementation. At this stage of the global Covid crisis, it is probable that the air quality assessment will include corona virus detection to fulfill its role of environmental KPI. The context creates room for an EPC guaranteeing certain levels of multi-benefits as indoor air quality ensuring wholesome air for all building occupants.

To intensify the pace of the EPC market uptake in Europe, ESCOs associations have a strong role to play. Capacity building is key for the market to gain confidence on this quite novel tool. These associations should be encouraged to deliver training to ESCOs and events targeting specific groups of stakeholders could spread the word about the EPC benefits and guarantees applications and management. These training activities could invigorate the development of the ESCO market and encourage the use of the EPC business model by these ESCOs, one can dream about a yearly market increase jumping from 8-10% to 15-20% per year.

In October 2021 Sustainable Places 2021 took place. SP2021 gathered more than 150 European projects representing €850 million in R&D and 1500 research performing organizations. EEnvest organized a clustering workshop “Finance for Energy Efficiency” with the following projects: Launch, Triple A, CitizEE and Quest. Each project works on a barrier towards important EEI identified by the EC. The main projects’ outcomes are solutions that will support directly or indirectly the development of the EPC market by improving the EE project design, creating KPIs to evaluate the potential of each project, creating a platform where investors can benchmark and select high potential EE projects, fluidifying the decision-making process providing standardized toolkits... These combined efforts are key to unlock the potential of the EE market and the directly related and dependent EPC market.

[26] https://www.euro.who.int/__data/assets/pdf_file/0019/331660/Evolution-air-quality.pdf

Table 12. Main solutions proposed by the EU projects attending the "Finance for Energy Efficiency" workshop organized by EEnvest at the SP2021.

Project name Barrier tackled	Main solutions proposed
EEnvest **Barrier identified** Lack of trust of investors in EEI projects. Unclear vision of technical, financial and multi-benefits of the investment.	De-risking deep renovation investments including non-energy benefits aspects in evaluation models developing: 1) A project quality self-assessment tool 2) Financial risk evaluation framework including technical risks 3) A framework to evaluate and translate non energy benefits and make them exploitable in ESG evaluation, 4) A Search&Match web platform
LAUNCH **Barrier identified** Lack of standardized material that would accelerate the deal closure and pipeline growth for Sustainable Energy Assets.	1) Development of a standardized toolkit to be used in real-life projects for successful financing 2) ESG compliant documentation 3)Training on use of the materials
TRIPLE-A **Barrier identified** Impossibility to identify the well-conceived EE projects	1) Enhancement of the investors' interest and capacity building paving the way for financing Triple-A Investments 2) Triple-A rating system fostering energy efficiency investments at an early stage 3) KPIs and benchmarks for the identification of Triple-A investments 4) Interactive web-based database on Energy Efficiency Financing
CITIZEE **Barrier identified** Limited private investments in energy efficiency in the building sector	1) CitizEE Investment Platforms: investment facility channeling public and private financing from several co-investors to provide funding to designated final beneficiaries and/or projects. 2) CitizEE CFs4EE Financing Schemes: innovative financing mechanisms based on integrating citizen financing schemes with available or to be developed Public Financing Instruments 3) CitizEE Toolkit: provides a better understanding of the adoption of citizen financing for energy efficiency, designed for citizen, private investor, project promoter, region, local authority and energy company...

Barrier identified High technical risk perceived by the investors.	1) Gather empirical data on technical risks in building projects and the impact of Quality Management Services (QMS) to mitigate them. 2) A dataset that compares impact of different QMS – guidance for project managers on how to use the dataset. 3) QUEST tool that calculates the added value of QMS on building projects.

7. Conclusion

This report addressed its three intended objectives.

As part of the first *objective "To guide the building owner through the selection of an appropriate business model and financing source for the envisaged EE project of its commercial building, based on a decision-making flow methodology"* the report firstly introduced business model concepts related to the two main business models commonly used for the delivery of EE services: the **Separate Contracting Based (SCB) business model** and the **Energy Performance Contracting (EPC) business model**. A particular focus has been placed on how Multiple Benefits create value and how that value is captured and also on the implications in terms of risk allocation and risk management of each business model and how the risks can be allocated to different stakeholders. The **EEnvest risk evaluation model** has been presented as a calculation method of the impact of the different risk allocations, based on four main risks: Energy performance gap, damage, climate risk and energy price risk. This report has also introduced a **decision-making flow methodology** based on six defined selection criteria which intends to guide the building owner through the selection of an appropriate business model and financing scheme. A practical decision-making flow has been elaborated and proposed, based on three defined criteria: Risk aversion, leverage and project size.

The second objective "*To apply the decision-making flow methodology on a set of business cases, based on actual data from building renovations"* has been addressed by **firstly analysing and benchmarking a set of thirteen business cases**, based on actual data from building renovations, and by providing KPI resulting from the application of the EEnvest technical and financial evaluation approach. Then the developed **practical decision-making flow has been applied to these thirteen business cases**, allowing to point for each business case, firstly, towards a suitable business model, and secondly, to suitable financing solutions.

The third objective *"To provide a market uptake potential analysis of the main EE business models in the pilot countries Spain and Italy, with specific focus on the most appropriate business model observing the EEnvest's de-risking approach"* has been dealt with, firstly by presenting the status of the **SCB business model and its possibility for uptake** in the framework of project certification and secondly by focusing on and presenting the status of the EPC business model in Italy and Spain and by discussing the necessity of **joint efforts to pave the way for EPC models**.

8. References

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Annex 1 - Variations of EPC Business Models

Energy Performance Contracting is a business model that allows for a high level of modularity and scalability as it is an output-driven model, i.e., the model is based on the delivery of energy performance using functional specifications. This means it leaves a lot of room for ESCOs to determine how to achieve this performance. Requirements are not based on detailed technical specifications as determined by the customer.

Also, the management of risk, related to this performance, and the way it is rewarded, can be done in different ways. This has led to the definition of 2 major variants depending on 1) how risk is shared between the ESCO and the customer and 2) how the results from savings are shared between both parties. These variations are the Guaranteed Savings model and Shared Savings model. This is described in the first paragraph of this Annex.

Another way different energy performance contracting models are defined is according to the way energy savings are determined. In standard EPC models, the savings are determined by measuring them against an energy baseline consumption in kWh. In so-called Energy Supply Contracting (ESC), the customer pays for an amount of “useful” energy produced on-site and delivered at an agreed price. This is typically the case for supply of heat, cold, compressed air, etc. They customer buys a number of kWh and there is no guarantee of savings as there is not incentive for the ESCO to reduce energy demand. This type of variation is explained in paragraph 2 of this Annex.

Finally, energy performance contracting models can vary according to the scope of services included or the way they are implemented. Also, the scope of energy measures may be focused on some but not all energy aspects. Some common variations are described in paragraph 3 of the Annex.

A summary view of most variations is given in the last paragraph.

1 Risk sharing models for EPC

a. Guaranteed Savings

The above schemes correspond to the “Guaranteed Savings” model, i.e. the ESCO delivers a guaranteed percentage (e.g. 35%) of savings versus the baseline energy consumption and is paid a fixed fee that covers investments and Operational & Maintenance costs. This is the predominant model for EPC in most projects in Europe. Underperformance and overperformance are managed based on bonus/malus principle: bonus in case of excess savings and penalty in case of shortfall in savings. Financing can be structured according to any of the three earlier mentioned options.

b. Shared Savings

Another scheme is the “Shared Savings” model, i.e., the ESCO gets an agreed fixed percentage of the energy savings (e.g. 30%), but the actual amount of savings is not predetermined. There is often an estimate of the overall savings, but that level is not guaranteed by the ESCO. The only thing the customer can be sure of is that he gets a fixed percentage of any savings that are made. This scheme is more used in North America. The risk for the customer is higher than in the Guaranteed Savings model. It is often combined with ESCO financing. A specific variant of the Shared Savings model is the one whereby 100% of the savings are allocated to the ESCO until the investment is being reimbursed. This model implies uncertainty as to the contract duration or enhanced risk for the customer or the ESCO if the contract duration is fixed but not the savings. In another variant of the Shared Savings model a certain fixed amount (not a percentage share) of savings is acquired by the customer and the remainder of the savings are allocated to the ESCO until reimbursement of the investment amount has happened. Uncertainties and enhanced risks are the same as with the previous variant.

2 Energy supply Contracting models

a. Energy Supply Contracting (ESC)

An alternative business model, that is part of the Energy Contracting family is the Energy Supply Contracting Model (ESC), a quite different contract from EPC, because it is a scheme not based on energy performance reduction.

Energy Supply Contracting is one of the most basic forms of Energy Contracting or Energy Service. In this model the ESCO renovates or replaces a local installation for the production of "useful" energy (thermal and/or electric). The ESCO delivers kWh of "useful" energy. This useful energy is typically heat, cold, compressed air or some other useful energy stream, delivered by a local production or transformation equipment (e.g., a gas boiler, a heat pump, a combined heat and power (CHP) or combined cold, heat & power plant or a compressed air installation), and installed, maintained and financed by the ESCO. The ESCO guarantees the "price" of this "useful" energy. The price may contain a fixed price component (i.e., covering the investment and maintenance costs) and a variable component (covering the gas, fuel or electricity supply). Essentially this means that the ESCO's risk is limited to guaranteeing the efficiency of the local useful energy production. There are no incentives for reducing energy demand in the building as is the case with EPC where this is the key element. If the customer is also interested in saving energy in the building based on energy conservation measures, the EPC or Integrated Energy Contracting (IEC) model, described further on, is required.

The ESCO's remuneration is made up of the following three price components:

- Energy price
- Service price for energy supply (flat rate) includes all operational costs
- Capital costs

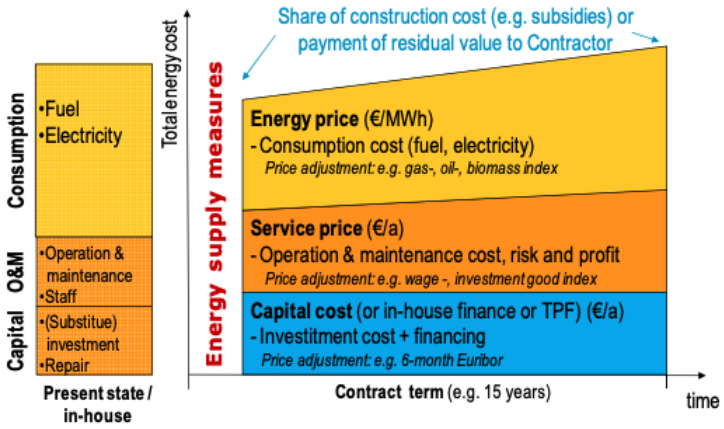


Figure 19. Energy Supply Contracting Business model (Bleyl-Androschin & Schinnerl, 2010)

b. Solar Supply Contracting (SSC)

Solar Supply Contracting is a particular and common form of ESC in which the ESCO installs thermal or electric (PV) panels, normally on the roof of the customer's building and sells the renewable heat or electricity. This type of Solar Supply Contracting model, when applied to renewable electricity production from PV panels, is often called a Power Purchase Agreement (PPA), although not all PPA's are ESC, as in case of an ESC the PV installation is always on the building of the customer. With PPA the PV panels may sometimes be installed elsewhere. Figure 19 shows the basic mechanism of an ESC

contract. The customer pays for the energy consumed (thermal or electric), based on a guaranteed price mechanism. The price typically is composed of a fixed and a variable component. Often, both contain a price indexation mechanism. The ESC model is about local production and supply, and it is not really related to energy efficiency or demand reduction in the building.

c. Integrated Energy Contracting (IEC)

Integrated Energy Contracting (IEC) was developed within the Grazer Energy Agency in Austria to address some of the perceived complexities with basic EPC and the associated Measurement & Verification (M&V) requirements (Bleyl-Androschin, 2009). The model is shown in Figure 7.

Integrated Energy Contracting tries to avoid some of the complexities of EPC, by combining the easier ESC model with energy efficiency measures, without guaranteeing the savings against an energy consumption baseline as is the case with EPC. Performance guarantees are replaced by Quality Assurance Instruments (QAI). Although the model has some interest it is hardly used outside of Austria, where EPC (and its variations) remain the predominant model.

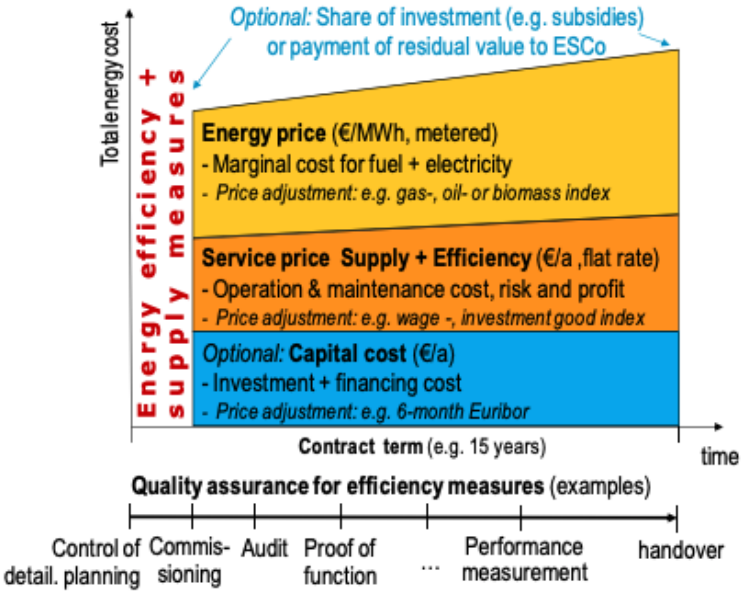


Figure 20. Business models for Integrated Energy Contracting (Bleyl-Androschin, 2009)

3 EPC variations, according to the scope of measures or services

a. Maintenance and Energy Performance Contract (M-EPC)

An EPC that includes the maintenance of the whole building is called a Maintenance and Energy Performance Contract or M-EPC. The Financial business case is based on a Baseline[27] that includes both Energy and Maintenance Costs.

In basic EPC, maintenance is often limited to new installations or on the installations concerned by the sole Energy Efficiency Measures. However, the maintenance needs often extend well beyond those single installations to include all energy related equipment (e.g. non-renovated boiler rooms, non-upgraded lighting) or even non-energy related equipment maintenance (sanitary installations, elevators, fire equipment, access control, etc.). It may even include maintenance of building envelope related items, like doors and windows, roofs, etc.

An EPC that includes the maintenance of the whole building is called a Maintenance and Energy Performance Contract or M-EPC. The Financial business case is based on a Baseline that includes both Energy and Maintenance Costs.

In some cases, this comprehensive maintenance may itself be performance-based as is the case for the M-EPC contracts based on the NEN2767 standard (NEN, 2019) widely used in the Netherlands and Belgium. Rather than using lengthy specifications for maintenance it uses condition scores (from 1 to 6) to determine the quality of installations before the contract and the result of quality maintenance during and at the end of the contract. This output-driven methodology offers many advantages compared to the traditional input-driven method of performing maintenance. This methodology is also used within one of the following categories of EPC, the smartEPC model.

b. Active building EPC (AEPC)

A fairly new model that is being developed is the Active building EPC (AEPC) model. It is developed under the EU H2020 AmBIENCe project[28] and combines the classical EPC model with Flexibility (or Demand Response) in the building. The flexibility allows to generate extra cost savings that are also guaranteed. Basically, customers can either adapt their energy consumption behaviour to save on energy expenses as a reaction to price signals (in case e.g., hourly or short-term energy pricing is available) or they can commit and dispatch flexibility (e.g., shut down of electrical equipment during certain moments) to so-called aggregators that can be sold or traded on the energy markets

The model is based on the electrification of heat production, typically with heat pumps. This implies a certain minimum level of insulation to allow to the heat pump to work at low temperatures.

As for all practical purposes in the EEnvest project this model is very similar to the basic EPC model it will not be detailed. The main aspect that is of importance, is the potential to improve the business case due to the extra cost savings from the flexibility.

The AEPC model involves some new stakeholders that are typically not encountered in the traditional EPC model. They are

[27] SANS 50010 defines the baseline as: "energy use representing conditions before the implementation of the energy-savings measures under a set of known energy-governing factors or relationships applicable at the time of the baseline measurement period to the activity in question (or both)"
[28] www.ambience-project.eu

- Distribution System Operators (DSO) and Transport System Operators (TSO), that are requesters of flexibility mainly to allow for network balancing, avoid congestion or delay investments in additional network capacity. This is called explicit demand response.
- Aggregators that typically bundle flexibility from multiple end-users and package and valorise it towards DSO/TSOs, that are willing to pay for activation of the Demand Response requests.
- Electricity suppliers, that by offering dynamic prices, based on when electricity is used or which carbon intensity it has, can increase the flexibility potential. They are key in case of such Implicit DR, where the price signals drive the flexibility.

Work on the combination of EPC with flexibility has been performed in several EU-funded projects like Novice. The AEPC business model has been studied and defined in the EU H2020 AmBIENCe project. The following schemes shows the generic AEPC business model with implicit demand response and with explicit demand response (with the ESCO acting as a technical aggregator of demand response.

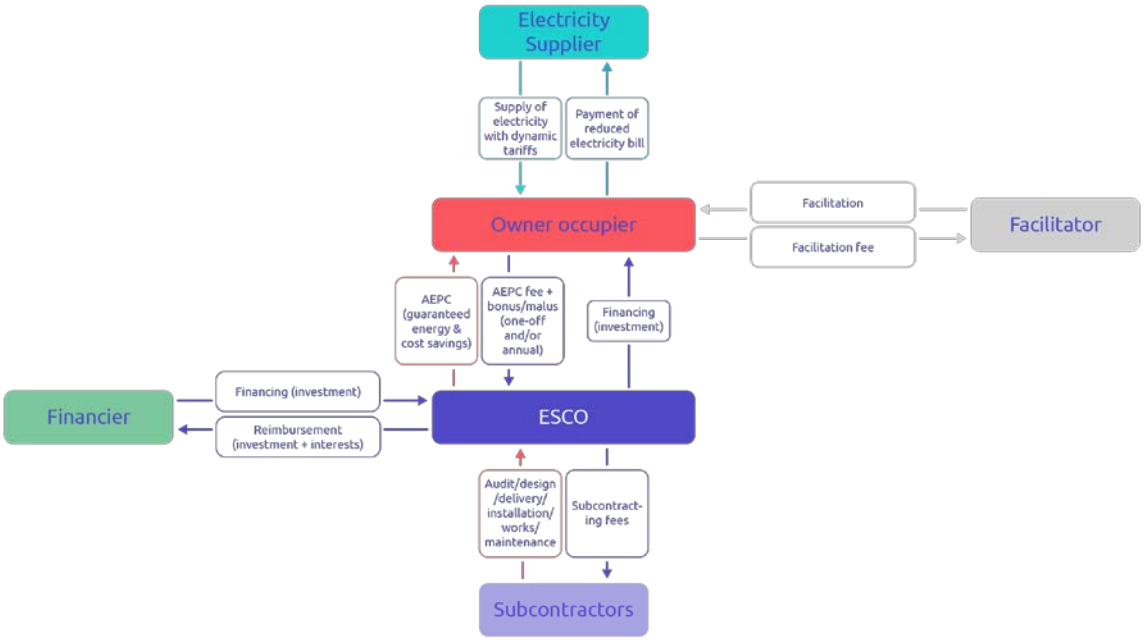


Figure 21. Generic AEPC Business model with implicit DR (EU H2020 AmBIENCe, 2021)

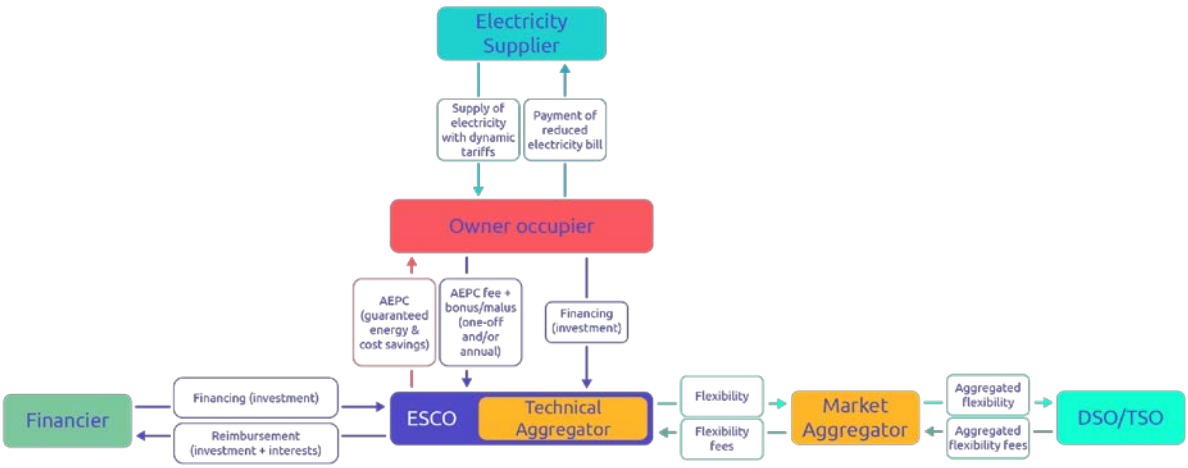


Figure 22. Generic AEPC Business model with explicit DR and the ESCO acting as Technical Aggregator (EU H2020 AmBIENCe, 2021)

Several other variations of these schemes have been described in the EU H2020 AmBIENce project (Deliverable D2.3 Business Models for the AEPC concept). Accounting for specific building sectors, occupation models or financing options.

c. SmartEPC

SmartEPC is an innovative EPC procurement model, developed initially in Belgium for the Federal Government's public buildings and now applied in many other EPC projects. It is a very modular business model based on the M-EPC model using NEN2767 as basis for the performance-based maintenance (see paragraph on M-EPC).

It was designed to meet a number of specific requirements and options:

- Variable contract durations between multiple buildings, which is sometimes the case in projects with multiple rented buildings
- A solution for the split incentive between the owner/lessor and the tenant/lessee or occupier, through a quantification of building residual values (or residual) values. It is based on a feature made possible by an extension of NEN2767, i.e., associating replacement and residual values with condition scores, using a "residual value %" derived from a standard aging curve.
- Output driven solution for maintenance
- Output driven solution for comfort
- High degree of standardization possible
- Modular
- Flexible to adapt to future requirements

SmartEPC has also been applied to Comprehensive Refurbishment projects and thus fits into the CR-EPC category. The rest value concept to deal with the split incentive was initially applied in the Fedimmo project, in 13 Belgian federal public buildings that were partially renovated by the tenant, in cooperation with the owner, after an earlier sale & leaseback operation. This meant the federal government sold about 60 buildings to the private sector and leased them back for long term periods (varying typically from 10 to 27 years) from the private owner after a partial renovation. The smartEPC project was initiated by Fedesco, the Belgian Federal Energy Services Company, to achieve – in

cooperation with the federal building agency who was the lessee – additional energy savings that provided a return on investment within the remaining lease terms. The project is described here: https://energinvest.be/references/fedimmo.

The underlying idea of the rest value concept is that when parties can quantify the "in situ" rest value of the energy assets or the energy efficiency measures at the end of the rental contract for the owner, from an investment by the tenant, that this provides a basis for negotiating a fair contribution from the owner, based on this rest value that is offered to them. The other way around, it allows the owner who invests to negotiate for a contribution from the tenant that takes into account the value that is delivered to the tenant who is solely benefiting from the energy efficiency investments done by the owner. Although it is not a magic bullet, it allows to objectify the value for both parties and thus to facilitate co-investments in building renovation.

An extension of the smartEPC model, based on the AEPC model is under development. It is called smartAEPC.

d. Comfort-as-a-Service (CaaS), Energy Efficiency-as-a-Service (EEaaS) and other Product-as-a-Service (PaaS) models

Energy Efficiency-as-a-Service (EEaaS) and its umbrella term Product-as-a-Service (PaaS) are other variations or hybrid models in which Energy Efficiency is delivered as a service and whereby the performance risk is being shifted to the service provider. Even the basic EPC model can be regarded as a service model, where the service that is being delivered are the energy savings. In other words, the customer only pays for effectively saved MWH or MegaWatthours of energy. These are sometimes referred to as so-called NWH or NegaWatthours ,(= "negative" Watthours).

A more specific energy driven PaaS service model and definitely the most common one is **"Comfort-as-a-Service" (CaaS),** where it is not the guaranteed energy savings that are being contracted, but a guaranteed level of thermal comfort in the building, most often expressed as a single comfort indicator ideally based on user preferences and needs. The basic idea is that the customer (or the building occupants) transfers the control of the thermal comfort equipment (e.g., HVAC and the related control devices) to the service provider (the ESCO) which operates it in order to keep the comfort levels within an agreed range at an agreed price. This often also means that the ESCO takes over the existing energy contract(s). Other comfort parameters can be included, like air quality.

Another service model that is being offered is "Light-as-a-Service" (LaaS), in which certain quality of light and light levels are guaranteed on a per square meter basis. They may involve energy savings, but not always. The ESCO will often take over the energy contract or the cost of energy will in general be included in the price of the visual comfort or light service.

Such "PaaS" models could also be combined with Demand Response/Flexibility as long as the flexibility service falls within the boundaries and KPIs of the "PaaS" service. Such solutions could combine demand management and energy efficiency services, facilitate the adoption of renewables and other decentralized supply sources, and also optimize the balance between demand and supply.

4 Summary view

The following graph shows a summary of most of the energy services business models shown above and how they relate to each other.

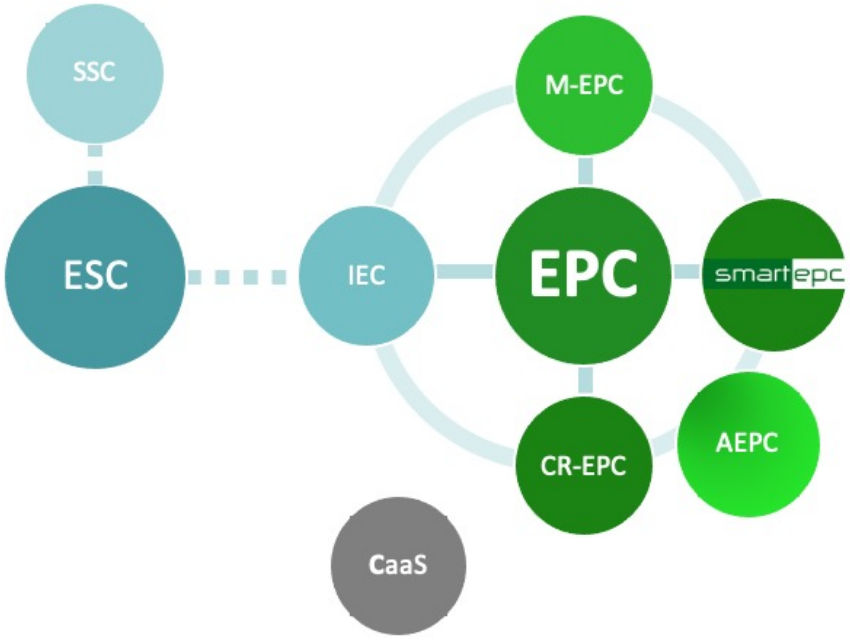


Figure 23. Overview of various energy services or energy contracting business models (Energinvest, EU H2020 AmBIENCe, 2021)

Annex 2 – Further detail on financing instruments

The following pages presents the long-listed financing instruments and provides more details about the FIs, including best practices examples, advantages, weaknesses, main obstacles to the instrument as well as the requirements to a large-scale roll-out of the FI.

a. Dedicated Credit Lines (Mature)

Dedicated Credit Lines	
Best practice examples	- Numerous for buildings: KfW, NRW.BANK, Kredex, etc. - For SMEs and industry: BPI France's Green Loan (2010-2013) and eco-energy loan (2014)[147] , KfW Energy efficiency programme, EBRD Sustainable Energy Finance Facilities (SEFF), OP PIK (CZ)
Advantages	- Easy to roll out, however careful ex-ante analysis of supply and demand and legal/tax framework needed - Leverage effect of public funds is usually between 4 and 10 which is higher than traditional grants - Standardised supply offering at the same time flexibility according to individual preferences (repayment, interest rate fixation etc.) - The use of Cohesion funds for soft loans in housing is facilitated with the "renovation loan" (off-the shelf instrument) - Allows 1:1 refinance to commercial banks (Basel III compliant) - Positive impact on public budgets[148] - Allows raising the ambition of the investment in terms of energy savings (e. g. by combining the loan with a grant component) - Can be used for ambitious renovation / refurbishing project as well as for individual measures: large flexibility - Usually offers longer duration than commercial loans
Weaknesses	- Capacity/ willingness of owners to take more debt (ie very country dependent) - Risk aversion of banks (calling for guarantees from Governments) - Often complicated, time consuming and static application processes which act as a hurdle for projects - Loans often require the additional implementation of costly non-energy related measures which change project characteristics

Dedicated Credit Lines	
Main obstacles to the instrument	- Transaction costs to implement (technically) and manage long-term programs within financing institutions - Increased regulations / provisions for (promotional) banks hinder commitments of credit lines (EBA-supervisory, State-Aid-rules….)
What is needed to roll out the instrument at a larger scale	- Comprehensive framework, e. g. including energy audits and independent expert advice - Large network of on-lending banks and equal conditions for all - Long term horizon and stability - A set of criteria that can easily be understood, processed and checked (MRV), possibly using software instruments. - An effective information strategy directed towards the final beneficiaries. - Greater involvement with Energy Performance Contract providers in selected sub-sectors.

b. Energy Performance Contracting (Mature)

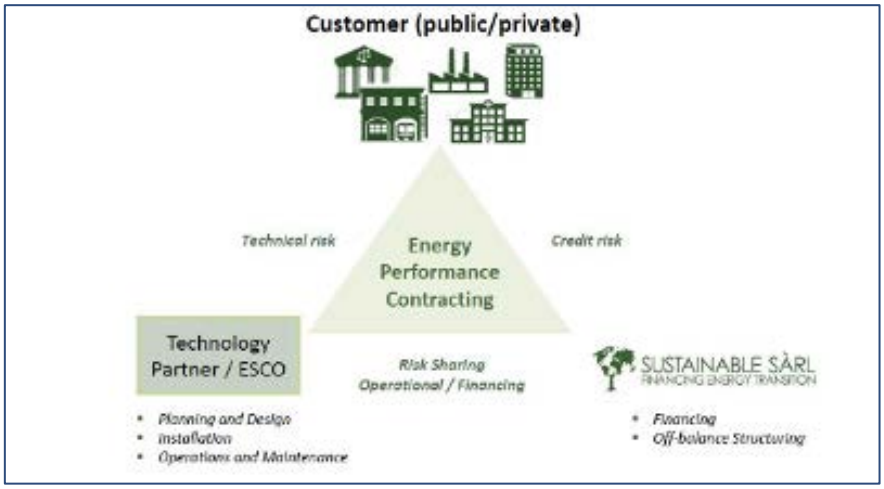
Energy Performance Contracting (Private Sector Provider)	
Best Practice Examples:	- Numerous for buildings: London's RE:FIT programme (UK)[152]; ELENA projects in Milan (IT)[153] [154] and Barcelona (ES)[155], Berlin Jewish Museum[156], Alsace high schools (FR)[157], Barts Health Care Trust[158], Peterborough Council[159], Croatian ESCO HEP[160] - In industry: CDC Climat's 5E Fund.
Advantages	- Turnkey contract: the Energy Performance Contract represents a one stop shop for the customer, with only one counterpart for the entire duration of the contract - Guaranteed savings: Energy Performance Contract provider manages the performance risks - Professionalism and expertise of Energy Performance Contract providers - Energy Performance Contract provider can bring financing or facilitate access to finance through savings guarantee.

Energy Performance Contracting (Private Sector Provider)	
Weaknesses	- In many cases, focused on short payback times due to low requirements of the client host, although the private sector is able to deliver deep renovation through Energy Performance Contract (when requested) - Increases transaction costs - Requires more developed skills on the client side - Lack of standardised framework and templates.
Main obstacles to the instrument	- Accounting treatment needs to be clarified for public and private clients - Lack of confidence in ESCOs - Lack of understanding of the Energy Performance Contract concept, in particular in the housing sector - Lack of capacity and willingness of the client side to launch Energy Performance Contracts for deep renovation of buildings - Split incentives in the buildings rental sectors - Procurement regulations may not be adapted at national level - Energy Performance Contract is seen as a self-financing whereas for deep renovation it is only part of the financing – the rest can come from grants or additional investment from the owner based on "green value" - Deep renovation often happens with general refurbishment measures which increase the overall investment - Fear of externalisation of energy management - Lack of access to public support schemes for Energy Performance Contract providers (tax breaks, soft loans, reduced or no VAT…) compared to project host and in-house ESCOs.
What is needed to roll-out the instrument at larger scale	- Capacity building on Energy Performance Contract towards public authorities (in particular financial and procurement departments) and private clients - Market facilitation and aggregation programmes, notably through project development assistance - Possibility for construction SMEs to group themselves to be able to offer Energy Performance Contracts - Standardisation of contracts and procurement procedures - Proper implementation by Member States of article 19 of the Energy Efficiency Directive (2012/27/EU) on the removal of obstacles to Energy Performance Contract in public sector - Proper implementation by Member States of article 7 (b) of the Energy Efficiency Directive on the partnership with obligated parties in order to preserve the energy saving targets towards the customer - Addressing the supply of finance supporting the Energy Performance Contract sector through making dedicated credit lines, guarantees[161] and factoring funds more considerate of the Energy Performance Contract model, where appropriate.

c. Energy Efficiency Investment Funds (Emerging)

Energy Efficiency Funds	
Best Practice Examples:	- Private funds: Sustainable Development Capital Limited, SUSI partners, 5E fund - Public funds: European Energy Efficiency Fund.
Advantages	- Dedicated vehicles for energy efficiency investing, which allows to better track the use of proceeds than in a general investment fund - Attractive to SRI investors.
Weaknesses	- High return and liquidity requirements may entail a focus on short and medium paybacks, not tapping higher energy savings potential.
Main obstacles to the instrument	- The lack of a clear project pipeline makes it difficult to show a clear business case to investors - Off-balance sheet accounting is a clear specification of public and industrial clients, but accounting frameworks make it increasingly difficult to ensure - Counterparty risk remains a key factor which may prevent a large number of investments in SMEs.
What is needed to roll-out the instrument at larger scale	- Support the development of a pipeline of projects - Guarantees or first loss facilities from public sources targeted to reduce the counterparty risk of SMEs.

One of the leaders on the matter is SUSI Partners. The swiss firm manages around EUR 1,000 million investment commitments across 5 funds. The SEEF (SUSI Energy Efficiency Fund) is Europe's largest fund dedicated to energy efficiency. Typically, SEEF finances the total investment costs of the measures through a customized financing structure and takes over the credit risk of the customer. Further, over the lifetime of the project, the achieved savings are shared between the customer, SEEF and an additional partner that may be a Technology Provider or in some cases, an ESCO. Ought to remark that SEEF does not undertake the risk of performance, construction nor technology. This reinforces the need of an additional partner (i.e., ESCO). Figure below better showcases the SEEF instrument.



d. Energy Services Agreement (Emerging)

Energy Services Agreement	
Best Practice Examples:	- US providers such as Transcend Equity, Metrus Energy, Green City Finance, Abundant Power. - UK example of Sustainable Development Capital LLP.
Advantages	- Bilateral contract does not require new regulations - Overcomes some traditional EE barriers (eg. split incentives) - No capex for owner, aligns incentives of project developer, building owner and investor.

Energy Services Agreement	
Weaknesses	- Limited scale to date - Fragmented market - 10 year contract period can limit third party measures installed to low hanging fruits (high returns) - Limited willingness to commit to one energy supplier and the current price level (lock-in) as well as with contractual obligations on the side of the supplier - Increases transaction costs - Requires more developed skills on the client side - Lack of standardised framework and templates.
Main obstacles to the instrument	- Accounting treatment should to be clarified - Lack of confidence in Energy Utilities as conflicted "energy managers" - Lack of understanding of the ESA concept - Unlikelihood of the use of ESAs for deep renovation of buildings - Fear of externalisation of energy management.
What is needed to roll-out the instrument at larger scale	- Education of building owners and project developers - Need for more pilots to help develop the market - Clarity on lease accounting and investors' rights in case of bankruptcy, tenant change or sale of host building.

e. Direct and Equity Investments in Real Estate and Infrastructure Fund (Mature)

Real Estate and Infrastructure Funds	
Best Practice Examples:	- Numerous: Listed and unlisted real estate investment fund - Real Estate companies - Infrastructure funds.
Advantages	- Existing instruments well established existing instruments across the EU - High leverage effect - Limits need for public funding - Rewarding companies' efforts to reduce their assets' obsolescence risks by investing in best performers - Sustainability and environmental criteria can be embedded as part of company's due diligence and valuation process - Fund managers can influence companies' environmental policies in relation to energy efficiency - Aggregating energy efficiency gains from buildings to portfolio level.
Weaknesses	- Difficult to estimate proportion of funds invested in energy efficiency - Limited to cost effective investment within the investment timeframe of each fund - Should deliver adequate return investment performance returns to investors, aligned with the investment risk, and (if possible) measurable and comparable to financial instruments that provide a similar level of returns - In the absence of specific regulatory requirements, achievements will occur but could be limited to best practice within the industry, or to focus on the low-hanging fruit, e.g. just "quick wins".
Main obstacles to the instrument	- None
What is needed to roll-out the instrument at larger scale	- Real Estate and Infrastructure Funds already have scale, but they can benefit from increasing the visibility of energy efficiency investments in their portfolios - While there are good examples of sustainability reporting by these funds, an increased focus on this – integrated with traditional financial reporting – would help raise the profile of energy efficiency

f. Factoring Fund for Energy Performance Contracts (Emerging)

Factoring Fund for Energy Performance Contracts	
Best Practice Examples:	- In Bulgaria, the Energetics and Energy Savings Fund (EESF) buys the future receivables of Energy Performance Contracts (the energy savings) from ESCOs (established by the EBRD with a €7m initial loan followed by a €10m loan in 2012) - European Energy Efficiency Fund has used public and private money for forfeiting Energy Performance Contracts for the Berlin Jewish Museum.
Advantages	- Secures refinancing for Energy Performance Contract providers, clearing their balance sheets and contributing to lower their capital costs - Could contribute to standardise energy efficiency assets - Dedicated vehicles to support the Energy Performance Contract procurement model, which should allow easier tracking of their performance than when spread across many small ESCOs - Potentially attractive to SRI investors.
Weaknesses	- New concept that will take time to mature - Unclear what "discounts" will make this work for Energy Performance Contract originators - Requires public money to kick-start.
Main obstacles to the instrument	- Very "early stage" with limited pilot examples - Public budgets and abilities and in-house capabilities of public sector to set-up new fund - Issues around the discount rate and "value for public money" - Need to be analysed and adapted country by country - May require changes in contracts and the legal framework, comply with financial regulations and to access the same fiscal benefits as individual project hosts - The lack of a clear project pipeline - Accounting and regulatory treatment for new vehicles and their clients.
What is needed to roll-out the instrument at larger scale	- Support the development of a pipeline of "factoring ready" Energy Performance Contracts - Public investment (or a public financial institution) willing to provide first-loss or initial junior investment to new fund.

g. On-Tax Finance -PACE- (Emerging)

On-Tax Finance	
Best Practice Examples:	- PACE has developed mostly in the commercial buildings sector, and a small amount of residential PACE in California and France. - In December 2013, there were 26 active PACE programmes in the US (200 commercial PACE projects had been completed, representing USD 56 million and an upcoming pipeline of USD 215 million) - In California, 6,000 homes have signed a PACE contract, as the State set-up a "PACE Loss Reserve programme" to overcome the FHFA's negative 2010 ruling for homeowners. - In March 2014, the first residential PACE bond was issued for USD 104 million, securitising contracts from the privately-funded HERO PACE programme. - In Europe, the Picardie and Alsace regions (France) are planning to adapt the PACE scheme for detached housing. They will set up a Public Service for Energy Efficiency (PSEE) entity which will accompany homeowners through the whole process to reach a deep renovation of their home. PSEE will help homeowners set up the financing plan through equity, tax incentives and bank loans; the remaining finance will be provided by the PSEE and recouped through local taxes. - So far, no examples of PACE schemes in industry have been reported.
Advantages	- Can overcome the split incentive between user and owner as it is connected to property (or corporate asset) not user - Overcomes the "split incentive over time" (ie short detention/occupancy time for buildings) as repayment obligation can be passed attached to the asset on to the next owner/user - Reduces the default risk (taxes are the most senior debt) - Can be used to finance deep renovation if that is the intention of the scheme - Can be run with public or private finance.
Weaknesses	- Impact on public debt if financed through public money - Legal complications related to the lien priority can occur - Some mortgage lenders can refuse to finance PACE mortgages because in case of default PACE loans are paid off before the main mortgage is paid to the lender.
Main obstacles to the instrument	- Requires the establishment of a specific legal framework - Requires modification to the tax collection systems - Would need to consider State-Aid clearance in EU.

On-Tax Finance	
What is needed to roll-out the instrument at larger scale	- Pilot projects to adapt and roll-out the PACE model in different Member States.

h. On-Bill Repayment (Emerging)

On-Bill Repayment	
Best Practice Examples:	- Green Deal in the UK - Utility obligation programmes in the USA.
Advantages	- Energy savings connected to energy bills - Public sector actors and utilities are more trusted by decision makers - Reduces transaction costs - Can overcome the split incentive between user and owner as it is connected to property (or corporate asset) not user - Overcomes the "split incentive over time" (ie short detention/occupancy time for buildings) as repayment obligation can be passed attached to the asset on to the next owner/user - Overcomes the lack of finance capacity of homeowners and SMEs.
Weaknesses	- May initially require additional public support (in form of risk sharing facility) to provide finance at an acceptable cost - Can be perceived as complex by users and may require technical assistance in order to avoid focus on low-hanging fruits - Complex instrument to manage/ market - Might crowd out small ESCOs.
Main obstacles to the instrument	- May require changes in the legal framework, in order to comply with banking monopoly regulations - May require modification to utility/ tax collection processing systems and/or tax code/ energy laws.
What is needed to roll-out the instrument at larger scale	- Green Deal espoused by a "public financial institution" (based upon the KfW approach) and offered at attractive rates and marketed by utilities to their customers - Review and showcase of working case studies from USA.

i. Green Bonds

Green Bonds	
Best Practice Examples:	- The first bond labelled "green" was issued in 2007 by the EIB. Since then other issuers have joined the green bond market, and issued over $35 billion of them during 2014[163], including: - Swedish property group Vasakronan Green Bonds SEK1.3bn ($197m) in Nov 2013, SEK1bn ($157m) in March 2014 - Unibail-Rodamco green property bond EUR750m 10 year, A+, Feb 2014 - Skanska green property bond, 5yr, SEK850mm ($131m), April 2014 - Vornado Realty green property bond, $450m, 5yr, BBB, June 2014 - Förvaltaren green property bond $55mm (SEK 400m), 5yr, AA-, Oct 2014 - Development Bank of Japan green property bond, EUR 250m ($315m), coupon 0.25%, 3yr, Aa3/A+, Oct 2014 - KFW, EIB, NRW Bank, and other public financial institutions - Ile de France region[164] - Cross Key Homes housing association (UK) [165] - SCA in the industry sector[166].
Advantages	- Large and deep pools of investor finance - Could be applied to most energy efficiency investments - High leverage effect - No need for public funding - Strong market signalling - Simplifies means to attract new investors - Diversification of investor base - Strong CSR message from issuer - Strong demand from investors ($10bn in 2013, $35bn in 2014).

Green Bonds	
Weaknesses	- Need to meet investors' expectations in terms of size of issue and liquidity - Issuers need to provide a minimum level of assurance to investors: green quality of the buildings financed, external verification of the use of proceeds, management of proceeds and environmental impact measurement - Most critical challenge for growing green bonds market is environmental integrity: current green bonds use a wide range of measurement for environmental performance and provide limited information on what the proceeds will be used for - Investors are not able to exit if use of proceeds is not in line with their expectations or if the investments are not implemented.
Main obstacles to the instrument	- Ability of issuers to provide the relevant key performance indicators to both select eligible green building projects and provide quality assurance reporting - Minimum size of projects or projects portfolio (eg. $50-100m) - Lack of a clear definition of and standards for green bonds in technical and governance terms - Lack of an acknowledged index for green bonds prevents some institutional investors from investing.
What is needed to roll-out the instrument at larger scale	- Some level of standardisation in the issuance process - Standardisation of the technical aspects in measuring the environmental performance delivered by use of proceeds - Stricter reporting and governance and third party verification of use of proceeds. - Further development of Green bond indices.

j. Citizens Financing

Citizens Funding	
Best Practice Examples:	- In Germany, there are over 500 energy co-operatives with 80,000 members which have invested up to EUR 800 million in solar plants - There are also a few examples of German community funding for schools energy retrofit through energy performance contracting eg. EcoWatt in Freiburg (DE)[170] - Bettervest (Germany) has launched several building retrofit crowdfunding projects, although focussing on lighting and heating plants - Energie Partagée in France gathers equity from individuals in order to invest in community-owned projects (sometimes energy efficiency). - An example of a crowdfunding website Abundance, set up in 2012.
Advantages	- Potentially low-cost source of financing - Involvement of citizens in the projects solving the aggregation and distribution issues - Positive publicity and social network-effects.
Weaknesses	- Legal framework still unclear - High trust required in website or intermediary structure (open to "fraud scandal") - Unclear if community entity benefits from same fiscal benefits for EE investing (same issue for ESCOs) - Competence in project selection and design required to enhance network trust in crowdfunding.
Main obstacles to the instrument	- Very "early stage" with limited pilot examples - Funding and skills for generating positive publicity required by the project owners (if no central entity bundles projects) - Need to be analysed and adapted country by country - May require changes in contracts and the legal framework, comply with financial regulations and to access the same fiscal benefits as individual project hosts - The lack of a clear project pipeline - Accounting and regulatory treatment for new vehicles and their clients.
What is needed to roll-out the instrument at larger scale	- Third party evaluation of projects to increase public trust - Proof of concept in more than one Member State and that the idea is quickly replicable within a Member State for target segments - Clear accounting and financial regulatory treatment - Project Development Assistance facilities to develop some pilot trials.

k. Risk Sharing Facilities

Risk-sharing facilities (Guarantee funds and First-loss Facilities)	
Best practice examples	- IFC's CEEF programme (Hungary, Czech Republic, Estonia, Latvia, Lithuania and Slovakia) - Energy Efficiency and Renewable Sources Fund (EERSF) in Bulgaria, targeting ESCOs[149] - Several Promotional Programs for commercial entities in Germany (e.g. NRW.BANK Mittelstandskredit mit Haftungsfreistellung) - European Energy Efficiency Fund (EEEF) - EIB's PF4EE guarantee scheme
Advantages	- Reduces the risks for banks and enables them to lend greater amounts - Anecdotal evidence suggests that energy efficiency loans experience "market standard" or better credit performance therefore risk sharing facilities can be a transition phase until energy efficiency loans are mainstreamed - Provides extra leverage for private sector funds - Potential to boost energy efficiency services market in EU
Weaknesses	- Time to structure and negotiate - Moral hazard if substantially all risk is removed from bank lending - Know-how to implement at regional and local government levels
Main obstacles to the instrument	- Often extensive and complex handling of risk-sharing facilities at EU level ("red tape") especially for smaller financial intermediaries and first-time users

Risk-sharing facilities (Guarantee funds and First-loss Facilities)	
What is needed to roll-out the instrument at larger scale	- Template approach to execution of risk-sharing facilities using ESIF 2014-2020 - Consensus view as to at what stage and for what market segments this Financial Instrument is most useful and pressure by EU public financial institutions to develop faster in those identified segments and Member States - Greater degree of collaboration/ resource commitment on the design and implementation of these instruments by private and public sector Financial Institutions - Further consideration of the role public guarantees might play in support of the energy efficiency services markets