Risk reduction for Building Energy Efficiency investments

Project H2020 n° 833112

D3.1

Financial risk evaluation framework

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Abstract

The EEnvest project will develop an innovative risk evaluation platform which is needed in order to tackle the widespread issue of uncertainty surrounding energy efficiency projects. The first step towards the setting up of the risk model, which is one of the main components of the whole EEnvest platform, is the definition of a framework with the objective of defining who could use the platform, what kind of calculation the platform will be able to perform and what outputs the users may want to have.

With this in mind, activities were carried out through a research work on existing risk models and tools and through a series of one-to-one interviews with relevant stakeholders in order to collect important information about their expectations from the platform.

The research work brought to the identification of three main methodologies, commonly used in the financial sector, that will be employed for the development of the financial risk model: Discounted Cash Flows (DCF), Monte Carlo analysis and Value at Risk (VaR). In literature, there is one existing model that has already dealt with risks of energy efficiency projects and which uses the same three tools previously identified. That model will be helpful from a methodological point of view for our purposes.

On the other side, interviews with stakeholders helped to identify and categorize the different types of users, which are basically divided according to the ownership of the building (owner/non-owner) and willingness to invest own resources or looking for investors (investors/non-investors). Interviews were also interesting to assess the sensitivity of different stakeholders towards different risks and to inquire their expectation from the platform.

Since the financial risk evaluation framework is defined, the actual model will be developed and described in D3.2.

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List of abbreviations and acronyms

EE	Energy Efficiency
DCF	Discounted Cash Flows
EBaR	Energy Budget at Risk
WACC	Weighted Average Cost of Capital
EeMAP	Energy Efficiency Mortgages Action Plan
ICP	Investor Confidence Project
DEEP	De-risking Energy Efficiency Platform
ESCo	Energy Service Company
IRR	Internal Rate of Return
KPI	Key Performance Indicator
NPV	Net Present Value
WACC	Weighted Average Cost of Capital
DSCR	Debt Service Cover Ratio
TV	Terminal Value
CV	Continuing value
KPI	Key performance indicator
CF	Cash Flows
HVAC	Heating, ventilation and air conditioning
VaR	Value at Risk
EeDaPP	Energy Efficiency Data Protocol and Portal

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INTRODUCTION

As a general concept of the EEnvest project, the development of an innovative financial risk evaluation model is needed in order to tackle the widespread issue of uncertainty surrounding energy efficiency projects.

In fact, while the financial industry is able to provide tools and methodologies for the evaluation of investments and risks in general, there's still uncertainty and little knowledge in the energy efficiency sector. This represents a significant hurdle for the development of the sector and in particular for the activation of large-scale investments with the support of financial institutions (i.e. banks and investment funds).

In the context of the Horizon 2020 programme, some other projects have tried to find solutions to the lack of information, knowledge and skills in the energy efficiency investment sectors. These projects, briefly described in Paragraph 1.2, addressed the issue from different perspectives and with different methodologies but all with the aim of filling the informative gap between the market for energy efficiency and financiers (in particular banks and other financial institutions).

In order to address this issue, the EEnvest project will setup an investment evaluation platform - within this context referred to as “the platform” - that will be able to identify, assess and calculate technical and financial risks related to an energy efficiency investment project. An increased knowledge of risks and their quantification will reduce the uncertainty surrounding an energy efficiency investment, thus allowing investors to take more informed decisions.

The first step to approach financial risk analysis is the development of a general framework, which is needed in order to define the context that must be taken into consideration for the development of the financial risk model.

The following Paragraphs describe the framework of analysis and the methodologies that were used in order to carry out each activity. The actual development of the risk model will be carried out in Task 3.2. - Development of financial risk evaluation model.

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1 SETTING UP THE FRAMEWORK

In the following paragraphs we will describe the methodology used to define the framework in terms of:

- Who will be interested in using the platform - Identification and characterization of potential platform users and their profile;
- What is needed to perform the evaluation - Identification of main input ad information needed for the technical and financial evaluation;
- What kind of analysis could the platform perform - Exploration of existing financial tools and risk models;
- What is each user expecting from the platform - Definition of relevant information, data and indicators required by each user;
- Why would each user use the platform - Identification of the needs of the potential users and the reason why they would use the platform.

For the definition of the framework, the analysis will focus on the financial aspects of the investment, namely those related to investment costs, revenues (energy savings), operating costs and financial indicators.

Technical aspects of the analysis, such as technical inputs and the technical risk evaluation model, are assessed in WP2 (Deliverable 2.1). The methodology for the transformation of technical risks into financial risks will be assessed in Task 3.3 - Technical/financial risk interaction and definition of a technical/financial conversion method, and reported in Deliverable 3.2 - Technical and financial risk evaluation model.

1.1 METHODOLOGY

The financial risk evaluation framework was developed through three main activities:

1) **Definition of the platform flowchart and features:** aimed at defining the overall structure and flowchart of the platform in terms of inputs, processing and outputs as well as the identification and definition of user profiles (see Paragraph 1.3);

2) **Research work on existing tools and financial risk models**: aimed at identifying existing tools commonly used in the financial industry for the evaluation and assessment of energy efficiency investments and related risks, as well as relevant existing models already developed and used (see Paragraph 2);

3) **One-to-one interviews with stakeholders**: aimed at identifying user profiles, a set of suitable requirements for each target platform user and their expectations from the platform (see Paragraph 3).

All activities were carried out in strict cooperation with the consortium partners, which gave their contribution in particular for the definition of the platform flowchart, as it involves also activities from Work Packages 2, 4 and 5.

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1.2 EEnvest and other European projects

Energy efficiency investments might be analysed from different perspectives as they involve multiple stakeholders, e.g. banks, constructors, private owners, public entities and others. Each stakeholder has its view and interest in such projects. For this reason, it is quite impossible to focus and satisfy at the same time any requirements or peculiarities of the different stakeholders and of different kind of renovation measure. The complexity derives from the entire value chain of a renovation measure and the quantity of data, numbers and information involved during the process. Therefore, European projects regarding energy efficiency investments usually start from the same topic of EE (i.e. need for boosting renovation, activating finance, etc.). Then, every project is different from another according to its specific object, perspective and focus abut it's any way possible to find similarities or common patterns between projects that help understanding the complexity of the topic. So, it is important to refer to and analyse such studies in order to retrieve useful information. Indeed, it is fundamental that results and limitations of on-going projects are considered, not only to avoid the same errors but also to replicate the positive parts. Thus, it is important to identify the connection between EEnvest and other projects, with a focus on the specificities of the former. This allows better understanding of the goal proposed in this work, which is the definition of a technical and financial risk evaluation model, and the peculiarities that distinguish it from the others, but also the similarities.

This is the reason why we identify and describe three main European Projects dealing with energy efficiency investments, namely EeMAP, Investor Confidence Project ICP and DEEP databases of Energy Efficiency Financial Institutions Group.

1.2.1 EeMAP project

EeMAP (Energy Efficiency Mortgages Action Plan) is an initiative focused on creating a standard mortgage for financing energy efficiency measures. Connected to EeMAP there is the EeDaPP (Energy Efficiency Data Protocol and Platform), aimed at gathering all relevant data about energy efficiency mortgages in order to help the realisation of a market for these contracts. The goal of the EeMAP project is to involve banking industries, with several banks and financial institutions, and firms or organisation from the energy industries, in order to cooperate for creating a new ad hoc instrument. Therefore, the final objective would be to foster the development across Europe of a market for energy efficiency mortgages, that is currently not well developed. The focus is on the financial aspects of such interventions, in particular to enhance the knowledge of financial industries about EE. Indeed, banks are usually reluctant in lending because they don't have enough instruments and skills to correctly identify the riskiness of such energy efficiency projects. However, the EeMAP project provides evidence of lower probability of default for mortgages receiving subsidy for energy efficiency interventions[1]. However, EeMAP was not able to prove the causality of the relationship between the lower probability of default and the receiving of subsidies for energy efficiency interventions, as the project lacked the necessary data to verify this possible causality. The problem it is not only on the supply side of lending. The demand for green mortgages itself is underdeveloped due to the lack of knowledge by homeowners about the positive aspects of energy efficiency, and particularly about the financing aspects. Hence, the project is also focused on the stimulation of the demand side. In order to do so, the members of the EeMAP Consortium explained the benefits of such energy efficiency interventions to both customers and to lenders, both in financial terms but also in terms of other benefits related for instance to the climate. Moreover, they also started a dialogue with the policymakers with the purpose of triggering the improvement of the energy efficiency market.

[1] EeMAP: WP 5, D5.3 Technical Report on the Econometric Assessment and Results, 2019

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The Energy efficiency mortgages pilot scheme was launched in June 2018, after a long period of roundtable events where the Consortium discussed the best solutions with financial institutions, ESCOs and technical experts. Indeed, the key point of the project was the cooperation with a significant number of financial institutions from different European countries. As a result, lending institutions committed to test the product and provide feedback to the Consortium, while technical experts expressed their intention to support the implementation of energy efficiency measures. The advisory council committed to support the dialogue between different stakeholders involved, such as banks and policymakers. The Consortium in December 2019 set out the definition of the Energy Efficiency Mortgages, outlining that the energy efficiency interventions should meet energy performance in line with the EU requirements and target an improvement of at least 30% compared to the existing energy performance.

Compared to EEnvest, the EeMAP project focuses on studying and creating ad hoc financial instruments, thus taking into consideration only stakeholders that would lend money to invest in EE measures. Moreover, EeMAP does not address the technical risks of such measures but only the credit default risk, which is not within the scope of EEnvest. Therefore, EeMAP's results and evidences could be useful as a general framework for the financial part of the EEnvest platform, to describe the requirements of users seeking financing, but could also be useful for financial institutions.

1.2.2 The Investor Confidence Project

The ICP (Investor Confidence Project) started in 2011 in the USA and was replicated in Europe in 2015 thanks to the Horizon 2020 funding. The idea behind such project was the lack of standardisation and validation of energy efficiency measures, where there was uncertainty in terms of risk and results. Indeed, every energy efficiency project is unique, is different from others, and hard to compare because technical and financial solutions strongly depend on the object (type, age, use, etc.) and the subject (owner, tenant, financier, etc.). Thus, these specific characteristics and complexity, typical of the energy efficiency sector, usually don't match the standardisation required by the financial market for the evaluation of project. There is not one simple and standard way to assess and evaluate an energy efficiency project as it cannot be considered a standard product. As a result, investors might not have the tools and/or the skills to evaluate or compare different energy efficiency projects in terms of performance and certain risks and therefore they may decide to not invest at all. In the light of these adverse conditions, the Investor Confidence Project's goal is to create a standard for quality of energy efficiency interventions. Thus, the objective is the creation of a protocol, called Investor Ready Energy Efficiency™ that will provide an independent evaluation through best practices of the project under examination. Therefore, the acquisition of the certification would make it easier to attract investors as it assures that from the technical point of view the project has been analysed, assess and evaluated as viable by a qualified third-party. In fact, the main problems for financial institutions are the lack of skills and dedicated resources to evaluate such energy efficiency projects and the impossibility to have standards due to the complexity of each project. However, having a protocol such as the one created by the ICP will provide a standard for technical quality, thus financial institutions would be less reluctant to provide financing for those EE projects. Indeed, the use of the protocol might reduce the cost of due diligence, because it is a certification made by experts of the quality and reliability of the interventions. The typical phases of an energy efficiency project consist of a design phase, followed by an implementation phase of the designed energy efficiency measures, often along with the financing activity, and finally, once the implementation is completed there is the operational phase. It is only during or after the operational phase that actual performance results can be compared to those forecasted during the design phase and that performance certainty can be given With the ICP, certification is provided after the design phase and before the implementation phase , whereby experts analyse the energy efficiency measures and decide

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whether the project will receive the certification. So, the quality and reliability of the energy efficiency measures, through the certification, is set before the financing phase providing a certain level of assurance to the investors

This system is helpful not only for investors, because they have a tool that gives them assurance of quality and reliability of the project as well as lower risk for their investment. It is also useful for private persons, institutions or companies wanting to carry out energy efficiency measures in their buildings, in case they do not find a party that lends them money. Moreover, they will be more knowledgeable about the ability of the energy efficiency measures to respect the quality requirements in terms of technicality and bankability.

Such type of protocol is available for both private and industry buildings and retrofit of public lighting system.

So, the ICP is different from the EEnvest project, because the focus is specific on the issuance of certification of standard quality of energy efficiency investments. Consequently, other aspects are not considered (e.g. how to translate technical risk profiles into financial parameters, or take into account the different profiles of potential users, etc…)

However, the protocol is important for EEnvest because it could be an additional tool for users seeking financing, as they could use it in order to have a quality certification and to increase their opportunity to get their projects financed. Thus, these two H2020 Projects might be somehow combined, in the sense that the platform could go along with the ICP procedure for the acquisition of the certification.

1.2.3 DEEP

The database of De-Risking Energy Efficiency Platform (DEEP) is freely available to anyone. It contains data about energy efficiency measures in Europe and also in the US. In particular, it is possible to analyse, for each country, the type of interventions (e.g. HVAC, lighting, integrated renovations and others) and per building typology (commercial, residential, industry). The indicators provided by the platform are average payback time of projects, divided by country, type of building and energy efficiency measure, avoidance costs and energy savings. So, the aim is to create benchmarks for energy efficiency measures and compare a specific project with the others. The DEEP platform allows the user to select a country, a building and an energy efficiency measure and compare the average values provided by the database with its own project or the projection of the energy efficiency measures in case it is in the design phase. Moreover, the subscribers can upload the features of their own project, in order to enlarge the databases. As such, the database might be used not only to have a broader view on indicators of energy efficiency projects but also to analyse in depth the values for a country, a building type or a single measure. Moreover, it might be used to benchmark projects.

Therefore, the objective is to gather constantly more and more data about energy efficiency projects that can be analysed by different stakeholders (private person, companies, organisations, investors). DEEP may be a reference source for such interventions that provide evidence of the performances in both technical and financial terms. So, it would support the uptake of the market for EE.

Compared to EEnvest, DEEP does not analyse in technical and financial terms the quality of a project and does not provide output to the different users, but it is useful for benchmarking. Therefore, DEEP may be considered as the following step after the analysis of the EEnvest platform. Namely, the latter will provide indicators (payback time, energy savings, avoidance costs etc…) of interventions in a specific building and these indicators are the same as presented by DEEP, thus the user might compare the results from EEnvest with the ones on

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DEEP in order to have an idea on how the project is performing in respect to the benchmark. In addition, after having applied EEnvest, the user might upload the data on the platform in order to enlarge the databases.

1.3 EENVEST PLATFORM REQUIREMENTS

The platform requires several data from users in order to perform the analysis. The type of information is multivariate. Indeed, the input deals with technical, economic and financial features of the project. In particular, for the platform structure these different data will be used for the different analyses performed. In fact, information about buildings, the proposed renovation measures and the expected energy savings will be directed to the technical analysis. On the other hand, economic and financial data and also the expected energy savings, are addressed by the financial analysis. Finally, the different EE measures are linked to specific multi-benefits analysis. As shown by Figure 1, technical and financial analysis are connected. In fact, the final Key Performance Indicators (KPI) provided by the platform are the results of the DCF model, which combines inputs provided by the users, market data (such as prices and climate data) but also on the results of the technical analysis.

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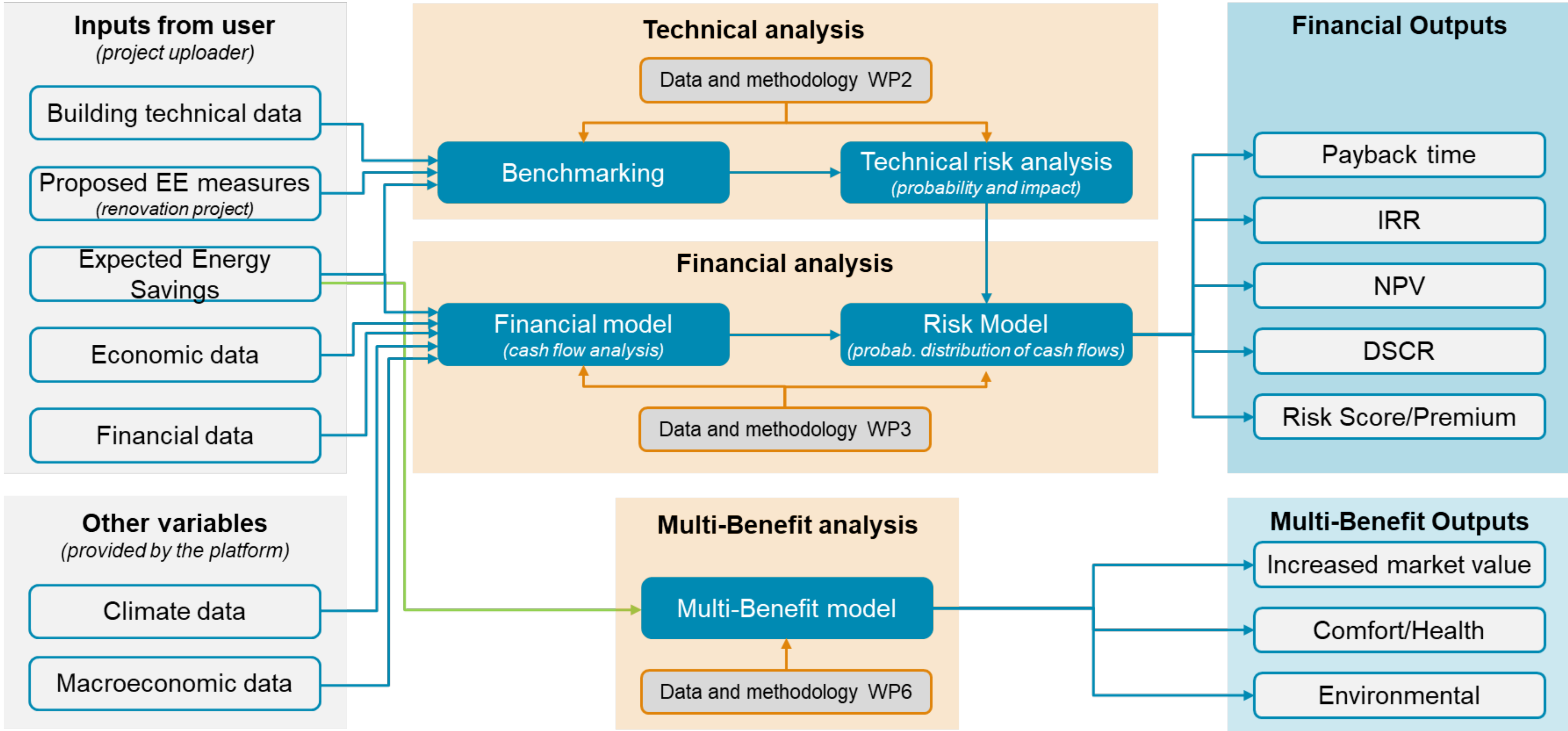

Figure 1: Platform flow chart

1.3.1 Inputs, variables and parameters

As mentioned above, the platform requires input data to be analysed and elaborated in order to perform the technical and the financial analysis.

For what concerns technical inputs, information deals with:

- **Building technical data:** square meters of the buildings, number of windows, number of floors, building typology (e.g. commercial or residential) and others;
- **Proposed EE measures:** the number of possible measures is wide and diverse and it is also possible to combine more than one measure within the same project. Each measure bears its own technical risk and one of the main challenges of the technical risk analysis is the assessment of the overall risk deriving from the combination of multiple measures;
- **Expected energy savings:** both in terms of kWh for the technical analysis and in terms of Euros for the financial analysis.

All these data and information are fundamental for technical analysis as they might impact the riskiness of the project. Technical inputs and analysis are treated in more details in WP2 (D2.1).

As far as the financial inputs are concerned, as stated above, expected energy savings are the baseline for the quantification of expected "income" from the project. In fact, energy savings represent the first input variable for the discounted cash flows model that will be used for the financial analysis of the investment. Other relevant financial inputs that will be provided directly by the user, may be divided into:

- **Economic data:**
  - energy price: the variation of energy price might produce higher or lower monetary savings. In facts, a decrease in energy price may results in a lower monetary value of energy savings, thus making the investment less profitable;
  - investment cost: the cost related to the purchase and implementation of each single measure and for the project as a whole is a fundamental value to assess whether the project produces enough cash inflows to cover this expenditure. Investment cost is also an important parameter to be referred to for the risk analysis and in particular for the risk related to damage, malfunctioning or fault of the equipment as assessed in WP2 and later on in Task 3.3;
  - recurring maintenance costs and other operational costs related to the project: depending on the type of measure implemented, these costs could be higher or lower with respect to historical values before the implementation of the project. They are important to assess and consider a correct value for yearly expenditure and cash outflows;

  All these data are important because they may all affect expected cash flows deriving from the energy efficiency measures.

- **Financial data:**
  - financial structure of the project: as will be deeply discussed in Paragraph 1.3.3, users may use own funds, a mix of equity and external financing or only third-party financing. The users' choice of the financial structure will have a direct effect on the discounted cash flow model, as it takes into consideration also the repayment of debt;

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– type and features of financing: in case of financing, the platform will require the user to provide all data and information needed to perform the financial calculations, such as interest rate, duration, repayment plan, banking fees, covenants, etc... These parameters have different financial impacts on cash flows for debt service and cash flows to equity (and related KPIs), and thus need to be assessed correctly. As a simple example, a variable interest rate may have an impact on the cash flows related to interest payment, thus increasing the risk and uncertainty of KPIs. If one or more of these values are not provided, the platform could perform, if required, a standard simulation based on standardized values;

– cost of capital: is an important parameter needed to calculate the Net Present Value of the investment. As this is a parameter that depends on the investors' risk profile, structure, and other variables, its value should be provided by the user itself. Otherwise, if the value is not provided, the platform could assume a value based on market benchmarks.

In order to perform all the calculations, the platform will also consider other variables and parameters that are not directly provided by the user, such as:

- **Climate data:** information about climate variability in the area where the building is located, which determines the risk related to the variability of heating degree-days during the project period. This aspect will be further described in detail in D3.2;
- **Macroeconomic data:** inflation rate, risk-free rate and other variables that will be used in the model, as well as the historical data needed to calculate the variability of energy prices which determines the risk related to the variability of energy costs during the project period. This aspect will be further described in detail in D3.2.

1.3.2 Main functions and analysis

Following the flow chart showed in Figure 1, inputs provided by the users of the platform flow into three main "engines" of elaboration:

1) **Technical analysis:** the first step of data elaboration is the technical analysis. Depending on the technical inputs provided by the user and on the assumptions made, the model performs a benchmarking analysis to check the consistency of data and then calculates technical risks. Technical risks will be calculated according to the methodology developed in WP2 D2.1. Particularly, the technical analysis will provide an estimation of frequency and impact of the different risks related to each single renovation measure. Technical risks may include, for example, the underperformance or fault of the installed equipment, damages to components that need to be replaced, unexpected events such as water/air infiltration, humidity and so on. So, for each renovation measure proposed by the platform user, the technical analysis "engine" is expected to provide a calculation of the statistical distribution of technical risks, that will then flow as an input into the financial analysis engine.

   The methodology for the deployment of the technical risk analysis is developed in WP2 D2.1 while the methodology for the definition of the technical/financial risk interaction will be defined in Task 3.3 and presented in D3.2.

2) **Financial analysis:** the economic and financial data provided by the user, together with the data about energy savings, will flow into the financial evaluation model. This model, that will be based on the Discounted Cash Flows (DCF) model as shown in Paragraph 2.2.1, will perform a first calculation using all data provided by users. This first calculation will represent the baseline model to which the risk analysis will be applied. Therefore, the following step will take into consideration technical risks in order to translate them

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into financial risks. In particular, statistical distribution of risks will be applied to the DCF model in order to provide a probability distribution of outputs (KPIs), with their expected value, variance and asymmetry. In fact, for example, the distribution of underperformance risk obtained from technical risk analysis could affect the amount of energy savings, thus the income or savings of the model. On the other side, the distribution of the risk related to fault of the equipment might increase costs for extraordinary maintenance. In addition to technical risks, the financial risk evaluation model will also take into consideration the risks related to variation of other variables, such as energy price and the impacts of weather.

Please note that the EEnvest financial risk evaluation model **will not consider**, as they are not in the scope of the project:

- Credit risk: which is related to the risk that the borrower of a loan defaults and is not able to meet with the contractual obligation of paying back the loan (the platform will indeed calculate useful indicators such as DSCR related to the project but will not assess the credit-worthiness of the borrower itself);
- Vacancy risk/change of use risk: which is related to the risk that the building, or part of the building, in which energy efficiency investments are made becomes vacant for a long period of time or its destination of use is changed so that there is a significant change in its time and type of use (e.g. an office that was planned to be open 10 hours/day per 5 days/week changes into an office open 5 hours/day per 6 days/week). These conditions may have a very significant impact on the euro amount of savings and thus on the payback and profitability of the investments. These variables cannot be considered by the platform as they are building-specific and can only be assessed by the building owner itself;
- Behavioral risk: the platform does not capture the risk of underperformance due to the user behavior such as keeping the windows open or other habits negatively affecting the performance of the energy efficiency measure;
- Cooling performances: the platform will focus on heating performances and will thus consider Heating Degree Days as a risk variable. For technical reasons, cooling performance and risk deriving from Cooling Degree Days will not be assessed

Task 3.3 will provide more accurate details about the financial risk analysis, that will be shown in Deliverable 3.2.

3) **Multi-benefits analysis:** This one relates to indirect benefits from the EE measures. In particular, the analysis describes the non-monetary outputs produced by investing in energy efficiency. Indeed, regardless of any economic financial result of such projects, users might be interested in other benefits. The other benefits group might be composed of environmental, comfort, social, health, increased buildings value and other benefits. In fact, users might be interested in the amount of CO2 reduction provided by the project. Moreover, the EE measures may create a more comfortable house and so improve the healthiness. In addition, the intervention might increase the buildings energy class or simply add value, thus the buildings value increases. This may be important for any owner who would sell the building. The peculiarity of the analysis and the description of multiple benefits will be deployed in WP4.

Ultimately, the platform combines the three analyses and produces a report. The process for the drafting of the report might take time. The pace may depend on the complexity of the project. Therefore, there will be two solutions: an immediate standard report for all the projects provided or the delivery of a tailored report for a specific case. The latter might derive from the huge amount of investments or from the complexity. The tailored report in any case provides more ad hoc information, unless it requires the intervention of an analyst. Thus, there would

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be the loss of immediacy of a standard report and such standard report might be enough for certain users. In order to cope with this problem, the solution is to directly request from the stakeholder about its preference. The results are developed in chapter 3.

1.3.3 User profiles

The platform will be available to any kind of person/organization having a vested interest in energy efficiency investments. Thus, there are various stakeholders who might be possible users and each of them has different expectations from the platform and may use it for different purposes and objectives. For these reasons, it is crucial to univocally identify these stakeholders and their needs, in order to have in mind all the possible outputs satisfying their criteria.

In order to do so, we developed a scheme to identify all possible user types by classifying them into categories and assigning them a feature to characterize their status. This way, we created a one-to-many database structure that will allow the platform to assign each user to a single pre-defined profile.

The first macro category relates to the **ownership** of the building. Users may be firstly divided into **Owners** and **Non-Owners**. This first classification allows to split all possible users into two main categories: the users that own the building to be renovated (regardless of their type) and the ones that don't.

Then, users are divided by **User Type**, which is a category that identifies the nature of the user, and then again by **Investor Type**, which is a category that splits users according to their willingness to invest or not into the renovation of the building.

At the end of this process, each possible user profile has been identified and it is possible to define, for each of them, the expectations from the platform and the most suitable outputs for them.

The detail of the categorization process is described in the following paragraphs.

1.3.3.1 Owners

Owner of the building is defined as the subject (physical person, bank, firm, ESCo or other) that owns the property of the building and that is interested in the energy efficiency project.

Additionally, an owner can physically occupy the building or not, being in the latter case a lessor. This distinction is important in order to assess whether the owner is looking to start a renovation project on a building that he occupies himself, thus directly benefitting from energy savings and other non-energy or multiple benefits, or on a building occupied by a tenant, thus making the tenant benefit from the renovation and indirectly himself through the possibility of increased rent income for example.

Eventually, there is the distinction between investors and not investors in the project. Indeed, the owner of the building, being an occupant or a lessor, could be interested in directly investing in the renovation measures with his own funds and/or could be looking for financiers (e.g. a bank or an ESCo) willing to invest in his project. Within the scope of the EEnvest project the investor is thus the party that provides the initial financing of the energy efficiency measures.

In all these cases, the expectation of the user and the purpose of the platform is different.

In conclusion, for our purposes, owners could be divided into:

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- **Owner - occupant - investor:** Owner of the property, which also is occupant, pays energy bills and invests own funds in energy efficiency measures. His goals for energy efficiency investment would be to reduce energy and maintenance costs, to increase building value and to achieve other non-energy benefits (comfort, air quality, health). The reason for him to use the platform would be to evaluate risks and outcomes of an energy efficiency investment. However, it is also possible that this type of user does not use only own funds to finance 100% of the project, but would also search for a third-party co-investor. Therefore, in this case the user would expect the platform to evaluate the project with the aim of attracting co-investors;

- **Owner - occupant - not investor:** Owner of the property, which also is occupant, pays energy bills but will not invest own funds in energy efficiency measures. The goals are the same as owner - occupant - investor. He will use the platform to obtain an evaluation of risks and outcomes with the aim of finding a third-party interested into financing (Investor, ESCo or Financial Institution).

- **Owner - not occupant - investor:** Owner of the property, which rents the building to tenant(s) and invests own funds in energy efficiency measures. The goals for this category would be to reduce energy and maintenance costs, to increase building/rent value and environmental benefits. The reason for using the platform is the same as for the owner - occupant - investor, while the focus would be slightly different. Indeed, this type of user would be interest in the value increase of the building rather than energy savings, as he is not the occupant and he might not directly be in a position to benefit from the reduction of energy costs. Even so, this type of owner may use the platform to find a co-investor in the case he is willing to invest less than 100% of his own funds.

- **Owner - not occupant - not investor:** Owner of the property which rents the building to tenant(s) but will not invest own funds in energy efficiency measures. The objective is the same as the previous category while the reason for him to use the platform would be the same as the owner-occupant-not investor user profile, thus looking for third-parties to finance the energy efficiency measures on the building.

1.3.3.2 Not Owners

The opposite case of Owner is Not Owner.

Not Owners are then divided by User Type according to their nature. For our purposes, we identified 5 User Types: Tenants, ESCOs, Financial Institutions/Financiers, Fund Managers and Crowdlending Platforms.

Possibly, in some cases there is a distinction between investors and not investors in the project.

The definition and characteristic of the Tenant user profile is as follows:

- **Tenant - investor:** Tenant of the property that is interested into investing in energy efficiency measures in the building that he occupies that guarantee a return before the expiry of the tenancy contract. The objectives could be to reduce energy costs and to achieve other non-energy benefits. The reason to use the platform would be to evaluate risks and outcomes of an energy efficiency investment. The expected outputs, other than risk assessment, is in particular payback time, as this category would benefit from the intervention only in case of positive return prior to the expiry of the tenancy contract; otherwise, there might not be reason to invest in such projects. As for the owner-investor case, also this category could decide to finance only part of the investment, thus using the platform to seek co-investors.

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- **Tenant - not investor:** Tenant of the property that is interested in energy efficiency projects but is not willing to invest own funds in energy efficiency measures. The goal is the same as in the previous case. The reasons to use the platforms are to evaluate risks and outcomes of an energy efficiency investment and to find a third-party interested into financing (Investor, ESCO and Financial Institution) or implementing (ESCo) the project. The expected outputs from the platform will mainly be payback time.

It may seem that tenant is a residual category, because it might be unusual for a person/firm to invest in a building whose ownership is not in his hands. Moreover, energy efficiency investments could have a longer payback time than the duration of the tenancy contract, or it could be possible that the investment would be profitable only after the termination of the tenancy contract, even if break-even is achieved. Thus, the incentive for tenants to invest are rather low. However, in some cases, especially in the public sector, there might be situations where tenancy contracts are very long, e.g. more than 10 years, therefore energy efficiency investments could be worth pursuing. Nonetheless, the platform should take into consideration all possible energy efficiency measures, for instance those energy efficiency measures on specific installations or parts of the buildings (e.g. recommissioning, relighting, on site renewable energy) that could pay back in shorter time and thus could be more suitable for tenants.

Other potential users of the platform are the Energy Service Companies (ESCo), which are companies that are able to integrate the whole project life of an energy efficiency project, often under a DB(F)M-type service (Design, Build, (Finance) and Maintain) or parts of it. ESCOs are considered a specific category as they may be interested into the promotion of a project or in the actual implementation of the renovation works.

Also, for this stakeholder there is a double classification, depending on their willingness to directly invest own funds or their preference to look for investors. Therefore, the two categories are:

- **ESCo - investor:** Energy Service Company financing the project. The goal of this category would be to promote and activate a new investment project with a good return and to obtain environmental benefits. The ESCo, as developer of a project, could also be interested into using the platform to have a third-party evaluation of the project to promote it to his customers. Therefore, the expectation is to receive a reliable assessment of the renovation measure and the related risks.
- **ESCo - not investor:** Energy Service Company looking for investors for a project. The objective is the same as in the previous case, while the evaluation from the platform would be used to attract third-party financing. For this reason, the main expectation would be the upload of the project on the search&match function of the platform in order to allow investors to evaluate it and to gather the funds needed to activate the investments.

The remaining user profiles, financial institution, fund managers and crowdlending platforms, are all considered to be investors, as their objective is to invest own funds, debt or equity, into profitable projects in order to have a return. The description of these user profiles is the following:

- **Financial Institution - debt provider:** Financial Institutions or other kind of financiers that provide debt capital for the investment. The objective would be, on one hand, to activate new lending, and on the other hand to support the achievement of environmental benefits. This user would use of the platform to have a support in calculating technical risks as they may lack the necessary skills to assess project risks

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and performance. Therefore, the expected outputs would be a risk assessment and specific KPI such as the Debt Service Coverage Ratio;

- **Fund manager - equity provider:** Manager of an investment fund investing in energy efficiency projects. The objective would be, on one hand, to activate new investments and, on the other hand, to support the achievement of environmental benefits. This user would use of the platform to have a support in calculating technical risks as they may lack the necessary skills to assess project risks and performance. As this user is investing in equity, the most important outputs (KPIs) would be IRR and NPV of the investment;
- **Crowdlending platform:** This category relates to a crowdlending platform that offers investment services to its registered retail investors. The platform operates on behalf of its subscribers by investing the funds (in the form of lending) into projects which have been filtered earlier on by the platform. The EEnvest platform could support this kind of users to activate new lending, while achieving environmental benefits. Thus, the platform could be useful to receive a valuation of the project risks and provide the necessary information to the retail investors. Finally, the expected outputs would be KPIs such as the payback time of the investment and DSCR.

As stated, these eleven different users expect specific outputs from the platform. Therefore, the framework and tools chosen to structure the analysis of energy efficiency investments are built considering all the stakeholders' peculiarities.

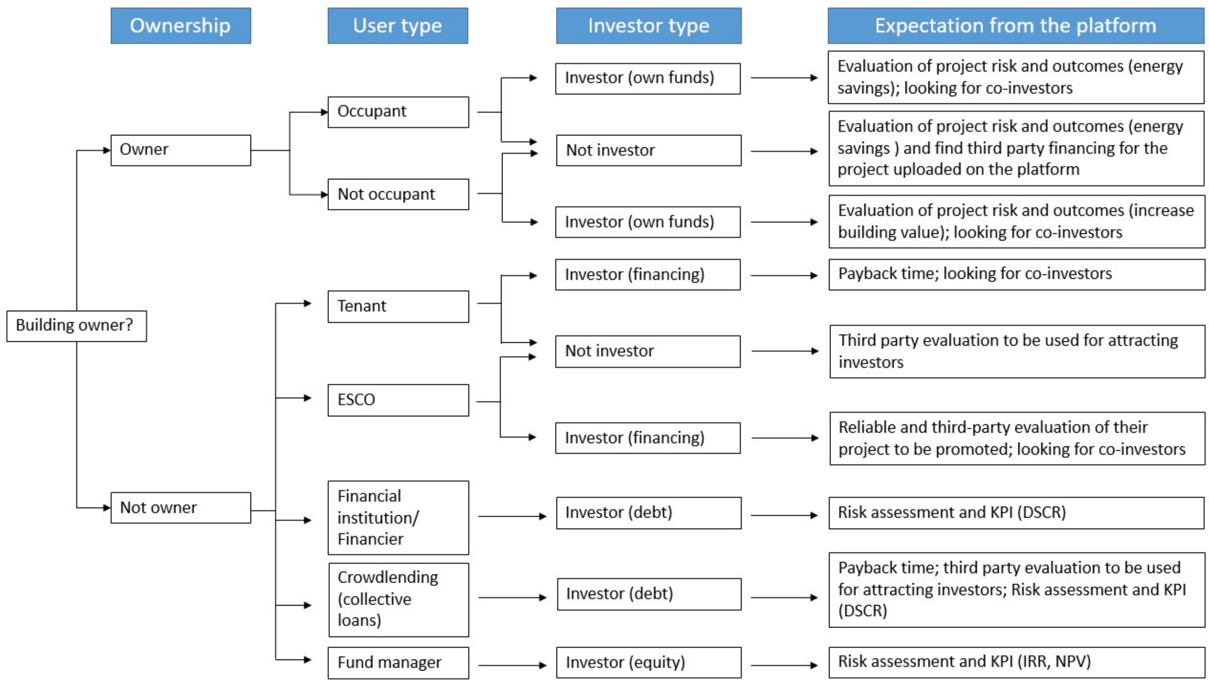

Figure 2: Types of users

1.3.4 Outputs

The platform will provide users with a complete analysis of the project. The result is a report made of the three levels of analysis, as already presented in Figure 1. It will hence contain data based on technical, financial and multi-benefit analysis. In particular, technical analysis will provide technical information about the EE measures. The methodology used related to the technical data is described in WP2 D2.1. As to the financial analysis, the outputs will feature

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several financial KPIs. Finally, the methodology related to the output of the multi-benefits analysis is presented in details in WP4.

The final report will be fundamental for the search&match function of the platform. In fact, it can be used as a third-party evaluation of the project. The role of this evaluation could be to attract investors or to validate the intervention in the case of ESCOs.

The focus in this section is the description of the resulting financial KPIs. These might be more or less important depending on the users' type. Therefore, the second aim of this section is the association between KPIs and each stakeholder. However, it is also important to identify the connection between users and the outputs derived from technical and multi-benefits analysis. In particular, the third-party evaluation output uses information from these two analyses. So, in order to have the complete picture, Table 1 will contain not only KPIs associated to users' type but also other outputs from the reports.

First of all, the identification of user profiles is very important because each user may be interested in the platform for a different reason, may have different expectations from it and, as a consequence, the outputs should be tailored on their needs. Indeed, the analysis of energy efficiency investments may produce a lot of information, such as payback time, energy savings, cash flows produced during the period, internal rate of return, CO2 reductions and so on. All these data and indicators can be calculated for any project. However, they may not have the same importance and relevance for the different type of users. Therefore, it is important to identify beforehand all possible outputs that the platform may generate and then to assess their relevance to each user in order to establish a standard framework of analysis and a standard set of outputs for each kind of user. The relevance of the outputs for each type of user has been assessed through a series of interviews with stakeholders as reported in Chapter 3.

The overall set of KPIs that the platform may generate as output are the following:

- **Simple payback time of the investment:** Indicates how much time (years) it takes for the project to produce enough net positive cash flows to repay the initial investment. This indicator is important because, in the form of a simple and easy to understand number, gives an idea of how many months or years are needed before the project breaks even and possibly becomes profitable. In other words, it indicates how long funds stay in a project. This indicator is primarily a risk measure, for instance a low payback time would indicate lower risk and possibly higher profitability. In some specific cases (I.e. in case of liquidity-driven investors) in the decision-making process of an investment it is the fundamental criteria to decide whether to invest or not. In fact, investors usually set a (often arbitrary) threshold payback time and use it to evaluate investments. However, this should not be the case of medium- and long-term projects such as deep retrofit of buildings. In this case, investors should appreciate KPIs that consider the time value of money.
- **Payback time of equity invested:** Indicates how much time (years) it takes to the project to produce enough cash flows to repay the initial amount of equity invested into the project. If the investment is fully financed with equity, it equals the simple payback time indicator.
- **Net Present Value (NPV) of the project:** It is an indicator of the economic viability of a project. It's calculated as the sum of the present value of future cash flows, discounted using an appropriate discount rate. It can be applied to project cash flows, which are the cash flows generated by the project itself regardless the financial structure (in this case using WACC as discount rate) or to Free Cash Flows to Equity, which are the net cash flows available for the investors after the payment of debt (in this case using cost of capital as discount rate). NPV is a monetary value (in Euros) that indicates the

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amount of value created (if positive) or destroyed (if negative) by the project. Thus, if NPV is positive the investment is convenient.

- **Internal Rate of Return (IRR):** It is one of the most widely used indicators of the profitability of a project. It is calculated as the discount rate that sets the net present value (NPV) of a series of cash flows equal to zero and it represents the rate of return of the cash invested in a project. IRR can be calculated both generically for the project, applying the formula to the overall project cash flows (regardless the financial structure of the project), or for the equity, applying the formula only to the cash flows related to equity. The IRR is important for an investor because it provides, in the form of a single number, the expected rate of return of cash invested in the project over the whole lifetime.
- **Debt Service Coverage Ratio (DSCR):** It is an indicator widely used in the *project financing* sector to evaluate the ability of a project to repay a debt. It's calculated as the ratio between the operating 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. If DSCR is over 1, the project generates enough cash to pay back the loan. Usually, banks require business plans to have a DSCR over at least 1,20 in order to ensure the bankability of the project.
- **Risk premium:** It represents the additional return required by the investor compared the risk-free rate. As every project has its own riskiness, investors require the return to reflect the risk accordingly in order to invest in that project. Thus, the higher the risk, the higher the return expected by the investor to bear that risk. Risk premium is an important indicator to calculate the correct discount rate to be used for the calculation of the NPV of the project.
- **Overall simple risk indicator:** Considering a combination of the abovementioned KPIs, the platform could provide a score that represents the overall riskyness of the project, easy and immediate to understand (as an example, it could be a numeric score on a scale 1 to 5 where 1 is the lowest riskiness and 5 the highest riskiness).

The aforementioned indicators are the KPIs provided by the platform to users. They are the results of the economic analysis of the project.

In addition to that, there are outputs from the technical and multi-benefits analysis, particularly the distribution of energy savings provided by technical analysis in terms of Kwh and the complete report in terms of third-party evaluation. But there is also a general risk assessment of the project and the relative multi-benefits as comfort, healthiness or lower environmental impact.

So, in the following table each output is connected to one or more users' type.

Outputs	Definition	User type
Payback time	Indicates how much time (years) it takes to the project to produce enough income and/or savings (cash flows) to repay the initial investment	Tenant investors, crowdlending
Internal Rate of Return	Discount rate that sets the NPV of a series of cash flows equal to zero and represents the rate of return of the cash invested in a project.	Fund manager

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Net present Value	Sum of the present value of future cash flows, discounted using an appropriate discount rate	Fund manager, Financial institution
Debt-Service Coverage Ratio (DSCR)	Indicator widely used in the *project financing* sector to evaluate the ability of a project to repay a debt	Financial institution and crowdlending
Risk score-premium	It represents the additional return required by the investor compared to the risk-free rate	Fund manager, Financial institution
Overall simple risk indicator	Score assigned to the overall riskyness of the project	All
Energy savings	Amount of expected savings from the energy efficiency interventions	Owner occupant
Third-party evaluation	Technical and financial report of the proposed project	Owner, tenant and ESCO that seek for financing
General risk assessment	Description of risk related to the intervention	Banks, Owner investors, Fund Manager, Financiers
Multi-benefits	Non-economic benefits derived from the EE measures (better air quality, lower CO_2 emission, more perceived comfort)	Owner occupant, ESCO

Table 1: List of outputs by users' type

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2 TOOLS AND MODELS FOR FINANCIAL RISK ANALYSIS

2.1 METHODOLOGY

Literature review is the starting point to gather all possible information about financial risk analysis and energy efficiency investments. Indeed, the first step consists of the analysis of what has already been proposed by authors or by other similar European projects. From this examination, it is possible to identify multiple sources as reference points for the EEnvest model. In fact, the aim of this work could be slightly different from the ones presented in literature, however the financial methods or the frameworks used for their analysis could be useful also for this project.

Therefore, after the collection of all materials, the following step is to screen the most used financial frameworks presented in literature. Then, among all the sources, the Consortium will identify the most appropriate one for its project.

The main interest at a first stage is to find different frameworks connecting and translating technical risks to financial risks. Although there are little empirical evidences about this relationship, there is a model, Energy Budget at Risk (EBaR®) that responds to our requests, and it is therefore used as a reference for this analysis. Indeed, under this framework, the author Jackson works on translating technical and other risks of energy efficiency investment into financial risks. Moreover, he also applies several financial methods, most commonly used in finance (e.g. Monte Carlo Simulation and Value at Risk), that are suitable for the EEnvest project as well. So, the next step is to tailor these instruments for the EEnvest objective of the analysis and re-proposing them into a model that follows the EBaR®, but with some adjustment and enhancement.

2.2 TOOLS FOR FINANCIAL ANALYSIS

In this first step of literature review about energy efficiency investments there is the collection of all relevant materials. The following step is to identify the works that could be a basis for the EEnvest approach. During the screening process, several financial tools are recurrent in the evaluation procedure of energy efficiency investments. For this reason, despite the different goals of the authors, and for their validity, DCF, Monte Carlo Simulation and VaR are chosen as backbone also in the EEnvest model.

2.2.1 Discounted Cash Flows (DCF)

The Discounted Cash Flow (DCF) model is one of the most used methods in valuations (Koller at al., 2015). The aim of this method is to calculate the present value of future cash flows of assets and liabilities. Taking into account both positive and negative cash flows (CF) generated by the project, the net cash flows (CF) for each year of the whole project life are assessed. Then, taking into consideration time-value of money, discounting those net CF, the results of DCF is the present value of a general investment (Damodaran, 2006).

The importance for DCF in the EEnvest platform lies on its effectiveness as a tool aimed at the evaluation of investments. Indeed, investors usually have the possibility to choose among different projects or stocks. Therefore, it is necessary to apply a screening criterion able to pick the most profitable option. The Discounted Cash Flows supports investors in the decision-making process. In fact, the decision is made at time 0 where only the amount of money to be invested is certain. Whereas, future cash flows may be not realized as forecasted. However, the DCF compare the initial cost at time 0 with future cash flow realization of the investment.

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The reason behind this method is that the value of a stock or a project should be the present value of its future cash flows. Thus, in order to be attractive an investment should produce present value of inflows at least equal to the one of the outflows. So, investors may use the DCF model for different investment alternatives and assess which alternative provides the highest present value. There could be cases where the NPV of the projects are all negative in each scenario analyzed. In that case, the solution could be to pursue the least negative or to look at other non-economic benefits generated by the investments.

The future inflows usually are dividends for stock (for shareholders), coupon payments for bonds (for lenders), rent income (for lessors) or increased revenues (for businesses) so generally a kind of income from the investments. However, in the case of energy efficiency (EE) investments there are no such type of inflows. Indeed, homeowners who occupy the dwelling themselves do not receive any revenues from the investment. Therefore, the revenues side of the model is replaced by the savings (or increase of savings) on energy expenditures generated by the energy efficiency investment. In fact, the f EE measure is analyzed comparing the implementation cost of the measure at inception, the possible replacement investments and additional operating expenses along the asset's life, and the annual inflows produced in terms of savings (energy, maintenance, labour,…). Looking exclusively at the DCF analysis based on financial logic would dictate that the interventions should be pursued only in case of positive NPV, otherwise there would be no reason to invest in non-profitable projects.

Even though the DCF model is one of the most used methods for the evaluation, there is the problem of uncertainty. Uncertainty is embedded in the future cash flows (amount, timing) which are estimated, as well as it is in the discount rates. For instance, the choice of discount factors depends on the type of investments, as some projects are risker than other, thus they require higher discount factor. Also, the investor's type matters, as being more or less risk adverse, or simply being a different subject, e.g. bank instead of a company, translates in different values since the discount rate should be at least the minimum rate of return required by the subject involved in the analysis, this rate is also known as the cut-off rate. In fact, an investor would choose projects with a return equal or higher than a threshold (Enzler et al., 2014 and Damodaran, 2005). Therefore, in the DCF this threshold is used as a starting point to define the discount rate, then possibly changed depending on the riskiness of the investment.

The importance of choosing the appropriate discount rate is measured by the consequences of this choice. An even negligible change in the rate can cause a remarkable change in the present value. In literature there are lot of methodologies to calculate the most appropriate discount factor, according to each specific case (e.g. WACC).

Furthermore, another issue arises when the project has an infinite life horizon, for example companies are usually evaluated under this assumption. In fact, in cases of non-definite life time period, DCF requires the calculation of a Terminal Value (TV) that captures the continuing value of a firm, from the last estimated cash flow to infinite. In order to do so, the TV needs assumptions that, most of the cases, are subjective. This produces lower robustness than the punctual estimation. Moreover, the continuing value of the project assumes that the cash flows could grow or could be stable, impacting directly the formula, creating even more complexity since it needs to be established whether or not the cash flows are likely to grow and then what growth rate should be applied.

The following is the general formula for a project of finite time horizon:

$$PV = \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \cdots + \frac{CF_n}{(1+r)^n} = \sum_{n=1}^{n} \frac{CF_n}{(1+r)^n}$$

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In case of infinite time horizon, the equation becomes the following:

$$PV = \sum_{n=1}^{t} \frac{CF_n}{(1+r)^n} + \frac{TV_t}{(1+r)^t}$$

This is the calculation for the Terminal Value with growth:

$$TV\ growth = \frac{CF_n\ x\ (1+g)}{(r-g)}$$

Instead, the calculation for stable CF is:

$$TV\ no\ growth = \frac{CF_n}{r}$$

In the specific case of energy efficiency investments cash flows over time are almost defined and renovation measures usually have a defined timeframe and duration. Thus, TV approach is not suitable and will not be used in the EEnvest platform.

Regardless of the specific formula applied (with or without TV, with or without growth), the model calculates the rate of return that makes equal to zero the sum of the cost for the initial investment and the cash flow generated from this initial investment, I.e. the rate that makes the net present value equal to zero. This rate is the so-called Internal Rate of Return (IRR), that is usually compared with a minimum rate of return in order to guide investment decisions and compare profitability of different projects.

This is the formula for the IRR:

$$NPV = 0$$

$$0 = \sum_{n=1}^{n} \frac{CF_n}{(1+IRR)^n} - C_0$$

Because of the nature of the formula, however, IRR cannot be calculated analytically and must instead be calculated either through trial-and-error or using software programmed to calculate IRR.

2.2.1.1 DCF for the EEnvest model

Technical risks may impact the profitability of the investments. In particular, they might increase the cost of the intervention or reduce energy savings. Moreover, there could be external factors (e.g. weather, energy price), that could affect CFs either positively or negatively. Therefore, the risk analysis performed with other calculation tools is reflected into EEnvest's discounted cash flow model. In fact, the input provided by users and the consequent risk analysis will be translated into a DCF. So, it is the tool chosen for the representation of financial output.

The DCF provides a yearly image of all the financial variable of the project. In fact, it is possible to calculate for each year the expected amount of energy savings, costs and so the expected cash flows. Then, each CF should be discounted to the present value in order to estimate the IRR and NPV of the project. This allows users to know whether the investment would meet the minimum required return or not.

Moreover, the DCF might be tailored for each user type. For example, in case of an owner who takes debt, the model would consider also the payment of interests and principal of the debt in order to calculate IRR and NPV for the equity invested. On the opposite, with the use of 100%

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own funds interest payment would not be considered. Thus, the DCF structure depends on the inputs provided by users at the beginning of the process.

A detailed description of the DCF model will be provided by WP4 while the actual application of the DCF to the EEnvest model will be described in D3.2.

2.2.2 Monte Carlo Analysis

Monte Carlo Simulation addresses the issue of estimating the result of a process that is not perfectly predictable due to the presence of random variables. Therefore, the aim of this analysis is to determine the possible impact in forecast and prediction, under an environment of risk and uncertainty. It is the best representation of the so-called *what-if* analysis (Raychaudhuri, 2008).

This statistical model is used in different sectors, such as finance, engineering, science and supply chain. The Monte Carlo analysis works as follows.

Firstly, after having identified the random variables and their distribution function, the simulation extracts a random value from the distribution and repeats the draw several times, e.g. one million, generating different numbers each time the simulation is performed. Therefore, in case more than one variable is involved, the simulation produces a group of values from each distribution. At the end, having generated thousands or millions of random values, the grouped results would show a final distribution of the process, that might take different forms. From the result obtained by the simulation it is possible to produce statistical considerations or analyses (e.g. mean, standard deviation, skewness). Therefore, the Monte Carlo simulation addresses the problem of randomness by obtaining a probability distribution function, as shown by Figure 4.

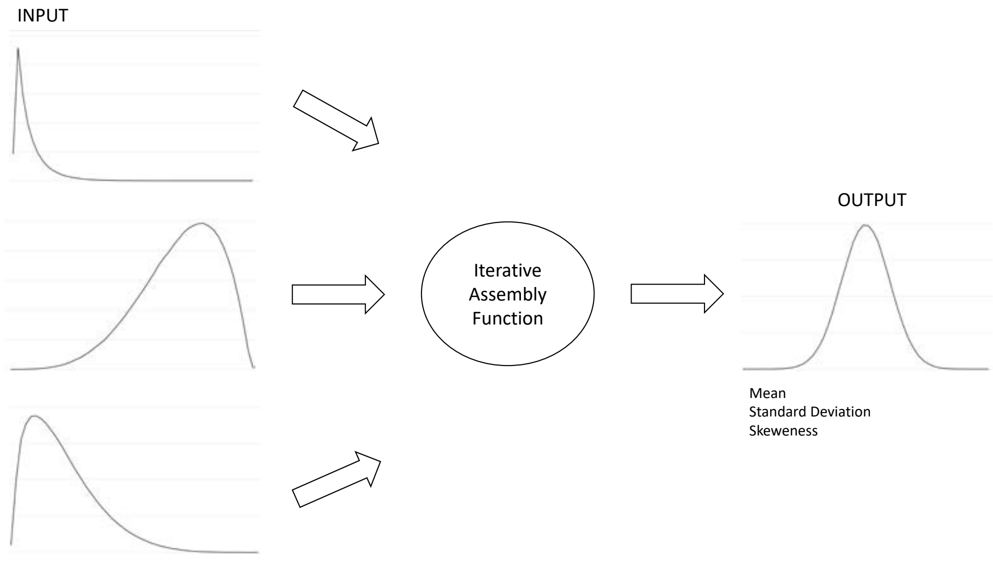

Figure 3: The process of Monte Carlo Simulation

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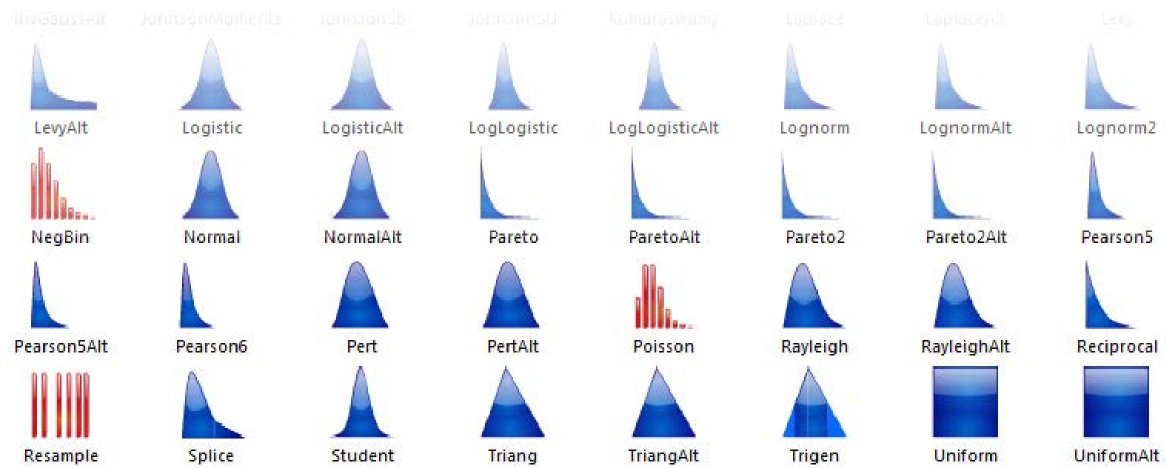

Figure 4: All possible distribution functions after Monte Carlo Analysis[2]

The important part of the process is also to verify whether the random variables are correlated or not, meaning that it's necessary to assess whether the extraction of one variable from a distribution does or does not influence the result of the extraction of the variable from the other distribution. As the Monte Carlo Simulation in its base form assumes stochastic independency between distribution functions, the set of results from the simulation are supposed to be not correlated to each other. However, in case of correlated random variables, the simulation should consider this relationship, as the second variable extraction should depend from the first one, so it could not be an uncorrelated draw (Chang et al., 1994).

Moreover, it is important to know the exact distribution of random variables in order to get relevant results from the simulation. Also, the greater the number of runs the higher the accuracy of the outcome, although this needs to consider the required time and the power of the machine.

2.2.2.1Monte Carlo Analysis for the EEnvest model

In the EEnvest model, the users provide the inputs for the analysis made by the platform. The Monte Carlo technique is fundamental to account for uncertain risks. In fact, technical risks may impact on the savings given by users, therefore the amount might not be the one provided. The Monte Carlo analysis starts from the distribution functions of technical risks related to each renovation measure and then combines them together. The result could be, for example, the distribution of the energy savings that would have an expected value, variance and asymmetry. In order to obtain a final distribution of the combined variable, the process will replicate the Monte Carlo simulation one million times, extracting respectively one million combinations of different parameters. More precisely, in each scenario there will be a cash flow produced by that Monte Carlo Simulation. This CF would be the differential between revenues and costs for that drawing. The repetition of the simulations, in the EEnvest case one million times, allows reproducing one million different outcomes of cash flows, from which a probability distribution can be derived. So, every simulation will produce the CF and the relative IRR for example and then the combination of million results will provide the IRR distribution, as the Figure 5 shows.

2 Retrieved from https://www.palisade.com/risk/monte_carlo_simulation.asp

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More technical details an explanation of Monte Carlo analysis in the EEnvest model will be described in D3.2 - Technical and financial risk evaluation model.

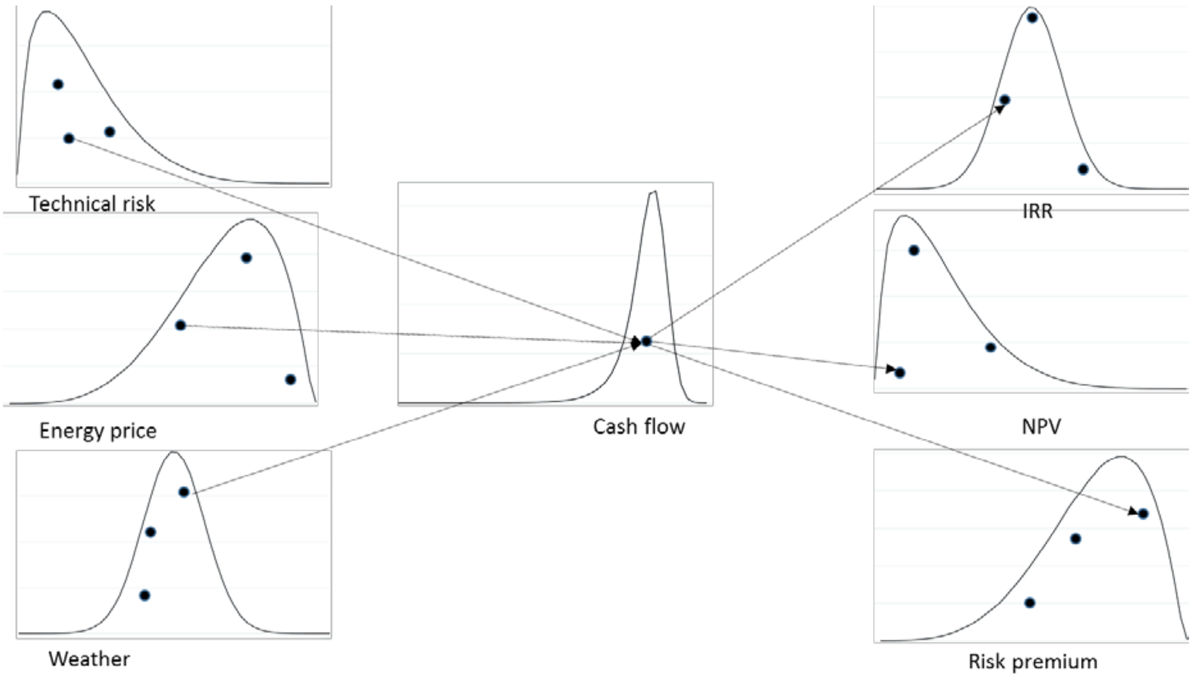

Figure 5: Monte Carlo Simulation in EEnvest model in each loop

2.2.3 Value at Risk (VaR)

The Value at Risk analysis focuses on the negative part of an investment, namely when things go bad or might triggering a loss. The aim of this method is to estimate, under a certain confidence level, what is the maximum loss expected in a given time period as Figure 6 shows. Moreover, it is also a measure adopted in banking regulation (since Basel I[3]) to test the capital requirement of banks (Manganelli and Engle, 2001). Due to its simplicity it is widely used in the financing sector, also because it is a way to compare different projects. Nevertheless, the accuracy of estimation of the parameters used is crucial, because when banks or companies decide where to allocate their money, in case of misleading calculation of VaR, there is a high possibility of sub-optimal allocation, affecting profitability and stability (Manganelli and Engle, 2001).

[3] The Basel Committee composed by the central banks and regulatory authorities of G10, enlarged during last years, reunited Basel in 1988 and issued the first set of minimum capital requirements. The set of rules was called Basel Accord, derived for the Swiss city. The Committee enhanced the Accord twice with Basel II in 2004 and Basel II in 2010.

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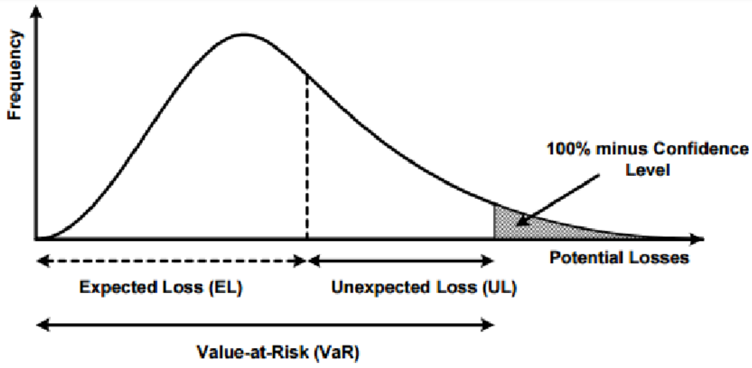

Figure 6: Value at Risk representation[4]

2.2.3.1 VaR for the EEnvest model

Concerning the EEnvest model, VaR could be useful to estimate the potential maximum loss amount for the energy efficiency investment, for a given confidence interval (usually 95%). In other words, a VaR of €100 with a confidence level of 95% means that there is a 95% probability that the expected loss on the investment, considering the probability and frequency of the risks, will not exceed €100.

Being a measure of riskiness of the project, VaR could be used to compare different investment opportunities, especially for Fund Managers and Financial Institutions.

More technical details an explanation of the application of Value at Risk in the EEnvest model will be described in D3.2 - Technical and financial risk evaluation model.

2.3 MOST RELEVANT EXISTING RISK MODELS

The screening process of existing models is conducted with particular attention to frameworks able to translate technical risks into financial risks. This particular focus is important for EEnvest as the platform should consider each type of energy efficiency measure and any possible kind of users. Householders, for example, will be interested in the riskiness of failure of such measures other than the energy savings. Thus, it is very important to be aware of how to map the uncertainty surrounding energy efficiency interventions.

With this screening criteria in mind, EBaR® has been identified as the best model, that connects technical risks and other peculiar risks of energy efficiency measures into financial risks.

2.3.1 Energy Budget at Risk®

Jackson (2008, 2010) proposes an empirical analysis on how companies should set up a budget for an energy efficiency investment. The EBaR® model follows the perspective of the firm, and therefore it is limited to this target subject. As a consequence, considering a broader scope of subjects (e.g. banks, ESCOs, private owners), the model cannot be replicated exactly as it is to consider all the different perspectives.

[4] Retrieved from https://www.researchgate.net/figure/The-relation-between-Expected-Loss-Unexpected-Loss-and-Value-at-Risk-adopted-from-Bank_fig5_283563698

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The aim of the model is to demonstrate that interventions for energy efficiency such as HVAC, could provide lots of benefits in the long run, in terms of IRR and net savings.

Nevertheless, the author is aware that companies usually evaluate an investment using mostly the payback period. In fact, even if they use a multiple decision process, payback period is the most important screening criterium. When firms decide on a time threshold as principal criterium, other criteria (IRR or NPV) are considered only if the threshold criterium is being met. The consequence is that companies could reject some profitable projects only because of these projects having a longer payback period.

However, this pay back focused investment decision strategy is a misleading behaviour because: "*If payback analysis is applied to avoid investment risk using only the annual savings and investment cost, it cannot distinguish between shorter or longer lived investments nor can it distinguish between investments that are intrinsically more risky because of weather impacts or other factors that vary across investment options*." (Jackson, pp. 3876, 2010)

The author stresses the excessive simplicity of payback as it does not consider elements that might influence the profitability of the project during the lifetime, fostering the underlying riskiness. Moreover, it could not compare investments that have different duration. Moreover, the complexity of energy efficiency measures is too high to use only payback as screening tool. Indeed, there are several factors, e.g. weather underperformance or unexpected costs, that could affect the project value during its lifetime.

So, Jackson suggests to create a more comprehensive tool, which takes into consideration not only technical performance risk, but also other risks related to this type of investment, in order to be a guide through the decision-making process of energy efficiency measures. Moreover, he also proposes the first framework for energy efficiency investment that combines the simple payback time with a deep risk evaluation. For the latter, the author bases the analysis on the existing and commonly used Value at Risk to budget in order to examine the riskiness of such interventions. The framework shaped by Jackson is EBaR®, that is able to: "incorporate all important sources of uncertainty surrounding energy efficiency investments and provide information on the distribution of expected savings with an explicit consideration of risk".

Uncertainty is a big issue in energy efficiency investments because factors that influence the performance of such measures are random variables. Namely, it is quite difficult to predict the impact of those parameters, in particular when we consider the effect of multiple random variables, as in the case of an energy efficiency project. In fact, the variability of success depends also on:

- weather that is no controllable nor predictable;
- performance of the renovation measure, that could be not as high as expected even though the works was done perfectly;
- energy price, which might be somehow determined looking at historical data.

All these elements create uncertainty and thus an investment decision strategy only based on a simple payback period would be inappropriate.

In order to deal with this variability of success, Jackson suggests running Monte Carlo Analysis. Indeed, as mentioned in the previous paragraph, it is a tool able to deal with the problem of random variables and prediction of uncertain elements. Monte Carlo Simulation requires knowing the distribution function of the parameter involved in the process and then it draws randomly a value from each distribution. For all the simulations the result is given by the combination of the variables draws. The random variables belongs to **three main dimensions** of risk namely the **weather**, the **performance** and the **energy price** The simulation of all the different random variables is repeated one million times in order to have enough values to

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shape the final distribution function of the process that for EBaR® is the **energy cost**, as shown by Figure 7.

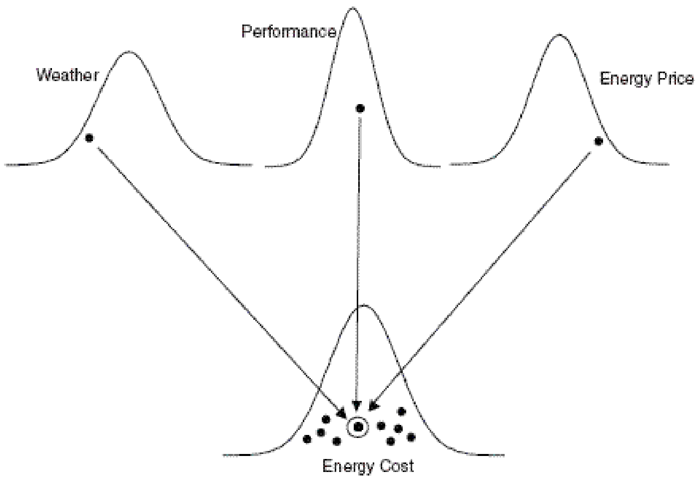

Figure 7: Monte Carlo analysis by Jackson (2010)

So, he proposes a case study of an office building in Texas, where he performs the EBaR® model simulation. He uses historical data from the State for cooling and heating degree-days, in order to have the distribution function for the Monte Carlo Analysis. Indeed, he identifies two seasons, summer and winter and for each of them he recognises an equation used to calculate the electric consumption. Moreover, he finds out that when there are peaks of consumptions different parameters are needed to estimate the consumption, so he writes down four equations for electric consumption. Finally, he adds a fifth equation in order to estimate gas consumptions.

The characteristics of the equations are a fixed part, the constant, calculated on historical values, plus two random parameters, one for cooling/heating degree-days and one for errors. Therefore, Jackson performs a Monte Carlo Analysis to draw the cooling degree-days of summer and winter to apply in the respective equations and other five simulations to extract the five errors. Then, he calculates the energy consumption for a single loop of analysis. Replicating the process one million times creates the distribution function of energy consumptions.

Then, considering the distribution of energy price (electric and gas) obtained with historical values and performance (it is not explained how it is structured by Jackson), it is possible with another Monte Carlo simulation to combine the three distributions and calculate the distribution function of energy cost.

This process is repeated monthly, in order to create monthly reports and budgets.

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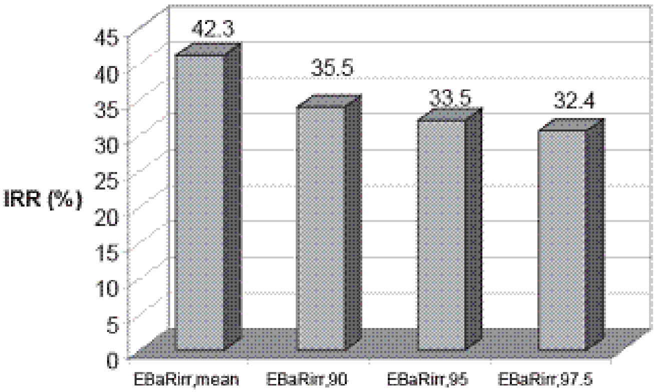

Figure 8: IRR with different confidence levels[5]

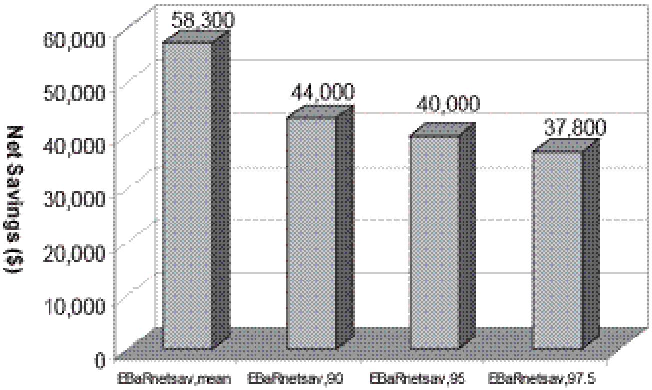

Figure 9: Net savings at different confidence levels[6]

2.3.1.1 EBaR® for the EEnvest model

The structure of Energy Budget at Risk and in particular the logical and procedural steps adopted in the analysis are essential for the framework proposed for the EEnvest platform. The rationale behind the method proposed by Jackson is the foundation of the EEnvest model, since it considers **external factors** such as performance and weather that might have huge impact in the success and profitability of energy efficiency projects. Furthermore, it suggests **financial indicators** in line with the financial outputs required by potential users of the platform, such as IRR, net savings, payback period. In addition, using **Monte Carlo** simulation is a consistent approach to deal with the uncertainty of EE interventions.

Nevertheless, Jackson's approach is only limited to budget analysis, i.e. from the firm's perspective (owner and occupant of the building). Indeed, users of the EEnvest platform could be different, e.g. banks, ESCo, Fund Manager and tenants that may have different needs and expectations. In order to consider a **broader range of subjects**, the EEnvest model would have different interfaces, depending on the types of user. In this way the final **output could be customised** as well, beyond to what EBaR® model would allow.

Moreover, the aim of the platform is to evaluate all the possible risks related to the renovation measures, so it develops a **deeper analysis**, in particular for the **technical side** of the projects.

5 Retrieved from http://energybudgetsatrisk.com/ecanal.htm
6 Retrieved from http://energybudgetsatrisk.com/ecanal.htm

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In fact, the EBaR® model only considers a generic performance risk, without an analytical assessment of the technical risks underlying each renovation measure. The EEnvest model would strongly examine the relationship between technical and financial risks and how the first affect the second. In particular, technical risks could cause on one hand lower performances in terms of lower energy savings and on the other hand higher maintenance costs.

Furthermore, the **weather** distribution would not be applied the same way as in Jackson's model. In fact, EEnvest model will focus on **heating degree-days** rather than cooling degree-days. This is because the estimation of cooling degree-days could produce some drawbacks with respect to heating degree-days. In fact, while the calculation of heating degree-days depends mostly on how cold it is outside, in case of cooling the energy consumptions depend on the temperature inside rather than outside. For instance, even in the same building, an office at the first floor will be differently impacted from heat than an office at the top floor. Moreover, if a house is not exposed to sun during the day, the use of air conditioning will be very different, even for buildings close to each other. The EEnvest platform should be available for any kind of building in any considered geographical area (Spain and Italy). So, considering the issues above, the model will only look at heating degree-days in order to be more accurate.

2.4 CONCLUSIONS

The analysis of literature and other European projects on energy efficiency investments leads to the identification of **three financial tools** mostly used to evaluate such projects: **Discounted Cash Flows**, **Monte Carlo Simulation** and **Value at Risk**. The approach used in various sources that were analysed is different since the final goal is specific in each of them. Nevertheless, these tools are the core of the various analyses that are being proposed.

DCF enables to calculate the distribution of cash flows (e.g. energy savings) of the investment during the lifetime of the project. Moreover, from the results of DCF it is possible to calculate more financial outputs useful for further analysis, such as IRR, NPV and payback time.

The peculiarity of **Monte Carlo Simulation** is to produce a distribution of a process influenced by random variables. Therefore, it deals with uncertain events that are connected and that are not predictable, providing definite values. This is important for EEnvest because energy savings are influenced by random variables as weather, underperformance and unpredictable additional costs. Monte Carlo would combine the distribution of such uncertain parameters into a final distribution.

The third tool is **VaR**, which define the riskiness of the project in term of maximum loss amount under a certain probability. For EEnvest, VaR would be useful to perform further analysis on the investment, providing more insight tailored to the different users.

The next step is to verify whether these tools can be used in the framework aimed at translating technical risks into financial risks and outputs. In fact, these tools might be useful for EEnvest to examine the approach applied by those studies.

The conclusion of this screening process leads to the identification of a reference model that is Energy Budget at Risk by Jackson.

EBaR® is a model that uses Value at Risk to demonstrate that energy efficiency investments for firms may be profitable even if their payback period is higher than that of other projects or than the usual thresholds set by firms. He uses the firm's perspective in his analysis, in particular the budgeting process for new investments, thus it is quite limited for the EEnvest purposes. Nevertheless, the process proposed by Jackson is a good starting point, because it takes into account external factors that influence the profitability of such interventions. These

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external variables (weather, performance and energy price) are considered random variables so the author suggests using a Monte Carlo simulation to combine their effect on energy savings. This is also the method adopted in EEnvest though with some adjustments. Therefore, the EBaR® framework has been analysed in each step, assessing the replicability of this project and the adjustment and enhancement necessary to reach EEnvest goals.

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3 INTERVIEWS WITH STAKEHOLDERS

3.1 METHODOLOGY

During the application phase of the Eenvest project, the Consortium members received letters of support from different stakeholders interested in supporting the project activities and in supporting its results. Supporting stakeholders have been involved in the development of Task 3.1, aimed at developing the framework of the financial risk evaluation model, where their support was requested in order to receive relevant and valuable feedbacks about the overall structure of the model and the platform (as presented in Paragraph 1.3).

Specifically, the involvement of the stakeholders was very important in order to:

- **identify** the **main characteristics** of each potential platform user;
- have a feedback about their **general approach** towards energy efficiency projects;
- assess their **perception** and **sensitivity** towards the **different risks and issues** related to energy efficiency investments;
- find the main **requirements** each user could have, what could be their **expectations** from the platform and **how the platform could be useful** to improve their investment decision-making process.

Given these objectives, in cooperation with all consortium partners, we developed a simple and brief questionnaire addressed to all stakeholders who provided the letters of support.

Then, in order to make the activity more effective and to gather more solid and accurate answers, we conducted one-to-one interviews with all stakeholders who agreed to participate in the survey, which were conducted through web conference call or, in some cases, face-to-face. The direct contact with the interviewees was necessary in order to explain to them the overall structure of the project and to introduce them to the framework and objective of the platform. Furthermore, during the interviews we could provide to the stakeholders the necessary background on all questions, thus clarifying any doubt. In most of the cases we filled in the questionnaires together with them by sharing the screen. This procedure allowed to receive the best and accurate answer to each question, enhancing the validity and robustness of the results.

The questionnaires were collected and shared among all the partners, as their results could be useful for various purposes such as the structuring of the platform but also to define potential exploitable results and to start thinking about possible business models for the exploitation of the platform (this theme will be addressed in WP7).

Paragraph 3.2 explains the structure of the questionnaire and the rationale behind each question whereas paragraph 3.3 reports on the results and main evidences of the whole interview activity.

3.2 QUESTIONNAIRES

The questionnaire is composed of **two parts**, namely **user profile** and **expectation** from the EEnvest platform.

The aim of the **first group of questions** is to identify the type of stakeholder and its general approach to energy efficiency investments. In particular, it is useful to understand how users

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decide to engage in the different types of investments, the possible issues faced in this stage and their mitigating actions implemented to address the possible issues. Besides the first question qualifying the subject, that is a multiple choice, the other three questions of this first part, are open questions. Stakeholders were free to give their personal answer which would probably allow to gather lots of information about their decision-making process in energy efficiency investments. The analysis for this part is only qualitative due to the open answers.

The **second part** deals with the expectations that the stakeholder would have from the platform. In this case the options, except for questions 6 and 7, were given by the interviewer, so stakeholders could only indicate their preferred choice out of the ones provided, and they could only suggest one additional option, or they were asked to rank a set of items. This second part is essential for the Consortium to understand the needs and requirements expected by users, and also their different behaviours related to risks. In fact, ranking is useful to assess in which way risk, indicators or benefits are perceived by stakeholders, which could have possibly divergent or even opposite visions on the same topic. The answers at this stage are more quantitative, and they are fundamental to better picture how to tailor the platform to better satisfy all possible users.

Finally, the open answers in question 6 are important to understand whether the platform results should be totally automatically feedbacked or whether it would need the manual intervention of physical persons, which could increase the platform's throughput time. Finally, question number 7 is connected to the first part of the questionnaire, as it queries the influence of the platform on the decision-making process.

PART 1 – USER PROFILE

1) **Who are you?**
   - ○ Private owner / Company
   - ◉ Bank
   - ○ Investment Fund
   - ○ Foundation
   - ○ Energy Service Company (ESCo)
   - ○ Other (specify) ...

2) **How do you currently choose to invest in building's energy efficiency?**

   ______

3) **What kind of issues do you face in the decision making of an energy efficiency investment, regarding technical/financial evaluation and risk assessment?**

   ______

4) **Have you already considered possible solutions to address the above-mentioned issues? Could you give some examples?**

   ______

PART 2 – EXPECTATIONS FROM THE EENVEST PLATFORM

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1) **Which variables and parameters would you like the platform to take into account in the evaluation of the addressed energy efficiency investment?**
☐ Technical information of the building
☐ Current energy consumption (energy baseline)
☐ Current energy and maintenance costs (economic baseline)
☐ Investment cost
☐ Financial parameter (interest rates, duration, etc…)
☐ Energy prices
☐ Climate (degree days)
☐ Other (specify) ______

2) **Which kind of analysis would you like the platform to perform?**
☐ Benchmarking of technical analysis and expected energy savings
☐ Calculation of technical and financial risk
☐ Calculation of economic/financial indicators
☐ Sensitivity and scenario analysis
☐ Probability distribution of financial indicators
☐ Other (specify) ______

3) **Which of the following risks are more important to you? (rank items from 1 to 12 where 1=most important and 12=least important)**
___ Inaccurate baseline data provided – Technical risk
___ Underperformance (compared to project expectation) – Technical risk
___ Higher maintenance cost – Technical risk
___ Low comfort for users – Technical risk
___ Increase in investment cost – Construction risk
___ Delays in construction timing – Construction risk
___ Low quality/competence/skill of executor of works – ESCo/Contractor Risk
___ Variation of weather conditions – Climate risk
___ Variation in building use – Behavioural risk
___ Non-adequate use of equipment by users – Behavioural risk
___ Variation in energy prices – Energy price risk
___ Variation in financial conditions/interest rates – Financial risk
___ Other (specify) ______

4) **Which of the following indicators are more important to you? (rank items from 1 to 8 where 1=most important and 8=least important)**
___ Simple payback time of the investment
___ Payback time of invested equity
___ Project and equity IRR
___ Project and equity NPV
___ Debt Service Coverage Ratio (DSCR)
___ Equity risk-premium
___ Overall simple risk indicator
___ Other (specify) ______

5) **Which kind of indirect benefits would you like the platform to assess? (rank items from 1 to 6 where 1=most important and 6=least important)**
___ Environmental
___ Social (increased employment)

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___ Comfort for users ___ Health ___ Productivity ___ Increased building value ___ Other (specify) _______ **6) Would you like the platform to provide you with a simple standard report in real-time or with a more complex tailored report after some time?** _______ **7) To what extent do you expect that the use of the platform will influence your decision-making process?** _______

Table 2: Stakeholders questionnaire

3.3 Results and main evidence

From the collection of the questionnaires it has been possible to compare and analyse the answers given by the different stakeholders. Firstly, the ESCo is the user profile most interviewed by the Consortium, while private owners are the less represented stakeholders. "Bank" and "Other" have the same percentage, 26%, and the remaining 9% of interviewees are investment funds.

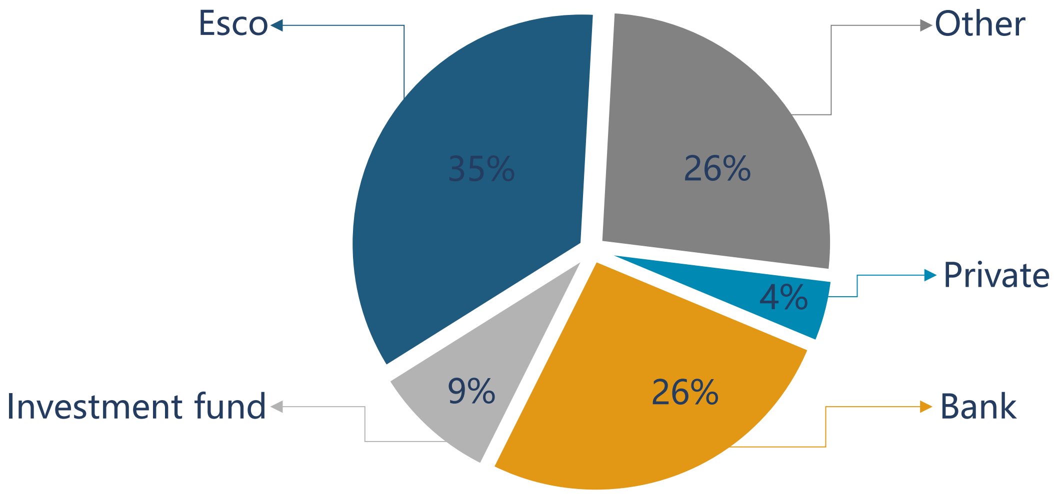

Figure 10: Distribution of user types

The second part of the questionnaire is more quantitative than the first part. As such, it is possible to analytically examine the answers of questions 3, 4 and 5. For the first, the stakeholders are asked to rank eleven risks with the possibility to add other options. The ranking is in a decreasing order, thus 1 is the highest while 11/12 the lowest. From the analysis of the answers, the evidence is that **increase in investment cost** and **underperformance** are perceived as the riskiest factors by the stakeholders. Also, **inaccurate baseline data** provided received a medium-high risk quantification. Whereas, the other factors are less

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important, in particular variation of weather condition is not considered a risk element for stakeholders. One respondent, introduced the twelfth category, namely anticipated building sale compared to the planned ROI, that is considered very risky from their perspective.

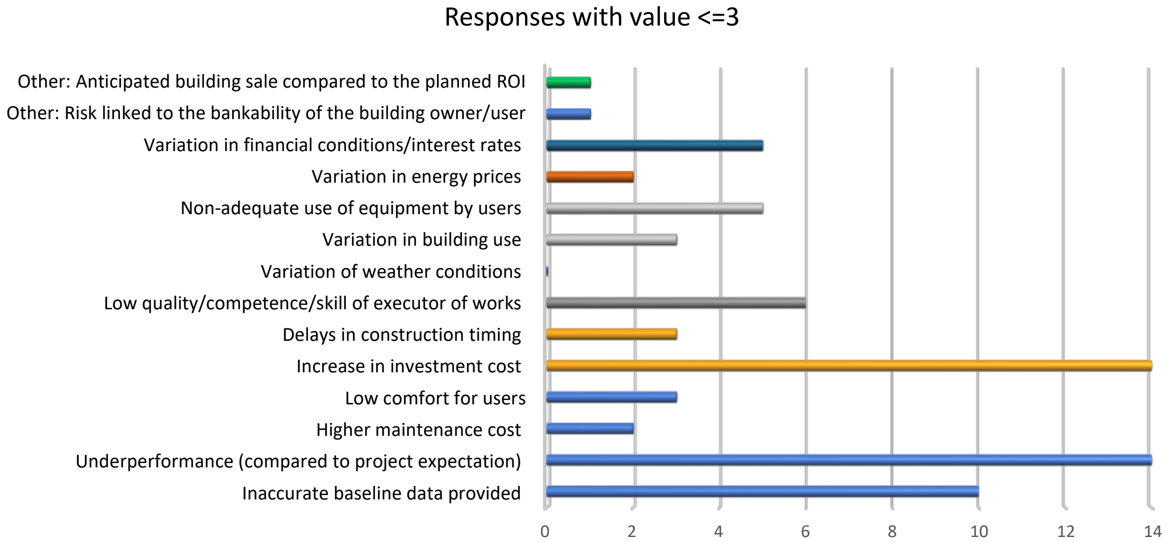

Figure 11: Risks importance representations

Question 4:

As to the analysis of question number 4, the ranking goes from 1 to 7 with the possibility to add one eighth indicator; also in this case the ranking is in decreasing order. The evidence is that **NPV** and **IRR** are the most required outputs by stakeholders, while **simple payback time** ranking third. The other indicators are perceived as secondary, in particular equity risk premium. One stakeholder suggests another risk factor to be taken into consideration, namely that of **credit risk**, even though with low importance. Whereas, for another interviewed the most important indicator is a mix of technical and financial indicators.

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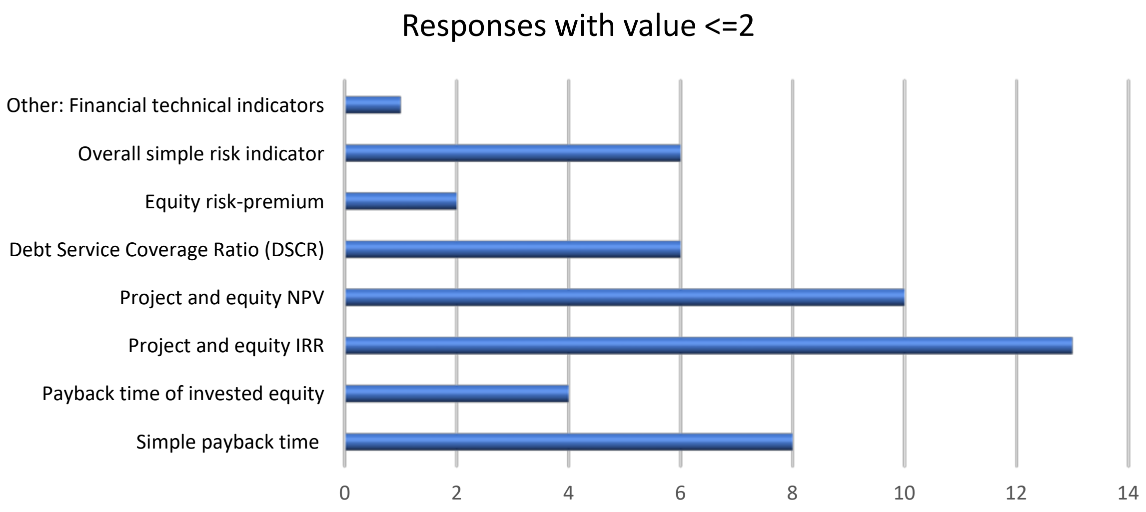

Figure 12: Indicators importance representations

Question 5:

Questions number 5 is about the evaluation of perceived importance of multiple-benefits. Stakeholders were proposed six multiple benefits and also in this case they were asked to rank them in a decreasing order. The evidence from the analysis of this part is that **environmental benefits** are the most important aspect of energy efficiency investments, while increased building value, user health and comfort are perceived a bit less important. Finally, productivity benefits and social benefits are not important to stakeholders. Only one stakeholder specifically underlines the importance of the CO2 savings, but this likely to be captured in the general Environmental benefit for most of the other respondents.

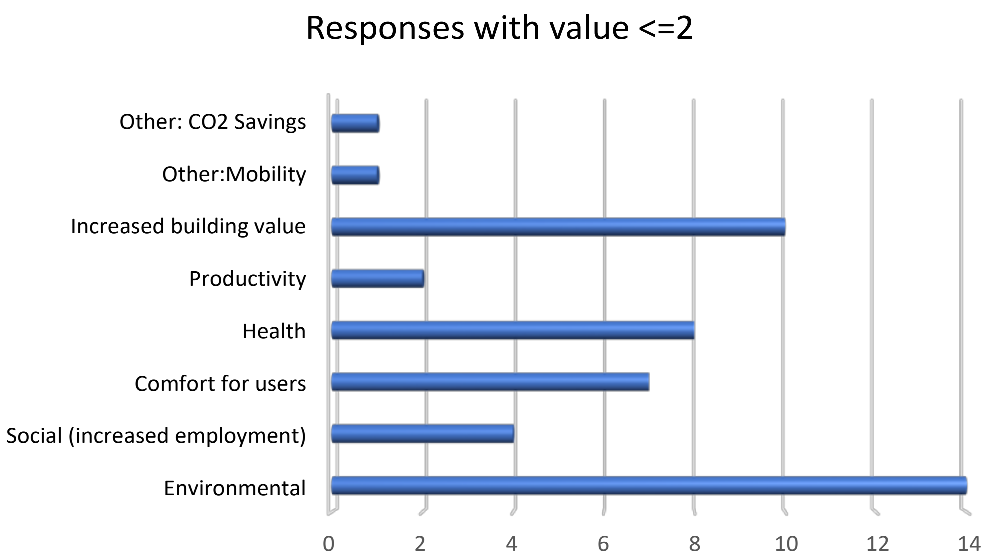

Figure 13: Multiple-Benefits importance representations

Question 6:

The analysis of the answers to questions 6 is fundamental for the implementation of the platform, because it directly asks the stakeholder whether or not to be provided with an immediate standard report or with a more complex and tailored report, meaning that this last option would require the intervention of an expert. The shared stakeholders' position is that a

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real time report is the preferred solution provided by the platform, although there is a case in which the tailored report is chosen to be the best option. Moreover, for some of the users it would be better if the platform could produce also a more complex and complete result, if it would not take too long to produce. Some stakeholders suggest the possibility of having both options available because of the investment amount requiring more analysis in cases of higher value, or because they require more accuracy due to the complexity of the project. Users are aware that a complex report depends on the availability of data and one respondent is prone to pay additional fees for a tailored report.

The conclusion is that a real-time report could be satisfactory and it would respect the common expectation, unless under some circumstances tailored report would provide a higher qualitative output.

Question 7:

As to question number 7, the answers related to the potential influence of the platform in the decision-making process are more disparate and they vary across interviews. However, the common view is that the platform would not replace the internal procedure. Some stakeholders, especially banks, stress the barrier of lack of skills related to such type of investments. The platform could hence be a useful **tool to fill the gap**, providing more complete information about the riskiness of the project. However, it would not be enough to substitute internal due diligence protocols and, in particular, will always come after the assessment of credit-worthiness of the borrower. For other users, the platform could have a major influence on the decision-making process, because it adds non-financial information that could be determining in making the final decision. Moreover, it could be used as a third part valuation or certification of a project only if the reliability of the platform is high and widely renown.

Eventually, a minority part of the stakeholders indicated that the platform would not be taken into consideration in the decision-making process but only after the implementation of the project as an ex-post evaluation.

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4 DATA MANAGEMENT IN WP3

H2020 projects require consortiums to describe the plan for management of data retrieved, used and analyzed during the project. The full description of the data management is part of WP1 – Project Management, deliverable D1.3 - Data Management Plan.

In order to make it easier for the reader to consolidate the information about data management in the different WPs, this paragraph is meant to list and describe the data and information that were used for the development of this Deliverable.

As stated in the text of the document, for the elaboration of this Deliverable the Consortium conducted a series of interviews with stakeholders in order to obtain useful information to set up the framework and to start designing the platform. Management of data and information coming from the interview is described in the following table:

Management of data – Stakeholders interviews	
Source of data	Direct interview with stakeholders, mainly the ones that provided LoS to the project. Data were collected through anonym questionnaires as described in Paragraph 3.
Use of data	Data and information collected are and will be used mainly to define the user profiles and their features
Storage Location	Questionnaires are stored in a MS Sharepoint folder, shared with the Consortium partners, and in Sinloc's internal server
Expected results	Data and information collected were very useful for the setting up of the framework described in this deliverable, in particular to analyse the sensitivity of each group of users towards risks.
Relation with other WPs	The same data will then be useful for the definition of the user profiles in the Eenvest platform (to be developed in WP5) and for the exploitation of results (to be developed in WP7)

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5 CONCLUSION

The framework described in this document is the preliminary step towards the actual implementation of the financial risk evaluation model that represents one of the main "engines" of the EEnvest platform.

The framework was built with the objective of defining:

1. The main requirements of the platform, in terms of types of users, inputs, elaborations and outputs;
2. Existing financial tools and models that could be used for the calculation of financial risks by the EEnvest platform;
3. Needs and expectations of stakeholders (potential users of the platform).

The first activity was carried out by drafting a preliminary concept of flowchart that was then discussed and improved by the Consortium partners up to its final version (see Figure 1). The flowchart assisted in the assessment of what the platform could deliver in terms of outputs, what it could perform in terms of data analysis and what kind of inputs it would need to work. Then, all relevant potential users of the platform were defined, in terms of categories, needs and expectations. This activity also represents a first step to the customer identification to be carried out in-depth in WP7, at least as far as the exploitation model is concerned.

The second activity was mainly carried out through a literature research on existing tools and models in order to find the most useful and suitable for our purposes. Eventually, three main financial tools were found appropriate for the financial and risk analysis: Discounted Cash Flows model (DCF); Monte Carlo analysis; Value at Risk (VaR) model. These three tools, combined together, are able to provide the expected outputs to the users. Moreover, the literature research work brought to the identification of an already existing risk model, called Energy Budget at Risk (EBaR®), which uses a specific methodology for the combination of different kind of risks that could be a good starting point also for the EEnvest model.

Finally, the third activity was carried out by conducting one-to-one interviews with relevant stakeholders, i.e. potential users of the platform (banks, ESCOs, investment funds). By filling in a questionnaire, the stakeholders provided useful information about their sensitivity toward the different types of risk in energy efficiency, their expectation from the risk evaluation tool in terms of outputs and how they could eventually use the information and data provided by the platform in their decision-making process.

The described framework sets an important starting point for the implementation of the actual risk model, that will be carried out by:

- Setting up of a first draft of the model (Task 3.2);
- Developing and applying a method to convert technical risks into financial risks (Task 3.3);
- Testing and back-testing of the model (Task 3.4);
- Fine-tuning and external presentation of the model (3.5).

Results of these activities will be described in D3.2.

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