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Working Paper 7: Desktop review report of international tools and systems relevant to benchmarking low carbon homes



Authors	Clark, M.
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Executive Summary

This report investigates a range of energy efficiency information systems in Europe and the United States. The analysis shows that a number of tools and systems have effectively provided information that allows the property and financial markets to value energy efficient buildings and drives large scale household retrofit activities.

The report identifies key characteristics of an effective information system, covering the type of information provided to households, when this information should be provided, who should provide the information, what form it should take, and what systems are needed to facilitate the process.

Based on this analysis, the report highlights a series of opportunities to enhance the effectiveness of future Australian energy efficiency information systems:

1. Develop a “reduced data” energy efficiency rating for application to existing buildings to provide simple energy efficiency information.
2. Include information that people care about in rating tools and information systems, as identified through ongoing EnergyFit Homes research
3. Maintain a discrete star label for ratings while ensuring that the scale is appropriate for existing buildings
4. Develop renovation advice as a key component of the energy efficiency rating application for existing buildings
5. Incorporate the existing building rating in a point of sale and lease energy efficiency information disclosure program, in partnership with the Liveability Property Features framework
6. Ensure adequate quality assurance that balances rating reliability and consumer protection with cost and ease of access for any future systems
7. Build an integrated program to stimulate large scale retrofit activity in the Australian existing household market, using an effective rating and information system as described above, delivered by engaged industry partners in the property and energy efficiency sectors, and supported by cost effective public/private investment.

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Introduction

Energy efficiency rating and labelling systems for homes have been implemented in many countries since the 1980s (Santamouris 2004, Resnet 2015). Labelling is one of the most widely adopted policy instruments to encourage improved building performance, as it complements regulatory standards by incentivising efforts beyond minimum compliance and common practice (Lee and Yik 2004). House ratings and labels are now used in many jurisdictions to set minimum performance standards, for loan incentives, and as mandatory components of house sale transactions.

This report analyses a number of prominent energy efficiency information systems and rating tools from Europe and the United States as the most mature markets for energy efficiency information systems, and attempts to identify the characteristics of systems that are influential in driving improved energy efficiency. Based on these findings, the report suggests key lessons for future energy efficiency information tools and systems in Australia. This analysis builds on the existing literature by consolidating and comparing findings from a broad range of reviews and systems, and specifically applying the lessons to a contemporary Australian context.

This report supplements the October 2014 report “Information Systems for Household Energy Efficiency” that reviewed energy efficiency information tools and systems for Australian homes. It is part of a broader research project for the Cooperative Research Centre for Low Carbon Living which is exploring the key information and behavioural factors as well as market structures that influence the purchase and leasing of new and existing homes with better health, comfort and sustainability benefits and lower running costs. To identify these influencing factors, the research project asks what information do people need, at what point, from what source, in what form, and what is required to deliver to make this happen?

Table 1 Key research questions for the EnergyFit Homes project

Question	Sub questions
What information do people need?	What issues influence people’s decisions to invest in energy efficiency feature for renovations/homes?
At what point?	What are the moments that matter?
From what source?	Who or what are the key influencers
In what form?	What message framing? What details? What mediums?
What is required to deliver make this happen?	What Governance arrangements? What market structures? What funding framework? What tools and technology? What is the business case to achieve this?

Methodology

This report is a desktop analysis of a number of prominent energy efficiency rating tools and information systems from Europe and the United States. The information included in the analysis includes reports and evaluations published by system administrators and independent researchers, identified through internet and research database searches.

The report focuses on Europe and the United States due to the maturity of these markets for energy efficiency ratings. Energy efficiency rating schemes were first introduced in the early 1980s in the United States (Resnet 2015), the UK (Murphy et al 2011), and Sweden (Santamouris 2004), with energy efficiency labelling of homes commencing in the 1990s in both Europe and the United States (Santamouris 2004).

It is not an exhaustive review of every system available - in the United States alone there are hundreds of energy rating and simulation tools (Mills 2002). Rather, the report focuses on a selection of energy information tools that are currently in wide use, provide information directly to households, and are supported by a reasonable amount of publicly accessible reviews and reporting.

The report seeks to identify whether the tools are effective in driving improved energy efficiency, and the characteristics that are particularly important in delivering this effectiveness.

Published evaluations and reports provide data to summarise the effectiveness of rating tools and information systems in section 4. Systems and tools are categorised based on scope to allow for comparison.

Data used includes effectiveness evaluations detailing outcome measures (delivered energy savings), reviews of output measures such as reported adoption rates and retrofit activities, peer reviewed articles considering the effectiveness of single or multiple information systems, and annual reports by system administrators. Note that the report was not able to compare energy efficiency systems on the basis of their ability to deliver measured energy savings, as most evaluations of home energy efficiency programs use calculated rather than measured results (Rosenow and Galvin 2012). The review of effectiveness is primarily based showing data on take-up rates and retrofit activity where available to give a relative indication of the more effective systems.

The report then analyses how the effectiveness of the different tools and systems can help to answer the research questions outlined in Table 1, based on differences between the systems and published reviews and recommendations for improved system performance where available. In particular, the report seeks to identify the particular characteristics of effective systems that inform our key research questions.

1 Tools and systems included in the review

This paper reviews a range of energy efficiency ratings and information systems, listed in Table 2 below. The reviewed systems were chosen to cover a range of approaches to energy efficiency labelling and information driven building upgrades. Tools and systems in broad use and with documented results were preferred.

Fifteen different systems are reviewed, including several for which the approach varies between participants.

Table 2 List of energy efficiency systems in this review

Name of system or group of similar systems	Location	Link
KfW-Effizienzhaus and Energy Efficient Refurbishment (applies to new and existing buildings)	Germany	www.kfw.de/inlandsfoerderung/Privatpersonen/Bestandsimmobilie/Energieeffizient-Sanieren/Das-KfW-Effizienzhaus/
Green Deal	UK	www.gov.uk/green-deal-energy-saving-measures/overview
Minergie (applies to new and existing buildings)	Switzerland	www.minergie.ch
Energy Star Home	US	www.energystar.gov
Leadership in Energy & Environmental Design (LEED)	US	www.usgbc.org/leed
National Green Building Standard	US	www.homeinnovation.com/services/certification/green_homes/
Austin Energy Green Building	Austin TX	austinenergy.com/wps/portal/aegb/home
Home Performance with Energy Star	US	www.energystar.gov
Home Energy Score	US	www.homeenergyscore.gov
Heat Bleed	US / UK	www.energyresponseforce.com
Energy Performance Certificates (note – approach varies between member states)	EU	www.epcregister.com (UK)
Energy Star Portfolio Manager, including mandatory benchmarking laws	US	www.energystar.gov
Energy Conservation Audit and Disclosure (ECAD)	Austin, TX	www.austinenergy.com/about%20us/environmental%20initiatives/ordinance/index.htm
Utility bill disclosure	Hawaii, Alaska, New York, Chicago, Montgomery MD	retrofit.cityofchicago.org (Chicago)
Disclosure of energy features	South Dakota, Kansas, Maine	www.maine.gov/mpuc/online/forms/EnergyEfficiencyDisclosure.html

To facilitate the analysis this review categorises systems by their temporal focus, that is whether they are descriptive or change oriented, and by their scope, whether they are aimed at new or occupied (existing) buildings. These categories are informed by the factors considered by Ness et al (2006). The three resulting categories are described below.

Energy efficiency information systems and tools for existing buildings, focussed on identifying retrofit opportunities (change oriented). These systems use energy calculation models as a means to identify upgrades. Implementing the upgrades may form part of an overall program.

Energy efficiency information systems and tools for existing buildings, with a primary focus on indicating energy performance (descriptive). The intent of these systems is to provide an absolute or comparative indicator of the energy efficiency of the building to allow for improved consumer decision-making, for example to compare buildings at the point of sale, or to improve year on year performance. Some of these systems also include retrofit opportunities as a secondary piece of information.

Energy efficiency information systems and tools for new buildings. These systems all focus on certifying buildings that achieve an energy performance that is better than minimum compliance, and are hence are change-oriented.

Table 3 Grouping of information systems for analysis

Scope	Temporal focus	Tools and systems included in category
Existing buildings	Change-oriented	Europe: KfW-Effizienzhaus (for refurbishments), Minergie (for refurbishments), the Green Deal US: Home Performance with Energy Star
Existing buildings	Descriptive	Europe: Energy Performance Certificates, Heatbleed US: Home Energy Score, Energy Star Portfolio Manager, mandatory disclosure schemes in various locations
New buildings	Change-oriented	Europe: KfW-Effizienzhaus (for new buildings), Minergie (for new buildings) US: Energy Star Homes, LEED, National Green Building Standard, Austin Energy Green Building

A number of well-regarded regional green building rating and labelling systems were considered but not included in the review due to low adoption or difficulty in sourcing evaluation data, including Earthcraft, a green building rating in south-eastern USA, Built Green, a new building standard in Washington State, GreenPoint Rated, which labels houses in California, and Earth Advantage, primarily based in Oregon. These systems are broad “green” rating tools that operate using a checklist approach, and include credits for energy efficiency based on performance beyond minimum standards. They operate similarly to the Austin Energy Green Building, National Green Building Standard and LEED systems that are included in the review.

2 Reported results from information systems

This section outlines the different systems by category, and summarises published information on their effective delivery. Reported outcomes are typically limited to the number of participants in the scheme, although some programs also report on estimated energy savings delivered from retrofit activities (such as in the KfW program, Germany).

2.1 Change oriented systems for existing buildings

This paper reviews five change-oriented systems for existing buildings, namely Minergie (Switzerland), KfW-Effizienzhaus (Germany), Green Deal (US), Home Performance with Energy Star (US) and the National Green Building Standard (US). These systems all focus on encouraging the actual installation of energy efficiency opportunities in existing buildings. Three of the systems (Minergie, KfW-Effizienzhaus and the National Green Building Standard) also have labels for efficient new buildings.

Each of the five programs uses an energy label as support for a retrofit program. However, the standards of labelling vary between them as shown below.

Table 4 Minimum standards to qualify for certification, existing building retrofit systems (source: compiled from ¹ Huber 2012, KfW 2015a, Luzier 2014)

Program	Minimum energy requirement to qualify
Minergie	25% less energy than building code for new buildings
KfW-Effizienzhaus	15% more energy than building code for new buildings to qualify for finance
National Green Building Standard	15% reduction from original energy use before retrofit
Green Deal, Home Performance with Energy Star	No minimum requirement

As shown above, the Minergie standard is the most stringent of the reviewed systems, requiring existing buildings to significantly exceed the minimum building code to qualify for certification. The KfW-Effizienzhaus funding starts for existing buildings that improve energy efficiency to a lower standard than that required for new construction, but the terms of finance improve with improved performance levels. A KfW-Effizienzhaus 115 building (15% more energy use than code) qualifies for a 2.5% reduction in their loan repayments, while a KfW-Effizienzhaus 55 (55% of the code compliant energy use) qualifies for a 12.5% reduction (Rosenow et al 2012).

Rather than a standard based on code compliance, the National Green Building Standard requires that the building reduce the energy use of the building by 15%. The Green Deal and Home Performance with Energy Star programs do not have any minimum entry requirements. Financial support is available under these programs for a range of retrofit activities, and qualification depends on the assessor identifying them as opportunities for that house through the assessment process.

For more information on each of these programs, refer to the appendix at section 8.

Table 5 summarises the published results for change oriented systems for existing buildings, based on the number of participating households and claimed energy savings (where available).

Table 5 Reported results for energy efficiency systems focussed on retrofits to existing buildings (source: compiled from Diefenback et al 2014, Schroder et al 2011, Jacobsohn et al 2014, UK Department of Energy and Climate Change 2015, www.minergie.ch, Home Innovation Research Labs 2015a)

Program	Reporting range	Number of participating homes	Claimed energy savings
KfW-Effizienzhaus – refurbishments	2013	276,000 households refurbished in 2013	1,715 GWh per year estimated

(Germany)			energy savings
Home Performance with Energy Star (US)	2013	80,000+ homes in 2013.	Estimated energy savings of 530 GWh ¹ . Average savings of 6.7 MWh per home.
Green Deal (UK)	2013-end December 2014	445,804 assessments in total. Taken action: 8,343 homes taken up Green Deal finance 41,023 homes installed measures with cashback or vouchers	Not reported
Minergie (refurbishments) (Switz.)	1998-2015	2,203 achieved Minergie between 1998-2015 123 achieved Minergie-A (2009-2015) 14 achieved Minergie-P (2013-2015)	Not reported
NGBS (remodelled homes) (US)	2013	38 remodelled homes certified under NGBS in 2013	Not reported

The KfW-Effizienzhaus, Home Performance with Energy Star and Green Deal assessments each led to a significant number of energy efficiency retrofits in most recently reported annual data. Of the three, the Green Deal appears to be the least effective in converting assessments into retrofits at a large scale. However, a UK Government survey suggests that a much larger number of participants are installing energy efficiency opportunities identified in the Green Deal than reported. The survey of Green Deal assessed households found that 62% of households had made an energy efficiency installation following a Green Deal assessment, and a further 14% were likely to do so (UK Department of Energy and Climate Change 2014a).

It appears from the reported participation data that that the stringency of labels has an impact on their effectiveness in driving energy efficiency refurbishments. The Green Deal and Home Performance with Energy Star do not set minimum standards for participants, and the minimum standard for the KfW-Effizienzhaus label is relatively low compared with the more stringent Minergie label. The most stringent label, Minergie, has a relatively low adoption rate, and the adoption rate decreases with increasing stringency – Minergie-P and Minergie-A are progressively more difficult compliance levels as noted in section 8.1.

However stringency is not the only barrier to the effectiveness of these programs. The overall complexity of compliance may also be a factor. The least adopted program for building retrofits of those reviewed is the National Green Building Standard for remodelled homes. While this standard is not particularly stringent, requiring an improvement from the baseline, it does require extensive documentation and actions for broader sustainability measures including water efficiency, indoor environment, resource efficiency and site location (Home Innovation Research Labs 2015c). The complexity of this compliance process and broad scope of required actions appears to limit adoption compared to the Home Performance with Energy Star program that operates in the same market.

2.2 Change oriented systems for new homes

Six systems focused on labelling new homes that meet or exceed voluntary energy efficiency standards are included in the review, including KfW-Effizienzhaus, Minergie, Energy Star Homes, the National Green Building Standard, LEED, and Austin Energy Green Building. Several of these systems also apply to the refurbishment of existing homes, although different standards apply.

Each of these systems requires proof of beyond compliance with minimum energy codes to qualify for certification. The standards for each system are outlined in Table 6.

¹ converted from quoted figures of 1.8 trillion BTU total and 28 MMBTU per home

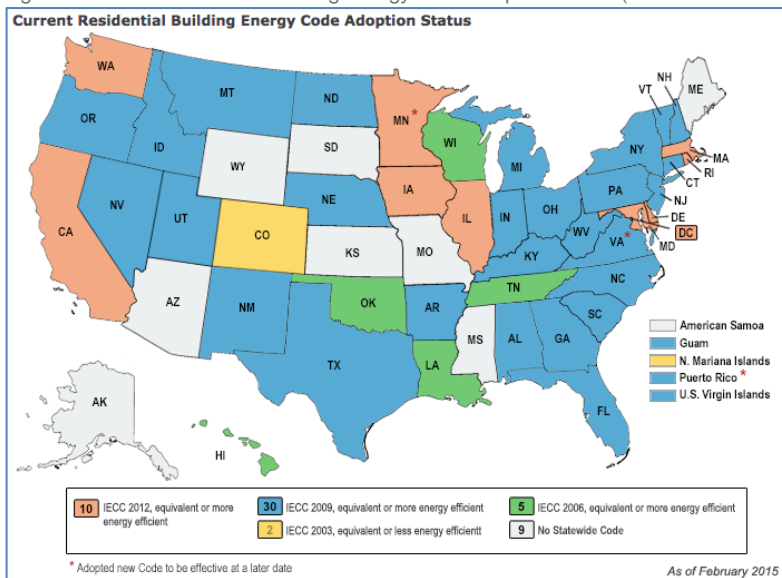
Table 6 Minimum standards to qualify for certification, existing building retrofit systems (source: compiled from KfW 2015b, Huber 2012, Energy Star 2015, US Green Building Council 2013, Home Innovation Research Labs 2015, Reed 2014, Galloway and Umpruss 2014)

Program	Minimum energy requirement to qualify
KfW-Effizienzhaus	30% less energy than building code
Minergie	25% less energy than building code
Austin Energy Green Building	International Energy Conservation Code (IECC) 2012 code compliance. IECC 2012 is approximately 15% less energy than IECC 2009.
Energy Star Home	15-20% less energy than IECC 2009
LEED	15% less energy than IECC 2009
National Green Building Standard	15% less energy than IECC 2009; or is an Energy Star Home

The KfW-Effizienzhaus and Minergie standards require a significant increase from minimum local code compliance to achieve recognition.

Varying local codes are likely to impact on the viability of the US labelling schemes as indicators of high energy efficiency. Different building standards are adopted across the United States as shown in Figure 1 below

Figure 1 Current residential building energy code adoption status (United States Department of Energy 2015)



The increasing stringency of building standards means a shrinking gap between certified and non-certified new homes. Several states require IECC2012 as minimum code compliance for new buildings, which is equivalent to the minimum stringency of each of the US systems listed above.

Of the four US systems, only Energy Star does not also include other sustainability measures – each of the other ratings require buildings to also take action across water efficiency and other measures.

For more information on each of these programs, refer to the appendix at section 8.

Table 7 shows results for reviewed systems in this category.

Table 7 Reported results for programs for newly constructed homes (compiled from Diefenback et al 2014, United States Environmental Protection Authority 2015b, www.minergie.ch, Salvi and Syz 2011, US Green Building Council 2015, Home Innovation Research Labs 2015, Shewmake and Viscusi 2014)

Program	Reporting range	Number of participating homes	Claimed energy savings
KfW-Effizienzhaus – new	2013	129,000 homes labelled in 2013 (54% of all)	336 GWh per year

builds (Germany)		approvals)	(modelled estimate)
Energy Star Homes (US)	2013	77,487 homes certified in 2013 (13% of all new houses)	133 GWh per year (modelled estimate)
Minergie (new build) (Switz.)	1998-2014	23,190 labeled homes in total. 15 percent of new houses in 2008	Not reported
LEED for Homes (International, primarily US)	2013	3,884 LEED for Homes projects were certified in the US in 2013 (~0.7% of all new homes). 132 homes were certified in other countries.	Not reported
National Green Building Standard (US)	2013	1,822 new homes certified in 2013 (~0.3% of all new homes)	Not reported
Austin Energy Green Building (Austin, Texas)	1991-2014	9,943 homes between 1991-2014 (unknown proportion)	Not reported

This table shows that KfW-Effizienzhaus, Energy Star Homes and Minergie have a significant market share, with between 13 and 54% of all new homes being built to these standards. This suggests an effective market for delivering efficient new homes exists in Germany, Switzerland and the United States – particularly in Germany where more than half of new homes are constructed to KfW-Effizienzhaus standards. Note that the impact of increased building code stringency appears to have significantly impacted on the market share of Energy Smart Homes. In 2011 (two years prior to these figures) 25% of new homes were certified as Energy Smart Homes (Energy Star 2012).

The claimed savings for these programs are estimates by the program administrators based on the modelled energy use of compliant buildings compared to an industry standard baseline. Measured energy savings from labelled buildings are not systematically measured or reported for any of these systems, although several independent studies have reported measured energy savings of between 4 and 12% for Energy Star Home certified buildings in particular markets (Hassel et al 2009, Kulkarni 2010, RLW Analytics 2007, Martin 2002, Coulter et al 2005, Pigg 2002).

While the evidence of measured energy savings are scarce, the results above show that the market can deliver retrofit activity and improved new building performance. In particular, the KfW-Effizienzhaus system has been particularly effective at driving deep retrofits and beyond compliance new building performance for a significant proportion of the German housing market.

2.3 Reported results for descriptive systems for existing buildings

The review has also considered a range of descriptive systems for existing buildings, including Energy Performance Certificates, Home Energy Score, Heatbleed, and a range of mandatory disclosure schemes in the United States, including the Energy Star Portfolio Manager. These measures provide an indicator of the current energy efficiency performance of occupied homes.

The information conveyed differs between systems. Energy Performance Certificates, the Home Energy Score and Heatbleed use a calculator to estimate the energy consumption of the home. Based on the estimated consumption, the Energy Performance Certificates rank the relative efficiency of the home compared to the market, communicated on an A-G scale (matching the energy rating label for appliances in the EU). The Home Energy Score similarly gives a ranking of the relative efficiency of the home, on a 1-10 star scale. Heatbleed does not give a score, but gives an estimated energy bill for the property. Each of the systems also shows opportunities to improve the energy efficiency of the home. Heatbleed summarises the total energy bill reduction potential from cost effective opportunities as a headline “heatbleed” cost to the householder.

Government mandates the use of several of these systems. Every member state in the European Union has implemented Energy Performance Certificates, and a certificate must be attached to homes when sold.

Some jurisdictions in the United States also require a disclosure of energy performance. These disclosure programs fall into four categories – disclosures of an energy audit at point of sale or lease, disclosures of energy features at point of sale or lease, disclosure of past energy bills at point of sale or lease, and annual disclosure of energy bill benchmarking.

Table 8 Summary of mandatory energy efficiency disclosure programs, United States

Type of disclosure	Location	Summary
Energy audit	Austin, Texas	Home owners provide a home audit report to potential homebuyers.

		For multifamily buildings, audit results must be posted for tenants to see, and buildings that use \geq 150% of the average must reduce their usage by 20% within 18 months.
Energy features	South Dakota, Kansas	New homes only must disclose checklist of energy efficiency features present.
Energy features	Maine	Rental properties only – landlord makes statement of compliance with voluntary minimum standards for range of features
Utility bills	Hawaii, Alaska, Montgomery (MD)	Home owners must include a summary of energy consumption in a statement provided to the buyer. The statement also includes other features about the property.
Utility bills	Chicago	Home owners must disclose actual energy use (provided by utility) to buyer.
Utility bills	New York state	Home owners must provide heating energy bills to potential buyers on request.
Energy benchmarking	New York city, Washington DC, Chicago, Boston (from mid 2015)	Large multifamily buildings must use the Energy Star Portfolio Manager to benchmark the energy performance of their buildings, and annually report results to the city.

For more information on each of these programs, refer to the appendix at section 8.

Table 9 summarises the reported results for the mandatory energy efficiency rating programs that measure and communicate the performance of buildings.

Table 9 Reported results for mandatory disclosure systems (compiled from European Commission DG Energy 2013, Gynther and Gerdes 2014, Seattle Office of Sustainability and Environment 2014, City of New York 2014, Washington DC 2015, Whitson 2014)

Program	Reporting range	Rate of compliance	Claimed energy savings
Energy Performance Certificates (Netherlands)	2000-2012	Varies from 10% (Cyprus) to 100% (Portugal, France)	Improved ratings – 70% of market had E, F or G rating in 2000, 36% had same rating in 2012 (Netherlands)
Seattle benchmarking	2012	96%	Not reported
New York City benchmarking	2013	84%	Not reported
Washington DC benchmarking	2010-2014	Over 70%	Average savings of 9% in energy use for tracked buildings
Austin Energy Conservation Audit Disclosure	2014	52% homes 80% multifamily	Not reported
Chicago	July 2013-Feb 2014	10%	Not reported

Compliance with mandatory disclosure laws varies between jurisdictions. As shown above, within the European Union compliance with the Energy Performance Certificates laws ranges from 10% to 100% between countries. A report on EPCs by the European Commission DG Energy (2013) suggests that compliance is improving over time, and with improved systems to monitor and enforce compliance within member states.

The mandatory energy benchmarking schemes in place in New York, Chicago and Washington are well subscribed with compliance between 70 and 96%. These programs are actively monitored by each municipal government, and use a relatively simple compliance measure in the Energy Star Portfolio Manager.

Compliance with the relatively detailed Austin Energy Conservation Audit Disclosure law is comparatively moderate. The City monitors compliance with the disclosure requirement, but while penalties apply for non-compliance, they do not actively issue fines (Whitson 2014). Compliance with the disclosure requirement was moderate.

With the exception of Chicago, who are able to track implementation through online real estate listing, the jurisdictions that have implemented a requirement to disclose energy utility information at the point of sale do not appear collect or

publish compliance information or report on program outcomes. The regulatory authorities implementing these systems tend to rely on complaints based enforcement through the courts or consumer protection authorities, rather than actively enforcing them. For example, The South Dakota Government notes that an honesty system applies to enforcement, with builders expected to “honestly answer questions asked of them to the best of their ability.” (South Dakota Government 2009). In New York state prospective buyers and tenants that are not able to obtain heating bills for a property can complain to the Consumer Protection Board (New York’s Utility Project 2013).

Benchmarking and disclosure schemes such as those listed above seek to transform the market through information to influence decision-making (Arcipowska et al 2014). To gauge program impacts, a number of reports measure the energy savings impact of point of sale disclosure by the improving standard of reported ratings. Gynther and Gerdes (2014) report for example a significant shift in household ratings between 2000 and 2012 in the Netherlands. In 2000, 70% of dwellings carried a low energy efficiency rating of E or lower. By 2012, only 36% of dwellings had these low ratings, showing a remarkable improvement in average energy performance. Similarly, the same study shows that between 2009 and 2011 the proportion of new buildings achieving an A rating in Finland improved from 21% to 49%.

An alternative approach to measuring the impact of benchmarking programs is to track changes in the reported energy performance for individual buildings as they comply with the scheme. The Washington DC benchmarking scheme, for example, has reported a 9% improvement in average savings for buildings that have benchmarked their performance between 2010 and 2012 (Washington DC 2015).

3 Drivers of effective information systems

This section considers the key characteristics of effective energy efficiency information systems based on the reported results for these systems outlined in section 4, and from consolidated research and other reviews identified through the desktop analysis.

To understand the drivers of effective information systems, this analysis uses the elements of the EnergyFit research question as outlined in Table 1 as a framework. The report seeks to identify aspects of information systems that inform the information that people need, the time in which it is most useful, who is best placed to deliver it, the form the information should take, and the structures that are needed to facilitate this.

The information that people need

Information consistent with new building standards

Reviewing the impact of renovation projects across Europe, Beillan et al (2011) notes that energy performance labels or certification that go beyond regulatory requirements have a positive impact on the energy-efficient refurbishment market. With these systems, building professionals have an increased awareness of the overall approach to energy efficiency, and are able to provide better advice during a renovation process of opportunities to improve beyond minimum compliance. Using a consistent approach for point of sale labeling and minimum standards means that advisors can also point to evidence of improved house values (as noted in section 5.2.1) to encourage deeper renovations.

The voluntary Minergie label in Switzerland shows the benefit of households that are able to demonstrate deep retrofits. 15% of new homes constructed in Switzerland in 2008 met the Minergie standard (Salvi and Syz 2011). This suggests that the industry has developed a very broad capacity to deliver deeply energy efficient buildings, making them a norm for new buildings. This flows into the renovation market as well, and thousands of homes across Switzerland have been refurbished over the last ten years to meet this stringent standard.

Evidence from Germany confirms that labelling beyond-compliance renovations improves the ability of the market to deliver energy efficiency. Power and Zulauf (2012) note that over time the German construction industry has acquired “great expertise” both in identifying and implementing energy efficiency opportunities.

Wells, Palmer and Gerarden (2013) provide further evidence of the benefit of linking new building standards with energy labelling. Researching the value premium associated with certified energy efficient homes, they found that while older certified homes attracted a significant value premium, there was no such premium on newly constructed homes. The authors determined that this was largely due to increasingly stringent local minimum standards, and therefore a limited point of difference between newer labelled and unlabelled homes. Linking minimum standards and building labelling allows policymakers and program managers to better monitor the impact of both the standards and building labels, and increase stringency accordingly to maintain the value of beyond compliance labels.

Energy efficiency experts also benefit from a consistent approach between new and existing buildings with fewer systems to learn and communicate to customers.

Information that links to issues people care about

For most homeowners, energy efficiency is a relatively low priority. When buying a new home, for example, Laine (2011) found that homebuyers were concerned about location, cost and size of homes, with only 14% of buyers considering energy efficiency as important. The IDEAL-EPBD (2011) study into the effectiveness of Energy Performance Certificates suggests that energy efficiency information would be more attractive to potential house buyers if it linked with their crucial decision-influencing factors, such as the condition of the dwelling, the cost of renovations to improve efficiency, and where to find expert advice. The researchers recommended that Energy Performance Certificates provide information on the cost and benefit of possible improvement measures, including comfort and aesthetic considerations, and include information that helps people find experts that can help them take action on recommendations.

Owner-occupants that have considered energy efficiency in house purchases or during renovations tend to do so because of a concern about running costs and building comfort (Ameke 2011, Laine 2011, Beillan et al 2011), while landlords consider energy efficiency will increase property value and make the building easier to rent (Beillan et al 2011).

Table 10 The importance of various factors for energy efficiency measures in renovation (Beillan et al 2011)

	(I) detached houses	(II) private landlords	(III) buildings in co-ownership
A. Points support for energy issues	(+++) lower bills (+++) comfortable temperature/quality of life inside the home (++) environmental dimension (awareness of the environmental benefit or symbolic value) (+/-) higher property values	(+++) higher property values (+++) easier to rent (lower bills, more comfort) (++) environmental benefit	(+/-) lower bills (+/-) comfortable temperature/basic comfort (+/-) environmental benefit (slight difference depending on the country: these three factors' influence is weak in Spain and France, medium in Germany)
B. Other factors that influenced the consideration of energy aspects	(+) financial support (+/-) local dynamics/ technical support	(+++) financial support (++) local dynamics/ technical support	(+++) financial support (+++) local dynamics/ technical support
C. Stakeholders who influenced the decision	Architect Energy consulting bodies (slight difference depending on the country: these stakeholders' influence is strong in Spain and medium in the other countries)	Architect Energy consulting bodies	Architect Energy consulting bodies "intermediate" stakeholder from the community Insulation manufacturer

Colour key:

- Little influence (of A, B or C) in the sector considered (I, II or III)
- Strong influence (of A, B or C) in the sector considered (I, II or III)
- Strong influence (of A, B or C) in the sector considered (I, II or III)

Meaning of the (+++), etc.:

(+++)	↑	a very important factor
(+/-)		a factor with little influence

However, existing energy efficiency information may not adequately communicate these benefits of more energy efficient homes. Ameke (2011) notes that German home buyers considered EPC as the least useful of six potential sources of information about building running costs, behind energy bills, their own visit to the building, information directly from the selling party, external professional advice and advice from friends. A survey of 2000 households in the UK (Laine 2011) found that Energy Performance Certificates only influenced 18% of respondents, and found strong consumer support for energy efficiency information that shows the potential energy bill of a property when they are looking for homes to purchase or lease.

Whole house approach

Independent research into the KfW-Effizienzhaus program suggests that a 'whole house approach' is more effective than component based information at stimulating energy efficiency retrofit activity. While households may adopt measures individually and as part of broader renovations, the whole house approach "enables people to get an overall view of the task ahead and to prioritise and plan for ambitious levels of energy saving." (Power and Zulauf 2012)

The key times to deliver effective information

Energy efficiency labels at the point of sale

Evidence suggests that the market responds positively to information provided at the point of sale and lease. Table 11 summarises the findings of 9 separate quantitative analyses of point of sale disclosure schemes across the world. These studies uniformly show a value premium for buildings with energy efficiency labels, and an increasing premium with increasing energy efficiency. Most analyses use a hedonic regression model which isolates the effect of a single building attribute in house sales and rentals – that is, all things being equal, what is the value difference for a building with a particular energy efficiency rating when compared to a similar building with no rating (or a lower rating).

Table 11 Summary of analyses into value premiums for labelled energy efficient homes

Report	Scheme	Method	Findings
Shewmake and Viscusi 2014	Austin Energy Green Building, Energy Star Homes	Hedonic and quantile regression of 15,668 homes including 1,079 with green label	+5% value for labelled homes. Increased premium for AEGB.
Brounen and Kok 2011	Energy Performance Certificates (Netherlands)	Hedonic regression analysis of 31,993 houses sold in Netherlands in 2008/09	+10% for homes with A grade (compared to D) +5.5% for B +2% for C -0.5% for E -2% for F -5% for G
UK Department of Energy and Climate Change 2013	Energy Performance Certificates (UK)	Hedonic regression modelling of 325,950 houses sold twice or more between 1995 and 2011	+14% for A/B grade (compared to G) +10% for C +8% for D +6% for E/F
Kok and Kahn 2012	Energy Star Homes	Hedonic price model of 1.6 million homes sold in California between 2007 and 2012, 4,321 of which had a green label	Average 9% value premium for green labelled buildings
Bloom et al 2012	Energy Star Homes	Matched pairs analysis of 600 homes sold in Fort Collins Colorado between 1999 and 2005. 300 Energy Star labelled buildings	Energy Star homes originally sold for \$8.66 per square foot more than non-Energy Star homes.
Salvi et al 2008	Minergie	Hedonic regression analysis of 9000 home sales	7% value premium.
Wells, Palmer and Gerarden, 2013	Austin Energy Green Building	Hedonic regression of 59,767 house sales, including 150 AEGB certified	10-26% value premium for certified homes
Wells, Palmer and Gerarden, 2013	Energy Star Homes	Hedonic regression of 171,087 house sales in Portland, Austin and North Carolina, 8% with Energy Star Homes certification	5-18 per cent premium for homes built before 2006. No statistically significant premium for newer homes.
European Commission DG Energy 2013	Energy Performance Certificates (Austria, Belgium, UK, France and Ireland)	Hedonic regression analysis of sales data in subregional markets	2.8 to 8% property value premium for one ranking increase (e.g. E to D) 1.4-4.4% rental premium for same increase.
Kaufman, 2008	Energy Star Homes or LEED	Direct comparison of sales prices of 424 certified homes to 2,113 non-certified homes sold over 9 months in Kings County, Washington	9.1% value premium for certified homes, also sold in 18% less time

These studies suggest that potential homebuyers or renters across different markets are willing to pay a value premium for energy efficient buildings. However some studies such as Shewmake and Viscusi (2014) note that the effect is not uniform, and that value premiums are more prevalent at the upper end of the market. Studies also caution against comparing the results across property markets, noting that a broad range of local factors such as market condition and local energy efficiency policies may influence the results (European Commission DG Energy 2013).

Consumer surveys into the effectiveness of point of sale labelling confirm that the desire for a higher energy efficiency rating is not universal. A number of surveys of homebuyers in different countries suggest that the proportion of buyers that consciously consider energy efficiency or the energy efficiency label during home purchases are in the minority. The

IDEAL-EPBD (2011) survey of households across Europe noted that of the respondents that received an Energy Performance Certificate, one third thought that the certificate was an important factor in decision-making, and less than 10% had actually used the certificate to negotiate a better price on a home they purchased. Surveys of German households found that 78% had used an Energy Performance Certificate at some point when looking for homes, but only 35% viewed the certificate for the homes they were closely considering, suggesting it was a relatively minor consideration for most homebuyers.

Conversely, a survey of real estate agents and solicitors in France found that 66% of agents and 84% of solicitors would “often” or “always” include a good Energy Performance Certificate when selling a property. Respondents also indicated that a good certificate increases the price of a property, and that a bad certificate reduces the property price (European Commission DG Energy 2013). This survey suggests that when the certificate is well embedded in the property market it is commonly used as a bargaining tool in property negotiations, often at the instigation of the real estate agent.

However this affect depends on a timely disclosure. Laine (2011) notes that it is important to define when the “point of sale” actually occurs. Prior to the 2010 recast of the Energy Performance Certificates by the EU, many certificates were provided to the buyer at the point of signing the contract. Laine notes that this reduced the effectiveness of the certificates, as householders were not able to include energy performance as a consideration when they were browsing homes for purchase. She concludes that point of sale information needs to be provided during property marketing so that consumers can actually use them when considering different properties. Haines and Mackres (2011) similarly found that energy audit disclosure in Austin Texas occurred at the time of sale, which did not allow for price negotiation or comparison of houses.

During renovation

A number of studies suggest that householders don’t initially seek to save energy as a main issue in renovations, but that renovations become a trigger point for both landlords and owner-occupants to incorporate energy efficiency (e.g. UK Department of Energy and Climate Change 2011, Beillan et al 2011, Judson and Maller 2014, Pettifor et al 2015). Beillan et al (2011) found that for European homeowners, the main goal for owner-occupiers commencing a renovation is to adapt the building to their needs, and for landlords it is to improve the condition of the building to increase property value. Pettifor et al (2015) found empirical research showing that households had greater interest in information about energy efficiency retrofits as their renovation intentions strengthened.

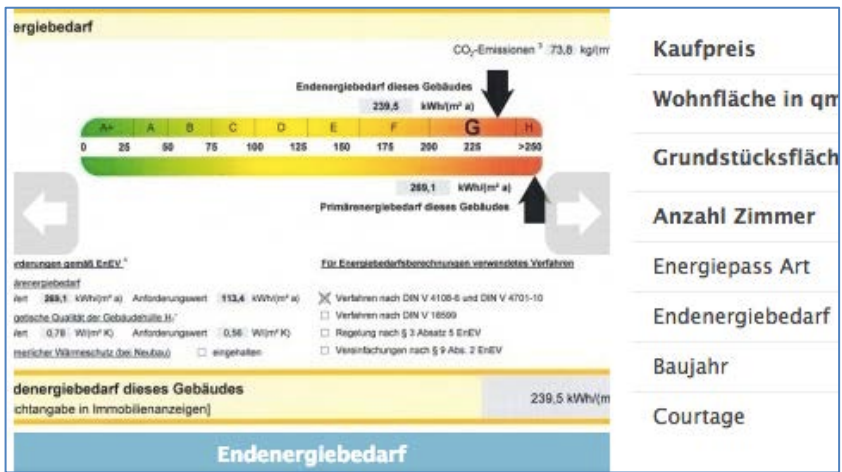
Information systems can provide an important stimulus for the decision to include energy efficiency during a renovation. A survey of 3000 European households (IDEAL-EPBD 2011) agreed with the finding that households tend to include energy efficiency as part of a broader home renovation, and further noted that information provided at the point of sale can be useful during renovation. The survey found that “people do not make a strict distinction between energy efficiency and other renovations, and view all renovations as investments in making their home their own, more comfortable and more valuable”. While the age and condition of a dwelling were the most important determinants for a homeowner to commence a refurbishment, they found that some households did use the information provided on Energy Performance Certificates, particularly when the certificate included recommendations on energy savings opportunities. Homeowners with these recommendations were twice as likely to have carried out one or more energy efficiency measures than those without.

The form of effective information

Discrete and intuitive labelling

Evidence from a number of qualitative scheme evaluations suggests that the most effective energy efficiency labels are intuitive, and allow people to easily differentiate incrementally improved performance. Research into the impact of Energy Performance Certificates in 2011 noted that the continuous energy indicators originally adopted by Germany (as described in section 8.4) were less understandable than the A to G scale used elsewhere. The survey of 3000 householders in five European countries found that Germans had trouble understanding the energy efficiency of their home, and determined that discrete label categories are more understandable (IDEAL EPBD, p5). The German scheme has since incorporated efficiency categories similar to those used throughout the EU.

Figure 2 Extract of house sale advertisement (Germany) showing EPC indicator with A to G labels (www.ebner-immobilien.de)



Studies also suggest that energy efficiency labels should allow consumers to see a range of performance, and value incremental efforts appropriately. The evidence from property transactions in both the US and EU confirms that consumers do place increasing value on more efficient properties when they are able to easily identify higher levels of performance. A study of different labels in Austin Texas found that consumers were willing to pay more for higher quality products as indicated by stringent “green” labels (Shewmake and Viscusi, 2014). This is supported by the increasing value premium for buildings with higher Energy Performance Certificates found across Europe in the reports summarized in Table 11 above. Figure 3 and Figure 4 below shows the increasing premium for homes with a higher energy efficiency rating in both France and the UK, with premiums of up to 27% for an A or B ranked home compared to a D ranked home in some French regions, and up to 13% for the same improvement in the UK.

Figure 3 Impact of EPC on property prices compared to a D rated building, France (Dinamic, 2013)

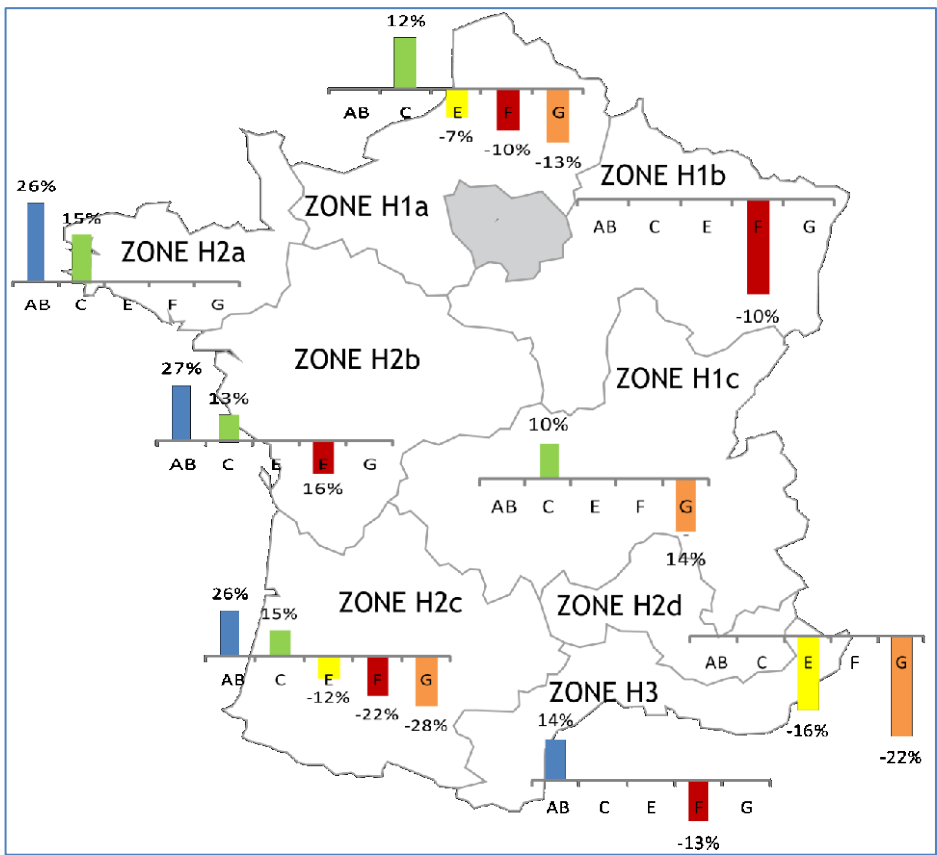


Figure 4 Average house price increases for EPC levels in the UK (UK Department of Energy and Climate Change 2015)

	EPC A/B	EPC C	EPC D	EPC E	EPC F
UK average	14%	10%	8%	7%	6%
North East	38%	26%	23%	20%	15%
North West	27%	21%	18%	16%	12%
Yorkshire & Humberside	24%	16%	14%	12%	9%
East Midlands	16%	11%	7%	5%	3%
West Midlands	17%	10%	7%	5%	5%
East of England	7%	5%	n/a ¹	n/a ¹	4%
London	12%	12%	12%	11%	10%
South East	n/a ¹	n/a ¹	n/a ¹	n/a ¹	n/a ¹
South West	12%	7%	4%	4%	3%

While the quantum of the value premium differs both within and between countries, there is a clear and increasing premium for buildings at different EPC levels across the board.

Shewmake and Viscusi (2014) suggest that these results correlate with health sector research into how consumers make data intensive decisions. They note that the research suggests that a simple evaluative metric such as poor/average/good or a star rating “reduces cognitive hurdles and helps consumers pick better higher quality products at similar prices”.

The benefits of reliable energy efficiency information extend beyond the point of sale and lease of houses. Kaza et al (2011) found a “substantial and significant reduction of the default and prepayment risks” for homes with Energy Star certification compared to those without. They note that an Energy Star home is one-third less likely to default on their mortgage than non-certified homes. They also report decreasing loan risks for homes with higher ratings – so the more energy efficient the home is, the lower the loan risk. Further evidence of this sort in other markets would certainly significantly enhance the value of energy efficient homes.

Conversely, consumer testing in Oregon (Earth Advantage 2014) found that, with proper contextualization, consumers appreciated the granularity of an energy metric such as MBtu/year, even though they had little understanding of what the unit of measurement actually represents. Earth Advantage (2014) considered that a discrete scale such as the A-G or five star scale less desirable as a primary metric for energy labelling. They noted that appraisers and other real estate professionals might be less likely to trust and use these relative systems that are likely to change over time. The evidence presented in section 5.2 above, particularly the strong support for the EPC label from French real estate professionals, suggests that this is not the case in a well established market.

Simple, quantitative and comparative

Modelling in existing buildings may be more difficult / less accurate than for new buildings. An Energy Trust of Oregon study (Earth Advantage 2009) found that more complicated energy models were not necessarily better at predicting the energy consumption of existing homes. Earth Advantage developed a spreadsheet model that used default values for many building parameters, and found that it could predict energy results in older homes better than a sophisticated simulation model that measured many more parameters. Two reviews of the Home Energy Score (Parker et al 2012, Merket and Heaney 2014) found a reasonable correlation between predicted and actual energy consumption for average homes, but that the model was very poor at predicting energy consumption for high users. This may be explained by energy uses such as swimming pools that are not considered by the model, and the poor energy habits of high users in comparison to the modelled default factors.

These results suggest diminishing returns for increased accuracy in existing buildings, particularly for very high-energy users.

While complex information may confuse homeowners and deter action, a lack of relevant information can lead to the same outcome. The Kansas Energy Plan (2007) reviewed local disclosure requirements and concluded that the disclosure of energy efficiency features alone is not helpful without also providing context for why these features are important. The Plan recommended that the disclosure form changed to include more “quantitative and comparative” information.

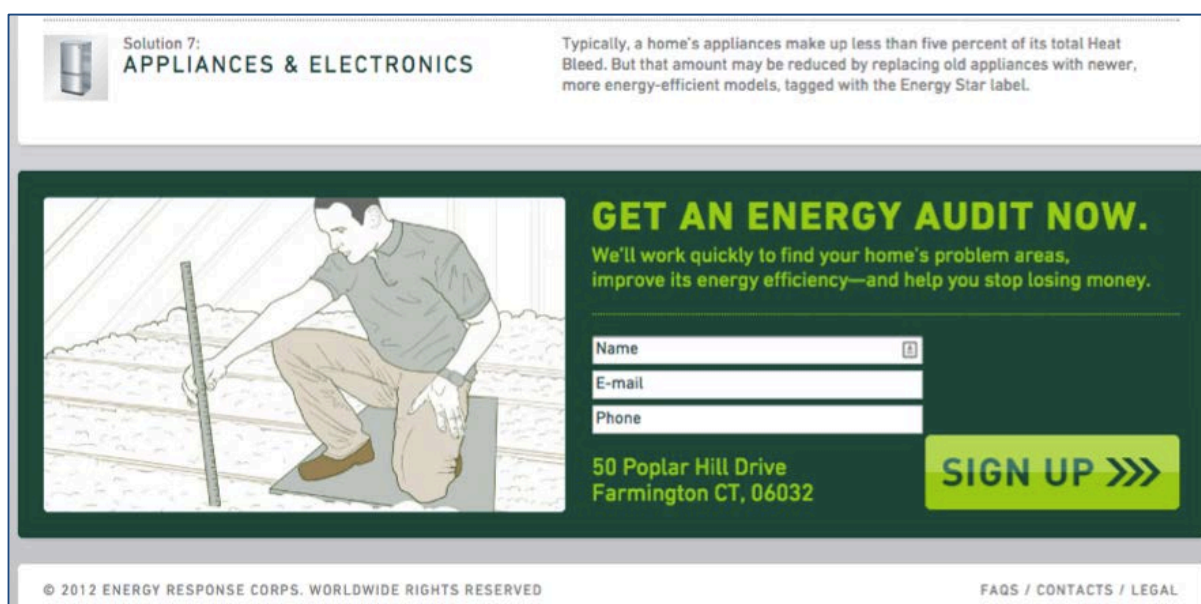
The source of effective information

The value of expert advice

Certified assessors primarily deliver the reviewed international energy efficiency systems. This is considered particularly important for information that may have direct financial value, such as the KfW-Effizienzhaus system which is used for low interest loans, and experts must assess both the label and project implementation (Hamilton 2010, Rosenow et al 2013), the Green Deal system which allows access to both loans and Government subsidy programs, and point of sale disclosure programs where the energy label may form part of sale considerations and create a value premium.

Consumer surveys in a number of jurisdictions also confirm the value of an on-site energy efficiency expert in influencing household decisions (Amecke 2011, Wilson et al 2014). The value of expert advice is recognised by Heatbleed. While this calculator provides energy efficiency information online, without expert assistance, the “call to action” on the Heatbleed page is to contact an expert for assistance, as shown in Figure 5.

Figure 5 Heatbleed call to action (www.energyresponseforce.com)



The screenshot shows a webpage for 'Solution 7: APPLIANCES & ELECTRONICS'. It features a header with a small appliance icon and the text: 'Typically, a home's appliances make up less than five percent of its total Heat Bleed. But that amount may be reduced by replacing old appliances with newer, more energy-efficient models, tagged with the Energy Star label.' Below this is a large green banner with an illustration of a man in a polo shirt kneeling on a roof, measuring insulation with a long ruler. To the right of the illustration, the text reads: 'GET AN ENERGY AUDIT NOW. We'll work quickly to find your home's problem areas, improve its energy efficiency—and help you stop losing money.' Below this text are three input fields for 'Name', 'E-mail', and 'Phone'. To the right of these fields is a large green button with the text 'SIGN UP >>>'. At the bottom of the banner, the address '50 Poplar Hill Drive Farmington CT, 06032' is displayed. The footer of the page contains the copyright notice '© 2012 ENERGY RESPONSE CORPS. WORLDWIDE RIGHTS RESERVED' and links for 'FAQS / CONTACTS / LEGAL'.

However, the value of on-site expert advice comes at a cost. A Parliamentary Committee investigating the early implementation of the Green Deal scheme blamed the high cost of the assessment on low takeup for the scheme, and noted that consumers regard the scheme as too costly (House of Commons 2014a). The Government response noted that successful energy efficiency schemes “need to strike a balance between ease of access, consumer protection and compliance with regulation” (House of Commons 2014b). Maintaining this balance between an accessible cost and trusted information system is an important governance consideration that is considered in section 5.5.2 below.

A simple “one stop shop” approach to help consumers take action

Energy efficiency information schemes seek to both inform householders about the potential for energy savings in their home, and inspire them to take action to improve. Systems that are effective in converting information into action across a range of national systems tend to see the information system as a part of a broader program and policy offering.

The KfW-Effizienzhaus label integrates with the local minimum construction standards and repayable loans at favourable rates for efficiency upgrades. The loan subsidy and amount available increases with increasing energy efficiency. This integrated approach encourages householders to move beyond information and to consider deeper retrofits, and has stimulated a large market for energy efficiency retrofits in Germany. Power and Zulauf (2012) note that the combination of generous subsidies and low interest loans with highly ambitious standards and a “whole house” approach generates an investment of around €36,000 per home in energy efficiency and renewable technology.

The Green Deal program has also been effective in generating energy efficiency retrofits for UK houses. While the level of investment in Green Deal loans is significantly lower than in Germany, most households that obtain a Green Deal assessment do take action to install energy efficient products through alternative funding such the Energy Company Obligation or cashback offers. In late 2014, four in five participants in the Green Deal program had either installed a

measure, were in the process of installing or reported that they definitely or probably would (UK Department of Energy and Climate Change, 2014b). The same survey notes the importance of supporting policy measures, with households that were not eligible for direct support through the Energy Company Obligation much more likely to have expressed an intention to install rather than actually having made an installation.

Evidence from US programs also supports packaging energy efficiency information with a broader program. The Home Performance with Energy Star program provides a “one stop shop” approach to energy efficiency upgrades. The program includes both a home assessment and facilitated retrofits for participants, and half of the Home Performance with Energy Star delivery partners offer rebates and other financial assistance to install recommended opportunities. (United States Environmental Protection Authority 2014b).

Engaged property professionals drive the market

Real estate agents play a pivotal role in property sale and lease, and both the quantitative evidence of improved property values and qualitative surveys of French property professionals (section 5.2.1) suggests that they will make use of energy efficiency information as a point of difference when selling a home, if it is readily available.

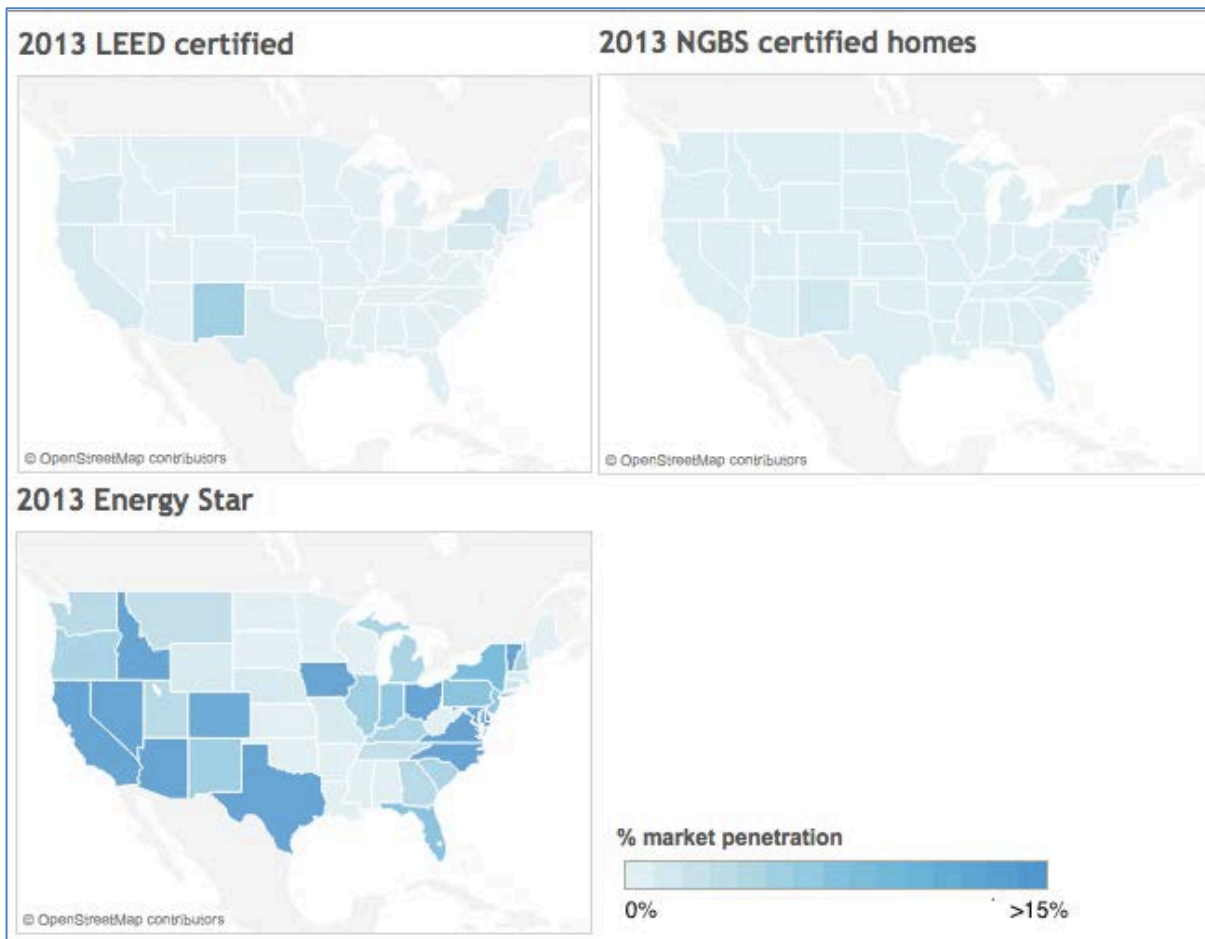
However, the form of information is particularly important to engage these individuals. Earth Advantage (2013) note that real estate agents in the city of Austin Texas found it challenging to educate consumers about the value of energy efficiency based on the information disclosed under the Energy Conservation Audit and Disclosure program. Some agents found the disclosed audit of energy efficiency confusing and challenging to communicate to consumers, and the report notes some concern about potential liability associated with presenting information that is not well understood. The report quotes a representative of the Austin Board of Realtors as supporting the disclosure, but agreeing that an energy rating or score would “work wonders in the marketplace” by clearly informing consumers and removing the risk of liability from the agent.

The delivery of effective information systems

A supportive policy framework

The importance of a supportive policy platform is highlighted by the disparate adoption rates of the three new building labels reviewed in the United States. The market share for these systems is not uniformly distributed across America, as shown in Figure 6 below.

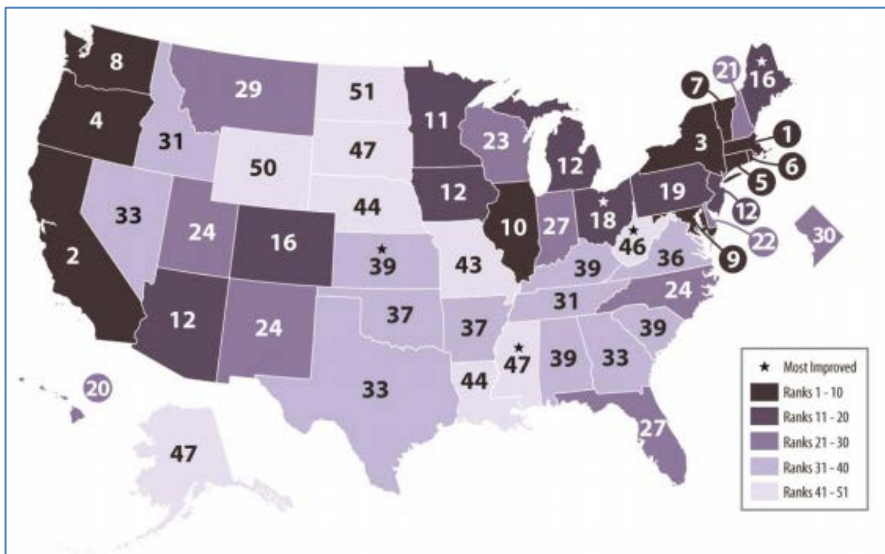
Figure 6 Distribution of new homes in 2013 with Energy Smart, LEED or National Green Building Standard certification (United States Environmental Protection Authority 2014a, US Green Building Council 2015, Home Innovation Research Labs 2015)



The 2013 market penetration of Energy Star Homes is most concentrated in the southwestern and northeastern states. More than 20% of buildings were certified as Energy Star Homes in five states, with more than 60% of new buildings in Arizona certified. The rate of adoption of LEED and the National Green Building Standard (NGBS) in the US market shares a similar pattern to that for Energy Star, although at much lower levels. In states that have adopted the IECC 2012 building code (shown in Figure 1 above), the adoption of Energy Star Homes is relatively low, although some homes still obtain the Energy Star certification.

The American Council for an Energy Efficient Economy annually ranks each US state on their policy and program efforts. The ranking reflects the relative effort made by states in regulations and incentives for improved energy efficiency. Figure 7 maps the rankings for each state in 2013.

Figure 7 State policy scorecard 2013, ACEEE 2013



A comparison of Figure 6 and Figure 7 reveals a close consistency between high ranked states (that is, those with the best energy efficiency policies) and the states with the greatest market adoption of the voluntary beyond-compliance energy efficiency certifications. The states with the lowest ranked energy efficiency policies, running in a band across the centre of the nation, also have the lowest adoption of voluntary energy efficiency standards. This provides strong evidence of the role played by government policies in building the market for energy efficient buildings.

Government support is also important to drive takeup of the change-oriented systems for existing buildings. Each of the effective retrofit systems reviewed above takes a cost effective approach, using a small government payment to attract private investment. For example, the KfW-Effizienzhaus system offers loans at very competitive rates using government funds to support private investment. Between 2006 and 2009, 1 million German houses were refurbished using low cost loans. The German government contributed €2 billion in subsidies that generated a total of €17 billion in private investment.

The subsidies for Home Performance with Energy Star are similarly cost effective. In 2013, participants in that program spent an average of \$7,500 on energy efficiency projects, and received 18% in rebates and other incentives (United States Environmental Protection Authority 2014b). Rebates and incentives in that program vary between delivery partners, and include both government and private sector investment to stimulate retrofit activity.

Quality assurance framework

A common thread in evaluations of international systems is the need to improve quality assurance frameworks to improve consistency. Evidence from Europe suggests that trust in the certificate is important for scheme effectiveness (European Commission DG Energy 2013). That study reported concerns from professionals in a number of jurisdictions over the quality of assessors providing Energy Performance Certificates, and noting that different assessors may get different results for the same building. Respondents considered that this may undermine public confidence in the certificates if not addressed. In response to these findings, the European Union introduced changes to the system requiring member states to implement quality control systems over both the assessors delivering Energy Performance Certificates, and the certificates themselves.

Evidence from the UK reinforces the importance of trustworthy delivery of energy efficiency advice. A consumer advice line reported “widespread community mistrust” in Green Deal assessors to a Parliamentary Committee, and noted that the absence of quality control for Green Deal assessors and installers had led to “rogue traders and scams” (House of Commons 2014). The UK Government presented its own evidence in December 2014 showing a significant lack of consistency in the “data, results and advice generated by different assessors for the same property” (UK Department of Energy and Climate Change 2014b). They noted a variation of more than two rating bands in the EPCs provided by Green Deal assessors for a range of 48 properties that each received four assessments.

While trust is a matter of concern, so too is cost. The same parliamentary committee reported that consumers considered the scheme too costly, as noted in section 5.4.1. Clearly, the balance between cost and reliability is delicate, and getting it right requires the close attention of system administrators. Recognising that they had not yet got it right,

the UK Government announced in its response to the House of Commons Committee an intention to improve quality assurance for the Green Deal assessor framework (House of Commons 2014b).

4 Next steps for Australian information systems

The purpose of this report is to inform future energy efficiency information systems in Australia. This section considers the specific aspects of the findings from international tools and systems that could be adopted in the Australian context.

Table 12 summarises the findings presented in section 5 on the information that is most effective in the European and American markets, in the form of the overall research question for this project.

Table 12 Characteristics of effective information systems in Europe and the United States

	Question	Findings from European and American systems
1	What information do people need?	Information that is consistent with new building standards Information that links to issues people care about A whole house approach
2	At what point?	Energy efficiency labels at the point of sale Information intended for use during renovations
3	From what source?	Consumers value expert advice Engaged property professionals drive a market response
4	In what form?	Discrete and intuitive labelling Simple, quantitative and comparative information Retrofit opportunities alongside performance descriptions
5	What is required to deliver make this happen?	A supportive policy framework Quality assurance framework

The building blocks for many of these characteristics are already in place in the Australian context. A number of opportunities are listed below for future Australian systems, roughly in the order of potential implementation.

Opportunity 1: a “reduced data” energy efficiency rating for application beyond building compliance

The report finds that many effective information systems use a consistent platform for establishing the energy performance of both new and existing houses, such as the Standard Assessment Protocol in the UK that underpins Green Deal assessments, Energy Performance Certificates and building code compliance. Note that while the energy model is consistent in the UK, a reduced version of the model (RdSAP) is used for existing buildings applications to reduce the cost of assessment. (UK Government 2014). The model has also been adapted for commercial use in systems such as Heatbleed (Heath 2015).

Like the European and United States systems, Australia has a well-established energy simulation software platform for building code compliance, NatHERS. Like the UK and United States rating tools for building code compliance, NatHERS was originally developed more than twenty years ago in the early 1990s (Williamson 2000). However, the NatHERS software is currently only available for use in “regulation mode”, similar to the Standard Assessment Protocol for the UK. Ratings require a significant amount of information that is not easily obtained in existing buildings, such as building fabric information and measured building areas.

This presents a significant opportunity for Australian energy efficiency information systems. A “reduced data” energy efficiency rating, specifically tailored to reduce the cost of an assessment for an existing home, would allow for simple communication of energy efficiency in existing homes. Ideally, this could involve an integrated approach for new and existing buildings, and the potential to communicate a whole-house approach. This would likely provide the benefits noted in section 5.1.1 above, such as simplified and consistent communications with households throughout the life of a building, easier education of industry and consumers with no need for training in different metrics, and better equipped building industry to understand levels of efficiency and deliver improvements.

Minimising end user costs should be a primary focus in developing the reduced data requirements. This is a crucial element for the success of such a rating.

In the longer term, developing the rating model for access to third parties through web services or similar could also allow the implementation of ultra-simplified local energy efficiency information systems such as the Heatbleed approach in the UK.

Opportunity 2: include information that people care about in rating tools and information systems

Evidence from Europe and the United States suggests that consumers are interested in energy efficiency for a range of reasons such as running costs, building comfort and property values. This research report is currently gathering evidence of information that is important to Australian consumers. This will be crucial to establish effective information for energy efficiency information systems.

On establishing the information that is most important to Australian households, further work will be required to understand how to best incorporate this information in energy efficiency rating tools and information systems.

Opportunity 3: Maintain discrete star rating labels

Results from European and American systems agree that a discrete indicator of energy efficiency is more effective than a continuous scale or listing of total energy consumption or energy costs. While consumption and costs may be “information that matters” to people (as noted above) a simple, intuitive primary indicator is needed to help make it easy for consumers to pick out more energy efficient buildings, and understand their relative performance in the market.

The most effective US and American labels also align with their labelling programs for energy efficient appliances, Energy Star in the US and the A-G scale in Europe. The NatHERS scale graphically matches with the Energy Rating used for Australian appliances. It makes sense to maintain consistency with this familiar labelling program for future energy efficiency ratings.

However, as NatHERS was not developed with existing buildings in mind, it is likely that the actual thresholds of performance on a new rating scale for existing buildings will need to be revised ensure they appropriately reflect the actual range of performance. To ensure consumers are able to differentiate between buildings, most of the market should fall somewhere on the scale, while allowing room for excellent performance at the top.

Opportunity 4: Develop renovation advice

European and American systems developed to provide whole-house retrofits have been effective in driving installation of energy efficiency opportunities in existing housing at large scale. In 2013, more than 80,000 houses in America, and 300-400,000 houses in the UK and Germany retrofitted their houses to achieve significant improvements in energy efficiency through the systems reviewed in this paper.

The primary drivers of this success are effective information systems, and effective policy and market frameworks. These information systems have been particularly effective by establishing actual energy efficiency installations as a primary objective.

Again, Australia has an important building block already in place, with energy modelling software that is capable of providing advice on improvement opportunities. Energy efficiency disclosure certificates mandated in the ACT are generated by NatHERS software and incorporate upgrade opportunities.

A rating system that is specifically tailored for existing buildings and designed to identify upgrade opportunities would provide an excellent information system platform to encourage household refurbishment. The Green Deal Advice Report format could provide a useful guide for this advice. This report is well received by households, with 80% of participants satisfied with the recommendations (UK Department of Energy and Climate Change 2014a).

The ongoing research under this EnergyFit Homes project will be instructive for the layout of any upgrade advisory reports for a future rating and information system, by identifying information that Australian consumers consider effective and useful.

Opportunity 5: develop a point of sale and lease energy efficiency information disclosure program

International evidence suggests that the market responds when buildings have the ability to label improved energy efficiency performance. A effective rating system that discloses the energy efficiency performance of houses at the point

of sale and lease will likely lead to increased value for improved energy efficiency performance, and an improvement in energy efficiency levels overall.

Australia has one existing point of sale energy efficiency disclosure system in the ACT, and a newly launched property features marketing system Liveability that has been designed to promote energy efficiency ratings (among other property features) to potential homebuyers.

As noted above, an engaged real estate market is an important factor in driving the property market. The Liveability platform was driven from within the real estate industry, and should provide a platform for a future point of sale disclosure of energy efficiency ratings. An energy efficiency rating system built for existing houses, with upgrade advice, could be readily delivered to Australian households at the point of sale and lease through the Liveability framework.

Opportunity 6: Ensure adequate quality assurance for any future systems

The international energy efficiency systems included in this review are almost all delivered by on site energy experts. As noted in section 5.5.2, the most effective overseas systems acknowledge the need to establish quality assurance frameworks to ensure reliable and credible advice and for consumer protection. However, they also recognise the need to maintain low costs for ease of access into the assessment systems. This balance is crucial for the success of any future Australian information systems.

Any future energy efficiency information system for existing buildings in Australia should ensure that adequate protections are in place to maintain the quality of expert advice to protect consumers. At a minimum, this would involve reviewing the quality assurance and certifications currently in place for building code compliance and identifying whether any enhancements or modifications would be required for an existing building program.

Opportunity 7: A supportive policy framework

The change-oriented international systems reviewed above are all driving significant private investments in energy efficiency. In each case, a small amount of public and/or corporate finance leverages significant private investment.

The Clean Energy Finance Corporation has the capacity to provide a similar role in Australia to the KfW bank in Germany. Like that bank, the Clean Energy Finance Corporation is charged with using public finance to leverage private investment in climate change mitigation measures.

An effective Australian household retrofit program could be modelled on the KfW-Effizienzhaus or Green Deal scheme, adjusted for the Australian market. Such a program would feature an integrated energy efficiency retrofit approach, using an effective rating and information system as described above, and be delivered by engaged industry partners in the property and energy efficiency sectors. A supportive policy framework would include subsidised finance either through a KfW-style investment to improve loan conditions, or a Green Deal approach to allow loan repayments through energy bills. The large scale adoption of the KfW system compared with the relatively modest number of upgrades supported by Green Deal Finance (as shown on Table 5 above) suggests that, at this stage, the former option is significantly more effective in driving private investment.

5 Conclusion

This report has identified a number of lessons for Australian energy efficiency information systems. A number of energy efficiency systems from Europe and the United States have been remarkably effective, stimulating significant private investment in both countries in energy efficiency retrofits, and empowering the market with the tools it needs to value energy efficiency at the point of sale and lease, and in private investment.

The report finds that effective international systems use a whole house rather than component based approach. They provide information that is consistent with new building standards and information that links to issues people care about. Energy efficiency information is most effective when presented at point of sale or lease, and is deliberately structured to be useful during renovations. The most effective top level information is discrete and intuitive, providing simple information that allows consumers to immediately weigh up the relative energy efficiency of the property as easily as reviewing the energy efficiency of a fridge or washing machine. These systems also provide a second level of quantitative information that provides greater insight into the performance of the property in easily understood terms, and clear guidance on the best opportunities to improve the energy efficiency of the property.

In terms of the delivery of effective systems, consumers place more value on advice that is delivered by experts, and the enhanced value for certified energy efficient buildings in markets around the world shows that engaged property professionals will help to drive a market response. A quality assurance program supports effective energy efficiency systems to protect consumers and ensure reliable results, while seeking to minimise costs to households.

Finally, the most effective programs exist in a supportive policy framework, with Government and the private sector working in partnership to deliver energy efficiency information and retrofit activities to households.

Each of these important characteristics may be implemented in Australia. The ongoing research in the EnergyFit Homes project will provide important evidence to support future Australian information systems, particularly in identifying the information that matters to Australian consumers. The project will also map out the delivery system needed for to effectively label existing Australian homes as energy efficient, and stimulate household retrofits at scale.

6 Appendix: detailed system description

6.1 Minergie

Table 13 Minergie standards (Minergie 2011)

Label	Requirements
Minergie	General energy consumption 25% lower than a conventionally designed building. Calculations consider heating energy, hot water and equipment energy use.
Minergie-P	Equivalent to international Passivhaus standard. General energy consumption 40% lower than a conventionally designed building. Particular limits on heating energy demand, and mandatory inclusion of appliances with "best energy category".
Minergie-A	Net positive energy balance, with strict limits on heating energy demand and best energy category appliances.

Minergie is a voluntary standard administered by a non-profit organisation, with members from the property industry and each of the Swiss canton governments. It is a certification scheme for newly constructed homes and major refurbishments in Switzerland. Homes may be awarded a Minergie label for a significant improvement beyond standard practice.

The Minergie label can be used to differentiate a home in property markets, or even by fixing a plate to the home certifying it as a leading energy efficient home. Several Swiss banks offer incentives to help homeowners invest in their home to achieve a Minergie certification. 19 of the 26 Swiss canton governments offer significant subsidies averaging at the equivalent to USD\$12,000 for homeowners seeking a Minergie-P certification (Minergie 2010).

Figure 8 Sample Minergie label



6.2 KfW-Effizienzhaus

The German KfW bank, the German Energy Agency (DENA), and the German Federal Ministry of Transport, Building and Urban Development created the KfW-Effizienzhaus label. It is awarded to households based on their performance relative to the minimum standards for new houses in Germany (EnEV). "KfW-Effizienzhaus 100" represents compliance with the current minimum standard for new construction. Refurbished houses are awarded a label based on their relative efficiency compared with this standard, ranging from KfW-Effizienzhaus 115 (15% higher than the standard for new buildings) to KfW-Effizienzhaus 55 (building uses 55% of the energy of the minimum standard for new buildings). The minimum legal standard for refurbishments is also communicated on the same scale, at a score of 140 – that is, refurbished buildings may use 40% more energy than new build requirements.

(source: KfW 2015a, KfW 2015b)

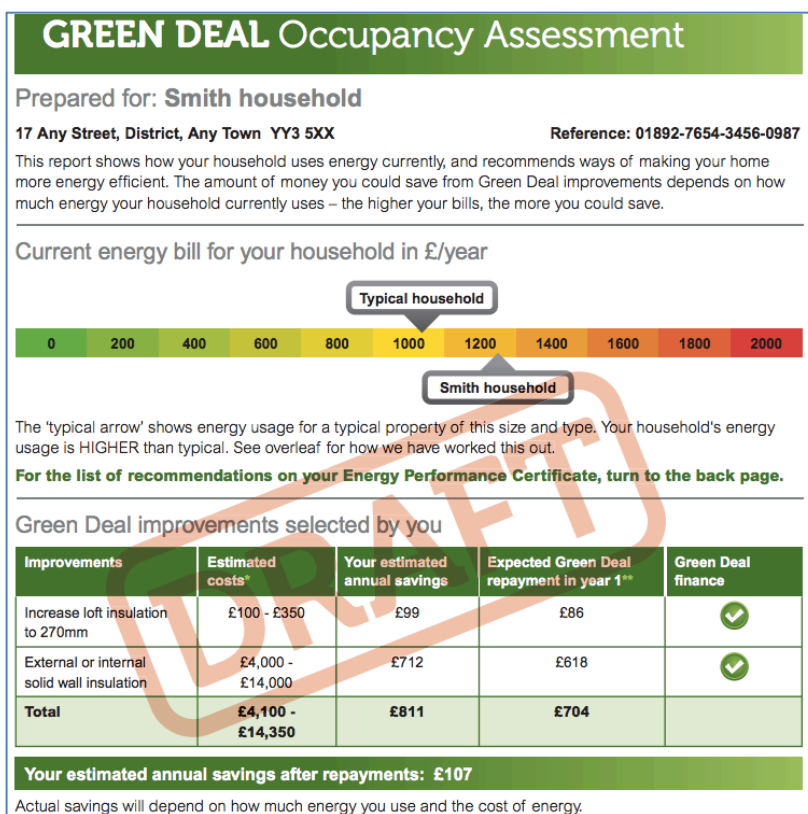
Figure 9 KfW-Effizienzhaus label



6.3 Green Deal

The Green Deal is a UK Government initiative to assess the energy efficiency of homes in the UK, and arrange finance to upgrade the building. Under the Green Deal, a Green Deal Assessor provides a Green Deal Advice Report that is lodged on a national register. The report includes an Energy Performance Certificate and an “occupancy assessment” to identify energy efficiency measures and the potential costs and savings. The “in use factors” used in the Green Deal Assessment reflect the “performance gap” between modelled and actual energy consumption (UK Department of Energy and Climate Change, 2012). The factors are fixed for each measure and reduce the expected energy consumption compared to the model (for example, wall insulation savings are reduced by 35%).

Figure 10 Example Green Deal Advice Report



The Green Deal Advice Report has been designed to highlight actual and comparative energy costs, and clear information about the cost effective savings identified by the assessor with the householder and next steps to take action on these savings opportunities.

A number of finance options are available for households that choose to install the measures.

A private loan may be arranged through Green Deal finance. This finance is available through Green Deal providers and repaid through charges on the energy bill for the property. The amount of finance available is capped to the expected energy savings – the new on-bill charges must be less than modelled bill savings. Savings are conservative, based on

fixed energy costs (3 year historical average) with no inflation, and calculated using the same model as EPCs (RdSAP) adjusted for “in-use factors”. The RdSAP is in turn based on the Standard Assessment Protocol used to measure compliance with the UK building code.

Alternative finance is available through the Green Deal Home Improvement Fund, which allocates cashback payments in tranches. Under this Fund, the household applies for a cashback voucher prior to commencing work, based on quotes from a registered provider. A £30 million tranche was released in December 2014, with a maximum of £5,600 available per household and up to £4,000 towards solid wall insulation. The funds for solid wall insulation were fully allocated just one day after the scheme went live.

Households can also use their Green Deal Advice Reports to apply for retrofits paid through the Energy Company Obligation. This program obliges energy suppliers to help improve the energy efficiency of their domestic customers’ buildings. Measures that can be installed through the Energy Company Obligation include those that cannot be fully funded through the Green Deal, including wall insulation. Additional support is also available to low income and vulnerable homes.

6.4 Energy Performance Certificates

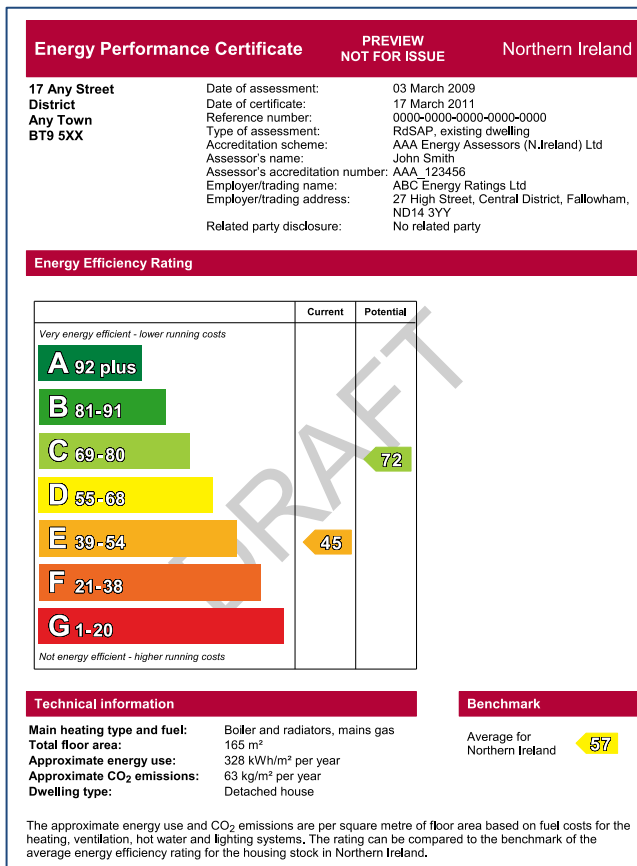
The European Union implemented mandatory energy labelling for households through the 2002 “Directive on the energy performance of buildings” (EPBD), which came into force in 2006. Under the directive, European member states were required to “ensure that, when buildings are constructed, sold or rented out, an energy performance certificate is made available to the owner or by the owner to the prospective buyer or tenant.” (Directive 2002/91/EC article 7.1) The EPBD included general guidance on the methodology for the Energy Performance Certificate, with each member state responsible for establishing detailed calculations. The format of the certificate was also left to the discretion of the member state, with a stipulation that the certificate must make reference to minimum legal standards and benchmarks to allow consumers to compare and assess performance.

The EU recast the directive in 2010 to require that the main energy performance indicator of the certificate is included in advertisements for property sale and lease, rather than at the end of the process, and that the certificate also include “recommendations for the cost-optimal or cost-effective improvement of the energy performance of the building”, along with “an indication of where the owner or tenant can receive more detailed information” (Directive 2010/31/EU, article 11.2-4). The recast directive also included specific requirements for better governance of the system and improved certificate quality, such as independent certificate control systems, quality assurance for certifiers, and penalties for non-compliance.

Each of the 28 European member states has now implemented Energy Performance Certificates. The different approaches taken by each state provide useful insights into the impact of information disclosure at the point of sale.

Most member states have implemented certificates that use an A to G efficiency indicator, similar to that shown in Figure 11 below. This label is familiar to the European market, as it matches that used for household appliances.

Figure 11 Typical EPC format showing the A to H efficiency indicator (UK)



Some member states initially implemented alternative indicators. Italy used a selection of speedometer style dials to indicate efficiency across a number of metrics, while the primary indicator on Germany was a thermometer style bar, with labels indicating the expected performance of different building types from the highest efficiency standard “Passivhaus” (EFH 40) to a single-family home that has not had any significant energy efficiency investment. Both countries now use the A to G scale as shown in Figure 11, although Germany has retained the thermometer style presentation rather than the coloured bars used elsewhere.

6.5 Energy Star

Energy Star is a government program jointly administered by the United States Environmental Protection Authority and United States Department of Energy that includes a range of initiatives for households.

Energy Star Homes is a labelling program for homes that are newly constructed or have undergone a major refurbishment and meet particular energy efficiency standards. Homes with the Energy Star Home label can add the label to real estate listings.

The Energy Star Home label is based on a Home Energy Rating System (HERS) score. A certified home energy rater reviews the construction plans and carries out post construction tests to assign a HERS score. HERS is an index where a score of 100 represents the “current market standard” for a new home. Typically an Energy Star label requires a HERS of 85 – that is, the building is modelled to use 85% of the energy of the current market standard. Residential Energy Services Network (RESNET) certifies the rating procedures and assessors.

Ratings cost between \$300 and \$700 in 2009 (National Average Cost of a Home Energy Rating, Resnet 2009), with average of \$492.



Home Performance with Energy Star is aimed at occupied homes, rather than those in construction or renovation. This program involves an in-home assessment and report into current energy use and cost effective improvement opportunities. The program is delivered across the USA through 50 local delivery partners (at January 2014). While this program has common labelling with the Energy Star Homes program, the actual assessment method used by delivery partners is flexible. The primary goal of these assessments is to “facilitate the installation quality home performance improvements”, and partners must develop a Home Performance Assessment that is “designed and implemented to encourage the installation of performance improvement measures” (United States Department of Energy 2014).

Over 300,000 homes have participated in the Home Performance with Energy Star to date (April 2014 – HPwES 2014 Building Technologies Office Peer Review).

Figure 12 Home Performance with Energy Star sample (<http://www.illinoishomeperformance.org/>)



Energy Star Portfolio Manager is a benchmarking and utility tracking system for large buildings. High-rise residential buildings can use the Portfolio Manager to track their energy and water use over time. To allow comparison between

buildings, the Portfolio Manager normalises energy use based on weather and fuel source data. In 2014 the United States Environmental Protection Authority implemented a 1-100 score for high rise residential buildings using the Portfolio Manager. The score represents the percentile performance of the building. Buildings with a score of 75 (that is, buildings that have an energy performance better than 75% of the market) are awarded an Energy Star label.

Using the Energy Star Portfolio Manager to benchmark and report energy use to owners and tenants is mandatory for high rise residential buildings in several cities including New York, Boston and Washington DC.

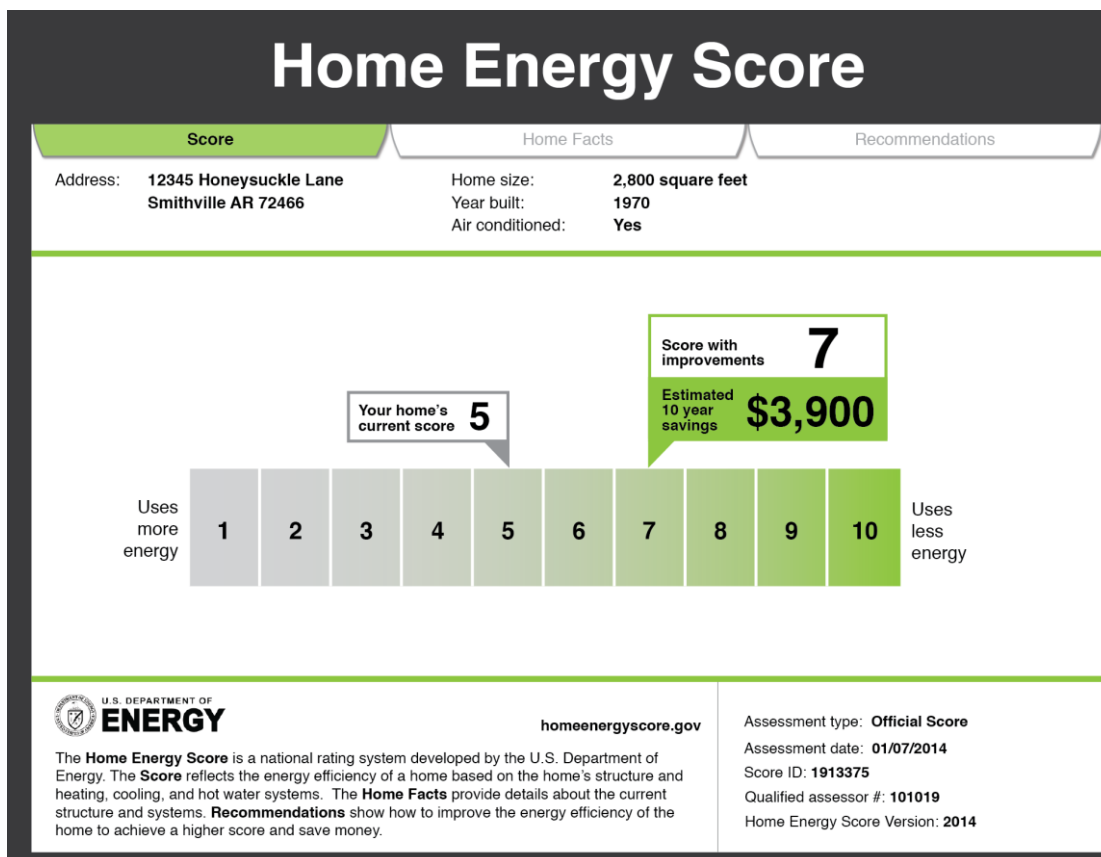
6.6 Home Energy Score

The Home Energy Score is an asset-based analysis of single-family dwellings. It is a standalone calculator that forms the basis of both the Home Performance with Energy Star system and other programs. Lawrence Berkeley National Laboratory developed the Home Energy Score for the US Department of Energy.

The Home Energy Score estimates home energy use based on a standard set of data on the building including its envelope, heating, cooling and hot water systems, and standard assumptions regarding occupant behaviour to allow for an asset-based comparison between houses that is independent of the actual occupant.

The Home Energy Score uses a comparative 10-point scale based on the distribution of energy use across the community. A score of “1” represents a home in the highest 20% of energy consumption, and a “10” scored home is in the lowest (most efficient) 12%.

Table 14 The Home Energy Score



The Home Energy Score is administered by the US Department of Energy and delivered through local or state partners. Partners may deliver the Score as a standalone offer, or as part of a broader program. For example, the Illinois state government sponsors a local non-profit and energy utility program that incorporates the Home Energy Score. Under the program households obtain a Home Energy Score, and are awarded a “certificate of completion” on installing recommended energy efficiency measures.

The Department of Energy requires partners to score at least 500 homes a year.

Only qualified energy assessors are allowed to access the online rating calculator to determine the Home Energy Score of a home. These assessors must hold an industry accepted qualification and pass a test before they are granted access to the software.

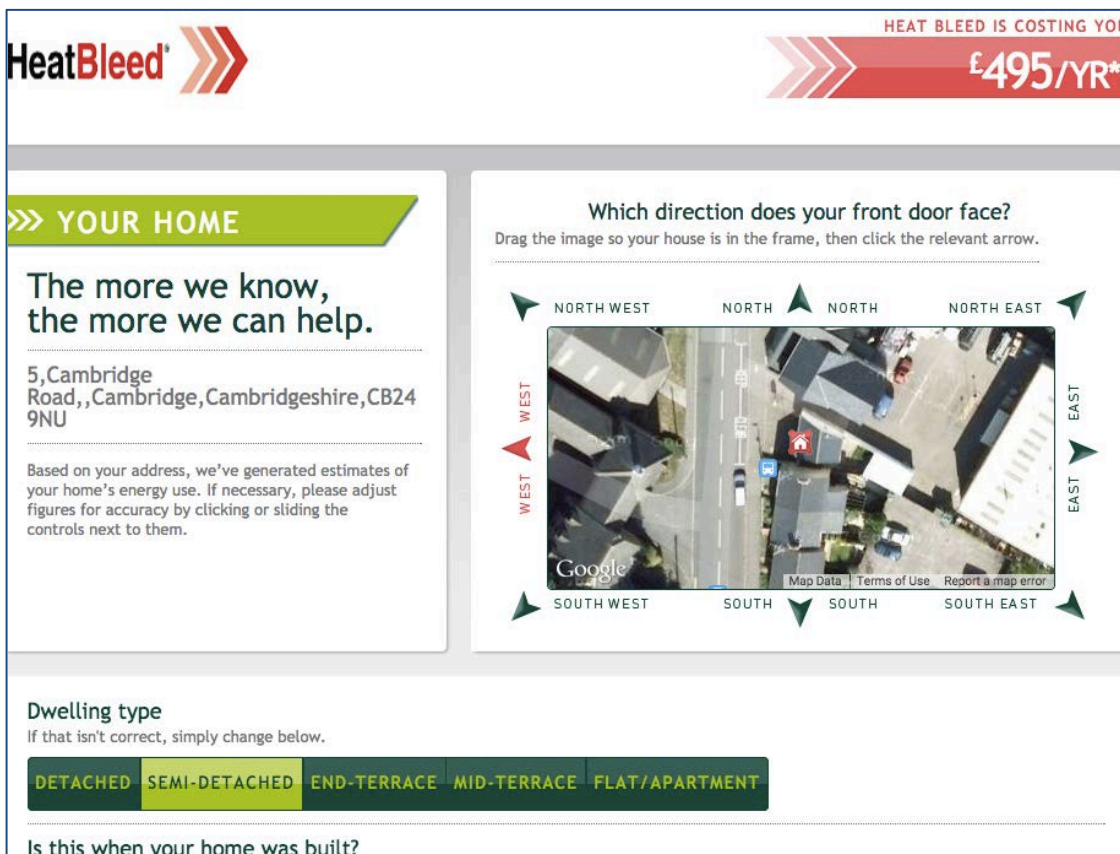
A quality assurance regime is in place for the program. The Department of Energy does a desktop review of the data used in every Home Energy Score, and delivery partners must also perform an on-site reassessment of a randomly selected 5% of local assessments.

The Department of Energy is currently considering whether to fully integrate the Home Energy Score with the Home Performance with Energy Star program (Glickman et al 2014). At present, most Home Performance with Energy Star partners do not use the Home Energy Saver. At January 2014, more than 8,500 homes had obtained a Home Energy Score in total (Glickman 2014). This is a small proportion of the 80,000+ homes that completed the Home Performance with Energy Star program in 2013 (Jacobsohn et al 2014).

6.7 Heatbleed

Heatbleed is an online calculator developed by Knauf Insulation as a quick and simple assessment of household energy efficiency, and advice on retrofit opportunities. The calculator aims to provide meaningful energy performance information for a homeowner based on the address of the home.

Figure 13 Heatbleed calculator screen capture



Heatbleed provides an immediate energy efficiency assessment of the home without any requirement for the user to add information on the home itself. The calculator makes use of a range of databases to determine the likely characteristics of a property based on the address, including the physical layout of the building, building construction, whether wall and ceiling insulation is already installed, the type and age of the boiler, and whether the building has double glazing.

The energy performance of the home is calculated using these data points and a simplified thermal performance model based on RdSAP, which also forms the basis of building standards, Energy Performance Certificates, and Green Deal calculations.

The user can modify all the assumed building characteristics if they are not accurate. Modifications are added to the Heatbleed database to improve the predicted building characteristics of other similar houses.

Knauf Insulation developed and administers the Heatbleed calculator, and licenses it for use by third party websites. For example, the hardware chain B&Q has incorporated Heatbleed in previous promotional activities. Knauf purchases annual licenses for access to the various property databases that drive the calculator.

6.8 Leadership in Energy & Environmental Design (LEED)

The US Green Building Council has developed green building design certification program called LEED (Leadership in Energy & Environmental Design). It is a points-based assessment system across a number of design features in different environmental categories, including energy efficiency. LEED awards one of four levels of certification, depending on points awarded: certified, silver, gold, or platinum. LEED for Homes is a subset of LEED that is appropriate for residential buildings. Points can be awarded if the design includes energy modelling of the building.

Figure 14 LEED Platinum label



6.9 National Green Building Standard (United States)

The National Green Building Standard is a voluntary building code in the United States administered by the Home Innovation Research Centre, which is a wholly owned subsidiary of the National Association of Home Builders (Home Innovation Research Labs 2015b).

Homes are awarded National Green Building Standard certification based on compliance with a checklist of a range of "green building practices" that are assigned point values. Depending on the points level achieved, homes obtain Bronze, Silver, Gold or Emerald. Mandatory provisions apply for each of the performance level (Home Innovation Research Labs 2015c).

Quality assurance checks on certified buildings by independent verifiers that are accredited by Home Innovation Research Labs. The scheme administrator also checks the submission for accuracy, and accredited verifiers are subject to an internal quality assurance program including regular audits (Luzier 2014).

Figure 15 Example National Green Building Standard certificate (source: brightngreen.com/ngbs)



6.10 Austin Energy Green Building

The Austin Energy Green Building (AEGB) program commenced in 1991. The AEGB rates homes on a five star level, and includes energy efficiency along with performance on other sustainability metrics including material use and water efficiency. Ratings are determined by a checklist, with points assigned for the presence of particular characteristics including home design features, thermal envelope efficiency, energy efficiency of equipment and appliances, and lighting and other electrical efficiency. Broader sustainability features include water efficiency material efficiency, construction waste management, interior materials and paint and landscaping.

The program is administered by Austin Energy, the local energy utility, and delivered by certified assessors.

6.11 Mandatory disclosure schemes, USA

A number of states and local governments across the USA have implemented legislation requiring energy information disclosure of residential buildings. These schemes fall broadly into four categories – disclosures of energy audit at point of sale or lease, disclosures of energy features at point of sale or lease, disclosure of past energy bills at point of sale or lease, and annual disclosure of energy bill benchmarking.

Disclosure of energy audit

Austin Energy Conservation Audit Disclosure

This law requires homeowners in Austin Texas to provide a home audit report to potential homebuyers. For multifamily buildings, audit results must be posted for tenants to see, and buildings that use $\geq 150\%$ of the average must reduce their usage by 20% within 18 months.

Registered energy professionals conduct the audits.

Disclosure of energy features applies in South Dakota, Kansas and Maine. Nevada previously implemented a similar disclosure system, but it was repealed less than one year after implementation in 2011.

Disclosure is required in South Dakota and Kansas for the sale of new homes only. Neither of these states have minimum building standards in place, and the disclosure acts as a defacto voluntary standard.

Maine requires the disclosure of an “energy efficiency disclosure statement” for rental properties only. The statement includes information on heating systems, insulation, windows, doors and appliances. Voluntary minimum standards are published for each attribute and the statement must disclose whether the property meets these standards.

Figure 16 South Dakota energy disclosure form (https://dlr.sd.gov/bdcomm/realestate/forms_publications.aspx)

BUILDER'S ENERGY EFFICIENCY DISCLOSURE STATEMENT

Builder _____

Property Address _____

This Disclosure Statement concerns the real property identified above situated in the City of _____ County of _____, State of South Dakota.

Part 1. Builder shall provide the following information about the new residential building:

- Has this new residential building been built or will it be built to meet the energy efficiency standards of the International Energy Conservation Code of 2006 (IECC 2006)?
Yes _____ No _____
- Has this new residential building received or will it receive any other energy efficient certification?
Yes _____ No _____
If yes, which certification(s): _____

Part 2. Builder shall describe the following energy efficiency elements of the new residential building:

	Actual	2006 IECC*	2006 IECC*
	Value	Zone 5	Zone 6
Wall Insulation R-Value	_____	R-19 (or R-13 cavity + R-5 insulated sheathing)	R-19
Attic Insulation R-Value	_____	R-38	R-49
Foundation Insulation R-Value			
Basement Walls	_____	R-10/13**	R-10/ 13**
Crawlspace Walls	_____	R-10/13**	R-10/13**
Slab-on-Grade	_____	R-10, 2 ft. depth	R-10, 4 ft. depth
Floors over Unheated Spaces	_____	R-30	R-30
Window U-Value	_____	0.35	0.35
Door U-Value	_____	0.35***	0.35***

Part 3. Builder shall provide the following information about equipment:

- Does the new residential building contain an Energy Star certified:
 - Water heater? Yes _____ No _____
 - Heating system (furnace, heat pump, or other)? Yes _____ No _____
 - Cooling system (air conditioner, heat pump, or other)? Yes _____ No _____

Part 4. Builder's Notes and Comments:

*IECC stands for International Energy Conservation Code.
**The first R-Value applies to continuous insulation; the second to framing cavity insulation.
***One opaque door per building is exempt from this requirement.

Disclosure of utility bills at the point of sale applies in Hawaii, Alaska, Chicago, New York and Montgomery County (Maryland).

In Hawaii, Alaska and Montgomery County laws require an inclusion of energy bill information alongside a large number of other disclosures that a vendor must make to a person buying their home. Below shows an extract of the point of sale disclosure form in Alaska. Utility costs must be disclosed, along with five pages of other features and issues about the property.

Figure 17 Alaska point of sale property disclosure form

If Yes, explain: _____

- ◆ Have you had any work maintenance or inspections done on the sewerage system during your ownership?

If Yes, explain: _____

Approval Source (and date if known): _____

- ◆ Are you aware of any abandoned sewage systems, leachfields, cribs, etc. on the property?

➤ **Freeze-ups:**

- ◆ Have you had any frozen water lines, sewer lines, drains, or heating systems?

➤ **Average Annual Utility Costs:**

Gas	\$ _____	Company/Source: _____
Electric	\$ _____	Company/Source: _____
Oil	\$ _____/Gallons: _____	Company/Source: _____
Propane	\$ _____	Company/Source: _____
Wood	\$ _____	Company/Source: _____
Coal	\$ _____	Company/Source: _____
Water	\$ _____	Company/Source: _____
Sewer	\$ _____	Company/Source: _____
Refuse	\$ _____	Company/Source: _____
Other	\$ _____ \$ _____	Company/Source: _____

To the best of your knowledge, are you aware of any of the following conditions with respect to the subject property? If answer is "Yes," indicate the relevant item number and explain the condition on the Addendum/Amendment(s) To The Disclosure Statement.

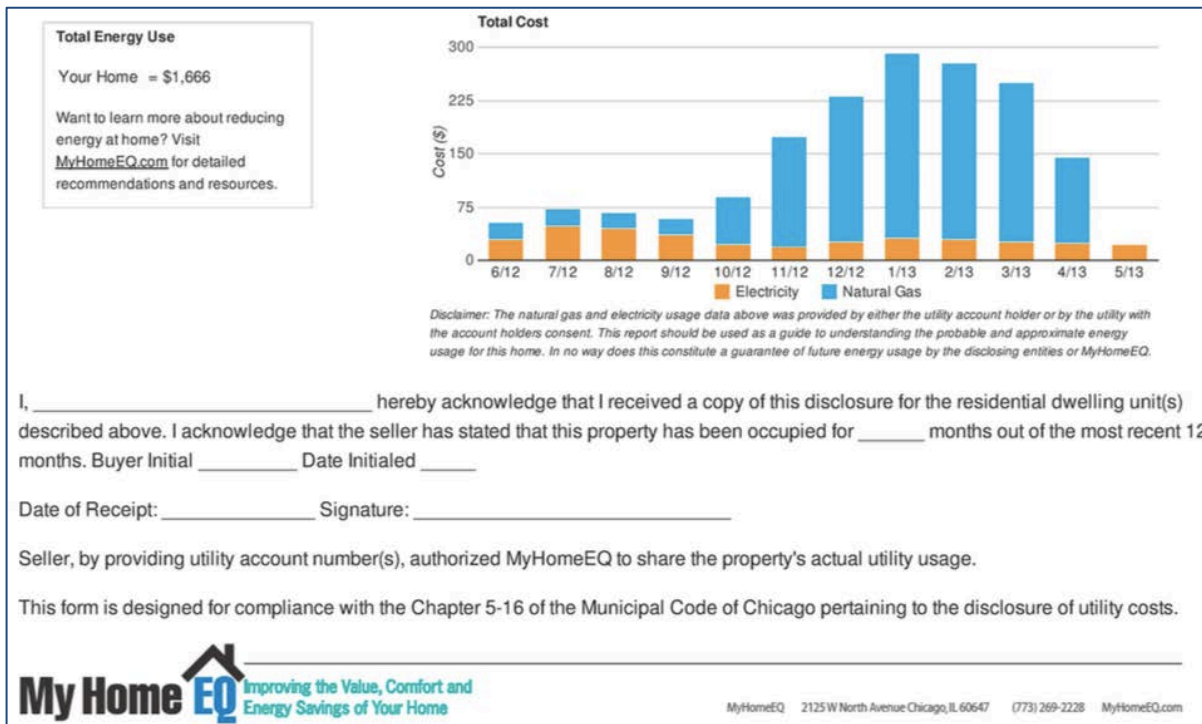
➤ Title:	Yes	No
1. Do you know of any existing, pending, or potential legal action(s) concerning the property?.....	<input type="checkbox"/>	<input type="checkbox"/>
2. Do you know of any street or utility improvements planned that will affect the property?.....	<input type="checkbox"/>	<input type="checkbox"/>
3. Road maintenance provided by? _____	<input type="checkbox"/>	<input type="checkbox"/>
4. Is the property currently rented or leased?	<input type="checkbox"/>	<input type="checkbox"/>

The New York State "Truth in Heating" law was introduced in 1980 and is a requirement for owners to disclose heating and/or cooling bills on written request from a potential buyer, if they have not already signed a contract for sale. Utility retailers must provide this information to homeowners on request (New York's Utility Project 2013).

The Chicago Residential Energy Disclosure Requirements requires that homeowners disclose their actual energy use (electricity and gas) to potential buyers. The system makes use of the smart meter data. Energy bill data is provided over the internet from utilities to real estate agents as they enter the home details on the real estate listing system, making compliance with this requirement simple.

The utility provides a certificate showing the energy billing details, and links to www.myhomeeq.com. This site includes an energy efficiency calculator and other information to help the householder better understand the energy consumption of the building.

Figure 18 Sample energy bill disclosure, Chicago



Benchmarking property performance of multi-family dwellings applies in New York City, Seattle, Washington DC, and Boston (from May 2015)

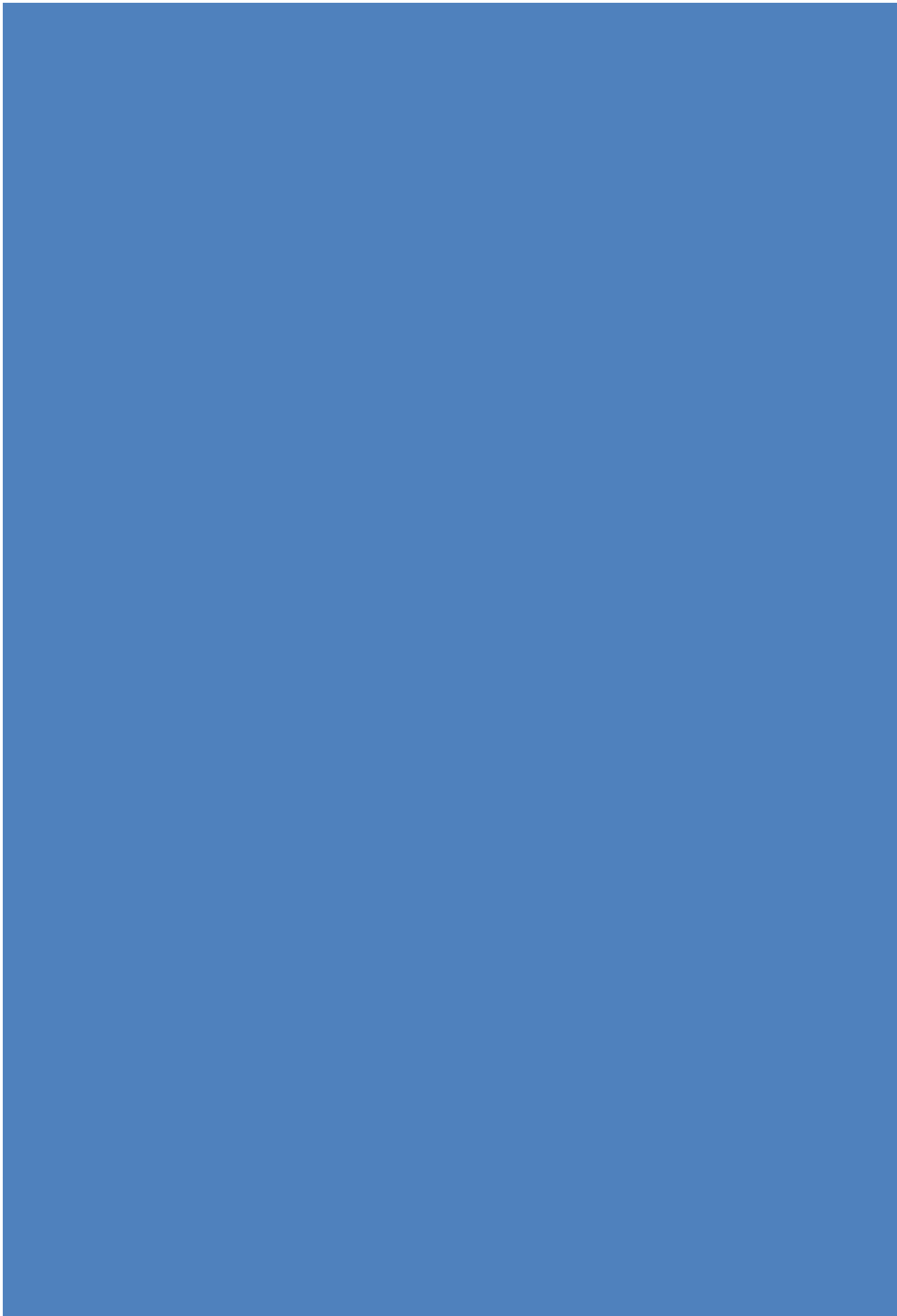
These cities require large multi-family dwellings (between 20 and 50,000 sq.ft) to annually benchmark their energy consumption, and report it either publicly or directly to Government for aggregate reporting. Each of these jurisdictions also has similar requirements for commercial building benchmarking.

In each city building owners comply by using the Energy Star Portfolio Manager. None of the benchmarking schemes require collection of energy use information from residents – benchmarking covers either common area use, or whole building if there is a single meter. The differing coverage of benchmarking between buildings may make comparison difficult. The 1-100 Energy Star score, for example, is only calculated on a whole building basis. The Energy Star website notes that buildings with only common area energy information can “benchmark the energy you can measure” but that this information will be useful to “measure and improve your energy, cost and emissions over time” (United States Environmental Protection Authority, 2015a) – not to compare with other buildings.

To overcome these difficulties, utilities in some locations provide aggregate data to building owners. In Washington DC, the local energy providers provide building level billing data to authorised people for inclusion in benchmarking reports.

The impending Boston Energy Reporting and Disclosure Ordinance includes provisions that poor performing buildings must also perform an energy audit every 5 years. Buildings can be avoid this requirement if they “demonstrate a pattern of energy-performance improvement over this period”, if they have a LEED score, or an Energy Star score higher than 75.





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