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# The wandering energy stars: The challenges of valuing energy efficiency in Australian housing

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## **The wandering energy stars: The challenges of valuing energy efficiency in Australian housing**

### Highlights:

- The valuation of energy efficiency and ratings in residential property
- A national survey of Australian residential valuers
- Energy efficiency has limited consideration and a minor effect on value
- Valuers have limited knowledge of energy efficiency rating tools
- There is a lack of data, due to the absence of a mandatory disclosure scheme

## Abstract

In the context of curbing greenhouse gas emissions to meet the ambitious but much-needed targets to limit global warming to reasonable levels, residential housing can play a significant role. By enhancing the energy efficiency of residential housing, emission reductions, reduced costs and better health and wellbeing of occupants may be achieved. Despite gradual improvements in home energy efficiency, homeowner engagement could be greatly enhanced by the demonstration of how energy efficiency and energy ratings can be reflected in residential property values. Ascertaining the value of energy efficiency may enable greater investment and potential for increased availability of finance for added energy efficiency options in new and existing housing. Extant research suggests a significant relationship between house values, rental prices and energy efficiency certifications, particularly where mandatory disclosure operates. However, limited research has examined residential valuers' (appraisers) perspectives and practice considerations.

This paper examines the challenges for valuers in identifying and considering energy efficiency initiatives and ratings on residential property value and the capacity of residential valuation professionals to incorporate energy efficiency into the valuation (appraisal) process.

The research identified limited means available to valuers in Australia in identifying energy efficiency attributes and ratings; challenges in awareness, knowledge, and understanding of energy efficiency ratings; and, subsequently, limitations in consideration of initiatives and ratings in valuation. This research affirms findings of other Australian and international studies, suggesting mandatory disclosure and certification are essential if energy efficiency is to be considered by the market and reflected in residential valuation.

## Keywords

Market Value; Valuation; Appraisal; Housing; Energy Efficiency; Energy Rating Tools

# 1. Introduction

The challenges of meeting carbon emission reductions are momentous, and the need to limit global warming to 1.5 degrees is imperative to mitigate some of the catastrophic effects of climate change [1]. The built environment is a significant contributor to and generator of emissions, and there is significant opportunity to realise reductions through the residential housing sector of the built environment [2, 3]. The energy efficiency agenda for the residential sector is twofold: first, from an affordability perspective (maintaining and minimising energy bills); and second, from an emissions reduction potential, which is linked to the energy consumption of the home. Driving greater energy efficiency in the home has been the focus of governments for several decades; however, broad-scale engagement across the sector appears to be limited. Lorenz et al. [4] suggested that identifying value in sustainability and energy efficiency would drive increased investment and engagement in energy efficiency throughout the property life cycle. This perspective has subsequently supported a detailed level of quantitative and empirical research examining the relationship between energy efficiency, ratings and value in both commercial and residential property [5]. Yet, detailed analysis of valuers<sup>1</sup> considering energy efficiency and ratings in practice (predominately commercial property) have identified low levels of engagement and knowledge by valuers across the United Kingdom (UK) and Europe [6] despite specific guidance notes provided by the Royal Institution of Chartered Surveyors on how to assess sustainability, and in the commercial valuation sector in Australia [7, 8, 9]. This is the first study that investigates residential valuers practising in Australia and explores their knowledge, understanding and consideration of energy rating tools and energy efficiency *per se* in the practice of valuation for residential property.

## 2. Residential Valuation: The art, science and need for knowledge development

According to the Australian Property Institute (API), a valuation is:

An established, ethical and evidence based process for assessing the monetary value of an asset at a specified date, that is legally defensible and undertaken by a qualified, professional valuer.<sup>2</sup> [10]

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<sup>1</sup> Valuers, a term short for property valuers, often known as appraisers, are suitably qualified and certified by a professional body to undertake valuations of real property [11]. They should not be misinterpreted as real estate agent who is involved in the transaction of property.

<sup>2</sup> In Australia, the API certifies valuers as ‘Certified Practising Valuers’ (CPV) or ‘Residential Practising Valuers’ (RPV) allowing them to practice as property valuers in Australia, the latter being restricted to residential property only with a maximum value [11]. Certification requires an accredited degree, 24 months of experience for CPV and 12 months for RPV, three reports for assessment by the API and successful completion of the viva voce (a professional interview testing applicants experience and knowledge of standards, legislation and guidance notes). To remain a CPV or RPV, continuing professional development and membership with the API is required. The Royal Institution of Chartered Surveyors (RICS) also provides professional recognition of valuers that requires two years of work experience, submission of reports and valuations and a professional interview. Although RICS membership is not as widespread as the API CPV, there is a growing membership in Australia. However, all respondents identified themselves as either CPV or RPV in this study.

1 A property valuation is an estimation of a property's market value at a point in time and is  
2 defined as:

3 The estimated amount for which an asset or liability should exchange on the valuation  
4 date between a willing buyer and a willing seller in an arm's length transaction, after  
5 proper marketing and where the parties had each acted knowledgeably, prudently and  
6 without compulsion. [11]  
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9 The property market is cyclical and market value can fluctuate in line with economic pressures.  
10 Market value is the price achieved on the open market by a willing buyer and seller, both acting  
11 with knowledge and without undue coercion. In the residential market, which is considered a  
12 regularly transacting market, the predominant approach to assessing value is the comparative  
13 approach. Valuers consider comparable properties to the subject, based on location,  
14 characteristics and features of the property. A valuer uses extant market evidence to assess the  
15 market value of the property in question. They utilise information and evidence from recent  
16 transactions in the market and interpret this information to apply it in the context of the subject  
17 property to ascertain an estimate of the market value. All valuers are required to justify their  
18 assessments, which often involves the process of making adjustments to the settled sales prices  
19 of comparable properties to make it like the subject [12].  
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25 Many residential valuations are commissioned from a lending institution for mortgage security  
26 [13]. From a purchaser's initial mortgage enquiry, for refinancing or other mortgage purposes,  
27 the lending institution will seek a valuer's confirmation of the market value of the asset held  
28 as security. Upon receipt of a formal request, the valuer will assess the land, using statutory  
29 records and visual inspection. Property location, dimensions, shape, aspect, topography, zoning  
30 and development potential are factors influencing land value. A visual inspection of  
31 improvements on the land is also conducted, with consideration of size, layout, quality, age  
32 and condition [14]  
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37 Prevalence of the comparison approach across all valuations means that the comparison of  
38 characteristics and features that may affect value is paramount. This is especially true of  
39 residential property valuations, where the comparison approach is the primary method. The  
40 role heuristics has to play in valuations, particularly in the comparative approach, has been well  
41 documented across several decades of research [see 15,16, 17, 18, 19, 20, 21, 22, 23, 24, 25,  
42 26, 27, 28, 29, 30]. Based on heuristics identified by Tversky and Kahneman[31], experimental  
43 research has revealed the role of heuristic behaviours, rather than the perceived methodological  
44 normative valuation model [17, 19, 21, 28]. It was shown that a student or newly appointed  
45 valuer would employ a methodological approach, follow the normative valuation model and  
46 utilise a large quantum of data. An expert's approach is more efficient but utilises short cuts  
47 based on extant knowledge, industry experience and heuristics, in particular, the anchoring and  
48 adjustment heuristics. Warren-Myers [29, 30] suggested the importance of strategic knowledge  
49 development and its translation to intuitive knowledge, or heuristics, be applied in the process  
50 of valuation. This was highlighted by Warren-Myers [7, 8] in a study of valuers that examined  
51 their current knowledge of sustainability and rating tools and how their lack of knowledge led  
52 to a lack of consideration or reference to in value assessments and reporting. As a result, valuers  
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1 were not generating the strategic knowledge required to enable the creation of heuristics in  
2 relation to sustainability or energy efficiency.

3 Accordingly, it is critical to establish valuer knowledge of sustainability, energy efficiency  
4 initiatives and perceptions of their influence on market value. The literature on perceptions of  
5 sustainability in valuation has broadly focused on commercial valuation or, more specifically,  
6 understanding tools to assess green impacts on value [7, 8]. Warren-Myers [7] noted that  
7 elements of sustainability are considered to positively affect valuers' assessments in Australia,  
8 with energy efficiency attracting the strongest positive response. However, this study also  
9 identified considerable inadequacies and inaccuracies of knowledge. As explained by Warren-  
10 Myers [7, 8] and Michl et al. [6], adequate and accurate knowledge of sustainability factors  
11 and tools is required to enable correct and reliable measurement and comparison. Historically,  
12 the focus has been on the commercial sector, with limited research examining the residential  
13 valuation sector's knowledge, considerations and utilisation of industry tools and benchmarks.  
14 Further, no studies have examined the methods used for comparison nor valuers' extant  
15 knowledge and expertise in energy efficiency in the residential sector.

16 Valuers have a pivotal role in providing a broad range of stakeholders with estimates of value.  
17 In the residential context, they sit at the junction of developers/builders, finance, real estate  
18 agents and the purchasing market [6]. Consequently, understanding valuers' perspectives for  
19 value relationships with energy efficiency in the home is an important factor for driving energy  
20 efficiency initiative adoption within the residential property market. Further, the value  
21 attributable then provides a foundation for developers and builders to include in a new product;  
22 a marketing advantage for agents; the financing of additional energy efficiency features in the  
23 home by financial institutions; and the accrued benefits both financially and comfort-related  
24 by the purchaser.

### 25 3. Energy efficiency, property values and valuation

26 Globally, studies examining residential values, energy efficiency and ratings have increased  
27 over the past decade, with much of the research focused on the European policy environment,  
28 because of the introduction of the Energy Performance Certificate (EPC) across the United  
29 Kingdom (UK) and many European countries. For example, empirical studies examining price  
30 effects in the Netherlands [5, 32, 33], Scandinavia [34, 35], Switzerland [36], Ireland [37, 38],  
31 Germany [39, 40], Italy [41], Spain [42] and the UK [43, 44], as well as studies in Japan [45,  
32 46], Singapore [47], China [48, 49, 50, 51], the United States [52, 53, 54, 55] and Australia  
33 [56, 57, 58]. A detailed analysis can be found in the meta-analysis performed by Daly et al.  
34 [59]. While many of these studies identify relationships suggesting premiums, brown discounts  
35 or null findings, the variability in the results across these studies can be attributed to localised  
36 market dynamics; the source and quality of data; controls for housing types; and quality,  
37 climate, energy costs and environmental concerns [60, 61]. Valuation and the role of valuers is  
38 pivotal in decision-making; broader financial markets and their assessments can have  
39 significant flow-on effects for lenders, purchasers, occupiers and investors [8, 62, 63]. One of  
40 the key challenges for valuation in the assessment of market value is constraints in what they  
41 consider. Specifically, as noted by Sayce [64], valuers do not consider aspects like cost savings  
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1 and additional health and wellbeing benefits that may come from ownership or occupation of  
2 a more sustainable or energy efficient building. It is implicit that these benefits are considered  
3 by market participants (homebuyers) and represented through the market evidence, by which  
4 valuers would identify in the evidence the differences and use the extant evidence to assess the  
5 market value of an asset.  
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7 In Australia, the identification of a relationship between energy efficiency and sustainability  
8 has been demonstrated empirically by several studies, albeit to a certain extent. The Australian  
9 Bureau of Statistics (ABS) [56, 57] identified a value premium for properties with higher  
10 energy-efficiency rated homes in the Australian Capital Territory (ACT). In a much larger  
11 study of the same region over a longer period, Fuerst and Warren-Myers [58] also identified  
12 that premiums associated with energy efficiency ratings (EER) and features in the home were  
13 related to energy efficiency for both sales and rental prices. In the commercial market, Newell  
14 et al. [65] identified value premiums for ‘top-end’ rated National Australian Built Environment  
15 Rating Scheme (National Australian Built Environment Rating System (NABERS) and Green  
16 Star certified buildings in Australian cities; however, this was contested by Gabe and Rehm  
17 [66] who examined the rental market of the Sydney CBD and found no significant price  
18 premiums. Despite these empirical demonstrations, understandings of the relationship between  
19 value and energy efficiency do not necessarily translate to market values and valuation  
20 practices, as found by Warren-Myers [8] and Thanh Le and Warren-Myers [9] in their analysis  
21 of the commercial market and valuation practices. Moreover, this disconnect is not unique to  
22 the Australian market, as found by Michl et al. [6], who identified that valuers’ knowledge of  
23 sustainability and energy rating tools was inadequate and, consequently, that application of  
24 value relationships was limited if not non-existent. This is despite the guidance provided by  
25 RICS<sup>3</sup> in 2011 and 2013, relating to the collection of appropriate and sufficient sustainability  
26 data [64, 67, 68]. Warren-Myers [69] suggested that the absence of valuers considering  
27 sustainability in valuations did not necessitate a ‘new’ valuation approach, but rather  
28 acknowledgement of the shortfall in their knowledge and understanding of the rating systems  
29 and tools, and devising new ways to consider the effects on transactions. The disconnect  
30 between empirical studies and valuation practice has been discussed at length by Warren-  
31 Myers [60], who identified the use of information and the barriers involved in translating  
32 empirical evidence of this nature into practice. Yet, Chegut et al. [5] suggest that empirical  
33 studies may have influenced a change in valuers’ practice in the UK and Netherlands markets.  
34 Their recent study examined assessed values between 2010 and 2015 for both regions; they  
35 found no significant relationship between energy efficiency and values in 2010, but, by 2015,  
36 they identified higher-rated energy efficiency labels did lead to higher valuations, indicating a  
37 green premium or a brown discount for low-rated properties in their UK analysis. Chegut et al.  
38 [5] suggest that valuers may be taking into account the effect of energy efficiency labels in  
39 their valuations; however the authors raise four likely reasons (which they then discredit): first,  
40 that valuers are responding to market evidence; second, response to higher rents; third, valuers  
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57 <sup>3</sup> RICS operates globally with their foundations in the UK, and acts as one of the governing bodies of valuers  
58 specifically in the UK, Europe and other countries with a RICS presence. It has its own *Red Book* of valuation  
59 standards providing professional standards and guidance notes for practising valuers, along with additional  
60 guidance notes.  
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1 are responding to changing valuation standards; or fourth, because of policy changes, in  
2 particular the UK governments' declaration that, from 1 April 2018, low EPC properties will  
3 be illegal and penalties will be applied. The authors concluded that it is likely that academic  
4 consensus between 2011 and 2015 played a role in valuation practices. While acknowledging  
5 that these trends are not observed by those practising in the market, the authors note:  
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7 This illustrates how hard it is to assess the correct value of many different building  
8 quality characteristics – of which energy performance is merely one – solely on the  
9 observation of market information without formal statistical analysis, even if that  
10 observation is immediate and frequent. (Chegut et al., [5], fn. 24).  
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13 Broader sustainability and energy efficiency consideration in the valuation process from a  
14 practice perspective has been investigated by Sayce and Wilkinson [63], Thanh Le and Warren-  
15 Myers [9], Michl et al. [6], Ciora et al. [70], Warren-Myers [7, 8, 60], Lorenz and Lützkendorf  
16 [4, 71], Lützkendorf and Lorenz [72, 73], Sayce et al. [74], Muldavin [75, 76, 77], Warren et  
17 al. [78], Sayce and Ellison [79, 80] and Sayce et al. [81]. These studies focused on both global  
18 and Australian scales, but mainly focused on the commercial sector. Empirical evidence in  
19 relation to green buildings or ratings assessing energy efficiency is now abundant in most major  
20 commercial markets; however, the engagement and consideration of sustainability and energy  
21 efficiency is limited in valuation reporting [8, 9] Much of the reluctance of valuers to consider,  
22 acknowledge and place value on energy efficiency has been found to reside in valuers' limited  
23 knowledge of sustainability and energy efficiency per se (and its rating systems) as well as  
24 mechanisms to analyse the credentials for comparative analysis [6, 8, 9, 82, 83]. However,  
25 there has been little, if any, significant focus on residential valuation processes and practices.  
26 A recent publication by RICS examined much of the empirical evidence across the UK and  
27 Europe and suggested that energy efficiency is beginning to impact value and value drivers,  
28 one of which is lenders factoring in energy efficiency considerations [63]. While the authors  
29 note that there are still a considerable number of barriers to reporting the value relationship  
30 with energy efficiency, they suggest that value recognition is occurring and provide further  
31 guidance and recommendations for residential valuers [63].  
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33 Residential property valuation is one of the highest volume sectors in the valuation profession,  
34 particularly when compared to commercial, retail and industrial valuation work. Its prevalence  
35 is due to banks' requirements for residential valuations primarily for mortgage purposes.  
36 Indeed, valuation for mortgage purposes constitutes the bulk of residential valuation work in  
37 Australia and elsewhere [5, 84]. Most buyers looking to purchase a home require finance and  
38 lenders' approval which is contingent on a valuation. In Australia, 66% of the population are  
39 homeowners, yet only 37% have a mortgage. However, 94% of recent home buyers (home  
40 purchased in 2017–2018) bought their home with a mortgage [85]. Consequently, the demands  
41 on residential valuation for mortgage purposes forms the bulk of residential valuation in  
42 Australia.  
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44 The residential valuation process is fundamentally approached from a comparative analysis  
45 standpoint, which entails a valuer considering comparable properties and their range of  
46 attributes, adjusted to match the subject, to determine a value for the subject property [12].  
47 While this approach is relatively simple, with residential property considered an uncomplicated  
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1 area of valuations, the residential market can be one of the most difficult markets to interpret  
2 because of the broad range of attributes to consider, especially the emotive decisions made by  
3 purchasers [12]. Energy efficiency is an attribute of a home that a rational consumer should  
4 consider as adding value through a reduction in electricity bills, thus reducing ongoing costs.  
5 From the perspective of economic theory, reduced costs over a period of time should equate to  
6 a discounting of a comparative property with higher bills or a premium paid for a property with  
7 lower bills. Empirical studies sampling the Australian market have identified premiums for  
8 energy-efficiency rated homes and certain energy efficiency features [56, 57, 58]. However,  
9 both of these studies are situated in a small area of Australia and cannot be considered as  
10 representative of the rest of Australia. While lacking larger studies considering energy  
11 efficiency and energy efficiency ratings in the broader Australian housing market, some studies  
12 have examined consumers' willingness to pay and examinations of trust [86, 87, 88, 89].  
13 Although, as noted by Warren-Myers et al. [90] in a study of 362 Australian new home buyers,  
14 awareness of the NatHERS<sup>4</sup> certification was quite low, despite NatHERS being one of the  
15 most common forms of assessment for meeting the minimum energy efficiency requirements  
16 under the National Construction Code for all new homes [91]. Although, in a smaller study,  
17 the comparison to other sustainability and energy ratings, NatHERS was found to have a higher  
18 level of familiarity and awareness [92]. Interestingly, those home buyers who were aware, did  
19 trust the certification and demonstrated a significant willingness to pay more for the  
20 certification [90, 92, 93]. Yet, Warren-Myers et al.'s [94] study in a sustainably certified estate  
21 using a small sample of new home buyers found that resident engagement with the  
22 environmentally friendly aspects of home purchase was limited due to a lack of awareness and  
23 trust in sustainability certifications, which stemmed from poor communication of information  
24 from the developer and builder to new residents. This lack of awareness and trust is not  
25 unsurprising, when limited and often misleading information is provided and communicated to  
26 consumers by the volume builders about their homes energy efficiency and sustainability [95,  
27 96, 97]. Romanach et al. [98, 99] also identified that residents would seek more energy  
28 efficient homes. Adams et al. [100] found consumers would pay more to understand the energy  
29 efficiency of their dwelling and would like to know this information during the sales process.  
30 Leviston et al. [89], in their study of 2,008 respondents in Australia, found people were willing  
31 to pay for more energy efficient homes even with higher price tags. However, willingness to  
32 pay does not necessarily equate to price premiums, and is only a suggestion of intent of  
33 consumer behaviour [60]. Despite there being a number of studies examining willingness to  
34 pay for sustainable homes, or more energy efficient homes, in Australia, and two empirical  
35 studies demonstrating value premia, the interpretation and incorporation of value  
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52 <sup>4</sup> NatHERS, the Nationwide House Energy Rating Scheme, is the dominant way in which builders of new  
53 residential homes can demonstrate that they are meeting the energy efficiency benchmark set out in the  
54 Australian National Construction Code (NCC). The NatHERS program assesses the thermal performance of the  
55 dwelling and does not consider appliances, unlike the EPC program in the UK and Europe. The rating uses a 0–  
56 10 star range, with a higher rating indicating a higher energy efficiency of the dwelling's thermal envelope. The  
57 current benchmark, the minimum for new builds, is six stars for most regions of Australia [101, 102]. The  
58 CSIRO estimate that 80% of new homes built are utilising the NatHERS assessment scheme to comply with  
59 NCC requirements [91]. The energy efficiency requirements in the NCC were introduced in 2003; therefore, by  
60 the start of 2020, an estimated 1.36 million homes (15%) should have a NatHERS rating [103].  
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1 considerations for energy efficiency in the residential valuation process are relatively unknown  
2 in the Australian context.

3 Greater energy efficiency in the residential sector is paramount for increasing the built  
4 environment's contribution to meeting Australia's emission targets. However, engagement in  
5 residential energy efficiency across the board has been limited to incentives provided by  
6 different levels of government. Lorenz et al. [4] suggested that broader engagement can be  
7 achieved by determining value relationships. In Australia and internationally, the value of  
8 energy efficiency in the residential sector has attracted significant empirical attention, but  
9 limited academic research from a valuation perspective. However, valuation has significant  
10 implications for future borrowing and the direction of increased investment in energy  
11 efficiency by homeowners. Therefore, to better understand the relationship between energy  
12 efficiency and value, this research seeks to explore:

- 13 • the residential valuation process and the role of energy efficiency initiatives on the  
14 overall value of a residential property
- 15 • the use of tools currently available to residential valuation professionals.

16 It is currently unknown how or whether energy efficiency is considered in the residential  
17 property valuation process, particularly in Australia. This research examined residential  
18 valuers' knowledge and understanding of energy efficiency, ratings and value metrics used in  
19 the valuation process. An online survey was distributed via the API, with responses collected  
20 from 59 experienced residential valuers across Australia.

## 21 4. Research approach

22 The research questions explored valuers' consideration, adjustment and value decisions in  
23 relation to energy efficiency in the residential valuation process:

- 24 • Is energy efficiency an attribute considered in the assessment of market value?
- 25 • What tools or benchmarks are utilised to assess, compare and value the energy  
26 efficiency of a home?
- 27 • What is the depth of knowledge valuers have of NatHERS, the energy efficiency rating  
28 tool for residential property?

29 The research approach comprised a structured online survey distributed by the weekly  
30 newsletter of the API (the primary Australian valuation organisation). The survey comprised  
31 structured and unstructured questions (see Table 1) with the following themes:

- 32 • characteristics or features that contribute to the value of houses and apartments
- 33 • tools and metrics used for comparison of energy efficiency in residential valuation
- 34 • consideration and knowledge of NatHERS.

35 Demographic data were collected to assist in understanding the sample. This information and  
36 the summary statistics are shown in Tables 2 and 3.

There were some limitations to this research approach. The survey attracted 59 respondents from across Australia. Respondents were recruited via a national peak body newsletter; specifically, via an online survey link. Respondents were not offered an incentive to participate. Inherent challenges were encountered with recruiting the sample from the statistical population because control of recruitment was transferred to the valuation population on an opt-in basis. Due to the nature of third-party survey distribution, the researchers had limited direct control. The anonymous survey link was also shared with heads of departments in large valuation firms within the researchers' professional networks to increase the response rate. Bias may exist if participants had a pre-existing interest in energy efficiency assessment or sustainability outcomes in residential valuation, or were acquainted with the research project because of professional association with one or more of the researchers. These factors would create bias because participants would be more engaged than non-participants.

To obtain a qualified opinion, selected questions contained a 'don't know' option to enable the respondents to choose the most appropriate answer without explicit guesswork.

The research sought a snapshot of the dominant collective opinion on various aspects of energy efficiency in residential valuation. Analysis of frequencies is presented along with indicators of the strongest sentiment. Table 1 provides an understanding of the measures utilised in the survey and background for analysis and subsequent tables and figures provide the results of the research.

Table 1. Survey Measures

<b>Dimension</b>	<b>Measure</b>	<b>Description</b>
<b><i>Experience in Valuation</i></b>	Experience in valuation practice	<i>Closed response: previously valued residential; currently value residential; and none of the above (selection of the last close-ended survey)</i>
	Certification status	<i>Closed response: Certified practising valuer, Residential practising valuer, and other</i>
	Time in valuation practice	<i>Closed response: &lt;5 years, 5–10 years, &gt;10 years</i>
	Residential type experienced at valuing	<i>Closed response: houses, apartments/units/townhouses, both</i>
<b><i>Value drivers for Residential Property</i></b>	Attributes or characteristics identified by valuers in a house or apartment, that have an effect on value	<i>Closed response: 5-point Likert scale, unipolar scale 1–5 (no effect to high effect) and 'don't know' option (e.g., location, layout, double glazing, heating system, solar panels, a/c and heating)</i>
	<b><i>Tools for assessing and comparing Energy Efficiency in residential</i></b>	Use of tools, calculators and assessment techniques in valuation practice
Current satisfaction with tools, calculators and assessment techniques		<i>Closed response: 5-point bipolar Likert scale: extremely satisfied (1), satisfied (2), neither (3), dissatisfied (4) and extremely dissatisfied (5).</i>
<b><i>Knowledge of NatHERS</i></b>	Awareness of the residential energy efficiency rating system	<i>Closed responses: yes/no and Likert scaled levels: nil, a little, some knowledge, detailed knowledge and expert knowledge</i>

1 2 3 4 5 6 7 8 9 10 11 12	Knowledge of the residential rating system and its requirements in minimum standards and whether information is requested	<i>Closed response:</i> - <i>Minimum star rating under National Construction Code (NCC): 1–10, &gt;10 stars, don't know</i> - <i>Number of stars possible for NatHERS: 1–10, &gt;10 stars, don't know</i> - <i>Provided with NatHERS information: yes, no, sometimes</i> - <i>Request NatHERS information: yes, no, sometimes</i>
13 14 15 16 17	NatHERS implications for value (minimum and above minimum standards)	<i>Closed response: Likert scale unipolar scale 1–5 (no effect on value to very high) and don't know</i>
18 19 20 21 22 23	NatHERS implications for value (minimum and above minimum)	<i>Open response: state why and what effect does it have.</i>

## 5. Results

The survey results are presented in the following themes:

- *demographics*, including valuer qualifications
- *characteristics* of energy efficiency in the home and the impact on the overall value of the property
- *tools*, including valuer knowledge and awareness of NatHERS and voluntary initiatives to assess energy efficiency in the real estate market.

Fifty-nine qualified respondents completed the survey. After confirming informed consent, qualifying questions were presented. Questions were categorised into the following themes: NatHERS, characteristics of energy efficiency, tools used to assess energy efficiency in valuation, and demographics. Demographic questions were placed at the end of the survey to minimise participant fatigue.

### 5.1 Demographics of valuers surveyed

Members who are considered CPV and RPV by the API and practising as valuers in Australia are shown alongside the responses from valuers in the survey. Although RPV indicates they can only value residential property, many CPVs also value residential property, but this is not indicated in their membership according to the API (Kristy Anderson, personal communication 26/11/2019). The response rates in each state displayed a similar spread to the population within each area, with the exception being South Australia. The results demonstrated a higher representation from South Australia (37%) compared to other states. This is likely a distribution bias as one of the researchers has strong relationships with the API and networks within South Australia that may have assisted in response rates. The second largest response rate was Queensland (24%). The majority of respondents worked in a metropolitan zone (68%), with 95% having experience within Australia only. As identified in Table 3, approximately half of

the respondents work for large firms (53%), with the remainder in small to medium sized firms. Private valuation firms comprised 75% of the sample, with 5% from banks, 5% from state governments and the remainder declining to comment.

The expertise of the valuers was measured, with 74% indicating they were experienced residential valuers currently undertaking residential property valuation. The remaining 26% have previous residential valuation experience. In terms of residential expertise, 93% of respondents indicated they have broad experience in valuing both houses and apartments.

Table 2. Demographics: Location

	All (API)* N=5,092	All (study) N=59	CPV (API) N=4,802	CPV (study) N=52	RPV (API) N=290	RPV (study) N=7
Victoria	24%	17%	24%	15%	2%	2%
New South Wales	33%	15%	32%	27%	1%	0%
Queensland	20%	24%	20%	24%	0.3%	0%
Western Australia	10%	5%	9%	5%	9%	0%
South Australia	6%	37%	5%	27%	5%	10%
Australian Capital Territory	2%	2%	2%	2%	2%	0%
<b>Total</b>		<b>100%</b>		<b>88%</b>		<b>12%</b>

\* API indicates the % of valuers in the API membership as valuers, CPV and RPV.

Note: No respondents were received for this survey from the Northern Territory (34 valuers, 1%) and Tasmania (94 valuers 2%).

Table 3. Demographics: Organisation size and type

Demographics: Size of Organisation		Demographics: Type of Organisation	
Small (<50 employees)	29%	Private valuation firm	75%
Medium (50–100 employees)	14%	State government	5%
Large (>100 employees)	53%	Bank	5%
Rather not say	5%	Other	5%
<b>Total</b>	<b>100%</b>	Rather not say	10%
		<b>Total</b>	<b>100%</b>

## 5.2 The value effects of dwelling characteristics and energy efficiency features

The survey initially examined valuers' perceptions of established characteristics in a dwelling, examining the perceived effect they have on a property's value. The housing characteristics

1 and features were compiled through an examination of hedonic studies, which examine features  
2 that have a statistical effect on value. Also included were several features commonly reported  
3 in residential valuations and some sustainability and energy efficiency considerations. The  
4 results are displayed to show consideration of characteristics when valuing apartments and  
5 detached or semi-detached houses, in addition an explanation of the characteristics and  
6 attributes are shown in Table A.1. This question was structured for the characteristics that deal  
7 with the usual dwelling attributes and characteristics and a range of energy efficiency related  
8 characteristics for houses (see Figure 1 and Table 4) and apartments (see Figure 2 and Table  
9 5). Figures 1 and 2 show the frequency of responses to the five-point Likert scale, ranging from  
10 no effect to a very high effect on value, with an additional feature of 'don't know'. Tables 4  
11 and 5 summarise the statistics of responses with the 'don't know' responses removed and  
12 provide the means and standard deviations for each.  
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17 As expected, location was the most prominent variable affecting value. A 98% response rate  
18 indicated that location had a very high effect on the value for both houses and apartments, with  
19 means of 4.98 and 4.92 respectively. Layout of the house or apartment (means of 3.81 and 4.17  
20 respectively) and amenity of the house or apartment (means of 4.19 and 4.20 respectively) were  
21 also considered to be desirable characteristics that had a high effect on value. Heating and  
22 cooling variables, including whether the dwelling had an air-conditioning unit, its orientation  
23 and type of heating system, were subsequent features in the home that commanded some  
24 consideration by valuers. These variables had a moderate to high effect on value. As expected,  
25 the type of fixed appliances within the dwelling had a moderate effect on value, with a higher  
26 mean for apartments. Conversely, the builder and building materials had inverse weighting for  
27 houses versus apartments, suggesting that houses are gauged more by the materials, while  
28 valuers give greater consideration to the builder in the case of apartments. Overall, energy  
29 efficiency characteristics, such as double glazing, solar panels, window shading, lighting,  
30 ventilation, insulation and draft proofing, were perceived to have minimal effect on value, as  
31 demonstrated in both houses and apartments in both the lower mean scores and lower frequency  
32 of response indicating an effect on value.  
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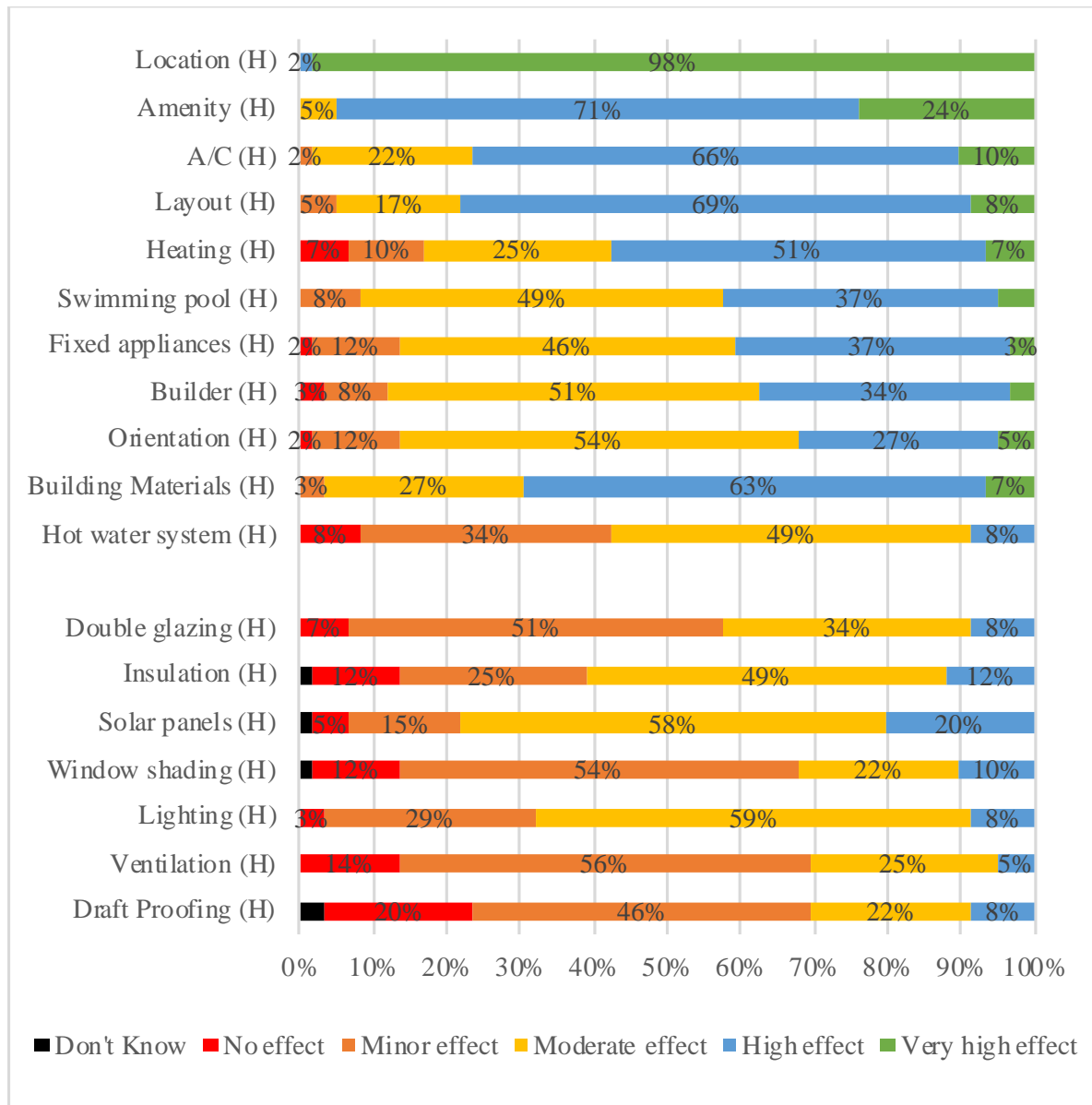


Figure 1. Variables that have an effect on value - Houses

Table 4. Housing characteristics and their effect on value

<i>Traditional</i>	Mean	Median	Minimum*	Maximum	Standard deviation	Coefficient of variation
Location	4.98	5	4	5	0.13	1.80
Amenity	4.19	4	3	5	0.51	2.98
A/C	3.85	4	2	5	0.61	3.01
Layout	3.81	4	2	5	0.66	3.09
Heating	3.41	4	1	5	1.00	3.41
Pool	3.39	3	2	5	0.72	2.88
Appliances	3.29	3	1	5	0.79	2.92
Builder	3.25	3	1	5	0.80	2.91
Orientation	3.22	3	1	5	0.79	2.86
Materials	3.73	4	2	5	0.64	2.98

Materials	3.10	3	1	5	0.84	2.85
Hot water system	2.58	3	1	4	0.77	2.26

**Energy efficient attributes**

Solar panels	3.00	3	1	6	0.85	2.77
Lighting	2.73	3	1	4	0.67	2.23
Insulation	2.68	3	1	6	0.95	2.62
Double glazing	2.44	2	1	4	0.75	2.11
Window shading	2.37	2	1	6	0.95	2.31
Draft proofing	2.32	2	1	6	1.11	2.44
Ventilation	2.22	2	1	4	0.74	1.92

\*5-point scale, removed 'don't know'

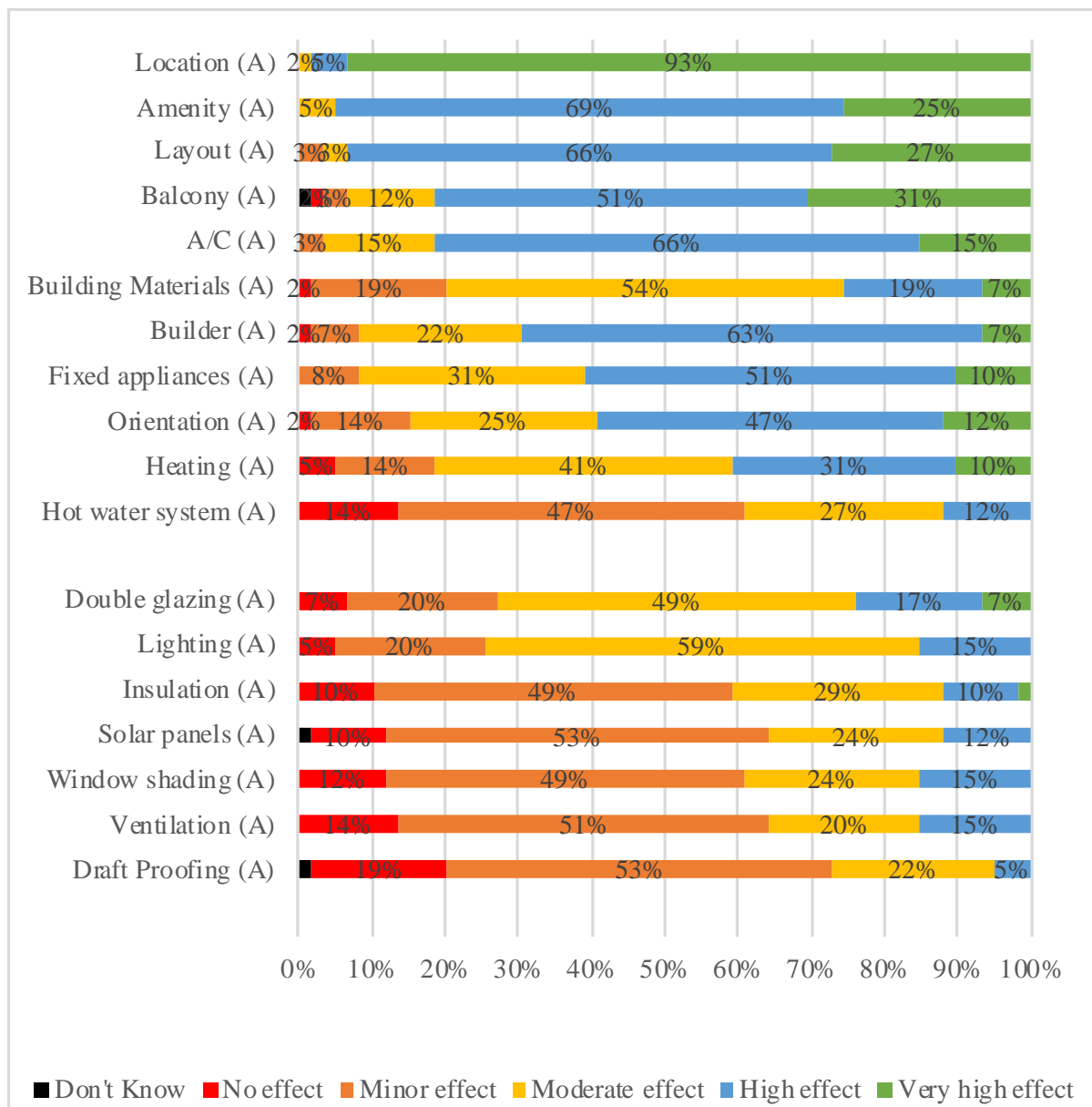


Figure 2. Variables that have an effect on value - Apartments

Table 5. Apartment characteristics and their effect on value

	Mean	Median	Minimum*	Maximum	Standard deviation	Coefficient of variation
<b><i>Traditional</i></b>						
Location	4.92	5	3	5	0.34	2.85
Amenity	4.20	4	3	5	0.52	3.03
Layout	4.17	4	2	5	0.65	3.35
Balcony	4.10	4	1	6	0.88	3.86
A/C	3.93	4	2	5	0.67	3.21
Materials	3.10	3	1	5	0.84	2.85
Builder	3.66	4	1	5	0.78	3.23
Appliances	3.63	4	2	5	0.79	3.21
Orientation	3.54	4	1	5	0.93	3.42
Heating	3.27	3	1	5	1.00	3.27
Hot water system	2.37	2	1	4	0.87	2.21
<b><i>Energy Efficiency attributes</i></b>						
Double glazing	2.97	3	1	5	0.96	2.91
Lighting	2.85	3	1	4	0.74	2.45
Insulation	2.44	2	1	5	0.88	2.28
Solar panels	2.44	2	1	6	0.95	2.38
Window shading	2.42	2	1	4	0.89	2.29
Ventilation	2.37	2	1	4	0.91	2.26
Draft proofing	2.20	2	1	6	0.92	2.12

\*5-point scale, removed 'don't know'

### 5.3 Valuers evaluation of energy efficiency in homes and use of rating tools

It was important to understand whether valuers considered energy efficiency in their valuation of homes. Accordingly, valuers were asked, 'Do you use any tools or calculators or assessment techniques to examine added value of energy efficiency in residential property valuation and, if so, what are they?' Nearly all valuers (98%) indicated no, with only one valuer indicating their use of an assessment technique. When asked to elaborate on the specific method used, the participant responded, 'my own system'. Overall, 98% of respondents did not use any tool or approach to consider energy efficiency in residential valuation.

The next question focused on valuers' perceptions of the industry tools available for assessing energy efficiency in houses. Results indicated an apathetic sentiment, with 66% of valuers indicating they were neither satisfied nor dissatisfied with the current tools to assess energy efficiency in housing valuation. Only one respondent indicated that they were satisfied, while the remainder (32%) indicated that they were dissatisfied, as shown in Figure 3. The majority do not utilise any form of assessment for energy efficiency and their satisfaction with the tools and methods to assess energy efficiency were relatively mute, as indicated by the results.

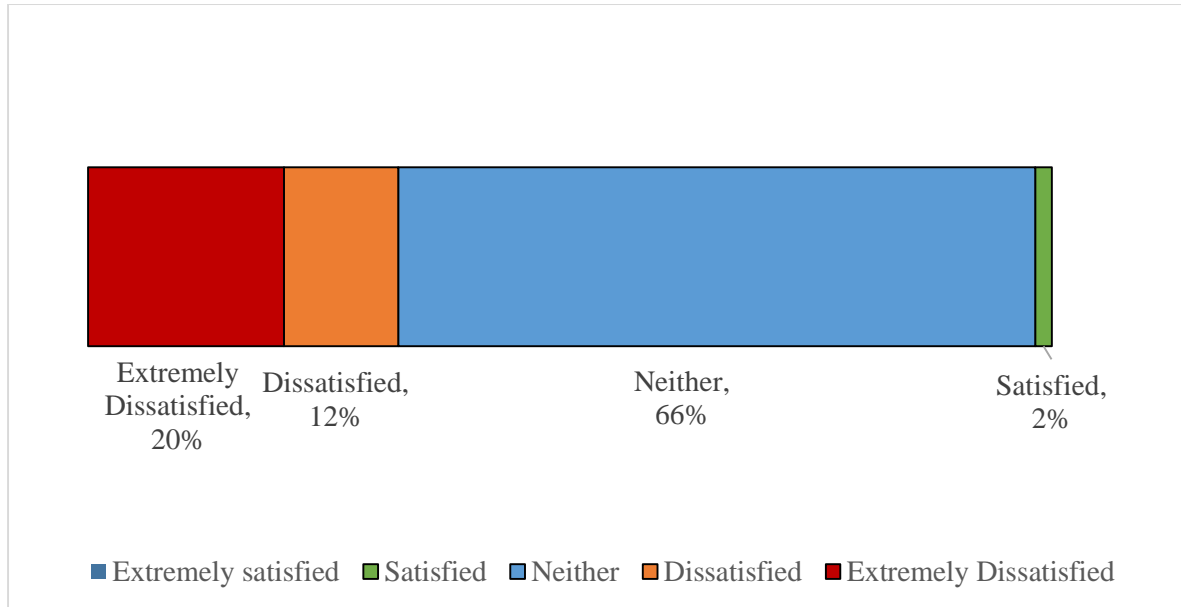


Figure 3. Valuer satisfaction with current tools, if any, and approaches to assessing energy efficiency

#### 5.4 Valuers knowledge and use of the NatHERS rating tool in valuation

Reponses to previous questions established that residential valuers were not using any established method, tool or approach to assess the energy efficiency of a home. Nevertheless, this part of the survey sought to understand the perception and knowledge of the NatHERS certification system and its utilisation in new homes.

First, valuers were asked if they were aware of the NatHERS certification scheme, with 59% indicating they were aware and 41% indicating they were unaware. Second, valuers were asked to rate their knowledge of NatHERS. As shown in Figure 4, 63% indicated they had knowledge of the NatHERS certification program. However, as shown in Figure 5, participants' knowledge is variable and perhaps limited, with 49% not being able to identify what the minimum NatHERS rating is for new dwellings under the NCC, and 65% not knowing how many stars were available under the NatHERS scheme.

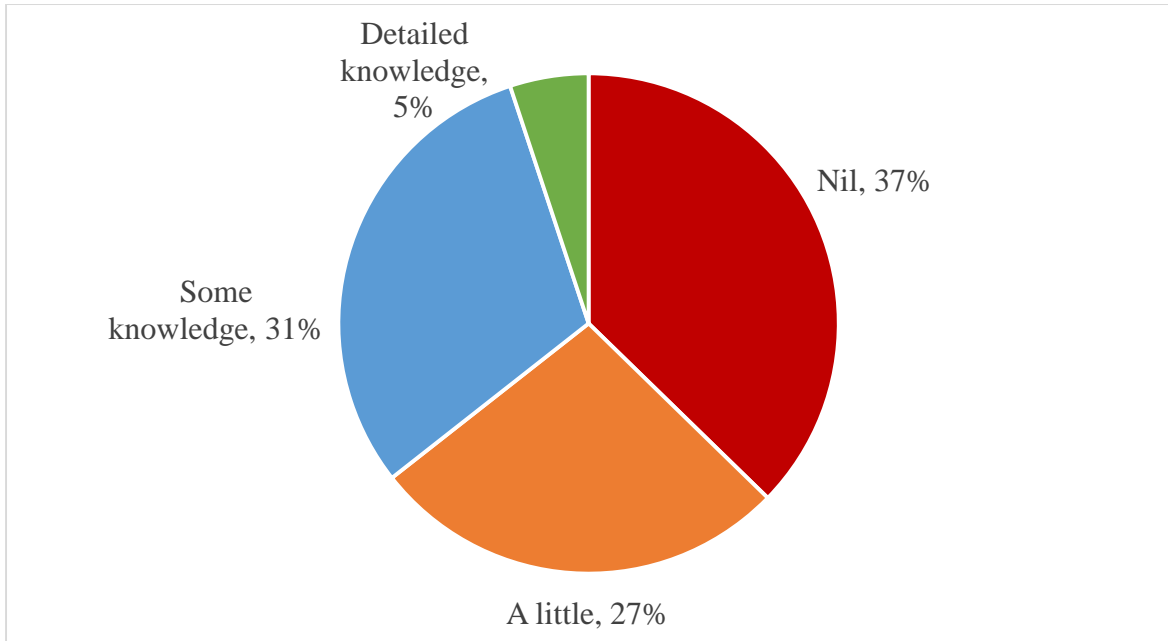


Figure 4. Valuers' self-rating of NatHERS knowledge

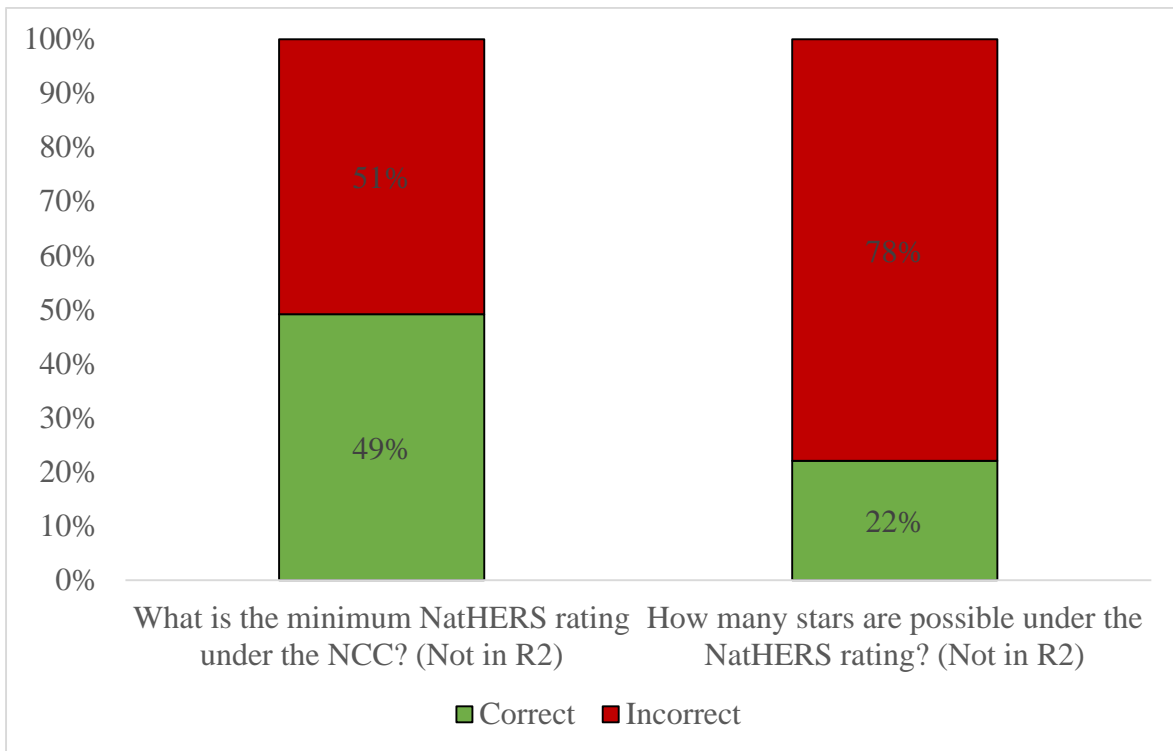


Figure 5. Valuers' awareness of NatHERS

Valuers were asked whether they were provided with information relating to a building's NatHERS rating and whether they sought this information. The results represented in Figure 6 indicate that NatHERS information is rarely provided and is almost never sought by the valuer.

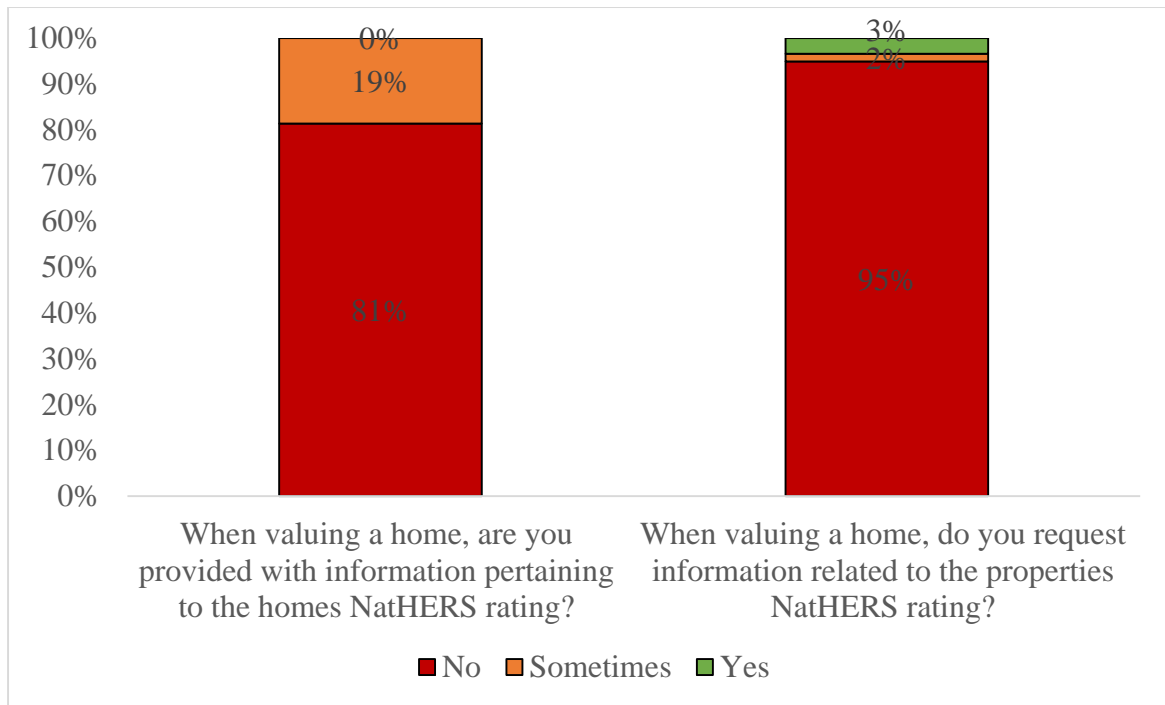


Figure 6. Provision of information pertaining to NatHERS

The limited knowledge and understanding of NatHERS suggested low levels of consideration, further compounded by a lack of seeking or receiving information about the rating. Consequently, when asked what the effect might be on value, opinions were mostly ‘don’t know’ and ‘no effect on value’ for a property that had the minimum standard (six stars) and those above the minimum standard, as shown in Figure 7.

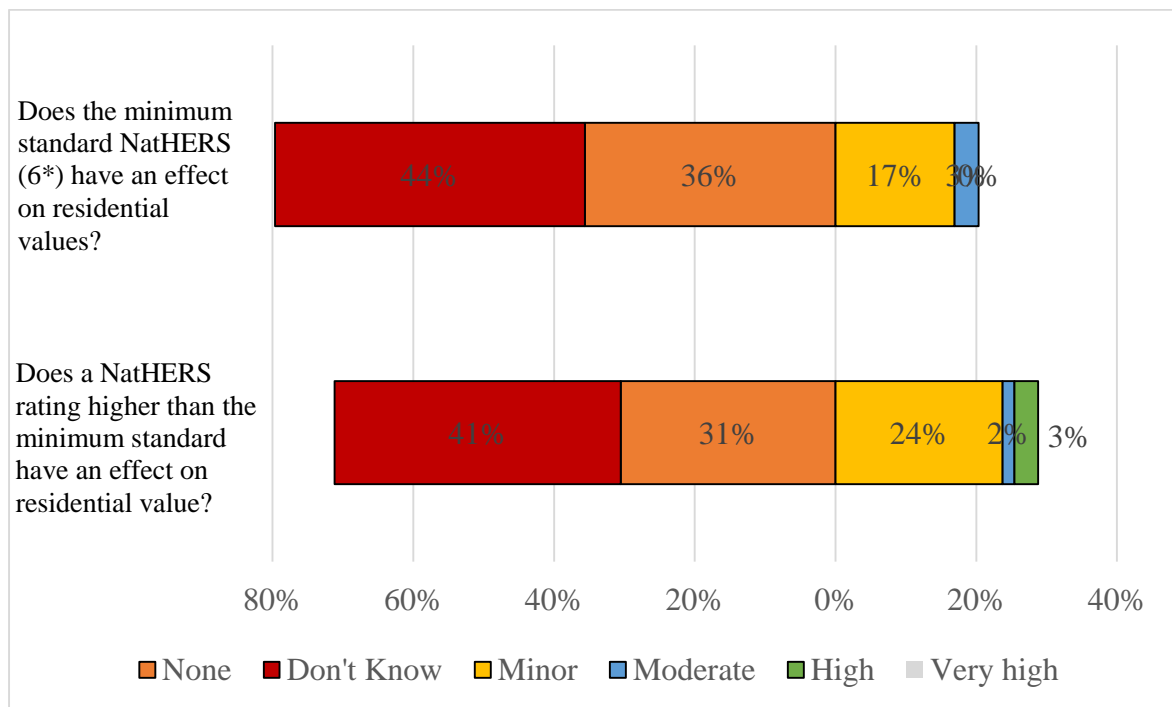


Figure 7. The effect of NatHERS ratings on value

1 Subsequent to being questioned about the impact of minimum NatHERS rating on value,  
2 valuers were asked to comment on the reasons for their response. Pertinent and contrasting  
3 comments are shown below, accompanied by the respondent's rating of NatHERS impact on  
4 valuation:  
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- 6 • 'More expensive to operate (heating/cooling), as such less desirable' (Impact answer:  
7 '1 = No effect on value')
- 8 • 'No indication market places any value on NatHERS' (Impact answer: '2 = Minor  
9 effect on value')
- 10 • 'It is not a tool/criteria we consider' (Impact answer: '6 = Don't know')
- 11 • 'NatHERS ratings are not considered in the valuation process. (Impact answer: '1 = No  
12 effect on value')
- 13 • 'I don't believe it is at the forefront of most purchasers decision to buy at present'  
14 (Impact answer: '1 = No effect on value').

15 After being questioned on the 'impact of higher than minimum NatHERS', valuers were asked  
16 to comment on the reasons for their response. A sample of comments are shown below:  
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- 18 • 'It doesn't because there is no disclosure of this' (Impact answer: '1 = No effect on  
19 value')
- 20 • 'No indication market places any additional value on NatHERS' (Impact answer: '2 =  
21 Minor effect on value')
- 22 • 'No awareness yet' (Impact answer: '6 = Don't know')
- 23 • 'A more substantial count may be seen as possible enhancement' (Impact answer: '2 =  
24 Little effect on value')
- 25 • 'Energy consumption/efficiency is still a small percentage of the overall value of  
26 dwellings' (Impact answer: '2 = Minor effect on value')
- 27 • 'It may not at the moment but as it is more widely known it will become a selling  
28 feature, particularly if the rating and costs to run a house are linked' (Impact answer:  
29 '6 = Don't know').

## 30 6. Discussion

31 The research used four key questions to provide insight into valuers' perceptions and actions  
32 in the process of valuing residential property; specifically, the effect of energy efficiency  
33 characteristics and features on value and methods used to examine energy efficiency in  
34 dwellings.  
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36 Firstly, our research confirmed that traditional characteristics are the most significant variables  
37 affecting value (e.g., location, amenity and layout). This finding aligns with the commonly  
38 established residential factors in hedonic analysis as well as with valuation literature [4, 7, 8,  
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1 58, 60, 71, 72, 73]. While much literature has noted the premiums associated with energy  
2 efficiency in residential property [59], our research found that features or characteristics  
3 relating to energy efficiency were considered to only have a minor effect on the *market value*  
4 of residential property. This supports the findings of empirical studies in Australia that  
5 identified premiums for energy efficient features [56, 57, 58]. However, in the context of this  
6 research, results should be considered with caution, as the investigation did not ask whether  
7 valuers specifically investigated these energy efficiency attributes. The prominence of energy  
8 efficiency features being lower on the list is unsurprising given the knowledge levels of valuers  
9 in addressing or consideration of energy efficiency in the valuation process, as based on other  
10 questions in the survey. The suggestion of this study that valuers have limited means and  
11 knowledge of the energy efficiency ratings and assessment of features is supported by findings  
12 in other studies that examined valuers and found low levels of consideration relating to  
13 sustainability or energy efficiency knowledge and consideration in the valuation process by  
14 practising valuers [e.g., 6, 8, 9]. As with all valuations, cost does not necessarily equal value.  
15 Similarly, initiatives in a household incorporating sustainability features in the dwelling do not  
16 necessarily translate to market value [14].  
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23 This study explicitly assessed whether tools or benchmarks were used to assess, compare and  
24 value the energy efficiency of a home, and the findings identified that the overwhelming  
25 majority of respondents (98%) did not utilise or consider any tool or benchmark for considering  
26 energy efficiency in the home. This led to a significant proportion of valuers being neither  
27 satisfied nor dissatisfied with the current tools, benchmarks or measures available to energy  
28 efficiency evaluation in homes. Nevertheless, 32% of participants indicated they were  
29 dissatisfied with the current availability of options to consider energy efficiency in residential  
30 property. This suggests that there is a need for better approaches to display or distribute the  
31 energy efficiency related information of dwellings for purchasers and valuers.  
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36 While it was acknowledged by respondents that there is a residential tool, NatHERS, valuers'  
37 actual knowledge of the rating system was low. Sixty-three per cent of respondents indicated  
38 they had knowledge of the NatHERS rating certification program. However, only 49% were  
39 aware of the minimum standard for new homes, with only 22% knowing the number of stars  
40 possible within the NatHERS rating system. These findings are comparable to the findings of  
41 Warren-Myers [7, 8], which identified that valuers perceived themselves to have knowledge of  
42 the rating system despite inconsistency or limitations in their knowledge when questioned. For  
43 example, results were highly variable when respondents were asked about the minimum,  
44 mandatory and highest levels of NatHERS ratings.  
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49 Given the widespread unfamiliarity with the NatHERS rating tool among survey respondents,  
50 it is understandable that 81% of surveyed valuers were not provided with information relating  
51 to NatHERS and that 95% did not seek such information. In light of the limited knowledge of  
52 NatHERS within the group surveyed, the valuers' perceptions of the effect of NatHERS on  
53 overall property value were based on a premise of unfamiliarity. This is indicated by the  
54 proportion of valuers who responded 'don't know' to the question on the minimum (44%) and  
55 above minimum (41%) NatHERS standards. A further 36% (minimum) and 31% (above  
56 minimum) of respondents suggested that NatHERS has 'no effect on value'.  
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1 Neither the energy efficiency features nor the current use of the NatHERS ratings system has  
2 much weight in the valuation process. Accordingly, there were very low levels of connection  
3 or consideration of their effect on the value of residential property. These findings are at odds  
4 with the recent analysis of the ACT market by Fuerst and Warren-Myers [58], who identified  
5 premiums for energy efficiency ratings (and energy efficient features in the home. However,  
6 the ACT has a mandatory disclosure program that requires all homes for sale or lease to display  
7 the energy efficiency rating, suggesting market participants are likely more aware of EER in  
8 the ACT because they are prominently displayed. Consequently, valuers are more likely to be  
9 aware of these factors in the market. Unfortunately, there was only one respondent from the  
10 ACT in this study. The contrast between the analysis of the present study and that of Fuerst  
11 and Warren-Myers [58] suggest there may be a substantial role for the introduction of  
12 mandatory disclosure in residential property Australia wide to increase the market and valuers'  
13 awareness of certification and energy efficiency. Warren-Myers [8] found that the introduction  
14 of a mandatory disclosure program in the commercial sector increased the number of certified  
15 properties, market engagement and, to some extent, improved valuer knowledge and  
16 consideration of energy efficiency features and energy efficiency ratings in valuation practice.  
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## 23 7. Conclusion

24 This research sought to examine the role of energy efficiency initiatives and, more specifically,  
25 the NatHERS energy efficiency rating on overall residential property value. It also explored  
26 the use of current tools available to residential valuation professionals for enabling energy  
27 efficiency to be incorporated into the valuation process.  
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31 The drivers of value in real estate have long been established as location, amenity and layout,  
32 which is supported by the results of the survey conducted in this research. In the context of  
33 curbing greenhouse gas emissions through energy efficiency and other sustainability measures,  
34 passive and active energy efficient design should be reflected in residential property value to  
35 enable investment and the availability of finance for added energy efficiency options in new  
36 and existing housing to drive uptake. Unfortunately, the research indicated that 98% of valuers  
37 surveyed do not use any form of energy efficiency analysis or tool in the valuation process to  
38 assist with the assessment of the contributory value of energy efficiency measures in new and  
39 existing residential property. While the NatHERS rating tool is available as an indication of  
40 energy efficiency in new homes, respondents' knowledge of NatHERS was very limited, with  
41 73% not knowing the minimum standard. The overarching valuer sentiment was that features  
42 of passive and active energy efficient design have minimal effect on overall property value.  
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49 The study concludes that the valuers surveyed do not have a means to consider applying a  
50 premium or discount in regard to the NatHERS certification and their ability to evaluate energy  
51 efficiency initiatives in a dwelling (or lack thereof) is limited, although, when prompted, there  
52 is a minimal consideration on how this affects value. Much of this is due to the lack of data and  
53 suitable comparative tools or measures that are readily available and useable in the residential  
54 valuation process. Further, valuers are not explicitly directed to consider NatHERS, energy  
55 efficiency or sustainability by the client (mostly banks). Such direction might drive greater  
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1 knowledge development and consideration of value in the valuation process, as it has done in  
2 the UK [63].

3 Our research confirms the key finding of other studies conducted in Australian. Firstly, in the  
4 context of Fuerst and Warren-Myers's [58] residential study, that there is some consideration  
5 of energy efficient features by valuers, although no explicit consideration of the NatHERS  
6 rating. Secondly, this study finds similar challenges, barriers and policy opportunities to studies  
7 that have examined valuers, such as Warren-Myers' [8] and Michl et al.'s [6] observations of  
8 the effects of the mandatory reporting scheme on the commercial sector, valuers and valuation.  
9 Finally, the results of this study are mirrored in the findings of Sayce and Wilkinson [63]  
10 indicating that the initial tentative consideration of energy efficiency features in valuation and  
11 the challenges facing Australian valuers is not unique to the Australian context. The UK and  
12 Europe have moved ahead with mandatory disclosure schemes utilising the EPC, greater  
13 recognition and development of the market and valuers' experience, meaning that knowledge  
14 and consideration in valuation practice will likely accelerate. Australia lacks such a scheme to  
15 drive change. The results suggest that for energy efficiency to be considered in residential  
16 valuation and priced more specifically by the market, mandatory disclosure and certification  
17 are essential. The mandatory disclosure of energy efficiency points directly to its importance  
18 in the home and will create an additional factor for consumer consideration. More evidence  
19 will elicit a stronger relationship between energy efficiency in the home and market values in  
20 the future, as the market utilises clear information signalling to make decisions in the purchase  
21 of a home.  
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## Appendix

Table A1. Definition of characteristics examined and their description for clarification

<i>Characteristics</i>	<i>Description</i>
Location	The effect location of the dwelling (apartment or house) has on the value.
Amenity	The effect the amenity of the dwelling or building has on the value.
A/C	Whether the dwelling has air conditioning and its impact on the value.
Layout	The effect layout may have on the value of the dwelling.
Heating	Whether the dwelling has a heating system installed and its effect on the value.
Swimming pool	The effect on value of the house having a swimming pool.
Fixed appliances	The effect the quality/type of appliances installed and fixed in the dwelling and the effect on value. In Australia these comprise kitchen cooktop, oven and dishwasher.
Builder	Whether the type of builder has an effect on value.
Orientation	Whether the orientation of the dwelling has an effect on value.
Building Materials	The effect of differences in building materials and perceived quality and the effect on the property value.
Balcony	Whether the apartment has a balcony and its effect on value.
Hot water system	The presence of the type of hot water system installed in the dwelling and the effect on value.
<i>Energy efficiency attributes</i>	
Double glazing	The effect double glazing to the dwelling has on value.
Insulation	Whether insulation levels have an effect on value.
Solar panels	The installation of solar panels to the roof of the dwelling and its effect on value.
Window shading	Whether window shades (external) are on the dwelling and its effect on value.
Lighting	The type of lighting and its effect on value, specifically noted for this category was the use of LED lighting.
Ventilation	Whether the property is deemed to have good ventilation and if this has an effect on value.
Draft proofing	Draft proofing of the dwelling to reduce drafts, noted through connection around cavities like windows and doors.