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Advanced quality and use of energy performance certificates (EPCs) by investors and financial institutions

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Contents

Abstract

This report has been conducted by the European Commission's Joint Research Centre on behalf of DG Energy with the objective to give an overview of the use that investors and financial institutions can make with the information from Energy Performance Certificates (EPCs). The report gives a takes a look onto what are EPCs and their use by these financial institutions, what type of investors have been consulted to make this evaluation and has a look into the financial institutions standard risk assessment concerning energy performance investments and the different types of risks associated to performance-based investment and different endogenous risks. A connection to EPCs for investors is made and an evaluation of the current awareness and use of EPCs by financial institutions in building-related investments is made. A suggestion of what may be the requirements for the success of using EPCs in this context, which are the barriers todays and flaws from the financial institutions perspective were presented along with specific recommendations.

1 Introduction: Energy performance certification description (EPC)

Energy Performance Certificates (EPCs) made prominent in the EU in the early 2000s have evolved as a core policy tool for driving energy performance and efficiency in the building sector. An EPC must be issued for all buildings or building units which are sold or rented out to a new tenant. The EPC must include the energy performance of a building (in kWh/m^2) and recommendations for improvement. The EPC may present additional indicators such as CO_2 emissions or the percentage of renewable energy sources. The idea behind EPCs is that they inform relevant actors, such as building owners, tenants and real estate agents, about the energy performance of their buildings, which in turn shapes the building market. This study investigates the particular impact and use of EPCs on financial funds and institutions in energy efficiency investment and their current influence on European markets.

EPCs are policy tools aimed at improving the energy performance of buildings. Article 20 of the Directive (EU) 2010/31, hereinafter referred to as Energy Performance in Buildings Directive (EPBD), requires that Member States provide information on the purpose and objective of EPCs and the possible financial policy tools that could ameliorate the energy performance of buildings, for owners or tenants.

The EPBD frames the role of EPCs, the content, and the context of the energy ratings. EPCs are designed to encompass all new buildings, buildings that undergo a major renovation and larger buildings occupied by public authorities. In an effort to foster transparency, EPCs are to be readily available to tenants and buyers and displayed in certain buildings. EPCs must include the energy performance of a building and its reference values as well as recommendations for the cost-optimal or cost-effective improvements of the energy performance of a building or building unit.

In regard to value and trustworthiness, Member States are mandated to ensure that EPCs are carried out in an independent manner by appropriately qualified and/or accredited experts. Furthermore, all Member States must develop independent control inspections for EPCs as per the Annex II of the EPBD. (Zangheri et al., 2020)

1.1 EPC Methodologies

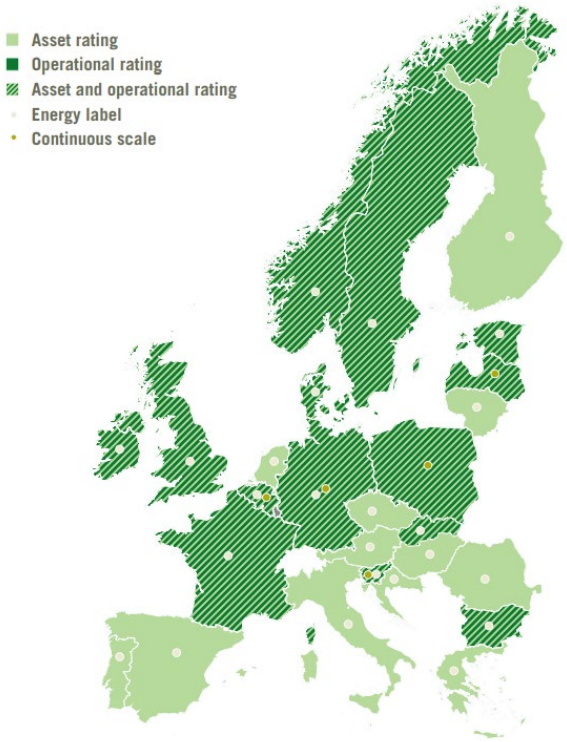
Besides the mandatory aspect of issuing an EPC for all buildings sold and rented, Member States have outlined different methodologies that evaluate further factors: location and orientation, ventilation, air conditioning, indoor climate, thermal characteristics, and heat and hot water systems. Moreover, each methodology normally (Semple & Jenkins, 2020):

1. Calculates the overall energy performance index in total and per area unit of energy,
2. Provides an overall minimum efficiency level,
3. Provides a breakdown of energy use by dwelling component,
4. Displays the results on an A to G branding.

While the above are common to EPCs,the rating methodologies vary widely across Europe. In fact, 29 methodologies for EPCs are used in the European Union with individual methodologies for each Member State and for each of the three regions in Belgium. The UK has an EPC system with different systems for Scotland, England and Wales and Northern Ireland.). Consequently, the metrics for the grading of EPCs are non-standard. A direct comparability of EPCs across markets is therefore complicated, as innovative and technical solutions and ratings are not consistently applied in all markets. As a result of varying methodologies, a residence in Austria with an energy efficiency performance of 50 kWh/m^2 year would be given an EPC rating of C, whereas in Germany a residence with the same performance metric would be given a rating of B. This will be an issue for any cross-border financial institution.

While the methodologies are distinct, three general categories can describe the approaches taken: asset rating, operational rating, and a combined rating. The map displayed in Figure 1 illustrates the methodology types in use in each Member State.

Figure 1. Overview of methodologies used in European countries for the evaluation of the energy performance of buildings.



Source: Arcipowska et al., 2014.

Such methodologies are described in short below:

Asset rating: considers the primary energy needed for a building to meet the theoretical, as designed, energy efficiency. It neglects the losses stemming from the production of energy but accounts for the intrinsic performance of the building envelope and its services such as HVAC and lighting (Arcipowska et al., 2014; Lewry, 2013). Since asset ratings are based on designed or intended use, they do not necessarily reflect the occupants or users behaviour. Consequently, this method can be more easily applied to new buildings but does not necessarily accurately reflect the building actual consumption level.

Operational rating: accounts for the energy use from a building over a defined period. The consumed energy is then benchmarked against other buildings of a similar type. This rating scheme is therefore suitable for existing buildings where user behaviour is relatively predictable and static.

Combined rating: Asset and Operational ratings are combined to create one, more holistic unit. How this is done, diverge between Member States.

1.2 Description of current uses

A recent review by Pasichnyi et al. (2019) found that EPCs and EPC data are being used in the following domains across Europe:

Application domains	**Description**	**Examples**
Decision-making in real estate market Market popularity of retrofitting solutions Design of new buildings	Decisions of actors such as tenants, landlords and building owners.	German housing market where energy-efficient rental units are rented at a premium (Cajias, 2019).
Energy planning	The use of current energy indicators or metrics for planning of new buildings or appropriate refurbishments.	Creation of an energy certification database to develop metrics for energy planning in northern Italy (Dall'O', 2015).
Framing incentives for energy efficiency	Identification of areas at greatest risk of energy poverty and targeting incentives to address them.	Development of a Fuel poverty risk index based on building energy performance in Italy (Fabbri, 2015).
Investment analysis	Assessment of building investment based on EPC rating and/or EPC data.	Evaluation of mortgages based on EPC data as inputs in the UK (Hamilton, 2016).
Mapping building energy performance Predicting future energy and CO_2 emissions Occupant behaviour influence on the building energy performance	Ranking energy efficiency performance among various building stock.	Comparing energy efficiency performance between rental and cooperative apartment buildings (Broberg, 2018).
Performance gap	The difference between estimated and actual energy performance.	In Greece, EPC data offers a basis for more accurate metrics and standard assessments stemming from actual energy use (Balaras, 2016).

These applications can have tangible implications for financial institutions and groups that participate in building sector activities. As demonstrated by the German housing market, where energy-efficient rental units are valued significantly more than their counterparts, the valuation of building stock and energy efficiency is an important factor for understanding the market behaviour, the value of assets and consumer demand.

The same principles have brought the introduction of Green Leases in countries like Ireland and have been gaining popularity in other markets such as the UK and Sweden. The launch of Green Leases shows an evolution of the real estate industry from offering a physical space, presenting a value proposition based on a space with related services where energy efficiency is a core tenant. As Green Leases formalise the interaction between

building owners and occupants with a focus on sustainability, these efforts demonstrate some level of movement toward business models of co-creation enabled by tools like EPCs, though the customer interest appears low.

In a financial context, the valuation of energy efficiency has also been correlated with the risk of mortgage default: buildings that are more energy efficient have a lower likelihood of mortgage default (Billio, 2021). Although an equal relationship was not found between energy efficiency and credit risk, the independent value of energy efficiency as a factor in these types of financial agreements are important to be considered. Therefore, the use of a standardised scheme for measuring this risk when issuing financial arrangements, such as mortgages, can be useful to financial institutions.

2 Methodology: interview sources and method

A literature review was performed to inform interviews and provide context on the current uses, methodologies and implementation across the EU Member States.

Research on the practice of financial funds and institutions was then conducted by interviewing these parties to understand the degree to which EPCs are being used to value potential energy efficiency investments. The interview questions were designed to investigate whether financial funds and institutions use EPCs in their assessment of investments. The financial funds were also asked to provide insight on how EPCs could be made more applicable to their analyses and operations.

2.1 Interviewee selection criteria:

2.1.1 Investor type

The aim of this study is to investigate the use of Energy Performance Certificates (EPCs) by financial institutions. Uses for EPCs will depend heavily on the intent, risk appetite and investment model of the financier. To understand this dynamic, the researcher selected interviewees from banks as well as private and institutional funds. Each of these three have differing levels of risk appetite directing the types of finance they provide and their potential use of EPCs.

2.1.2 Financing type

There are many forms of investment, and it was not relevant to cover them all. The two main categories are reviewed here. The first type is comprised of classic asset-backed loans that are – almost exclusively, based on the creditworthiness of the client. Here, the ability of the client to pay is the only primarily relevant factor, while other risk factors are secondary. Social and environmental concerns may be a consideration, but these will not be reflected in the risk assessment, as they will be set as investment criteria for a particular portfolio.

The second financing type is comprised of performance-based loans or equity investments. These look to treat energy efficiency measures as a service which will – at least in theory, be paid back through the energy savings made, and therefore include an important element of performance requirements. Risk factors included in this form of investment are described in Section 3. Performance-based investments could, in theory, find EPCs of value, if they could be used to set a baseline against which to measure performance.

2.1.3 Investment type

Financial institutions buy buildings, manage buildings, renovate buildings to sell them again at a profit, and invest in renovations to improve efficiency or carry out any combination of these activities. The types of real estate covered include commercial, residential or industrial real estate. The potential uses of an EPC differ in each instance.

The interviewees selected for this research, therefore, came from all groups named above. They include banks, funds and institutional investors. They provide both performance-based investments and asset-backed loans (in different forms). They buy, manage, renovate and perform energy efficiency upgrades in buildings. This selection of interviewees ensured that the comments made represent as much as possible the general categories found in the market today and that their feedback concerning EPCs could be presented in context and was representational.

2.2 Questionnaire

A standard set of questions (Annex 1) were posed to each respondent to gauge their personal and institutional level of awareness of EPCs as well as determine how and if EPCs were being used by their financial fund or institution. The questions were designed to gather information on the following topics:

- Types of investment/loans the fund or institution is involved in
- Level of EPC familiarity/knowledge
- Method of risk assessment for energy efficiency investments
- EPC usage in current business practice
- Rationale for EPC usage

— Recommendations for improved use of EPCs.

A list of 54 relevant financial funds and institutions were compiled and invited to participate in an interview. Of the 54 invited funds and institutions, 18 agreed to participate in the study; upon request, the questionnaire was issued ahead of the scheduled interview. 3 of the 18 respondents opted to complete responses on their own, while the remaining 15 answered the questions by phone. Interviews were conducted between December 2019 and February 2020.

The key analysis then lay in looking for and defining patterns to answer the following questions:

— Does the use of EPCs change the perception or behaviour of financial institutions or funds concerning the risk profiles of investment?

— Is there a connection between investment nature and EPC usage?

— Are there common reasons for financial institutions not to use EPCs, and are the financial institutions aligned in their recommendations for the improvement of EPCs?

3 Financial institutions standard risk assessment concerning energy performance investments

Evidence from the study reveals that the EPC relevance to a financier is directly proportional to how well it supports the institution in quantifying the potential value or manage its investment risk, and thereby improve returns. Below is a list of the full set of key risks used by many financial institutions when analysing the risk/returns of a given real estate investment. However, for asset-backed loans, the credit risk of the end client will be of primary importance and the analysis is far simpler.

This section describes only those risks looking to assess the risks associated with an individual investment and its security of returns –for the complete set of risks, Annex 2.

3.1 Key standard risk assessment factors for performance-based investments

This section describes the principal risk assessment factors typically evaluated for performance-based investment.

Construction risk

Construction risk takes into account the risk that a project can be delayed or cancelled before it is completed and begin to generate returns. Many factors can contribute to this risk, the bankruptcy of the main party, theft, issues with zoning, technical failures, supply chain delays or failures, unforeseen regulatory issues, so on and so forth. Based on that, a fund will either accept or reject construction risk. If they accept this risk, they will pay the project developer before the completion of the project at a slightly higher interest rate. If they do not accept this risk, they will pay the developer only once the project is completed and functional, and interest rates will be slightly lower.

Relation to energy efficiency: the majority of project developers are SMEs. Therefore, though this risk does not relate directly to energy efficiency *per se*, it is relevant. If developers can only receive the payment after the completion of the project, the project finance may be of no use to them.

Regulatory risk

Regulatory risk is the risk incurred when returns on investment are based on some measure paid for by the government. If the government changes the policies (e.g., retroactively changes feed-in tariffs for renewables or energy efficiency projects), the funds may not receive payment. That has indeed taken place multiple times in Europe. Two examples are the Spanish government cancelling their feed-in tariff obligations under the feed-in tariff, and the UK government cancelling their financial obligation to support Anaerobic Digestion plants in Northern Ireland. In both markets, it is likely to find investors today who will not accept regulatory risk. This means that a project must not be reliant on payments from a government-backed scheme for repayment.

Relation to energy efficiency: energy efficiency projects, by and large, contain a minimal degree of regulatory risk. That said, this risk negated the energy efficiency support schemes for Spain and – to a lesser degree, Italy, due to the fact that funds may not include their support mechanisms as part of the investment returns. Therefore, once investor trust is lost, the impact is severe and long-lasting.

Credit risk

Credit ratings offer an evaluation of a prospective debtor's ability to pay back the debt. This rating is a metric for comparing fixed-income securities. Companies are assigned a rating based on their financial outlook, past and current situation. Credit risk is the most important risk on any debt-based financing measure. This is particularly true of asset-backed finance: in most instances, it is the most important metric, to the exclusion of others, such as the reliability of the technology or the energy savings that may be achieved. The more the focus of a fund is on energy savings or other performance metrics, the more they will also include the range of risk factors in this list. Credit risk will then be just one of the important elements in the full risk analysis of the investment.

Homeowners are as well given an individual credit rating scored by various bureaus on a three-digit numerical scale using Fair Isaac Corporation credit scoring (FICO). These scores determine whether the homeowner is approved for credit as well as the interest rate at which it will be repaid.

Relation to energy efficiency: credit risk assessment is the risk category that has the greatest impact on project funding. The percentages of failure are unknown, but according to the authors experience, the percentage of

SMEs that would fail to pass a credit assessment for an energy efficiency project is between 70% to 80%, depending on the capital source, investment duration and contract type.

To mitigate this issue, some EU Member States central banks offer credit risk guarantees to local branch banks, effectively protecting them from credits risk. The intent being to allow for a wider range of companies to pass a credit check and grow the local energy efficiency market. However, some banks use these first loss instruments to improve their own profit margins rather than widen the range of entities that can access energy efficiency project funding. Therefore, today the credit protections put in place to encourage investment may only improve the returns of the local banks who use them rather than grow the energy efficiency markets. It is worth noting that the number of banks acting in this way is not known by the authors, as the use of the credit guarantees is not made public.

Energy price risk

The unpredictability of the price development over the project investment term is an important risk if repayment is based on financial savings. Historical data shows electricity price increases above inflation rates, but extrapolations from historical data are obviously bound to forecast errors at best and cognitive biases at worst. Particularly in long-term projects of 10 and more years, the relative steepness of the slope of the energy price curve will have a significant impact on the overall investment performance. Investors will almost never accept taking this risk, and they will review the risk only to ensure that it will indeed not impact the security of their investment. They will insist on that the project assumptions concerning price developments are realistic and robust, and that if the price does not develop as expected, either the provider or the client is willing to accept this risk.

Relation to energy efficiency: a well-constructed energy efficiency project will protect the investor from this risk as investors will not be willing to accept it. Depending on the financing type, the client or the project developer, or both, may be exposed to price changes.

3.2 Endogenous risks

The second category of risks is more strictly related to the individual projects and includes, to a large extent, rather qualitative than purely quantitative assessments. Many of these risk types are addressed directly or indirectly through certain contractual agreements.

Investors will generally only be concerned about this category of risk if the project returns are **performance**-based. If the project is financed exclusively as repayment against an asset and the creditworthiness of the clients, then these risks may not be considered at all. Therefore, by looking at what risks a fund or bank include in their analysis, it is possible to know what they actually prioritise. For example, if a bank says they prioritise carbon reduction but do not take into account whether an investment will indeed achieve such reductions, then it is possible carbon reductions are actually not a top priority for them. If it were, they would check that the projects are technically viable. The risks outlined are those that will be highlighted by funds that are prioritising project results.

Technical risk

Technical risk relates to equipment malfunction and/or breakdown and its treatment is generally considered one of the most standardised for all risk categories. Investors usually want to see the best available technologies used and the equipment to be covered by warranties for the full project term. The installation, maintenance and – potentially – replacement has to be performed by either the manufacturer or a certified professional.

Performance risk

This risk is emphasised when the outcome and results of a project are important. The relevant factors included in this risk type are essentially:

1. Poor or faulty design
2. Flaws in the implementation of energy efficiency measures
3. Mistakes in the operation of the measures
4. Fluctuation of usage patterns, including change of user behaviour.

Design risks concern the failure of the energy modelling, selection of energy efficiency measures and engineering design to accurately predict the energy savings, all other factors being equal. This failure may come

about for a number of reasons, including design error and the inaccuracy of design models. A design failure may be difficult to establish unless it involves a clear mathematical error or obvious misspecification. Design failures can occur in single measure or technology projects but are more likely in complex multi-technology projects where there are interactions between measures that are sometimes difficult to accurately model or predict. The issue of actual energy performance not matching design performance in buildings is called the performance gap.

Mitigation methods: Engineers typically will not accept saving risks associated with their designs. Professional Indemnity (PI – also called Errors and Omissions,) insurance will not therefore cover savings, but it will cover mistakes in calculation or specification. There are several standard practices that are often observed that will mitigate design risk, including:

- Engineers working for the developer share all data, calculations and simulation files. Their awareness that this information will be on file will compel a higher degree of care.
- Third party engineers experienced with retrofits may be tasked with reviewing of all design work. For larger projects, financial institutions often require independent engineers to carry out technical due diligence.
- The use of appropriate national or international standards in project development and documentation such as the Investor Confidence Project Protocols may be specified. Use of the Investor Confidence Project's Investor Ready Energy Efficiency project certification system brings with it the added confidence of an independent third-party verification that best practices have been followed in project development.

Lenders and investors may consider reducing savings projections or investigate the methods the developer may have used in the design process to reduce them. Where simulation programs are used to model building physics, the level of confidence in the model calibration needs to be considered. The magnitude of any reduction, or "de-rating", of the savings will depend on the degree of interaction among measures, the difficulty of the retrofit, the extent to which the technologies are proven, and other factors identified by the third-party engineer.

In theory, EPCs could be used to support creating a baseline expectation for a building as part of the analysis of performance risk.

Operations and Maintenance risk

The contractor shall outline all necessary Operations & Maintenance (O&M) tasks, including timing and service levels, in a detailed O&M schedule, and disclose all relevant documentation from previously undertaken and/or ongoing projects of similar nature in support of that. The important pieces of information that should be contained in the O&M schedule are:

- Historical O&M performance by O&M provider
- Credit quality of O&M provider (in case it is different from the contractor)
- Measurement and verification (M&V) systems used for outage detection
- Downtime period estimation
- Number of O&M staff compared with commercial growth
- Presence and nature of any backup O&M arrangements
- Interface risk

Interface risk refers to any potential interference of End Clients or third parties with or misappropriation of the installed equipment. Any moving, maintenance or operational tasks shall be the sole responsibility of the appointed contractor.

Occupancy risk

Project cash flows are calculated and forecasted based on specific assumptions of building occupancy and user behaviour. Occupancy risk arises from significant deviations to these initial assumptions, which usually result in a lowered use of the installed equipment and thus in reduced savings compared to the baseline. For this reason, it is important to assess the following:

- How are energy consumption baselines adjusted for change in occupancy levels?
- What % drop of occupancy level is (still) financially sustainable?

— Is there a contractual stipulation in case of decommissioning of the facility where measures were installed? (e.g. termination schedule?)

— Is there a contractual stipulation that specifies at what state the promoter/contractor is no longer obliged to provide services?

The promoter/pontractor is responsible for regular adjustments to the energy consumption baselines, while the implementor/client is responsible for timely and transparent communication about any change of occupancy level.

Pipeline risk

Investors who choose to invest in small projects often do so with the understanding that more projects of the same type will be developed and brought to them. The fact of dealing with the same counterpart, the replicability of project opportunities and because the same client agreements, manufacturers and insurances are involved, the due diligence work and related costs are brought down significantly. Energy efficiency sales pipeline normally consists of projects at various stages of maturity, and therefore information about the following three stages is crucial:

— Contract signed with implementor/client – ready for installation

— With agreements to proceed (to be closed in less than three months)

— With agreements to proceed (to be closed in less than six months).

It is, however, important that the projects contained in the pipeline have similar specifications, in particular:

— The same equipment

— The same client type (sector, maturity)

— The same contractual agreement

— The same project terms.

4 Key possible connection to EPCs for investors

As part of the interviews, financial institutions and funds were asked about their risk assessment practices, and which risks they review when considering a building loan or refurbishment investment. The risks outlined in Table 1 were defined as the priorities in the risk assessment practices. As stated above, the credit risk will be the primary and sometimes only fully analysed risk for asset-backed loans, where the actual performance of the measures do not impact the repayment of the loan. Indeed, three of the respondents explained that it is the only criteria they look at, and they would finance a project as long as the credit risk is acceptable.

A bank or fund that is not concerned with the performance of a project or facilitating measurable carbon or energy savings will obviously also not use EPCs. They will be beyond their scope. Responses below, therefore, must be understood within this context. Many financial institutions today focus on financial returns through repayment of debt – independent of social or environmental considerations.

Table 1. Priority Risk Factors in Risk Assessment Practices of Financial Funds and Institutions

Priority Risk Factor	No. of Respondents
Credit Risk	14
Technology Risk	8
Performance Risk	8
Contractor Track Record	7
Location Risk	4
Market Risk	3
O&M Risk	2
Pipeline Risk	1

Source: JRC, 2021

In terms of evaluating the quality and condition of a building as part of risk assessment, all EPC users responded affirmatively. Conversely, only 30% of EPC non-users would consider the quality and condition of the building in their risk analysis.

Based on these responses, it is apparent that when utilised, EPC ratings can offer a comprehensive measure of the building's quality and condition. However, the information available through EPCs was not generally found to impact other aspects of risk assessment for the financial institutions and funds. As many funds focus on investing in specific measures, air-conditioning and heating upgrades, combined heat and power, lighting, behind the meter renewable generation, and so on and so forth, a standard measure of the building quality may not be of primary importance. As a result, analysing the responses of institutions and funds that used EPCs in their investment practice (EPC users) against institutions and funds that did not use EPCs (EPC non-users), one key area of divergence was the value placed on technology risks. Only 20% of EPC users named technology risk as one of their priorities (because they tend to focus on deep renovation and the quality of the building) compared to 60% of EPC non-users who tended to invest in specific energy efficiency technology-based measures.

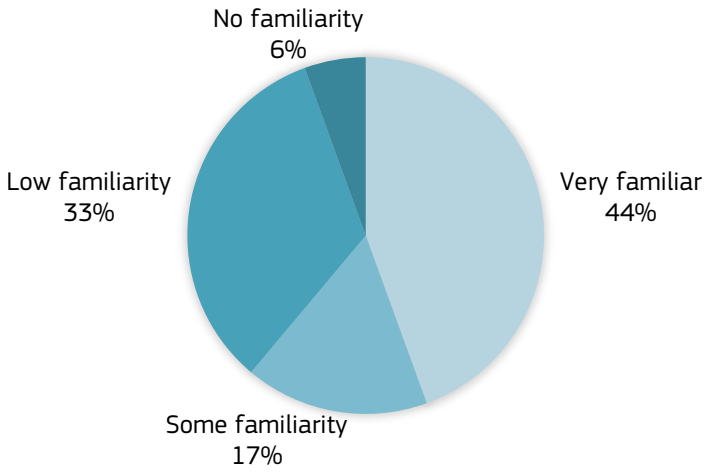
5 Interview results

5.1 Current awareness and use of EPC by financial institutions in building-related investments

Regarding familiarity and awareness of EPCs by financial funds and institutions, approximately 61% of respondents were familiar or very familiar with EPCs. While the large majority had a good insight into the certificates and how they work, one-third of all respondents had low familiarity, and roughly 6% had no familiarity whatsoever. However, this finding is in all probability not representational of the investment community as a whole, as the interviewee group was intentionally made up of investors who could have insights into how to improve EPCs. That means that of those investors known to perform the relevant types of investment, 61% of the respondents were familiar with EPCs. Therefore, the general knowledge of EPCs of the investment community as a whole is probably lower.

EPC Familiarity of Respondents

Figure 2. EPC Familiarity



Source: JRC, 2021.

As one would expect, EPC users reported a good working knowledge of EPCs. However, there were also EPC non-users that demonstrated a good level of awareness while not making use of EPCs in their investment practice. When questioned why, this group offered specific criticism of EPCs. These are presented in general below, before being analysed according to investment type.

For example, one non-user with awareness of EPCs remarked that

> *the current forms of EPCs are not accurate enough for us to use and do not clarify the actual costs of the building's rating in terms of consumption.*
>
> *The EPCs would also need to be made publicly available to financial institutions, then they would be able to detect what is green and what needs attention, as well as identify where the risks are.*
>
> *If EPCs came with public requirements attached, they would be more effective, for example a set of policies on the labels, e.g., which buildings should achieve what rating by a certain date. These requirements would be all the more important because any price incentive will never outweigh the burden of the homeowner for refurbishments.*

Similarly, another respondent offered recommendations to address this criticism, suggesting that EPCs include not only energy consumption in primary energy but also include final energy.

> *This makes more sense from a refurbishment point of view. They should also indicate what the minimum energy performance requirement per measure is and how much better each appliance or measure needs to be to raise the rating. An increased level of consistency and standardisation in methodology cross border would also be helpful for financial institutions.*

5.2 EPCs impact and requirements for investment decisions

According to the interview results, those financial institutions fully aware of EPCs would consider them valuable toward multiple ends. The envisioned uses depended heavily on the focus of the financial institutions. Three of these uses are possible today, and two would require robust adjustments. Below is a short description of the uses named:

5.2.1 Current uses of EPCs

For institutions purchasing real estate:

- As a basic tool for quantifying the assumed carbon footprint of their real estate portfolio. That is commonly used not for investment purposes but reporting purposes and to demonstrate the institution's priorities.
- To set minimum internal requirements for the purchase of real estate. For example, a bank might want to purchase only buildings that have a C grading or higher.

Both of these uses are possible today with the current forms of EPCs. In neither case are they being used to actively assess potential returns on an investment (part of a risk assessment process) but rather either to quantify in general terms the possible carbon footprint of a portfolio (with the understanding that this will not be accurate) or to set a basic baseline for the grade of buildings purchased. EPCs, in this instance, therefore, are a passive, general marker of quality.

5.2.2 Requirements for success

Consistent quality in national methodology and reporting

The quality of EPCs as a reporting tool is directly linked to the national methodology and the quality of the application and reporting process. That appears to vary widely. For example, one Spanish investor stated that they do not use EPCs in Spain due to the fact that metrics are self-reported by the developers or building owners. Others, such as a Belgium bank, find them to be useful benchmarking tools.

Standardisation

Banks and institutional investors often invest across Member States. The standardisation of EPC methodologies and reporting requirements across borders would enable like to like comparisons. Today, an EPC in one country is not equivalent to an EPC in another, and this lowers their quantitative potential as well as their reporting value for large institutions.

Public availability

If EPC ratings are public information, financiers can access them for multiple purposes. For example, a large French bank with real estate holdings is looking to map the EPC ratings of its portfolio. Today, it must go and request this information one building at a time. If the information was publicly available, that would not be necessary. It would also be possible for this investor to make comparisons between their own holdings and the national average. Another potential use mentioned would be their ability to make pro-active enquiries into potential investments using the ratings as one criterion.

5.3 New uses for EPCs:

For institutions carrying out building renovations:

EPCs are utilised to establish a rough baseline prior to conducting a building audit. They do not replace the building audit but only allow for a general idea of what buildings might be of interest to audit.

EPCs may be used as a mapping tool to identify clients with the largest investment potential in terms of environmental and/or social impact. For example, investors named utilising public EPC data (when available) to find low rated households in order to offer them retrofits and maximise social benefit as well as their return on investment. Investors will usually only pro-actively seek out energy efficiency investments in this way when they also partially or fully own a project developer. Therefore, the EPC is a useful mapping tool enabling them to better target client outreach.

There are certain banks that are experimenting green mortgages. That means that they take into account the increased value of a home after a renovation and energy efficiency upgrade when providing a mortgage. As a result, the mortgages may be offered at lower rates. A home may be taken from an EPC grade E to a grade B.

However, the quantification of value is based on the energy cost reductions assumptions provided by the building audit (not the EPC rating). The rating is a means of expressing the improvement in the condition of the building.

5.4 Uses not possible today

For institutions investing in specific energy efficiency measures

Investors are not able to use EPCs for this type of investment today. Thats is due to the fact that these investments cannot make use of rough baselines. EPC methodologies are not sufficiently granular to allow for their use in specific energy efficiency measures such as heating or cooking upgrades, lighting, ventilation systems, etc.

Investment institutions looking to government to spur building renovation

Governments have been slow to insist that buildings meet a certain EPC standard. That is due to the renovation costs and the political difficulty in enforcing such regulation. It is also made more difficult by a current lack of off-balance sheeting financing options for homeowners and businesses. Even in countries where the ability to rent or sell a building is, in theory, dependent on maintaining a particular EPC rating, such as in the UK, these rules have yet to be enforced. However, this issue is due to a lack of political will and is not a failure of the EPC as such.

5.5 EPC flaws in financial institutions perspective

In summary, though financial institutions today may make use of EPC's as a general marker of a building's condition, EPCs cannot be used:

- To accurately quantify a building's carbon footprint;
- To quantify the impact of a particular measure on a building's carbon footprint or energy consumption;
- To quantify a potential return on investment against certain measures;
- To replace a building audit;
- To make a final investment decision concerning a building renovation or upgrade;
- To manage investment risk concerning a return on investment;
- To ascertain if a particular building renovation plan or set of specific measures will bring a building from one EPC grading to another.

The following criticisms were made by investors interviewed:

- Absence of mandatory use policies for financial institutions and funds;
- Lack of set timeframes for improvements or buildings to reach certain rating, to encourage definite refurbishments and increase finance;
- Lack of standardisation across European Union Member States, making comparability of results impossible;
- Lack of clear regulation around the quality of EPC rating methodologies. Issues around unreliability and inaccuracy. For example, self-reporting is allowed in certain Member States, (such as over the phone, without any visit from an inspector to the property),
- Lack of assurance of qualified personnel performing the EPC audit. Unequal, low or inconstant requirements and thresholds for becoming a licensed EPC issuer/inspector. The implication for financial institutions is a consequent risk in quality assurance;
- Lack of detail and robust quantification. EPCs are considered overly simplistic for use in financial analysis. Out of all the flaws named in the course of this study, lack of details was the most frequently mentioned;
- Methodologies do not enable funds to quantify the value or the impact on an EPC rating of a specific renovation plan;
- Methodologies are not granular enough to consider the impact or value of individual energy efficiency measures such as improved heating, cooling or lighting.

Lack of education around EPC rating content

Overall, EPC data and the inputs that go into EPC gradings appear poorly understood. This lack of understanding was visible when financial funds and institutions offered criticism of the perceived absence of measurable environmental metrics in EPC ratings. Many of these financial institutions focus on improving the carbon footprint of the buildings that they are investing in through specific measures to reduce CO_2. How the EPC rating would change based on these activities was unclear for many investors. This is an important barrier to the usage of EPCs.

Standardisation

All the flaws named were common to both EPC users and non-users. Differences arise when certain funds only operate in specific markets, and encounter issues of credibility related to the issuance of EPCs in those Member States. The main example of the discrepancy in this study was the experience of respondents who have made investments in Spain. Conversely, financial institutions and funds operating in the UK, where EPC use is more enforced, did not experience the same concerns around trust or quality of ratings. These issues further highlight issues around standardisation across markets and the impact of varying levels of regulation from Member States.

In addition to the challenges outlined in this section, 5 of the 18 respondents expressed that EPCs were unnecessary or irrelevant to their current business practice. Several institutions and funds voiced that they were already using other methods to assess energy efficiency investments. A clear case of such approach is represented by a state-owned development bank that has established its own investment standards and procedure for assessment without EPC data. However, that may lead to reflecting on the lack of standardisation and trust: generally, a fund prefers to include a well established and tested methodology rather than rely only on their own, assuming this outside method has indeed been proven robust over an extended period of time.

5.6 Specific recommendations for improvement

Below are specific recommendations for improvement:

- For the wider use of EPCs within the current methodology, mandatory use policies for financial institutions and funds would support an increase in awareness among investors and increase in their use. These could include reporting requirements, for example.
- Ensuring that quality and reporting standards for EPC ratings are consistent and robust across Member States would improve the image of EPCs in those markets and encourage their uptake
- The creation of regulatory timeframes for building refurbishment or buildings to reach certain rating, to encourage definite refurbishments and increase funding in a substantial manner. However, for this to be effective, reporting requirements would need to be consistent and reliable.
- Training and qualification requirements concerning personnel performing the EPC audit would need to be reviewed and improved in some Member States.
- In order to form the basis for the quantification of the value of any form of investment, the accuracy in EPCs ratings must improve substantially. This must include a significant increase in reporting granularity and also in measurement and verification. The level of granularity will have to increase further if the impact of specific measures such as heating, cooling or lighting are to be included.
- EPCs could be further promoted among the investment community in order to ensure that financial institutions understand their possible current uses. In particular, their environmental components should be emphasised as investors are increasingly looking for ways to benchmark the environmental impacts of their portfolios.

6 Conclusions

EPCs function within a wider societal and political context that directly impacts their uptake and visibility. It also may impact the ambition level of any improvements made on EPCs. For example, it should be remembered that the vast majority of national governments do not require building stock to reach a particular EPC rating, nor are most governments creating strong tax incentives or other financial incentives to support building renovations in general. However, this is gradually emerging with the increasing public concern over climate change and long-term renovation strategies as part of the European Green Deal.

On the side of financial institutions, the majority of banks do not make substantive investment decisions based on environmental or social factors. However, this tide is also turning: ESG criteria are increasingly adopted. Traditionally, these actors did not actively seek to quantify the impact of their investment decisions on the environment. They are in the business of supporting market function and ensuring a return on investment as payment. Also in this regard, pressure is mounting on financial institutions to consider the impact of their decisions. More and more often, if they do not do so, the public will do so for them. They are also becoming aware that it is harder to justify directly destructive investments such as the destruction of the rain forest or the expansion of coal mines, though they continue to analyse and accept such assets.

That said, as the risk of such investments rises, the appetite of risk-averse financial institutions will decrease in proportion. Nevertheless, to be realistic, the majority of banks look to both earn from carbon-emitting investments, carbon reduction investments and climate change mitigation investments. They look to earn from financing the causes of climate change, financing the fight against climate change and financing the infrastructure projects or disease/storm/flood/fire recovery projects resulting from climate change.

Though this is the practice of many commercial banks today, it is not the practice among investors or financial funds or responsible banks who are increasingly concerned with climate change mitigation and reversal strategies. Indeed, the market is awash in money and fund managers searching for viable environmental investments - having raised between €100 million and €1 billion to spend on more or less anything that could be called 'green'. That includes improvements in the building sector.

The potential for EPCs lies with this group.

EPCs are used today by a minority of financial institutions as a basic benchmark of a building's general condition. This is already providing value within the market. However, although the pool of financial institutions selected for this research was already biased towards those that were likely to be aware of the importance of energy efficiency and other environmental issues, 39% had none to low awareness levels of EPCs, and approximately 20% more did not seem to have a full understanding of what they quantify. For example, they did not necessarily know that EPCs included environmental metrics.

That would indicate that there is room for education among financial institutions on the opportunity to use EPCs to carry out basic benchmarking activities or to communicate the general condition of their existing building stock. That said, this may be of limited value in Member States where there are viable concerns over the reliability of EPC reporting requirements.

To summarise, according to the findings of this study, there are two degrees to which EPCs could be improved to bring additional value to financial funds.

Passive use - benchmarking

EPCs are already used in multiple ways to benchmark the general carbon footprint of a building portfolio and to decide whether or not to engage at all with a particular real estate investment – such as refusing all buildings below a certain level. In markets where EPC ratings are public, funds also use them to compare the quality of their investment portfolio to the national average or create reports on their own carbon footprint. In the case of green loans, EPCs are used as a communication of the final result or the requirement for the loan provided.

EPCs could also already be used today by governments to, for example, create tax incentives for upgrading buildings from a rating to a higher one, or as a requirement for renting or selling of buildings –assuming the reporting requirements are sufficiently robust. This is a political decision. If and when EPCs ratings will be public, investors owning a project development arm will also use them to actively find new potential clients.

These uses could be supported and expanded through the improved application of the existing framework**,** through, for example, improved training. Benchmarking is therefore valuable on its own, and it can increase transparency and allow for better, more responsible investment decisions. Improving EPCs as benchmarking tools would require improving the consistency of training provided to the personnel performing the EPCs,

improving the reporting requirements, in particular in Member States, requiring EPC ratings to be made public and at least considering standardisation across Member States, as detailed above.

Active use – measurement and quantification

What is not possible today is to utilise EPCs to quantify the monetary value of an investment, the impact of a specific measure on the EPC rating, or the real energy savings which a measure could produce. Therefore, they cannot be used as a basis for investment decisions for performance-based investments – either at the level of building renovation or the installation of particular measures.

Expanding the use of EPCs beyond the passive benchmarking level requires substantial political and technical effort and resources. The gap between a rough benchmark to a quantification tool able to support the assessment of the potential monetary value of a planned measure is substantial. Requirements would include:

- Standardising and increasing the training for those performing the EPCs, ensuring reporting requirements are robust and consistent, and that self-reporting is impossible;
- A complete and detailed review and a substantial expansion of the metrics measured in each Member State;
- A total review of the methodologies used for quantification of data in each Member State;
- A review and increase in the frequency of updates and reporting;
- Ensuring that EPCs measure and report the final energy consumption of a building when occupied, rather than assumed consumption only.

All of the above would have to be carried out in cooperation with investors in order to ensure robust development and gain the financial industry's trust. If a Member State invested these types of resources in their own EPC, they would, in fact, create a new tool – separate from any other EPC methodology in Europe. This might benefit that country but have almost no impact elsewhere.

If such an effort were to be made, therefore, it may be best to renew the entire EPC concept and methodology at the European level in order to enable all Member States to benefit equally from one concentrated effort. That would allow for the coordinated development of a useable standard and investment tool for the informed renovation of buildings across Europe.

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List of abbreviations and definitions

AML	Anti-Money-Laundering
EPBD	Energy Performance in Buildings Directive, official name: Directive (EU) 2010/31
EPC	Energy Performance Certificates
ESG	Environmental, Social, and (Corporate) Governance
KYC	Know-Your-Customer
HVAC	Heating, ventilation and air conditioning
FIOC	Fair Isaac Corporation credit scoring
M&V	Measurement and verification
O&M	Operations and Maintenance

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Annexes

Annex 1. Interview questions

Standard set of questions posed to each participant:

1. How familiar are you with Energy Performance Certificates (EPCs)?
2. Does your company consider the use of funds in a building when providing a loan to building owners for building refurbishment?
3. Are your investments in buildings ever performance based?
    (a) If so, in what way? How is this reflected in the risk assessment and contractually with the client?
4. Do you consider the quality and condition of a building as part of your risk review process prior to providing a loan for a building refurbishment or purchase?
5. Do you consider management or building running costs when considering a loan to a building owner for building refurbishment on purchase or any other use of funds?
6. Is credit risk and ability to pay your only criteria when providing a building refurbishment or purchase loan, or do you consider other factors.
    (a) If so, what types of factors are they?
7. Do you make use of Energy Performance Certificates in your analysis of building quality and/condition?
8. Do you make use of them when deciding the payback or benefit or risk profile of a refurbishment loan or building purchase?
    (a) If so, what is most useful to you about Energy Performance Certificates in this context?
    (b) If not, why do you not make use of these certificates?
    (c) What would be required for you to be able to make use of them in this context
9. Do you have any recommendations for improving the relevance and use of Energy Performance Certificates for financial institutions and in your own institution, in particular?

Annex 2. Risk assessment criteria performance based energy efficiency investments

Construction risk

Construction risk takes into account the risk that a project will be delayed or cancelled before it is completed and begin to generate returns. Many factors can contribute to this risk, the bankruptcy of a main party, theft, issues with zoning, technical failures, supply chain delays or failures, unforeseen regulatory issues, so on and so forth. Based on that, a fund will either accept or reject construction risk. If they accept this risk, they will pay the project developer before the completion of the project at a slightly higher interest rate. If they do not accept this risk, they will pay the developer only once the project is completed and functional, and interest rates will be slightly lower.

Regulatory risk

Regulatory risk is the risk incurred when returns on investment are based on some measure paid for by the government. If the government changes the policies (e.g., retroactively changes feed-in tariffs for renewables or energy efficiency projects), the funds may not receive payment. That has indeed taken place multiple times in Europe. Two examples are the Spanish government cancelling their feed-in tariff obligations under the feed-in tariff, and the UK government cancelling their financial obligation to support Anaerobic Digestion plants in Northern Ireland. In both markets, it is likely to find investors today who will not accept regulatory risk. This means that a project must not be reliant on payments from a government-backed scheme for repayment. Energy efficiency projects by and large contain a minimal degree of regulatory risk.

Credit risk

Credit ratings offer an evaluation of a prospective debtor's ability to pay back the debt. This rating is a metric for comparing fixed-income securities. Companies are assigned a rating based on their financial outlook, past and current situation. Credit risk is the most important risk on any debt-based financing measure. This is particularly true of asset-backed finance: in most instances, it is the most important metric, to the exclusion of others, such as the reliability of the technology or the energy savings that may be achieved. The more the focus of a fund is on energy savings or other performance metrics, the more they will also include the range of risk factors in this list, rather than focusing exclusively on the clients' ability to pay.

Energy price risk

The unpredictability of the price development over the project investment term is an important risk if repayment is based on financial savings. Historical data shows electricity price increases above inflation rates, but extrapolations from historical data are obviously bound to forecast errors at best and cognitive biases at worst. Particularly in long-term projects of 10 and more years, the relative steepness of the slope of the energy price curve will have a significant impact on the overall investment performance. Investors will almost never accept taking this risk and they will review the risk only to ensure that it will indeed not impact the security of their investment. They will insist that the project assumptions concerning price developments are realistic and robust, and That if the price does not develop as expected, either the provider or the client is willing to accept this risk.

Currency risk

Currency risk typically signifies the risk of loss associated with fluctuating foreign exchange rates. Exposure to foreign currency investment can present a significant risk for investors. In the context of project investments, it will be important to assess whether project cash flows will be generated in a different currency than the one in which the investment is made. Also, potentially diverging currencies for capital expense (CAPEX) and operating expense (OPEX) must be identified. One method to safeguard against this risk is hedging to mitigate the impacts of undesirable exchange rate changes. Similarly to an insurance policy, a hedge is an additional investment made to decrease the risk of loss from adverse price movements in an asset. A hedge is often a counter position or the possession of an offsetting position in a comparable security.

Endogenous risks

The second category of risks is more strictly related to the individual projects and includes, to a large extent, rather qualitative than purely quantitative assessments. Many of these risk types are addressed directly or indirectly through certain contractual agreements.

Investors will generally only be concerned about this category of risk if the project returns are performance-based. If the project is financed exclusively as repayment against an asset and the credit worthiness of the clients, then these risks may not be considered at all. Therefore, by looking at what risks a fund or bank include in their analysis, it is possible to know what they actually prioritise. For example, if a bank says they prioritise carbon reduction but do not take into account whether an investment will indeed achieve such reductions, then it is possible carbon reductions are actually not a top priority for them. If it was, they would check that the projects are technically viable. The risks outlined are those that will be highlighted by funds that are prioritising project results.

Technical risk

Technical risk relates to equipment malfunction and/or breakdown and its treatment is generally considered one of the most standardised for all risk categories. Investors usually want to see the best available technologies used and the equipment to be covered by warranties for the full project term. The installation, maintenance and – potentially – replacement has to be performed by either the manufacturer or a certified professional. Regarding best available technologies, a good practice is to consider products included in the EcoDesign regulation and otherwise to present evidence of past projects and respective performance.

Performance risk

This risk is emphasised when the outcome and results of a project are important. The relevant factors included in this risk type are essentially:

— Poor or faulty design

— Flaws in the implementation of EE measures

— Mistakes in the operation of the measures

— Fluctuation of usage patterns, including change of user behaviour.

Design risks concern the failure of the energy modelling, selection of energy efficiency measures and engineering design to accurately predict the energy savings, all other factors being equal. This failure may come about for a number of reasons, including design error and the inaccuracy of design models. A design failure may be difficult to establish unless it involves a clear mathematical error or obvious misspecification. Design failures can occur in single measure or technology projects but are more likely in complex multi-technology projects where there are interactions between measures that are sometimes difficult to accurately model or predict. The issue of actual energy performance not matching design performance in buildings is called the performance gap.

Mitigation methods: Engineers typically will not accept savings risk associated with their designs. Professional Indemnity (PI) (also called Errors and Omissions) insurance will not therefore cover savings, but it will cover mistakes in calculation or specification. There are several standard practices that are often observed that will mitigate design risk, including:

— Engineers working for the developer share all data, calculations and simulation files. Their awareness that this information will be on file will compel a higher degree of care.

— Third party engineers experienced with retrofits may be tasked with reviewing of all design work. For larger projects, financial institutions often require independent engineers to carry out technical due diligence.

— The use of appropriate national or international standards in project development and documentation such as the Investor Confidence Project Protocols may be specified. Use of the Investor Confidence Project's Investor Ready Energy Efficiency project certification system brings with it the added confidence of an independent third-party verification that best practices have been followed in project development.

Lenders and investors may consider reducing savings projections or investigate the methods the developer may have used in the design process to reduce them. Where simulation programs are used to model building physics, the level of confidence in the model calibration needs to be considered. The magnitude of any reduction, or "de-rating", of the savings will depend on the degree of interaction among measures, the difficulty of the retrofit, the extent to which the technologies are proven, and other factors identified by the third-party engineer.

In theory, EPCs could be used to support creating a baseline expectation for a building as part of the analysis of performance risk.

Operations and Maintenance risk

The contractor shall outline all necessary Operations and Maintenance (O&M) tasks, including timing and service levels, in a detailed O&M schedule, and disclose all relevant documentation from previously undertaken and/or ongoing projects of similar nature in support of that. The important pieces of information that should be contained in the O&M schedule are:

— Historical O&M performance by O&M provider

— Credit quality of O&M provider (in case it is different from the contractor)

— Measurement and verification (M&V) systems used for outage detection

— Downtime period estimation

— Number of O&M staff compared with commercial growth

— Presence and nature of any backup O&M arrangements

— Interface risk

Interface risk refers to any potential interference of End Clients or third parties with or misappropriation of the installed equipment. Any moving, maintenance or operational tasks shall be the sole responsibility of the appointed contractor.

Occupancy risk

Project cashflows are calculated and forecasted based on specific assumptions of building occupancy and user behaviour. Occupancy risk arises from significant deviations to these initial assumptions, which usually result in a lowered use of the installed equipment and thus in reduced savings compared to the baseline. For this reason, it is important to assess the following:

- How are energy consumption baselines adjusted for change in occupancy levels?
- What % of drop of occupancy level is (still) financially sustainable?
- Is there a contractual stipulation in case of decommissioning of the facility where measures were installed? (e.g. termination schedule?)
- Is there a contractual stipulation that specifies at what state the promoter/contractor is no longer obliged to provide services?

The promoter/contractor is responsible for regular adjustments to the energy consumption baselines, while the implementor/client is responsible for timely and transparent communication about any change of occupancy level.

Financial risks to funds

Below are risks that funds review when considering whether to engage with either a project developer or client. These risks are particularly relevant if the project or project portfolio is rather small, and the fund or bank wants to ensure that the relationship will be valuable to them over time.

Pipeline risk

One of the key challenges to scale in sustainable energy asset project finance, is the minimum investment volume investors are willing to engage with. While the size of an individual project can be relatively small, depending on the technology as small as € 10 000 , the significant agency costs in due diligence, negotiation and deal closure rarely justify individual projects below € 50 000 -100 000 to be processed, without adding a too high cost to the investment opportunity and thus increasing the cost of capital beyond anything acceptable.

Investors who choose to invest in small projects often do so with the understanding that more projects of the same type will be developed and brought to them. The fact of dealing with the same counterpart, the replicability of project opportunities and because the same client agreements, manufacturers and insurances are involved, the due diligence work and related costs are brought down significantly.

Prepayment risk

Prepayment risk is usually understood as the risk involved with the premature return of principal on a fixed-income security, such as a bond. In case principal is returned early, future interest payments will not be paid on that remaining part of the principal, which in turn means that investors will not receive interest paid on the principal.

Management risk

Anti-Money-Laundering (AML) laws obliges financial institutions in most countries to perform mandatory checks on their customers prior to taking on any business relationship. Aside of the credit risk assessment – that can be dealt with separately, the management risk here refers to qualitative factors related to experience, governance and potential criminal history of the key personnel and the businesses concerned. In order to ensure sound governance of investments and installed equipment, the following “Know-Your-Customer” (KYC) data is required:

- Type of entity
- Sector of activity, including sector code
- Number of employees
- Ownership structure
- Background and track record of key management personnel

The promoter/contractor is obliged to gather the KYC information from the implementor/client and submit it together with the same data on the promoter/contractor company. The following documentation shall be provided to support the KYC information:

- Chamber of Commerce registration document
- Documentation of shareholder structure
- CVs of key management personnel.

Market Risk

While credit risk measures the ability of the party receiving finance to pay, similar risks can exist for markets as a whole that can be assigned ratings. Consequently, companies or markets with good credit ratings will have a reasonable level of debt, a good track record of paying it back, as well as a healthy earnings potential. Credit agencies such as Standard and Poor's, Fitch Ratings, and Moody's, distinguish investment grade ratings from non-investment grade or speculative ratings. Following the rating scales of these three global credit rating agencies, the threshold for investment grade ratings begins at BBB-/Baa3.

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