Research

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# Building Permits and Sustainability: A method for measuring the uptake of sustainability in the built environment over time

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# Building Permits and Sustainability: A method for measuring the uptake of sustainability in the built environment over time

# Report for Royal Institution of Chartered Surveyors

## Report written by:

**Dr Sara J Wilkinson**
University of Technology, Sydney
sara.wilkinson@uts.edu.au

## RICS Research team

**Dr. Clare Eriksson FRICS**
Director of Global Research & Policy
ceriksson@rics.org

**Amanprit Johal**
RICS Global Research and Policy Project Manager
ajohal@rics.org

**Anthony Walters**
RICS Global Research and Policy Project Manager
awalters@rics.org

**Pratichi Chatterjee**
Global Research & Policy Assistant
pchatterjee@rics.org

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# Glossary of Acronyms and List of Abbreviations

| | |
|---|---|
| **ABCB** | Australian Building Codes Board |
| **AS** | Alternative Solutions |
| **BASIX** | Building Sustainability Index |
| **BCA** | Building Code of Australia |
| **BEEC** | Building Energy Efficiency Certificate |
| **BRE** | Building Research Establishment |
| **BREEAM** | Building Research Establishment Environmental Assessment Method |
| **Building Permit Permission** to build compliant with BCA in Victoria | |
| **CAD** | Computer Aided Design |
| **CBD** | Central Business District |
| **COAG** | Council of Australian Governments |
| **DECC** | Department of Energy and Climate Change |
| **Development Approval Permission** to build compliant with BCA in NSW | |
| **DTS** | Deemed-to-Satisfy Provisions |
| **DCLG** | Department for Communities and Local Government |
| **GBCA** | Green Building Council of Australia |
| **GHG** | Greenhouse Gas |
| **ECO** | Energy Company Obligation |
| **EUAs** | Environmental Upgrade Agreement |
| **EPC** | Energy Performance Certificate |
| **EPBD** | Energy Performance of Buildings |
| **HIPs** | Home Information Packs |
| **HQE** | Haute Qualite Environmentale (High Quality Environmental standard France) |
| **LABC** | Local Authority Building Control |
| **LEED** | Leadership in Energy and Environmental Design |
| **NABERS** | National Australian Built Environment Rating System |
| **NCC** | National Construction Code |
| **PCA** | Plumbing Code of Australia |
| **UK** | United Kingdom |
| **UK GBC** | Green Building Council |
| **USGBC** | United States Green Building Council |

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# Executive Summary

The built environment emits around 50% of total greenhouse gas emissions (GHG) and mitigating climate change through sustainable building adaptation is a high priority. Typically 1 to 2% is added to the total stock annually and around 87% of the stock most developed countries will have in 2050, is already built. It follows that precise data in respect of the sustainability measures incorporated into new and existing buildings is recorded and quantified. The benefits are that built environment related GHG reductions may be measured and quantified over time and that policy and regulations may be made more efficient and their effectiveness may be enhanced on the basis of empirical evidence. Melbourne aims to be carbon neutral by 2020, with a target of 1,200 sustainable adaptations to deliver 38% GHG reductions. Whilst some owners use tools such as Green Star to demonstrate sustainability, most do not. Furthermore sustainable adaptations and new builds are few in number and will not deliver sufficient reductions. Large increases in gas and electricity consumption in buildings presents considerable challenges to policy makers, professional practitioners and the community and a method of calculating all building related carbon emissions is required.

The framework for quantifying emissions reductions in the total stock over time is fragmented and largely undeveloped. This project proposes a conceptual framework for quantifying the uptake in sustainability measures in the whole built environment over time. The research proposes an approach with international application. For this reason, the research used England and Wales and Australia to ascertain the advantages and disadvantages of this proposal. When a new building is proposed or an existing building altered, a building permit is required by law with building data outlined in the permit application. Expanding the collection of data regarding sustainability measures implemented could allow quantification of the type and extent of measures undertaken across the whole stock over time; capturing all works, particularly the myriad of small projects which are un-quantified in existing models and projections. Such an approach allows policy makers to track progress, and to refine and target policy making more effectively.

The research methodology was designed to ensure the four research aims were met and this project embodied characteristics associated with qualitative research. The first stage identified key stakeholder issues in respect of changing building permit data collection to include sustainability measures currently covered in the building regulations. Stakeholders were policymakers or regulators and practitioners. Each stakeholder contributed to the discussion around effective ways of measuring the uptake of sustainability measures into the built environment over time. Stage two comprised collection of the views and perceptions of the stakeholders via focus groups held in Melbourne, Canberra, Sydney, London and Sheffield. Stage three was the production of a conceptual model to identify the measures which should be collected in revised building permit data for Australia and England and Wales.

The four research aims and the key findings were;

### 1 To evaluate the viability of collecting data on sustainability measures integrated into buildings through an enlargement of data currently in building permit data.

It is technologically feasible to collect data on sustainability measures within the building permits in Victoria and NSW in Australia and England and Wales. Economically, however, costs need to be covered, and it is unclear whether this should be passed onto taxpayers, clients or owners. Socially the benefits would be to determine how society is progressing towards the goals. The benefits of achieving reduced carbon and GHG emissions would be mitigation of the predicted changes to climate and this proposal would inform society of progress. Politically, it is unlikely that there is a will to make provisions for this proposal in existing regulatory systems.

### 2 To ascertain the content and scope of building permit data collection across Australia and England and Wales and types of data collection and storage methods adopted.

Similar data is collected in Australia and England and Wales. England and Wales and Victoria have online submission of applications and collect data for the whole country or State. Online submissions offer great potential to analyse data and to assess patterns of construction works over time. Accuracy and consistency of data varies from one jurisdiction to another. There is a lack of consistency across Australia with its three tiered system of government; and a national system would need support in the Federal Government, which is highly unlikely.

### 3 To identify the barriers and scope for changing building permit data collection across Australia and England and Wales.

The barriers are perceptions about costs, additional workloads and doubts about the usefulness of the data collected. Furthermore, the issue of changes during building works were discussed and a more accurate approach might be to collect data from occupancy permits. Occupancy permits record what construction works have been undertaken.

### 4 To develop and propose a model for collecting sustainability data in building permits for all building types and land uses in Australia and England and Wales to deliver regulatory efficiency and effectiveness.

A conceptual model is proposed, starting with the submission online of applications, the second stage is the extraction of data for analysis. Data on energy and water would be collected. Further development could embrace waste and other sustainability criteria, as they are incorporated into law. The potential outputs could include an overall trend analysis in all building types. Time data allows users to see how things change over time and whether; other legislation and policy initiatives have an impact. It would be possible to see if regions and cities adopt changes at faster rates than others or whether different property types take up different measures. It would be possible also to determine whether building age is a factor in the uptake of measures.

Overall there is potential to have a system of data collection of the uptake of sustainability measures across the whole building stock using building permit data and outside of the current rating tools adopted by small sectors of the market. The environmental benefits are clear and technologically it is feasible, however economically there would be issues in terms of who pays for the costs of entering the data and; finally, there is likely to be a lack of political will to adopt such an approach. We must be mindful that we cannot manage what we do not measure.

# 1.0 Introduction

## 1.1 Rationale and background for the study

The built environment emits around 50% of total greenhouse gas emissions (GHG) and mitigating climate change through sustainable adaptation is a high priority (IGT, 2010). Typically 1 to 2% is added to the total building stock annually and around 87% of the stock most developed countries will have in 2050, is already built (Kelly, 2008). *"While buildings offer the largest share of cost-effective opportunities for GHG mitigation among the sectors examined, achieving a lower carbon future will require very significant efforts to enhance programmes and policies for energy efficiency in buildings and low-carbon energy sources well beyond what is happening today"* (IPCC, 2007). The research explores one such possibility in terms of policy innovation and the quantification of the uptake of sustainability measures into buildings over time.

It is said that measurement is imperative as we cannot manage what we cannot measure. How are we to measure the changes to the built environment over time as sustainability measures are integrated into the new and existing stock? Data in respect of the sustainability measures incorporated into new and existing buildings should be recorded and measured. The potential benefits are that built environment related GHG reductions may be measured and quantified and that policy and regulations may be made more efficient and their effectiveness may be enhanced on the basis of empirical evidence.

Australia and England and Wales were selected as case study countries for the purposes of this research. Each country has a system of building regulation and controls which must be complied with, as such they have records of building projects. They are geographically and climatically very different countries and their systems of building regulation and control are different. A comparison of the proposal in different countries was considered beneficial; as it was considered the proposal would have universal application. Furthermore it would be useful to learn the attitudes towards and perceptions of the notion from professionals' practicing in those countries.

### England and Wales Background

The United Kingdom's (UK) commitment to reduce carbon and other greenhouse gas emissions is a legal obligation, embodied in the Climate Change Act 2008 (IGT, 2010). The aim is to reduce UK emissions by 26% by 2020 (compared to 1990 levels) and by no less than 80% by 2050. It is an ambitious target. The UK Low Carbon Transition Plan sets targets for residential and non-domestic buildings as follows;

**Residential**

1. Increased residential energy efficiency to reduce emissions by 29% by 2020 (from 2008 levels).
2. All new homes to be zero carbon from 2016.
3. Smart displays to be fitted to existing meters for two to three million households by 2016; and smart meters to all homes by 2020.
4. Major retrofit programme to increase energy efficiency of existing stock.

**Non-Domestic Buildings**

1. Increase in efficiency to reduce emissions by 13% by 2020 (from 2008 levels)
2. All new public sector buildings to be zero carbon from 2018, and private sector buildings by 2019. (IGT, 2010).

According to the IGT report (2010), focusing on energy and carbon:

*'brings simplicity and rigour, and provides a focus for action and a sense of priority; but carbon reduction is not the only critical issue for the industry, nor the only measure of sustainability, and plans across all measures, addressing both mitigation and adaptation, need to be integrated'* (IGT, 2010).

## Australian Background

Akin to England and Wales, Australia too has set targets for GHG reductions. Australia ratified the Kyoto Protocol to the United Nations Framework Convention on Climate Change in 2007, agreeing to limit annual carbon pollution to an average of 108% of 1990 levels during the Kyoto period (2008 to 2012). Furthermore Australia has committed to reducing its emissions by between 5 and 15 or 25% below 2000 levels by 2020 (DOE, 2014). The five per cent target is unconditional. However the 'up to 15%' and '25%' targets are conditional on the extent of international action. Australia will reduce GHG emissions by 80% compared with 2000 levels by 2050, which is very much in line with the UK target above. Australia has some of the highest per capita emissions globally – it is fortunate given this figure that the total population is relatively small at 23.38 million (ABS, 2014).

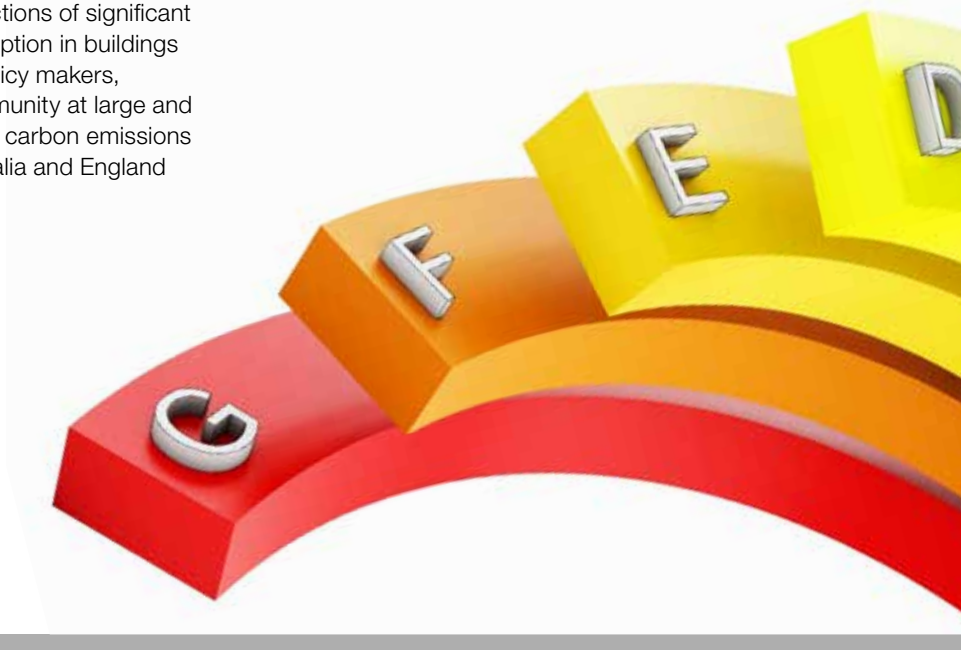
The setting of these targets is crucial for us as a society to know what it is we must strive for. Yet still we have to measure, in order that we are then able to manage. However important questions arise, such as; *how do we measure the changes which occur in our built environment?* Furthermore *how can we track the changes that are being implemented in the built environment over time?*

In addition, cities such as Melbourne, have adopted carbon neutral strategies to deliver emissions reductions and the policy initiatives are largely directed to building adaptation. Melbourne aims to be carbon neutral by 2020 and has a target of 1,200 sustainable retrofits of commercial buildings to deliver 38% GHG reductions. Whilst some owners use environmental rating tools such as Green Star to demonstrate sustainability, the majority do not. Furthermore these sustainable adaptations and new builds are so few in number that they are unlikely to deliver sufficient reductions in the timeframe on the basis of current take up (Wilkinson, 2012). However, what about the collective contribution to GHG emissions reduction of all the small retrofit and adaptation projects which do not form part of these programmes? Predictions of significant increases in gas and electricity consumption in buildings present a considerable challenge to policy makers, professional practitioners and the community at large and a method of calculating building related carbon emissions across all the stock is required in Australia and England and Wales.

## Overview

It is the case that the framework for quantifying emissions reductions in the total building stock over time is fragmented and largely undeveloped. Existing efforts largely focus on individual buildings and are measured through green building rating tools such as BREEAM in the UK, LEED in the US and Green Star in Australia. This research study investigated a methodology for quantifying the uptake in sustainability measures across the whole built environment stock over time. The proposed approach could provide a new tool for policy makers worldwide. Furthermore the research proposes an approach with an international application in developed and developing countries and across all regions.

When a new building is proposed or an existing building is altered, a building approval or permit is required under legislation with building data outlined in the permit. This system is adopted in most countries around the world, and whilst the standards adhered to do vary, the approach is similar. Building permit data has value (Wilkinson, 2011) where building permit data formed the starting point for analysis of all building adaptations in Melbourne CBD from 1998 to 2008. Such extensive modelling had never been undertaken previously and the study demonstrated that further research utilising building permit data is desirable and potentially useful. Expanding the collection of data regarding sustainability measures implemented allows quantification of the type and extent of sustainability measures undertaken across the whole stock over time; capturing all works particularly the myriad of small projects which are un-quantified in existing models and projections. Such an approach allows policy makers to track progress, and to refine and target policy making measures more effectively.



## 1.2 Research aims

The research aims for the study were as follows;

1. To evaluate the viability of collecting data on sustainability measures integrated into buildings through an expansion of data currently available in building permit data.
2. To ascertain the content and scope of building permit data collection across Australia and England and Wales and types of data collection and storage methods adopted.
3. To identify the barriers and scope for changing building permit data collection across Australia and England and Wales.
4. To develop and propose a model for collecting sustainability data for building permits of all building types and land uses in Australia and England and Wales to deliver regulatory efficiency and effectiveness.

The purpose of this RICS funded research is to provide policymakers such as the Department of Climate Change and Energy Efficiency, City of Melbourne and the Australian Building Codes Board in Australia and the Department of Energy and Climate Change in the UK, with the empirical evidence to consider if amendment to the policy instruments and legislation regarding building approval or permit data. The research develops a model for data collection that ensures regulatory effectiveness may be monitored and audited with ease. The research facilitates the efficient measurement of the uptake of sustainability measures in buildings over time and the model has transnational application.


## 1.3 Structure of the report

This research comprised four phases which were;

1. A literature review of the prevailing considerations and views with regards to measurement of sustainability criteria within the built environment globally;
2. An analysis of focus groups discussions undertaken in Australia during 2012 and 2013 to determine policy makers, practitioners and academics views and perceptions of the notion of using building permit data to measure the uptake of sustainability measures in the built environment;
3. An analysis of focus groups undertaken in England in 2013 to determine policy makers, practitioners and academics views and perceptions of the notion of using building permit data to measure the uptake of sustainability measures in the built environment; and;
4. Development of a model for collection of sustainability related data.

There are two research techniques adopted in the study and in the interests of clarity and simplicity each phase is reported in its entirety before moving on to the next phase. For each phase, the methodological issues, research method and data collection techniques are explained prior to a presentation of the results and a discussion of the findings. Limitations of the methodology are also highlighted.

A final concluding section identifies the overall conclusions, examines the research aims, highlights the key findings from the research project and identifies areas of further investigation.

## 1.4 Limitations

The limitations of this research are as follows;

The data was collected from a group of experienced stakeholders including practitioners and policy makers in Australia and England. The views that they expressed do not represent those of their employers. Further, the research did not include any analysis of existing calculations to compute building related GHG emissions.

# 2.0 The literature

This review evaluates current measurement of sustainability criteria within the built environment with a focus on measures adopted in Victoria and New South Wales (NSW), Australia and the UK. Measures are categorised into regulatory and voluntary approaches. Given that this research examines the potential to collect data on the uptake of sustainability measures into all buildings, new and existing, over time; tools that measure operational sustainability, such as "BREEAM In Use" in the UK, are excluded from the review.

## 2.1 Regulatory Approaches

The main method of ensuring minimum standards in respect of building energy efficiency and water economy are found globally in building regulations or codes. These minimum building standards initially centred on health and safety measures, for example structural design and load-bearing capacity. In this way authorities were able to reassure themselves that buildings would be structurally sound as a result of the regulations. Over time the scope of the regulations has been expanded. During the oil crisis of the 1970s, attention started to focus on energy efficiency in Europe and the UK because oil prices increased operational costs and it was determined that more efficient buildings would reduce Western reliance on Middle Eastern oil. Later still in the 1990s these minimum standards were then increased in the UK due to the rising interest and concerns about climate change and global warming. In Australia energy efficiency was introduced as part of the Building Code in 2005 for residential and in 2006 for commercial buildings. Initially the regulations were limited to new construction in most countries. However, over time the regulations have been extended to cover refurbishment works over a certain threshold.

## 2.2 Building Codes and Regulations in Australia

### 2.2.1 National Standards

The regulatory framework for building control consists of the National Construction Code (NCC), developed by the Council of Australian Governments (COAG) which incorporates all on-site construction requirements in one comprehensive code. NCC comprises the Building Code of Australia (BCA) as Volume One and Two; and the Plumbing Code of Australia (PCA) as Volume Three. The volumes, in a performance format, allow a choice of Deemed-to-Satisfy (DTS) Provisions or Alternative Solutions (AS) based on existing or new innovative building, plumbing and drainage products, systems and designs. The Australian Building Codes Board (ABCB) publishes a guide to Volume One and for Volumes Two and Three provides explanatory information boxes to assist users.

The BCA and PCA are produced and maintained by the ABCB for the Australian Government and State and Territory Governments and have the status of building regulations in all States and Territories. The goal is to facilitate efficient and nationally consistent, minimum standards of safety (including structural and fire safety), health, amenity and sustainability objectives efficiently. Proposed changes to the BCA and PCA are subjected, to a Regulatory Impact Assessment process. Each State and Territory is responsible for the implementation of the BCA. Consequently each State system is slightly different and adopts different terms, though the standards which are implemented are national. Within the BCA regional variations due to climate are permitted. The hierarchy of the BCA is shown below.

The objectives represent the reason the community want a matter regulated and refer to the requirement to safeguard people and protect adjoining property. An example is "The Objective is to safeguard the occupants from injury or loss of amenity caused by inadequate height of a room or space" (BCA, 2013). Functional Statements state how a building could satisfy the Objectives, an example is; "A building is to be constructed to provide height in a room or space suitable for the intended use" (BCA, 2013). Performance Requirements, outline the performance level to be met by materials, components, design and construction methods and compliance is mandatory. Level 4 Building Solutions has two options; Deemed-to-Satisfy Provisions (DTS) and Alternate Solutions (AS). Building Solutions set out the means of achieving compliance with the Performance Requirements. DTS Provisions include examples of materials, design factors, components, and construction methods which result in compliance. An example of a DTS Provision is: "Ceiling heights must be not less than 2.4 metres in a habitable room" (BCA, 2013). With Alternative Solutions, there is no obligation to adopt any material, component, design or construction method and this is the essence of a performance based approach. An approval authority may still issue an approval if it differs in whole or in part from DTS Provisions described in the BCA if it can be demonstrated that the design complies with the Performance Requirement.

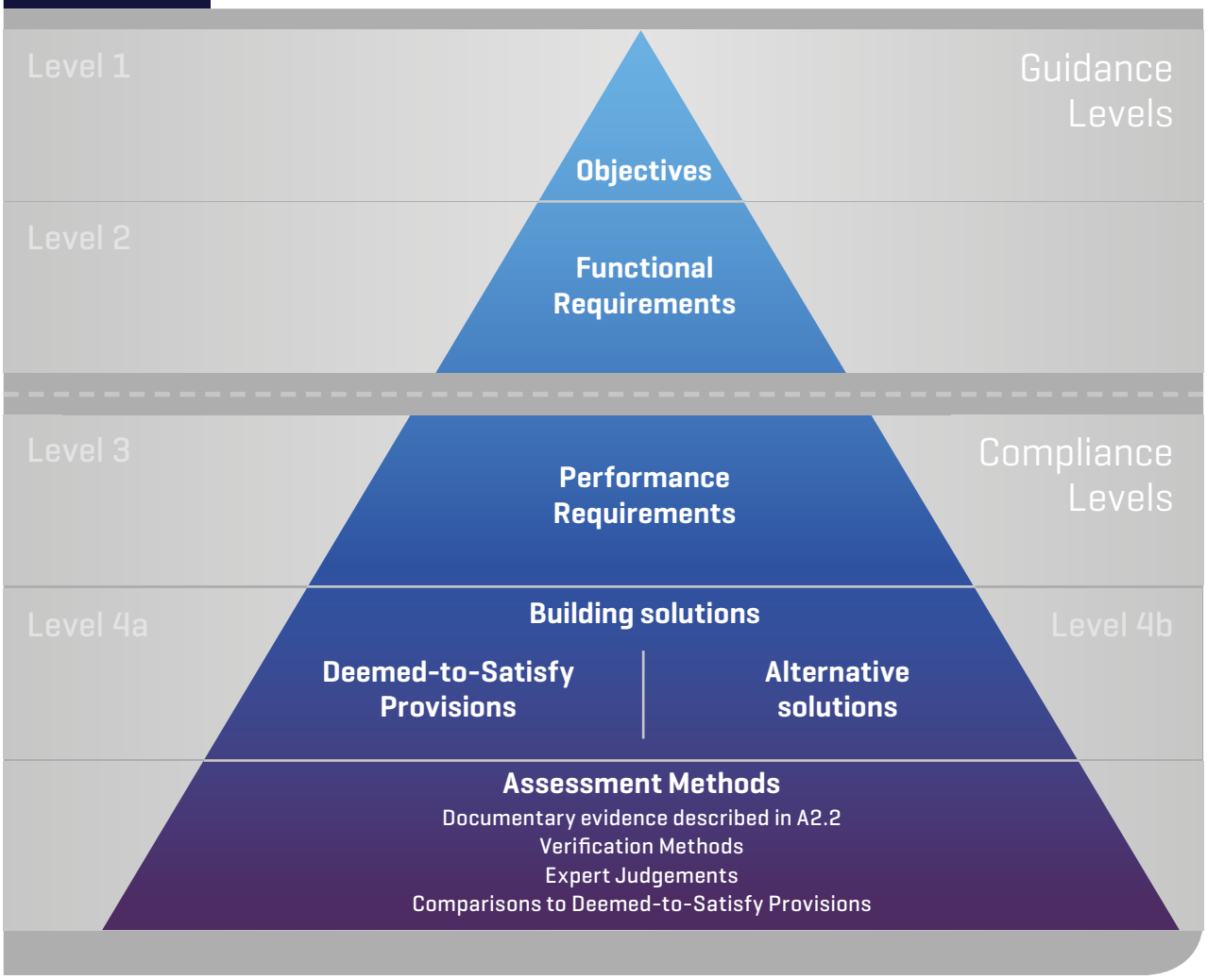
Assessment Methods determine whether a Building Solution complies with the Performance Requirements. The Assessment Methods are evidence of suitability, which allows the evidence to be submitted that a material, form of construction or design meets a Performance Requirement or a DTS Provision. Evidence may take the form of a report from a Registered Testing Authority, a current Certificate of Conformity or Certificate of Accreditation, a certificate from a professional engineer, a current certificate issued by a product certification body that has been accredited by the Joint Accreditation System of Australia and New Zealand or; another form of documentary evidence that demonstrates suitability for use.

Alternately, there is the option to use verification methods which includes calculations – using analytical methods or mathematical models; and/or, tests – using a technical operation either on-site or in a laboratory to measure performance criteria delivered by a given solution. Practitioners are not limited to using listed verification methods; provided the method establishes compliance. In decision making, an authority may consider the relevant DTS provisions or verification methods in the BCA. The 'comparison with the DTS provisions' method compares a DTS provision and a proposed building solution. If it can be demonstrated to the authority that the building solution complies in an equivalent or superior way to a DTS provision, then it can be deemed to meet the relevant performance requirement. The final option is 'expert judgement', where the opinion of a technical expert may be accepted when physical criteria cannot be tested or modelled by calculation.

The PCA contains the technical provisions for the design, construction, installation, replacement, repair, alteration and maintenance of water services, sanitary plumbing and drainage systems, storm-water drainage systems, heating, ventilation and air conditioning systems, on-site wastewater management systems; and on-site liquid trade waste management systems. The BCA and PCA have an impact on the amount of sustainability integrated into the built environment directly and indirectly throughout the lifecycle. Direct impacts include the carbon content of materials, whereas indirect impacts are levels of operating energy and water consumption enabled by the building design. This impact was formally acknowledged in Australia in 2005 when Part J energy efficiency was included for residential buildings and then in 2006 when commercial buildings were added into part J provisions.

**Figure 1** **The BCA Hierarchy**




**Source:** BCA, 2013

### 2.2.2 Building permit information

In Victoria, the building permit form requires applicants to disclose the following; description of the project, contact information, property details, builder details (if known), building practitioner details and registration numbers (see Table 1). There is a requirement to specify whether the work is new build, extension, alterations or change of use to an existing building, demolition, removal or re-erection of a building or other. The proposed building use must be stated. In addition, information regarding the cost of the work and whether a contract exists is required. If the work is staged the estimated value of the work for the stage covered by the permit is stated. The remaining information relates specifically the aspects of the construction works covered in each relevant section of the BCA. Similar information is required in New South Wales where building permits are called development approvals.

Therefore, even though sustainability has been a part of the BCA since 2005, the existing form has no requirement for building practitioners to provide any separate or specific information regarding sustainability measures that are integrated into the works whether it is a new or an existing building. This research concludes that additional fields are added to the form to include measures integrated into buildings under Part J of the BCA.

**Table 1** **Building Permit Information Required in Victoria Australia**

| | |
|---|---|
| 1 | Description of the project |
| 2 | Contact information |
| 3 | Property details |
| 4 | Builder details (if known) |
| 5 | Building practitioner details |
| 6 | Building practitioner registration number |
| 7 | Is the work - new build, extension, alterations or change of use to an existing building, demolition, removal or re-erection of a building or other |
| 8 | Proposed building use |
| 9 | Cost of the works (for staged work estimate of stages covered by permit) |
| 10 | Contract |
| 11 | Aspects of work which relate to the BCA |

**Source:** Author

### 2.2.3 Other sustainability related legislation and incentives

This section of the report sets out other legislation and incentives which exist to increase and encourage the uptake of sustainability into buildings. These laws and incentives may conflict with the conclusions of the research proposal, in that they already cover some of the areas that would be included in a new proposal.

#### a) National Australian Built Environment Rating System

The National Australian Built Environment Rating System (NABERS) rating is either a base building energy rating or whole building energy rating. A base building rating covers the performance of central services and common areas, which are usually managed by the owner whereas a whole building rating covers tenanted space. NABERS Energy rates the energy efficiency of commercial buildings by comparing them against a set of benchmarks developed using building performance data. NABERS rates performance on a scale of 0 to 6 stars. A 6 star rating is awarded for market leading performance, and represents a 50% reduction in greenhouse gas emissions or water use from a 5 star rating. A zero star rating means the building is performing well below average and has considerable scope for improvement.

#### b) Building Sustainability Index (BASIX)

The Building Sustainability Index (BASIX) aims to deliver water and GHG reductions across New South Wales (NSW) (BASIX 2014).BASIX is integrated into the planning system under the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) and State Environmental Planning Policy (Building Sustainability Index: (BASIX 2004) and (BASIX SEPP). BASIX applies to all residential buildings and forms part of the development application process in NSW. BASIX is assessed online using the BASIX assessment tool, which checks elements of proposed designs against sustainability targets. BASIX sets sustainability targets for water and energy and minimum performance levels for the thermal comfort of proposed developments (BASIX 2014). The targets are calculated based on NSW average benchmarks. The BASIX assessment tool assesses a project based on these benchmarks – taking into account regional variations such as soil type, climate, rainfall and evaporation rates.

The targets include up to a 40% reduction in potable water consumption, up to a 40% reduction in GHG and minimum performance levels for thermal comfort. The benchmarks for water are the average NSW annual potable water consumption from the residential sector measured on a per capita basis. For energy the benchmark is the average NSW annual GHG from the residential sector on a per capita basis. The benchmarks are calculated from NSW average residential water, electricity and gas consumption data collected from state-wide energy utilities by government departments. For water the NSW benchmark is 90,340 litres of water per person per annum, and for energy the NSW benchmark is 3,292 kg of CO2 per person per annum (BASIX 2014).

BASIX is a part of the Development Application or building regulations approval process in NSW. Once design plans are complete, the steps involved are to obtain a certificate by completing an assessment online. When all sections are passed a certificate is generated for which there is a payment. By generating the certificate owners commit to constructing the project as described. The certificate is then lodged and assessed by the council. If approved the building should be built as described and inspectors will attend site to survey the building and certify the project. Construction certificates are required before construction commences and the BASIX certificate is attached to the application for a construction certificate. Upon completion, the BASIX certificate is attached to the occupation certificate. The certifying authority will only issue a final occupation certificate when satisfied that the project has been built as described on the BASIX certificate (BASIX 2014).

#### c) Building Energy Efficiency Disclosure Act 2010

Under the *Building Energy Efficiency Disclosure Act* 2010, there are mandatory obligations applicable to many commercial buildings. The Act, implemented through the Commercial Building Disclosure program, forms part of a package of measures to encourage building energy efficiency developed by the Australian government. The Commercial Building Disclosure is a national program to improve the energy efficiency of office buildings and is managed by the Department of Climate Change and Energy Efficiency. The scheme shares similarities with the EU Energy Performance Certificates (Warren, 2011). Most sellers or lessors of office space of 2,000 square metres or more are required to obtain and disclose a Building Energy Efficiency Certificate (BEEC). A BEEC comprises a NABERS Energy star rating for the building, an assessment of tenancy lighting in the area of the building that is being sold or leased and general energy efficiency guidance. BEECs are valid for 12 months and must be publicly accessible on the online Building Energy Efficiency Register. From 1 November 2011 a full BEEC needs to be disclosed. Mandatory Disclosure requires minimum standards of energy efficiency and the aim is to encourage the market to take up greater energy efficiency (Warren, 2011). Analysis of the Melbourne commercial building adaptation market from 2009 to 2011 shows greater levels of energy efficiency and that this policy appears to be delivering on its aims (Wilkinson, 2012).

## d) Environmental Upgrade Agreements

Environmental Upgrade Agreements (EUAs) provide access to finance for environmental improvements to existing commercial, industrial, strata scheme and large multi-unit residential buildings in NSW and for sustainable retrofit to existing buildings in Melbourne as part of the 1200 Buildings Program (Environment NSW, 2014. City of Melbourne, 2014). It is voluntary and aimed at incentivising owners to undertake environmental upgrades. Under the NSW EUA a finance provider lends funds to a building owner for water, energy and other environmental upgrades, and this low-risk loan is repaid through a local council charge on the land. Tenants of commercial buildings can be asked to contribute to the costs (Environment NSW, 2014). However, these additional costs must be offset by their reduced energy and water bills. In Melbourne an EUA is a contract between building owner, bank and the City of Melbourne (City of Melbourne 2014). When the agreement is in place the lending body forwards the retrofit loan to the owner. The loan repayment is collected by the city through a rates charge and passed on as a loan repayment to the lender. The benefits to owners of using EUAs include:

- competitive and fixed interest rates,
- no re-financing is required,
- a repayment period of 10 years or more is available,
- the loan stays with the property if you decide to sell, and;
- the option of sharing the retrofit cost with tenants so both parties are better off financially, socially and environmentally.

Investing in retrofitting improves the value and marketability of a building and EUAs will support better performing buildings (Newell et al, 2013). The key legislation and incentive programmes in Victoria and NSW are shown in Table 2.

**Table 2** **The key legislation and incentive programmes in Victoria and NSW**

| Legislation / Incentive | Building type covered | New build | Existing | Sustainability attribute(s) covered |
|---|---|---|---|---|
| **BCA (Legislation)** | All | x | x | Energy and water |
| **NABERS (Legislation)** | Residential commercial office | x | | Energy and water |
| **BASIX (Legislation)** | Residential | x | | Energy and water |
| **BEECS (Legislation)** | Commercial | x | x | Energy |
| **EUAs (Incentive)** | Residential commercial office | x | x | Energy water and other sustainability improvements |

**Source:** Author

## 2.3 Building Codes and Regulations in England and Wales

### 2.3.1 National Standards

Building regulations encompass the rules for building work in new and existing buildings to make them safe, accessible, and to limit waste and environmental damage. Under the Building Act 1984 individuals carrying out building work must usually arrange for their work to be assessed by an independent third party to verify that the work meets the required minimum standards. This inspection can either be by a local authority building control officer or an "approved" independent inspector. In some cases installers (such as registered electricians) can self-certify that their work is compliant. The Department for Communities and Local Government (DCLG) is responsible for the building regulations and enacted a package of deregulatory changes to the building regulations in 2012 to ensure they continue to be current and effective. The DCLG's responsibilities include:

- publishing supporting guidance known as" Approved Documents" AD) to show builders how compliance with regulations may be achieved;
- overseeing and support building control organisations;
- authorising competent person self-certification schemes;
- producing circulars and letters to inform interested parties about changes to policy;
- publishing research to provide a scientific basis to underpin the regulations;
- adjudicating in disputes between people carrying out building work and a building control body through the determinations and appeals process;
- providing the secretariat for the Building Regulations Advisory Committee for England (BRAC), which advises the Secretary of State for Communities and Local Government on the exercise of power to make building regulations; and;
- being the UK lead on Construction Products Regulation (CPR) where DCLG provides guidance and represents the UK at the European Commission (EC).

The first set of national UK building standards were initiated in the Building Regulations 1965 and comprised a set of prescriptive standards that had to be adhered to. The Building Act 1984 introduced major changes with functional performance standards, set in terms of what was adequate, reasonable or appropriate, supported by statutory guidance in the ADs and competition in building control through the addition of the optional use of private sector approved inspectors. The ADs cover technical aspects of the building regulations and comprises 14 parts, which are as follows;

**A** Structural Safety;

**B** Fire Safety;

**C** Resistance to contamination and moisture;

**D** Toxic Substances;

**E** Resistance to Sound;

**F** Ventilation;

**G** Sanitation, Hot Water Safety and Water Efficiency;

**H** Drainage and waste disposal;

**J** Heat Producing Appliances;

**K** Protection from falling;

**L** Conservation of fuel and power;

**M** Access to and Use of Buildings;

**N** Glazing safety; and;

**P** Electrical Safety.

Since the 1984 Act further changes have been undertaken to improve the quality of buildings, have improved the effectiveness of the building regulations and reduced unnecessary burdens on users. On 18 December 2012 the DCLG published a summary of responses to the building regulations consultation issued in January 2012. The consultation contained proposals to improve the building regulations regime in England in respect of proposals on technical aspects of the regulations, energy efficiency of buildings (Part L), electrical safety in homes (Part P) and changes to the building control system.

Concurrently the Cabinet Office examined the potential to reduce the volume of regulation and DCLG initiated a review of the regulations framework and voluntary housing standards in October 2012. The review sought to achieve deregulation to decrease the unnecessary cost and complexity in house-building. UK Government Ministers have considered the findings and are examining the effect of the responses on a plan of action.

Within Part L of the UK Building regulations there are two sections; one deals with energy in new build whilst the other focusses on energy in existing buildings. The UK system also includes the concept of consequential improvements where, if a certain level and scope of work is undertaken, owners are required to carry out consequential improvements. In some cases, depending on the economic outcomes, owners will determine not to do certain works as the consequential works will be triggered, although there is a cap to 10% of the value of the works. Similar information is required for submitting building approvals applications in England and Wales as is outlines above for Australia.

### 2.3.2 Local Authority Building Control (LABC)

LABC are a not-for-profit, member organisation, representing all local authority building control teams in England and Wales. LABC members ensure that buildings are habitable, safe, dry and warm with over 3,000 professional surveyors and building technicians working in local authority building control. LABC is a national service provider who delivers services at a local level (LABC, 2014). LABC has an online submission of Building Control applications via http://www.submitaplan.com/ which facilitates electronic applications to all Local Authorities in England, Wales and Northern Ireland. The website is designed as a single location for public and professional users and users can track the progress of their application online. According to LABC (2014) the main features of "Submit-a-Plan" are highlighted in Table 3.

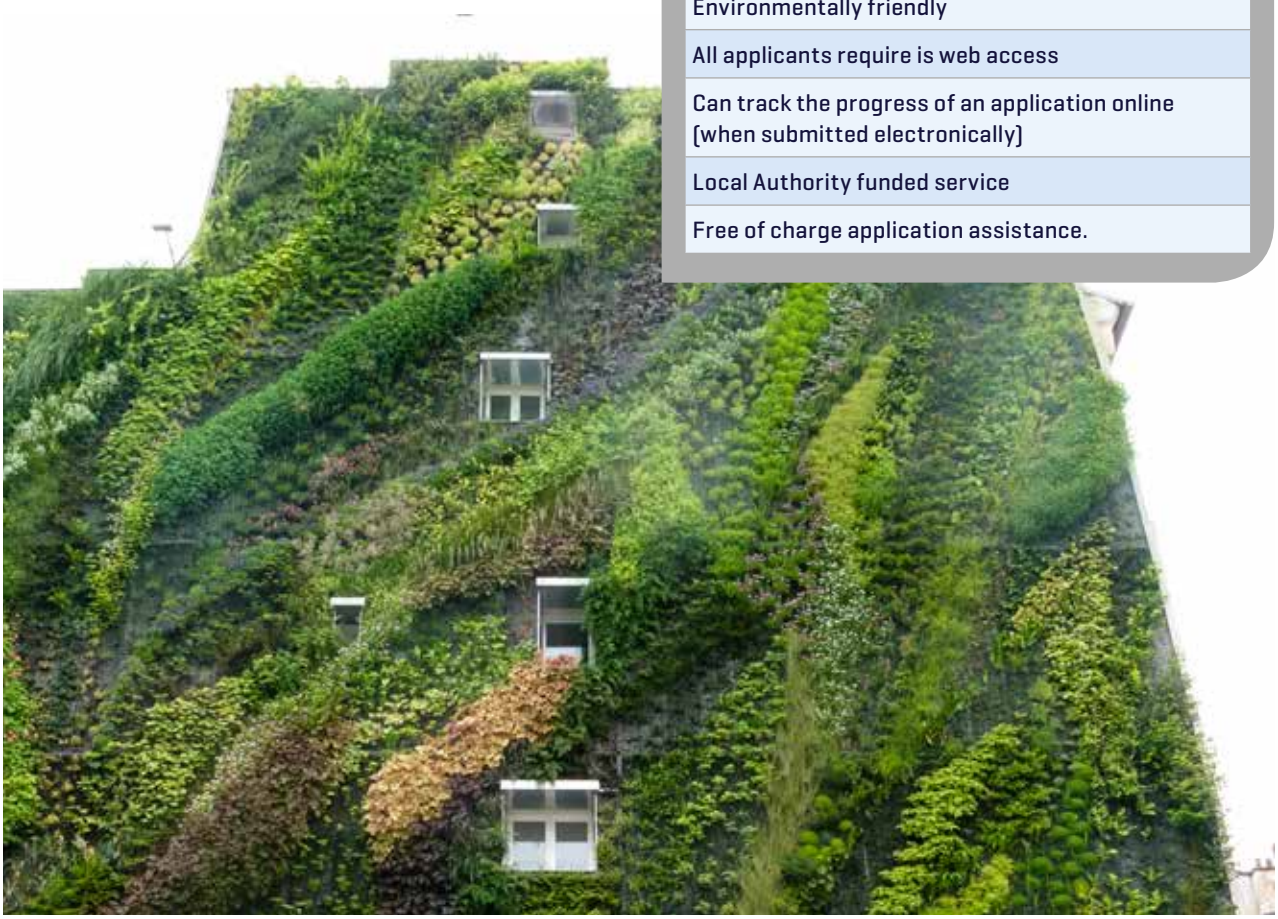
Applications can be submitted on line, tracked and amended on line. There are five steps to making an application, which are;

1. Logon;
2. Select relevant local authority;
3. Complete the on-line version of the application form;
4. Select the electronic drawings included with the application; and;
5. Submit.

Submit-a-Plan.com is a direct response from LABC services to provide feedback from its clients and partners. As more clients use CAD systems and work online, LABC identified a need for a simple electronic application system that would extend to Building Control surveyors. The concept was conceived by The City of Sunderland Building Control and then fully specified and developed in conjunction with LABC services to meet the needs and embrace the principles contained within the Modernising Local Government agenda (LABC, 2014). Currently the service is run by Resolution Data Management Ltd and funded by Local Authorities. It may be possible to adapt existing LABC software to accommodate the additional data collection proposed in this research report.

**Table 3** **Main features of LABC Submit-a-Plan**

| |
|---|
| Free of charge |
| Works with all CAD applications and paper scans |
| Eliminates sending multiple paper plans (when submitted electronically) |
| Saves time and money |
| Able to send an application at any time |
| Environmentally friendly |
| All applicants require is web access |
| Can track the progress of an application online (when submitted electronically) |
| Local Authority funded service |
| Free of charge application assistance. |



## 2.4 Other sustainability related legislation and incentives

### 2.4.1 Energy Performance Certificates

The EU Directive on the Energy Performance of Buildings came into effect progressively from 2007 and forms part of UK government strategies for confronting climate change. The principle underlying the Directive is to make energy use in buildings transparent by issuing a certificate displaying the energy rating of a property, together with recommendations on how to improve efficiency. The Energy Performance Certificate (EPC) must be provided whenever a property is constructed, leased or sold. The EPC shows the energy efficiency rating (relating to running costs) of a dwelling. The rating is presented on an A–G rating scale similar to those used for electrical appliances.

When the construction of a new building is completed, the builder or person responsible for the construction obtains the completion certificate for the owner and this is a duty under the Building Regulations. This applies to new construction and also if a building is converted into fewer or more units and if there are changes to the heating, hot water provision or air conditioning/ventilation services.

Domestic properties require an EPC on construction and some commercial buildings, with a gross floor area exceeding 500 $m^2$, are required to obtain and display an EPC on construction or conversion. The Department of Communities and Local Government (DCLG) is introducing energy and cost saving measures to make all buildings more efficient to a zero carbon standard. The measures are being applied across all European Union (EU) countries and are in line with the European Directive for the Energy Performance of Buildings (EPBD). Incrementally over time all buildings in the EU will need to have EPCs.

### 2.4.2 Code for Sustainable Homes

The Code was established as the UK national standard for the sustainable design and construction of new homes, with the aim of decreasing carbon emissions and creating a more sustainable residential stock. The Code measured the sustainability of a new home against categories of sustainable design, rating the 'whole home' as a complete package using a 1 to 6 star rating system. The Code set minimum standards for energy and water use at each level. Within England and Wales, the Code replaced the Eco Homes scheme developed by the Building Research Establishment (BRE). Given that one per cent is added annually to the total stock it would take many decades and centuries to cover all buildings.

In some way progress has faltered in respect of sustainability legislation, for example the UK Government suspended Home Information Packs (HIPs) in May 2010. In a similar move the requirement for sellers to give a sustainability certificate (either a Code for Sustainable Homes certificate or a nil-rated certificate) to buyers of newly constructed homes was also suspended. Although the Code for Sustainable Homes is still operational and remains the Government's national sustainability standard for new homes, it also faces amendments or suspension in the future. The present position is that parts of the code have been absorbed into the Building Regulations (Parts L and G). Other parts of the code are likely to be dropped as a result of the Technical Housing Standards Review process, whose recommendations have been submitted for Ministerial consideration.

According to the IGT Report (2010) with existing UK residential stock, work to identify appropriate retrofitting treatments for different forms of construction is underway, and this thinking needs to continue and to be developed at scale. There are six key considerations which are:

1. a perceived or actual reluctance on the part of householders to undertake work and the need to stimulate demand;
2. the consequent need for a suite of measures beyond the Green Deal finance package, including regulation or fiscal measures, to ensure success (see 2.4.3 below);
3. the need for an existing homes hub – a research, development, deployment and strategy group which can own the strategic research agenda for the sector, collect and disseminate the learning, and provide leadership for the industry to start planning for delivery;
4. the development of practical measures of treatment, from room by room to whole house;
5. the development of an accredited supply chain for the retrofit programme, with the necessary skills and practices; and
6. the use of the social housing stock to kick-start scale retrofit (IGT 2010).

In the England and Wales market there are barriers to the uptake of carbon reduction related sustainability measures, although some programmes such as the Green Deal are aimed at stimulating the market. Therefore some quantification of what measures are being adopted would be assist policy makers in determining whether programmes have any impact; the question is; what is the best way of quantifying the uptake of these measures?

### 2.4.3 The Green Deal

The Green Deal launched in 2013 is a UK government programme that covers the upfront cost of energy-efficiency improvements. The aim is to improve the energy efficiency of more than 14 million homes by 2020 (Wright, 2014). Households can get loans of up to £10,000 to cover the work which is then paid back over 20 years through energy bills. The energy-saving improvements include installing insulation (including solid wall, cavity wall or loft insulation), upgrading heating, fitting draught-proofing or double glazing, or installing renewable energy generation such as heat pumps or solar panels (Gov UK, 2014). The Green Deal allows owners to make energy-saving improvements without having to pay all the costs in advance. Owners are required to repay the cost of the improvements over time as the Green Deal is a loan and not a grant. The Green Deal is predicated on the basis that the savings on energy bills post improvements should cover the repayment of the loan. If owners prefer they can choose to pay for improvements in advance using Green Deal providers and certified installers. For landlords the tenant's permission is required before proceeding with improvements, whereas tenants must get the landlord's permission to make improvements. The same conditions apply to social housing.

It is possible to combine the Green Deal and other schemes to make improvements more affordable if an individual or a property meets certain conditions as follows:

- **Energy Company Obligation (ECO)** – is a programme operating alongside the Green Deal that places obligations on energy companies to provide additional help to undertake home improvements for those on benefits or a low income, or for certain "hard-to-treat properties" (cavity and solid wall insulation). The Department of Energy and Climate Change (DECC) is currently consulting with stakeholders on the future of ECO, particularly in relation to reducing the risk of fuel poverty The Consultation is open until the 16th April 2014 (DECC, 2014a)
- **Feed-in Tariffs** – payments from energy providers for those generating their own electricity (i.e. through solar PV panels, mini-hydros or wind turbines);
- **Renewable Heat Incentive** – finance to help meet the cost of installing renewable heat technology for businesses or not-for-profit organisations; and
- **Renewable Heat Premium Payment** – provision of finance to help with the cost of installing renewable heating technologies in homes (Gov UK, 2014).

Although the Green Deal is intended to be easy and relatively cheap, there have been problems with financing, with the excessive amounts of paperwork and unclear information which has deterred customers. Furthermore delays in credit checking mean it can take almost a month to complete finance, compared to 24 hours with high street lenders (Wright, 2014). These problems are confirmed by the head of a company funding the project, Mark Bayley chief executive of the Green Deal Finance Company. He expected around 1,000 households to have energy saving measures installed under the plan in its first year but conceded that by October 2013 his company, which has a start-up fund of £244m to loan to households, had processed applications worth £3.4m and signed off on only twelve (Wright, 2014). By October 2013 in total 71,000 Green Deal assessments had been completed, with 961 households signed up for Green Deal financing; a conversion rate of 1.35%. The cost of the borrowing at 7.9% per annum is lower than most personal and credit card loans; but it is more expensive than a mortgage and this may deter some applicants. It is early days for the scheme and there is growing interest and 81% of households who have a Green Deal assessment stating they have, are getting, or intend to install at least one energy saving measure. These measures will be recorded and collated by the companies involved in the Green Deal. However, it is possible that a new government might rescind the legislation or adapt it going forward and the data collected would be amended. Statistical data on the Green Deal scheme is being collected and published on a monthly basis by the Department of Energy and Climate Change to track the changes to the building stock over time (DECC, 2104b).

### 2.4.4 Other Initiatives in the Sector

The UK Green Building Council (UK-GBC) has prepared a report for DCLG investigating the potential for zero carbon in new non domestic buildings. This followed from the targets set out in the Code for Sustainable Homes to achieve sweeping emissions reductions in new homes. As part of the housing and construction Red Tape Challenge, introduced in early 2012, the DCLG published a Housing standards consultation document in August 2013 to obtain views on the results of the recent review of building regulations and housing standards including the review of the Code for Sustainable Homes mentioned above. The consultation closed on the 22 October 2013 and thus in the UK there is an ongoing review of the existing methods and approaches to the integration of sustainability into legislation. The prevailing view of the UK Conservative Liberal coalition Government is to reduce perceived 'red tape' and as a result some schemes have already experienced suspension; it is possible further suspensions will occur. There are attempts to review existing legislation to align with changes to Part L of the Building Regulations and with the proposed approach to adopting the 2016 definition of zero carbon, although there is no published decision currently.

Table 4 summarises the key legislation and incentives programmes currently available.

**Table 4** The key legislation and incentive programmes in England and Wales

| Legislation / Incentive | Building type covered | New build | Existing | Sustainability attribute(s) covered |
|---|---|---|---|---|
| Building Regulations (Legislation) | All | x | x | Energy and water |
| EPC (Legislation) | Residential Commercial | x | | Energy and water |
| Code for Sustainable Homes(Legislation) | Residential | x | | Energy |
| Green Deal(Incentive) | Residential | x | x | Energy |
| New Non Domestic Buildings | Commercial | x | x | Energy |

## 2.5 Existing voluntary methods of measurement of sustainability in the built environment

The era of sustainability rating tools started in 1990 with the launch of the UK BREEAM rating tool, followed in 1995 by the French HQE, and then by the US LEED in 2000. Initially these tools focussed on new build and a limited range of sustainability metrics. The scope, breadth and depth of the tools evolved as accounting and assessment methods developed over time. Typically the tools cover management of the building, energy and transport emissions, health and wellbeing issues, water consumption, land use and ecology and pollution and sustainable sites. There is variation in the weighting of issues which reflects the importance of the issue locally. For example, water issues are more important in drought stricken countries like Australia compared to flood prone countries like the UK (see Table 5 below). Note that BRE Global is in the process of updating BREEAM UK New Construction 2011 with a plan to launch the new version of the scheme in 2014 and new weightings and criteria are under consultation at the time of writing (BRE 2014). The predominant systems in the UK and Australia are BREEAM and Green Star which have a large geographical market penetration in the respective property markets. However they are mostly directed on new building, where typically only 1-2% is added annually to the total building stock in most markets, though this figure may have decreased given the global financial crisis since 2008. Most retrofitting work is to existing buildings and the stock is improved and upgraded with enhanced sustainability features, some of which may be captured in the tools and programmes which cover refurbishment. However, most are not captured in any way and this is a missed opportunity for policy makers to quantify changes to the entire stock over time.

**Table 5** Issue Weighting Comparison Table for New Office Construction

| Sustainability Measure | BREEAM 2011 | Green Star V3 |
|---|---|---|
| Management | 12 | 9 |
| Indoor Environment Quality | | 20 |
| Energy | 19 | 25 |
| Transport | 8 | 8 |
| Health and wellbeing | 15 | - |
| Water | 6 | 12 |
| Materials | 12.5 | 14 |
| Land use and ecology | 10 | 6 |
| Pollution | 10 | 6 |
| Waste | 7.5 | - |
| Innovation | +10* | |
| Total | 100+10* | 100 |

* Additional points available.

**Source:** BRE 2014, GBCA 2014

## 2.6 Stakeholders

Decision-making in construction and adaptation works is made more complex because of the multitude of stakeholders who influence the decision to varying degrees and at different points in the process (Ball 2002, Kincaid 2002). Ohemeng and Mole (1996) found the numerous stakeholders represented interests which are very diverse, with each having different educational and professional backgrounds, which further influence their decisions. Furthermore some stakeholders fulfil more than one role in the process.

Table 6 illustrates the relationships between the stakeholders and their respective roles and responsibilities. Table 6 includes UK and Australian professional bodies. With this research it is the policy makers and regulators who hold the power to instigate the changes to mandate and enforce the collection of additional data in building permit applications. However, clearly there are numerous other parties who have an interest and who will be affected to some extent by any proposed changes to existing systems.

One characteristic of previous research has been that researchers have taken one of the stakeholder perspectives For example, in some studies interviews and case studies have been undertaken with architects or developers and reflect their perspectives. This means that there is inevitably some bias as the researcher is ultimately investigating a view of an issue through only one perspective (Moser & Kalton, 1971). This research study obtained the views from producers and regulators who are those most directly involved in compliance of regulations. In this respect the research is limited to their perspectives.

**Table 6** **Stakeholders involved in construction and adaptation of buildings**

| Stakeholder | Description & professional affiliations | Stage in construction adaptation where decisions made |
|---|---|---|
| **Investors** | Pension / superannuation funds, insurance companies, banks, independent investors, professionals who find capital to invest | Beginning / early |
| **Developers** | Organisations that combine investment, production & marketing in whole or in part. Professionals from above bodies and others | Beginning / early |
| **Owners** | Business organisations<br>Private individuals | Beginning / early |
| **Policy makers** | Federal, State and Local Government departments | Indirect effect on decision-making in construction adaptation at all stages |
| **Regulators** | Local Authorities, Planners, Heritage, Building Surveyors, Fire engineers (Planning Institute of Australia, Institute of Fire Engineers) | During design stage (and possibly during construction if amendments are made) |
| **Producers** | Professional team – Facilities Manager, Quantity Surveyor, Architects, Engineers, contractors, surveyors, suppliers (Royal Institution of Chartered Surveyors, Australian Institute of Architects, Australian Institute of Quantity Surveyors, Australian Institute of Building Surveyors, Fire Engineers, Structural and Mechanical & Electrical Engineers) | Quantity Surveyor / Architect at feasibility stage |
| **Marketeers** | Surveyors, stakeholders, professionals who find users for buildings (Australian Property Institute, Royal Institution of Chartered Surveyors) | During design (if selling off plan) and/or construction stage |
| **Users – Corporate Residential** | Large institutional owners and users<br>Individuals<br>Business organisations<br>Occupiers | |

Source: Wilkinson, 2011

# 3.0 Research Methodology

The research methodology was designed to ensure the research aims were met. From the outline and definitions of the nature of the research problem and the research questions, this research project embodies the characteristics associated with qualitative research (Silverman, 2000:8). The main features of qualitative research are a preference for qualitative data with the analysis of words and images rather than numbers, featuring observation rather than experiment, and unstructured rather than structured interviews. This type of research has a preference for meaning rather than behaviour, a rejection of natural science as a model and, finally, a preference for inductive, hypothesis generating research (Silverman 2000:8).

## 3.1 Stages in the Research Method

The first stage was to identify and evaluate key stakeholder issues in respect of the practicality of changing building permit data collection to include measures currently covered in Part J of the BCA in Victoria and NSW and Part L in the UK. The stakeholders were policymakers or regulators (Department of Climate Change and Energy Efficiency, City of Melbourne, the Victorian Building Commission) and practitioners or producers including (RICS members, Building Surveyors). Each stakeholder contributed to the discussion around effective ways of measuring the uptake of sustainability measures into the built environment over time.

Stage two comprised collection of the views and perceptions of the stakeholders via recordings of focus groups held in Melbourne and Canberra in 2012, Sydney in 2013 and London and Sheffield in the UK in June 2013. Focus groups were adopted as a means of exploring in real time the various nuances of views expressed by experienced professionals. Recording the focus groups ensured a good flow of ideas and views (Silverman, 2000). Best practice guidelines were followed in respect of focus group procedures to ensure all participants had the opportunity to express their views (Silverman, 2000).

Stage three of this research was the production of a conceptual model to identify the measures which should be collected in revised building permit data for Australia and UK. The final stage of the research comprised the write up of the report.

Qualitative research is inductive and hypothesis generating. That is to say; as the research assimilates knowledge and information contained in the literature ideas and questions are formed these are then put directly to research participants and from this process conclusions are drawn. The limitations and criticisms of focus group data collection are that the sessions may be dominated by individuals holding strong views (Silverman, 2000). This effect can be countered with an effective focus group coordinator who is able to direct the flow of information and views to ensure all views are heard and discussed.

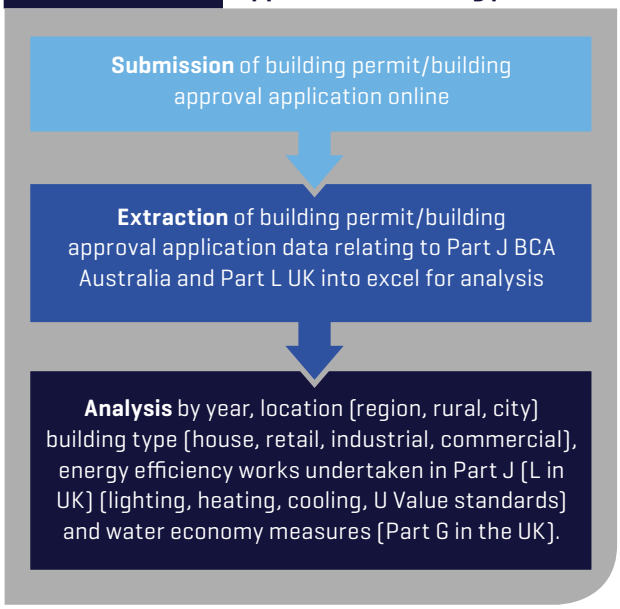
## 3.2 The conceptual model

In conclusion the conceptual model showing how building approval or building permit data could be used to measure and quantify the uptake of sustainability measures over time is shown in figure 2 below. The model starts with the submission online of application for building control approval in the UK or building permit / development approval in Australia. The second stage shows the potential for extraction of selected data for analysis. Depending on the system; applicants could either input data in text form or, they could select from a series of drop down boxes. The use of drop down lists is preferred to allow faster data inputting. For example, when inputting data on building type, applicants can select from residential, retail, commercial industrial or other.

The third stage in figure 2 shows the options for analysis based on time (years or months or seasons), by location (allowing analysis of whole cities, suburbs within cities or sections of cities and comparisons made based on rural or urban locations). Further analysis is based on building type and it is possible to sub categorise building types for example, residential could be townhouse, detached, semi-detached, high rise apartment and so on.

The next section for applicants to complete would be a list of the different energy efficiency measures undertaken. Typical measures would be identified and then other options for non-typical measures to be noted down. After energy efficiency, water economy measures would be covered in the same manner as energy measures. Further development of the scheme could embrace measures to reduce waste and other sustainability criteria as they get incorporated into building permit legislation over time.

**Figure 2** **Conceptual model showing the measurement of sustainability in the built environment using building approval and building permit data**



# 4.0 Data Analysis

## 4.1 Focus Groups Australia – discussion and interpretation

The Melbourne and Canberra focus groups were attended by 17 people and participants were drawn from a range of key stakeholders at Federal and State government level and leading practitioners working nationally and internationally. Participants included the Department of Climate Change and Energy Efficiency, the Victorian Building Commission, the Association of Refrigeration and Heating Engineers (AIRAH), leading professional consultants and Building Surveyors. A second round of Focus Groups were held in Sydney NSW and were attended by 7 people, representing professional bodies, leading property consultants and government bodies. Collectively they represent a range of perspectives of the stakeholders of the legislative environment in Australia. They were asked;

1. What they thought of including data on sustainability measures in permit data?
2. What would we use this data for?
3. What data should we collect? and
4. Which professional would be best to provide this information?

With regards to incorporating data on sustainability measures into building permits in Victoria or Development Approvals (DAs) in New South Wales, overall the responses were positive and all agreed it was desirable to come up with a solution that incorporated all building types. One Melbourne participant stated it *'has huge potential'* while another commented that he *'believe[s] that's been the biggest gap so far in the research that we are doing …we don't have any real-world, across-the-market understanding'* of what changes occur over time to individual buildings. He went to say *"having a program like this, where you've already got that data collection happening"* would facilitate the statistical analysis of the changes which are taking place in the built environment across all building types.

The data could be used to ascertain what measures are being adopted in the free market and by which building types, and in which regions or locations. If the data allowed the calculation of estimated GHG emissions reductions from the measures then overall GHG emissions reductions could be stimulated and made possible. A Sydney participant commented that *"data is everything"*; which reflects the growing importance and application of datasets in construction in Australia. The comment reveals that, with such data, it would be possible to make more informed decisions in respect of the built environment.

The next stage in the research was to ask what sort of data should be used collected. Currently the BCA is restricted to energy efficiency (Section J) and some water economy measures in the PCA. One respondent suggested a Section J report be prepared, but then some projects *'may have a dispensation for an Alternative Solution (AS) that has varied from Part J and the Building Surveyor has accept[ed] that, so you need to look into that further'*. In city centres 50-80% of high quality projects adopt AS. However this was considered to be much less in the outer areas. Preparation of separate reports was deemed an unnecessary burden on the Building Surveyor or building owner's team, as the intention of this proposal is not to drive up overall construction costs.

There is the potential with this approach to collect data to feed back into building energy models, increasing reliability and validity, as one Melbourne based participant noted;

*'A lot of work in building codes is based on energy models – let's collect the data, build it back into the models and compare where the models were right and so when they build the next lot of models they build them on the evidence rather than on gut feel'.*

The concern here was the amount of paperwork created in this proposal and who would be responsible for collating and submitting the data. Ultimately it depends on what you are trying to achieve; calculation of GHG emission reductions or a general tracking of changes and transformation in the built environment.

A number of programmes exist in Australia, for example BASIX in NSW, which covers some energy and water related sustainability measures for residential buildings only and is submitted as documentary evidence of compliance. The question arose; *would the proposed scheme duplicate this information?* The proposal is that a basic level of data would be pulled out of the building permit or development approval application for incorporation into the State wide database on building permits. However an issue arises here, because in Australia, whilst Victoria collates information on a state wide basis, NSW does not. The goal would be to adopt the State wide approach to data collation and be able to analyse data at national level.

Another issue is that many owners like to retain flexibility when the building permit is submitted. *"Clients generally try to be as non-committal as possible at building permit stage, because they want to be as flexible as possible … because sometimes you can have really long gestation periods"*. These views were reiterated by the Canberra and Sydney focus groups. In some cases, the building and development *'might change'*, and therefore the detailed design information also changes.

Although changes should be incorporated into an amended building permit, *'it may not always be'* undertaken. There is a requirement to provide data for the Australian Bureau of Statistics with regards to construction and this includes classification of all building types, the total number of buildings, the value of the construction and relationships with other classifications (ABS, 2013). With this in mind the occupancy permit, which is signed off when the building is ready for occupation, might be the place to incorporate data on the sustainability measures that have been adopted in the building. Depending on the use and type of data collected it could be a case of *'adding another layer of information gathering which is of little use'* and therefore the level and extent of data collected needs careful consideration. Another concern raised in the Sydney focus group with regards to requirements for inspections was the reliability and accuracy of the inspections. It was not unknown to the group for inspectors to miss large items of plant on their inspections of buildings. Such omissions or inaccuracies would affect the reliability of any conclusions drawn from the data.

There was concern in all the focus groups about over burdening Building Surveyors with additional and possibly, onerous, time consuming, administrative tasks. When asked, which professional would be best to provide this information, different members of the design team were discussed as well as Building Surveyors. The possibility of having an online permit system whereby the permit number and a password would allow different professionals such as, mechanical and electrical engineers, to access and submit information was debated. It was discussed in Sydney that a system of multiple choice questions for building surveyors might be an easier way for them to fulfil the obligations of supplying data in this approach. An additional advantage of this approach would be that data analysis would be made easier as the system would pre-code the data. The Victorian system was more centralised in terms of building permit record keeping than New South Wales and this is a problem with National statistics in this instance. It might be easier to initiate the system in Victoria than New South Wales in which case the issue of collecting nationwide statistics and an overview of national trends becomes more challenging.

A concern expressed in the Sydney focus group was the quality of information that might be provided especially for the very small scale projects where suppliers might be less well known and their products less reliably labelled. It was perceived that a scheme might operate more reliably for larger projects with mainstream consultants. The other issue which arose in this discussion was the possibility that users and owners frequently modify retrofit and new measures shortly after installation. For example the owner who installs water efficient shower fittings and then removes them because the water pressure is insufficient for a *'good shower'*. In this case the NABERS rating is a better tool as it measures actual energy and water usage.

There were also concerns expressed about the time frame for introducing a new system and the lead in period required to raise awareness and understanding amongst stakeholders. The scope of the system was also discussed at length especially concerns whereby some projects were outside of the system; for example defence projects. Here large scale projects are undertaken but they are not required to disclose data publicly and this would be an omission from the dataset.

Finally there was a discussion about planned maintenance activities whereby owners undertake works that improve sustainability but would not be part of a Development Approval in NSW or a Building Permit in Victoria. For example all the light fittings might be replaced with LEDs substantially reducing energy use and carbon dioxide emissions. The groups noted this type of work is being undertaken on a regular basis and the weakness was that it would not be captured in the dataset, thereby reducing its accuracy as a decision making tool. Furthermore some of this information is being collected under the BEECs, though currently only for spaces over

2,000m². However, there are calls to reduce this figure to 500m². It is unlikely the current Australian government would make this change in the legislation.

Regarding what can be done with this data, it would be possible to monitor results to ensure that policy is working and inform future improvements. In addition it would be possible to establish pathways for attaining an increased stringency of regulations, based on empirical evidence. As one legislator commented;

*'To make a case for collecting additional data through the building permit system, something that's been close to my heart for years, the key word is evidence. If we can link it to developing evidence around the effectiveness of the building regulations, and developing further building regulations, we can make the case'.*

Table 7 summarises some perceived benefits and concerns.

## 4.2 Conclusions – Australia

The data collection process explored the viability of incorporating sustainability measures into building permits in Australia. There is a need to measure how the built environment is being transformed through sustainability focussed legislation. Two focus groups identified the perceived benefits and concerns which exist in respect of the proposal to incorporate sustainability measures and it was found that there are positive aspects to the proposal depending on the scope, breadth and depth of data collected. At the detailed end of data collection the data could validate building energy modelling although this approach would place onerous data collection demands on professionals. At the other end of the spectrum if the data is too superficial little may be gained. Furthermore, variation of State based initiatives means a universal Australia wide proposal is preferred. After consideration, the occupancy permit was felt to provide more reliable data on what has been installed or retrofitted compared to what would be covered by the building permit application.

**Table 7** Summary of perceived benefits and concerns in Australia

| Benefits | |
|---|---|
| 1 | Could feedback into building energy models increasing reliability and validity |
| 2 | Allows us to see what is happening to the built environment over time |
| 3 | Online building permit application allows a range of built environment professionals to provide the information |
| 4 | Joining up a number of databases |
| 5 | Could make building regulations more effective |

| Concerns | |
|---|---|
| 1 | Building permits change during construction |
| 2 | Over burdening Building Surveyors |
| 3 | Another layer of information gathering which is of little use |
| 4 | Duplication with existing schemes |
| 5 | Quality of information provided |
| 6 | Quality of inspections made and accuracy of data |
| 7 | Size of projects – very small jobs |
| 8 | Possibility of owners and users adapting building post inspection |
| 9 | Planned maintenance works would be omitted from the dataset |
| 10 | State differences between NSW and Victoria |

## 4.3 Focus Groups UK – discussion and interpretation

The London and Sheffield focus groups were attended by eight people and participants were drawn from Professional and Academic sources as well as senior leading practitioners who work nationally and internationally. Participants included the partners and senior staff from Trident Building Consultancy Limited, Tuffin Ferraby Taylor, Watts International Group, Consultants to the Watts Group, United Sustainable Energy Agency, the Director of Built Environment Professional Groups RICS, the Associate Director of the Built Environment, Professional Groups & Forums – the Centre of Excellence for Professional Standards and academics from Sheffield Hallam University, Faculty of Environment and Development. Collectively these individuals have substantial experience and represent a range of perspectives of the stakeholders of the building regulations and legislative environment in the UK.
They were asked;

1. What they thought of including data on sustainability measures in building regulations approval data?
2. What would we use this data for?
3. What data should we collect? and
4. Which professional would be best to provide this information?

Generally UK participants could see some positive benefits in the notion of incorporating data on sustainability measures into building approvals. For example, one participant stated it could enable us *'to draw conclusions on progress towards de-carbonising'* the built environment. There was agreement that it would be useful to collate data on energy however there was also some question of how the best way to do this would be. Given the plethora of schemes in existence, which tend to measure different types of sustainability to different sectors or land uses and to different points in the building lifecycle there will be challenges. Currently no central data collation point exists and it is unlikely the disparate groups would be prepared to share their data, even if all the groups currently collate their own data to central databases.

Where aware, participants thought the UK's online system for submission of applications (see www.labc.org) and drawings could be adapted to accommodate information on sustainability measures. However, it was also thought that currently considerable information is contained on the drawings for inspectors to examine for compliance and it is not provided separately. The proposed system therefore would establish an additional time requirement, to separate the information which relates to compliance with all building regulations in order to track the integration and uptake of different sustainability measures. The cost of the time would become a responsibility of one of the stakeholders. It was agreed that if the time requirement was onerous and undertaken by owners consultants it would lead to higher professional fees. Conversely, if the task fell to public servants then the fees for building regulations approvals may increase or the burden would be passed on to tax payers. Given the current Conservative Liberal coalition government's commitment to cutting perceived 'red tape' the notion was unlikely to gain much, if any government support.

When the groups explored what the data collection point might look like, it was considered imperative to set up an explanation to applicants. The explanation would inform applicants about what data were required and why, and furthermore what it would be used for, and finally how it would benefit the community as a whole. In this way people would have a greater understanding of their contribution to national statistics.

The discussion on what form to have data collated, explored the merits of adopting simple data collection; for example, T5 lighting to all office areas or 32 no. low flush WCs to sanitary accommodation. Or, alternatively, compiling more detail that would enable insertion of data into a calculation procedure that would predict the annual consumption based on typical consumption for that land use.

There was perceived to be a possible conflict with the Conservative Liberal coalition's Green Deal legislation which was launched in 2013, but had experienced a slow take up. The Green Deal was felt to be *'a really complicated system'* by participants. The implications are that any scheme needs to be simple in order to be understood and taken up. If the data submission was mandated along with submission of the application these issues of the Green Deal take up would be circumvented. There are many similarities in the UK's Green Deal incentive structure to the Environmental Upgrade Agreements operating in the commercial market in Melbourne and Sydney, whereby the cost of improvements is offset by reduced rate loans repaid over a number of years. The other issue raised is that the Green Deal potentially should generate a lot of data which should enable government officials to track the type and amount of improvements undertaken by householders over time. However the downside is that it only applies to residential land use and not the retail, commercial or industrial land use sectors. With an election due in 2015 it was felt further inducements would appear to encourage increased take up of the Green Deal.

There were discussions on schemes such as BREEAM and the Code for Sustainable Homes which all try to encourage and recognise sustainability in the various land uses. Some schemes are limited to new build only whereas others, such as BREEAM, now include refurbishment for some land use categories. However it is not clear whether data is collated and transferred to a central point as a means of determining nationally how change is occurring. Often it was felt, that sustainability measures *'captur[ed] the bigger building projects'* with the rating schemes, and missed the opportunities from counting the collective contribution to sustainability made by a myriad of smaller projects.

Another discussion was the practice within design teams of calculating the opportunity costs of additional sustainability when using environmental rating schemes like BREEAM.

The team determine the most effective means of achieving the level desired by the client, for example, a BREEAM "Good". After this the team examine ways to achieve the next grade up, say "Excellent" and what would be the implications of adopting the most cost effective way of doing this is. This information is then presented to the client for consideration.

One of the issues facing practitioners is the confusion and ambiguity over some of the current terms used. For example, there is a perception that the definition of 'zero carbon' can vary from meaning very low carbon to no carbon. With new buildings there seems to be a clearer view of what is required, however the position with regards to existing stock is less clear *'looking at the existing stock we've got a slightly different picture and that's open to more debate'*. There was agreement that if the focus is on new build only *'its only going to scratch the surface'* of the problem of mitigating climate change through the built environment. One of the current strategies is incremental change through Part L of the UK Building Regulations up to 2020. A small change was scheduled in 2013 and again in 2016 to Part L.

As with Australia, there are a number of existing programmes in the UK which focus on energy. Energy Performance Certificates were mentioned by UK participants as a means of recording current levels of consumption and performance – the intention is to improve standards over time to a point where by 2020 all new buildings will be rated A or A+ the best performance possible in the scheme. The view was that most existing stock will be performing at level E, D and C; that is relatively poorly. Although participants saw weaknesses in the EPC approach (*'they're not the greatest thing'*), their advantage is that they are seen as 'a simple measure' and; more importantly, understood by practitioners. It appears that practitioners are constantly trying to keep abreast of changes in legislation and practice and that another scheme would be perceived as more work to them. Table 8 summarises some perceived benefits and concerns expressed by the UK participants.

## 4.4 Conclusions – UK

The data collection explored the viability of incorporating sustainability measures into building permits in the UK. Three focus groups distinguished the perceived benefits and concerns which exist in respect of the proposal to incorporate sustainability measures and observed that there are positive aspects to the proposal depending on the scope, breadth and depth of data collected. They also acknowledged a need to measure how the built environment is being transformed through sustainability focussed legislation. As with the Australian focus groups it was agreed that if detailed data was collected building energy models could be validated, although this level of information would place onerous data collection demands on professionals. At the other end of the spectrum, if the data is too superficial little may be gained. Overall, there is little will to engage in onerous data collection in the current economic and political climate. A nationwide approach is possible because of national and consistent building regulation legislation over most of the British Isles, unlike Australia.

**Table 8** UK summary of perceived benefits and concerns

| Benefits | |
|---|---|
| 1 | Could feedback into progress on decarbonising |
| 2 | Online building approval allows a range of built environment professionals to provide the information |

| Concerns | |
|---|---|
| 1 | Building approvals may be amended during construction |
| 2 | Over burdening Building Control Surveyors |
| 3 | Another tier of information collection which may be of limited use |
| 4 | Possible overlap with some aspects of existing schemes such as EPCs |

# 5.0 Findings and research questions

The research investigated four research questions. These questions are the key findings and are as follows;

1. **To evaluate the viability of collecting data on sustainability measures integrated into buildings through an enlargement of data currently in building permit data.**

   It is found to be technologically feasible to collect data on sustainability measures within the building permit and approval in both Victoria and NSW in Australia and the UK. Economically, however, the costs of the system need to be covered, and it is unclear whether the best option is to pass these costs onto to the taxpayer or the clients/building owners. Clearly, a more sophisticated level of data collection would involve higher costs whereas a simple system could incur little or no additional costs if undertaken during the submission of the application or the occupancy permit. Socially the benefits of the proposal would be the collation of data to determine as a society how far it is progressing towards the goals for GHG reductions. Environmentally, the benefits of achieving reduced carbon and greenhouse gas emissions would be mitigation of predicted changes to climate and this proposal would inform society whether there is a need to increase the scope of measures in legislation or whether Society is making adequate progress. Politically, it is unlikely that there would be any will either in the UK or Australia currently to make provisions for this proposal to be adopted in their respective existing regulatory systems.

2. **To ascertain the content and scope of building permit data collection across Australia and the UK and types of data collection and storage methods adopted.**

   The focus groups revealed that similar data is collected in Australia and the UK. The UK and Victoria currently support online submission of applications and collect data for the whole country or State. Online data submissions offer great potential to analyse data and to assess patterns of construction works over time. NSW has a more delegated system where each authority collects its own data with basic information passed to the State government. Accuracy and consistency of data may also vary from one jurisdiction to another. In NSW some jurisdictions will input paper based applications into databases. This lack of consistency across Australia with its three tiered system of government means a national system would need support in the Federal Government, which is highly unlikely.

   Some of the key data collected in Victoria is already collated into software, where analysis is undertaken. These data includes location, building ID number, date of application, address, building classification in the BCA, type of work (that is retrofit, new build demolition etc.) and a general description of the works The Victorian system could be expanded to include items undertaken to comply with Part J of the BCA, without requiring too much additional work for those inputting the data.

3. **To identify the barriers and scope for changing building permit data collection across Australia and the UK.**

   A number of barriers were identified in the focus groups to changing the existing systems. These barriers are summarised in tables 6 and 7 above. The barriers were perceptions about economic costs, additional workloads as well as doubts about the usefulness of the data collected. Furthermore, the issue of changes during the building works were discussed as many projects are subject to amendments and on this basis a more accurate approach might be to collect data from occupancy permits. Occupancy permits are issued prior to occupation and represent what construction works have been undertaken.

4. **To develop and propose a model for collecting sustainability data in building permits for all building types and land uses in Australia and the UK to deliver regulatory efficiency and effectiveness.**

   The simple conceptual model proposed in figure 2 was described above. The approach shown in the model was discussed at length in the focus groups. As a result of these discussions there was no revision to the sequence of actions which would be required under current approaches to building regulation submissions in the UK and Australia. Starting with the submission online of applications, the second stage is the extraction of data for analysis into an Excel format. As well as building information, data on energy systems and water measures would be collected. Further development of the scheme could embrace measures to reduce waste and other sustainability criteria, as they get incorporated into legislation over time.

With an advanced application data would be collected also on criteria such as age of building, construction type (cavity wall, concrete etc.), Gross Floor Area (GFA) and Net Lettable Area (NLA) and number of storeys. Collection of these data would allow if desired some analysis to be undertaken in terms of likely reduction in greenhouse gas emissions.

The potential outputs from this expanded permit data collection are numerous and are shown in an extended conceptual model (see Figure 3 below). These outputs are labelled 'Trends on uptake of sustainability measures in the built environment' in the figure. An overall analysis could show trends in all building types and gives an indication of the type of trend analysis reports which could be produced from these data. Time data would allow users to see how things are changing over time and whether, other legislation and policy initiatives are having any impact. It would be possible to see if some regions and cities are adopting changes at faster rates than others or whether different property types within land use classes are taking up different measures. It would also be possible to determine whether building age is a factor in the uptake of measures.

**Figure 3** **Conceptual model of building permit data collection of sustainability measures showing trend report attributes**

# 6.0 Overall conclusions


Both the United Kingdom's and Australia's commitment to reduce carbon and other greenhouse gas emissions is a legal obligation. The realisation of this commitment is challenging and the environment in which reductions will be delivered is fragmented, diverse and complex. The strategies by which this might be achieved in both countries will extend into many aspects of the built environment. Furthermore it is contingent for its delivery upon all stakeholders, including the property and construction professions working towards sustainable outcomes. Up to 2050, the transition to low carbon can be viewed as one of opportunity for innovation as well as growth in knowledge and understanding.

The challenges in the development of governance frameworks and tools to deliver the reductions include addressing the conflicting and different philosophies and expectations of stakeholders. Also the timeframe in which the frameworks and tools operate vary from short to medium and longer term. With some frameworks and tools it is necessary to act now in order to implement the changes in time for 2050. Not only are frameworks and legislation needed but also radical behavioural change in all areas and levels of society as well as courageous politicians to propose changes to legislation (Bell, 2014). This research proposal is but one of a myriad of options for delivering sustainability into the built environment over time. If implemented, it could provide some information to policy makers and regulators with regards to the changes which are occurring to the built environment. The quality and accuracy of that information is dependent on the amount of information extracted from building approvals and permits. Its advantage is that it builds on an existing system which is well known to all stakeholders.

Some of the recommendations in this report are, by the nature of its scope, directed to the Governments of Australia and the UK. Further, due to the scale of the challenge, only Government can set the framework for action and instigate policy change and innovation.

This research has found that for those already involved, and the many still to be involved, there is a need for simplicity. Currently, the path through all the intricacies around the move to low carbon is not clear. There are a plethora of initiatives; some of which affect different periods of the building lifecycle, and some of which relate to particular land uses and not others. For effective action the professions and Government needs to work together to find that simplicity and intelligibility in order to enact policies and plans that will work. In addition there is a lack of conviction and a degree of scepticism that some of the schemes, such as the UK's Green Deal, are well considered and are working.

Although in the focus groups the proposal to use building regulation approvals / building permits / development approvals was welcomed as having merit and potential, in the current climate it is unlikely to be taken up. This lack of central data based on what is actually happening in the built environment over time to inform policy makers is a weakness for decision makers. It is a weakness because the policy making and assumptions behind them are not based on actual historic patterns of change.

The conclusion of this research does not involve incentivising any stakeholder; it merely seeks to ascertain what the market is doing over time across all sectors. The market failure needs to be addressed so that building owners and occupiers are incentivised to become customers for commercial offers aimed at carbon reduction and other initiatives. However, it still remains the case that these initiatives need to be measured. If they are not measured, they cannot be managed. In the meantime, there is a powerful sense of pent up potential in the industry.

For the construction and property professions, one of their roles is to firstly lead by example and to de-carbonise their own businesses and practices, secondly to deliver buildings that enable members of their societies to lead more sustainable and energy efficient lives and; thirdly to supply the infrastructure which enables the supply of clean energy and sustainable practices in other areas of national economies. The means of delivering these changes is to innovate, to search for new ways of working and to acquire new knowledge and skills in sustainable property and construction throughout the lifecycle.

These opportunities are present at every stage of building lifecycles, and although there is much to resolve up to 2050, there is also much that can be done, predominantly to existing buildings.

This research has examined the potential to use the existing building approval system in the UK and the building permit / development approval systems in Victoria and New South Wales, Australia. Whilst there was support and acknowledgement of benefit in both countries in using an infrastructure that already exists to collect data to quantify the sustainability measures that get taken up into the stock over time, there are also some difficulties in this approach. The main challenges are that there are a number of approaches currently being rolled out in both countries and another approach may be perceived to add little overall benefit as well as being another scheme for practitioners to acquaint themselves with.

The issue of measurement also throws up the challenge of what to measure, and; whether absolute measurements for improvements to the whole stock can be made. It seems that a relative measurement would be possible; for example x number of buildings or a total area of whichever building/land use type has undergone retrofit of lighting, heating systems, HVAC in each year or location. From such data it would be possible to see trends in retrofit and also saturation of markets. However, there still needs to be a will to collate and analyse such data. Currently governments in both UK and Australia are moving away from 'red tape' and whilst this information could inform policy making it would also involve more bureaucracy and on this basis is likely to find little support

# 7.0 Further study

This study canvassed the views of a limited number of stakeholders involved in building regulation policy making and enforcement in Australia and the UK. Many positive views were expressed by the participants and if an overall framework is to be developed a number of questions need to be addressed such as;

- ***Who would collect and analyse data – what are the options?***
- ***Which metrics are essential?***
- ***What data is less essential?***
- ***What would trigger the process?***
- ***What is the relationship to EPCs, BEECs, SAP ratings, NABERS, BASIX, soft landings, Carbon Buzz and other assessment tools (BREEAM and Green Star), climate change monitoring and so on?***
- ***How would the analysis process be managed, and by whom?***
- ***What are the cost implications? Is there a low cost low detail option available?***
- ***Would BIM or Building Management Systems information partly help to resolve the data handling issues? And finally;***
- ***How does this relate to the whole notion of international measurement standards?***

Possibly the proposal to use building permit data as a means of quantifying the uptake of sustainability measures across the whole built environmental stock is an idea whose time may come at some point in the future. The clock to 2050, however, is ticking ever more loudly and the imperative to act increases.

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# Appendix A: Research Participants

## Australia

**Richard Adler**, Associate QS/PM, Area3 Consulting, Sydney.

**Philip Alviano**, Sustainable Building Advisor, Master Builders Association of Victoria, 332 Albert St, East Melbourne 3002, Australia.

**Matthew Brook**, Associate Director Chartered Building Surveyor, McLachlan Lister Pty Ltd Hill International (Australia) Pty Ltd.

**Rob Enker**, Specialist Sustainability Advisor Victorian Building Authority Goods Shed North, 733 Bourke Street, Docklands, 3008.

**John Goddard**, J Goddard & Co. Building & Sustainability Consultants.

**Dr Joeren van der Heijden**. Assistant Professor Australian National University, Research School of Pacific and Asian Studies, Regulatory Institutions Network (RegNet), Canberra, ACT 0200, Australia and University of Amsterdam, Faculty of Law, Oudemanshuispoort, 4-6, 1012 CN Amsterdam, The Netherlands.

**Bob Hird**, Hartigan Bolt. 75 Miller St North Sydney NSW 2060 Australia.

**Collin Jennings**, RICS Government Liaison, RICS Oceania Sydney Australia.

**Judith Knott**, JCK Consulting Pty Ltd., Sydney, Chartered Building Surveyor. Level 5, Science House, 157-161 Gloucester Street, The Rocks NSW 2000.

**Joseph McCabe**, PE, LEED AP+ Senior Engineer, Philip Chun North America, Inc., 7935 W. Badura Avenue – Suite 1045 – Las Vegas, Nevada, USA – 89113-2158.

**Ros Pascoe**, Principal Building Surveyor, BCA Certifiers (Aust) Pty Ltd, Phillip, Canberra, ACT Australia.

**Doug Rayment**, Associate Director, Davis Langdon, An AECOM Company Level 21, 420 George Street, Sydney, NSW 2000.

**Michael Skelton**, Business Integration and Market Strategy Buildings + Places, Global AECOM Level 45, 80 Collins Street, MELBOURNE, VIC 3000.

**Phil Wilkinson**, CEO AIRAH Australian Institute of Refrigeration Air Conditioning and Heating, Melbourne Victoria Australia.

**Geoff Woolcock**, Manager MBA Building Services, Master Builders Association of Victoria, 332 Albert St, East Melbourne 3002.

## UK

**Alan Cripps**, Associate Director of the Built Environment, Professional Groups & Forums – the Centre of Excellence for professional standards.

**Brad Hook**, Chief Executive Officer United Sustainable Energy Agency.

**Matthew Lown**, RICS Partner Tuffin Ferraby Taylor LLP2 Throgmorton Avenue London EC2N 2DG.

**Alan Muse** FRICS, Director of Built Environment Professional Groups RICS UK.

**Mike Ridley** MA MSc FRICS. Consultant Watts Group PLC 1 Great Tower Street, London EC3 5AA.

**Stuart Smith** MRICS PGCLT MRICS MIFireE FHEA. Head of Recruitment, Faculty of Development and Society, Sheffield Hallam University, City Campus, Howard Street, Sheffield, S1 1WB.

**Micah Wilson** BSc BSc MBA MBEng Building Surveyor / Building Control Officer Department of the Built Environment Sheffield Hallam University, City Campus, Howard Street, Sheffield, S1 1WB.

 

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### RICS HQ

Parliament Square, London SW1P 3AD
United Kingdom

### Worldwide media enquiries:

**e** pressoffice@rics.org

### Contact Centre:

**e** contactrics@rics.org
**t** +44 (0)24 7686 8555
**f** +44 (0)20 7334 3811

**United Kingdom**
Parliament Square
London SW1P 3AD
United Kingdom
t +44 (0)24 7686 8555
f +44 (0)20 7334 3811
contactrics@rics.org

**Europe**
(excluding United Kingdom and Ireland)
Rue Ducale 67
1000 Brussels
Belgium
t +32 2 733 10 19
f +32 2 742 97 48
ricseurope@rics.org

**Asia**
3707 Hopewell Centre
183 Queen's Road East
Wanchai
Hong Kong
t +852 2537 7117
f +852 2537 2756
ricsasia@rics.org

**Americas**
One Grand Central Place
60 East 42nd Street
Suite 2810
New York 10165 – 2811
USA
t +1 212 847 7400
f +1 212 847 7401
ricsamericas@rics.org

**South America**
Rua Maranhão,
584 – cj 104
São Paulo – SP
Brasil
t +55 11 2925 0068
ricsbrasil@rics.org

**Africa**
PO Box 3400
Witkoppen 2068
South Africa
t +27 11 467 2857
f +27 86 514 0655
ricsafrica@rics.org

**Ireland**
38 Merrion Square
Dublin 2
Ireland
t +353 1 644 5500
f +353 1 661 1797
ricsireland@rics.org

**Oceania**
Suite 1, Level 9
1 Castlereagh Street
Sydney, NSW 2000
Australia
t +61 2 9216 2333
f +61 2 9232 5591
info@rics.org.au

**Middle East**
Office G14, Block 3
Knowledge Village
Dubai
United Arab Emirates
t +971 4 375 3074
f +971 4 427 2498
ricsmenea@rics.org

**India**
48 & 49 Centrum Plaza
Sector Road
Sector 53,
Gurgaon – 122002
India
t +91 124 459 5400
f +91 124 459 5402
ricsindia@rics.org


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