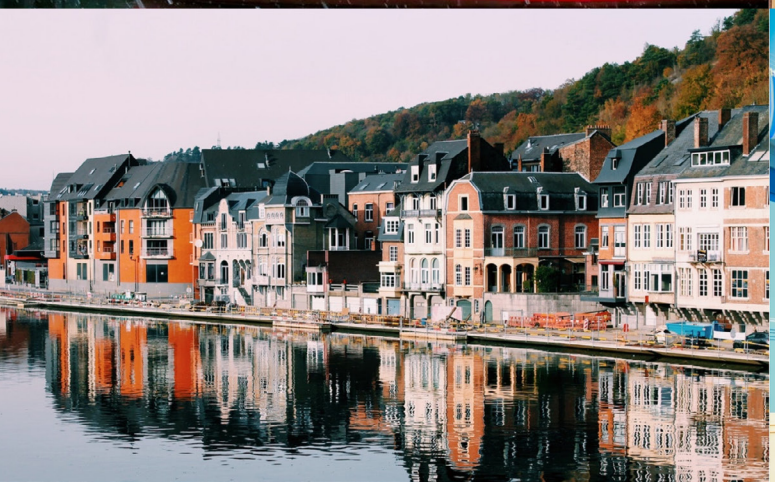
RICS insight paper

Energy efficiency and residential values: a changing European landscape

March 2019



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Report written by

Sarah Sayce FRICS

University of Reading, UK

s.l.sayce@reading.ac.uk

Sara Wilkinson FRICS

University of Technology, Sydney, Australia

sara.wilkinson@uts.edu.au

Steering group

Ben Elder (RICS)

Ursula Hartenberger (RICS)

With special thanks to:

John Baguley MRICS (RICS)

Reno Cardiff MRICS (Cushman and Wakefield)

Fiona Haggett FRICS (Green Door Consulting)

Chris Nicholls (BEIS)

David Park FRICS

Zsolt Toth (European Mortgage Federation)

Contents

Foreword

It is widely acknowledged that there is an urgent need to upgrade the energy efficiency of our housing stock across Europe in order to meet the ambitious EU targets aimed at reducing the now inevitable impact of climate change.

While much has been achieved to raise building standards of new dwellings through better design and more efficient services, the real challenge lies with the existing stock. Much of this is old and energy inefficient, but the solution cannot lie in mass demolition and rebuilding. Not only is this simply not feasible, socially it would be unacceptable as it would displace communities and it would not be economically viable.

The solution has to lie in refurbishment, but who is to take the initiative? Whether buildings are owner-occupied or let, the owner would normally be responsible. But what provides the motivation: reduced costs, increases in value or is the answer more complex? For commercial buildings a return on investment, combined with the risk of investments becoming obsolete, is gaining traction as a business case. Further, large Institutional investors are increasingly important stakeholders in the build to rent field. Given that their decision-making is driven by cash flow analysis, this will add focus on the need to improve efficiency, although the so-called split incentive remains a challenge For business occupiers reducing business running costs makes commercial sense. In the light of this there would be an expectation that, quite aside from notions of corporate responsibility, improving building energy efficiency should make good business sense.

However, the case in the residential market may be different. Not only is the percentage stock in owner occupation high in most European countries, landlords are often predominantly social housing providers. For owner-occupiers, the purchase decision is not based on purely economic grounds: buying a home is often as much an emotional decision as a financial one – though tempered in many cases by the ability to borrow money for purchase. For social landlords, the health and wellbeing of the occupiers is high on the agenda. So a pure economic case may not be the solution yet too often it is the only one put forward. It is indeed a complex issue

Valuers observe and reflect market conditions when carrying out their due diligence. But they need to reflect trends and risks to value as they exercise their professional judgement. Under the *RICS Valuation – Global Standards 2017* it is acknowledged that sustainability and environmental matters are growing in importance and that valuers should have proper regard to their relevance and significance. They are therefore 'strongly advised to collect and record appropriate and sufficient sustainability data'. Further, for secured lending, valuers should 'comment on maintainability of income over the life of the loan' and this may require valuers to consider the broader sustainability context.

The requirement on valuers is clear: they must understand and be able to reflect the changing market context in relation to sustainability and at the moment the most dominant concern is energy. However, data remains scarce with Energy Performance Certificates being the only widely available measure – even this does not yet have comprehensive cover or total market confidence.

This insight paper should therefore be welcomed. It provides a comprehensive review of the issues that connect values in the residential sector to energy efficiency. It reviews the evidence

and enables valuers to better understand the impacts of energy efficiency on the value and/or liquidity of residential buildings; in the short-term it may be liquidity that has the more significant role.

The paper rightly points out that the market is moving: finally, regulation will be a key driver to support upgrades but until new levels of energy efficiency are reached by all buildings, the value of less efficient stock will increasingly lag behind. We may witness both green premiums and brown discounts.

Reno Cardiff

Cushman & Wakefield

Executive summary

Aims

The aim of this insight paper is to provide valuers and other interested stakeholders with an overview of the impact of energy efficiency on the value of residential property in Europe, whether that housing stock is owner-occupied, rented within the private sector or social housing. It considers the role of the valuer and how, through their data collection and reporting processes, they can play a part in promoting a more energy efficient housing stock. To achieve these aims, it reviews the context within which energy efficiency is rising up the European regulatory agenda and the impact that this is having on value drivers.

Through a review of academic literature and consideration of the wider context, it provides a set of recommendations for valuers of residential properties to assist them with considering how energy efficiency is beginning to influence property values. This understanding can then enhance their advice to clients.

Context

The climate change agenda has led to an urgent need to decarbonise all aspects of the economy, including buildings. The residential building stock in Europe is old, with estimates suggesting that only 3 per cent of the stock is fully energy efficient. This has led to energy efficiency measuring tools such as energy performance certificates (EPCs) and a trajectory of likely regulations surrounding the energy efficiency levels of existing housing stock, as well as new builds. For example, minimum standards have already been introduced for UK investment stock.

It is acknowledged that energy efficient buildings offer cost-savings to occupants. While this has been promoted as a business case for retrofitting, payback periods may render such cost-savings insufficient for few other than long-term owner-occupiers. This is particularly the case for investor-owners who suffer from the so-called 'split incentive' problem.

From both the occupier and owner-occupier perspective, connections have been found between energy efficient buildings and the health and well-being agenda, because some retrofitting and energy efficiency solutions provide increased levels of comfort and feelings of security.

Findings

There have been many large-scale quantitative studies conducted in Europe, most using hedonic pricing analysis, to seek a relationship between EPCs and either capital or rental value. The results generally show a positive relationship, though the outcomes are variable. It is suggested in at least one study that the small supply of energy efficient stock has led to a skewing of demand that, as new energy efficient stock is developed, will reduce any premiums observed.

One of the large-scale studies notes that energy upgrades may result in higher values but that these may not outweigh the costs, whereas another study found a high return on investment. The variations in findings from such large-scale studies do not produce a single firm relationship: it varies between countries and study parameters.

There has been limited qualitative research, but where this has been conducted, the individual characteristics of properties that impact on energy efficiency levels are deemed to be more influential in terms of value than EPCs. Overall, energy efficiency has not been viewed as a major driver.

Case studies reveal a number of important market-led initiatives aimed at supporting the energy efficiency agenda. Valuers are seen to have a key role in supporting decision-making in rented stock, notably social housing (as shown in the REVALUE project – see section 5.1), and through working with lenders to support movements towards so-called 'green home mortgages', which encourage retrofits and help reduce credit risk.

Conclusions

Overall, the evidence points towards energy efficiency beginning to impact on value, though this is a small impact compared with traditional value drivers. Currently, some specific 'visible' characteristics, such as good quality, climate-appropriate glazing, may be more important than any certification. However, moving forward, energy efficiency is likely to be of increasing importance in owner-occupier and investor-owner decisions, including those relating to lending and mortgages, and this will be reflected more clearly in reported property values.

Some barriers to upgrading residential property to improve energy efficiency still exist. Collectively, the barriers reduce the pace at which improvements are carried out and add complexity in terms of understanding how far the market will translate energy efficiency into increased value. These barriers include lack of availability of energy data, apart from EPCs, some continuing lack of clarity surrounding the 'business case' for energy upgrades and the transience of some grants and fiscal incentives.

Many residential transactions are dependent on borrowed funds; some lenders are now beginning to factor in energy efficiency to their lending decisions. If sustained, such moves send out a clear signal to the market about the importance of energy.

Moves to increase building standards through regulatory measures are taking place and are likely to become increasingly stringent. This has value implications as stock becoming substandard will be likely to suffer value loss (the 'brown' discount). In some cases there will be a need for grant aid to prevent properties becoming 'stranded'.

Recommendations for valuers

The report contains a series of recommendation for valuers including:

- recognising and being knowledgeable about the potential impact of climate change on the residential building stock and the consequent need for the majority to be upgraded to meet carbon targets, together with the associated market demand changes and regulatory implications
- being aware of how buildings' energy efficiency characteristics may lead in some cases to a 'green premium' but also 'brown discounts', or the risk of being 'stranded' in value terms and, where appropriate, advising their clients accordingly as to the risks presented
- where possible, enhancing their data collection and analysis to provide a firmer basis on which to undertake future valuations and
- working with other with other professionals as appropriate to develop a more granular knowledge of services and structures that might influence the cost and feasibility of energy retrofits.

1 Introduction

This insight paper aims to provide valuers and other interested stakeholders with an overview of the impacts of energy efficiency on the value of residential property in Europe, to include owner-occupied property, property that is rented within the private sector and social housing. It does not attempt to instruct the valuer, but it does review the context within which energy efficiency is beginning to play a role in the determination of market value and investment worth. To do this, it reviews the outcomes of several relevant academic studies and market-based initiatives that are aimed at market transformation. In particular, it provides short case studies covering some significant research projects.

The report should be read in the context of the regulatory and social agendas around climate change, accepting that improvements to residential building stock are critically important for delivering on binding targets.

Finally, the report provides advice to valuers to assist them with considering the impacts of energy efficiency on residential property values.

2 The links between climate change, energy efficiency and housing stock

2.1 Climate change and the need to upgrade residential buildings

Climate change, and the need for a response from all sectors of society and industry, is widely acknowledged. Previously, the emphasis has been on how to mitigate against such change. Now, however, it has been recognised that mitigation alone will not be enough: adaptation is required.

The Intergovernmental Panel on Climate Change (IPCC) reported in 2018 that, at best, our climate is on track for a 1.5C global temperature increase, which will result in many EU countries experiencing an increased number of days with intense heat (however, they will still experience cold winters). In order to maintain this trajectory and limit climate change, a reduction in carbon emissions of 80 per cent will be required (from the 1990 base), as agreed in the 2015 Paris Climate Conference (**COP21**) and reinforced in subsequent COP21 meetings. Yet climate change means less predictable weather patterns coupled with increased demand for energy to heat and cool property will increase unless action is taken to improve the energy efficiency of the residential housing stock. Furthermore, any energy supply issues may increase energy prices, which will fall hardest on those with poor purchasing power and may lead to negative health outcomes and, at worst, fatalities.

Therefore, the need for energy efficiency has never been greater. However, Europe's housing stock is old and energy inefficient: the **Buildings Performance Institute Europe** (BPIE) estimates that only 3 per cent of housing stock is constructed or improved to the highest energy standards (BPIE, 2017). The **World Green Building Council** (2018) found that the energy efficiency of stock correlates closely to its age, and rented stock is likely to be less energy efficient than owner-occupied stock. As most energy consumed still emanates from fossil fuels, residential emissions account for a significant percentage of carbon emissions.

In addition, the replacement rate of stock is very low and demolition rates slow. This, combined with slow construction means it seldom exceeds 1 per cent per annum – less in periods of economic slowdown (Balaras et al, 2007). Although some progress towards improving the rate of replacement has been made, greater advances in building renovation and replacement are required (Artola et al, 2016). Indeed, the 2018 IPCC report stated that building renovation is critical to achieving climate change targets, and it calls for 'rapid and far-reaching transitions' (IPCC, 2018) to reduce the demand for energy from housing, as well as moving from fossil fuels to clean electricity and improving building envelope insulation to reduce the need for heating and cooling.

Policies and regulations aimed at influencing the speed and specification of building renovations and overall occupier behaviours are likely to be introduced. Over time, these will change the supply/demand relationships between old and new stock, leading to value differentiation between efficient and non-efficient buildings. Until recently, the emphasis on building-related policy in Europe has tended to be on moving towards energy efficiency; in future, this requirement is likely to be matched by a shift to decarbonise energy sources.

2.2 Measuring energy efficiency

There is no universal measure of a building's energy efficiency. The common metric used across EU member states is the energy performance certificate (EPC), which was first mandated by the *Energy Performance of Buildings Directive* (EPBD) 2002/91/EC (amended in 2010 and 2018). Although the Directive applies across member states, the technical measurement is a matter for individual jurisdictions. Common across countries is the requirement for valid EPCs to be produced as part of property advertising material whenever a building is to be let or sold, thereby alerting potential buyers or tenants to the energy efficiency of the property. Concerns about the quality, reliability and consistency of EPCs between countries have been recognised, and the latest re-cast of the Directive requires member states to express their certificates in ways that allow cross-country comparison.

The Directive does not just require buildings to have EPCs: the original Directive placed a further requirement that, over time, new buildings should be constructed to nearly zero energy building (NZEB) standards by 2020 (2018 for public sector buildings). NZEBs are defined as having 'a very high energy performance with the nearly zero or very low amount of energy required covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby' (European Commission, 2016[a]). This should be placed in the context of an already steep trajectory in the volume of social and environmental legislation (Datamaran, 2018). Individual member states may apply the definition differently according to local circumstances, including climate, and indications so far suggest that much progress has been made in relation to new buildings (European Commission, 2016[a]).

The latest amendments to the Directive also make it clear that upgrades to existing buildings are critical to achieving energy and carbon targets. By recognising the slow pace of building replacement, they have placed a requirement on member states to develop strategies for upgrading buildings to higher energy standards, with an obligation to put in place long-term renovation strategies aimed at decarbonising the existing building stock by 2050.

There is little consistency between EU member states with regard to calculating EPCs. In some countries, the EPC relates to kWh output; in others, it is a design calculation that may or may not account for the cost of fuel. Further, in some jurisdictions (such as Germany and Spain), there are within-country variations. Critically for valuers, there is evidence to suggest that some EPCs, particularly those produced during the early years, may not provide accurate information on which valuers can rely. This variability in calculation and inconsistency in results has led some countries to regard EPCs as unhelpful as a measure to establish comparative energy efficiency. Moves across Europe to ensure compliance with international targets are being reflected in a tightening of regulatory frameworks.

The implication for valuers of the Directive's requirements is that they need to consider the impacts of current and published regulations and national 'road maps' towards achieving increased energy efficiency measures. An example of such regulations is the UK's minimum energy efficiency standards (MEES), which apply to almost all investment stock (BEIS, 2018; RICS, 2018[a]) and imposes restrictions on a landlord's ability to let out buildings that do not meet minimum energy standards. Valuers need to consider the impact that such regulatory shifts may have on value and, in particular, the risk of value decline for non-resilient stock.

2.3 Energy efficient buildings present economic benefits

Upgrading buildings in terms of their energy efficiency can bring economic benefits on many levels (European Commission, 2016[b]). For example, an energy efficient building will normally reduce the costs incurred for heating, cooling, lighting and ventilation. In turn, this may lead to reduced operational costs and, potentially, reduced maintenance requirements (World Green Building Council, 2013). Given the variable (sometimes unpredictable but generally rising) cost of energy, the case for retrofitting to improve the energy efficiency of buildings appears irrefutable. The economic case extends beyond revenue cost-savings: it has been claimed to result in greater tenant demand, leading to increased rents and making housing more attractive, easier and quicker to rent out or sell (RICS, 2014; Fuerst, 2014). A review of this evidence is presented in section 4.1. Furthermore, energy efficiency may lift bill-payers out of fuel poverty to the economic advantage of the occuper (usually a tenant) and fulfilling social aims for portfolio landlords (Milne and Boardman, 2000).

While energy improvements may produce significant revenue savings, they come at a cost, and the payback period will vary depending on the type of measure adopted, the current and future cost of energy and the method of calculating payback used. For owner-occupiers intending to live in their property long term, the case for investment may seem clear but is still often constrained by uncertainty and inertia, information gaps and inability to finance, although it is strongest when combined with deeper retrofit measures (European Commission, 2016[b]; see also the REVALUE case study in section 5.1). However, for investor-owners the situation is different: the capital investment can only be justified in financial terms if either the rent can be increased or the capital value will be enhanced (or both). This so-called 'split incentive' problem has often led to underinvestment by landlords and is a critical reason why market transformation of stock is too slow to meet carbon reduction targets (Melvin, 2018).

2.4 Connecting energy efficiency and the health and well-being agenda

A number of studies (e.g. Fisk, 2000; Willand et al, 2014) have linked energy efficiency with occupant health and well-being. While it is acknowledged that the relationship is complex, research points to energy upgrades providing a number of social and health benefits, including psychosocial factors, better air quality and the reduction of damp. However, Roulet et al (2006) found that while insulation, central heating and double glazing can reduce cold-related illnesses and stress by making it easier for occupants to keep homes warm, they sometimes lead to poor ventilation, dampness or poorer indoor air quality. What appears critical is that the quality of the upgrade is sufficiently good that it does not lead to undesirable outcomes and a lack of trust in the technology.

A meta-analysis (Maidment et al, 2014) concluded that, on average, household energy efficiency interventions led to small but significant improvements in the health of residents. The REVALUE project (see section 5.1), through interviews with social housing providers, found that the health and well-being of tenants was as compelling a business case for energy improvements as the financial cost-saving or value enhancement.

When considering the relationship between energy efficiency and value, it is important that valuers take into account the possible impact of improvements in terms of both cost-savings and the residents' mental and physical well-being, including feelings of security and comfort (Basham et al, 2004).

3 The residential market in the EU

3.1 Residential tenure patterns in the EU

Within Europe, the split in terms of residential tenures varies. Owner-occupation is the most common type of tenure, although with significant variations across countries. Incidence of owner-occupation ranges from close to 100 per cent owner-occupied in Romania and Hungary, to a little over 60 per cent in the UK and the Netherlands, just under 60 per cent in France, and less than half in Denmark, Germany and Sweden (Pittini et al, 2017). Of the rented stock, Austria, the Netherlands, Denmark and the UK all have significant social housing provisions of between 18 and 30 per cent, while Poland and Sweden have no social housing but instead provide cooperative housing as an alternative to owner-occupation. Overall, it is estimated that social housing comprises around 17 per cent of overall EU housing stock. In most cases, social housing is associated with government rent caps and large-scale portfolio ownership, whereas the privately rented sector – which is most prevalent in northern European countries such as Germany, Denmark, Sweden and the UK – is notable for the prevalence of small-scale investors, often owning less than four units (Scanlon and Whitehead, 2016).

However, housing tenure is not static. Pittini et al, (2017) note that over the last decade there has been a trend away from owner-occupation and towards renting (notably at market rents). Furthermore, within the owner-occupation sector, mortgage finance dependency has increased. This, according to Williams and Whitehead (2017), links to affordability issues and falls in real wages following the global financial crisis. More specifically, since 2007, the share of owners with a mortgage increased at the expense of owners outright (except in the UK), and the share of tenants who rent at the market price increased while those renting at a reduced rent decreased. Overall, renting is more common among low income brackets and within less efficient, older housing stock (Pittini et al, 2017). The declining number of those who own outright and the consequent involvement of others (such as landlords and lenders) may impact the relationship between energy efficiency upgrade decisions and value.

Tenure patterns are critical in terms of the potential funding and value impact of energy efficiency improvement measures. For owner-occupiers, the value driver for carrying out improvements and the reflection of these in capital value could be expected to relate most strongly to comfort, prestige and security for high value units, and more to cost-savings for lower value dwellings; however, for the commercially-orientated private investor, the impact on investment worth (rent and yield) is critical. For social housing, the health and well-being agenda, tenant satisfaction and taking tenants out of fuel poverty are critical drivers (see section 5.1 for more information).

3.2 The requirements for valuers

The main reasons for commissioning valuations are:

- sale/purchase
- secured lending
- investment monitoring/decision-making and
- entry into company accounts.

For each, valuation professionals will be mandated to work within the requirements of the *RICS Valuation – Global Standards 2017* ('the Red Book'), with adherence to national variations where appropriate. For most purposes, the basis of valuation will be market value or, for investment decisions, investment value (or, as it is commonly referred, investment worth).

In undertaking any market value instruction, the valuer's role is to reflect the market, not to influence it; therefore, a valuer can only reflect the energy efficiency of a property to the extent that it is an identifiable value driver. The challenge to the valuer is how (using evidence of comparable transactions) to analyse the impact of energy against the number of factors that drive market buying behaviours. This will be a challenge when valuing within a context in which the evidence is primarily derived from owner-occupation sales.

However, where valuers are preparing a calculation of investment worth on behalf of a specific client, the importance of energy efficiency will be factored in to any discounted cash flow (DCF) prepared. To an investor, the future impact on rent and capital value of energy efficiency and pricing may be a consideration, particularly if this will impact on the value risk profile of the asset. Lenders too may be concerned regarding the future security of the loan.

RICS provides guidance to valuers on due diligence in relation to sustainability. Under the Red Book, regarding market value, valuers are recommended to:

- assess the extent to which the subject property meets sustainability criteria and arrive at an informed view on the likelihood of these impacting on value
- provide a clear description of the sustainability-related property characteristics and attributes that have been collected
- provide a statement of their opinion on the relationship between sustainability factors and the resultant valuation, including a comment on the current benefits/risks that are associated with these sustainability characteristics, or the lack of risks, and
- provide a statement of the valuer's opinion on the potential impact of these benefits and/or risks to relative property values over time.

In relation to secured lending valuations, valuers are advised that sustainability factors are becoming a more significant market influence, and where a valuation for secured lending is undertaken they should consider the relevance of sustainability matters to the particular assignment. In addition, valuers are advised to comment on the maintainability of income over the life of the loan (and any risks to the maintainability of income), and this may need to be considered in a broader sustainability context. As explained within two of the case studies presented in chapter 5, some lenders are recognising that less energy efficient dwellings may present additional credit risk, and this is leading to changes in lending policies. As the 'green mortgage' movement develops, valuers undertaking secured lending valuations will need to take account of the potential differentiation in mortgage-ability between energy efficient and non-energy efficient stock.

3.3 The valuation of residential property

The basis of valuation, and hence the method, is always dependent on the purpose for which it is carried out. For the valuation of residential units, the starting point will be the Red Book. As stated in section 3.2, for most purposes (except for assessing investment worth and in some cases for accounting (book) values), the basis used will be market value. For accounts or book valuations, the basis will be prescribed by accounting conventions and is not fully explored here as the basis may vary from country to country, especially for social housing.

To establish market value, evidence from comparable transactions is critical. If the valuer, as part of their due diligence, can find evidence that energy efficiency is a factor impacting tenant, landlord or buyer behaviour, that evidence should be evaluated in the same way as any other items revealed during inspection and as required under the Red Book. If there is no comparable evidence, while the valuer should take note of the energy efficiency related factors for future reference, they will not impact on the reported figure). Within the residential mortgage market (and for some other purposes), automated valuation models (AVMs) are increasingly used in preference to individual inspections. Within the residential field, it is claimed that AVMs can be as accurate, or more so, than valuations prepared by valuers as a result of a visual inspection; however, they can only be as good as the factors fed into their algorithm, and these can lack transparency (Matysiak, 2017).

Few AVMs have as yet been developed that consider energy efficiency in the calculation. One exception is a small-scale trial in Italy (Tajani et al, 2018). Results from the trial showed that EPC labels A and G had an influence on value (positively and negatively, respectively), but they also revealed no impact on the value for other, intermediate, EPC labels. Over time, AVMs – at least within the residential field – offer the potential to incorporate energy data as it becomes both more plentiful and reliable.

However, where an assessment of investment worth is required using a DCF approach, the energy efficiency and the potential/actual impacts on cash flows and on the risk to future capital values are normally a matter of judgement after discussion with the client. In these circumstances, it is more likely that greater energy efficiency may impact on the assessment of net present value (NPV). However, in the case of social housing portfolios, where the valuation is prepared either for accounting purposes or in contemplation for sale, and the most likely buyer is another social housing provider, the valuer should be aware of any rent caps or other constraints on cash flow. In some countries, another basis of valuation may be required; for example, in the UK the current basis will probably be existing use value – social housing (EUV–SH) (see *RICS Valuation – Global Standards 2017: UK national supplement 2018*).

In summary, the changing pattern of tenures within housing stock may lead to a greater emphasis on investment worth forming the basis on which stock changes hands. However, property rented in the private sector, so long as it is dominated by small investors, is likely to be driven by owner-occupation transactions and comparable evidence. As and when greater reliance is placed on AVMs for the estimation of value in the future, the influence of energy efficiency is likely to remain obscure.

4 Assessing the evidence base

This chapter reviews the evidence linking value and energy efficiency and explores the changing context in which valuations take place. This comprises three strands:

a quantitative evidence obtained from statistical analyses

b qualitative evidence from surveys and interviews and

c a series of short case studies of consortium projects seeking to support market transformation (see chapter 5).

4.1 Review of quantitative evidence

More than twenty studies globally have evaluated the relationship between capital and/or rental values and energy efficiency in the owner-occupied, private rented and social housing sectors. Most have been large-scale studies conducted using the hedonic pricing model developed by Rosen (1974). This model seeks to isolate the impact on value of one variable (here, energy efficiency – measured in terms of ratings); the chief intent in most studies has been to isolate the impact of the EPC within the assessment of either transaction or rental prices achieved.

The results are dependent on researchers accurately identifying, quantifying and eliminating the impact of other variables, such as location, age, condition, etc. While researchers have sought to remove 'noise' from their analyses, the results need to be considered in context, as the presence of short-term incentives or changes to energy rating systems, and the extent of their adoption, can make it difficult to interpret the evidence from the academic studies meaningfully. Specifically, many studies relate to the relationship between EPC ratings – which were introduced in 2008 under the *Energy Performance of Buildings Directive* 2002/91/EC and altered in 2012 – and rental or capital values achieved. Some are based on valuations, while others recorded market prices.

For this review, only studies relating to EU member states are included. The selection is not comprehensive, but it seeks to present a balanced picture of findings. All these have been researched during changing regulatory, economic and social contexts and in which, in some member states, various fiscal or grant incentives have been in place – in some cases for short periods. As shown in Table 1, almost all provide observational evidence of a positive link between levels of energy efficiency, normally measured in terms of the EPC, and transacted prices (rental or capital). They collectively provide strong trend data; however, they do not explain why such value differentiation is occurring, nor can they give evidence to assist valuers commissioned to value a specific property in a specific location, on a specific date.

Almost exclusively, most studies concentrate on one member state; however, one large cross-country study has been conducted as part of the EU-funded REVALUE project (see section 5.1) and comprises a regression analysis of social housing across four member states. This examined over 5,000 valuations of residential social housing in the UK, the Netherlands, Sweden and Germany, analysing their reported (assessed) values against both their EPC rating and standard assessment procedure (SAP) indexes, as well as components affecting energy performance (such as provision of double-glazed windows, etc.). The results revealed a slight value premium in some locations, but they also showed increasing evidence over time

of a 'brown discount', in which properties with poor energy ratings decreased in value relative to the mean. In all cases, while it was possible to see that energy efficiency had an influence on reported capital values, particularly in the Netherlands, this was still small (approximately 1 per cent) compared with the 79 per cent explained by traditional value drivers and 20 per cent that could not be explained via the model. However, supporting the findings of Feige et al (2013), the impact of individual components was important; indeed, within the analysis of a large housing portfolio in the UK, the quality of the glazing was found to be a significant value driver.

The implication of these results is that visible components that in themselves contribute to energy efficiency may be more influential in terms of value determination than actual certification. This finding has importance for valuers, who normally have limited time to inspect residential units.

Country	Sample size	Dates	Value effect (+/-)	Sector (OO, PRS or SH)	Premiums
Finland	7,000	2015	+	OO	Premium 3.3% apartments, adjusted to 1.5% to exclude neighbourhood characteristics.
Germany	2,630	2008 – 2010	+	OO PRS	Premium up to 3.15% 0.76 euros/m^2 rental. Energy efficiency was significantly correlated with rental levels but not with vacancy nor maintenance costs.
Berlin	not stated	2011 – 2014	+	PRS	Investor purchasers anticipated future capital growth related to energy efficiency. While tenants paid a small premium, their willingness to pay was less than the investors had anticipated in the asking prices.
Hungary	1,399	2012	+	OO	Premium 9.42% for retrofitted apartments; however, price increases were less than the cost of improvement work, implying a need for subsidy.
Ireland	40,568	2011	+	OO PRS	Relative to D-rated properties, A-rated properties had asking rents that were 1.8% higher, but discounts for F/G rates of 3.2%. In the capital market, the spread was far wider, with premiums of up to 9.3% for A-rated properties and F/G rate discounts of 10+%. It was concluded that market conditions were a critical factor. Premium of 1.5%.

Country	Sample size	Dates	Value effect (+/-)	Sector (OO, PRS or SH)	Premiums
Dublin	2,792	2009 – 2014	+	OO	A 50-point improvement in the Building Emission Rate (BER) had a 1.5% higher list price. Using this metric, a 1-point improvement in the 15-point scale from G to A1 yielded list price increases of 1%.
Netherlands	17,835	2008 – 2013	+	SH	Price premium between 2% and 6.3% compared to those with the same characteristics; the lower premiums related to social housing, although unobserved differences in quality could not be ruled out. They could not conclude whether retrofit costs would be covered by value increases.
	14,451	2012 – 2015	partial	SH PRS	Rental premiums were observed in the regulated part of the rental market for energy efficient dwellings, but not in the unregulated part, indicated an unwillingness from some tenants to pay additional money.
Romania	64	2011	+	OO	Price premium 2–3% for apartments with thermal retrofits, producing a value payback of some 60%.
Spain	1,507	2015	+	OO	Owner's own value estimation premium between 5.4% and 9.8%, compared to those with the same characteristics but a lower energy efficiency level.

Country	Sample size	Dates	Value effect (+/-)	Sector (OO, PRS or SH)	Premiums
Sweden	67,559	2009 – 2010	?	OO	Inconclusive, but early indications show that actual energy performance is associated with house prices in some subsectors of the market, such as low value and some highly energy efficient stock. Premium values were associated more with visible elements, such as triple glazing and heating systems, than with EPC labels.
	77,000+	2009 – 2010	+	OO	Tenants and owner show through willingness to pay methodology, a preference for a range of sustainability factors, including, but not restricted to, energy savings.
Switzerland	305 2,453	2007 2009	n/a -	PRS PRS	A regression analysis showed a negative correlation with rents, possibly due to the inclusive rent structures in Swiss leases, but a positive relationship with water efficiency and 'soft' criteria such as health, comfort and security.
England	333,095	1995 – 2012	+	OO	Price premium dwellings in EPC bands A and B sold for a 5% premium, C band properties had a 1.8% premium. Discounts for lower-rated dwellings. This study covered the period both before and after EPCs became mandatory with stronger findings after the introduction.
Wales	191,544	2003 – 2012	+	OO	Price premiums of up to 12.8% for top-rated properties against the price of average (band) dwellings (band D), with discounts of 6.5% for those below the average. Significant regional and tenure variation. Less conclusive results on repeat sales.

Key: OO = owner-occupied; PRS = private rented; SH = social housing

Table 1: Selected European studies evaluating energy efficiency and residential value, based on numerous publications listed in appendix B

4.2 Review of qualitative evidence

The quantitative evidence available is large-scale, trend-based data. However valuable this is, it does not represent, and cannot be used as a basis for valuing, an individual property or portfolio.

There are few qualitative studies that seek to link energy efficiency and residential values. A large-scale study (Michl et al, 2016) considered sustainability and the perceptions of value held by valuers, but this was related to commercial and residential instructions. It concluded that there was very limited evidence to suggest that energy efficiency was a factor influencing residential values – although investment worth was beginning to be impacted, mainly due to levels of certification (both mandatory and voluntary). A Slovenian study by Ferlan et al. (2017) considering the contribution of factors impacting residential values found that energy costs were influential, but they were of far lesser importance than other traditional factors (such as location) and less important than proximity to noise or pollution.

A very focused qualitative analysis was conducted as part of REVALUE (see section 5.1), in which valuers across England, the Netherlands, Germany and Spain took part in round tables to explore the role of energy efficiency in valuation. The headline conclusions of this research were that:

- Valuers are seldom specifically instructed to consider energy matters in their reports, although this is changing in relation to bank valuations in some countries.
- There is limited confidence in EPCs as an accurate measure of efficiency, as well as limited evidence that they impact on the market value of residential assets. Values continue to be driven by traditional factors.
- Where demand outstrips supply, energy efficiency tends to get pushed further down the value agenda.

However, the research also found that, in many ways, energy efficiency has become part of the conversation in terms of specification expectations: for example, a lack of good double glazing will, except in heritage properties, most likely result in a 'brown discount' – this is something that is now expected. Finally, valuers expressed the view that better and more transparent data would help market transformation.

4.3 Analysis

The results from the academic quantitative studies suggest that there is a positive relationship between energy efficiency and values, both rental and capital, in Europe. However, the premiums varied from country to country, so care should be taken when interpreting these results. Recent studies have begun to observe discounts rather than premiums, and greater attention being paid to the value impact of specific items. For example, there is a connection between value and glazing units, and the comfort and security agenda has been recognised as well (Feige et al, 2013). Other factors, such as boilers, tend not to feature – possibly because such information may not have been available to the researchers. In addition, as revealed in a commercial study (Fuerst et al, 2017), if there is a short supply of top-rated properties, any premiums may relate more to the scarcity factor than the intrinsic value. Furthermore, some of the larger premiums found in quantitative studies vary over time depending on the other variables in the market; these qualifications are recognised by the

study authors, who caution against over-reliance on findings. There is no conclusive evidence that the owner-occupier market clearly and consistently outperforms the private rented or social housing sectors, or vice versa.

While the quantitative studies point to value premiums, only a few consider this is in the context of retrofits. Where retrofits are examined, there is evidence that value increases do not outweigh the cost of the work, leading to an argument for subsidies and incentives.

The evidence from the quantitative studies may at first appear to contradict that presented in the qualitative research available, in that there was little evidence emerging of energy efficiency influencing market pricing. However, the two sets of results may be possible to reconcile. The quantitative studies pick up trend data; valuers deal with the particular details and simply build in energy efficiency factors, not as 'add-ons' but as integral to their holistic judgement. What is apparent from both types of analysis is that some features – such as good glazing – are important, but the value case for this lies not just as an energy feature, but as a matter of comfort and security.

The evidence from the case studies points to a more complex picture: the definitions, reliability and quantity of data, the role of well-being and owner motivations, the availability of finance and the attitudes of lenders all lead towards energy efficiency beginning to have some impact on markets. However, there is a caveat: energy efficient buildings tend to be newer and better maintained (e.g. heating systems are well-serviced and windows renewed, etc.), so it is likely that high energy ratings are connected with higher value buildings. It is worth noting that, over time, as new stock is being built and retrofits are being undertaken, any premium attached specifically to energy features will probably not be maintained; however, as so much residential stock is sub-standard, any property that is significantly above the average energy efficiency level may benefit from this 'halo' effect. As refurbishment and new builds shift the median from a C/D rating to a B, it becomes more likely that 'brown discounts' will become more prevalent.

It is apparent that markets are shifting but that there are still some barriers to clear recognition of energy efficiency within a property's reported value.

5 Case studies of practice-led projects

Chapter 4 reviewed much of the academic evidence of links between the value of residential stock and its energy efficiency characteristics. This chapter considers some recent practice-led initiatives, which all aim in different ways to drive market transformation and promote demand for more energy efficient stock. The results provide a deeper knowledge of the relationship between energy efficiency and value. The projects do not represent a comprehensive list of work recently undertaken to support market transformation; they are chosen for the size of their potential impact. Collectively, they point to the involvement of many major market players and a determination to drive changes in market demand and supply of energy efficient dwellings.

5.1 REVALUE

The **REVALUE** project is a four-year EU-funded project aimed at developing a deeper understanding of the relationship between energy efficiency and residential values in selected European member states within rented (primarily social housing) stock and deepening the case for energy retrofits. The starting point of the REVALUE project was the contention that increasing transparency in the valuation process in relation to a property's energy characteristics, and providing more explicit guidance to valuers, would create a case for valuers to report additional value for energy improvements and support the residential investment decision-making process. There was also the assumption that a major barrier to upgrading property to energy efficient standards among investment housing stock is the 'split incentive' issue, whereby any capital investment by the landlord that results in benefits to the occupant is unlikely to be undertaken, unless it results in additional value through the rental line or it enhances the capital value.

Through a series of round tables, interviews, case studies and a large-scale regression analysis of social housing, the project sought to explore this issue and the possible role valuers could play in market transformation. The project has identified a number of barriers to retrofits and drawn conclusions to drive the agenda forward. The project revealed that the relationship between energy efficiency and value is complex, and the business case often quoted – one of cost-savings and value-adds – is too simplistic. For social landlords in particular, the motivation focuses more on tenant comfort and well-being, which in turn leads to lower voids in lettings and fewer tenant defaults. This finding offers an alternative business case to that of initial return on capital.

The REVALUE team found that the link between enhanced capital or rental value and energy efficiency is currently difficult to sustain at the level of the individual building. Upon investigation, it was confirmed that valuers and market participants often have a lack of trust in the accuracy of EPCs and/or inadequate knowledge of some technologies. Further, other energy data was often missing or not available. However, while little connection was found between EPC ratings and reported values either through the regression analysis or through surveys, REVALUE did find a less apparent connection between the energy efficiency of a dwelling and its value. This was through a connection both to individual characteristics, such as windows (which do influence values), and to feelings of well-being and occupant satisfaction. Another major finding of this project is that the data that is available to valuers

in relation to energy efficiency is insufficient to enable meaningful analysis to support value differentiation.

The project team concluded that while 'traditional' drivers remain paramount in determining market value, over time the building specification that is expected by owners and occupiers alike will change. This, they concluded, will lead not to the presence of premium values for green buildings but to 'brown discounting' and an understanding that inefficient buildings present a risk to their owners and, where involved, financiers. In making recommendations, the project places emphasis on the need for greater consistency in EPCs and for more comprehensive data collection by investment/social housing providers to better enable valuers to incorporate datasets into their valuation reports and advice.

5.2 The LENDERS project

The **LENDERS project**, based in the UK and comprising a consortium of organisations, including the **UK Green Building Council**, analyses the link between property energy efficiency and fuel bills to explore whether homes with lower fuel costs, due to better energy efficiency, could result in a tangible benefit to homebuyers. By creating a working calculator using limited property and household information, it found that this could provide home buyers and their mortgage providers with more reliable assessments of the real running costs of homes, and therefore the affordability of specific mortgage offers. The project found that the fuel bill savings in a home with an EPC two bands higher than an equivalent dwelling could support additional mortgage finance of around £4,000. While not arriving at a 'one-size-fits-all' solution, the project concluded that the benefit of this knowledge being made available at the right point in the mortgage process might have a behavioural impact and influence homebuyers' perception of value. It could therefore act as a 'nudge' to consumers and, in the longer term, a factor in lender affordability calculations.

Following the publication of the **LENDERS report**, Barclays has developed a 'green home mortgage' offer at a discounted rate for properties with an A or B EPC rating (see 5.3).

5.3 Barclays' green home mortgage

In 2018, **Barclays**, a major bank operating in the UK, launched its green home mortgage product. Under this, any purchaser buying a new home within an energy efficiency band A or B from one of their partner housebuilders is eligible to apply for a fixed rate mortgage on preferential terms. While the product is only for new builds, it provides a further incentive to purchasers that, in areas where new builds are in good supply, might impact the value of older units.

5.4 The energy efficient mortgages action plan (EeMAP)

EeMAP is an EU Horizon 2020-funded project through which the EeMAP consortium are creating a framework for energy efficient mortgages in Europe. These mortgage products aim to incentivise borrowers – through reduced interest rates and increased loan amounts – to improve the energy efficiency of their buildings or to acquire highly energy efficient properties. Working with banks, investors, policy-makers and financial regulators, the consortium is developing and piloting ways of achieving energy efficient mortgage products that should reduce risks for the lender. The mechanism envisaged is that appropriate refurbishment work, which includes energy efficiency measures, should enhance capital value and decrease default risk. This work is still ongoing.

RICS is a consortium partner and has developed a due diligence **checklist** for valuers. The checklist enables valuers to reflect upon the building characteristics that impact on energy efficiency and form a judgement as to whether such characteristics present a risk reduction or increase the security of the asset for the loan. The checklist is based on an RAG (red, amber, green) assessment and is undertaken by the valuer as an intended part of their reporting.

By implication, the checklist will:

1. engender a greater awareness of energy matters in valuers and encourage participation in upskilling and
2. build awareness of energy efficiency risk among the banks' risk assessment departments and improve their skills in relation to interpreting valuation and EPC reports. Banks will also learn how to challenge valuers in the case of incomplete valuation reports.

The EeMAP project therefore intends a more far-reaching approach to supporting private sector financial support for renovating residential stock in line with EU climate change ambitions.

6 Conclusions

6.1 Barriers still exist

Some barriers to upgrading residential property to improve energy efficiency still exist. Collectively, the barriers reduce the pace at which improvements are carried out and add complexity in terms of understanding how far the market will translate energy efficiency into increased value.

The barriers can be summarised as follows:

- **There is no clear business case:** frequently, the costs of undertaking energy efficiency improvements are not economic in terms of the financial return on investment. They may be, but the payback periods can be long and uncertain. To pin policies on a cost-saving/value-add within the residential sector may be inappropriate. The business case that is emerging is more strongly linked to comfort, well-being and, for investors, a reduced risk of 'brown discounting', as well as the impact of future regulatory changes.
- **The split incentive:** the split incentive in terms of a landlord's capital spend and a tenant's cost-saving is well-rehearsed and understood. Over time, this will weaken as rents begin to reflect a demand for higher-specified and more energy efficient homes. The future cost of energy is likely to impact the speed at which the split incentive issue decreases in importance.
- **A technological conundrum:** common improvements undertaken to achieve higher energy efficiency have not always proved successful. Poor workmanship, technologies that may not perform to design expectations or become quickly obsolete, or disruption during installation may act as barriers to implementation, and the improvements may not have a resulting positive impact on market values. Conversely, some installations (such as good-quality replacement glazing) will result in a positive value impact.
- **EPCs do not provide useful decision-making information:** for a number of reasons – including a lack of trust in their accuracy, difficulty for occupiers/purchasers to translate the EPC ratings/grades into consumption and likely bills – first-generation EPCs have not been shown to be effective at providing a trustworthy measure that valuers perceive as influential on purchaser choices. Furthermore, as EPCs remain valid for ten years, alterations to the building and the obsolescence of some services may affect their accuracy at the date of valuation.
- **Data is still an issue:** evidence is growing that energy efficiency is becoming a much stronger part of the 'value landscape'; however, it is complex and dynamic. Among the challenges to more explicit consideration of energy within valuation due diligence, judgement and reporting is a continued lack of fine-grained, reliable data, in terms of energy source/supply, efficiency and estimated consumption.
- **Incentives can distort markets:** the presence and promotion of subsidised schemes – for example, for installation of photovoltaic panels or wall/roof insulation – have proved successful in some cases, but not always. They have led to a rise in expectations in standards; however, if such schemes are short-lived, they will not have a significant impact on the overall quality of properties traded in the market and so any increase in value may not be reflected in the overall market's value. This varies from scheme to scheme.

6.2 The attitudes and actions of lenders are increasingly important

A key change is the increasing reliance on mortgage lending for many homeowners. Fewer properties are owned outright, so lender attitudes to energy efficiency in financial decision-making is important. Banks are asking valuers questions about the energy efficiency of stock against which they lend (Michl et al, 2016). Three initiatives (see sections 5.2, 5.3 and 5.4) point to a property's energy efficiency being linked to the ability to maintain payments by the borrower and to preferential lending. If such projects do lead to sustained changes in lending practice, this will effectively lower the cost of running energy efficient properties over and above the energy cost-savings and lead to further differentiation of capital values between stock that is easier to finance and that which is not. It sends a clear signal to the market about the importance of energy.

6.3 Fiscal incentives and grants

Within the valuation process, valuers need to assess the extent to which any fiscal incentives or grants have influenced the market conditions and resultant values. One of the issues is that such grants and incentives tend to be short-lived (for example, the UK government's green deal was passed over to a private scheme, having not made market impact) or vary in amount, sometimes quite suddenly (for example, the UK's **feed-in tariff**). Others, such as the renewable heat incentive and Germany's **KfW energy efficiency programme**, have shown greater stability over time. If schemes are long-lived, they may impact buyer choice or influence retrofit decisions.

6.4 Regulation is a key driver

Regulation has an impact on the quality of new build. Over time, in most member states, provision for energy efficiency standards within new builds has been gradually introduced and enhanced, although there is a wide variation in mandated energy standards. Energy standards also impact on the standard of refurbishment. In turn, this will change the nature of the overall stock and its condition, albeit slowly (Kelly, 2009). Specific requirements aimed at awareness-raising among market players has primarily been in the form of EPCs, but these have not resulted in the anticipated market transformation and are, in themselves, unlikely to be instrumental in delivering the changes called for by the IPCC (2018). It is only when mandatory measures require investment in improvements that this is likely to happen, and then only if accompanied by an effective enforcement regime. Under regulation, the impact on value is more likely to be at risk for failure to comply than a reward for compliance.

Although there is a trend to increase regulations, the quality of construction and confirmation of compliance can mean that buildings do not necessarily perform to the levels predicted. For example, Pan and Garmston (2012) in their study of 376 UK houses, found that compliance 'was poor, at a level of 35 per cent; accompanied by 43 per cent "grey compliance" and 21 per cent "grey non-compliance", due to insufficient evidence of achieving required carbon emissions reductions'. They concluded that their results were of serious concern.

While the value implication of buildings that fall below mandated standards will depend on market conditions, it is likely that regulation will tighten either to the point where investment is mandated, such as in the UK (see section 2.2), or become economic simply to prevent value depreciation. For investor-owners, the risks of holding non-compliant housing stock, or that which is not 'future-proofed', is likely to lead to higher discount rates being applied to cash flow analysis and reduced exit values.

6.5 The case for retrofitting does not rest on financial criteria alone, but in some cases grant aid is required

The key challenge to meeting climate change targets lies in the need to retrofit the 97 per cent of existing stock that is energy inefficient (BPIE, 2017). While the link between 'green premiums', 'brown discounts' and market value and rent is strengthening, some research studies demonstrate that to pin a case for retrofitting on financial returns may be misguided, as capital improvement costs may outweigh the increase in value. Examining the motivations for improvements shows that other arguments may be more compelling. Within owner-occupied stock, visible appearance, comfort, noise reduction and added security are important, while to social landlords, corporate responsibility, health and well-being, tenant retention and reductions in defaults are important for creating a business case.

Finance matters. Some simple energy measures, such as draught exclusion, are quick and cheap, but payback periods for significant retrofitting projects can be long (unless government subsidies exist). Until recently, the need to support retrofits has been the remit of governments. However, private sector lending is responding with preferential terms, where the costs borne by occupiers are likely to be less due to energy efficiency. Such lending is based on not just added value but also a reduced credit risk.

6.6 'Brown discounts' and potentially stranded assets are an emerging consequence

Mandatory approaches, such as MEES in building regulations and codes and minimum standards in EPCs, are increasing over time. For example, the UK government frequently revises Part L of the Building Regulations, which applies to new builds and alterations. The EU Directive 2018/844/EU, further amending the 2010 amendment to the *Energy Performance of Buildings Directive* (EPBD) 2002/91/EC and in force from July 2018, includes targeted amendments to accelerate cost-effective retrofits of existing buildings, with the goal of a decarbonised EU building stock by 2050. Member states have until 10 March 2020 to adopt its provisions into national law.

Though retrofit rates are slow, they will reach a tipping point in various locations and for various property types where 'brown discounts' will appear. Where supply is good and demand is low, some assets could become stranded.

6.7 Overall

The evidence points to energy efficiency beginning to impact value, though this is at a very small scale compared with traditional value drivers. The strongest statistical evidence comes from large-scale hedonic analyses, and practice-based research provides evidence regarding what is driving the observed changes. These vary depending on the stakeholder group but include regulation, health and well-being and, critically, the changing views of the lender.

Energy is likely to be of increasing importance in future decisions made by occupiers and investors, and this will be reflected in property value. However, much will depend on the approach taken to regulation, the availability of grant aid, the attitudes of lenders and the transparency of the evidence.

Currently, visible retrofits such as double and secondary glazing appear to attract the most uplift in value per euro/pound spent (Artola et al, 2016). For owners and occupiers, payback periods and the total cost of the retrofit measures will influence the amount and extent of

retrofits. Expected length of tenure/ownership, access to funds, prevailing interest rates and knowledge will also affect and vary the take-up rates.

6.8 Recommendations for valuers

In light of the research, this paper recommends that valuers should:

- recognise and be knowledgeable about the potential impact of climate change on the residential building stock and the consequent need for the majority to be upgraded to meet carbon targets
- be aware of the changing market place and the varied motivations to upgrade, together with knowledge of the changing regulatory landscape
- work with clients to improve the quality and quantity of the data collected and analysed, in order that they have a firmer basis on which to undertake future valuations
- recognise that, overall, occupier and investor behaviour and demand is towards more energy efficient assets, which is leading towards the risk of value decline for non-resilient stock
- recognise the implications of the regulatory frameworks that exist and are being introduced, both by the EU and in member states, to impose increasingly higher mandatory energy standards to both new and existing buildings
- where possible (and appropriate), advise clients of the risks presented by properties that are energy inefficient; this may include the risk of such assets becoming 'stranded' in the event of increased regulation or suffering from 'brown discounts' and
- develop a more granular knowledge of services and structures that might influence the cost and feasibility of energy retrofits, and work with other professionals to ensure that appropriate advice is supplied to clients.

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ricsamericas@rics.org

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australasia@rics.org

Greater China (Hong Kong)
ricshk@rics.org

Greater China (Shanghai)
ricschina@rics.org

Japan
ricsjapan@rics.org

South Asia
ricsindia@rics.org

Southeast Asia
sea@rics.org

EMEA

Africa
ricsafrica@rics.org

Europe
ricseurope@rics.org

Ireland
ricsireland@rics.org

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