



# EeMAP

Energy efficient  
Mortgages  
Action Plan



## CREATING AN ENERGY EFFICIENT MORTGAGE FOR EUROPE

**Mortgage lending valuation and the impact of energy efficiency:  
an overview of current practice**



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#### **AUTHORS**

Ursula Hartenberger, RICS  
David Lorenz, Karlsruhe Institute of Technology  
Sarah Sayce, University of Reading  
Zsolt Toth, RICS

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# EXECUTIVE SUMMARY

Buildings account for 40% of EU energy use, and it is estimated that the EU needs to invest around €100 billion annually in building renovations to meet its energy and climate goals. The EU has increased the amount of public funds available for energy efficiency, but the European Commission has indicated that there is a need to boost private energy investments – the EeMAP project is intended to deliver a concrete, market-led finance solution to help bridge the gap.

Mortgage lenders have a clear interest in the state of the EU building stock. Mortgage loans are estimated to account for around a third of the total assets of the European banking sector. Investments in building performance improvements can help to free-up disposable income for borrowers through lower utility bills and can enhance property value. As a result, they can reduce credit risk, so they are a win-win for lenders, investors, consumers and climate.

***Our Vision:** The EeMAP Initiative ([www.energyefficientmortgages.eu](http://www.energyefficientmortgages.eu)) aims to create a European energy efficiency mortgage (EEM), to incentivise borrowers to improve the energy efficiency of their buildings or acquire highly energy-efficient properties. The incentives the EEM will offer borrowers (e.g. reduced interest rates and/or increased loan amount) aim to reflect the reduced credit risk of these loans.*

The ability of valuers to advise on the impact of energy efficiency is a key piece for lenders to calculate mortgage affordability without increasing the credit risk and thus allowing additional funds to be provided to the consumer at the same rate as the principal mortgage. A better understanding of the relationship between energy efficiency and value is also important for a more robust and risk sensitive property rating in the loan portfolio of banks.

This report reviews existing theoretical and practical barriers hindering the integration of sustainability aspects into risk assessment and valuation of properties for mortgage lending purposes. It covers the following key aspects:

- the current role of the valuer within the mortgage origination process,
- the extent to which energy efficiency or ‘greenness’ plays a part in that valuation and associated risk assessment processes, and
- an evaluation of the body of research on the relationship, if any, between a property’s energy performance rating, or other energy or sustainability characteristics and its market or/and rental value.

The evaluation of empirical studies found that some of them have identified premiums on pricing in some sub-markets. However, the report stresses that, there is no guarantee that an investment into energy efficiency upgrades will automatically lead to higher property values or higher rents. Yet the review on the state of play of valuing energy efficiency and wider sustainability aspects shows that, while no straightforward or automated formula to account for energy efficiency and wider sustainability issues in valuation exists, there are various ways of reflecting energy efficiency within the valuation process and in mortgage valuation reports.

And, while a secret formula that will automatically transform building energy efficiency investments into higher property values does not exist, the report

clearly states that energy efficiency has the potential to contribute to long term value creation and preservation of a property and value creation which help reduce the risks of so-called “brown discounts” and/or obsolescence. It concludes that energy efficient properties may therefore be of a lower risk to lenders, especially as energy efficiency upgrades are commonly coupled with other measures, resulting in an overall quality improvement of the property.

Key requirements for a more accurate quantification and documentation of any potential value increases are the availability and accessibility of data and information on both building physical and performance characteristics. However, the report illustrates that the market is still far from having a consistent approach to capturing and managing of data and information. It also questions the usefulness of Energy Performance Certificates for establishing the link between energy performance and value but concedes that they may be an enabling tool for raising stakeholder awareness.

Finally, given the EeMAP project’s focus on the residential market and its stakeholders, the report also explores the specific economic and non-economic drivers of potential consumers as well as for the “energy efficient” mortgage lending product. Whereas in the commercial market segment, economic interests dominate the investment decision-making process, the residential owner’s decision-making process is often driven by non-economic, “soft” and emotional factors that may not always be directly related to energy efficiency.

## SUMMARY OF KEY CONCLUSIONS AND RECOMMENDATIONS

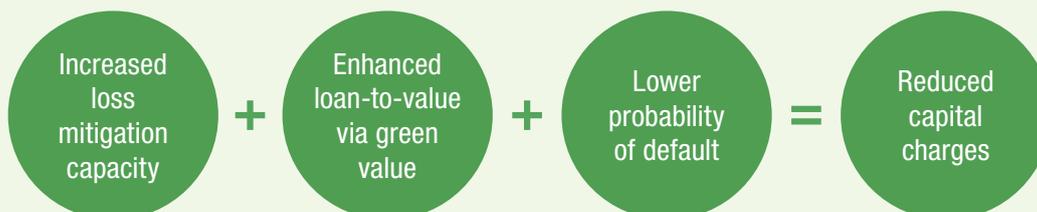
- *There is no guarantee that improvements to the energy efficiency of a dwelling will automatically translate into enhanced market value.*
- *Energy efficiency can contribute to long term value preservation and value creation that reduces the risk of obsolescence and protects sellability and lettability of the asset. Energy efficient properties may therefore be a lower risk to lenders.*
- *Depending on occupant behaviour, energy efficient buildings may have reduced running costs, and this, in turn, can reduce mortgage default risk.*
- *Many people will upgrade their buildings, including for improved energy efficiency, for reasons other than pure economics, e.g. wanting a higher level of comfort, or simply the desire to invest in their homes present; the impact on market value may not be a prime motivation.*
- *Properties that have high levels of energy efficiency tend to be either comparatively new stock, built to modern building codes or those which have undergone retrofits that extend beyond just energy measures as it is normally more economic and less disruptive to address energy performance as part of larger scale works, rather than in isolation.*
- *Adequate data capture and information management will be required to deepen understanding of this complex area. EPCs are the only real measure available but are acknowledged to be less than a robust tool for correlation with value.*



## EeMAP Energy efficient Mortgages Action Plan

The EU Horizon 2020 funded EeMAP Initiative aims to create a standardised Energy Efficient Mortgage (EEM), that will incentivise building owners to improve the energy efficiency of their buildings or acquire an already energy efficient property by way of preferential financing conditions (reduced interest rates and/or increased loan amount) linked to the mortgage.

The EeMAP Initiative aims to demonstrate that energy efficiency has a risk mitigation effect for mortgage lenders.



Lower risks deliver a strong incentive for lenders and investors to enter the market and play a central role in driving climate action across Europe's building sector.

This report, while primarily targeted at banks and their valuers, it is also aimed at experts in the construction and real estate sector, to spark discussion about how we begin to formulate a European EEM.

This report is one of a series of four produced by the EeMAP Initiative, which respectively review the state of play in relation to energy efficiency, valuation, finance and probability of default in the context of the EU's building stock. The reports are aimed at banks and other financial institutions interested in understanding how an EEM could be established from the different perspectives of finance (both origination & funding), valuation and energy efficiency measurement.

Both new build and existing residential and non-residential buildings are within the scope of the work EeMAP is doing to establish an EEM, but the Initiative's central focus is how we create the biggest impact on Europe's climate goals by driving renovation across the residential building stock.

The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement 746205. See: <http://energyefficientmortgages.eu/>

## 1. INTRODUCTION

The EeMAP Initiative aims to create a standardised "energy efficient mortgage" which will incentivise building owners to improve the energy efficiency of their buildings or acquire an already energy efficient property by way of preferential financing conditions linked to the mortgage.

Over the recent past, a substantial body of research has been undertaken to examine the relationship, if any, between a property's EPC rating, or other energy or sustainability characteristics and its market or/and rental value.

This body of research shows mixed results but increasingly there is some evidence that a statistical relationship can be observed between the energy efficiency rating of a residential unit and prices paid for properties. By itself it is not yet an explicit element within a valuation and there is no proven causal link – it is an observed one.

However, it is beginning to be recognised by market participants that properties which are below average in their energy efficiency may suffer value erosion as the market and government policy starts to push the need for more efficient buildings. Similarly, those with very efficient ratings, which may in turn be also better maintained buildings, may sell or rent at a slight premium.

This report will explore in more detail the current state of understanding of the relationship between energy efficiency and value: the so-called "green value" premium and the associated "brown" discount. The objective of the report is to support European mortgage banks to develop a dedicated "Energy Efficient Mortgage" market-based lending product that will help drive the move towards low carbon buildings.

### In particular, it aims to:

- **clarify** the current role of the valuer within the mortgage origination process,
- **review** the extent to which energy efficiency or "greenness" plays a part in that valuation and associated risk assessment processes, and
- **make** recommendations with regard to the development of a 'energy efficient mortgage' product which could result in lower risks to lenders and long-term value creation.

The objectives of the valuation part of the project are to ensure that valuers are "tooled" up and given access to sufficient, robust data. This will enable them to provide expert advice as to the impact of energy efficiency ratings on their valuations and to support lenders in incentivising property purchasers and owners to improve their assets through upgrades.

### This will:

- **protect** these assets against obsolescence and value loss,
- **provide** better end-user comfort and lower running costs,

- **better meet** owner’s aspirations for their homes and,
- **may increase** capital values, thus reducing risks to borrower and lender alike.

## 2. DEFINING ‘VALUE’ FOR LENDING PURPOSES

The basis of any valuation depends on the purpose for which it is being prepared, be that for accounts, investment purchase, taxation, statutory purposes or something else. It is only when the purpose is determined that the appropriate basis is chosen by the valuer. Many purchases of residential real estate depend on funding secured through mortgage lending. It is therefore critical to this project to have a clear understanding of what basis of value is adopted for lending purposes and what the underlying internal processes are within financing institutions.

The prevailing basis of value used for lending purposes is Market Value (MV). Market Value is defined in the International Valuation Standards (IVS) 2017, published by the International Valuation Standards Committee (IVSC) as:

*“the estimated amount for which an asset or liability should exchange on the valuation date between a willing buyer and a willing seller in an arm’s length transaction, after proper marketing and where the parties had each acted knowledgeably, prudently and without compulsion.”*

IVS 104 paragraph 30.1 and reproduced in RICS (2017) VPS 4

It is crucial that there is a clear understanding that Market Value does *not* necessarily represent the transaction price. It is an *estimate* of what the transaction price would be if the transaction were to take place on the date of valuation and that, as stated in the definition, each party to the deal were to be knowledgeable and prudent and not under any form of compulsion.

In reality, many residential buyers and sellers are not knowledgeable and therefore the role of the valuer in providing advice to the lender will be critical. One of the key points of note regarding the Market Value definition is that it is a “moment in time value”. Therefore, it does not, provide the recipient with a view as to the place in the property or economic cycle at which the valuation has taken place. It is essentially a “mark to market” figure normally based on market evidence of recent transactions of comparable properties within a nearby location, i.e. the valuer’s view on a given date of the likely price given the estimate of demand against the local supply of substitutable properties. As the global financial crisis clearly demonstrated, this market situation can change rapidly. If demand collapses, Market Value will also fold which can leave a lender exposed to risk in the event of default.

Notwithstanding any concerns about the potential issues in using this basis for lending purposes, this definition is adopted by RICS within its Valuation Professional Standards<sup>2</sup> (widely known as the Red Book and hereafter so referred) and is noted as being the prevailing basis used by banks to determine the mortgage lending value. Given its reliance on evidence it is defensible and robust, as long as the commissioning client recognises the constraints.

Market Value is normally arrived at by reference to analysis of comparable transactions. It is the method that is both most used, and promoted for the valuation of individual properties for lending purposes, within many EU

Member States. However, in the case of residential investment properties, notably portfolio transactions, a cash flow approach is likely to be adopted. While grounded on evidence of prevailing rents and using evidence of market capitalisation rates, the cash flow approach is more susceptible to inaccuracy where evidence of rents and capitalisation rates are less plentiful. This will be the case in countries where most transactions are for owner-occupation purposes.

It was stated above that there is an assumption that buyers and sellers are “knowledgeable” but that this sometimes is not the case. Not only is the valuer’s opinion critical here, the valuer has to take into account that prices achieved and which should be analysed, may have been settled without recourse to borrowing – and hence without a formal valuation. However, they are still part of the evidence base. It is therefore critical that valuers do have sufficient knowledge of the data and fact surrounding the transactions that they are using as evidence. The ability to adjust comparable evidence in the light of professional judgement goes to the heart of the valuer’s skill base.

It should be noted that where there are legislative and regulatory constraints on residential lettings, different rules regarding both the basis and method of valuation may apply. As this project is concerned primarily with the funding of owner-occupier to owner-occupier or for improvement investments of owner-occupied stock, consideration of valuation for social/public rented stock and large residential portfolios is not in scope.

However, even for lending secured against individual residential units, Market Value is not the only basis of value that may be used. In some jurisdictions, alternative bases may be recognised or expressly required, for example, as a result of statute or regulation. One such example that is widely used in Germany and in some other European countries is Mortgage Lending Value (MLV).

Mortgage Lending Value is defined in article 4 (74) of EU regulation 575/2013 as:

*“the value of immovable property as determined by a prudent assessment of the future marketability of the property taking into account long-term sustainable aspects of the property, the normal and local market conditions, the current use and alternative appropriate uses of the property.”*

Although this basis of value is recognised within the Red Book, it is not generally promoted. It is also recognised (as is Market Value) by TEGoVA (The European Group of Valuers’ Associations) in their European Valuation Standards (colloquially known as the Blue Book and hereafter so referred). Whereas Market Value is a ‘mark to market’ approach, Mortgage Lending Value is sometimes described as a ‘mark to model’ approach, as it is essentially a risk-adjusted figure taking into account perceptions of the long-term risk of the loan from the lender’s perspective.

To clarify the difference, the Blue Book<sup>3</sup> states that Mortgage Lending Value is understood by banking supervisors as a risk management tool where only long-term sustainable aspects of the property and no speculative elements shall be taken into account. Art. 229 par. 1 CRR explicitly stipulates that: *“institutions shall require the independent valuer not to take into account speculative elements in the assessment of the mortgage lending value and to document that value in a transparent and clear manner.”* This is in contrast to Market Value which is a ‘point in time’ figure.

1 — IVSC (2017) *International Valuation Standards*, paragraph 30.1 and reproduced in RICS (2017) *International Valuation Standards (The Red Book)*, VPS 4.

2 — RICS (2017) *International Valuation Standards (The Red Book)* <http://www.rics.org/uk/knowledge/professional-guidance/international-standards/international-valuation-standards-2017/>

3 — TEGoVA (2016) *European Valuation Standards*, EVS 2, paragraph 7.2.3



Although both Market Value and Mortgage Lending Value are widely recognised and used, there are concerns that the methods employed do not, of themselves, protect against major market movements, such as happened in 2008 when lenders found themselves exposed to unacceptable levels of risk. In seeking ways to prevent such an occurrence which can destabilise markets and indeed the banking system, research is being undertaken in the UK for the Bank of England and an interim report has been published<sup>4</sup>. This is exploring ways in which a new approach to better recognise and identify risks in valuation can be developed. In particular, the Bank of England's research is exploring the ability of valuations to provide advance warning signals of major market movements and thus help financial institutions protect against major value crashes like the ones in 1991 and 2008 respectively.

The work commissioned from the Property Investment Alliance (PIA) by the Bank of England has as its reference frame UK commercial stock but over the duration of the EeMAP project may provide relevant information. The PIA work is exploring three bases of valuation: adjusted market value, investment value and Mortgage Lending Value:

1. **Adjusted Market Value (AMV)** is derived by use of regression to compare current Market Value to long-term trend values but is only possible where such trend data is both collected and available. It is viewed as having the benefit of simplicity and low cost.
2. **Investment value (IV)**, based on discounted cash flow modelling, may be applicable to commercial property and large scale investment portfolios, but would not be applicable to individual residential units.

**3. Mortgage Lending Value (MLV)** has already been outlined above. This work is still in progress but analysis to date, reported in June 2017 found that *"MLV methodology runs fairly consistently at a 19% discount to market (...) increasing only to anticipate and recognise the 2007-08 crash. It does not provide any reliable market leading information."*<sup>5</sup>

During the course of the EeMAP project the intention is to monitor any outputs from the Debt Group project for application to this work.

Similar work is currently being undertaken by the Long-Term Sustainable Value Network. Long-Term Sustainable Value (L-TSV) is based on the sustainable long-term characteristics of the property, and excludes speculative elements and cyclical fluctuations in value.<sup>6</sup>

Long-Term Sustainable Value is designed as a risk management tool. The concept seeks to use a value-based approach to mitigate exposure to risk. It therefore differs from Market Value, which requires accompanying regulation by bank and/or national authority when used for risk management purposes.

In summary, there is a continuing debate within professional valuation bodies around which basis of valuation most adequately fulfils the needs of commissioning clients. This debate is most active in terms of valuation for lending. The most widely used basis of value used for lending purposes is that of Market Value; however, by itself it does not provide the lender with a consideration of the risk attaching to the loan other than at the moment of grant. As economic conditions change or/and the type of property that is

4 — Property Industry Alliance Debt Group (2017) *Methodologies and Real Estate Lending: A report by the Long-term Value Working Group of the Property Industry Alliance Debt Group*.

5 — Property Industry Alliance Debt Group, *ibid* (2017), p.14.

6 — <http://ltsv.info/ltsv/about/ltsv-network.html>

demanded alters in line with, for example, demographic, social, legal or other factors, such as the level of supply, the security of the asset may increase or decrease. Mortgage Lending Value overcomes some of these issues but the resultant valuation will always be at – or frequently below – market value and, as outlined above, is not immune from issues either. An important trend that is developing in relation to long-term value, be that a long-term sustainable value or an adjusted market value is that both aim to provide a further dimension of value to banks to help them assess and mitigate lending risk.

### 3. THE ROLE OF THE VALUER IN THE MORTGAGE LENDING PROCESS

For most mortgage transactions, the level of the loan, including loan conditions, will depend on both the status of the borrower, as determined by the bank and the quality of the asset being offered as security for the loan. Therefore, the bank, or other finance supplier, will normally require an assessment of the value of the physical asset achieved through the commissioning of a valuation report by an appropriately qualified valuer. The role of the valuer is normally to supply an estimate of the Market Value (MV) of the asset as at the date of valuation, although in some countries (notably Germany) a Mortgage Lending Value (MLV) is the prescribed basis (see Chapter 2 above). This will either equate to, or be below, Market Value.

In the majority of cases this is undertaken by an expert, qualified and independent valuer who inspects the property taking note of all factors considered

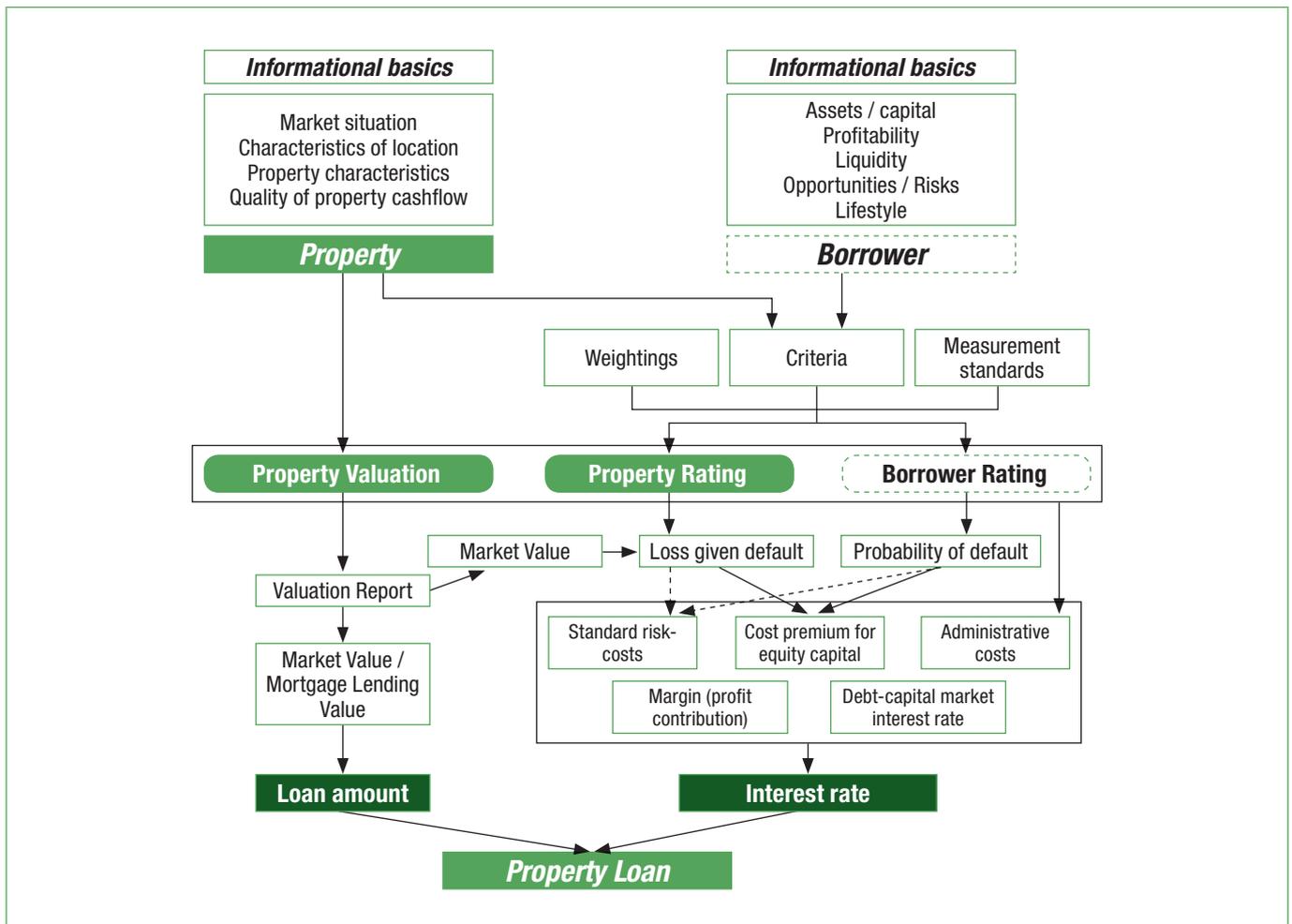
salient to value, analyses other market transactions from within the locality and arrives at a judgement of Market Value. Current prevailing practice for secured lending is that the valuer will not be instructed specifically about the energy rating of the property but they may be asked about anything that presents a risk to the figure. However, this will depend on the instruction to the valuer. Some lenders are beginning to ask specific questions about the ‘sustainability’ characteristics of the asset or at least its EPC rating, if this exists. RICS, in their Red Book, set out the main items that should be inspected and the due diligence process that valuers should follow. It should be noted that there is a general recommendation, which though not mandatory, “strongly advises” that valuers:

*“collect and record appropriate and sufficient sustainability data, as and when it becomes available, for future comparability, even if it does not currently impact on value. This could be particularly beneficial where the valuer is retained to provide regular reports to a client.”<sup>7</sup>*

The intention is that, as more data becomes available, and is stored within databases of comparable evidence, data on matters affecting sustainability, and notably energy efficiency, will be both routinely collected by valuers during their due diligence process and will therefore be available for use within the analysis phase of the valuation.

Increasingly the use of Automated Valuation Models (AVMS) is being employed, especially when a portfolio, rather than an individual property, is being valued. This has the advantage that the valuation may be capable of

**Figure 2: Determination of financing conditions under the advanced IRB-approach of the Basel Accord**



7 — RICS (2017) Red Book, VPS 3.

being produced more quickly and cheaply, but the automated modelling will only analyse comparable transactions sitting within the database to which it is linked and in accordance with programmed variables. These do not, it is believed, generally currently include energy ratings, although further work of investigation is to be undertaken as part of the research for the project. Furthermore, as discussed below, they are not normally programmed to take account of non-economic factors which may, in reality, be key value drivers.

In addition to providing an estimate of value, in accordance with the basis agreed as part of the instruction, the valuer will normally be asked to comment on some of the most common risks to value in relation to the property and its general suitability for a loan. The most common property risks will include flooding, condition, site or locality issues and planning risk. The energy rating is not normally a specified risk. However, some lenders are now asking for information in relation to energy ratings and energy efficiency<sup>8</sup>. An initial survey conducted by the EeMAP project team (EeMAP, 2017) revealed little engagement with valuers in terms of 'energy efficient mortgages, with only half the survey respondents even requiring the valuer to comply with recognised professional body standards. Although some lenders do ask their valuers about the energy performance rating of the asset offered as security and others are asking about spending on energy as part of 'lifestyle' analysis of borrowers, this practice is, as yet, in its infancy.

As an alternative (or complement) to the valuer's comments on risks to value, many banks require a dedicated risk assessment of the asset obtained through the application of a so-called property rating procedure carried out either through a qualified valuer or other qualified property professional/rating analyst. The application of property ratings in the context of the lending process is common practice in Germany and other European countries. Property ratings are also required as a precondition for the application of the 'advanced internal rating-based approach' under the Basel Accord. This approach for determining the bank's equity capital is perceived to be beneficial as it allows banks to deviate from predefined capital requirements and to calculate (within certain boundaries) the required amount of equity capital for property financing.

In a general sense, a rating is a procedure that illustrates the assessment of an object, a person or situation, etc. on a given scale. Ratings are used within the banking industry to predict the probability of default (PD) of granted loans as well as the amount of loss in the event of default (loss given default, LGD) based on historical credit data. A number of property rating systems developed over the last decade already comprise energy efficiency-related rating criteria. Examples include:

- the property rating system developed by the Association of German Public Banks (Bundesverband öffentlicher Banken Deutschlands, VÖB) includes the rating criteria "ecological sustainability", "environmentally-friendly building concept", "energy consumption" as well as further socio-cultural and functional aspects,
- The European Group of Valuers' Associations' (TEGoVA) Property and Market Rating guide for valuers lists "ecological sustainability" as a sub-criterion as part of their rating in the criteria class "Property – Residential".<sup>9</sup>

The following Figure 2 provides a simplified representation of the role of valuations and ratings within the process of granting a property loan under the advanced internal rating based (IRB) approach of the Basel II/III Accords. It illustrates how loan conditions (loan amount and interest rate) depend, amongst other issues, on a combination of valuation and rating results and highlights the critical role of valuers/property professionals within the lending process.

A significant weakness of the current property rating processes is that many banks arguably do not treat a lack or absence of information as a potential risk factor. Or in other words, they do not appropriately acknowledge the 'value of information' which does not encourage better information management and data collection.

When banks apply property rating systems they typically judge the rating criteria on a scale (usually ranging from 1 = very good to 10 = disastrous). If no information is available on a particular rating criterion (e.g. energy consumption), then an **average** rating (rating grade 5) is usually applied for judging this criterion. From a methodological and risk-sensitivity perspective, this clearly is less than ideal as it significantly impedes adequate assessments of correlations between energy efficiency, value and loan performance. A more robust approach to property rating is another critical ingredient for the success of the EeMAP project.

Beyond that, there are three other issues pertinent to the role of the valuer in relation to secured lending valuations which will be mentioned in Chapter 6. These are: availability of data, fees and the pressure on valuers to comply. These will be explored further down in the report.

## 4. DEFINING "GREEN VALUE" AND "BROWN DISCOUNT"

The term 'green value' has no universally accepted definition. The first mention can be traced back to 2005 when an RICS report on 'Green Value' was published<sup>10</sup> but it started to appear routinely in the literature in about 2010<sup>11</sup> and by 2013 was widely adopted in the US<sup>12</sup> as equating to sustainability in real estate. The term had become a catch-all for a variety of building attributes relating not only to a range of environmental features (water and waste efficiency and resilience to flooding) but also to social aspects such as health and well-being. However, in Europe the term "green value" or "green premium" has generally been distinguished from "sustainable" value and restricted to environmental consideration and more specifically, to energy efficiency and low carbon. For this reason, studies of the link between "green" and "value" have generally looked to measurements of energy, commonly taken as the Energy Performance Certificate (EPC) as being the only Europe wide measure as the benchmark against which to assess market impact<sup>13</sup>. A consideration of the findings of such studies is given below (see section 5.3) and an annotated table of major studies relating to residential values and sustainability/energy is provided in Appendix A.

Alongside the definitions of "green value", two further terms have arisen which are relevant to this project. These are "brown discount" and "stranded asset". Both have relevance as they indicate assets which may

8 — UK Green Building council (2017) LENDERS Project: Core report available from [http://www.ukgbc.org/sites/default/files/Lenders\\_Core\\_Report\\_1.pdf](http://www.ukgbc.org/sites/default/files/Lenders_Core_Report_1.pdf)

9 — The European Group of Valuers' Associations, 2013, European Property and Market Rating: A Valuer's Guide, p.12.

10 — RICS (2005) Green Value, Green Buildings, Growing Assets.

11 — See for example Sayce, S. Sundberg, A. and Clements, B. (2010) *Is Sustainability reflected in Commercial Property Prices* an RICS Research Report, RICS; Fuerst, F. and McAllister, P. (2011) Eco-labelling in commercial office markets: Do LEED and Energy Star offices obtain multiple premiums? *Ecological Economics*, 70(6), pp.1220-1230.

12 — See for example WGBC (2013) *The Business Case for Green Building*, World Green Building Council.

13 — See for example, Bio Intelligence Service, Lyons, R and IEEP (2013) *Energy performance certificates in buildings and their impact on transaction prices and rents in selected EU countries*, Final report prepared for European Commission (DG Energy).

be less suitable for a loan – or conversely – be ones where the opportunity (if available) to add value through retrofitting is highest.

“Brown discount” refers to the recognition that, as market expectations rise and as standards of code compliance are adjusted and increased, assets that have not been improved may suffer accelerated value depreciation. Where this relates to environmental degradation or energy inefficiency the term “brown discount” has been adopted, although similar to the so-called “green value”, it does not have a technical definition. It essentially means that older, outdated, inefficient buildings may start to present an economic risk for mortgage banks and investors – being more expensive to run and likely to become increasingly less attractive to purchasers who recognise the need to upgrade. Indeed, properties that are or could potentially be suffering from a “brown discount” are the stock which this project is intending to support through the development of a product which will assist and underwrite the upgrade decision.

A stranded asset is normally regarded as one in which the level of obsolescence is such that it has gone beyond experiencing a “brown discount” to become one which is, in corporate terms, loss making. Within residential stock, stranded assets would include properties for which the costs of bringing up to standard simply significantly outweigh any potential value through refurbishment or profitability by redevelopment. They are therefore ones that may fall into dereliction or disuse without subsidy.

## 5. RELATING VALUE TO ENERGY EFFICIENCY

### 5.1 REFLECTING ENERGY EFFICIENCY AND WIDER SUSTAINABILITY ASPECTS IN THE VALUATION PROCESS

Energy efficiency and wider sustainability aspects can be reflected in the valuation process in different ways. Literature on this topic, summarised through the RenoValue project<sup>14</sup> identifies three main approaches:

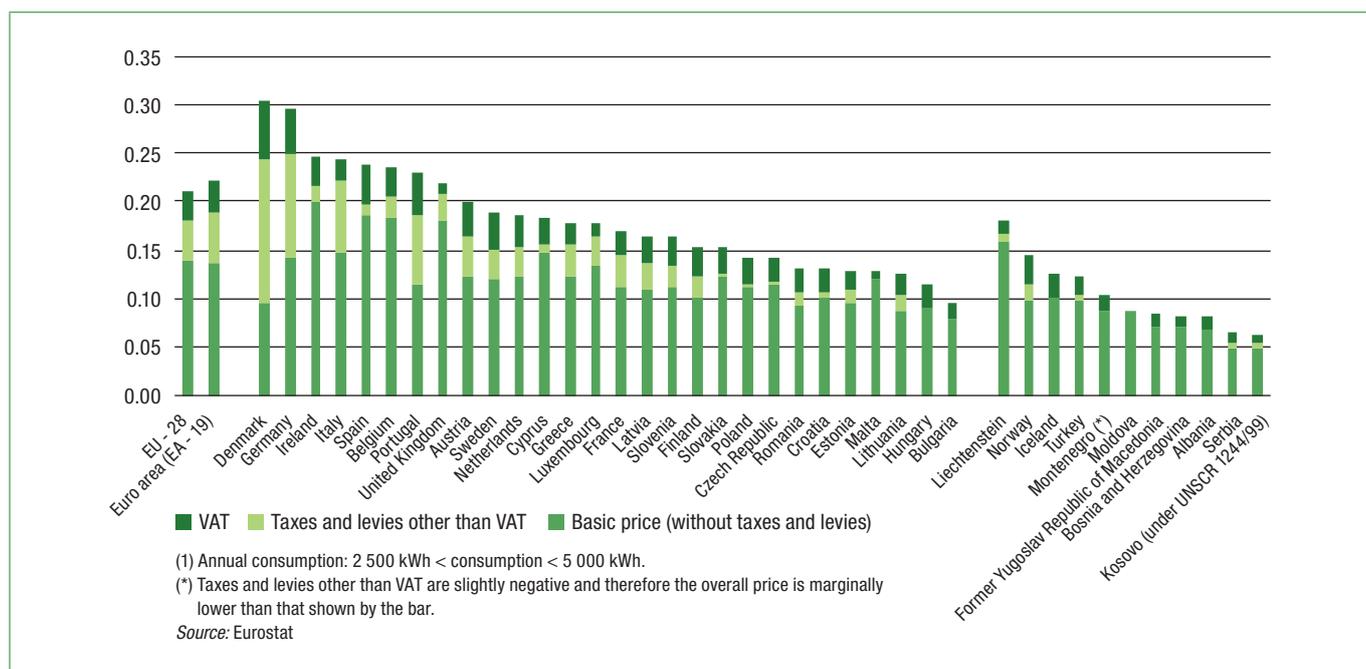
1. lump-sum adjustments on the preliminary valuation result;
2. calculation of a dedicated correction factor to adjust the preliminary valuation results; and
3. direct adjustment of comparable sales data or of single valuation-input parameters such as gross or net rents, risk premiums within the determination of discount and capitalisation rates, maintenance costs and other capital expenditures, lease terms and lease provisions, growth rates, marketing costs and marketing time frames, and depreciation.

From a methodological viewpoint, the last approach (i.e. adjusting comparables or single valuation parameters) is the preferred and most consistent approach (see RenoValue training material<sup>15</sup>). It also works within nationally and internationally accepted valuation methods. But basically, any approach for reflecting energy efficiency in the valuation process is about assessing the position of the property in the competitive marketplace with regard to its energy efficiency and wider sustainability features and about making the necessary adjustment based on this assessment. This assessment can be based on both, quantitative and/or qualitative reasoning (i.e. the valuer’s professional judgement).

Nonetheless, the perception of what constitutes a ‘sustainable’ or energy efficient building will change over time and between locations. Additionally, there are varying interpretations of the concept of sustainability and each actor in the property lifecycle will have a different perception as to what the critical issues or the potential risk/value drivers are. Buildings are complex structures, and every element from design to construction materials to location, is likely to have an impact on the building’s performance against sustainability criteria. Therefore, it has to be acknowledged that assessing a building’s sustainability credentials as well as their potential impact on value is a complex activity and that it is not a precise science.

Furthermore, for the valuer, who is reflecting consumer (i.e. buyer) considerations, the importance of energy in the purchase decision is likely to relate both to their need to use energy to heat the dwelling and the energy price. Across Europe, there are both differing climatic conditions, with three

Figure 3: Energy Prices to Consumers: Europe Compared 2015



14 — See: <http://renovalue.eu>

15 — Online e-learning available at: <https://academy.rics.org/e-learning/property/valuation/reno-value-integrating-sustainability-into-valuation-practice>  
 Online material for face-to-face workshop material available at: <http://renovalue.eu/activities-2/training-material/>

different climates being recognised<sup>16</sup> and energy pricing structures in which the price of energy varies significantly<sup>17</sup>, as shown below. It could therefore be reasonably expected that consideration of energy within the valuation process may vary across countries.

In summary, no straightforward or automated formula to account for energy efficiency and wider sustainability issues in valuation exists. The extent and approach of reflecting this in value estimates strongly depends on a range of factors.

These are:

- the underlying definition of value,
- property type,
- regional and local market conditions,
- regional and local climate and energy price relationships,
- regional and local conventions, etc.
- availability of comparable evidence within the local sub-market.

## 5.2 STRENGTHS AND LIMITATION OF ENERGY PERFORMANCE CERTIFICATES AND GREEN BUILDING RATINGS FOR THE VALUER

### Energy Performance Certificates

The EeMAP Report on Building Performance Indicators provides an overview of the EPC system across EU Member States and also introduces the findings of the UK Lenders project<sup>18</sup> which aims to provide better data to mortgage providers in terms of energy than has previously been collected. However, from a value perspective there are additional comments to add.

Underpinning the introduction of EPCs has been the belief that adding visibility to the property transaction process of a property's energy (or carbon emissions) profile would influence purchaser or tenant behaviour by becoming a decision-making factor when comparing properties. Also, the intention was that this, in turn, would prompt decisions to renovate. In the UK, this "soft" market change agent has been further developed with a minimum standard of EPC (E) being imposed on most new lettings (commercial and residential) from April 2018 and all residential lettings from 2020<sup>19</sup>. From a lender perspective, in the UK, there is therefore beginning to be a link between *security* of income for residential portfolios and the EPC. While currently there is no regulation in relation to sales or impositions on owner occupiers, such measures have been suggested in some places<sup>20</sup>. In simple terms, a property with a poor energy rating may be at legislative risk of becoming what is known as a "stranded asset"<sup>20</sup> unless capital injection takes place.

Summarising the views known about the usefulness of the EPC as a tool to assist valuers in evaluating the link between energy efficiency and market values the following can be concluded based on current knowledge.

#### Strengths:

- EPCs add visibility to the market and over time, as purchasers and vendors and their agents gain knowledge, are more likely to form part of the decision-making matrix.

- EPCs are a standardised product which is gaining traction and should be increasingly available to valuers, even where valuing not at the point of transaction.
- Within countries they are theoretically (and increasingly in practice) consistent in how they are assessed.
- As EPCs provide advice regarding the measures that can be undertaken to upgrade properties for enhanced energy efficiency they prompt purchasers to consider upgrade works when they have the finance so to do.

#### Limitations:

- EPCs usually relate to an asset rating. They do not directly relate to energy consumption and hence to bills. Ideally, they should provide an asset and an operational rating because the asset rating enables comparability and therefore underpins the comparison method and the operational rating will provide important information to the financing institution regarding the monthly fuel expenses and hence about the borrower's monthly disposable income.
- As discussed in EeMAP Report on Building Performance Indicators, EPCs may not be accurate. This is more of an issue in some jurisdictions than others and can lead to players in the market disregarding them
- EPCs have a 'shelf life' of ten years; therefore, they may not represent the actual position as changes in the property may not trigger a new assessment.
- EPCs are only required upon sale or rental, i.e. at transaction stage. This excludes from 70% to 98% of the existing stock which is not subject to any transaction, i.e. because the buildings in question are not actually on the market (for more detail, see EeMAP Report on Building Performance Indicators).
- The EPC may be skewed by the type of characteristics included. Some characteristics may not actually be part of the building fabric. For example, installing LED lights can enhance the level of certificate obtained – but this can be changed easily. Similarly, they account for the cost of fuel choices and this will vary over time – perhaps dramatically with fluctuations of wholesale markets.

#### Labels/Rating Systems

Initially sustainability labels or rating systems, such as LEED, BREEAM, etc. were pure asset ratings, focusing mainly on new built. Subsequently, rating systems operators have also started introducing in-use ratings.

From a valuation perspective, key building attributes/characteristics and actual performance matter whereby in-use-performance assessments are as important as designed assessments. However, the usability and usefulness of labels/ratings as an information source for valuers depends upon the disaggregation of the assessment results including the provision of the basic (i.e. non-assessed) information/data inputs.

## 5.3 A REVIEW OF THE EVIDENCE: LINKING VALUE TO EPCS AND ENERGY EFFICIENCY

There has been much research examining the relationship, if any, between a property's EPC rating and its market or/and rental value. In most cases, such work has been undertaken using multiple regression analyses to test

16 — See for example [http://publications.europa.eu/resource/cellar/057e5f2e-904a-4507-815e-cdf5c616a750.0001.01/DOC\\_1](http://publications.europa.eu/resource/cellar/057e5f2e-904a-4507-815e-cdf5c616a750.0001.01/DOC_1)

17 — Source: [http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Electricity\\_prices\\_for\\_household\\_consumers\\_second\\_half\\_2015\\_\(%C2%B9\).\\_\(EUR\\_per\\_kWh\)\\_YB16.png](http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Electricity_prices_for_household_consumers_second_half_2015_(%C2%B9)._(EUR_per_kWh)_YB16.png)

18 — <http://www.ukgbc.org/resources/publication/lenders-core-report>

19 — The Minimum Energy Efficiency Standards (MEES) are being introduced under the provisions of the Energy Act 2011. The Regulations were published in 2015 but at the time of writing detailed guidance to the residential sector is still awaited. Whilst the standards do not relate to the capital transaction market, they are proving effective in heightening knowledge.

20 — See for example Green Construction Board (2014) *Project GCB610 Mapping the Real Estate Life cycle for Effective Policy Interventions final report*



the hypothesis that a rating above the average (normally taken at a D rating) results in either a higher transaction price, or in the case of investment stock, higher rents. A review of the literature supports the view that in some sub-markets there is beginning to be evidence of linkage. This linkage is gaining traction since the penetration of EPCs deepened following the recovery of housing markets some while after the global financial crash. However, the evidence in terms of a 'brown discount' for inefficient stock is beginning to be stronger than evidence of a 'green premium'. This is perhaps critical as it points to a market movement in which the general market requirement in terms of energy efficiency is increasing as standing stock has to compete with newer, more efficient, stock.

Hedonic pricing studies using actual transaction data regressed against a number of known value drivers and energy labels indicate evidence of a strong "general" argument supporting differential values in which at the high end there a slightly enhanced value for energy efficient and a rather larger discounting of those which have poor energy efficiency.

#### **Main findings from the literature review:**

- To the authors' knowledge, there are as yet no studies which link the quantum of any "brown discount" to the costs of renovation to upgrade to labels of A/B.
- Hedonic regression requires accurate isolation of value into the appropriate component factors. However, they do not provide full 'fit' and in some studies the level of variation (i.e. possible statistical inaccuracy) outweighs the observed price differential. Furthermore, all such studies work on factors such as construction, age and location and cannot accommodate emotional influences and factors that are known to drive residential purchase decisions.
- Purchasers of residential property may work to an agenda that stretches beyond the economic. This applies also to decisions to upgrade. In the references and appendix list include some key studies that point to the complexity of residential decision making in relation to improvement decisions.
- Strong conclusions from the research to date are hampered by extreme heterogeneity of the stock being considered. Whilst hedonic studies can help with trends, the banks will be considering not just policy but decision making at the individual level. For this, fine grained value reporting is required as well as local market knowledge.
- Whilst EPCs may at first glance appear to measure the same thing – efficiency at the asset level – they do not. Even within countries, the regulations vary and this means again that it is the specific impact in the specific sub-market which is critical.
- As indicated above, climatic variations across Europe mean that the types and cost of works required to upgrade properties will vary which will influence the potential impact on value.
- Empirical results vary significantly across and even within national markets. Results for one particular country or regional market cannot be conveyed to another property market. This is, amongst others, due to the large differences in average construction and quality standards across countries.
- Behavioural studies show a variation in response depending on demographic type, type of energy and how the possibilities for refurbishment are presented.
- Value advantage of energy efficiency is increasingly recognised in places such as Germany, Switzerland, Netherlands and Denmark.
- There is a connection with the state of the overall market conditions.
- The research is focused on sales and rent – but far less on the residential investor issue. For EeMAP, which is focused on the owner occupation market, the impact on sales price is of greater importance than on the investment considerations, given that in other than sub-markets, the majority of housing stock lies in the owner-occupied sector.

## 6. CHALLENGES IN VALUING ENERGY EFFICIENCY AND SUSTAINABILITY

### 6.1 DATA AND QUANTUM OF EVIDENCE

In some parts of the globe and in some markets, comparable evidence is emerging through empirical studies that certain sustainability characteristics – primarily those relating to energy efficiency – are beginning to filter through to market pricing. In other markets, the evidence is far less apparent. Due to the constrained amount of data in the market, it is likely that it will be some time before sufficient information exists to empirically support a valuer's decision to differentiate values based on the full range of sustainability criteria. In some submarkets – for example, low value properties where occupiers are cost-conscious – the market may react more swiftly, particularly where supply and demand are not in equilibrium.

A major part of the valuer's role is to undertake a process of due diligence to ensure, as best as they can, that they have sufficient and appropriate data on which to found their opinion of value. The level of due diligence that is expected is set out within the RICS Red Book.

If the EPC is either not available or cannot be relied upon, there is often no firm data for the valuer to rely on in terms of energy efficiency other than that which is apparent upon inspection – for example, whether windows are single, double or triple glazed, the amount of insulation that can be seen and the type of heating system. Frequently, however, matters such as a wall insulation is not clearly visible, the efficiency of a boiler can be difficult to observe visually and records may not be available. Even with obvious items such as glazing and solar panels, the visual inspection may not provide accurate data.

Energy consumption data may be available, but valuers will tend to discount this as it is as much a factor of occupant behaviours or/and numbers than the efficiency of the structure.

It follows that, in the absence of consistent and comprehensive data in respect of energy performance, it is unlikely that energy will be a driving factor of value. However, if and when consistent, reliable and accessible data becomes routinely available to purchasers and valuers alike, so the bid price for dwellings may well become more distinguished by energy performance, especially in cold climates and/or where energy prices are high.

Better information and data on energy efficiency features and outcomes, as well as on the consideration of the demand for such features and outcomes, is required to properly assess incremental premiums or discounts for energy efficiency.

In terms of data regarding energy and other sustainability matters, the valuer is advised to collect what information they can, but frequently this is limited to little more than the EPC.

Findings from the Renovalue workshops and survey responses and from a recent global built environment stakeholder survey<sup>21</sup> carried out as part

of the work programme of the Working Group for Measurement, Data and Accountability within the Global Alliance for Buildings and Construction<sup>22</sup> identified a number of data and information related challenges.

These include:

- Data storage
- Data compatibility
- Lack of publicly available central database of EPCs
- Data accessibility / Disclosure
- Lack of operational cost data
- Lack of adequate property transaction data
- Inadequate data quality

All these issues lead to the process of valuation being very much one of judgement and professional experience. While adjustments to reflect energy efficiency features within a valuation could also be based on qualitative reasoning (professional judgement), practical experience suggests that most valuers are likely to be reluctant to do so because of liability issues. In addition, adjustments based on qualitative reasoning require an adequately trained and conscious valuation professional. As valuation round tables in the framework of the EU funded RenoValue and REVALUE project found an acute need for upskilling and general awareness raising.

Consequently, one of the biggest challenges in valuing energy efficiency and sustainability lies in improving quality and quantity of building information and market transparency. But data alone is not enough; the valuer also needs evidence that it is a motivational driving factor for buyers.

### 6.2 INVESTMENT IN RESIDENTIAL PROPERTY: NON-ECONOMIC FACTORS

Residential purchase decisions are seldom solely driven by economic and rational considerations, such as expectations of energy cost savings and associated financial payback. For most people, the purchase decision is driven by a complex intertwine of economic and emotional factors, in which “softer” issues, such as aesthetics, ambience and ‘feel’ and match to personality are all relevant factors<sup>23</sup>. Indeed, as Judson and Maller argue<sup>24</sup>, they relate to the “mundane” and the “everyday” and decisions to upgrade are dictated more by these than financial gain; therefore there is a need to understand the wider picture.<sup>25</sup>

The fact that residential investment decisions are not merely taken on a narrow view of costs and financial benefits, presents the valuer with an additional challenge as he or she will have to somehow capture and reflect these sentiments which from the lender's point do not constitute a value-add.

However, the “soft” issues mentioned above will have implications for how lenders are going to market the “energy efficiency mortgage” product. Future marketing strategies that merely focus on saving energy may be doomed to fail.<sup>26</sup>

21 — See forthcoming RICS Insights Paper 2017, Global Trends in Data Capture and Management in Real Estate and Construction

22 — See: <http://globalabc.org/>

23 — See, for example Wilson, C., Crane, L. and Chrysoschoidis, G. (2013) Why do people decide to renovate their homes to improve energy efficiency. *Tyndall Centre for Climate Change Research, Norwich, UK, Working Paper*

24 — Judson, E. P. & Maller, C. (2014) Housing renovations and energy efficiency: insights from homeowners' practices, *Building Research & Information*, 42(4), 501–511

25 — Fuller, M.C. (2011) Driving Demand for Home Energy Improvements: Motivating residential customers to invest in comprehensive upgrades that eliminate energy waste, avoid high utility bills, and spur the economy, *Lawrence Berkeley National Laboratory*.

26 — See: Lorenz, d. et al, 2008, Sustainable Property Investment & Management, Key Issues & Major Challenges, RICS, London, p.8

The understanding of the most effective ways to market sustainable products to target groups is still in its infancy, although some significant work has been carried out principally in the US.

Figure 4 below is an illustration of how building owners' and mortgage lenders' perceptions of benefits and ultimately value and resulting from investing in energy efficiency may potentially differ.

### 6.3 FEES

The level of fee that is paid will have a material impact on the due diligence process undertaken by the valuer. Research carried out for RICS<sup>27</sup> in the wake of the financial crisis into issues surrounding residential valuations revealed that the low level of fee was such that carrying out mortgage valuations was perceived as a high risk to the valuer. Whilst this investigation was confined to the UK, similar issues arise in other EU countries. The matter tends to stem from the practice that the valuation is commissioned by the lender but paid for by the borrower – hence there is an ambition to keep the fee as low as possible. But in turn this impacts on the time that the valuer can spend on the commission and may result in a limited inspection and investigation process. When the loan to value (LTV) ratio is low this is not of importance, where the ratio is high, the risk becomes two-fold:

1. the valuation may be compromised due to failure to conduct full and detailed enquiries. This risk will always remain with a valuation produced by AVM; and
2. the value, if based on Market Value, is very susceptible to market movement.

The valuer is thus not incentivised to carry out and provide any additional due diligence as the risk involved is disproportionate to the pay s/he will receive.

### 6.4 CLIENT PRESURE AND THE VALUER'S INDEPENDENCE

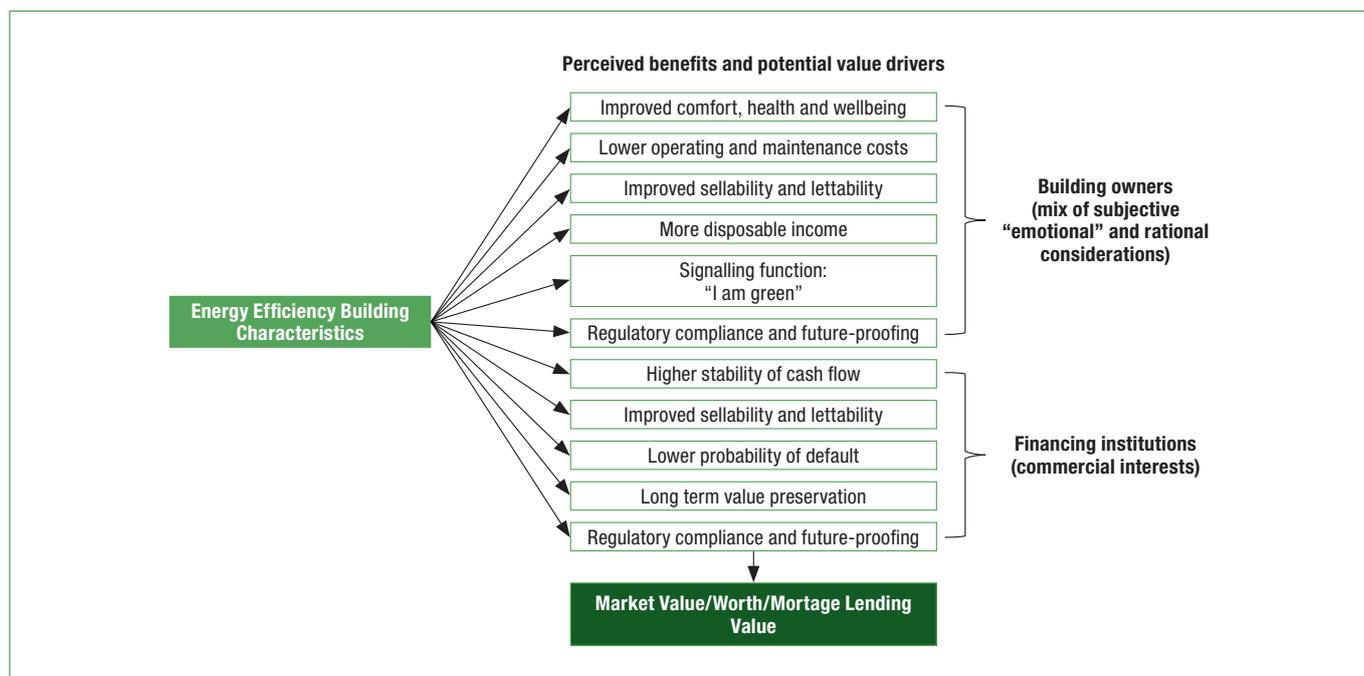
Where the lending is for purchase, the main terms of the transaction are normally agreed at the point of instruction, including, importantly, the proposed purchase price. Therefore, there is pressure for the valuer to endorse the figure already agreed. However, in terms of exercising their independence the valuer should not be influenced by the proposed transaction price. While there is a body of evidence suggesting that the client can seek to bring influence on the valuer<sup>28</sup>, the independence and integrity of the valuer is paramount. This can be difficult as, for example, Agarwal and Ben-David<sup>29</sup> found that financially constrained borrowers could pressurise valuers to increase their valuations to help them refinance, whilst Bellman and Ohman<sup>30</sup> found that information supplied by the client can influence the thought process of the valuer. Crosby *et al.*<sup>31</sup> analysing valuations conducted during the global financial crash, concluded that appraisals reflected the differing needs of clients. This research all points to pressures on valuers to supply the figure that is asked for – rather than that which they consider to be accurate.

## 7. CONCLUSIONS AND NEXT STEPS

As this review on the state of play of valuing energy efficiency and wider sustainability aspects has shown that while, no straightforward or automated formula to account for energy efficiency and wider sustainability issues in valuation exists, there are various ways of reflecting energy efficiency within the valuation and lending process.

Ahead of the development of the EeMAP “energy efficiency mortgage” lending product, it is important to note that the use of the term “green value” may be raising unrealistic expectations amongst end-users and mortgage lenders. Although empirical studies have identified premiums on

**Figure 4: Differing perceptions of benefits and value derived from energy efficiency related building characteristics**



27 — McDonagh, O (2014) *Balancing Risk and Reward: Recommendations for a Sustainable Valuation Profession in the UK* a report commissioned by the RICS available from <http://www.oonaghmcdonald.com/uploads/3/9/0/8/39086241/rics-balancing-risk-reward-sustainable-valuation-report.pdf>

28 — See for example Levy, D. & Schuck, E. (2005) The influence of clients on valuations: the clients' perspective. *Journal of Property Investment & Finance*, 23(2), 182-201

29 — Agarwal, S., Ben-David, I. and Yao, V. (2015) Collateral valuation and borrower financial constraints: Evidence from the residential real estate market. *Management Science*, 61(9), pp.2220-2240

30 — Bellman, L. and Ohman, P., 2016. Authorised property appraisers' perceptions of commercial property valuation. *Journal of Property Investment & Finance*, 34(3), pp.225-248.

31 — Crosby, N., Devaney, S., Lizieri, C. and McAllister, P. (2015) Can Institutional Investors Bias Real Estate Portfolio Appraisals? Evidence from the Market Downturn, *Journal of Business Ethics*, pp.1-17.

pricing in some sub-markets, there is no guarantee that an investment into energy efficiency upgrades will automatically lead to higher property values or higher rents as there are a number of factors that come into play when valuing a certain property, such as the type of property, regional and local market conditions and conventions and end-user preferences.

A crucial prerequisite for the valuer in order to be able to quantify any potential value increases, is the availability and accessibility of data and information on both building physical and performance characteristics. Feedback from valuers indicates that as yet, consistent collection and management of data and information is not standard market practice. Whereas Energy Performance Certificates represent a (fairly) standardised product and have added visibility of energy efficiency within markets and have helped to raise awareness amongst buyers and sellers and real estate agents, they may not necessarily be a robust enough tool for establishing a correlation with value, as their current scope is an asset rating only and do not directly relate to energy consumption and hence to bills. Even if they did, in many countries energy bills are a relatively small part of running costs compared with property taxes and mortgage payments.

One aspect that gets often overlooked is the specific profile of the residential building owner. Whereas in the commercial market segment, economic interests dominate the investment decision-making process, the residential owner's decision-making process is often driven by non-economic, "soft" and emotional factors. For many owners, an energy efficiency upgrade of their home may not be solely motivated by monetary considerations. This may add further challenges for the valuer.

Finally, even though the silver bullet formula that will automatically translate investments made into energy efficiency into higher property prices does not exist, it is safe to say that energy efficiency can contribute to long term value preservation and value creation and that, in turn, both will reduce the risks of so-called "brown discounts" and / or obsolescence and that energy efficient properties may therefore be of a lower risk to lenders, especially as energy efficiency upgrades are commonly coupled with other measures, resulting in an overall quality improvement of the property.

### Next steps

Based on this report of the state of play of current valuation and risk assessment practices, RICS will now begin to prepare detailed technical recommendations for better articulating value and risk implications of energy efficiency improvements. We will gather additional market insights on existing data collection routines and use of energy performance/sustainability data to calculate and monitor mortgage lending risks as well as current mortgage origination processes across Europe. The findings will be validated through a workshop in Q1 2018, which will be an opportunity for a wide range of stakeholders to provide feedback on the draft recommendations for how a European approach to the energy efficient mortgage could work, and what would be needed to support implementation in their markets.

Further on, RICS aims to:

- develop a framework for standardised data collection and data analysis routines;
- create a valuation checklist for banks and valuers to support systematic collection of data;
- develop a practical toolkit for valuers with a special focus on property rating and energy efficient mortgages;
- develop a "data warehouse" intended to register and record the link between property features, energy rating, market transactions and loan performance.

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## APPENDIX – studies on linking energy efficiency and sustainability to value

### Studies 2008-2012

Study/Author	Year	Country	Sustainable features	Impact	Positive (√) or not (x)	Magnitude
Australian Dept. Environment, Water etc	2008	Australia	Energy Efficiency star rating (0.5 increments 1-10)	Sales price	√	1.23% to 1.91% per 0.5 star
Salvi et al	2008	Switzerland	MINERGIE label	Sales price	√	7% houses; 3.5% flats
Griffin et al	2009	USA (Portland/Seattle)	Variety: Built Green; Earth Advantage; Energy Star; LEED	Time to sell	√	Reduced by 18 days
Salvi et al	2010	Switzerland	MINERGIE label	Rental	√	6%
Wameling	2010	Germany	Primary energy demand per m <sup>2</sup>	Sales price	√	€1.4 per reduced kWh/m <sup>2</sup>
Brouen & Kok	2010	Netherlands	EPC (grades A, B, C)	Sales price	√	2.90%
Yoshida and Suigiura	2010	Japan	Tokyo Geen Labeling system	Sales price	x	minus 6%-11%
Wuerst und Partner	2011	Switzerland	MINERGIE label	Sales price	√	4.90%
Muri et al	2011	Switzerland	Noise Exposure	Rental	√	0.19% per decibel
Amecke	2012	Germany	impact of EPC on purchasing decisions	Consumer preference	x	does not influence decision-making
Feige et al.	2012	Switzerland	Economic Sustainability Indicator (ESI)	Rental	√	15% (resource use); 11% health/comfort; 11% security
Deng and Quigley	2012	Singapore	Green Mark	Sales price	√	4% to 6%
City of Darmstadt	2012	Germany	Primary energy value below 250 kWh/m <sup>2</sup> or below 175 kWh/m <sup>2</sup>	Rental	√	€0.38 to €0.50 per m <sup>2</sup>

### 2013-2015

Study/Author	Year	Country	Sustainable features	Impact	Positive (√) or not (x)	Magnitude
Hyland et al.	2013	Ireland	EPC rating	Rental/Sales	√	generally positive but more likely to matter when economy poor
Cajias & Piazzolo	2013	Germany	Energy consumption/EPC category	Rental/Sales/Return	√	1% decline in energy use leads to .15% increase in return; 0.08% increase in rents and 0.45% increase in CV
Stanley et al.	2015	Ireland	Energy Performance Indicators	Sales price	√	increase of 1% per grade – but need to be careful on interpretation re age of building
Yang et al.	2015	Denmark	Energy source and products	N/A	N/A	Different types of consumers adopt differing approaches – depending on their priorities (VFM; green etc)
Fuerst et al.	2015	UK (England)	Energy efficiency	Sales price	√	positive influence-but more for flats/terraced than detached

Study/Author	Year	Country	Sustainable features	Impact	Positive (✓) or not (x)	Magnitude
de Ayala <i>et al.</i>	2016	Spain	Energy efficiency judged through household surveys	Sales price	✓	5.4% and 9.8%
Bond and Devine	2016	USA	LEED	Rental	✓	8.90%
Brouen and Aydin	2016	Netherlands	transparent EPC on sales	Sales price	✓	A label quicker to sell and 2% premium against a D; G rated slower and 13% brown discount
Fuerst <i>et al.</i>	2016	UK (Wales)	EPC grade	Sales price	x	higher grade sell for more – but not necessarily due to EPC label
Wahlström	2016	Sweden	Energy efficiency feature /energy consumption	Sales price	mixed	Consumption has no impact; presence of construction features that lead to efficiency are desired



# EeMAP CONSORTIUM MEMBERS



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