Risk reduction for Building Energy Efficiency investments

Demo-case investment evaluation report

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement n. 833112

Abstract

The EEnvest project's objective is to develop a web-based energy efficiency investment evaluation platform (**EEnvest platform**) for specific stakeholders such as financiers, private investors and building owners (project owners), based on the **EEnvest Investment Evaluation Methodology** (EEnvest Methodology) for Energy Efficiency investments including multiple benefits analysis. The EEnvest Methodology provides these stakeholders with an evidence-based and investor-friendly method to evaluate the impact of both energy and non-energy related benefits of investments in energy efficiency renovation projects.

The purpose of this document is to provide a proof-of-concept for the EEnvest methodology by evaluating the renovation investment carried out by the two demo-cases of the EEnvest project, putting these into perspective, looking at appropriate financing sources and providing recommendations.

The **Introduction Chapter** presents the EEnvest Evaluation methodology as the backbone of the EEnvest platform as it provides the core process allowing the EEnvest platform to identify, assess and calculate technical and financial risks and provide multiple-benefit information related to the EE projects uploaded to this EEnvest platform. The ultimate output of the EEnvest platform is the EEnvest Risk Assessment Report, presented digitally or as a pdf-report, which produces a full and straightforward assessment of technical risks, financial and multiple benefit performance. The EEnvest Risk Assessment Report also features a Project Quality Self-Assessment score, based on the Project Quality Self-Assessment Tool (PQSAT) developed during the EEnvest project, which objective is to indicate the probability that the energy efficiency project will achieve its intended objectives.

Chapter 2 discusses the EEnvest Evaluation Methodology based on the EEnvest Risk Assessment Report applied to the demo-case buildings in Italy and Spain. The demo-cases are being subjected to an investment evaluation based on their respective EEnvest Risk Assessment Report.

The possible relevance of the PQSAT to enhance the risk analysis of the EEnvest Risk Assessment Report is being analysed and commented in **Chapter 3**.

In **Chapter 4** the demo-case buildings are being put into perspective, comparing some of their KPI with other cases in the EEnvest database.

The financing options available to the demo-case buildings are investigated in **Chapter 5**, applying a **decision-making flow methodology** developed by EEnvest which intends to guide the building owner through the selection of an appropriate business model and financing scheme.

Chapter 6 provides recommendations to the owners of the demo-case buildings and finally **Chapter 7** is also providing recommendations, though to possible investors regarding the renovation investments of the two demo-case buildings.

In **Chapter 8** the conclusions of this report are being provided. One of the most relevant conclusions of this chapter is that both demo-cases represent strong investment cases, though seen from different angles: the Italian demo-case because of its sound financial performance and the Spanish demo-case because of its high performance in terms of multiple-benefits, including its achieved property value increase. Another relevant conclusion is that the EEnvest Evaluation Report and the PQSAT pointed in the same direction when dealing with the risks surrounding comparable KPI, indicating that both approaches are complementary as to the risk indication and as such enhance the risk analysis of the renovation cases.

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List of abbreviations and acronyms

ECM	Energy Conservation Measure
DDDQ	Desktop Due Diligence Questionnaire
DER	Deep Energy Retrofit
DSCR	Debt Service Coverage Ratio
EE	Energy Efficiency
EPC	Energy Performance Contracting
ESCO	Energy Services Company
IRR	Internal Rate of Return
KPI	Key Performance Indicator
LEED	Leadership in Energy and Environmental Design
MCDA	Multiple-Criteria Decision Analysis
NPV	Net Present Value
nZEB	near Zero Energy Building
O&M	Operation & Maintenance
PQSAT	Project Quality Self-Assessment Tool

1 INTRODUCTION

The EEnvest project's objective is to develop a web-based energy efficiency investment evaluation platform (EEnvest platform) for specific stakeholders such as financiers, private investors and building owners (project owners), based on the EEnvest Evaluation Methodology for Energy Efficiency investments including multiple benefits.

The EEnvest Evaluation Methodology developed by EEnvest basically de-risks energy efficiency investments and provides jargon-free KPIs to its relevant stakeholders. Its main objective is to provide these stakeholders with an evidence-based and investor-friendly method to evaluate the impact of both energy and non-energy related benefits of investments in energy efficiency renovation projects. The EEnvest methodology follows a logical process of input, process and output that starts with data collection, continues with the assessment of these input data, then allows benchmarking of different Deep Energy Retrofit (DER) project alternatives using MCDA-analysis (Multiple Criteria Decision Analysis) and ends with the provision of the EEnvest Risk Assessment reports for investors or project owners.

The EEnvest Evaluation methodology is thus the backbone of the EEnvest platform as it provides the core process or structure allowing the EEnvest platform to identify, assess and calculate technical and financial risks and provide multiple-benefit information related to the energy efficiency projects uploaded to this EEnvest platform. The EEnvest platform firstly gathers the required data, such as building technical data, energy efficiency measures, expected energy savings, economic data and financial data, by means of an Input Data Collection Sheet that the project owner needs to upload to the platform. The platform then performs the technical and financial risk analysis and calculations of the input data along three assessment dimensions: (i) Technical Risk Assessment, (ii) Financial Performance Assessment and the (iii) Multi-benefits assessment. Finally, the EEnvest platform translates the aforementioned identified, assessed and calculated risks into financial and multiple-benefits outputs and relevant Key Performance Indicators. These outputs and KPI are the ultimate output of the EEnvest platform in the form of the EEnvest Risk Assessment Report which can be presented digitally on the platform or by means of a pdf-report.

The EEnvest Risk Assessment Report is hence the EEnvest methodology put into practice, it exhibits general and technical project data and general evaluation scores, it produces a full and straightforward assessment of technical risks, financial and multiple benefit performance, categorised according to the three assessment dimensions.

In order to provide an indication of the quality and inherently the risks surrounding the uploaded data in the platform, a Project Quality Self-Assessment Tool has also been developed by EEnvest. Based on a desktop due diligence questionnaire, its objective is to indicate the probability that the energy efficiency project will achieve its intended objectives, e.g., energy savings, expected investment and operational costs, etc... A Project Quality Self-Assessment score integrates the EEnvest Risk Assessment Report.

This document basically discusses the EEnvest Evaluation Methodology based on the EEnvest Risk Assessment Report applied to the demo-case buildings in Italy and Spain. The demo-cases are being subjected to an investment evaluation based on their respective EEnvest Risk Assessment Report. The document further looks at the PQSAT to investigate its possible relevance to enhance the risk analysis of the EEnvest Risk Assessment Report. It also puts the demo-case buildings into perspective, comparing some of their KPI with other cases in the EEnvest database, it looks at the financing options available to the demo-case buildings applying a decision-making flow methodology -intended to guide the building owner through the selection of an appropriate business model and financing scheme- developed by EEnvest, and finally provides recommendations to both the owners of the demo-case buildings as well as to possible investors.

2 EVALUATION OF THE ENERGY RENOVATION OF THE DEMO-CASE BUILDINGS

This chapter performs the investment evaluation of the two demo-case buildings (pilots) participating in the EEnvest project, one is in Rome, Italy and the other is located in Olot, Spain. The respective investment evaluations are based on the EEnvest Risk Assessment Report. Here all results and KPI of the EEnvest Risk Assessment Report are being analysed and discussed and eventually evaluated as a whole.

2.1 INVESTMENT EVALUATION OF THE ITALIAN DEMO-CASE

The IFAD building is the Italian demo-case building. It is located in Via Paolo di Dono 44 in Rome and it is managed by **Prelios SGR**. The office building was built in 2001, and has a total gross surface area of more than 46,000 m². It is composed of ten floors, eight above-ground and two below-ground stories. The net heating area is about 24,470 m²with a net heating volume of 97,048 m³.

In 2019, considering the rather high energy consumptions, IFAD and Prelios SGR decided to renovate it's the building with the support of Prelios Integra SpA. A deep energy audit on the energy consumption of the whole building was conducted. The annual amount of the energy costs was about 470,000 €/year, divided between 11% for natural gas and 89% for electric demand. Motivated by the necessity to reduce the electric consumption, it was planned, and later realized to improve the energy performance of the technical system. The building envelope, in good condition because renovated in 2015, was excluded from the energetic renovation.

The **envisaged renovation strategy** aimed to increase the energy performance and to produce electric energy as much as possible. The building envelope elements (façade, windows, roofs, shading system…) were excluded from the energetic renovation because, renovated in 2015, they were still in good state of conservation. In the light of this, the renovation project focused on improving the energy performance of the technical systems, of:

- **heating generation system**: substitution of the existing gas boiler with a new installation of a co-generator (a system able to produce thermal and electric energy from natural gas) and a heat pump.
- renovation of the **distribution system** with installation of new pipes, fittings, valves, circulators, expansion vessel…
- substitution of the **mechanical air ventilation system**
- **air-conditioning system**: cooling system
- replacement of the **lighting system** with LED technology
- Building Energy Management System (BEMS) installation, and building automation system for lighting, thermal system (heating and cooling), and monitoring system of energy consumption.
- **photovoltaic** system installation of 38 kWp, for about an energy production of 43,200 kWh/y.

Mitigation measures were very important to achieve, at the end the renovation, the energy target pre-identified in the planning phase. The IFAD renovation strategy included several important mitigation measures adopted in different phases of the renovation, form the planning project to the construction and operation phase such as:

- Certification protocols. IFAD is certificated LEED Platinum in 2021
- Verification and monitoring of the energy consumption and RES system during the
- Maintenance program of construction (building envelope), thermal plant (heating, cooling, PV…) and electric plant (lighting system…)
- Fault detection of the mechanical ventilation system (VMC)

- Installation and monitoring of sensors, controllers and dimmers
- Certification of the Building Energy Management System (BEMS) by an external expert in accordance with UNI-EN 15232.
- Building automation system of lighting system, thermal system (heating and cooling), ventilation and monitoring system of energy consumption.
- PV system verification performance and maintenance program is based on different actions as: component testing, design review and construction monitoring, and basic monitoring system.

The energy renovation project aimed at achieving a reduction of about 37% of the energy consumption costs of the building from 2019 to 2021, with a reduction of the CO_2 emissions of about t 21.35 kg/kWm²/y. The whole investment of the IFAD renovation was about 1.3M€.

The IFAD building results are reported in the EEnvest Risk Assessment Report as exhibited in Figure 1 hereafter.

Figure 1: EEnvest Risk Assessment Report of the Italian demo-case building (Pages 9 to 13)

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EEnvest RISK ASSESSMENT REPORT

GENERAL DATA

Name: IFAD

Address: Via Paolo di Dono 44, Rome, IT

Building use/typology: Office

Owner: -

Contact: -

TECHNICAL DATA

Construction year: 2001

Last renovation year: 2019

Gross floor area: 46,000 m^2

Gross volume: 97,048 m^3

HDD: 1,902

Project size:
1,300,000.00 €

Financing amount requested:
1,300,000.00 €

Investment cost:
53.37 €/m^2

Expected M&O costs:
6.87 €/m^{2}y

Primary Energy savings:
27%

Primary Energy demand:
266 kWh/m^{2}y

PV production:
Yes: 43,200 KWh/y

Solar thermal production:
No

Expected start date of the renovation:
01/01/2018

Expected end date of the renovation:
31/12/2018

Project ambition:
Minimum primary energy cost saving of 35%.

Project Quality Self-Assessment score:
High probability of reliable, consistent and achievable energy savings. **370/400**

Renovation and mitigation measures adopted:
- Heating system
- Cooling system
- Ventilation system
- Lighting system
- PV system
- Energy monitoring, LEED certification

Technical average risk

Mitigated	Needs attention	Needs action

Financial average performance

High	Medium	Low

Multi-benefit average performance

High	Medium	Low

Model version: XXX - Date: XX/XX/XXXX - 2 -

TECHNICAL RISKS

DAMAGE

The Damage indicator quantifies the investment deviation due to possible malfunctioning or failures of the energy renovation measures adopted in the renovation project. Such deviation is expressed as a percentage of the planned investment.

For this specific project, the Damage indicator has been estimated as:

0.30 %

ENERGY GAP

The Energy gap indicator quantifies the energy performance deviation. It is expressed as a percentage of the calculated energy performance costs after the renovation project.

For this specific project, the estimated Energy gap is:

1.04 %

FINANCIAL PERFORMANCE

PAYBACK TIME

The Payback time is the amount of time that the investment will take to recover the initial cost when the length of the investment time reaches a breakeven point.

For this specific project, the estimated Payback time is:

8 years

MATURITY

The Maturity is defined as the total duration of the project needed to achieve a zero NPV (IRR equal to cost of capital).

For this specific project, the estimated Maturity is:

12 years

INTERNAL RATE OF RETURN (IRR)

The Internal Rate of Return (IRR) is the discount rate that makes the net present value (NPV) of a specific project equal to zero.

For this specific project, the Internal Rate of Return is:

12.70 %

NET PRESENT VALUE ON INVESTMENT (NPV/investment)

The Net Present Value (NPV) is the value of all future cash flows (positive and negative) over the entire life of an investment discounted to the present. The NPV/investment ratio gives a measure of profitability of the project.

For this project, the estimated NPV/investment is:

0.71

DEBT-SERVICE COVERAGE RATIO (DSCR)

The Debt-Service Coverage Ratio (DSCR) is an indicator of the project's ability to repay a debt. It is calculated as the ratio between the operative cash flows generated by the project and the cash flows for debt, lease, or other obligations (debt service, both for interests and principal payment) due in one year.

For this project, the DSCR has been estimated equal to:

2.36

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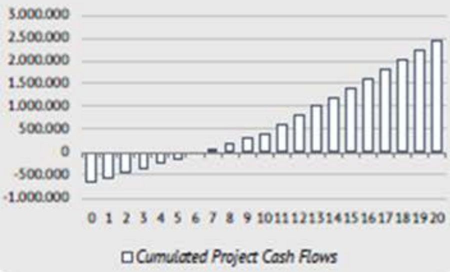
EEnvest RISK ASSESSMENT REPORT

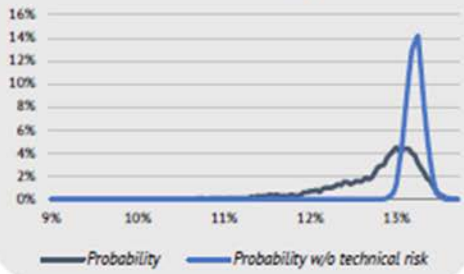
Graph n.1 - Cumulated project cash flows

This graph shows the cumulated cash flows generated by the project over time. The value for each one of the years is calculated as the simple sum of the cash flow of that year and all the previous cash flows. The graph below provides a quick view of the time needed to payback the initial investment cost.



Graph n.2 - Project IRR Distribution

This graph shows the probability distribution of IRR. Each value on the horizontal axis has a probability value. The area underneath the curve sums up to 100% probability. The dark blue curve includes all risks, so it's more extended to the left, meaning that there is higher probability that the IRR is low. The light blue curve includes only financial risks, so it's more concentrated around the expected value.



MULTI-BENEFIT PERFORMANCE

CO_2 EQUIVALENT EMISSION REDUCTION

The CO_2 Emission Reduction Indicator estimates the decrease of the CO_2 emissions as result of undertaking the renovation project. It is derived from the predicted energy savings, and it is applied a conversion factor that varies from country to country as well as the type of energy used in the building.

21.35 kg/m^{2}y

This KPI contributes to the following SDG targets: 8.4, 11.6, 11.9, 12.2

PREDICTED ENERGY SAVINGS

The Predicted Energy Savings indicator is the difference between the actual energy consumption of the building (baseline) and the estimated energy consumption after the renovation project. It includes heating, cooling, lighting and ventilation.

108.4 kWh/m^{2}y

This KPI contributes to the following SDG targets: 7.3

For this project, the predicted energy savings are:

NUMBER OF JOBS CREATED

The Number of Jobs Created metric refers to new jobs created as a result of the investment. This KPI is based on a proclaimed BPIE study that states that per 1 million euro invested on energy efficiency projects, 18 new jobs on average are created. It depends on the location of the building (for example, country) and the amount of the investment.

23.5 jobs

This KPI contributes to the following SDG targets: 8.2, 8.5, 9.1

For this specific project, the number of jobs created is:

Model version: XXX - Date: XX/XX/XXXX - 4 -

EEnvest RISK ASSESSMENT REPORT

EU TAXONOMY COMPLIANCE

The EU Taxonomy Compliance indicator defines whether or not the investment complies with the minimum requirements defined by the EU Taxonomy. In specific, whether the project being assessed has a minimum of 30% primary energy consumption reduction.

NO

PROPERTY VALUE INCREASE

The Property Value Increase indicator brings light to the possible increment on the value of the asset after the renovation project. This is also referred as the "greemium". In practical terms, it is not possible to predict this increase before the renovation project. Therefore, this metric is qualitative, and it provides a range of possible value increase backed-up by literature.

For this specific project, the Property Value Increase is:

Rental price: **2-5 %**

Sale price: **10-20 %**

LINK TO SUSTAINABLE DEVELOPMENT GOALS (SDGs)

The Link to SDGs indicator depicts to which specific SDGs the project contributes to. It is a qualitative indicator that showcases the non-financial benefits of investing in the renovation project.

7 AFFORDABLE AND CLEAN ENERGY | 8 DECENT WORK AND ECONOMIC GROWTH | 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE | 11 SUSTAINABLE CITIES AND COMMUNITIES | 12 RESPONSIBLE CONSUMPTION AND PRODUCTION | SUSTAINABLE DEVELOPMENT GOALS

Technical recommendations

A well-done renovation project reduces the difference between real energy consumption and estimated energy demand, guaranteeing the estimated energy savings for investments. To that hand, it is recommended to:

- engage an external expert to define the most relevant energy-efficient/mitigation measures and improve the energy performance of the building;
- adopt standard protocols for the design and process verification (e.g., Passive House, LEED);
- include different specific analyses and tests during the construction phase (e.g., Blower Door Test, thermography);
- assess the energy performance during the operation phase (e.g., energy consumption monitoring, maintenance programs).

Please note that the technical risk is calculated only on the building elements and technical systems under renovation/substitution; internal walls, slabs, furnishing are excluded.

Financial recommendations

In general terms, the financial performance of the investment can be improved by:

- revising the mix of energy conservation measures, focusing on the ones with lower payback time;
- using public incentives/grants to cover part of the investment costs;
- optimizing the financial structure of the project (e.g., through low-cost financing).

Multi-benefit recommendations

The multi-benefit performance of the project can be improved by:

- selecting the mix of energy conservation measures with the highest impact on energy savings;
- implementing a standardized procedure to compute the multi-benefits for in-doors impact, such as thermal comfort, indoor air quality, acoustic comfort and productivity through smart sensors and questionnaires;
- optimizing the energy consumption levels on a monthly basis.

The first page of the report allows to obtain several information about the building (general and technical data), followed by information about the proposed energy renovation project, investment cost, date of the renovation, energy performance and energy renovation measures adopted. This page also shows the technical risk, as well as the financial and multi-benefits performance.

Technical average risk level is shown as a simple scale from low to high risk, according to the mitigation measures adopted:
-*Mitigated*, technical risks are estimated to be low due to the presence of two different mitigation measures, chosen between a) Certification protocol b) Building Monitoring or energy consumption c) Maintenance programs.
- *Needs attention*, a medium level of technical risks is estimated when the renovation project adopts only one mitigation measure, chosen between a) Certification protocol b) Building Monitoring or energy consumption c) Maintenance programs.
- *Needs action*, a high level of technical risks is estimated when no mitigation measure (chosen between a) Certification protocol b) Building Monitoring or energy consumption c) Maintenance programs) is included in the renovation project.
In the IFAD building case, the technical risks are quite low, achieving the “mitigated” level due to the presence of several mitigation measures, as LEED Certification protocol, monitoring of the energy consumption and maintenance programs.

Financial average performance means the profitability of the investment from a purely financial point of view. Projects with IRR over 10% are considered to have a “high” financial performance, while projects with IRR lower than 5% are considered to have a “low” financial performance. In this case the IFAD renovation project achieved the high-performance level.

Multi-benefit average performance addresses the investment case based on the compliance with the EU-Taxonomy, consisting in the achievement of at least 30% of reduction of primary energy savings. The compliance guarantees whether the investment can be classified as sustainable and therefore has the potential to be marketed and communicated as such. Renovations with up to 3% annually achieved primary energy savings are considered “Below Threshold”, followed by “Light renovations” with annual PE savings ranging from 3% to 30%, then “Medium renovations” scoring between 30% and 60% savings, and lastly the so called “Deep Renovations” with annual PE savings reaching higher than 60%.

In this case the IFAD renovation project achieved a low average performance on multi-benefit since it doesn’t reach the 30% of reduction on primary energy savings. Overall, ought to remark that accomplishing the 27% of primary energy savings over the 30% goal for the accomplishment of the EU Taxonomy compliance, can still be evaluated very positively in terms of environmental benefit impact.

The **Damage technical risk** indicator is 0.30%, meaning that the investment cost is expected to increase about 3.900 € which is, compared to the overall investment cost of over 1 million €, quite low. At the same time, the **Energy Gap Indicator,** calculated as a deviation in terms of envisaged energy cost, has a value of 1.04%, meaning that it can be expected that the actual energy consumption cost is higher than the planned one by 3,000 €/year. Again, compared to the absolute value of energy cost after renovation (€295.436 €), this is a small deviation and the risk can be considered low.
In fact, according to the Likert scale defined in Deliverable 4.2, the damage indicator of 0.3% can be considered a very low risk (corresponding to a 5/5 points in the Likert scale), while the energy performance gap indicator of 1.04% can be considered very low risk (corresponding again to a 5/5 point in the Likert scale).

As can be seen from the Financial Performance section of the report, from a financial point of view the project is performing well. The expected payback time of the investment is about 7.5 years and the expected Internal Rate of Return (IRR), calculated over a 20-year time horizon, is over 12%. This is mainly due to the relatively high expected energy saving (37%, corresponding to about €175,000) compared to the overall cost of the investment (about €1,400,000). This convenience, in particular, comes from the strategic renovation choice of installing a cogeneration plant that increases the consumption of natural gas, which is cheaper, and to reduce the amount of electricity to be bought from the grid, which is more expensive.

Another profitability indicator that is shown in the report is the ratio between the Project NPV (Net Present Value) and the Investment Cost. This indicator has been selected as NPV as such is an absolute measure, expressed in terms of Euros, that is not useable for a comparison between projects as it mostly depends on the project size. In other terms, a project with a higher NPV is not necessary “better” than a project with a lower NPV, as the profitability depends on the amount of money that was initially invested in the project. The NPV/Investment ratio, instead, is a KPI that is not commonly used in the financial practice, but is useful to understand “how much” the overall economic attractiveness of an investment is compared to other market opportunities. This KPI is different from IRR. Indeed, NPV/Investment is an overall measure of the additional economic value created by the project over the whole-time horizon, compared to average return on similar investments in the market. The IRR, however, is a measure of the yearly yield on the initial investment. In the specific Italian demo-case, this indicator scores around 0.7. This means that the project is able to generate an additional value, compared to what is considered “fair” on the market for similar projects, that is measurable as the 70% of the initial investment. In other words, investing in this project, that has an IRR of over 12%, allows to get an additional remuneration compared to the average return that could be obtained in a similar investment on the market[1], meaning that the investment is economically convenient.

The last financial indicator in the report is the Debt Service Coverage Ratio (DSCR), that is a bankability indicator assessing the capacity of the project to payback a loan from the operating cash flows generated. When the financial parameters of the loan are not input in the platform, the system automatically calculates this KPI using a set of standard parameters that are:

- Interest rate: 3.00%
- Loan duration: 10 years (10 instalments)
- Leverage factor (amount of debt on total investment cost): 50%

In the Italian demo-case, the average DSCR value is about 2.3, meaning that the yearly cash flows generated by the projects are more than double the cash needed to pay the debt instalments. This means that, from an external investor (bank) perspective, the risk that the project will not be able to pay back the loan is very low.

It should be noted that the financial calculations do not consider any change in the Operation and Maintenance (O&M) cost, as data was not available for the Italian demo-case. In general terms, when assessing an energy renovation project, it is important to also consider in the calculation the differential cost of the operation and maintenance of the building equipment before and after the renovation. In fact, this differential could be positive, meaning that the renovation project brings additional O&M savings, if the new installed equipment requires less maintenance than the previous one (usually, it is the case of LED lighting, with longer lifetime); in other cases, the renovation measures could result in additional O&M costs, such as in the case of installation of new PV plants that require periodic maintenance to perform as expected. The differential value between pre and post renovation could thus play a key role in the assessment of the financial profitability of an energy efficiency investment.

When looking at Graph 2 of the report, it can be seen that the probability distribution of IRR which includes technical risks (blue curve) is asymmetric towards the left-tail but doesn’t go much further than 11%. This means that the probability of the actual IRR of the project to be lower than 11% is very low. In order to calculate a synthetic risk indicator of the financial performance, we could instead calculate the distance between the expected value of the IRR and the 5th percentile of the distribution, meaning

[1] A standard value of 8% is used by the platform to calculate NPV if no value for Cost of Capital is provided by the user. WACC (Weighted Average Cost of Capital) is then calculated according to the standard financial parameters as mentioned further on.

that threshold that leaves only 5% probability for the IRR to be lower than that. In this case, the distance of the 5th percentile of the distribution and the median value is only 9%, meaning that there is only 5% probability that the actual IRR is lower than 11.7% (that is, the median value of 12.7% less the "distance" of 9% of the same value, equal to about 1 percentage point). This means that the financial risk on the investment is very low.

This makes the project interesting as an investment opportunity both for the property owner itself or for third party financiers. For the property owner, because the project features a short payback time and a good IRR (compared to average returns on the investments in the energy efficiency sector), while also benefitting from other multi-benefits, and for an investor, as the project shows low riskiness from technical and financial points of view, making this investment attractive.

From the multi benefit performance section of the report, the Italian demo-case achieves a limited impact in terms of environmental KPIs of CO2 emission reduction and predicted energy savings. This is due to the light renovation that was carried out, focused on light energy efficiency measures and intervention. However, regarding the KPI of number of jobs created that assesses the general economic impact of the project on the local economy, the IFAD project performs well. In fact, the project size, with over 1 million euros of investment, contributes to the creation of 23.5 jobs, calculated as 18 jobs created per each 1 million euro invested. In this sense, the project generates a high impact supporting economic growth.

As per the EU taxonomy compliance, IFAD renovation doesn't achieve the compliance for a very little percentage, accomplishing 27% over 30% goal of reduction of primary energy savings. Overall, the reduction contributes to generate positive environmental impact, even though it cannot be advertised as compliant. The achieved impacts in this sense generally contribute to specific Sustainable Development Goals targets: 8.4, 11.6, 11.9, 12.2.

Finally, the Property Value increase KPI provide a generic range of percentage that according to literature correspond to the fluctuation of rent and sale price after renovation. The percentages are approximations that are deeply influenced by the market dynamics that vary from country to country and even from one district to another in the same city. Nonetheless this KPI need to be considered as it adds a fuller view of potential impacts of non-energy benefit coming from DER projects.

2.2 INVESTMENT EVALUATION OF THE SPANISH DEMO-CASE

The Spanish pilot project is located in the city of Olot, a medium-sized Catalan city with a centre that presents opportunities. It is a private project developed by Fem Nucli, a private socially responsible investment company, which seeks to act in the recovery of cities, giving life back to historic, forgotten or impoverished neighbourhoods so that they are the nucleus of sustainable cities and healthy communities. In this project, called Mulleras, a residential building, has been rehabilitated.

The building has the following characteristics:

•It has 3 floors (approximately 400 m2)

•Built in 1881

•Overall budget for the renovation -approximately € 500,000

•Start of the deep renovation Q2 2019, end Q3 2020

•It had low sustainability criteria

The building is located on the very first street in the city of Olot and thus it was one of the first structures with more than one floor in the area. The construction works leveraged on the available resources of Olot's surroundings, such as solid stone, volcanic stone, volcanic sand layer and hydraulic tiles. Furthermore, the first floors had religious imagery with Olot's saints, thus acknowledging the historical background of the building. Given the fact that the building was built before 1883, it has very low energy efficiency according to the current sustainability criteria context. Moreover, the building was inhabited since 2008 and in some cases, illegally occupied and in very bad condition.

Prior to the renovation project, the energy performance of the building in 2013 was the lowest, scoring a letter G. Given the context of the historical building, the baseline energy consumption and costs before the project amount to a bit more than 12.500 € per year and include only electricity,

Given the characteristics of the Spanish demo-case, it's evident that the renovation work not just entailed shallow energy efficiency improvements, but rather a deep energy retrofit aimed at making the building habitable again whilst respecting the historical heritage of being one of the very first buildings of Olot.

The **renovation strategy** was designed by FemNucli. FemNucli's core values are aligned with environmental and social principles and thus all partners and stakeholders ought to share the same vision and values. Further, FemNucli defines as a low-profit and low-risk company, prioritizing social and environmental wellbeing over maximising financial returns while attracting impact investors. Among the technical renovation measures are to be highlighted:

- Centralized and shared sources of light, water and communication systems
- Solar elevator
- Rear façade of wood covered with solar panels
- Rainwater storage and usage systems

The **objective of the renovation project** included Sustainability in the broad sense, in economic, environmental and social aspects. The economic aspect represents the viability of the project promoter and with a fair rent for the tenants after the works are finished. From an environmental point of view, the building will be energy efficient with the aim to reach an "A" certification level, and to recycle materials available in the region and in the building itself. Finally, from the social aspect, the building will have spaces and services shared between the neighbours creating a feeling of community and co-responsibility, and also improving the urban environment of the city centre.

The project is inspired by Goal 11 of the United Nations Sustainable Development Goals that seeks, among other things to:

11.1. Improve access to housing
11.3. Inclusive and sustainable urbanization
11.4. Safeguard cultural heritage
11.6. Reduce the negative per capita environmental impact of cities

In addition, the project is also aligned with Goals 7 and 12:

7.2. Significantly increase the share of renewable energy
7.3. Doubling the global rate of improvement in energy efficiency
12.2. Achieve sustainable management and efficient use of natural resources
12.5. Significantly reduce waste generation through prevention, reduction, recycling and reuse activities

The FemNucli building results are reported in the EEnvest Assessment Report as shown in Figure 2 hereafter.

Figure 2: EEnvest Risk Assessment report of the Spanish demo-case building (Pages 18 to 22)

EEnvest RISK ASSESSMENT REPORT

GENERAL DATA

Name: Fem Nucli

Address: Carrer Mulleras 6, Olot, ES

Building use/typology: Office

Owner: -

Contact: -

TECHNICAL DATA

Construction year: 1883

Last renovation year: 2018

Gross floor area: 382.5 m²

Gross volume: 1,308 m³

HDD: 2,337

Project size:
250,000.00 €

Financing amount requested:
250,000.00 €

Investment cost:
719.76 €/m²

Expected M&O costs:
- €/m²y

Primary Energy savings:
97%

Primary Energy demand:
14.8 kWh/m²y

PV production:
Yes: 6,600 KWh/y

Solar thermal production:
No

Expected start date of the renovation:
01/01/2020

Expected end date of the renovation:
31/12/2020

Project ambition:
Minimum reduction in primary energy demand of 50%.

Project Quality Self-Assessment score:
Reasonable probability of reliable, consistent and achievable energy savings. 307/400

Renovation and mitigation measures adopted:
Building envelope renovation (roof, wall, floor, windows, shading)
Heating system
Ventilation system
PV system

Technical average risk

Mitigated	Needs attention	**Needs action**

Financial average performance

High	Medium	**Low**

Multi-benefit average performance

High	Medium	Low

Model version: XXX - Date: XX/XX/XXXX - 2 -

TECHNICAL RISKS

DAMAGE

The Damage indicator quantifies the investment deviation due to possible malfunctioning or failures of the energy renovation measures adopted in the renovation project. Such deviation is expressed as a percentage of the planned investment.

For this specific project, the Damage indicator has been estimated as:

0.38 %

ENERGY GAP

The Energy gap indicator quantifies the energy performance deviation. It is expressed as a percentage of the calculated energy performance costs after the renovation project.

For this specific project, the estimated Energy gap is:

32.33 %

FINANCIAL PERFORMANCE

PAYBACK TIME

The Payback time is the amount of time that the investment will take to recover the initial cost when the length of the investment time reaches a breakeven point.

For this specific project, the estimated Payback time is:

22 years

MATURITY

The Maturity is defined as the total duration of the project needed to achieve a zero NPV (IRR equal to cost of capital).

For this specific project, the estimated Maturity is:

> 20 years

INTERNAL RATE OF RETURN (IRR)

The Internal Rate of Return (IRR) is the discount rate that makes the net present value (NPV) of a specific project equal to zero.

For this specific project, the Internal Rate of Return is:

0.04 %

NET PRESENT VALUE ON INVESTMENT (NPV/investment)

The Net Present Value (NPV) is the value of all future cash flows (positive and negative) over the entire life of an investment discounted to the present. The NPV/investment ratio gives a measure of profitability of the project.

For this project, the estimated NPV/investment is:

-0.41

DEBT-SERVICE COVERAGE RATIO (DSCR)

The Debt-Service Coverage Ratio (DSCR) is an indicator of the project's ability to repay a debt. It is calculated as the ratio between the operative cash flows generated by the project and the cash flows for debt, lease, or other obligations (debt service, both for interests and principal payment) due in one year.

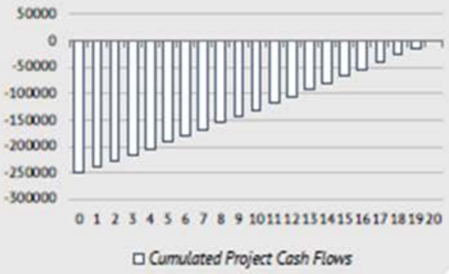
For this project, the DSCR has been estimated equal to:

0.81

EEnvest RISK ASSESSMENT REPORT

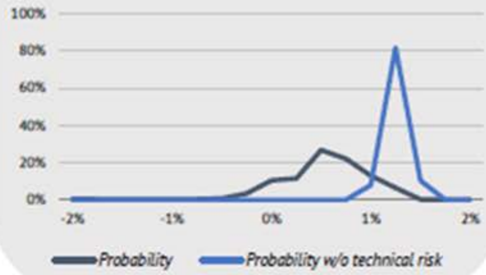
Graph n.1 – Cumulated project cash flows

This graph shows the cumulated cash flows generated by the project over time. The value for each one of the years is calculated as the simple sum of the cash flow of that year and all the previous cash flows. The graph below provides a quick view of the time needed to payback the initial investment cost.



Graph n.2 - Project IRR Distribution

This graph shows the probability distribution of IRR. Each value on the horizontal axis has a probability value. The area underneath the curve sums up to 100% probability. The dark blue curve includes all risks, so it's more extended to the left, meaning that there is higher probability that the IRR is low. The light blue curve includes only financial risks, so it's more concentrated around the expected value.



MULTI-BENEFIT PERFORMANCE

CO_2 EQUIVALENT EMISSION REDUCTION

The CO_2 Emission Reduction Indicator estimates the decrease of the CO_2 emissions as result of undertaking the renovation project. It is derived from the predicted energy savings, and it is applied a conversion factor that varies from country to country as well as the type of energy used in the building.

75.60 kg/m²y

This KPI contributes to the following SDG targets: 8.4, 11.6, 11.9, 12.2

PREDICTED ENERGY SAVINGS

The Predicted Energy Savings indicator is the difference between the actual energy consumption of the building (baseline) and the estimated energy consumption after the renovation project. It includes heating, cooling, lighting and ventilation.

442.4 kWh/m²y

This KPI contributes to the following SDG targets: 7.3

For this project, the predicted energy savings are:

NUMBER OF JOBS CREATED

The Number of Jobs Created metric refers to new jobs created as a result of the investment. This KPI is based on a proclaimed BPIE study that states that per 1 million euro invested on energy efficiency projects, 18 new jobs on average are created. It depends on the location of the building (for example, country) and the amount of the investment.

4.5 jobs

This KPI contributes to the following SDG targets: 8.2, 8.5, 9.1

For this specific project, the number of jobs created is:

Model version: XXX - Date: XX/XX/XXXX - 4 -

EEnvest RISK ASSESSMENT REPORT

EU TAXONOMY COMPLIANCE

The EU Taxonomy Compliance indicator defines whether or not the investment complies with the minimum requirements defined by the EU Taxonomy. In specific, whether the project being assessed has a minimum of 30% primary energy consumption reduction.

YES

PROPERTY VALUE INCREASE

The Property Value Increase indicator brings light to the possible increment on the value of the asset after the renovation project. This is also referred as the "greemium". In practical terms, it is not possible to predict this increase before the renovation project. Therefore, this metric is qualitative, and it provides a range of possible value increase backed-up by literature.

For this specific project, the Property Value Increase is:

Rental price:

2-5 %

Sale price:

10-20 %

LINK TO SUSTAINABLE DEVELOPMENT GOALS (SDGs)

The Link to SDGs indicator depicts to which specific SDGs the project contributes to. It is a qualitative indicator that showcases the non-financial benefits of investing in the renovation project.

Technical recommendations

A well-done renovation project reduces the difference between real energy consumption and estimated energy demand, guaranteeing the estimated energy savings for investments. To that hand, it is recommended to:

- engage an external expert to define the most relevant energy-efficient/mitigation measures and improve the energy performance of the building;
- adopt standard protocols for the design and process verification (e.g., Passive House, LEED);
- include different specific analyses and tests during the construction phase (e.g., Blower Door Test, thermography);
- assess the energy performance during the operation phase (e.g., energy consumption monitoring, maintenance programs).

Please note that the technical risk is calculated only on the building elements and technical systems under renovation/substitution; internal walls, slabs, furnishing are excluded.

Financial recommendations

In general terms, the financial performance of the investment can be improved by:

- revising the mix of energy conservation measures, focusing on the ones with lower payback time;
- using public incentives/grants to cover part of the investment costs;
- optimizing the financial structure of the project (e.g., through low-cost financing).

Multi-benefit recommendations

The multi-benefit performance of the project can be improved by:

- selecting the mix of energy conservation measures with the highest impact on energy savings;
- implementing a standardized procedure to compute the multi-benefits for in-doors impact, such as thermal comfort, indoor air quality, acoustic comfort and productivity through smart sensors and questionnaires;
- optimizing the energy consumption levels on a monthly basis.

The **Technical average risk** of the renovation project, as described in the previous Chapter, indicates "needs action". In this case, in order to mitigate possible risks related to the renovation FemNucli could have adopted one or more proposed mitigation measures such as a a) Certification protocol, a b) Building Monitoring or energy consumption or ac) Maintenance programs.

Financial average performance means the profitability of the investment from a purely financial point of view. Projects with IRR over 10% are considered to have a "high" financial performance, while projects with IRR lower than 5% are considered to have a "low" financial performance. Consequently, the FemNucli renovation project shows a low performance level.

The **Multi-benefit average performance** is defined as "high", "medium" and "low" based on the compliance with the EU Taxonomy. The EU Taxonomy compliance consists on the achievement of at least 30% of reduction of primary energy savings. According to this scoring method, renovations with up to 3% annually achieved primary energy savings are considered "Below Threshold", followed by "Light renovations" with annual PE savings ranging from 3% to 30%, then "Medium renovations" scoring between 30% and 60% savings, and lastly the so called "Deep Renovations" with annual PE savings reaching higher than 60%.

The FemNucli renovation project, as deep energy renovation (PE savings 97%), achieves a high average performance on multi-benefits.

The **Damage technical risk** indicator is 0.38%, meaning that the investment cost is expected to increase about 950 € which is, compared to the overall investment cost of about 250.000 €, quite low. At the same time, the **Energy Gap Indicator,** calculated as a deviation in terms of envisaged energy cost, has a value of 32,33%, meaning that the risk of deviating from the expected energy savings is quite high. It can be expected that the actual energy consumption cost could be higher than the planned one by 165 €/year. Compared to the absolute value of energy cost after renovation (509,54€), this is a small deviation in absolute terms, but not in relative terms. Bottom line, the risk of an energy gap is quite existent though its impact is low.
In fact, according to the Likert scale defined in Deliverable 4.2, the damage indicator of 0.38% can be considered a very low risk (corresponding to a 5/5 points in the Likert scale), while the energy performance gap indicator of 32.33% can be considered high risk (corresponding to a 2/5 point in the Likert scale).

As can be seen from the Financial Performance section of the report, from a purely financial point of view the project could be qualified as not being attractive or performing well. This does not mean that the project is not "desirable" at all, since a project owner could also take other investment criteria, i.e., multiple benefits into account, such as the increase in property value (see further in the paragraph). The expected payback time of the investment is about 22 years, which exceeds the standard time horizon of energy efficiency investment projects that are usually set to 20 years. For this reason, the expected Internal Rate of Return (IRR), calculated over a 20-year time horizon, has an almost null value of about 0.04%. This is mainly due to the relatively high cost of the investment (about €250,000) compared to the absolute value of the expected energy saving (about €11,400/year) and the increase of the expected O&M costs (about €750/year). These financial results are not surprising and are expected as more than 85% of the investment value in energy conservation measures relates to the renovation of the building envelope. Payback times of investments in building envelope renovation are usually very long and often exceed 30 years.

For the same reasons, the NPV is also negative, as the project is not able to return to the investor a sufficient amount of cash to remunerate its investment within the project time horizon of 20 years. As a consequence, the NPV/Investment ratio is negative too with a value of about –41, meaning that, from a financial point of view, investing in this project brings an economic "loss" of about 41% of the investment, compared to other similar investments on the market.

The DSCR indicator, showing the bankability of the project, is below value 1, meaning that the project is not able to produce enough cash flows to pay back a standard loan (at the standard conditions shown in the previous Chapter 2.1 about the Italian demo-case).

When looking at Graph 2 of the report, it can be seen that the probability distribution of IRR which includes technical risks (blue curve) is almost symmetric and includes also negative values. This means that there is almost equal probability of the actual IRR of the project to be lower or higher than expected, but within a limited interval (from about –0.5% to about 1.5%).

In order to calculate a synthetic risk indicator of the financial performance, we could instead of focusing on the probability distribution of IRR, calculate the distance between the expected value of the Payback Time and the 95th percentile of the distribution, meaning that threshold that leaves only 5% probability for the Payback Time to be higher than that. In this case, the distance of the 95th percentile of the distribution and the median value is about 22% (about 4.8 years), meaning that there is 5% probability that the actual Payback Time is higher than 27 years. This means that the financial risk on the investment is very low.

These negative financial values are understandable and consistent with the strategic renovation choice of the project owner. In fact, the investment project is about a complete renovation and restructuring of the building, making it a Near Zero Energy Building (nZEB) achieving a high 97% energy savings level compared to the initial situation. Thus, the investment decision towards this investment needs to be driven by other factors and variables that are assessed in the Multi-Benefit component.

The Spanish demo-case under the multi-benefit perspective achieves a High average performance.

This is a project that has carried out a deep energy retrofit, as a deep renovation of the whole building, including energy conservation measures on the technical installations and building envelope. This renovation strategy led to high results in terms of primary energy savings, achieving 97%. Clearly this indicator ensures the EU Taxonomy compliance and therefore justifies the high-performance evaluation. The deep energy renovation measures implemented generate relevant impact in terms of environmental benefits, for both considered KPIs of predicted energy savings and CO2 emission reduction. As to the impact on the economy, the project size has to be analyzed in order to evaluate its impacts. The Spanish project size, with 250,000 euros of investment, can be classified as small (< €500.000), therefore, applying the computation formula of *Total Investment in euros x 18 / 1.000.000* the jobs created are 4.5 approximately. Nonetheless, it is necessary to remark that it is hard to assess the actual number of jobs created as a direct cause of an investment, since numbers might fluctuate depending on the project demands, market dynamics, and geographical location of the project.

Adding up to the impressive primary energy savings achieved by the renovation, the Spanish demo-case represents a strong investment case when considering the property value increase. In fact, the integral renovation has resulted in a solid revaluation of the property value. A post renovation property value evaluation set the market value of the property at 450.000 € versus a market value of 130.000 € prior to the renovation. Or, an increase of € 320.000, resulting from a renovation investment cost of 250.000 €. This is a clear example of how the market valorises deep retrofit of forgotten or run-down housing in city centers.

The Spanish-demo case indeed shows at best the importance of including a multi-benefit assessment for a complete investors’ evaluation of DER as investment cases.

3 Comparison of the results of the PQSAT with the results of the EEnvest Investment Evaluation for the demo-cases

3.1 An approach to comparing PQSAT and EEnvest Investment Evaluation

This chapter compares the results of the EEnvest Risk Assessment report with the Project Quality Self-Assessment Tool (PQSAT), developed within the EEnvest project, which is based on the Desktop Due-Diligence Questionnaire (DDDQ) and is intended to be integrated in the EEnvest Investment Evaluation Platform.

Both, the EEnvest Risk Assessment report and the Quality Self-Assessment tool, deal with de-risking energy efficiency investments aiming at providing information to better understand relevant risks inherent to these EE investments, though they have different objectives.

The EEnvest Risk Assessment Report, on the one hand, is the ultimate output of the EEnvest Investment Evaluation Platform based on the three assessment dimensions of the EEnvest Methodology, i.e., (i) Technical Risk Assessment, (ii) Financial Performance and Risk Assessment and the (iii) Multi-benefit Assessment. Its objective is to provide a set of KPI that investors and building owners can use to analyse the envisaged DER project in terms of risk, financial performance and multiple benefits. Relevant KPI calculated from the Technical Assessment are Energy Gap and Damage. From the Financial Performance and Risk Assessment relevant outputs include, among other, Payback Period, IRR, NPV and probability distribution of IRR. The third assessment dimension, the Multi-benefit assessment provides insight in comfort and well-being to the project owners and relevant investment criteria such as CO_2 emission reduction, Energy Savings, EU taxonomy compliance and SDG alignment to the investors. The input required to perform the different calculations and to provide the different KPI comes from a detailed data collection sheet that needs to be filled out by the project owner. The data input process requires a non-negligible input effort from the project owner, in terms of time and data quality.

The Project Quality Self-Assessment tool (PQSAT) tool, on the other hand, is based on a desktop due diligence questionnaire consisting of six Themes covering the design, implementation and ongoing operation of the energy efficiency project and on a related scoring methodology. Its objective is to provide an indication of the probability that the energy efficiency project will achieve its objectives in terms of energy savings, expected investment cost, expected amounts for operation and maintenance costs and envisaged user's requirements. The output of the PQSAT is a score per Theme and a Global score for the whole project. The input effort required for PQSAT is limited to 1 hour maximum and is based on a Yes/No reply to a set of questions. Different to the EEnvest Risk Assessment Report the PQSAT does not provide any concrete information on the financial performance or the multiple benefits performance of the energy efficiency projects.

Though different in approach both the EEnvest Risk Assessment report as the PQSAT address the impact of risk on certain important KPI's as can be seen on the following comparative Table 3. As can be observed the EEnvest Risk Assessment Report addresses risks related to Energy Gap (or Energy savings), Damage (the investment value) and probability surrounding financial KPI such as IRR (also influenced by operating expenses) but does not provide risk assessment on multiple benefits. The PQSAT addresses risks related to energy savings, investment value, operating expenses and multiple benefits, the latter related to occupiers of the building.

Table 1: KPI addressed by the EEnvest Assessment Report and the Project Quality Self-Assessment Tool

EEnvest Risk Assessment Report					
		Energy Gap (Energy Savings)	Damage (Investment value)	Probability distribution IRR (incl. O&M costs)	Multiple-Benefits
1.	Technical Risk Assessment	X	X		
2.	Financial Performance & Risk Assessment	X	X	X	
3.	Multi-Benefit Assessment				

Project Quality Self-Assessment Tool					
		Energy Savings	Investment value	O&M costs	Multiple-Benefits
1.	Design of ECM and energy savings calculations	X	X	X	X
2.	Implementation of ECM	X	X	X	X
3.	Maintenance & Operation of EE assets	X	X	X	X
4.	Monitoring of EE Assets and their energy consumption	X			X
5.	Measurement & Verification of energy savings				
6.	Communication with and training of users and/or occupants	X			X

Another difference is to be found in the granularity of the results. Indeed, whereas the EEnvest Risk Assessment Report is much more detailed and provides a set of concretely calculated KPI based on very detailed input information the PQSAT is much more high-level and provides only a few scores and is more indicative, less specific.

One more difference relates to the approach towards the indication of risk between the EEnvest Report and the PQSAT. Whereas the risk-related KPI of the EEnvest Report provide indication of risk, the PQSAT provides an indication of the probability of achievement of results. Nevertheless, both approaches are indication of risk. In order to compare the results from both approaches the following equivalence table is adopted:

Table 2: Probability and Risk Equivalence table

PQSAT	EEnvest Report
Probability	**Risk**
Very High Probability	Very Low Risk
High Probability	Low Risk
Reasonable Probability	Moderate Risk
Low Probability	High Risk
Very Low Probability	Very High Risk

The purpose of the comparison is to investigate to which extend the information provided by the project owners points into the same direction, in other words to which extend the results impacted by risk are complementary and enhance the risk analysis of the envisaged EE project. This will be done, for the KPI listed in the following Table 3 by comparing the risk assessment of PQSAT with the EEnvest Report.

Table 3: KPI addressed by EEnvest Report and PQSAT risk assessment

PQSAT Themes	EEnvest Report Assessment dimension	KPIs	PQSAT risk indicator(s)	EEnvest Report risk indicator
1, 2, 3, 4, 6	Technical assessment	Energy Gap (Energy Savings)	x	x
1, 2, 3	Technical assessment	Damage (Investment value)	x	x
1, 2, 3, 4, 6	Financial performance & risk assessment	Probability distribution IRR	x	x
1, 2, 3, 4,6	Multiple-Benefits	Multiple Benefits	x	No risk indicator

3.2 PQSAT VERSUS EENVEST EVALUATION OF THE ITALIAN DEMO-CASE

The EEnvest Risk Assessment Report of the Italian Demo-case has been analysed and discussed in depth in Chapter 2.1. For each of the KPI Energy Gap, Damage and Probability distribution of IRR, which are the ones that we are comparing with the PQSAT, the risk assessment has been defined as very low.

The PQSAT results for the Italian Demo-Case are exhibited in the Table 4 hereafter. It shows the global scoring and the scorings on the different due diligence themes obtained by the Italian demo-case building.

Table 4: PQSAT: Global score and scores per Theme of the Italian demo-case

Themes	Total score	Maximum score
1. Design of ECM and energy savings calculations	70	80
2. Implementation of ECM (Energy Efficiency Assets)	80	80
3. Maintenance and Operation of the Energy Efficiency Assets	80	80
4. Monitoring of the Energy Efficiency Assets and their energy consumption	55	60
5. Measurement and Verification of the energy savings	45	60
6. Communciation with and training (awareness) of users and/or occupants	40	40
Global scoring	370	400

The Global Score indicates that:

"All of the Themes have been adequately conceived and set up, **with some minor flaws**, **almost always** taking into account the **highest** standards, highest quality criteria and best practices. This level of conception and implementation indicates a **high probability** of the envisaged energy savings being reliable, consistent and achievable and the uncertainties surrounding the investment cost and future operation and maintenance costs being minimised".

At first glance the Italian Demo-case projects obtains rather high to very high scores for most of the due diligence themes.

The Table 5 hereafter shows the probability score for the different due diligence themes:

Table 5: Probability scores of the PQSAT Themes for the Italian demo-case

PQSAT

Theme	Probability
1. Design of ECM and energy savings calculations	High
2. Implementation of ECM	Very high
3.Maintenance & Operation of EE assets	Very high
4.Monitoring of EE Assets and their energy consumption	High
5.Measurement & Verification of energy savings	Reasonable
6.Communication with and training of users and/or occupants	Very high
Global score	High

When the probabilities shown in the previous table are being transposed to the relevant KPI and when using the risks definitions of the EEnvest Report, the risk assessments are as follows: Energy savings/Energy Gap (Theme 1,2,3,4 and 6) range from very low risk to low risk, Investment value/Damage (Theme 1, 2 and 3) range from very low risk to low risk and the Probability distribution of IRR (Theme 1,2,3,4 and 6) range from very low risk to low risk.

The comparison Table 6 below shows the risk assessments for both the EEnvest Report and the PQSAT.

Table 6: Risk assessment of the EEnvest Report and PQSAT of the Italian demo-case.

PQSAT Themes	EEnvest Report Assessment dimension	KPIs	PQSAT risk indicator(s)	EEnvest Report risk indicator
1, 2, 3, 4, 6	Technical assessment	Energy Gap (Energy Savings)	Very low, Low	Very low
1, 2, 3	Technical assessment	Damage (Investment value)	Very low, Low	Very low
1, 2, 3, 4, 6	Financial performance & risk assessment	Probability distribution IRR	Very low, Low	Very low
1, 2, 3, 4,6	Multiple-Benefits	Multiple Benefits	Very low, Low	No risk indicator

From the previous table we can conclude that, both the EEnvest Evaluation Report and the PQSAT, have very similar risk indicator results. In other words, both approaches point rather consistently in the same direction when dealing with the risks surrounding the compared KPI. This indicates that, for the Italian Demo-case, the EEnvest Evaluation Report and the PQSAT are complementary with respect to the risk indication of the compared KPI and as such enhance the risk analysis of these KPI.

3.3 PQSAT VERSUS EENVEST EVALUATION OF THE SPANISH DEMO-CASE

In Chapter 2.2. the investment evaluation of the Spanish Demo-case, has been performed in detail, based on the analysis and discussion of the EEnvest Risk Assessment Report. For the KPI Energy Gap, Damage and Probability distribution of IRR, which are the ones that we are comparing with the PQSAT, the risk assessment has been respectively defined as, high, very low and moderate.

The Table 7 hereafter shows the PQSAT results for the Spanish Demo-Case, i.e., a global scoring and the scorings on the different due diligence themes obtained by the Spanish demo-case building.

Table 7: PQSAT: Global score and scores per Theme of the Spanish demo-case

Themes	Total score	Maximum score
1. Design of ECM and energy savings calculations	62	80
2. Implementation of ECM (Energy Efficiency Assets)	75	80
3. Maintenance and Operation of the Energy Efficiency Assets	55	80
4. Monitoring of the Energy Efficiency Assets and their energy consumption	40	60
5. Measurement and Verification of the energy savings	35	60
6. Communication with and training (awareness) of users and/or occupants	40	40
Global scoring	307	400

The Global Score indicates that:

"**Most of the Themes**, but not all, have been properly conceived and set up though **not always** following the **highest standards**, highest quality criteria and best practices. This level of conception and implementation indicates a **reasonable probability** of the envisaged energy savings being reliable, consistent and achievable and the uncertainties surrounding the investment cost and future operation and maintenance costs being minimised".

The Spanish Demo-case projects shows dispersed scores ranging from low scores over reasonable scores to very high scores.

The Table 8 hereafter shows the probability score for the different due diligence themes:

Table 8: Probability scores of the PQSAT Themes for the Spanish demo-case

PQSAT

Theme	Probability
1. Design of ECM and energy savings calculations	Reasonable
2. Implementation of ECM	Very high
3.Maintenance & Operation of EE assets	Reasonable
4.Monitoring of EE Assets and their energy consumption	Low
5.Measurement & Verification of energy savings	Low
6.Communication with and training of users and/or occupants	Very high
Global score	Reasonable

When using the risk definitions of the EEnvest Risk Assessment Report the probabilities shown in the previous table are being transposed to the KPI that are being compared as follows: Energy savings/Energy Gap (Theme 1,2,3,4 and 6) range from very low risk, over moderate risk to high risk, Investment value/Damage (Theme 1, 2 and 3) range from very low risk to moderate risk and the Probability distribution of IRR (Theme 1, 2, 3, 4 and 6) range from very low risk, over moderate risk to high risk.

The comparison Table 9 below shows the risk assessments for both the EEnvest Report and the PQSAT.

Table 9: Risk assessment of the EEnvest Report and PQSAT of the Spanish demo-case.

PQSAT Themes	EEnvest Report Assessment dimension	KPIs	PQSAT risk indicator(s)	EEnvest Report risk indicator
1, 2, 3, 4, 6	Technical assessment	Energy Gap (Energy Savings)	Very Low, Moderate, High	High
1, 2, 3	Technical assessment	Damage (Investment value)	Very low, Moderate	Very low
1, 2, 3, 4, 6	Financial performance & risk assessment	Probability distribution IRR	Very Low, Moderate, High	Moderate
1, 2, 3, 4,6	Multiple-Benefits	Multiple Benefits	Very Low, Moderate, High	No risk indicator

When observing KPI Energy Gap/Energy Savings the PQSAT risk indicator ranges from very low, over moderate risk to high risk as not all of the themes 1, 2, 3, 4, 6 have been set-up equally from a quality point of view. These indicators suggest an overall moderate risk. The risk indicator of the EEnvest

Assessment Report indicates high risk for this KPI. The indicators of PQSAT and EEnvest Report differ thus slightly, by one scale, but point more or less in the same direction.

KPI Damage/Investment value shows very low and moderate risk whereas the EEnvest Report indicates very low risk. Although no perfect match is being observed here it can be stated that all risk indicators are in the ballpark and point in the same direction.

As regards KPI Probability distribution of IRR, the PQSAT risk indicator suggests an overall moderate risk in analogy with the risk indicator of KPI Energy Gap/Energy Savings discussed above. The same risk indicator moderate risk is being observed in the EEnvest Report. Here both PQSAT and EEnvest Report are pointing exactly in the same direction.

Although somewhat more dispersed than in the Italian Demo-case risk assessment comparison, we can also conclude for the Spanish Demo-case that, both the EEnvest Evaluation Report and the PQSAT, have similar risk indicator results. Here also both approaches point in the same direction when dealing with the risks surrounding the compared KPI. The Spanish Demo-case risk assessment comparison confirms that the EEnvest Evaluation Report and the PQSAT are complementary as to the risk indication of KPI compared and as such enhance the risk analysis of these KPI.

4 Benchmarking of the demo-cases with other or similar cases in the EEnvest database.

In this chapter both the Italian demo-case and the Spanish demo-case are being put into perspective, comparing some of their KPI, with eleven other case studies collected in the EEnvest database, all renovated commercial office buildings, analysed with the EEnvest framework for evaluating financial impacts of technical risks related to energy-efficient renovation projects. The comparison with the eleven other cases focuses on financial performance, limiting the comparison of the multiple benefits to expected energy savings as no other multiple-benefit data for the other eleven cases was available.

The Table 10 hereafter exhibits some financial KPI (Investment value, Payback time, IRR and financial risk) and expected energy savings of the 13 case studies. Project ID No. 11 is the Italian demo-case building and project ID No.13 relates to the Spanish demo-case building.

Table 10: KPI on case studies collected.

Rank	ID	Investment	Expected energy savings	Payback time	IRR	Financial risk (distance from 95th percentile of PBT)
		€	%	year	%	%
1	8	80.000 *	15%	6,29	15.9%	11%
2	4	*24.067 **	22%	6,63	14.9%	16%
3	2	*110.000 **	21%	6,76	14.6%	17%
4	**11**	**1.306.000**	**37%**	**7,57**	**12.7%**	**9%**
5	7	*165.340 **	12%	14,99	3.8%	40%
6	**13**	**250.000**	**97%**	**21,96**	**0.04%**	**23%**
7	1	*404.253 **	30%	23,15	-0.5%	12%
8	12	201.850	44%	40,08	-5.0%	10%
9	3	*638.361 **	30%	58,70	-7.8%	70%
10	5	*684.088 **	24%	58,70	-7.8%	70%
11	6	*748.788 **	16%	61,64	-8.1%	62%
12	9	*1.742.890 **	59%	85,32	-10.2%	17%
13	10	4.800.000	73%	104,60	-11.5%	43%

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

4.1 BENCHMARKING OF THE ITALIAN DEMO-CASE

Among the sample of renovation projects analysed within EEnvest, the Italian demo-case is one of the best performing from a financial point of view. Its payback time and IRR rank in the top 4 of the analysed project sample shown in the Table 10 above.

This good ranking is because the project owner has defined a cost-optimal mix of renovation measures that makes the investment sustainable and profitable, while achieving a good result in terms of energy savings (37%, which is over the average), especially taking into consideration that the building envelope has been renovated in 2015. In fact, as typical in this sector, deep energy retrofits, with expected energy savings over 50% or 60%, are usually not performing well from a financial point of view, but still can be evaluated positively if they can bring additional multi-benefit (environmental, comfort, property value, etc.).

Regarding financial risk, intended as the risk of the project to have a payback longer than expected, the project is performing well too. The indicator that was developed to assess the financial riskiness of the project, calculated as the "distance" between the median value of the KPI and its 5th (for IRR) or 95th (for payback time) percentile, is among the lowest within the project sample.

Considering the Italian demo-case under the multi-benefit perspective, the project is classified as low average performance and this is due to the non-compliance with the EU-Taxonomy. In fact, to define the multi-benefit average performance, the KPI considered is the compliance with the EU-Taxonomy, consisting in the achievement of at least 30% reduction of primary energy demand. The Italian demo-case achieves 27% (or 37% energy savings versus the baseline energy consumption cost as shown in the Table 10 above) and is the result of the type of energy renovation implemented. In Table 10, it is observable how the Italian-demo project nestles in the upper middle part of the ranking compared with the other cases of renovations, scoring 37% in terms of expected energy savings. This result depends on the fact that the energy retrofit of the Italian demo-case can be categorized as a rather Light Renovation, because it mostly dealt with technical installations rather that a deep energy intervention.

4.2 BENCHMARKING OF THE SPANISH DEMO-CASE

Among the sample of renovation projects analysed within EEnvest, the Spanish demo-case is the best performing from the energy savings perspective as shown on Table 10, as its objective is to achieve a near Zero Energy Building. However, as typical in this sector, deep energy retrofits with high expected energy savings are usually not performing well from a financial point of view. In fact, the simple payback time of the investment is about 22 years, beyond the typical time horizon of energy efficiency renovation projects that is 20 years (the typical lifetime of the renovation), though lower than longer payback times (over 30 years) that can be observed in the energy efficiency renovation market. At the same time, the expected IRR of the investment, calculated on a 20-year time horizon, is almost equal to zero[2]. Considering an average cost of capital for investment projects in the energy efficiency sector of about 8%, this means that the Net Present Value (NPV) of the investment is negative, with a value of – 102.617 euros.

This does not mean that the project is not attractive from a project-owner perspective as it still can be evaluated positively if it can provide additional multi-benefits (environmental, comfort, property value, etc.).

Regarding financial risk, intended as the risk of the project to have a payback longer than expected, the project is not performing so well, as the technical risk, particularly the "energy gap" is quite high when expressed as a percentage of deviation. The risk indicator that was developed to assess the financial riskiness of the project, calculated as the "distance" between the median value of the KPI and its 5th (for IRR) or 95th (for payback time) percentile, with a value of 23% ranks the project in the middle of the project sample. A value of this KPI of 23% means that there is a large share of probability (45%) that the actual Payback Time is higher than expected, falling in the interval between 22 and 26.5 years. The

[2] One could note that if the payback time of the investment is higher than the time horizon, then the IRR should be negative. However, for simplicity and for the purpose of our calculation model, the simple payback time is calculated at fixed prices (no inflation) while the IRR is calculated considering a price increase over time (making the investment more profitable as increasing energy prices mean increasing value of the energy savings).

upper bound is rather high compared to the expected value, meaning that the tail of the probability distribution is long.

The Spanish demo-case under the multi-benefit perspective achieves a high average performance. The deep energy retrofit ensured impressive high level of environmental impacts in terms of CO_2 emission reduction as well as primary energy savings corresponding to 97%, resulting the full compliance of the project with the EU taxonomy criteria.

Fem Nucli renovation is a great example of the importance of the multi-benefit performance assessment when evaluating different DER projects investment options. In fact, if from a financial standpoint the project might not look very appealing, the multi benefit KPIs provide a more holistic perspective to the positive impact achieved by the renovation.

5 Benchmarking financing options and seeking of sources of finance (application of decision-making tree)

When it comes to comparing financing options searching for sources of finance for a renovation project, it ought to be remarked that the ultimate decision for choosing one or another financing source relies on the point of view of the building owner as well as the investor. For the building owner, the decision relies on his or her (i) risk profile and preferences when seeking financing and (ii) the unique characteristics of the renovation project. Whereas for the investor, the decision depends on the (i) credit-worthiness of the customer, (ii) guarantees given by the customer and lastly, the (iii) financial and impact metrics of the investment.

The EEnvest Project is focused on commercial buildings, thus it is necessary to select those financial instruments that are more relevant for this type of infrastructure. Each financial instrument is described in detail in deliverable D4.2, here are listed the ones with the highest rank on the commercial building category:

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

In order to compare these instruments, a Decision-Making Flow has been developed, shown in the Figure 3 below. This decision-Making Flow defines the criteria that can help navigate through the different financing options. The selected criteria are (i) Risk aversion (ii) Leverage and (iii) Project Size. Depending on the decision upon each binary option, High/Low Risk Aversion, Use/No use of Leverage, and the final criterion, Project Size the Decision-Making Flow points to the best suitable financing options. In fact, the project size (i.e., total investment cost) leads to different financing instruments as some of them are tailored to smaller investments amounts whereas others, such as EE Investment Funds, are usually fit for larger projects.

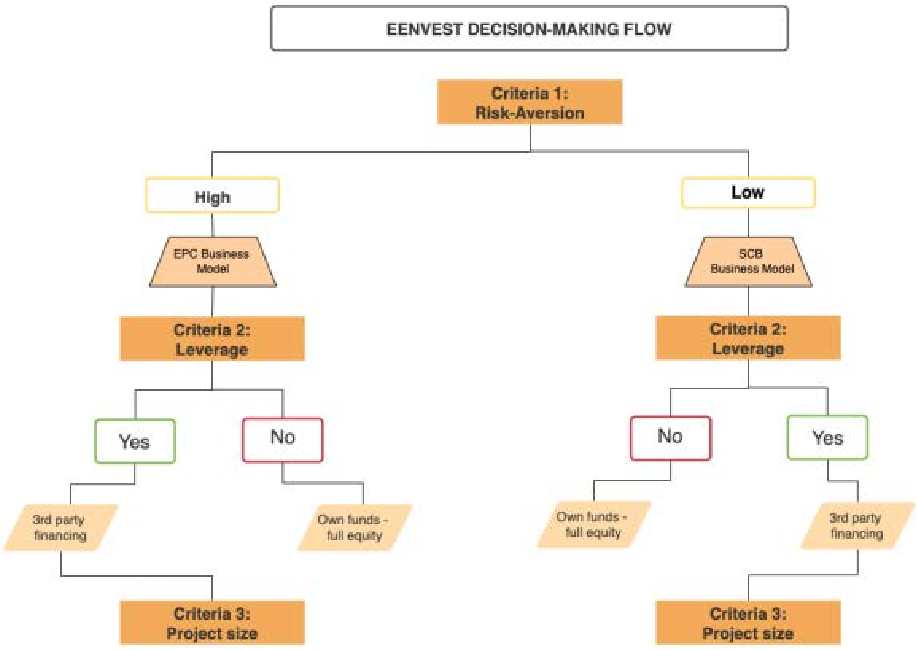


Figure 3: EEnvest Decision-Making Flow

As presented, the EEnvest Decision-Making flow is as a standard methodology, described hereafter, that any building owner can access and apply. It's a useful first step to provide guidance to building owners that are entering the renovation process and need clarity on the most suitable available options of business models and financing instruments.

In Task 4.3 and the related deliverable D4.2, project partners have defined a methodology to identify the best financing solution for the investment project, according to a series of variables, namely;

- **Risk-aversion**: Reluctancy to bear with the risk of performance of the renovation project (i.e., energy savings). A building owner with low risk-aversion is prone to deal with more risk than a building owner with high risk-aversion. Provided that risk-aversion is a subjective variable, only depending on personal perception, for the purpose of this exercise, risk-aversion is addressed on an objective base through the technical risk KPIs ("performance gap" and "damage");
- **Financial leverage**: Willingness to cover a portion or the full investment cost with third-party financing;
- **Project size**: It refers specifically to the total investment value of the renovation project.

In the following paragraphs, this methodology is applied to the demo-cases in order to benchmark these with the other investments in the project sample and to define, for each of them, which is the most suitable business model and financing option.

5.1 THE FINANCING OPTIONS OF THE ITALIAN DEMO-CASE

According to the EEnvest Evaluation methodology, the Italian demo-case can be defined as a **low-risk project**, since the technical risks related to the renovation investment, and consequently their impact on the financial performance and risks, are considered to be low (scoring 5/5 for the "damage" variable and 4/5 for the "performance gap" variable). This means that, if the project owner is confident enough and willing to manage the project on its own, he or she can go for the SBC model instead of an EPC, bearing a relatively low technical and performance risk.

The second step of the methodology relates to the financial leverage. Again, this is a subjective decision of the project owner, depending on many different factors such as: the budget constraints; the willingness to invest own money; the availability of interesting financing opportunities on the market. This aspect will be addressed as a recommendation in the following Paragraph.

If the recourse to financial leverage is chosen, then the next variable that matters when choosing the best financing option is the size of the project. According to the methodology, the Italian demo-case, with its €1.3 millions of investment, can be defined as a **medium-size project**. This means that sources of financing could be found from investment banks and investment funds (only within a portfolio of investments).

5.2 THE FINANCING OPTIONS OF THE SPANISH DEMO-CASE

According to the methodology, the Spanish demo-case can be defined as a **high-risk project**, since the technical risks related to the renovation investment, and consequently their impact on the financial performance and risks, are considered high. In particular, while the "damage" variable is considered low, scoring a 5/5, it is the "performance gap" variable that makes the project risky, with a score of 1/5 and an expected value of about 32%. This means that investing in this project has a high probability of not achieving the expected energy savings and that the relative difference between the expected and actual energy savings can be high. In this context, it could be really difficult for a project owner to bear this risk and directly manage the investment. Thus, the solution would be to enter an EPC, transferring the technical risk to the ESCO.

The second step of the methodology regards the financial leverage. Again, this is a subjective decision of the project owner, depending on many different factors such as: the budget constraints; the willingness to invest own money; the availability of interesting financing opportunities on the market. This aspect will be addressed as a recommendation in the following Paragraph.

If the recourse to financial leverage is chosen, then the next variable that matters when choosing the best financing option is the size of the project. According to the methodology, the Spanish demo-case, with its €250,000 of investment, can be defined as a **small-size project**. This means that sources of financing could be found within the ESCO own resources, dedicated credit lines or even citizen crowdfunding.

6 Recommendations to the owner of the demo-case building

6.1 Recommendations to the owner of the Italian demo-case

The results of the technical risk analysis reported in the EEnvest Risk Assessment report (Chapter 2.1) show that the renovation project result is "*mitigated*", this means that the technical risks of the IFAD building are quite low due to the presence of several mitigation measures, as LEED Certification protocol, monitoring of the energy consumption and maintenance programs. Such mitigation measures aim to achieve the energy performance planned checking and verifying the renovation project during its development: the design project, the construction work, the operation phase through monitoring of the energy consumption and adaptation of maintenance programs. Considering that the last renovation of IFAD building was made in 2015, with the renovation of the building envelope, no recommendation to the building owner is suggested except to continue with what they are already doing.

From a financial point of view, a possible recommendation would be to evaluate, in any case, also the opportunity to implement the renovation through an Energy Performance Contract. Even though the project is considered to have a low-risk profile, and SBC would be a viable option, the EPC still has some advantages that the project promoter might find interesting in the decision-making process. For example, the project owner could be interested in outsourcing all the design, permitting and construction activities, as well as all the operation and maintenance activities at a fixed price and with a guarantee of performance over time. This feature, typical of EPCs, could make this contractual model more attractive, especially if the project owner doesn't have the necessary resources and/or time to deal with all the aspects of the renovation project by itself. Of course, this comes at a price, that is the adequate return on the investment made by the ESCO, that as a consequence reduces financial attractiveness of the investment for the project owner.

Hence, the choice between the SBC and EPC model should be made by the project owner according to the personal sensitivity and weighting of pros and cons of each option.

From the multi-benefit perspective, it needs to be stressed that any sort of renovation project, regardless of its size, will improve the multiple-benefit performance from the building occupants' point of view. From a building owner's point of view, it is observable that all KPIs, i.e., thermal comfort, acoustic comfort, visual comfort, air quality, perceived mental and physical health, productivity, as described in depth in D4.3, are relevant as it directly impacts the building occupants (i.e., personnel) which, at the very bottom line, might improve productivity and therefore a company's profitability and competitive advantage.

Possible recommendations of the multi-benefit performance improvement for the Italian demo-case mostly deal with measures that could improve the impact on energy savings, opting for an effective selection of mix of energy conservation measure, as well as optimizing the energy consumption levels on a monthly basis. The improvement of just 3% - 4% in terms of reduction in primary energy demand would highly impact the project's multiple benefit performance due to the achievement of the EU Taxonomy compliance according to the of 30% criteria[3]. On the other hand, further recommendations regard the possible implementation of a standardized procedure to compute the multi-benefits for in-doors impact. Due to the lack of standardized methods of quantification for this kind of impacts, a good practice of assessment could be the involvement of the employees of the building. Their engagement with questionnaires would be useful to get their perspective about improved comfort.

[3] Retrieved from *https://ec.europa.eu/sustainable-finance-taxonomy/activities/activity_en.htm?reference=7.2*.

6.2 RECOMMENDATIONS TO THE OWNER OF THE SPANISH DEMO-CASE

The results of the technical risk analysis reported in the EEnvest Risk Assessment report (Chapter 2.22.2) show that the renovation project “needs action”. This is a suggestion to include the mitigation measures in the renovation project, to check and verify the design project, the construction work and during the operation phase monitoring the energy consumption, or the state of the art of the building through the adaptation of maintenance programs.

From a financial point of view, it is quite clear that the performance of the project is not attractive, as the IRR over 20 years is almost nil. Moreover, the technical riskiness of the project, particularly about the “energy gap” and the relatively high probability of the actual energy savings to be lower than expected, makes the project even riskier also from the financial perspective. In other words, while the investment itself has negative expected results (NPV is negative), there is a relatively high probability that those negative results could even be more negative (IRR could go below zero and NPV could assume a higher negative value).

The recommendation, in this case, given the high probability of not achieving the expected energy savings, would be to do the renovation through an Energy Performance Contract or, at least, to foresee a valid maintenance and operations program, as to transfer a major part of or the whole technical risk to the ESCO. However, this choice has a cost, as the ESCO needs to obtain a return on the investment. So, while theoretically an EPC can allow to “stabilize” the expected results, the actual feasibility of this specific type of contract needs to be calculated. Another important consideration to be done for the specific demo-case, is that the size of the investment (about €250,000) is quite low to be attractive for an ESCO, thus the transaction costs (fixed costs to start an EPC) could set off the value of the transferred risks.

From the multi-benefit point of view, the Spanish demo-case has a very satisfactory performance. The deep energy retrofit improved drastically those KPIs related to the health and comfort of the building occupants, as well as achieving high impact on environmental benefits in terms of energy savings and CO2 emission. As a consequence, the recommendations for the building owner are especially directed to standardize the measurement of the multi-benefits for in-doors impact, such as thermal comfort, indoor air quality, acoustic comfort possibly through questionnaires for the tenants. Because of the reduced size of the project, the economic impact generated in terms of job creation is not as considerable, however it ought to be remarked that the building owner has contributed overall very positively to develop social benefits in the local community.

7 Recommendations to the investor

7.1 RECOMMENDATIONS TO THE INVESTOR ON THE ITALIAN DEMO-CASE

Regarding the investment itself in the project, provided that, according to the decision-making tree presented in Chapter 0, the project has a low-risk profile and is medium sized, a proper and suitable financing source would be a simple bank loan from an investment bank. Unfortunately, as a typical approach in the energy efficiency sectors, this kind of loan are not treated by banks as project financing, with limited or non-recourse on the borrower. Thus, banks, lending money to invest in energy efficiency projects, usually evaluate these as corporate loans, whose characteristics depend just on the creditworthiness of the borrower. This is why the technical and financial risk analysis made by the EEnvest platform should support de-risking the investment from the investor perspective. The EEnvest reports and all their details will provide the investor with information, visibility and knowledge about the investment project features, performance and risks.

For the specific case of the Italian demo-case, since the project shows a good financial performance and a low technical riskiness, investors might be willing to accept increasing the leverage factor on the investment and/or reduce the required interest rate. This will be beneficial for the project owner in two ways: first, it reduces the amount of equity (own capital) required for the up-front investment cost; second, it increases the return on the equity invested by the project owner.

As regards an investor perspective to multiple-benefits, it has been demonstrated[4] that multiple-benefits are increasingly relevant in the investment decision-making process and therefore may guide the investors towards one project or the another. Investments are increasingly valued with an enlarged focus on sustainable criteria with social and environmental impact. This change is also being driven by regulatory and legal compliance requirements. In this sense, the EU Taxonomy compliance and the Sustainable Development Goals are extremely relevant as they are the means of determining whether investments can be classified as sustainable[5] and therefore, have the potential to be marketed and communicated as such.

Given this context, the Italian-demo case just missed to comply with the EU Taxonomy, not achieving the reduction of primary energy demand of at least 30%. However, it needs to be remarked that this Technical Screening Criteria of the EU-Taxonomy entered into force in June of 2021[6] whereas the building renovation of the Italian site took place during 2020. The renovation project still achieved to integrate sustainable criteria and generate environmental, social and economic outcomes estimated by the selected KPIs. For this reason, this investment case can be successfully associated with an opportunity for the investor to support sustainable investments and contribute to SDGs targets.

[4] Throughout EEnvest Project Work Package 4 and in particular in deliverable 4.3

[5] Retrieved from https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

[6] Retrieved from https://ec.europa.eu/finance/docs/level-2-measures/taxonomy-regulation-delegated-act-2021-2800-annex-1_en.pdf.

7.2 RECOMMENDATIONS TO THE INVESTOR ON THE SPANISH DEMO-CASE

Regarding the investment itself in the project, provided that, according to the decision-making tree presented fin Chapter 0, the project has a higher-risk profile and is small-sized, a proper and suitable financing source would be the ESCO itself or a simple dedicated credit line. However, as stated before, the project size is really small, such that it might not be attractive for an ESCO to enter into an Energy Performance Contract, as the transaction costs would be very high. In any case, there are small and specialized ESCOs on the market also looking at small-scale projects if this is remunerative enough from the financial perspective and if they could add a value also to the corporate image. In this case, the project is supposed to achieve a very high 97% energy savings, making the building basically autonomous from the energy point of view. This is a very ambitious target but, at the same time, some ESCOs may be willing to accept the challenge and take charge of additional renovation works, especially if guaranteed energy savings could be kept out of the scope of the project

In some cases, ESCOs also could get financed through crowdfunding campaigns, offering attractive interest rates to retail and citizen investors, usually at local level. This could bring even additional added value to the project.

Finally, the availability of public incentives and/or subsidies should be explored. If local or national grants are available to cover part of the investment cost, then it might also become attractive from the financial point of view, making this good investment from the energy reduction perspective also a good investment for an investor.

The Spanish demo-case is a great opportunity for investors who are looking for greener investment opportunities. In fact, although it is a small-scale project, the Spanish demo-case succeeds to comply with the EU Taxonomy thanks to the deep energy retrofit. The compliance represents an extremely relevant KPI to consider when evaluating the investment case as an actionable KPI that could complement their investments analysis in terms of environmental commitment and regulation compliance in the long-term. The Spanish DER project generates quantifiable environmental outputs, analyzed by the multi-benefit KPIs of predicted energy savings and CO2 emission reduction, together with a broader social impact on the local community.

With a High multi-benefit average performance, the Spanish demo-case could be positively valued by those who are interested in impact investing, specifically regarding ESG criteria and contribution to the SDGs targets. Specifically, investors who are evaluating investments opportunities with an increased focus on sustainable investments with social and environmental impact, but also being driven by regulatory changes and legal compliance requirements. From a portfolio level perspective, investors could maximize impacts and results of this demo-case if it would be aggregated into one larger group with others small DER projects. The rationale of this is backed up by the fact that, for investors, the smaller the DER project, the minor the result of multiple-benefits.

8 Conclusion

In this report the two demo-case buildings participating in the EEnvest project (i.e., Rome, Italy and Olot, Spain) have firstly been subjected to an investment evaluation based on their respective EEnvest Risk Assessment Report. Then the report investigated the possible relevance of the PQSAT to enhance the risk analysis of the EEnvest Risk Assessment Report. It then put the two demo-case buildings into perspective by comparing some of their relevant KPI with other cases in the EEnvest database. It further looked at the financing options available and best suitable to the demo-case buildings and finally this report provided recommendations to the owners of the demo-case buildings as well as to the possible investors in these demo-case energy efficiency projects.

The investment evaluation of the Italian demo-case building revealed that from a technical risk point of view, assessed according to the EEnvest methodology, this energy efficiency project can be considered very low risk. From a financial performance point of view the project is performing well with e.g., a relative short payback time, a rather high IRR and a probability distribution of IRR indicating that the financial risk on the investment is very low. It was concluded that from a financial point of view the project is interesting as an investment opportunity both for the property owner itself or for third party financiers. From a multiple benefit performance point of view, as a result of the shallow energy renovation carried out, the project has rather limited though still positive impact on the environmental KPI and does not achieve EU Taxonomy compliance. However, given the magnitude of the project (over €1 million investment in ECM), the project generates a high impact supporting economic growth.

As to the Spanish demo-case building, the investment evaluation showed that from a technical risk point of view the project has mixed technical risk indicators, the Damage risk indicator pointing to very low risk and the Energy Gap indicator pointing to high risk. From a purely financial point of view the project would be qualified as not performing well with a long payback time, barely positive IRR and a negative NPV, though with limited financial risk on the investment as measured by the probability distribution of IRR and Payback time. The less well performing financial values are consistent though with the type of renovation executed, i.e., a complete renovation and restructuring of the building. This type of renovations typically shows very long payback terms and very low IRR. As a result of the deep renovation strategy the project shows high performance in terms of multiple benefits, i.e., relevant impacts in terms of environmental benefits (high energy savings and high CO_2 emission reductions) and thus EU Taxonomy compliance. Though, the small size of the project (about €250K) indicates limited impact on the economy. The evaluation also indicated that the Spanish demo-case represented a strong investment case when considering its achieved property value increase, showing the importance of including a multi-benefit assessment in the investment consideration.

From the comparison of the risk indicator results of the EEnvest Risk Assessment report with the Project Quality Self-Assessment Tool (PQSAT) it could be concluded that both the Italian and Spanish demo-cases have similar, although individually somewhat more dispersed, risk indicator results. Indeed, both approaches pointed in the same direction when dealing with the risks surrounding the compared KPI. Both demo-cases' risk assessment comparison confirmed that the EEnvest Evaluation Report and the PQSAT are complementary as to the risk indication of KPI compared and as such enhance the risk analysis of these KPI.

When benchmarking the demo-cases with other cases in the EEnvest database the conclusion for the Italian demo-case was that it was ranking very high among the other cases (top 4) from a financial performance point-of-view, though less top ranked i.e., in the upper middle part, compared with the other cases on the matter of expected energy savings. The Spanish demo-case ranked in the middle part from a financial point-o-view, so not performing that well, but had the best ranking in terms of energy savings percentage.

The EEnvest Decision-Making Flow methodology, intended to guide the building owner through the selection of an appropriate business model and financing scheme, has been applied to both the Italian and Spanish demo-cases. For the Italian demo-case it could be concluded that sources of financing could be found from investment banks and investment funds (only within a portfolio of investments) and for the Spanish demo-case the sources of financing could be found from ESCO financing, dedicated credit lines or even citizen crowdfunding.

The report concluded with recommendations to the owners of the demo-case buildings as well as to the possible financiers of or investors in these demo-case energy efficiency projects. Recommendations to the owner of the Italian demo-case related to evaluate also the opportunity to implement the renovation through an Energy Performance Contract and from a multiple benefits perspective to increase the energy savings by only a few percentages in order to reach EU Taxonomy compliance based on the 30% primary energy savings criterion. To the owner of the Spanish demo-case the recommendation was to implement some mitigation measures from a technical risk point of view, e.g., monitoring of the energy performance, implementing maintenance programs or to achieve de-risking by performing the renovation through an Energy Performance Contract, and from a multiple benefits point of view to consider to standardize the measurement of the multi-benefits for in-doors impact possibly through questionnaires for the tenants.

Given the good financial performance and a low technical riskiness of the Italian demo-case, the report highlighted that investors might be willing to accept increasing the leverage factor on the investment and/or reduce the required interest rate. From a multiple benefits point of view, it further concluded that the Italian investment case could be successfully associated with an opportunity for the investor to support sustainable investments and contribute to SDGs targets. As to the recommendations to the investors in the Spanish demo-case, the report's main conclusion was that its attractiveness for investors, and specifically for impact investors, had to be found in the High multi-benefit average performance, i.e., the project's quantifiable environmental outputs, its social and environmental impact through EU Taxonomy compliance, ESG criteria focus and contribution to the SDGs targets.