Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings

Draft Report

20th September 2019
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Executive Summary
1. Executive summary

Summary of report findings

- Existing commercial buildings in Australia currently contribute around 10% of greenhouse gas emissions and present an important opportunity to reduce emissions and energy consumption, improve energy productivity, and minimise businesses’ energy bills.
- Cost-effective solutions already exist but existing commercial buildings face a variety of barriers to energy efficiency and onsite renewable energy improvements.
- A complementary approach comprising: information and capacity building, finance and incentives, and regulation can be used to address the various barriers.
- Six policy options have been prioritised, all of which have positive benefit-cost ratios (ranging from 1.5 to 2.7) indicating that they are likely to be cost-effective.
- A further benefit cost assessment will be undertaken in time for the final version of this report, which will identify the benefits and costs in more detail.
- There is scope in each of the policy options to increase the ambition and impact of the interventions over time.
- The prioritised policy options contain a package of proposed interventions. These are expected to be further defined during a subsequent detailed policy design phase which is beyond the scope of this report.

Background to this report

The Department of the Environment and Energy (DoEE) and the Council of Australian Governments (COAG) Energy Council are seeking to identify the most compelling policy options to help deliver emissions reductions and energy efficiency improvements in Australia’s existing commercial (non-residential) building stock. In February 2019, Energy Ministers agreed on the Trajectory for Low Energy Buildings, a national plan that aims to achieve zero energy and carbon-ready buildings in Australia, as a key initiative to address Australia’s 40% energy productivity improvement target by 2030 under the National Energy Productivity Plan.

The policy options considered in this report focus on existing commercial buildings and set out practical options that will inform the COAG Energy Council’s plan for achieving its zero energy and carbon aim. This report was prepared by EY for the Department of the Environment and Energy with contributions from Strategy Policy Research (SPR) and ClimateWorks Australia. The policy options were refined with valuable input from industry and government stakeholders.

This report outlines:

- **Recommendations** for maximising the impact of the prioritised policy options.
- **Key drivers** of energy consumption and emissions in existing commercial buildings in the context of zero net emissions goals and the global transition to a low carbon economy.
- An overview of the commercial buildings market, setting the scene for the consideration of policy options.

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Key outcomes from stakeholder engagement workshops held with government and industry stakeholders across Australia, which informed the prioritisation and refinement of potential policy options.

An assessment of the prioritised policy options, including a high-level benefit/cost analysis.

This report builds on previous analysis into the barriers and potential policy options. The ‘Phase 1 Report’ (provided as Appendix B) outlines:

- **Barriers** to transitioning to more efficient and low carbon energy consumption. Existing commercial buildings encompass diverse characteristics including different building classes, locations, and tenure arrangements that create unique barriers to action.

- **Existing policies** in relation to existing commercial building energy efficiency, including national and international examples.

- **Potential policy options** to improve the energy and carbon performance of existing commercial buildings.

**Scope of work**

The Scope of Work was limited to consideration of existing commercial buildings and included a high-level identification of policy options and a benefit cost analysis. The impacts of policy options were modelled independently and did not consider the collective net emissions reduction potential of all policy options or the comparative additionality of each option. The assumptions and limitations of this analysis are described in Section 7.1 of this report. The prioritised policy options are described at a high-level, as detailed policy and program design is beyond the scope of this work.

The approach undertaken to deliver the Scope of Work is summarised in the diagram below.

**Recommendations**

The focus of this work has been on identifying and framing a set of policy options that can underpin energy and emissions reductions for existing commercial buildings. As the COAG Energy Council considers its plan to deliver zero energy and carbon ready buildings in Australia, it is recommended that:

- **An objective** for energy and emissions reduction for existing commercial buildings be endorsed, at least in line with Australia’s commitments under the Paris agreement.

- The package of six prioritised policy options is adopted in a **coordinated** manner.
Scene setting for commercial building considerations

Drivers for net zero emissions

The Paris Agreement established a global goal of limiting global warming to less than 2°C above pre-industrial levels. This requires significant action to reduce emissions to net zero by the second-half of this century. Developed countries, such as Australia, are expected to transition to a low carbon future as soon as possible. This is reflected in Australian States’ and Territories’ emission reduction targets which include aims to achieve zero net emissions by 2050.²

Commercial buildings (such as offices, shops, hotels, restaurants, warehouses, schools and hospitals) are responsible for approximately 10% of Australia’s greenhouse gas emissions³ and so represent a significant opportunity for emissions reductions. Fortunately, many of the technologies required to achieve carbon neutral buildings already exist and are already cost-effective. For example, upgrades to lighting and heating, ventilation and air conditioning (HVAC) equipment can generate energy savings resulting in positive financial returns through reduced energy bills.

Barriers to energy and carbon reduction

There are a variety of challenges in the commercial buildings sector that impede the uptake of energy efficiency measures, despite the availability of technical solutions and apparent cost-effective nature of energy efficiency measures. Key barriers are summarised in the table below and are further described in Appendix B.

Table 1 - Barriers to energy efficiency

| Diversity of commercial building types and markets. This can make many commercial buildings ‘hard to reach’ combined with other barriers such as are listed in this table. | Tenure related issues such as Split incentives between tenants and landlords for leased buildings. Owner-occupied buildings also face barriers to motivation and a lack of triggers for refurbishment. | Lack of motivation, where other organisational priorities take precedent over energy and emissions savings. This occurs across many commercial buildings outside of premium offices and retail. | Capital constraints, in terms of access to financing as well as capacity constraints such as with knowledge, skills, human resource and time to pursue energy efficiency opportunities. | Lack of triggers for building upgrades, present for many commercial buildings, outside of premium offices and retail, where natural refurbishments cycles are relatively frequent. |

Addressing the entire range of barriers for existing commercial buildings can be difficult and is likely to require time, considering a blend of policy approaches. Long-term policy certainty is required to drive investment, encourage innovation and help to realise the benefits of moving towards a trajectory for low energy and carbon ready buildings. Policy options will need to be aligned with the vision for rapid decarbonisation required to meet the goals of the Paris Agreement, considering suitable timeframes for achieving zero energy and carbon ready buildings whilst providing enough flexibility to respond to prevailing market conditions and increase ambition over time in line with the transition to a low carbon, and energy efficient, economy.

² Six of the eight Australian States and Territories have net zero by 2050 emission reduction targets.
Energy consumption and intensity

Energy consumption and intensity was modelled across commercial building classes to the year 2050. See Section 10 of this report for illustrated findings. It shows higher average energy intensities in building classes that also have a larger shares of commercial energy consumption – namely healthcare, retail, offices and education (which together account for the majority energy consumption of commercial buildings in Australia). Additional data such as from the NABERS program identifies high energy intensities for hotels and data centres, along with large variations in energy intensities across building classes and geographies, where savings could be particularly targeted.

Existing and planned policy options

An assessment of Australian and international literature related to energy efficiency policies was conducted to identify common approaches and lessons learned applicable to the Australian context. A longer list of potential policy options was identified, with a shortlist of ‘prioritised options’ subsequently pursued through stakeholder engagement and further analysis. The initial analysis of potential policy options is presented in Appendix B.

Stakeholder engagement

Industry Stakeholder workshops were conducted in Perth, Melbourne, Sydney and Canberra with government officials. This collaborative process enabled policy options to be tested as they apply to existing commercial buildings across jurisdictions. While stakeholder engagement has been considered, more recent received feedback will be considered along with the final opportunity for input to comment on this version of the draft report. The cut-off for feedback is 14th October 2019.

Prioritised policy options

During Phase 1 of this work, EY presented a set of possible policy options to key stakeholders. Through consultation with government and industry stakeholders, the long-list of policy options was refined into six prioritised policy options:

1. Clarify and enforce National Construction Code provisions
2. Mandatory HVAC inspection and certification
3. Universal, low-cost mandatory disclosure consistent with existing schemes (incl. NABERS)
4. Mandatory minimum standards for government procured and used buildings
5. Financial incentives linked to minimum energy performance
6. Expand Minimum Energy Performance standards (MEPS) for building technologies and equipment

These policy options can be categorised into three complementary policy approaches: information and capacity building, and financial incentives, and regulation as shown in the diagram below.

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4 The long-list of potential policy options are also outlined in Appendix B.
5 This three-pronged policy approach is outlined in the International Energy Agency (IEA)’s Efficient World Strategy which sets out a globally applicable approach to incentivising energy efficiency in buildings, available at: https://www.iea.org/topics/energyefficiency/policies/buildings/
These approaches work together and each address different barriers to energy efficiency. The six prioritised policy options are designed to be implemented as a coordinated package with the purpose of information and capacity building, unlocking investment by creating financial incentives, and enhancing regulation to encourage uptake of energy efficiency and low carbon energy opportunities.

The policy options draw on a blend of the approaches outlined in Figure 2. As an illustrative example, for policy option 3 (universal, low-cost mandatory disclosure) to successfully lead to energy performance improvements, the following would all be necessary:

- Increasing the capacity and knowledge of staff working in specific building classes, through targeted guidance, tools and training. This is a cross-cutting theme that supports many of the proposed policy options in this report.

- Identifying suitable financing mechanisms linked to performance improvements (such as those outlined in policy option 5). For hospitals and schools, Victoria and New South Wales serve as good examples with their Treasury-led Loan Facilities for energy efficiency and onsite renewables, which cover whole of government and incorporate suitable performance targeting and finance mechanisms such as Energy Performance Contracts.

- Enshrining disclosure into regulation as a mandatory requirement.

The diagram below illustrates how barriers faced by key decision makers (typically building owners and/or tenants) can be addressed by the six prioritised policy options.
A high-level benefit cost analysis (BCA) was undertaken to assess the potential impact of the prioritised policy options. The assessment of each of the six prioritised policy options is summarised in the table below.

Table 2 - Summary of the prioritised policy options

<table>
<thead>
<tr>
<th>Policy option</th>
<th>Description</th>
<th>Benefit cost ratio</th>
<th>Avoided emissions potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clarify and enforce Code provisions</td>
<td>A pathway for clarifying existing Code provisions, better enforcing of them, and harmonising effective provisions across the jurisdictions.</td>
<td>1.9</td>
<td>2.1 MtCO₂-e</td>
</tr>
<tr>
<td>2. Mandatory HVAC inspection and certification</td>
<td>Progressive strengthening of provisions and development of new standards related to existing commercial buildings, focusing on HVAC inspection and certification.</td>
<td>1.9</td>
<td>3.1 MtCO₂-e</td>
</tr>
<tr>
<td>3. Universal, low-cost mandatory disclosure</td>
<td>Low-cost, mandatory disclosure of building energy consumption and energy intensity on an annual basis, covering all buildings over a minimum size threshold. Potentially focussed on a few building classes such as health and education to begin with. To minimise time and cost, a simple existing web portal could be utilised (such as NABERS online).</td>
<td>1.5</td>
<td>5.5 Mt CO₂-e</td>
</tr>
</tbody>
</table>

The assumptions used in the cost-benefit analysis are provided in Section 7.1 of this Report.

This is cumulative GHG emissions savings over a ten-year period (FY21-FY30). The assumptions used to estimate potential electricity savings, gas savings, and GHG emissions savings are provided in Section 7.1 of this Report.
<table>
<thead>
<tr>
<th>Policy option</th>
<th>Description</th>
<th>Benefit cost ratio</th>
<th>Avoided emissions potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Mandatory minimum standards of government procured buildings</td>
<td>Encouraging government to only occupy NABERS 5.5+ star offices in capital cities, or 5-star offices in other areas, by 2030. This could be achieved by upgrading owned buildings and/or by seeking progressive upgrades of leased ones. Similar targets could be incorporated into procurement standards for hired floorspace and hotels. The detailed policy design could consider aspirational targets at first to give the market time to respond, followed by moving to mandatory standards.</td>
<td>1.8</td>
<td>2.5 Mt CO$_2$-e</td>
</tr>
<tr>
<td>5. Financial incentives</td>
<td>Financial incentives linked to minimum performance improvements, including a whole-of-government approach to energy efficiency and onsite renewables investment for the public sector. For non-government building classes, there are a range of options such as Environmental Upgrade Agreements, grants, rebates, subsidies, retailer obligations, tax depreciation, co-financing and green bonds, and suitable performance related vehicles such as Energy Performance Contracts.</td>
<td>2.7</td>
<td>4 Mt CO$_2$-e</td>
</tr>
<tr>
<td>6. Expand MEPs for building technologies and equipment</td>
<td>Enhanced standards for commercial appliances and equipment that replace lower efficiency products in the market. This involves setting minimum energy performance (and potentially labelling) requirements for specific equipment and is designed to be additional to those already covered (or planned to be covered) by Greenhouse Energy Minimum Standards (GEMS).</td>
<td>1.5</td>
<td>8.2 Mt CO$_2$-e</td>
</tr>
</tbody>
</table>

Each of the policy options has a positive benefit-cost ratio indicating that they are cost effective. Whilst the analysis indicates notable emissions reduction potential, the policy options were modelled independently, and the BCA does not consider the collective net emissions reduction potential of all policy options or the comparative additionality of each option. We note that further modelling has been commissioned to address this. There is scope in each of the policy options to increase the ambition and impact of the interventions over time.
Recommendations
2. Recommendations

As the COAG Energy Council considers its plan to deliver zero energy and carbon ready buildings in Australia, it is recommended that:

► An objective for energy and emissions reduction for existing commercial buildings is endorsed, at least in line with Australia's commitments under the Paris agreement.

► The package of six prioritised policy options are adopted in a coordinated manner.

► Three yearly reviews of the implementation programs are considered as policies are designed to evolve over time, in line with emissions reduction ambition the trajectory for low energy buildings.

► Detailed program design for each of the policy options in undertaken, including continued coordination across the jurisdictions to confirm the details of the programs through key stages including implementation, enforcement, and evaluation.

These recommendations are further described below and are intended to maximise the impact of the policy options outlined in this report.

2.1 Endorse an objective for energy and emissions reduction in existing commercial buildings

Long-term policy certainty creates an environment in which decision makers can invest. In the case of commercial buildings, this is typically the building owner and/or tenants. A coordinated and forward-looking plan can unite businesses, policy makers, regulators, and other stakeholders in delivering a shared goal for improving energy productivity and emissions reduction. This calls for a COAG level plan that combines the policy options listed in this report with a uniting policy objective. Rather than continuing the 'piecemeal approach' to policy that has existed to date, as has been observed from discussions with and feedback from some property industry stakeholders. With the target being the achievement of net zero emissions across the commercial buildings sector by 2050.

A long-term goal or reduction target will have the most impact if ownership and implementation can be established at the appropriate levels. While some policy is best managed centrally at the Commonwealth government level, the States and Territories clearly have an important role for many of the policy options that are set at the jurisdictional level. This includes how they call upon national policy and legislation, down to jurisdictional regulation and enforcement, provision of incentives, and supporting capacity building such as with education and training. Local government also possesses relevant powers, such as with the planning and permitting of changes to existing commercial buildings, with an added ability to facilitate and support local implementation of policies and programs.

CASE STUDY: Creating a Planning Pathway to Net Zero in New South Wales (City of Sydney)

‘Creating a Planning Pathway to Net Zero Buildings’ is a series of forums to help identify, in collaboration with local, state and industry stakeholders, how to best support the NSW Government’s targets for net zero emissions by 2050, the Greater Sydney region plan, and Resilient Sydney - a strategy for city resilience 2018. In June 2019, the City of Sydney initiated the development of performance standard pathways to transition to net zero energy office, hotel, multi-unit residential, shopping centre and mixed-use new developments. The focus is on high-rise development. The pathways will provide a framework that identifies step changes in NABERS Energy, Green Star Design & As Built and BASIX Energy targets and timeframes for the different asset classes.¹
2.2 The package of six prioritised policy options are adopted in a coordinated manner

There are varied barriers to achieving energy efficiency in commercial buildings. This requires some flexibility with the policy approaches used. It is recommended that all six policy options are implemented in a coordinated manner. The interrelationship between each policy option, and the capacity for each policy option to build on another and influence decision-makers in the short, medium and long-term further reinforces the usefulness of implementing them as a coordinated package.

While many of the prioritised policy options can be adopted simultaneously, they can generally be considered in the following order:

- **Clarify and enforce existing Code provisions during the first two years.** Establishing a nationwide education and awareness raising program would help to coordinate this activity across the jurisdictions and begin to address knowledge and skill gaps. There is a link between clarifying and harmonising provisions, so these activities may be addressed in parallel to a certain degree.

- **Mandatory HVAC inspection and certification.** Focussed on mandatory reporting on HVAC systems. Legislative changes would likely require at least a two-year timeframe to come into effect. Supportive changes in regulation at State and Local Government levels would require consideration. Mandatory requirements could potentially be ramped up and expanded beyond HVAC into the future. Some stakeholders have emphasised the urgency of this, considering the need for rapid decarbonisation and for also establishing a strong mandate for action. There were differing views in how this is achieved. Therefore, this recommendation is intended as starting point for further potential evolution as part of the three-yearly review cycles.

- **Universal, low-cost mandatory disclosure.** Focussing on selected building classes for the first two years (such as health and education). Followed by all building classes not captured by other schemes (such as the CBD program). A CBD consistent threshold size could be used (1000m2) which can be further tested as part of the detailed program design. Disclosures on an annual basis would provide a trigger in the absence of event based (i.e. sale and lease) triggers in owner-occupied and less ‘traded’ building classes/markets. From year three, stronger signals such as public indications of non-compliance, disclosing physical labels in reception foyers (for example, as with the UK Display Energy Certificates) and ultimately regulatory minimum energy performance standards could be added.

To help to shift from disclosure to performance improvements, guidance material could be prepared on how to achieve energy savings and reduced energy/carbon intensities in certain building classes. Similar to Victoria’s Greener Government Buildings program which provides energy management guidance for regional hospitals (highlighting a range of typical technical opportunities to hospital energy managers), as well as government incentives and support programs. The aim would be to provide information and knowledge to help to drive action, investment and performance improvements.

- **Mandatory minimum standards of government procured buildings.** This seeks to build on the initiatives already in place in relation to leasing energy efficient buildings under most State and Territory governments, with coverage of building design and/or performance via their leasing requirements.

The main opportunities identified are for the development of a more ambitious standard for:

- Government tenanted and owned buildings. The aim of this policy option is to expand existing policies in terms of coverage.
- Procurement including for hotels and conference centres.
While the actual impact on Australia’s emissions may be limited, this initiative serves to lead by example and raise the bar for both the public and private sectors.

e. **Financial incentives** linked to minimum performance improvements.
   
i. This includes a whole of government approach to energy efficiency and onsite renewables investment (as in NSW and VIC, for example). Supported by suitable performance related vehicles such as treasury funded loan facilities and Energy Performance Contracts.
   
ii. For non-government building classes, there are a range of options such as environmental upgrade agreements, grants, rebates, subsidies, retailer obligations, tax depreciation, co-financing and green bonds.

f. **Expand MEPs for building technologies and equipment.**

Coupled with the overarching objective for energy and emissions reduction in existing commercial buildings this coordinated package of policy options would prevent an inefficient policy suite.

2.3 Establish a regular review cycle to ramp up ambition as required

Three-yearly reviews of the implementation programs would enable an ongoing evolution, in line with requirements, progress and changes in the property sector. For example, as technology, refurbishment practices, awareness and skill levels develop with the capacity to deliver more efficient energy and emissions performance at lower cost.

As buildings are long-lived built infrastructure, it is recommended that these reviews be open to considering the net benefits to society over the long term. This includes looking beyond simple payback periods to societal benefits not typically quantified in benefit cost analysis, such as safety and resilience (e.g. in the event of power failure and extreme heatwaves), quality outcomes, and the potential for enhanced staff wellbeing and productivity within commercial buildings.

An illustration of how this could potentially work is outlined in alignment with the National Construction Code (NCC) timeline in the figure below.

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** Clarify and enforce Code provisions  
Clarifying and educating the property industry will take some time, and levels of awareness and feedback could be collected during the 3-year revision cycle points. The risk of non-compliance penalties will also require clarifying and enforcing. This approach could be communicated from the outset as part of an enhanced awareness and enforcement program. This can help to address recommendations from ASBEC in its Low Carbon High Performance report, in particular to ‘develop a national built environment energy efficiency and emissions education and training agenda’.

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Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings  
Department of the Environment and Energy
| Mandatory HVAC inspection and certification | The 3-year revision cycle will allow for consideration to strengthening performance standards – considering the case for this, including the benefits and costs, and re-assessing our position with the trajectory for low energy commercial buildings, the ‘gap’ in where we need to be, and how we are going to get there. Including with strengthened performance standards. The roles of government with implementation – not just at federal but also at state and local government levels, should be addressed. |
| Universal, low-cost mandatory disclosure | The path to mandatory disclosure of energy reporting could begin with expanding current schemes (such as NABERS Online and Green Star) and establishing a phased plan for the introduction of reporting and disclosure requirements coupled with information and capacity-building to support building owners to comply with new reporting requirements. As well as to link disclosure to actual action and investment, in energy efficiency and onsite renewables. Referral (or more active government support) to take up financial vehicles such as EUs, Energy Performance Contracts, etc. could help to unlock barriers to action. |
| Mandatory minimum standards of government procured buildings | The process of setting appropriate standards would include: understanding the current performance of government buildings by jurisdiction, identifying where improvements could be made (drawing on case studies such as NSW’s GREP policy - with hotel procurement, NABERS ratings by building type or location, etc.), and establishing evaluation points in line with 3 yearly NCC reviews. As technologies, drivers, etc. change over time, procurement standards will also need to evolve. Government could draw on the existing low carbon trajectories for Australian cities such as that Climate Bond Initiative’s low carbon building calculator which also takes into account the expected improvement in building energy efficiency performance over time. |
| Financial incentives linked to minimum performance | Considering the large number of options for financial incentives in Australia, and low interest rates at the time of writing, a first step is to clarify the available options for financial support. To support regulatory policy interventions, such as those suggested above. This could be designed to complement the work of the Australian Sustainable Finance Initiative. Government investment in energy efficiency tends to require Government vision, leadership and management/administration to get off the ground. Examples being the Treasury led Greener Government Buildings program in VIC, and a similar program led by the Department of Environment, Energy and Science (previously OEH) in NSW. These programs include the use of EPCs as investment and risk management vehicles. |
| Expand MEPs for building technologies and equipment | Over time the MEPs could first increase coverage then increase stringency, progressively removing low energy efficiency technologies from the market. Reviews of the GEMS scheme have identified potential areas for further development and expansion, which will be required to set a positive advancement towards a zero emission trajectory for commercial buildings. |

Figure 3 - Evolution of policy options over time

2.4 Detailed program design for each of the policy options is undertaken, including continued coordination

Acknowledging the interplay between national, state, and local government, it is recommended that coordination across all levels and jurisdictions continues with the aim of agreeing a harmonised approach to incentivising energy performance improvements. It is recommended that all levels of government are involved in the development and implementation of the six policy options, with the purpose of elevating and utilising local and regional considerations and establishing alignment on the design, implementation, evaluation, and on-going of the policy options.
Drivers for Zero Net Emissions
3. Drivers for zero net emissions

Drivers for the transition to zero net emissions include amongst others: Australia’s emissions reduction target, the National Energy Productivity Plan, an array of energy efficiency co-benefits, and the need to respond to the impacts of climate change.

Australia’s emissions reduction target

In 2015, the international community committed to the overarching goals of the Paris Agreement; to limit global temperature increase to well below 2°C and pursue efforts to limit temperature increases to 1.5°C above pre-industrial levels. Keeping global temperature rise to below 2°C degrees is expected to require net zero emissions by 2050, while limiting warming to below 1.5 degrees means achieving net zero emissions at an earlier date. Achieving this goal requires significant action. Developed countries, such as Australia, are expected to transition to a low carbon economy as soon as possible. Individual states and territories, responsible for 80% of Australia’s emissions, have committed to achieving net zero emissions by 2050 or earlier.

The buildings sector produces almost 20% of Australia’s greenhouse gas emissions and of that, approximately half are attributed to commercial buildings (such as offices, shops, hotels, restaurants, warehouses, schools and hospitals). Commercial buildings therefore represent a significant opportunity for emissions reduction. If the building sector improves its energy efficiency as well as encouraging fuel switching and on-site renewable energy generation this could deliver 28% of Australia’s 2030 emissions reduction commitment. This is all possible through measures that are available today. However, recent analysis suggests that whilst the buildings sector has the potential to reduce emissions by 69% on 2005 levels by 2030, current and proposed Australian policies are unlikely to realise this potential and are estimated to achieve just an 11% reduction. This leaves 21MtCO₂-e of emissions that could otherwise be avoided if current opportunities in energy efficiency and renewable electricity were implemented to their full potential.

Therefore, additional policies are required to maximise the energy efficiency and emissions reduction potential of this sector.
To achieve the scale and pace of emissions reductions required, progress needs to be made in four key areas:

- energy efficiency (reducing energy consumption)
- low carbon energy generation (for example, renewable energy)
- electrification (for example, switching from gas to electricity for heating)
- reducing residual emissions (for example from the industrial and land use sectors).  

Improving energy efficiency in commercial buildings is one of the quickest and most cost-effective ways to reduce greenhouse gas emissions and help mitigate climate change. Energy efficiency measures can deliver a range of benefits in addition to emissions reductions including financial savings from reduced energy bills, reducing demand on the electricity grid, and improving thermal comfort (particularly during extreme weather events).

Many of the technologies required to achieve low-zero energy, carbon ready buildings already exist and are already cost-effective. For example, upgrades in lighting, and heating, ventilation, and air conditioning (HVAC) equipment can generate energy savings resulting in positive financial returns through reduced energy bills. As these technologies represent a significant proportion of the energy use in commercial buildings they hold significant potential for reduction in energy consumption.

It is estimated that around half of the 2050 building stock has already been built. New building construction is estimated to add only around 1% to the existing stock each year. This means that

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Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
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addressing the energy performance of existing buildings is critical. As buildings are long-standing assets, any delays in improving energy performance can lock in higher emissions for decades into the future. Long-term policy certainty is required to drive investment, innovation and realise the benefits of energy efficiency.

This means seeking to improve the energy performance of all existing commercial buildings, in all locations and markets. A logical approach is to first focus on the larger energy consuming sectors (offices, retail, health and education) along with higher energy intensity building types which also includes hotels and data centres. Flexibility can enable differentiated strategies (often with some flexibility for the market to decide) to address the diverse situations in which commercial buildings exist.

National, state and local governments are in a position to shape the future of Australia’s commercial building sector. Policy approaches typically include 1) capacity building information, education and training, 2) incentivisation which are often financial/tax related and 3) regulation to mandate action. With government intervention industries can implement net zero business plans with confidence. Investment in renewables and energy efficiency can grow and, in turn, help make technology more affordable and advance the industry.

**National Energy Productivity**

The National Energy Productivity Plan 2015-2030 provides a framework and an initial economy-wide work plan designed to accelerate action to deliver a 40% improvement in Australia’s energy productivity by 2030. This is planned to be achieved through better coordinating energy efficiency, energy market reform and climate policy.

A focus on energy productivity has sharpened in recent years as countries have begun developing targets. Examples include the United States’ goal of doubling energy productivity by 2030 relative to 2010, and Germany’s goal of doubling energy productivity by 2020 relative to 1990.

According to ClimateWorks, Australia has enough potential across multiple sectors of the economy to double its productivity by 2030 (far beyond the current 40% improvement target by 2030).

**Co-benefits of energy efficiency**

When buildings are energy efficient, their occupants are better off - they have lower energy bills and higher levels of comfort and wellbeing. Energy efficient buildings are better for the economy and better for the environment. Reducing energy use allows the money saved to be invested elsewhere. Energy efficiency improvement also reduces the negative environmental impacts of energy use - such as greenhouse gas emissions.

Commercial buildings are also where many of us spend a large proportion of our time, for work. The quality of these places - how they make us feel, and how healthy they are - influence productivity. There is established evidence that commercial buildings that are designed or refurbished with the wellbeing benefits of occupants and of environmental sustainability in mind, can lead to improved productivity along with lower energy consumption and associated costs. This includes refurbishments towards well-ventilated and well controlled buildings to enable tailoring to workplace

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24 See, for example, IEA, Energy Efficiency: Multiple Benefits, available at: [https://www.iea.org/topics/energyefficiency/multiplebenefits/health-and-well-being.html](https://www.iea.org/topics/energyefficiency/multiplebenefits/health-and-well-being.html)
conditions, with suitable qualities for comfort such as exposed thermal mass for radiant heating and cooling.

Improving the energy efficiency and productivity of commercial buildings can potentially yield good energy and emissions savings, along with ‘co-benefits’ for the economy and for society more generally. However, a host of barriers to energy efficiency (discussed in Section 8 in Appendix B of this report) need to be addressed and overcome to realise these benefits.

Resilience to climate change

Looking forward, we will need to design and adapt our buildings to be resilient to anticipated effects of climate change. For example, the urban heat island effect is forecast to increase average ambient temperatures in some cities by more than 4°C. Cooling and ventilation strategies will need be able to cope with such conditions, in energy efficient ways. Increased frequency and intensity of heat-waves is a risk throughout Australia, which will pose a threat to health and well-being, notably for our ageing population. We will therefore need to place greater focus on the summer performance of buildings. Strategies such as shading, high-performance glazing, insulation, greater attention to air-tightness, mechanical ventilation with heat recovery, appropriate use of exposed thermal mass, different forms of energy storage, can all be deployed to improve the summer performance of buildings, improving their liveability and resilience while potentially reducing total energy use.

At the same time, we should be mindful of the diversity of climate zones across Australia and the varied impacts from climate change. For example, in cooler climate zones, energy efficiency can also improve the winter performance of buildings and reduce heating demand.

A trajectory for low energy commercial buildings

To set out a trajectory for improving energy productivity in the built environment, we need to know: where we are now, where we need to get to, and what are the best pathways to take us from where we are now to where we need to be.

Where we are now?

Australia’s emissions are currently around 12% below 2005 levels. The Australian government forecasts emissions will increase to 2030, with the forecast for Australia’s emissions in 2030 to be around 7% below 2005 levels. This would see Australian emissions in 2030 exceed its current commitment under the Paris Agreement (to reduce emissions by 26-28% on 2005 levels)

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25 City of Sydney Energy Efficiency Master Plan – Foundation Report

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Where do we need to get to?

The charts below outline energy consumption and emissions in the building sector globally under different IEA scenarios. The Reference Technology Scenario (RTS) takes into account international commitments to improve energy efficiency and reduce emissions (including Paris Agreement targets), the 2°C Scenario (2DS) is aligned with the scale of global emissions reductions necessary to achieve the Paris Agreement’s goal of limiting the global warming to 2°C, and the Beyond 2°C Scenario (B2DS) represents what is technically possible with technology that are already available or in the innovation pipeline. All of the scenarios presented below go beyond ‘business-as-usual’.

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26 EY Analysis based on Department for the Environment and Energy, Australia’s Emissions Projections (2018)
27 IEA, Energy Technology Perspectives 2017, available at https://www.iea.org/etp/explore/
28 EY Analysis based on IEA, Energy Technology Perspectives 2017
In Australia, the buildings sector accounts for approximately 20% of emissions, half of which are associated with commercial buildings. Current policies are expected to deliver a modest 11% reduction in emissions on 2005 levels, but the potential is far greater. Increases in activity have outweighed emissions intensity improvements resulting in a 5% growth in absolute emissions since 2005. Tapping into cost effective energy efficiency opportunities can deliver significant reductions in energy consumption and emissions.

![Figure 9 - Building Sector emission reduction potential](image)

**How do we get there?**

This report proposes a set of policy options to set us on the course towards achieving Australia’s energy productivity goals, its emission reduction target under the Paris Agreement, and alignment with net zero emissions by 2050.

**Long-term policy objectives**

Buildings are long-standing assets, most of the equipment within in has an effective life of between 5-15 years, and typical refurbishment occur at every 15 years depending on the market circumstances. It is generally more cost effective to work with natural investment cycles for replacement and refurbishment. This means that delays in implementing energy efficiency measures can ‘lock in’ poor emery performance for several years.

Long-term policy certainty creates an environment in which decision makers (in the case of commercial buildings, typically the building owner and/or tenants) can invest. A coordinated and forward-looking plan can unite businesses, policy makers, regulators, and other stakeholders in delivering a shared goal. An overarching framework and a uniting goal are required for existing commercial buildings, centred around net zero emissions by 2050, along with other key goals in the safety and resilience space. This approach could work to provide a clear rationale for measures imposed onto existing buildings.

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Scene Setting
4. Scene setting

The commercial building market is complex in nature, with diverse building types, commercial markets, building ownership types, building management models and locations. This creates an array of challenges to consider for identifying and pursuing policy options that will move buildings towards zero net emissions.

The Energy Services sector is still maturing in Australia, perhaps due to limited demand for energy efficiency in the past. This means that there are limits in terms of capacity and skills for energy efficiency upgrades on more complex buildings. Some government intervention is likely to be required to support this transition.

4.1 Considerations by building class

Energy consumption within commercial buildings is dominated by retail (33%), offices (23%), education/assembly (19%) and healthcare (11%) buildings.

![Figure 10 - Share of energy consumption of buildings in 2019 (PJ, %)](image)

Electricity and gas intensity are generally the highest in the same four building classes - retail, offices, education/assembly and healthcare buildings. Along with aged care for gas intensity.

![Figure 11 - Electricity consumption by building class projected to 2050](image)

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34 EY & SPR, 2019, Building Stock Model
4.1.1 Mid-tier Office Buildings

In Australia, offices account for around 23% of the existing commercial building stock, with mid-tier office buildings representing around half of the office buildings stock. Mid-tier property owners are a disparate group with varying levels of engagement, attitudes, strategies and levels of knowledge on energy efficiency opportunities. Environmental performance is generally not integrated in the business of mid-tier owners, nor is it well understood.35

Table 3 - Characteristics of Mid-Tier Buildings

<table>
<thead>
<tr>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>According to EY research, ‘Mid-tier commercial office buildings in Australia: Research into improving energy productivity’, mid-tier buildings tend to:</td>
</tr>
<tr>
<td>► Have a lower level of energy efficiency than premium or A-Grade buildings</td>
</tr>
<tr>
<td>► Be smaller buildings, generally under 10,000 square metres</td>
</tr>
<tr>
<td>► Have a diverse ownership profile (e.g. private, family-owned, strata titled, government, foreign)</td>
</tr>
<tr>
<td>► Generally older, built before 2000, with older HVAC plant and lighting, HVAC is likely to be the original system with minimal controls. HVAC is often either a mix of central plant or individual package/split system units</td>
</tr>
<tr>
<td>► Some have natural ventilation (operable windows) so the base building can be energy efficient by default</td>
</tr>
<tr>
<td>► A small proportion have NABERS ratings, mostly triggered by Commercial Building Disclosure</td>
</tr>
<tr>
<td>► Have typically higher vacancy rates than premium and A-grade assets</td>
</tr>
<tr>
<td>► A mixture of smaller offices, with mainly SME tenants</td>
</tr>
<tr>
<td>► Shorter lease terms than premium and A-grade assets</td>
</tr>
<tr>
<td>► Less rent per square metre</td>
</tr>
<tr>
<td>► Generally, no on-site dedicated team for property/facilities management.</td>
</tr>
</tbody>
</table>


Figure 12 - Gas intensity by building class projected to 2050
In addition to the characteristics set out above, the barriers affecting energy efficiency improvements in mid-tier commercial buildings can be grouped into three categories; financial, motivational, and capacity (including time, knowledge and access) related.

Table 4 - Mid-tier office building considerations

<table>
<thead>
<tr>
<th>Financial Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>► Reluctance to invest - Mid-tier building owners may not prioritise spending money in the short term for longer-term impacts/benefits. In some cases, they may be choosing to invest capital in other higher earning investments.</td>
</tr>
<tr>
<td>► Management fees are more competitive in the mid-tier portfolio resulting in less management hours.</td>
</tr>
<tr>
<td>► Capital Constraints - Financial Managers or property agents are sometimes instructed to minimise costs rather than encouraged to think strategically about the long-term value of the property.</td>
</tr>
<tr>
<td>► Split incentives.</td>
</tr>
<tr>
<td>► Capacity Constraints.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Motivational Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>► Lack of tenant demand - this is prevalent in the mid-tier sector where the tenant (and property sales) market tends to be more illiquid, with less value placed on sustainability. Compared to higher graded top tier buildings.</td>
</tr>
<tr>
<td>► Lack of motivation amongst owners - Unless the equipment is at its end of life or there is a high level of vacancy that is affecting rental income, some owners lack motivation to improve their building. This is especially the case if the building is not their core or highest earning business.</td>
</tr>
<tr>
<td>► Strata titled buildings - Amongst strata-titled buildings, owners corporations may see themselves as fulfilling a purely administrative function and not there to provide advice around sustainability.</td>
</tr>
<tr>
<td>► No corporate policies driving environmental outcome - Mid-tier owners don't generally have company policies that consider the energy efficiency and sustainability of their portfolio.</td>
</tr>
<tr>
<td>► Lack of trust and certainty - Information on energy upgrades provided to the mid-tier sector may be coming from a 'vested' interest, not in the best interest of the owner.</td>
</tr>
<tr>
<td>► Confusion from owners over what is the best option - Mid-tier owners, when it comes to implementation, may shy away due to confusion around the costs and benefits of upgrading or the technology being upgraded itself.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capacity Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>► Lack of knowledge regarding energy efficiency.</td>
</tr>
<tr>
<td>► Information asymmetries - lack of access to complete set of information.</td>
</tr>
<tr>
<td>► Time poor: other competing issues take priority. Typical in many mid-tier building, public and private owned.</td>
</tr>
<tr>
<td>► Lack of skills for energy management</td>
</tr>
<tr>
<td>► Owners are hard to access, and property managers carefully control the limited access.</td>
</tr>
</tbody>
</table>

HVAC is generally responsible for a significant proportion of office building energy consumption. A typical HVAC system accounts for around 40% of total building consumption and 70% of base building (i.e. landlord) consumption.
Many building upgrades in the mid-tier are triggered by equipment failure or continued vacancies. Mid-tier owners sometimes have an inclination to avoid capital expenditure for as long as possible. However, failing to keep adequate conditions inside the building puts the owner at risk of breaching lease requirements and disgruntling tenants.

In addition, once a decision has been made to retrofit, many owners ask for a ‘like for like’ replacement of equipment, showing the lack of knowledge around energy efficiency, or the perceived notion that energy efficiency upgrades are expensive.

Whilst current HVAC technology available in the market is generally efficient, (especially when comparing current efficiency to that of a 25+ year old system), the final solution also needs to include proper controls and commissioning, and a detailed assessment upfront to ensure that the equipment is appropriately sized for the building load. This is an extremely important part of the process which doesn’t always happen and suggests that contractor and facility management education in this space needs to be improved.

Another common scenario is rather than undertaking a complete energy efficient lighting upgrade, owners may simply get the individual lights replaced. Given that there are a high proportion of energy intensive T8 fluorescent tubes or dichroic down lights in mid-tier buildings, this is a wasted opportunity for energy efficiency improvement.

A number of existing energy efficiency policies are applicable to mid-tier commercial buildings. These include the Commercial Building Disclosure (CBD) Program, Minimum Energy Performance Standards (MEPS), and State based schemes for example NSW’s Energy Savings Scheme (ESS) scheme, Victoria’s Energy Upgrade scheme and many more. Policy types that would not be applicable to the mid-tier building type include those with large volume/size thresholds for example the National Emissions Reduction Fund requires an abatement potential of 2000 tonnes CO\textsubscript{2}-e which would rule out nearly all mid-tier buildings.

The major actions that can significantly reduce energy intensity in mid-tier buildings are described in the Table below.

<table>
<thead>
<tr>
<th>Table 5 - Mid-tier office building considerations</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>HVAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>► Installing modern temperature sensors to ensure that heating and cooling is responsive to real ambient and indoor temperatures</td>
</tr>
<tr>
<td>► Fixing jammed dampers to enable fresh air to be brought into the building</td>
</tr>
<tr>
<td>► Clearing blocked coils and ducts to reduce the amount of energy needed to pump air through buildings</td>
</tr>
</tbody>
</table>

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Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
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Installing modern building management systems to optimise how plant and equipment work together, and to detect and rectify problems quickly
- Balancing air to measure air flow rates and recommissioning dampers and controls to distribute air flow more effectively
- Recommissioning timers to make sure equipment is only operating when necessary
- Installing sub-metering to give facility managers better visibility as to where energy is being used in buildings
- Installing carbon monoxide sensors in car parks, so that exhaust fans run only when a build-up of exhaust gases is present
- Complete replacement of HVAC system

### Lighting
- Installing occupancy sensors to reduce unnecessary lighting in common areas
- Installing lux sensors to reduce unnecessary lighting in outdoor areas
- Replacing older lighting (fluorescent, CFL, etc.) with LED lighting

### Other options
- Improved insulation (roof and wall cavities, or window film), subject to payback calculation
- Installing timers on kitchen boilers to prevent constant/unnecessary boiling
- Potential for lift upgrade to more efficient models (more likely to be timed with end of life replacement)
- Applying power down and sleep mode settings for office equipment

## 4.1.2 Education

Australia has more than 9,500 schools across the country, with 3.4 million full time school students. It has a further 1.3 million students who attend tertiary education facilities. Many of these students and teachers spend each day in schools with badly designed classrooms, poor indoor air quality and limited access to daylight. Evidence and experience show that this affects student health and learning, teacher morale and school operational costs – as well as the environment.

HVAC and lighting consume a significant amount of electricity in schools, with gas consumption mainly used for space heating (more than 90%) and the remaining gas consumption for hot water heating.

![Figure 15 - Estimated electricity use for schools](image)

In university buildings, HVAC accounts for 50% of electricity use and lighting 18%. However, the diversity of buildings sub-types within universities can have very different energy uses and intensities. For example, laboratories, cafes, and lecture theatres can be grouped within this category.

Education has disparate groups in terms of ownership and thereby the source of funding for the upgrade. Smaller, devolved buildings such as schools are often self-managed, which creates capacity and skill limitations for building tuning and retrofitting. The education sector can be broken into privately owned and government owned facilities and then again into early childhood centres, primary/high schools and universities/TAFEs. Each group has its own hurdles in terms of buy-in from stakeholders including parents, or red tape and regulatory challenges. Unless government

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37 Pitt & Sherry 2012, Commercial Building Baseline Study
mandated, acquiring the funds from the relevant State department would in the current climate be time consuming and onerous.

Education sector retrofits can be attributed to a number of factors such as:

- Diverse nature of buildings and uses, such as schools, TAFEs and universities
- Lack of capacity or capability for building tuning
- Lack of dedicated capital for energy efficient equipment upgrades
- Challenges relating to devolved building management
- Lack of knowledge and awareness around energy efficiency both in tools that may exist to help in the decision process and options available for upgrading
- Perception that the energy efficiency investment won’t yield a return
- Lack of motivation or human resources to undertake the project
- Disruption to students and classes

The key opportunities for the Education building sector include:

- Installing PV panels; schools are typically used during daytime hours which is when PV panels are most effective.
- Decreasing the amount of time lights and HVAC systems are left on when buildings are unoccupied, this can be resolved through the use of an electronic room management system and overall energy management system like those seen more commonly in the hotel sector.

4.1.3 Retail and hospitality

Retail and hospitality buildings tend to have high energy usage per square metre, this is because of the use of HVAC systems in buildings that have entrances constantly being open to the elements. A ClimateWorks study calculated that retail buildings would consume 28% of total energy use in commercial buildings in 2020. 38

Figure 16 - Estimated energy-use in commercial buildings (2020, %) 39

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The major electricity usage within the retail and hospital sector is linked to HVAC systems with 37% of energy consumption coming from heating and or cooling. The second largest consumer is Lighting at 23%.

For shopping centres and supermarkets, electricity is estimated to account for more than 97% of energy use. Some retail tenancies are more energy intensive than others. For example, fast food outlets are typically the most energy intensive retail tenancies in shopping centres. Supermarkets are also a relatively energy intensive tenant in shopping centres. Consequently, the proportion of shopping centre floorspace allocated to supermarkets can significantly impact a shopping centres overall energy consumption and energy efficiency.

The major challenges for energy efficiency within the retail sector are:

► Diverse commercial markets, from city centres to regional centres and small towns, with differing levels of motivation, capacity, etc.
► Capital constraints and long payback periods for larger equipment such as chillers, boilers etc.
► High transaction costs
► Split incentives for leased properties and for owner occupied properties, there can be capacity constraints with facility manager’s time and scope of contract - which require time and money to change
► Information and skills gaps

The key opportunities for energy efficiency within the retail sector are:

► Large opportunities for decreasing the number of light fittings as well as ensuring all incandescent and halogen bulbs are transferred to LED’s. The other major opportunity is around the HVAC systems, both for tuning existing systems and replacing older systems with new more efficient systems. A range of other opportunities may exist, such as:
  o better sealing doors e.g. installing a revolving door rather than one that is constantly open to the elements.
  o ensuring the space is as insulated as possible
  o destratification fans for high ceiling areas, etc.

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40 ClimateWorks Australia, 2011, Low Carbon Growth Plan for Australia: Retail Sector Summary Report
41 Pitt & Sherry 2012, Baseline Energy Consumption and Greenhouse Gas Emissions in Commercial Buildings in Australia
42 Pitt & Sherry 2012, Baseline Energy Consumption and Greenhouse Gas Emissions in Commercial Buildings in Australia
4.1.4 Health

The majority of healthcare related energy consumption is from Hospitals, which tend to have relatively high energy intensity due to constant energy loads for heating/cooling and lighting, etc. This is reflected in the graph below which puts 41% of energy consumption to ventilation and cooling.

![Health sector energy consumption by end use](image)

The major challenges in the health sector are:

► Building access/limited opportunities for refurbishment

► Capacity constraints (energy efficiency often comes low in the priority of daily demands for facility managers)

► Capital constraints (dedicated financing can be an issue, although increased energy prices in recent years has escalated the issue for Hospital finance directors)

► Motivation (there have been few targets or programs incentivising energy efficiency in hospitals)

From samples of hospital energy audits, opportunities include:

► Improved controls for HVAC systems

► Replacement of old, inefficient boilers, chillers, pumps and motors

► Improved lighting controls, including motion or lux sensors in suitable places

► Operating theatre HVAC – damper and heat exchanger optimisation

► Heat recovery such as from IT communications rooms

► Solar Photovoltaics – reduce grid electricity consumption as well as peak demand, battery storage linked to Solar PV technology is becoming increasingly popular and economically viable. Roof mounted or possibly ground mounted (possibility also for solar thermal).

► Improved insulation (i.e. replacing old hot water pipe insulation, and roof/cavity insulation)

► Replacing old energy intensive appliances with new efficient items. Including in laundry and kitchens.

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43 Typical rates derived from US Energy Information Administration
4.1.5 Hotels

Hotels are significant energy consumers. This is because hotels run HVAC systems constantly, along with other continuous energy uses such as in foyers, laundries, swimming pools, gyms etc. Energy efficiency levels tend to be low, with large opportunities for improvement.

In hotels, HVAC accounts for more than 50% of total energy use, followed by lighting at 20%, other equipment at 11%, pool heating at 6%, etc. Of total energy use, gas use account for 35% and is dominated by space heating, domestic hot water, other gas use, kitchen and laundry use.

The main considerations for energy efficiency improvements in hotels include:

- Motivation and Split incentives - Many major hotels are owned by one party but leased to and operated by another, creating a split incentive. The length and other terms of hotel facility agreements will be diverse. However, as with other non-owner-occupied buildings, the hotel operator is likely to need to obtain the agreement of the owner before major changes to HVAC plant or other elements could be undertaken, and also agree the commercial terms. This can slow and complicate decision-making processes.

- Cost and capacity concerns - It is not unusual for hotel operators to be concerned with costs for non-ordinary items energy efficiency. Generally, hotel operators do not seem to look beyond the initial costs of energy management investments or consider the total lifecycle costs of existing conditions and the savings that could be realized over the same period.

On the other side of these barriers are the potential for substantial energy and cost savings. The Park Hyatt Melbourne’s introduction of an electronic room management system, which automatically turns lights and HVAC systems off when guests are not in the room, helped to reduce the Hotel’s total energy consumption by between 20-30%. This system has been coupled with an overall energy management system and lighting upgrades throughout.

4.1.6 Data Centres

Data centres tend to be highly energy intensive, with large amounts of IT server racks and supporting infrastructure.

The key challenges for data centres include:45


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Split incentives, between departments within companies and between co-location data centres and their tenants

Uncertainty and imperfect information about the performance of new technologies, and

Trade-offs with data centre uptime

In February 2019, the M1 Melbourne data centre became officially certified as Australia’s first NABERS 5-star rated data centre infrastructure facility. The data centre has a long-term vision for energy efficient design, coupled day to day commitment in performing disciplined onsite real-time monitoring and ongoing tuning, which plays an integral role in achieving a NABERS 5-star standard. M1’s energy saving design elements include ensuring that innovative use of indirect economy cycle free cooling is running optimally and continuing to maintain indoor air quality for the critical IT infrastructure. The building also has a solar array on the roof, and the building owner has participated in the Melbourne Renewable Energy Project (MREP) since its inception in 2014.

Some of the simpler low-cost energy efficiency actions that can lead data centres to achieving 20-30% energy savings are to:

- reduce lighting levels and install sensors
- reduce unnecessary airflow and cooling
- minimise hot spots in the server room
- prevent mixing of hot and cold air in server racks
- organise server racks into hot and cold aisle configuration

4.2 Considerations by climate zone

The Clean Energy Finance Group (CEFC) published a 50 Best Practice Initiatives Handbook comparing the effectiveness of energy efficiency projects across the eight climate zones in Australia. The climate zones are:

- High humidity summers and warm winters (North coast WA, NT, and QLD)
- Warm humid summers and mild winters (East coast QLD)
- Hot dry summers and warm winters (Northern WA, Mid NT, Mid/South QLD)
- Hot dry summers and cool winters (Mid WA, Northern SA and VIC, inland NSW)
- Warm temperate (Southern Coast WA, South coast SA, East coast NSW)
- Mild temperate (Parts of VIC and SA, South WA)
- Cool temperate (ACT, TAS, Parts of VIC)
- Alpine (Parts of VIC, NSW and TAS)

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The effectiveness of energy efficiency opportunities can differ across these climate zones. While the CEFC Handbook relates to new buildings, where energy efficiency is planned from the beginning, most of those measures are also appropriate for existing buildings. For retrofits of existing buildings those measures can also be considered. The following energy efficiency initiatives are intended to give general guidance and should not replace specialist project-specific advice from building industry professionals. From this analysis there are five energy efficiency measures that are applicable in all states of Australia that could be implemented as part of an upgrade to existing commercial buildings. Those with payback periods of less than five or less than 10 years:

► Electrical: LED Lightning (<5 years)
► Electrical: Occupancy Detection (<5 years)
► Electrical: Daylight Dimming (<5 years)
► Heating and Cooling: Water-side Free Cooling (<5 years) and
► Ventilation and Heat Recovery: Low-Pressure Low Temperature VAV (<10 years).

4.3 Other technical considerations

4.3.1 HVAC

HVAC is a dominant energy consumer in most of the commercial building classes. Therefore, HVAC efficiency presents a major opportunity for energy and emissions abatement. Research shows optimisation and tuning can save a significant amount of energy in commercial buildings, potentially up to 14 PJ. HVAC tuning – and broader controls tuning (such as lights, and even lifts) can have a

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significant impact. However, this is an exceptionally difficult area to regulate, as it is skills and process rather than technology driven. Possible approaches to addressing this include energy reporting and disclosure, where possible, with some inclusion of basic control parameters, and programs based around controls tuning. With a focus on the achievement of performance outcomes rather than the process of tuning or commissioning – either of which can be done with little impact on performance in the absence of a clear performance outcome requirement.

Oversizing of HVAC systems is an issue for the commercial buildings sector. This can cause inefficiency (most problematically at the point of delivery into the conditioned space) and increase costs (such as by adding an extra chiller that in practice rarely operates). Furthermore, it is noted that there are valid reasons for some degree of oversizing in terms of flexibility in fitout and operation; and it can help to maintain comfort conditions considering the increased variability of peak temperatures due to climate change related weather events. Therefore, this is not a simple area to address and requires a complex approach. Dealing with oversizing could potentially be addressed through mandatory requirements such as are proposed in this report.

4.3.1 Energy supply

Renewable energy generation or consumption is relatively high in jurisdictions such as Tasmania, South Australia and the ACT. This means that (from an emissions perspective at least) a low energy trajectory will increasingly need to address the range of other fuel and emissions sources, including gas, diesel, petrol, etc. Such as through fuel switching and electrification in the buildings and transport sectors, as well as by addressing other high emission sectors such as agriculture, land use, etc. An issue that may shape policy and action, is that penetration of gas in commercial buildings varies by state, and by access to the gas grid. Gas used by central gas hot water systems, and for cooking in this sector is often very inefficient.

4.3.2 Integration with energy policies

Integration of energy considerations into existing policies that do not currently incorporate energy requires a whole of government approach to send a consistent policy message. For example, many of the policy options include opportunities to increase uptake of distributed renewable energy systems such as solar PV. These types of policy mechanisms can send a signal to the industry about expected uptake of distributed renewable energy in the context of broader electricity grid decarbonisation, which would provide greater certainty on the likely speed of distributed energy uptake and support planning for future energy upgrades51. Coordination with broader energy policy is needed to determine the appropriate level of ambition for policies that support distributed renewable energy uptake, in order to manage the integration of these systems into the electricity grid.

4.3.3 Energy policy integration as peak energy demand is an energy network issue

There are tensions between reducing peak energy demand and reduction in annual energy use and greenhouse gas emissions. Interactions between internal heat generation, air leakage, solar gain through glazing, thermal bridging, highly glazed facades, occupant behaviour, tenant fitouts and other factors are complex, and often influenced by aesthetic, cultural, narrow financial and other drivers. In general, a focus on annual base building energy use in commercial buildings can often drive higher peak demand, while reducing peak demand can lead to increased annual energy use. Importantly, policies relating to operation, design and construction should focus on both peak demand and annual greenhouse gas emissions and operating costs.

Stakeholder feedback
5. Stakeholder feedback

A collaborative process was undertaken to identify views on the proposed policy options. This ensured that jurisdiction specific considerations were factored into the final shortlist of options. The stakeholder engagement included:

► Workshops with stakeholders and jurisdictional policy officers in Sydney, Melbourne, Canberra, Perth and Brisbane.

► A questionnaire distributed to each of the jurisdictions, which feedback on each initial policy option.

► Conversations with representatives from jurisdictions to understand their views on preferred policy options.

► Meetings with government officials to share EY findings and collect views on policy options

5.1 Themes from feedback

5.1.1 Minimum energy performance standards for buildings

► Harmonisation of NCC (‘Code’) provisions. There was general support for reducing variations to how the NCC is ‘called up’ by the jurisdictions. It was noted that this might sit more with the State/Territory jurisdictions than requiring changes to the NCC itself. The role for local government was also raised, and discussion with the City of Sydney confirms that local government can play an important role in improving the understanding and capacity of the property industry to achieve energy efficiency improvements.

► Better enforcement including undertaking audits and enforcement action where breaches are discovered. The general feedback was that this would be achievable, and amendments to legislation/regulations would be required in most jurisdictions to ensure compliance, along with extra resources for auditing and enforcement.

► Strengthening NCC (‘Code’) provisions. Such as by providing greater clarity (and less discretion) about the circumstances in which Section J of the NCC is triggered for existing non-residential buildings. States with warmer climates also raised the challenge of adopting Section J in tropical or warmer environments with high humidity, which might need special consideration for HVAC requirements.

► HVAC tuning – and broader controls tuning (lights, and even lifts) was viewed to need to be the lead area under this policy option. However, this is an exceptionally difficult area to regulate, as it is skill and process rather than technology driven. It was felt that HVAC tuning could be led with an energy reporting/disclosure requirement, supported by a certification scheme (e.g. like the UK EPCs) but, where possible, with some inclusion of basic control parameters, and programs based around controls tuning.

► There are linkages between this sort of policy initiative and the EU HVAC inspection regime. Whatever measures are taken in this area are only useful insofar as they generate an outcome, which involves improvements actually being made. The structure of any policy in this area should therefore focus on the achievement of performance outcomes rather than the process of tuning or commissioning – either of which can and will be done with little impact on performance in the absence of a clear performance outcome requirement.
Double-glazing: Double glazing was highlighted as an opportunity, since large amounts of heating energy can be lost, and heat gained through windows. Particularly for older buildings of various commercial building classes including mid-tier offices, hospitals, schools, etc. New Zealand was cited as an example where policy changes in 2008 led to a large uptake in double glazing and a high rate of retrofits to existing buildings. The Tasmanian Energy Efficiency Loan Scheme (TEELS) was cited – with lots of retrofits to energy efficient double glazing.

Some stakeholders highlighted the pressing need for strong mandatory requirements, beyond what has been proposed. While there was some suggestion that the NCC is the most obvious mechanism for this (notwithstanding the significant work required to shift the NCC focus to regulating existing buildings), there were strong views that something other than the NCC should be used to drive such change.

In favour of the NCC, it was suggested that it could become the fundamental defining document across the entire industry, with the target being the achievement of net zero across the sector by 2050. Where the NCC would set the requirement for new buildings and then also provide the framework by which existing buildings would be assessed. Noting that there would be substantial work required on the content of the Code (which would need to include post-construction performance as well as dealing with more difficult subjects like commissioning and control) and the legislation enforcing the Code (which would need to be expanded to cover post-construction).

This was felt to be required for an effective policy trajectory, since existing policy instruments have to date not delivered sufficient change required for transformation towards zero net emissions. This approach would potentially work not only to provide a clear rationale for measures imposed onto existing buildings, but it could also significantly simplify the Code as it applies to new build – because, if a building will be assessed on compliance (either by performance or deemed-to-satisfy) – there are numerous ways to simplify in Code. It would furthermore reduce the potential policy overlaps and inefficiencies of the current piecemeal policy environment.

The interaction between all the policies implemented should be carefully monitored, and a recognition of the impact on all stakeholders should be considered. The policy reviews should assess the relevance of existing policies and how they should adjust to changing market conditions. A framework to phase-out policy that becomes irrelevant could be developed.

Maximising energy savings should be balanced with maximising human health and productivity. For example, creating quality lighting outcomes through ‘human centric lighting’ and the use of higher illuminance levels for certain tasks can have benefits such as maximised productivity and improved human health, so should be included as a minimum requirement.

5.1.2 Providing focused advice, training and assistance for industry to comply with harmonised NCC requirements.

The feedback received through the workshops generally indicated support for increased resources for education and information. However, it was suggested that a further stage of work could be conducted to inform the program design – by way of an information gap analysis to identify where current information and education programs are not succeeding.

Budget constraints were also raised as a limitation for this option.

Information and capacity building supports several of the proposed policy options. Examples were provided as to how government entities are using information and capacity building to...
underpin energy efficiency outcomes. Examples include the ACT government and the City of Sydney which have developed policy logic and theory of change maps.

► Education of the market regarding the benefits of technologies should be a priority, such as government guidance material for commercial buildings, point of sale material, energy bill information and targeted education campaigns.

► Education of the construction industry (including developers, builders, electricians, architects, designers, building owners, commercial tenants) when buildings are refurbished/renovated/upgraded should be a priority.

► Education and training of the market could be undertaken by Governments in conjunction with specialist peak industry bodies.

► Widespread market education initiatives including suggested priorities for upgrading buildings with the lowest cost and highest benefit potential should be undertaken. Case studies and information sheets on the various upgrade options (e.g. upgrading to LED lighting) should be developed and widely promoted.

5.1.3 Universal, low-cost mandatory disclosure

► Mandatory annual disclosure of energy performance of all non-residential buildings was discussed. The feedback through the workshops suggested that while this policy option is generally supported, it might need to be iteratively introduced, focussing on certain building classes first.

► The complementarity of this initiative was noted, with government plans for expanding the voluntary NABERS program to all commercial building classes. As well as the existing CBD program and any expansion to new building classes. Clearly, this policy option would need to build on rather than duplicate such plans.

► Support was provided for beginning with a focus on the education and health sectors, with some views that it wouldn’t itself lead to energy savings due to lack of motivation by government. Necessary support includes capacity building initiatives for hospital and school energy managers and setting up the right investment processes through the Treasuries. This would help to link disclosure to more active reporting and benchmarking, to identify and then deliver energy efficiency or onsite renewable energy projects. The government programs successfully undertaken in VIC and NSW serve as somewhat of an example.

► Suggestion was made that annual disclosure could be through the government’s annual reporting process. Noting that further detailed policy/program design would allow for clarifying the benefits, direction and agreed-upon protocols.

► ‘Warrant of fitness reporting’ for existing buildings was suggested. Which could be structured as an assessment of buildings status relative to the current NCC. This goes beyond energy efficiency but helps to provide a framework by which the Code can be more effectively relayed into the existing buildings market. This WOF approach could reveal some key operational issues that are known to be critical in terms of energy efficiency, such as simultaneous heating and cooling, VSDs running at 100% and poor time control.

► A further suggestion was to feature the online Calculating Cool tool, as part of the reporting and disclosure tool or questionnaire. As a way to identify HVAC poor performance, and to leverage such existing work.
5.1.4 Financial incentives

► There was broad consensus that financial tools are effective at incentivising investment in building efficiency and are useful in supporting good performance.

► Some jurisdictions noted that they are already actively applying financial incentives, for example the grant programs through Sustainability Victoria. Providing best practice guidance on grants could be an outcome of pursuing this option.

► Where financial incentives are provided, it was suggested that lower performers who achieve higher levels of improvement should receive the most financial support, and requiring evidence of building improvement, in order to link support with performance. Mechanisms discussed included:

  ▶ Environmental upgrade agreements (EUAs) - there was general interest in pursuing EUAs, learning from experiences in States such as Victoria and New South Wales. This includes where it has worked, and challenges, such as working with multiple parties, across different organisations (local government and private enterprise), lack of understanding or processes for EUAs within councils, etc.

  ▶ Energy performance contracts (EPCs) have been successfully applied to Hospitals, Universities and to a lesser extent Schools in Australia, as well as abroad such as in the UK. Feedback from the Victorian Government Treasury department was particularly useful in highlighting how in both Victoria and New South Wales, it has taken a Government Department to champion building retrofit programs, with EPCs used as a vehicle, subject to a Treasury approved funding program (e.g. Greener Government Buildings in Victoria). This provides a model for successful program delivery in other States.

  ▶ The Clean Energy Finance Corporation (CEFC) provides support to the property sector across a spread of building classes. Current projects include health, offices and retail sector financial support to institutional property investors.

  ▶ The National Green Leasing Policy is the first nationally consistent approach by the Australian Government and state and territory governments, as tenants of buildings, to drive a reduction in the environmental impact of buildings through improved operational performance. It contains Green Leasing principles to guide governments.

  ▶ Green Leases can also be used in the private commercial building sector with publications developed to encourage the uptake of Green Leases in private leasing arrangements.

5.1.5 Tax incentives

► Tax incentives were less of a focus of stakeholder feedback compared with other policy options. However, support was provided by the property industry as well as one particular government jurisdiction that is low on revenue (where taxes can raise money for energy efficiency programs - instead of inaction due to lack of funding). Particular suggestions from the property industry (received subsequent to the shortlisting of the policy options in this report) include:

  ▶ Modernising the 10% green building managed investment trust (MIT) withholding tax regime by:

    ◆ Expanding the regime to all buildings held for rental purposes (regime is currently limited to offices, hotels and shopping centres)
Applying the rate to buildings that have been refurbished to achieve the necessary green star ratings (regime is currently limited to newly constructed buildings)

Applying the test on an asset by asset basis (regime currently requires all the MIT’s assets to satisfy the green star rating requirements)

- Extending the instant asset write-off scheme to include energy efficiency upgrades of buildings up to $100k.
- Green depreciation, which would see the deferment of taxable income in early years in exchange for bringing forward investment in large upgrades that exceed the instant asset write-off threshold.

EY and SPR note that an important element of such tax initiatives is to establish a performance-based process. Including to document the before and after case for evaluation and potential case studies for the benefit of others; and introduction of a minimum upgrade or performance level. Buildings that are 5-star or higher could be excluded. The idea would be to generally avoid subsidising owners of higher quality buildings, such as large institutional property investors, but instead focus on the mid-tier, retail, warehouses, etc. commercial building classes. A limitation is that tax breaks do not have meaning for the government and community sectors, schools, etc. However, it could be part of a package - particularly for mid-tier.

5.1.6 Government leadership

- There was strong support for government leadership, with this being on the agenda for reform in property industry circles for a number of years. Jurisdictions have varying degrees of existing action in this space.
- Government procurement and leadership was considered as part of a suite of tools that should be used for general awareness raising as opposed to its own, standalone option. NABERS tenancy ratings and procurement policies were discussed.
- While there was general support it was noted that government energy spend, and procurement, is a low proportion of consumption (and savings) that we need to address from commercial buildings.
- New South Wales was discussed as a leader though its GREP policy.

5.1.7 Information and capacity building

- Increasing awareness and information availability through education and data sharing was generally well received as an option, as capacity building that could support other policy options.
- There was general consensus that more data analysis is needed to understand key drivers in each sector, and that once energy intensity considerations have been defined then it will be possible to identify individual sector needs to provide education and guidance. However, there is a challenge of delivery related to budget and resourcing constraints.
- Current challenges were discussed that education and information sharing could potentially help to resolve. For example, green energy and efficiency improvements are often not widely understood within certain sectors or regions, and there is greater focus on the price of energy.
There was general consensus that collecting and monitoring building data would enable better clarity around issues and decision making. Currently there is a lack of guidance in some states and jurisdictions from decision makers around particular building classes, so greater clarity of information is needed to provide this guidance. Some data has already been collected through existing audit schemes conducted around Australia which provides good bottom up data for commercial buildings and increases awareness of building energy consumption. However, some previous schemes that collected energy performance information were not able to be shared publicly, as applicants did not give this permission. So, in future these schemes should consider requiring public information sharing as part of the funding agreement.

- Education messages should be kept simple. For example, use LEDs, seek compliant products from reputable companies, and drawing on product associations which have information on selecting appropriate products and avoiding non-compliant products.

### 5.1.8 MEPS for appliances

- Minimum energy performance standards for appliances were also considered as a tool to drive market transformation. Through subsequent discussions with stakeholders this was kept on the table as a policy option worth pursuing.

- Gas consumption was suggested as an important area for coverage. GEMS does not currently cover gas equipment, although there is some talk of including gas boilers. The discussion about shifting away from gas is therefore currently separate from GEMS.

- Standards should be linked to overall quality as well as energy performance. There is some research to suggest that consumers incorrectly assume that more stars equal to higher quality, when in fact they mean better energy efficiency.

- For certain technologies, such as chillers, there is an argument that certain ages or classes of technology should be phased out ahead of the site’s desire to replace. This is doubly relevant given issues with refrigerant phase-out, and could be linked to financing options.

### 5.1.9 Energy efficiency obligation (EEO or ‘white certificate’) schemes

- EEO schemes were noted as being important cornerstones of existing policy for many of the States. There are opportunities for developing existing EEO schemes, as well as for eventual take-up in other jurisdictions.

- It was also noted that some of the prioritised policy options in this report link to existing EEOs, for example financial incentives. Therefore, integration of any new policy options is an important consideration.

- EEO schemes are highly effective. While harmonisation of the current schemes into a national scheme is one option, retaining existing state schemes, introducing schemes into Queensland, Western Australia, Tasmania and the Northern Territory and harmonising key features would deliver similar benefits and may be simpler.

- EEE schemes have proven highly effective at driving market transformation in specific products, such as commercial lighting. So far they have been less effective at driving whole-of-building upgrades, but this may evolve over time.

### 5.1.10 Market transformation

- This option was discussed in less detail at the workshops, but several suggestions came up related to changes in the market. For example, for the smaller states and jurisdictions where there are only a few major energy providers, there is concern that lack of competition among
the energy providers will create higher than necessary energy prices, although this could encourage efficiency improvements.

► Direct technology replacement programs are very popular in the US, where funding and facilitation is provided to eliminate older technologies with newer technologies. In Australia we have aspects of this within existing white certificate schemes, but the provisions around HVAC within these schemes remain difficult.

5.1.1 Cap and trade scheme

► A cap-and-trade approach was proposed by a few stakeholders, recognising the fact that we have to get to zero emissions at some point, so all buildings have to get from wherever they are now to zero.

► There are many buildings that are unique and difficult to measure, in such a way as to promote improved performance. Where policy options such as performance disclosure (such as with NABERS) is not feasible due to: lack of comparable buildings to benchmark against (e.g. stadiums, airports, etc.), boundary of measurement issues (particularly in multi-use buildings), lack of motivation in less competitive/commercial sectors, etc.

► Therefore, a cap and trade scheme could feature establishing a carbon benchmark for the industry as a whole and then set a reducing carbon budget, which is then allocated across the building stock based on function and/or site historical baseline. The result is then a performance target that can be used to frame the discussion around many different interventions, across the entire industry.

5.2 Feedback on specific policy options

5.2.1 Policy option 1 - Clarify and enforce Code provisions

► Triggers for services and/or for building fabric upgrades – could be based on area proportion, value of work etc.

► Support is needed for building surveyors as well as contractors and designers.

► In designing and implementing the proposed policies, City deals should be used to gather data, pilot programs, and engage with affected sectors. E.g. the City of Sydney could specifically work with key stakeholders to pilot policy ideas and/or implement policies including compliance, program delivery, community engagement and recognition. Local government is a most trusted level of government and valuable to the success of programs and policies.

► The role of local government in checking compliance (in NSW at least) has reduced over past years and any policy recommendations which require greater activity by local government must be accompanied by adequate levels of resourcing. Compliance problems must be resolved however the role of local government cannot be assumed. There is a great deal of confusion with apartment dwellers who are unsure as to whether they come under NatHERS or Section J. Clarity regarding this is needed.

5.2.2 Policy option 2 – Mandatory HVAC inspection and certification

► Strengthening NCC provisions by mandating HVAC inspection and certification. Also with an opportunity for HVAC tuning – and broader controls tuning (lights, and even lifts). However, this is a difficult area to regulate, as it is skill and process rather than technology driven. Some education and training is likely to be required to provide the industry with the capacity to deliver the requirements.
► The structure of any policy in this area should therefore focus on the achievement of performance outcomes rather than the process of tuning or commissioning – either of which can and will be done with little impact on performance in the absence of a clear performance outcome requirement.

► Some stakeholders highlighted the pressing need for strong mandatory requirements, beyond what has been proposed. While there was some suggestion that the NCC is the most obvious mechanism for this (notwithstanding the significant work required to shift the NCC focus to regulating existing buildings), there were strong views form the jurisdictions that something other than the NCC should be used to drive such change. Such as a separate national and/or state-based strategy and supporting regulation.

5.2.3 Policy option 3 – Universal, low-cost mandatory disclosure

► Mandatory reporting will show older stock as being very poor performing however it may not be cost effective to force them to be upgraded. This is a challenge.

► Strong support shown for the use of NABERS rating tools for the sectors that they are available for.

► Suggestions for the development of meaningful benchmarks, especially for smaller non-office buildings. And for setting appropriate minimum standards based on baseline performance.

► An option to reduce emissions (rather than energy performance) to maximum rate via renewable energy generation or purchase. A more detailed sector by sector analysis of the value proposition could be undertaken to further inform the program design.

5.2.4 Policy option 4 – Mandatory minimum standards for government procured or used buildings

► Governments have large and diverse building portfolios. Therefore, the scope needs to be defined given the diversity, scale and location of buildings e.g. a police station in a small regional town, railway stations & depots.

► Energy efficiency and Energy Performance Contract programs are being rolled out in Victoria for example, with very good energy savings identified for the regional hospitals

► Clarifying the definition of Government will be important - i.e. owned or occupied. And giving coverage of federal, state or local government plus agencies- e.g. healthcare, education, laboratories, community centres etc.

► The design of this policy, implementation pathway and supporting resources would need to be differentiated depending on the specific sub-sector.

► Capacity issues for smaller, devolved buildings e.g. VIC schools are primarily self-managed. Trialling the program on larger premises might make sense before burdening smaller ones.

► Meaningful benchmarks are needed for non-office buildings such as healthcare. Policy option 3 on disclosure (and data collection) could support this. It is worth noting that the portfolios of COAG Energy Council Ministers are unlikely to include government building procurement policies (this is more likely to be the responsibility of central agencies).

► Suggestion to set out a trajectory / pathway for each sector (i.e. what sector(s) would be targeted first).

► Governments must invest to upgrade the properties that they own using frameworks like the Victorian Greener Government Buildings (GGB) Program and NSW Government Resource Efficiency Program (GREP). The vast majority of energy used by governments is from owned, not leased buildings, such as hospitals, schools, defence and justice facilities. While minimum lease standards for government occupied buildings are important they will generally only impact office space, which is a small fraction of government occupied space.
Governments must introduce minimum standards for leased commercial buildings. The UK has introduced minimum standards for both commercial and residential properties via the Energy Efficiency (Private Rented Property) (England and Wales) Regulations in 2015. Minimum standards should be based on NABERS ratings. This is discussed in the Energy Efficiency Council’s new report ‘The World’s First Fuel’.

Minimum standards for procurement are not enough and are not the most cost-effective way forward. Governments must invest to upgrade the properties that they own using frameworks like the Victorian Greener Government Buildings (GGB) Program and NSW Government Resource Efficiency Program (GREP). The vast majority of energy used by governments is from owned, not leased buildings, such as hospitals, schools, defence and justice facilities. While minimum lease standards for government occupied buildings are important they will generally only impact office space, which is a small fraction of government occupied space.

5.2.5 Policy option 5 - Financial incentives

As well as financial support, informational and training resources for building owners and for the building industry will be required.

Considering a full range of financial mechanisms including EUAs.

Consider linking support to performance improvements, as well as absolute performance, to capture the lower/smaller end of the market.

Obligations to improve performance and provide performance data (before and after) is already a key requirement of grant programs – see various Sustainability Victoria grants.

Through good grant design (e.g. clear eligibility criteria and targeted questions) the ‘free rider’ effect can be minimised.

It is, however, noted that the type of grant being offered (e.g. a grant that is aimed at skill development of staff) will influence the metric / KPI that will be used.

A potential outcome from this policy option could be the development of best practice guidelines for grant design.

The triggers for monetary assistance would need to be carefully calibrated but would need to be accessible as without them, many building owners will push back against having to upgrade their buildings due to affordability issues. E.g. for smaller and older buildings.

In terms of additional incentives, it would be sensible to focus on policies that incentivise meeting certain whole-building performance levels. One highly-motivating but revenue-neutral approach would be differential council rates, with higher rates applied to buildings that are rated at below 3-star NABERS, and lower rates applied to buildings rated at over 3 star NABERS.

EEOs are relevant to this policy option – which are discussed under the EEO heading.

5.2.6 Policy option 6 - Expand MEPS for building technology and equipment

A shift away from gas in buildings should be supported and incentivised by this policy.

Upgrading the lighting in an office building would need to be scheduled with MEPS standard lighting and ideally would need to be registered in a log book or other recording medium.

Good energy efficient solar passive design presents great opportunities to improve the energy performance of existing commercial buildings. To achieve a lower heating and cooling artificial energy demand (through e.g. orientation, shading, air filtration and building system).
The policy could pursue more accurate evaluation of a building`s energy performance over its entire service life, differentiated extreme climates. The approach should be to pursue more accurate modelling so it is good enough to reflect the performance of a building in reality than solely on one or two thermal parameters. The relationship between those parameters, more design options and variations in modelling and consideration to all contributing factors (e.g. thermal mass, building system, new pollutant absorption innovations) should be included.

In addition, though a good passive design is usually achieved when initially designing and building, substantial renovations to an existing building can also offer a cost-effective opportunity to upgrade thermal comfort – even small upgrades can deliver significant improvements.

Majority of the commercial buildings are going to be renovated after a leasing period end for different business purposes. Assessing an existing commercial building`s prospects for thermal comfort and/or ability to be cost effectively upgraded to reflect good passive design principles in its climate has great potential in ensuring an energy efficient design.

Options for passive design reduces or eliminates the need for auxiliary heating or cooling, bills, and reduced greenhouse gas emissions for the life span of the building.

5.3 Building classes

During stakeholder discussions there was a focus on:

- The higher consuming building classes; Offices, retail, health and education account for the majority of commercial building energy consumption now and into the future
- Where there are gaps in participation and barriers
- Key opportunities for particular building classes

A summary of the discussions is provided in the table below.

<table>
<thead>
<tr>
<th>Building class</th>
<th>Opportunities</th>
<th>Barriers</th>
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| Hotels        | • Hotels are much more energy intensive than other commercial building types with opportunity to make improvements in energy efficiency on a building by building basis.  
• City of Sydney have been working with hotels and are willing to help inform future focus on them. | • Ownership can be an issue for hotels as they often have foreign ownership in capital cities and/or low motivation to act.  
• Some also have their own rating schemes  
• Energy costs can be a low % of total costs |
| Mid-tier offices | • Large amounts of mid-tier offices in most jurisdictions, with good opportunity for building improvements  
• In some jurisdictions, existing schemes are already being reviewed to capture more mid-tier offices. Opportunity to go beyond NABERS e.g. metering, monitoring and tuning of HVAC | • Difficult to reach for a number of reasons - lack of commercial triggers for refurb; lack of motivation; etc.  
• Financing can also be an issue  
• Plenty of research has been conducted on mid-tier but still little penetration into the sector |
| Office tenancies | • For addressing split incentives, grants and subsidies could be used to attract investment | • In the commercial sector, mandatory requirements may have an impact on landlords passing costs down to tenants  
• Mixed-use buildings are hard to rate for the purpose of NABERS |
| Shopping centres | • There can be solar PV opportunities for shopping centres considering the daylight opening hours, particularly in states with sunnier climates to utilise solar energy | • Shopping centres have a unique market, structured around locational profiling such as city centre, regional centre, village, etc. |
| **Data centres** | • Potential for further investigation as to whether purported existing regulatory requirements for energy reporting to be provided to new retail lessees could be captured for benchmarking purposes (refer to Policy option 3 in this report) | • Strong reluctance from the shopping centre industry for any new reporting/disclosure requirements
• Noting the potential exclusion of shopping centres from expansion of CBD programme
• Mandatory requirements may have an impact on landlords causing cost implications to be passed down to tenants - although there could be some offset from lower operational costs |

| **MEPS can be applied to Data Centres** | • Can be hard to identify, find and reach
• Sometimes limited opportunity for savings (large electrical load)
• Data centres have improved PUE but also are expanding due to growing demand |

| **Hospitals** | • Successful Energy Performance Contract examples in Victoria, with Treasury led funding model for whole of government, through the Greener Government Buildings Program
• There is opportunity to build upon the previous work already completed in the health building space in certain jurisdictions
• Good energy savings potential | • 24/7 operational environment is challenging for upgrade projects
• Lack of motivation/capital for building performance (cf other opportunities)
• Lack of refurbishment event triggers at end of lease or point of sale
• Lack of investment framework (with exception of VIC and NSW who have established funding models with Treasury) |

| **Schools** | • Schools are mainly operating during 9am-5pm hours, which creates large opportunities for solar PV. In certain jurisdictions, some incentivised rooftop solar on and schools already exist.
• Split units with increased renewable energy supply provide an opportunity to fuel switch from gas to renewable electricity
• Opportunity for a nationwide strategy for energy efficiency in schools | • Lack of commercial triggers for refurbishment
• Lack of knowledge and awareness of energy management
• Facility management is often not aligned to energy efficient management. Sometimes FM interests can be at odds with the school’s interests depending on the contract |
Prioritised policy options
6. Prioritised policy options and comments on considerations identified above

6.1 Framework and approach to energy efficiency in existing commercial buildings

Three broad policy approaches are identified that inform the policy options for low energy and emission buildings. These policy approaches can be applied individually or combined across the six prioritised policy options. The three policy approaches are outlined in the figure below.

![Figure 21 - Complementary policy approaches](image)

6.1.1 Information and capacity building

Lack of information, awareness and capacity to address potential energy efficiency opportunities is a key barrier and opportunity for energy efficiency investment in commercial buildings. It includes improving the quality and availability of energy performance information and labelling for buildings and components, while also expanding professional training programs and accreditation for designers, suppliers, installers and auditors, helping to overcome capacity and skills limitations. It is likely to play a role across most of the policy options, including: voluntary and mandatory disclosure schemes, government leadership with procurement, industry training, accreditation and capacity building and trials and demonstration projects.

6.1.2 Financial incentives

Financial incentives provide an opportunity to reduce the capital expenditure required by decision-makers and encourage commercial uptake of energy efficiency equipment. Financial and tax incentives can encourage energy efficiency upgrades and retrofits, while market-based instruments, including obligation and white certificate schemes could also be deployed to attract decision-makers with regards to implementing energy efficiency equipment.

Instruments that could be deployed within this policy approach include: grants, rebates, subsidies, retailer obligations such as EEO schemes, tax depreciation, co-financing, green bonds, mortgages and equity measures. Such incentives can support many (though not all) commercial building classes and segments where it can address relevant barriers. There is an obvious proportional burden on government through the adoption of this approach.

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52 The IEA’s Efficient World Strategy sets out three policy approaches. This is consistent with other policy frameworks, such as the Australian Alliance for Energy Productivity 2016 ‘roadmap to double energy productivity in the Built Environment by 2030’.
6.1.3 Regulation

Key regulatory options include Minimum Energy Performance Standards (MEPS) for buildings and introducing MEPS for appliances.

As it applies to all building classes, addressing barriers to the effectiveness of current minimum standards and strengthening them over time has been identified as a key energy efficient policy lever for decarbonising existing commercial buildings. An improved regulatory environment that is flexible and adaptable to technological developments has the potential for ease of uptake and widespread influence.

6.2 Refining the policy options

An initial set of eight policy types were identified from domestic and international literature:

- Minimum standards
- Building ratings and disclosures
- Energy efficiency obligation schemes (EEOSs)
- Fiscal incentives and tax
- Government procurement
- Information and capacity building
- Data sharing
- Market transformation

Through further analysis and engagement with industry and jurisdictional government stakeholders, the eight policy types were distilled into six overarching policy options:

1. Clarify and enforce Code provisions
2. Mandatory HVAC inspection and certification
3. Universal, low-cost mandatory disclosure
4. Mandatory minimum standards of government procured buildings
5. Financial incentives linked to minimum performance
6. Expand MEPs for building technologies and equipment

For the options not included in this list:

EEOS schemes are a cornerstone of energy efficiency policy in four jurisdictions. Stakeholder consultation noted that the above listed policy options would interact closely with existing EEOS schemes, as well as noting opportunities to develop and improve on these schemes further. An ultimate goal of harmonised EEOS schemes across all jurisdictions was generally agreed to be a worthy aspiration although not likely in the short to medium term.

EEOS schemes are currently in place in a number of states and territories; and other policy options were regarded as having a greater potential impact. There may however by opportunities for further development and improvement of existing EEOSs and opportunities; and for new schemes in jurisdictions that do no already have them. There can be a valuable role for the federal government in supporting, assisting and promoting best practice; and in commissioning applied research for example, comparing energy savings methodologies for all schemes.

With regards to market transformation, the economic context in Australia is not, at present, conducive to a market transformation model for example like that of Japan. Such a model relies on picking technologies or industries where onshore manufacturing would be beneficial. While this was discussed with a few stakeholders, for products like high performance glazing, it was not deemed justifiable to pursue as a dedicated option.

Information and capacity building has been consolidated into a cross cutting theme that will be an important part of program design and implementation, for many of the policy options.
6.3 Interplay between barriers, policy approaches and policy options

The figure below demonstrates the logical interplay and causality between barriers to low energy and emissions buildings, policy approaches (empower, incentivise and/or enforce) to address such barriers, and the development of policy options.

The identified policy options have some interlinkages, drawing on a mix of policy approaches. For example, although ‘1. Clarify and enforce Code provisions’ is not shown to link to financial incentives, that is not to suggest that as the policy is rolled out, financial (and tax) incentives could not be implemented to aid with uptake of this policy option.

6.3.1 Policy considerations

Commercial buildings operate in a diverse set of markets and other factors that influence investment in energy efficiency and renewable energy. Some of the key considerations include: building class, tenure, jurisdiction, and timing of implementation.

Table 7 - Key considerations for policy design

| Building class | The impact of policy options has been modelled universally in the benefit cost analysis, across all building classes (except for Offices currently covered by the CBD programme). A high-level narrative is also provided as to how policy options can be developed into programs, using a logical approach to focus on building classes with higher energy consumptions (mainly mid-tier offices, retail, education and health), while also keeping in mind the opportunity to address higher energy intensity classes (for example, health, hotels and data centres). A mix of barriers are likely to be experienced depending on building |
class combined with other considerations. Section 6.10 provides a summary table of how the policy options can be tailored to different building classes.

| Tenure | The tenure of a building, whether owner-occupied or leased, creates a range of barriers for energy efficiency. For leased buildings, the split incentive means that the owner's interest in energy efficiency is indirect. Energy efficiency is seen to be relevant where it adds to tenant retention, rental value and capital value drivers. For owner-occupied buildings there is some evidence to suggest that they are less energy efficient than institutionally-owned and leased buildings, due to lack of motivation, energy costs being a low percentage of total costs, perceptions of energy being a fixed cost and lack of awareness and access to capital. |
| Location and climate | The locations of buildings often inform the commercial markets in which they sit. For example, city centre buildings might operate with different tenant demand, and motivations for energy efficiency than in regional towns. Climate patterns can also play a role in determining which initiatives for enhancing energy efficiency are suitable and feasible. For example, higher humidity levels in northern jurisdictions will affect HVAC energy loads differently to those in the south. The existing policy context in states and territories also has the potential to shape a jurisdiction's perceptions of the policy options. |
| Timing and implementation | Each of the six policies are designed as a platform for policy evolution over time, and as a suite of policies they are targeted at the short to medium term (2-5 years). The timing of implementation may, however, vary depending on above considerations of building class, tenure and jurisdiction. The impact of the policies would be enhanced by a complementary investment, education and training plan to support long-term cultural change in the delivery of higher energy efficiency. Since implementation is a function of many factors - and moving from opportunity to performance/implementation requires a focus on education and innovation, to address the substantial cultural change required. Along with readily available financial investment options, to support the substantial investment required. |

6.3.2 Application of the policy options

The six options have the potential to be implemented as a coordinated package with the purpose of building understanding and capacity, incentivising action and then strengthening regulation. To hasten our progress towards a zero net emissions trajectory for commercial buildings.

A detailed description and application of each policy option is provided in the subsequent sections of this report. Note that this is intended as a summary of the policy options, and further details including from the stakeholder consultation can be added, following i) the 14th October 2019 stakeholder consultation response deadline; and ii) ultimately as part of the detailed program design that would eventually follow this report.

6.4 Policy option 1: Clarify and enforce Code provisions

Policy option 1 has two key objectives:

- The immediate objective is to ensure that current Code requirements are understood and applied. There is long-standing feedback from the property industry that the circumstances in which the Code is intended to apply to existing buildings is poorly understood, inconsistent across jurisdictions, and rarely enforced. This leads to a culture in which the default outcome is likely to be non-compliance, and where the substantial discretion of building surveyors is generally used in favour of the developer to not apply the Code requirements.
The second objective is to contribute to a wider change in the culture of the building industry, to move from minimal or optional compliance with energy performance requirements, to one where energy efficiency is seen as essential. Over time, this measure could contribute (along with other measures below) to developing a culture of energy performance excellence, building the skills and capacity of the Energy Services sector to deliver energy efficient solutions.

The focus on building awareness of existing Code provisions, enhancing enforcement and harmonising requirements and is underpinned by three tasks:

i. Improve understanding of existing Code provisions

The Planning legislation of States and Territories differ in how they treat the application of the NCC in relation to refurbishment. This is often unclear, leading to confusion and non-compliance within the industry.

Work undertaken by Exergy for the City of Sydney identified that few parties understood how the NCC should be applied to office tenancy fit-outs – including the council planners responsible for compliance. In high churn sectors such as retail this is a major issue. There can also be a lack of resourcing for compliance monitoring within local (as well as state) government. This needs to be addressed strategically at a national level.

The NCC applies to all new commercial buildings and major renovations, while the states and territories have a stronger capacity to focus on particular commercial building classes, depending on the existing policy structure. Local government, via planning regulations, can also play an instrumental role in establishing energy efficient outcomes. To build awareness of national, State and local policies and regulations:

► States and Territories should begin by reviewing their existing regulations, guidance and communication materials in this area; analysing the extent to which there are deficiencies, gaps or inconsistencies – including by consulting with the building industry to capture industry perspectives – and then determining the extent to which those regulations and guidance can be harmonised and clarified.

► Draft revisions to regulations, and draft guidance materials, should be ‘road-tested’ with industry and refined prior to national roll-out.

► Once measures and materials are finalised, design and implement a national education and communication program for industry – with a particular focus on building surveyors and energy assessors, but also builders and the wider construction community – to ensure that the clarified provisions become widely understood. Materials could be integrated within existing continuous professional development courses inter alia.

► After a suitable period of time (perhaps two years) state building regulators commence an extensive program of compliance audits and enforcement action, including given high profile to any infringements, in order to reinforce the messages with industry.

► Develop a range of suitable education and communication products for the States and Industry, in consultation with the ABCB and industry associations.

► Partner with industry associations (AIReH, ABCB, etc.) to target knowledge and skills gaps as required. Many energy services companies could deliver simple building tuning, however more sophisticated tuning on more complex buildings would run into capacity and skill limitations in the energy services industry. This is expected to be addressed over time, as regulations gradually ramp up.
ii. Enhance enforcement

Most States and Territories have emissions reduction targets and energy efficiency policies that are actively influencing commercial buildings. There is an imperative, therefore, to develop enforcement strategies with state building regulators to ensure that robust enforcement measures are developed and are able to be carried through. To achieve this, this program suggests to:

► Work with the State building regulators and build on NCC 2019 with a focus on addressing enforcement. Aim for strengthened checks and enforcement of Code application to existing commercial buildings.

► Work with local government to work towards a harmonised approach and consistency in enforcement.

iii. Harmonising requirements

Existing buildings are currently subject to shortcomings of the legislative framework (i.e. planning regulations) under which the Code is implemented at state level. There is an opportunity to establish a clear framework for the Code to be applied to existing buildings beyond the confines of planning regulation.

This seeks to embed a consistent approach across jurisdictions by:

► Harmonising the NCC triggers with other jurisdictions, such as through the ABCB/Building Minister’s Forum.

► Providing focused advice, training and assistance for industry to comply with harmonised NCC requirements.

► Focussed on those involved in the assessment of compliance. Currently the compliance assessment for Section J (commercial building energy efficiency requirements) is often undertaken by the design engineer who can state compliance without concerns relating the minor infringements. Certifiers then rely on the engineer, and councils rely on the certifiers.

► Educating all these parties is necessary but not sufficient to achieve improvements in this area. In particular, there needs to be a mechanism that introduces more accountability, so that there is increased motivation to act.

► Making greater and focused efforts to enforce harmonised NCC provisions, including undertaking audits by independent parties then of enforcement action where breaches are discovered.

There can be a valuable role for the federal government in supporting, assisting and promoting best practice; and in commissioning applied research for example, into what harmonised regulations could look like.
## Logic model for policy option 1

**Objective of policy option 1:** Clarify and enforce Code provisions

<table>
<thead>
<tr>
<th>Barriers addressed</th>
<th>Policies/Programs</th>
<th>Outputs</th>
<th>Outcomes</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ Diversity of commercial buildings and availability of data&lt;br&gt;▶ Capacity constraints&lt;br&gt;▶ Motivation</td>
<td>▶ Improve understanding of existing Code provisions&lt;br&gt;▶ Enhance enforcement&lt;br&gt;▶ Harmonise requirements</td>
<td>▶ Guidance and communications materials&lt;br&gt;▶ Enhanced enforcement capability</td>
<td>▶ Improved understanding of existing code provisions&lt;br&gt;▶ Enhanced enforcement capability</td>
<td>▶ Improved awareness and effectiveness of codes and standards&lt;br&gt;▶ Enhanced energy productivity&lt;br&gt;▶ Reduction in energy consumption and emissions&lt;br&gt;▶ Harmonisation across all levels of government around enforcing codes and standards for energy efficiency</td>
</tr>
</tbody>
</table>

*Figure 23 - Logic model for policy option 1: Clarify and enforce Code provisions*
6.5 Policy Option 2: Mandatory HVAC inspection and certification

This Policy Option would create new requirements in the National Construction Code for:

- Mandatory, periodic, inspection and condition assessment of building HVAC systems, considering at least essential maintenance requirements and building tuning requirements
- Reporting the above to building owners and a public register
- Systems would be assessed as ‘effective’ or ‘defective’
- Where defective, systems would require re-assessment after a period of time (3 - 6 months), and fines would apply where identified faults have not been rectified.
- Further changes as part of the 3-yearly cycle of NCC reviews. We note some stakeholder feedback suggesting that the NCC should become the main instrument for driving zero net emissions in existing commercial buildings (see section 5 of this report). This would require significant change to the NCC and could be further proposed and realised during future reviews.

This program responds to barriers identified in improving HVAC systems (refer to Section 8 of this report on barriers) with poorly maintained HVAC systems and poorly tuned buildings being extremely common and the most cost-effective opportunity for realising rapid energy savings.

The intended outcomes of the Program would be:

- To ensure that poorly-maintained and tuned buildings and HVAC systems are identified and rectified, leading to highly cost-effective energy and emissions savings
- To encourage and promote a wider culture of energy efficiency in building operations, including building owner awareness of good maintenance and tuning practices, and the Energy Services industry capacity to deliver these outcomes.

As with the process to develop commissioning requirements in the Code for new buildings, we would expect a similar process of industry consultation, analysis, and possibly standards development; which would be needed to refine and target the measure most effectively. Subject to that, details of the initiative design should be treated as indicative only. However, it may be that:

- Once certified ‘compliant’, HVAC systems for a given building would then not require re-inspection and certification for, say, 5 years
- Buildings without centralised HVAC systems may be exempted (or face simpler provisions)
- Where necessary, metering calibration may form part of the inspection process
- There may be a case for exempting small buildings, with size thresholds to be determined
- Key terms and reporting requirements would need to be defined from a technical perspective, understanding that a wide variety of HVAC systems and components, of different vintages, will be encountered.

It is likely that ‘effective/defective’ would need to be assessed based on a partially subjective standard such as “good industry practice”, or words to that effect. That is, systems would need to be assessed taking all relevant circumstances into account, including the building’s and plant’s age, design, operating conditions and other factors. The intention would be to identify major or significant opportunities for a) urgent maintenance and b) rectifying poor tuning of HVAC systems.
As part of developing this measure, governments should consider – and consult with industry – regarding necessary information and training requirements and materials, to help build capacity (particularly in smaller and regional markets) to implement this measure successfully. Stakeholders consulted during this project noted that there is, at present, limited demand for HVAC maintenance and tuning services, reflecting the low state of awareness of these issues. As a result, there are also relatively few highly skilled service providers – although many who could provide the required services if the demand existed and with suitable training and/or guidance.

This measure would both create the required demand and help to build capacity to supply. The measure of the program's success would be when the majority of buildings/systems inspected were judged 'efficient', in which case the measure would no longer be required. If achieved, this would be an example of market transformation, where changed culture and practices are permanently embedded without further intervention by governments.

Maintaining a public register of 'defective' systems would a) enable suitably qualified energy service providers to provide innovative and low-cost solutions where they are most needed, leading to a cost-effective overall improvement in operational building efficiency; b) involve an element of 'name and shame', designed to encourage compliance and assist with a wider cultural change within the sector.

Compliance costs would be minimised by enabling certification/recertification of buildings based on inspection of appropriate documentation (including contracts, for example) that evidences that a particular building has a regular and professional inspection, maintenance and tuning process in place. In such a case, a building could be certified or re-certified as effective without a physical inspection or condition report. However, the certification would still be registered for compliance purposes. This would ensure that all existing, well-maintained buildings would face minimal costs, once every 5 years, while the primary focus and impact of the measure would be on poorly-maintained buildings. Over time, the share of poorly-maintained buildings would be expected to fall, further reducing total compliance costs. Second, the measure (including public disclosure) should help to achieve the wider cultural shift noted above, leading to more 'anticipatory' maintenance and tuning, a lower ‘defective’ rate and lower-again compliance costs.

With the reach to address all building classes and relevant types covered under the Code, the NCC is a natural starting point for driving towards energy and emissions reduction, with the target being the achievement of net zero across the sector by 2050.

There are linkages between this sort of policy initiative and the EU HVAC inspection regime, the success of which is unknown and merits further research.

Other options include:

► Mandatory on-site renewable energy provisions with Code – this is often more cost effective than many of the traditional energy efficiency measures identified in the Code.

► Minimum standard of metering and monitoring/reporting of consumption. Most buildings (beyond premium and A rated buildings) tend to have very basic metering. Making use of improved metering requires the building owner/operator to have the time, resources and interest to interpret and act on the metering information. Therefore, a metering related requirement should be linked to other policy initiatives such as incentives, or working in tandem with mandatory disclosure of energy ratings.

► Consider a suitable framework for identifying HVAC oversizing.

► 3-yearly review of policy settings for existing non-residential buildings, aligned with NCC review cycle. The 3-year cycle aligns to the changing nature of technology and environmental issues. There are some loose ends and lost opportunities from a major Code upgrade that a regular cycle can bring to the fore.
Logic model for policy option 2

Objective of policy option 2: Mandatory HVAC inspection and certification

<table>
<thead>
<tr>
<th>Barriers addressed</th>
<th>Policies/Programs</th>
<th>Outputs</th>
<th>Outcomes</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>Mandatory, periodic, inspection and condition assessment of building HVAC systems considering at least essential maintenance requirements and building tuning requirements</td>
<td>Compliance audits</td>
<td>Strengthened commissioning requirements</td>
<td>Enhanced energy productivity</td>
</tr>
<tr>
<td></td>
<td>Public reporting of effective/defective HVAC systems</td>
<td>Mandatory turning and metering calibrated</td>
<td>Understanding and uptake of energy efficiency opportunities</td>
<td>Reduction in energy consumption and emissions</td>
</tr>
</tbody>
</table>

Figure 24 - Logical model for policy option 2: Mandatory HVAC inspection and certification
CASE STUDY: New York City, Mandating Energy Efficiency Upgrades

New York City has mandated that 14,500 of their least efficient buildings must accelerate and deepen their major efficiency upgrades. Introduced in 2017, it is considered to be the most ambitious program of its kind in the USA, it assists with financing to support retrofits, has steep penalties for non-compliance and was set to stimulate 17,000 ‘green jobs’

Mandated fossil fuel caps apply to all buildings over 25,000 square feet and will trigger replacement of fossil fuel equipment and efficiency upgrades in the worst-performing 14,500 buildings, which together produce 24% of the city’s total greenhouse gas emissions. In order to meet these targets, building owners will make improvements to boilers, heat distribution, hot water heaters, roofs and windows, requiring deeper changes during their replacement or refinancing cycles over the next 12 to 17 years.

The new targets will reduce total citywide greenhouse emissions 7% by 2035, the single largest step yet taken to reduce greenhouse gas emissions, equivalent to taking 900,000 cars off the road, and spur 17,000 green jobs performing building retrofits. The plan has been enacted via legislation.

To compel building owners to meet these aggressive targets, the legislation will set annual penalties that increase with building size and the amount the buildings exceed the fossil fuel use targets.

To help smaller owners achieve these objectives, the legislation will authorize a Property Assessed Clean Energy (PACE) program to provide financing at low interest with long terms that allow property owners to pay for energy efficiency investments through their property tax bill. A PACE program in New York City has the potential to finance $100 million annually in energy efficiency and clean energy projects. The City will also continue to provide expansive technical support and sharing of best practices through the NYC Retrofit Accelerator program.

The plan will stop landlords of rent regulated buildings from displacing tenants or raising rents based on the cost of improvements required by new mandates. Targets for these buildings will be established in 2020, in tandem with reform of rent regulation. They will also have an extended compliance date of 2035.

NYC estimates that by 2035, benefits from this program will include:

- **Emissions reductions**: a reduction in community emissions by 7% (the equivalent of taking 900,000 cars off the road).
- **Low carbon economy**: 17,000 skilled low carbon ‘green’ jobs created for plumbers, carpenters, electricians, engineers, architects, and energy specialists. The program recognises that a well-trained workforce is necessary and so the City's Green Jobs Corps, in partnership with industry, will help to prepare thousands of New Yorkers for ‘careers at good wages and benefits’ to do this work.
- **Reduced reliance on fossil fuels**: 14% reduction in natural gas use and a 20% reduction in fuel oil use.
- **Air quality improvements**: estimated to be ‘enough to avoid 40 premature deaths and 100 emergency room visits related to asthma every year’.
- **Lower annual energy costs, more comfortable indoor spaces**: Energy cost savings up to $300 million per year for building owners and more consistent temperature for tenants.

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CASE STUDY: City of Seattle, Building Tune-Ups Requirement

In 2013, the City of Seattle set out its Climate Action Plan, aiming for community-wide carbon neutrality by 2050.

As buildings were responsible for a significant proportion of the City emissions, the City set out to improve the energy and emissions efficiency of Seattle's existing building stock through The Implementation of Building Tune-Ups Requirement, which sets out to:

- Reduce emissions
- Promote high energy performing buildings
- Reduce energy bills and maintain affordability for building owners and tenants
- Support local low carbon jobs.

To support these outcomes, the Building Tune-Ups Requirement has been established as a Rule within the Seattle Municipal Code and states that all buildings in the City of Seattle that meet specified size thresholds (gross square feet) and building uses, must fulfill certain requirements to ensure optimized energy and water performance. Building Owners must comply with the Building Tune-Ups requirement once every five years.

The Rule requires owners of non-residential buildings that are 50,000 gross square feet or greater to tune-up building energy and water systems every five years. A tune-up includes:

1. (a) an inspection of building systems to identify operational or maintenance issues;
2. (b) Corrective Actions to operational and maintenance issues identified in the inspection; and
3. (c) a report to the Seattle Office of Sustainability and Environment (OSE) summarizing issues identified and actions taken.

The building elements to be assessed in a tune-up, and the associated Corrective Actions were designed to incorporate actions that taken together would, on average, reduce energy use by 10-15% and pay back in utility bill savings in 2-3 years. While the Building Tune-Ups Assessment and Corrective Actions were designed around that model, the Building Tune-Ups requirement itself does not require the calculation of energy savings or payback periods. Payback periods for any specific action or for combined actions for an individual building are not a determinant of whether a Corrective Action is required.

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6.6 Policy option 3: Universal, low-cost mandatory disclosure

Policy option 3 aims to build awareness of energy efficiency opportunities and to strengthen market and organisational incentives for their realisation. While there is some evidence that reporting of information by itself is sufficient to induce improvements, there are also examples where such schemes have led to little improvements. The objective of performance improvement therefore needs to be kept in mind, and we propose that mandatory disclosure is supported with a broader set of policy initiatives such as information and capacity building for certain building classes, and targeted government incentives linked to performance, to make the shift from disclosure to performance improvements.

Mandatory disclosure - unlike voluntary disclosure - can highlight how buildings are performing (poorly or well), relative to similar buildings. In more commercial sectors where buildings and/or tenancies are actively ‘traded’, such as offices and retail, mandatory disclosure is intended to work in two ways: 1) by informing consumers (potential future tenants or owners of a building/space) about the relative efficiency and operating costs of that building/space, helping them to choose the level of energy efficiency they prefer; and 2) by informing and creating competitive pressure for building owners to improve the performance of less efficient buildings.

There has historically been a lack of available energy consumption and intensity data, and therefore a lack of meaningful benchmarks, for many commercial building classes. A mandatory reporting scheme would help to address this, with statistically significant data by weight of the large volume of buildings participating. Following an approach of ‘keeping it simple’, this would aim for sufficient information captured to enable meaningful benchmarking – with the option of the building owners (or tenants) adding more information if they wish (without blowing out the compliance burden/cost).

The mechanism for disclosure could feature lodging a minimum set of energy performance and last refurbishment information by way of an online portal or questionnaire. This could feature use of existing disclosure tool/s such as NABERS Online (or Green Star) for decision makers around the energy intensity of buildings that they occupy, own, or are considering occupying.

A possible pathway for disclosure could include:

- **Targeting certain sectors first** - where the CBD scheme is not already focussed. An option is to first target Government buildings, applying a similar approach to the Display Energy Certificates for public buildings in the UK though without site visits required. There is some evidence of success with government energy rating disclosure schemes. Examples include the Energy Efficient Government Operations policy in Australia, which provided regular disclosure to parliament with demonstrated impacts on performance. The UK Display Energy Certificate scheme has some evidence of reduction in energy intensity across the time it has been in place (we also note that there are mixed reports on the effectiveness of Energy Performance Certificates). A single policy in place across all levels of government is preferable to separate schemes. For example, DECs in the UK cover national and local government (though limited to England and Wales).

- **Followed by application to all commercial building classes** – not captured by other schemes (in particular CBD). A CBD consistent threshold size could be used (1000m2) which can be further tested as part of the detailed program design.

- **Simple submission of data** - Utilising an online portal such as NABERS Online, it could be based on a simple set of questions such as: building type, location, annual energy bills, floor area and operating hours. This could be supported with questions around the year of last refurbishment and building age, to help identify its investment cycle. We need to drive adoption and use of advanced data analytics, bans on energy service businesses limiting

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client access to data, requirements for BMSs to provide appropriate, timely, actionable feedback against dynamic benchmarks. These are fundamental to effective outcomes.

► **Guidance on energy management** - For each building class, guidance on energy management could be produced based on the data collected and existing work on energy management such as Sustainability Victoria’s work with mid-tier buildings. This guidance could then be extended to other building classes such as hotels and data centres. Indicative energy intensities for benchmarking could also be included, as well as guidance on navigating common challenges such as for tenants and owner-occupiers, and technical energy efficiency opportunities.

► **Communication strategy** - The challenge is to make this information relevant to the building owner in such a way that they (1) feel it is a relevant and meaningful assessment of their building and (2) feel inclined/pressured as a result to undertake actions to improve performance. This is challenging across many commercial building sectors. The key is to find a way to communicate the results of the disclosure in a way that can be understood by the predominantly non-technical stakeholders who have the actual power to make decisions and to provide those stakeholders with education and motivation to act to improve the disclosure results. This requires careful planning of communication and policy design.

► **Annual disclosure** - Instead of disclosures being ‘event-based’ such as when a building is being evaluated prior to an auction or lease; disclosures could be made annual through this policy option. This could provide a trigger for disclosure in less commercial sectors and encourage a uniform approach to disclosure across a range of building classes. Current approaches like NABERS work well in some sectors where there are appropriate market feedback mechanisms, but other sectors may require stronger signals such as public indications of non-compliance (and ultimately, regulatory minimum standards).

► **A central database** - A central database could be developed to contain the energy intensity data and could be made publicly available for transparency via a public tool. Feedback could be shared with participants, for example, on energy intensities by building class. This in turn could be used to target further policy options, such as financing for energy intensive buildings.

► **Later requirement for physical labels in foyers** - As per the Energy Performance in Buildings Directive in Europe, a similar model could be adopted in Australia that would be complemented by annual reports.

► **A full NABERS rating disclosure** would be optional - This process could later evolve into a mandatory requirement based on uptake. NABERS already plans to expand into other commercial building classes and so there is an explicit link to this proposed policy option.

► **Compliance and quality control** are also important. There are lessons from some State based disclosure schemes and Energy Performance Certificate (EBPD based) schemes where quality and compliance have been low, which is partly a result of poorly designed schemes considering the points raised above.

► There is a large opportunity to improve on **data coverage and quality**, considering that there are existing limits of data for benchmarking across commercial building classes. This can help to address recommendations from ASBEC in its Low Carbon High Performance report, to:
  
  ▪ Develop a national built environment data and information strategy
  ▪ Develop a national built environment energy efficiency and emissions research agenda
A benefit of collecting such data is the ability for the energy services sector to access potential clients, with private Energy Performance Contract offerings.

There is also an opportunity to make public fiscal incentives more accessible to Small and Medium Enterprises and the mid-tier sector. Such as through the CEFC or EUAs; or more typically through a grant or loan scheme (such as is offered in Tasmania). Stakeholders flagged that mechanisms to enable this policy need to be identified and supported, as there may be a financial burden that falls disproportionately on SMES or regional areas. A positive benefit cost ratio could then eventuate from any public funding due to accessing to this untapped “low-hanging fruit” of the built environment and greater elimination of free-riders.

Note that this policy option could be delivered in a performance-based style (e.g. NABERS) for many building types, but it may also be necessary to have provisions that deal with a more deemed to satisfy approach (like UK EPCs) for building classes where meaningful performance measurement is difficult or impossible.

This policy option would be non-prescriptive in its design i.e. beyond reporting and disclosure, it would not require building owners to do anything in particular, including upgrading the energy performance of their buildings. However, the measure is expected to focus a large section of the currently ‘less responsive’ parts of the building sector on efficiency opportunities, while also enabling energy services providers to better target the most cost-effective opportunities for efficiency improvement. This would help to ensure that the efficiency upgrades that do occur are the most cost-effective available within the whole stock, which in turn would translate into the most cost-effective pathway for upgrading the total building stock over time.

An essential requirement for this measure would be to minimise compliance and reporting costs, as unlike the current CBD, or voluntary ratings like NABERS - it would deliberately seek to apply to and influence a very large number of buildings, and to do so regularly, and potentially annually. This would be facilitated by:

- Having a very simple disclosure requirement limited to: annual energy consumption (from energy bills) and very basic facility data (address, floor area covered by bills, facility type)
- Providing a very simple online data portal that organisations could use for reporting purposes
- Where buildings/organisations already have current NABERS or Greenstar ratings, these should be ‘deemed to satisfy’ the reporting requirements of this scheme, avoiding duplication.

Following a first disclosure (where extra time would be required to assemble the required information), subsequent disclosures could be completed more quickly.

A sector by sector analysis of the value proposition should be undertaken to determine the validity of this approach. Trialling a system on a limited scale, including capturing feedback from users, would be advisable as a way of ensuring the system is as valuable, easy-to-use and ‘bullet-proof’ as possible. This can extend to ensuring that automatic benchmarking information is relevant and useful. There may be merit in eventually tailoring questions for specific building classes, such as in relation to specific variables and uses within building classes. Ascertaining what if any additional information may be valuable to users. This could also extend to basic energy efficiency guidance and information, link to local service providers, and relevant government programs including financial incentives, or other practical assistance.
### Logic model for policy option 3

**Objective of policy option 3**: Improve the quality and availability of energy performance information to highlight opportunities for improvement

<table>
<thead>
<tr>
<th>Barriers addressed</th>
<th>Policies/Programs</th>
<th>Outputs</th>
<th>Outcomes</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversity of commercial buildings and availability of data</td>
<td>Monitoring and reporting on a minimum set of energy performance and last refurbishment information</td>
<td>Standardised energy performance ratings</td>
<td>Increased transparency and availability of information relating to energy performance</td>
<td>Improved market awareness and demand for energy efficient buildings</td>
</tr>
<tr>
<td></td>
<td>Mandatory disclosure of energy performance for all commercial buildings (including health and education and other building classes not covered by the CBD program)</td>
<td>Annual disclosure</td>
<td>Improved understanding on commercial building energy performance across all building classes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Online portal for reporting and a repository of energy performance data</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>Guidance on energy management for each building class</td>
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<td></td>
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<td>Energy performance ratings displayed in foyers and in leasing and sales information</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 25 - Logical framework for policy option 3
6.7 **Policy option 4: Mandatory minimum standards for government procured or used buildings**

Policy option 4 seeks to offer government leadership by leveraging its very extensive purchasing power to create incentives for building owners (government and private) to upgrade the performance of existing buildings, by requiring essentially all government buildings procured or used (with limited exceptions, for example for heritage buildings) to meet mandatory energy efficiency requirements.

Governments have large and diverse building portfolios. Therefore, the scope needs to be defined given the diversity, scale and location of buildings, such as police stations in small regional towns, railway stations & depots. The portfolios of COAG Energy Council Ministers are unlikely to include government building procurement policies, as this is more likely to be the responsibility of central agencies.

This will not only directly benefit governments, by minimising their operational costs, but - more significantly - will create ‘market pull’ for owners of buildings that are not currently occupied by governments to lift those buildings to the required standard, to attract a government tenant.

The development of a more ambitious standard could cover:

a. Government tenanted and owned buildings. The aim of this policy option is to expand existing policies in terms of coverage.

b. Procurement including for hotels and conference centres. For both events and accommodation.

While the actual impact on Australia’s emissions will be limited, this initiative serves to also raise the bar for public and private sectors by leading by example.

ClimateWorks have estimated that 3% of Australia’s 2030 emissions reduction target could be met by improving government energy productivity. The analysis shows that between 2015 and 2030, Hospitals, Schools, TAFES and Offices can play significant roles in achieving energy savings. The States have the largest share of capital costs and savings as illustrated below.

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Climate works, 2016, Energy Productivity: An Untapped Opportunity for Australian Governments

Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings

Department of the Environment and Energy
The NEPP is supported by a work plan that sets out measures to support the achievement of a 40% improvement in Australia’s energy productivity for the first 15 years of the NEPP. Under the work plan, the COAG Energy Council agreed that each government would endeavour to improve the energy productivity of its own operations. Under this measure, the COAG Energy Council considered that governments should lead by example, noting that actions undertaken by governments to improve their energy productivity performance are likely to benefit the economy. The NEPP work plan identified that energy productivity improvements could be captured in a range of government activities, including in relation to: Building requirements and green leasing tools, Schools and hospitals, and Procurement.

The range of options include:

► **A review of the effectiveness of the current jurisdictional policies.** Anecdotally, minimum requirements are not always being complied with and there is a significant gap between the intent of Green Lease schedules and their execution on the ground.

► **Encouraging government to only occupy NABERS 5+ star buildings** - both improving government energy efficiency and motivating other participants to follow suit. A size threshold could also apply. For example, 5 stars could be required for 10,000m², and 5.5 stars for 20,000m² office buildings in cities. The lower standard may also be applicable in regional markets and cities, where the supply of high-rated offices may be restricted.

► **NABERS tenancy ratings aligned with the base building rating target** - which tends to be higher in larger city centre office buildings

► **Hiring energy efficient floorspace and hotels** - Ensuring government procurement standards extend to hired floorspace and hotels via utilising standards such as NABERS or Green Star has the capacity to further enhance the government’s efficiency credentials. As the number of hotels with current NABERS ratings is limited, this measure would need to be phased in over time. For example, an initial requirement could be to only utilise hotels with NABERS or equivalent ratings, regardless of the rating score. Over time, minimum star rating requirements could be lifted, to create an incentive for energy efficiency upgrades.

► **Align with best practice leasing standards** - This could include standards developed by government or industry associations (Better Building Partnership, GBCA, etc.)
Logic model for policy option 4

| Objective of policy option 4: Government occupies energy efficient buildings: Government leadership and purchasing power shapes the market |
|---|---|---|---|---|
| **Barriers addressed** | **Policies/Programs** | **Outputs** | **Outcomes** | **Impact** |
| Motivation | | Minimum efficiency standard for Government owned or leased buildings (for example, NABERS 5+ star) | Enhanced energy efficiency of Government buildings (i.e. Government chooses only the highest performing buildings) | Reduction of Government energy consumption and emissions |
| | | Procurement policies prioritise energy efficiency in temporary spaces (for example, hotels and conference centres) | Enhanced energy efficiency of government hired spaces (i.e. Government chooses only the highest performing buildings) | Improved market awareness and demand for energy efficient buildings leading to uptake of energy efficiency measures |

Figure 27 - Logical framework for policy option 4
6.8 Policy option 5: Financial incentives

This is designed to ‘incentivise’ action by addressing relevant barriers to building improvements, and by linking performance to incentives. This could include, though is not limited to: grants, rebates, subsidies, loans, upgrade agreements, retailer obligations, tax depreciation, co-financing, green bonds, mortgages and equity measures. Most jurisdictions have some experience in administering financial incentives and it has been suggested that a ‘good practice guide’ could be developed to highlight the opportunities.

The issue of ‘free riders’ is difficult to avoid - that is, providing financial support to those who may have made upgrades even without support being provided - as has been observed with some previous policy initiatives such as the Green Building Fund. Targeting those who need the support needs to be considered, balanced with the need to achieve something useful as an outcome. Free-riding is generally easier to control where programs apply criteria, rather than entitlement-based approaches such as tax incentives. The ‘free rider’ problem can dilute applicants who have genuine financial barriers, leading to poor energy efficiency improvement despite grant funding such as for energy audits. Non-financial barriers including motivation, expertise, etc. can be a common cause for inertia which financing alone will not address. Linking funding to actual performance will help to sort through to those with genuine financial barriers, serious enough to follow through from feasibility to investment.

Loan repayments for measures should be linked to profitability or rental income, so that investor perception of risk is reduced. Offering streamlined methods to create ACCUs associated with savings will be an increasingly important option over time, as focus on cutting emissions from services businesses increases.

Policy design options include:

► **Develop guidance for jurisdictions** on how to establish a Treasury Finance Facility, with relevant examples being Victoria’s Greener Government Buildings program and New South Wales’ GREP policy and whole of government approach.

► **Promote financing options** – This could include:

  o Environmental upgrade agreements (EUAs) – learning from experiences in States such as Victoria and New South Wales including navigating the challenges, such as working with multiple parties, across different organisations (local government and private enterprise), and lack of understanding and processes for EUAs within councils.

  o Energy performance contracts (EPCs) – have a successful record in Hospitals, Universities and some extent Schools in Australia, as well as abroad such as in the UK. Strong government support is generally required to administer EPCs, with both NSW and VIC assigning Government Departments to champion building retrofit programs and negotiating Treasury approved funding programs (e.g. Greener Government Buildings in Victoria) for EPCs. This provides a model for successful program delivery in other States.

  o Innovative government mechanisms such as the ACT Carbon Neutral Government Fund, set up in 2010, with savings made from efficiency upgrades helping recipients to repay the Fund over an agreed timeframe. For example, a loan for a lighting upgrade project might be repaid in full from energy savings within 3 years. There are other examples of financing mechanisms such as in NSW, VIC (mentioned above) and Tasmania’s low interest loan for commercial building upgrades.

  o The Clean Energy Finance Corporation (CEFC) which provides financial support to the property sector across a spread of building classes. Current projects include:
- Targeting emissions reductions of 45 per cent for the Healthcare Wholesale Property Fund, drawing on $100 million in CEFC investment.

- Through an agreement with the CEFC, Lendlease is targeting net zero emissions across the $4.5 billion Australian Prime Property Fund Commercial; which has 21 assets across NSW, Victoria, Queensland, ACT and South Australia

- QIC Global Real Estate is looking to deliver improvements in energy efficiency across its portfolio of Australian shopping centres via a $200 million senior debt facility from the CEFC. The shopping centres are of different ages and are at different levels of sustainability, with a 4-star NABERS rating across its portfolio within 5 years.

  - Initiatives include: onsite rooftop solar PV, LED lighting, heating, ventilation and air-conditioning system upgrades, sub-metering and energy data monitoring systems to provide data to optimise energy management processes.

  - Green leasing could be further implemented, building on the National Green Leasing Policy - the first nationally consistent approach by the Australian Government and state and territory governments, as tenants of buildings, to drive a reduction in the environmental impact of buildings through improved operational performance. It contains Green Leasing principles to guide governments.

  - Green Leases can also be used in the private commercial building sector with publications developed to encourage the uptake of Green Leases in private leasing arrangements. A challenge for commercial green leases is extending them beyond top tier commercial buildings to most other building classes including mid-tier office buildings.

**Focus on improving business willingness to invest** - Including with Guidelines first created on opportunities for emissions reduction, which links to Guidance suggested in Policy Option 2, with requirements for energy efficiency funding.

**Focus on certain building classes** that can include:

  - High energy consumers, such as mid-tier offices, shopping centres and retail tenancies, as well as high energy intensity classes such as hotels and data centres. CBD or NABERS data could be utilised to help target buildings.

  - Directing money towards smaller buildings, where possible. Noting that the business case for investment is likely to be smaller than in larger buildings. While this could capture most buildings other than premium office or retail, it might explicitly include regional based shopping centres, hospitals and schools. As well as mid-tier offices.

**Grants for end-to-end delivery model of energy efficiency improvements** - Feasibility assessments/audits, tuning and replacement, measurement and verification could all be used to access grants. An example is Sustainability Victoria's Energy Efficient Office Buildings program for mid-tier buildings. Another option would be softening investment conditions subject to:

  - Meeting a minimum energy performance standard or target, such as incremental NABERS improvement.

  - Agreeing to share data or a case study to inform the wider market.
► **Linking financial support with other policy options** - This could include mandatory requirements and could incorporate a carrot and stick approach. For government health and education buildings, appropriate mechanisms such as jurisdictional Treasury financing or Energy Performance Contracts could be utilised to incentivise energy efficiency.

► **Directing finance to address specific barriers.** For example, overcoming split incentives to encourage investment in base building systems where the running cost benefits accrue to the tenant; or where the market is holding back from making a decision based on prioritisation of capital (i.e. focussing on other business objectives rather than energy efficiency).

► **Modernising the 10% green building managed investment trust (MIT) withholding tax regime by:**
  - expanding the regime to all buildings held for rental purposes (regime is currently limited to offices, hotels and shopping centres)
  - applying the rate to buildings that have been refurbished to achieve the necessary green star ratings (regime is currently limited to newly constructed buildings)
  - applying the test on an asset by asset basis (regime currently requires all of the MIT's assets to satisfy the green star rating requirements)

► **Linking support to performance improvements,** as well as absolute performance, in order to capture the lower end of the market.

► **Extending the instant asset write-off scheme** to include energy efficiency upgrades of buildings up to $100,000.

► **Green depreciation,** which would see the deferment of taxable income in early years in exchange for bringing forward investment in large upgrades that exceed the instant asset write-off threshold.

► **Both financial and non-financial barriers are often present for many commercial building classes.** In which case identified, a coordinated approach of 1) information and training, 2) financial incentives, 3) regulatory intervention is likely to be required. As identified at the beginning of this section of the report. Informational and training resources for building owners and for the building industry will be required to address some of the barriers that are non-financial.

An important element of the listed tax initiatives is to establish a performance-based process. Including to document the before and after case for evaluation and potential case studies for the benefit of others; and introduction of a minimum upgrade or performance level. Buildings that are 5-star or higher could be excluded. The idea would be to generally avoid subsidising owners of higher quality buildings, such as large institutional property investors, but instead focus on the mid-tier, retail, warehouses, etc. commercial building classes. A limitation is that tax breaks do not have meaning for the government and community sectors, schools, etc. However, it could be part of a package - particularly for mid-tier.
**Logic model for policy option 5**

<table>
<thead>
<tr>
<th>Barriers addressed</th>
<th>Policies/Programs</th>
<th>Outputs</th>
<th>Outcomes</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital constraints</td>
<td>Promotion of financing options, potential for public sector financing to</td>
<td>AUD of financial support provided by Government</td>
<td>Increased number of energy efficiency projects implemented</td>
<td>Energy efficiency potential in existing building stock tapped into</td>
</tr>
<tr>
<td>Split incentives</td>
<td>leverage private sector finance</td>
<td>AUD of financial support leveraged by Government</td>
<td>Reduced long-term costs for the business as benefits of energy efficiency projects are realised (for example, reduced energy bills)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grants, rebates, subsidies, tax depreciation</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Co-financing</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Retail obligations (EEO schemes)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Debt mechanisms (for example, green bonds)</td>
<td></td>
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<tr>
<td></td>
<td>Equity mechanisms (for example, attracting new investors)</td>
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</tbody>
</table>

*Figure 28 - Logic model for policy option 5*
6.9 Policy option 6: Expand minimum energy performance standards (MEPS) for building technology and equipment

Policy option 6 seeks to overcome the barrier of triggers for refurbishment by encouraging owner-occupiers to improve the energy efficiency of their buildings through the expansion of MEPS for building technology and equipment and improving the skills and capacity of the Energy Services sector to deliver these improvements. This option will leverage the policy approach of regulation to achieve this objective by regulating a minimum set of standards for owner-occupiers to adhere to.

Policy options include:

► Higher or new standards for key products such as packaged air conditioners, chillers, electric motor drive systems (pumps, fans), office equipment, refrigeration equipment, commercial kitchen equipment, LED lighting, and others. Glazing systems, HVAC components such as heat recovery equipment, and others could also be considered. These standards would each contribute to lifting the efficiency of energy use in existing non-residential buildings over time.

► At a plant level – it is possible to isolate a piece of plant and identify that it could have been a better piece of equipment. At a fabric level this policy option is difficult, where the performance is a function of the combined performance of many items working together. To address this, a performance calculation could be applied that estimates the building façade performance as a percentage of Code.

► Expanding MEPS to existing systems – For certain technologies, such as chillers, and some stakeholders suggest that certain ages or classes of technology should be phased out ahead of the site’s desire to replace. This is doubly relevant given issues with refrigerant phase-out and could be linked to financing options.

Technologies not incorporated include:

► Insulated ducting as this product may be more relevant to new rather than existing buildings.

For certain technologies, such as chillers, there is an argument that certain ages (or classes) of technology should be phased out, without waiting for the site’s desire to replace. This is especially relevant to refrigerant phase out and could be linked to financing options. Stakeholders noted that one of the challenges in developing Code is that MEPS currently appears to have more relaxed economic requirements than the Code. As a result, if something is specified that it must meet MEPS as a means of Code compliance, then there is a risk that this underperforms what could have been required if following the permitted economic limits for the Code. Therefore, evidence of improved benefits against costs would be helpful. This initiative would be likely to be given effect via the existing GEMS program. This program has an established process for evaluating the potential suitability and cost-effectiveness of including new product classes and/or higher standards.

While MEPS for appliances and equipment would be useful, effective provision of information and incentives are also needed to support leaders and drive innovation beyond compliance with MEPS that fall short of best practice. Procurement policies and practices are crucial. In the commercial sector, a lot of equipment is custom made or incorporated into systems. There can also be complex interactions between equipment and thermal energy requirements. Approaches that allow buyers and decision-makers to choose between such products (e.g. based on models that estimate energy performance of such products and systems) and approaches that deliver visibility and accountability regarding actual performance (e.g. ‘digital twins’ and advanced analytics) are required.
**Logic model for policy option 6**

| Objective of policy option 6: Progressively enhanced energy efficiency of technology and appliances in the market |
|---|---|---|---|---|
| **Barriers addressed** | **Policies/Programs** | **Outputs** | **Outcomes** | **Impact** |
| ▶️ Tenure and triggers for refurbishment/building upgrades | ▶️ Minimum energy performance standards (MEPs) for building technology and equipment | ▶️ Higher or new standards for key products | ▶️ Non-compliant products removed from the market | ▶️ Improved energy efficiency of key energy consuming appliances and equipment in existing commercial buildings |
|  |  |  |  | ▶️ Reduced energy consumption and emissions |

Figure 29 - Logic model for policy option 6
6.10 Mapping policy options to building classes

The table below provides a snapshot of how different policy options can address different barriers. While most policy options apply across the commercial sector, some policy options will be more relevant to particular building classes than others. The table below maps policy options from this section against building classes, assessing how strongly policy options address the challenges and opportunities described in section 4. While not a comprehensive map, it does illustrate priority policies for each sub-sector and across the board.

<table>
<thead>
<tr>
<th>Table 8 - Building class barriers addressed by policy options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mid-tier office</strong></td>
</tr>
<tr>
<td>Policy option 1: Clarify and enforce Code provisions</td>
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<tr>
<td>Policy option 2: Mandatory HVAC inspection and certification</td>
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<tr>
<td>Policy option 3: Universal, low-cost mandatory disclosure</td>
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<tr>
<td>Policy option 4: Mandatory minimum standards for government procured buildings</td>
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<tr>
<td>Policy option 5: Financial incentives</td>
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<tr>
<td>Policy option 6: Expand MEPS for building technology and equipment</td>
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</tbody>
</table>
Benefit Cost Analysis
7. Benefit Cost Analysis

7.1 Approach and limitations

The scope of the current project includes ‘high-level’ benefit cost analysis of the measures identified by jurisdictions and stakeholders as worthy of quantitative analysis. High-level implies that we do not attempt to take into account all possible variations in the way that policies may be framed, including potential variations from jurisdiction to jurisdiction. The intention is to provide estimates of the energy and emissions savings potentials, and financial benefits and costs, that are of the right order of magnitude. More detailed analysis could be undertaken at a later time if required.

The general approach and key assumptions adopted here is consistent with those used by the team analysing the potential for additional measures in the residential sector. This includes:

- Adopting the same projections for the emissions intensity of electricity consumption to 2050
- Modelling all measures as applying from FY2021 to FY2050

Modelling only private benefits, comprising avoided electricity and gas costs, and not at this stage quantifying public benefits, including the value of avoided greenhouse gas emissions, and avoided electricity network infrastructure costs, inter alia.

We note that this means that gross and net social benefits are under-estimated by this analysis, and a full social benefit cost analysis would be expected to find higher net present values and benefit cost ratios than those reported here.

Measures are costed primarily using electricity and gas cost data compiled by EY.

These cost curves quantify the typical relationships expected between energy savings derived and capital or investment costs. In practice, costs will vary as a function of many factors, including the exact nature of the upgrades undertaken, and the particulars of the building and plant design in question. However, it is important to note that the majority of measures modelled below are non-prescriptive in nature: that is, they do not assume in advance the exact nature of any investments that may be made in response to the measures. As an example, even mandatory disclosure of benefit energy performance does not require or force any energy efficiency upgrades, let alone upgrades of a particular type. For this reason, cost curves that are structured to apply least cost measures first, and higher cost measures later, are most appropriate.

For this analysis, therefore, we apply these cost curves to the unit electricity and/or gas savings modelled for each measure. In addition, we add an allowance for government administration costs as appropriate. Note that since the benefit cost analysis is conducted by jurisdiction, these costs must be distributed across jurisdictions. This has been done in a straightforward manner, allocating larger cost shares to larger states. However, depending upon the measure, the costs may be borne in part of total by the Australian government. In short, the distribution of administrative costs should be taken as indicative and for the purpose of the benefit cost analysis only. Similarly, we estimate compliance costs for different parties, as described for each measure below. Overall, the cost estimates are considered reasonable, and they would not be likely to change greatly with more detailed benefit cost analysis - unless the scope of the measures were changed. This is consistent with the observation above, that more detailed benefit cost analysis would be expected to show higher net present values and benefit cost ratios.

Some key assumptions and input values are discussed below.
Real Discount Rates

The default real discount rate applied in the analysis is 7%, in line with Australian government recommended practice. All benefits and costs over time are discounted back to real FY2020 values using this rate. We note that some jurisdictions apply lower values, and these could be tested in sensitivity analysis. References to financial values mean constant or inflation-adjusted FY2020 dollars.

Economic Life of Investments

The average economic life of capital investments varies for the measures, depending upon the nature of the capital investments anticipated. Where these include structural or building-fabric elements, including glazing or insulation, or long-lived HVAC equipment such as chillers, then a 25-year economic life is assumed. For measures such as building tuning, a shorter life of 10 years is assumed. For intermediate or mixed measures, we assume 15 years on average.

Energy Prices

Energy prices are important for the valuation of benefits over time. That said, the high-level nature of the analysis means that we have relied on external sources. Electricity price movements over time are based on work by Jacobs for the Australian Energy Markets Operator (AEMO), combined with historical prices (2017) sourced from the AEMO’s National Electricity Forecasting Report from 2016.\(^{57,58}\) We note with some regret that AEMO’s past practice of publishing expected prices by region appears to have ceased in 2017. We assume that only 50% of the retail prices modelled are avoidable. For the period 2020 – 2050, we assume 1% real price increases annually. As some measures require assumptions to be made even beyond 2050, we assume constant real prices after this date, as shown in Figure 30.

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Footnotes:

\(^{57}\) Jacobs, Retail electricity price history and projected trends, September 2018.

Gas prices are assumed to be the same as those applied for the COAG Energy Council Code Trajectory project, as indicated in Figure 31.

Figure 31 - Gas Price Assumptions by Jurisdiction

Notes: NT prices are based on Qld. Qld price assumptions are obscured in the above figure by ACT/NSW - refer to the brown line for all three jurisdictions.

Greenhouse Gas Emissions Intensity of Electricity Consumption

As noted above, we adopt projections of the greenhouse gas intensity of electricity consumption prepared for the residential projections, to promote consistency and comparability of results.

Figure 32 - Emissions Intensity of Electricity Consumption by Jurisdiction - Scope 2 + Scope 3

59 Based on Department of the Environment and Energy, extrapolated to 2075.
We note that since avoided carbon costs are not being valued in this analysis, these assumptions are not critical to the analysis. However, they do affect the calculations of cumulative emissions avoided over the FY2021 - FY2030 period presented below.

**Reference Scenario and Additionality**

Each measure is modelled on a stand-alone basis relative to 'business as usual' or existing policy. The BAU projections for electricity and gas intensity used are consistent with the BAU projections modelled in 2018 for the new building Code trajectory and take into account the historical and expected future impact of existing national and sub-national energy efficiency measures as modelled at that time. The reference projection of electricity and gas consumption in non-residential buildings, before the application of the measures modelled below, is depicted in Figure 33. As is evident, this reference scenario already models a significant flattening of expected demand, relative to past trends (not shown), due to the combined effects of new buildings and existing buildings policy measures.

It is possible that there could be interactions between measures - positive and/or negative - that may make it misleading to add up the impacts of each measure and assume that that adequately represents the expected net effect of all measures if implemented simultaneously. Such impacts could be quantified but would require analysis beyond our 'high-level' scope.

![Figure 33 - Projected Reference Electricity and Gas Consumption, Non-Residential Buildings, Australia](image)

**Limitations**

There is considerable uncertainty in relation to key inputs into the quantitative analysis presented in this report. Key assumptions and limitations to the analysis are noted below:

- **The absolute size of the non-residential building stock** - whether measured in building numbers by class, or floor area by class - is not measured directly. We utilise a stock model that is informed by a number of sources; primarily the 2012 Commercial Building Baseline Study and Geoscience Australia’s NEXIS database and others. Each of these sources has known limitations, and work on an updated Baseline Study has recently commenced.

- **Key elements of stock turnover** are not known precisely, including the number of new buildings constructed annually, the floor area constructed, the floor area demolished, and the floor area refurbished, either by building class or in total.
The annual energy consumption of commercial buildings is not known with precision. Australian Energy Statistics (AES) provides state-wide observations of annual fuel consumption by ANZSIC sector and state. However, the correlation between 'commercial and services' energy consumption and commercial building energy consumption is approximate. There are known data issues, with the AED model, including discontinuities, and NSW/ACT are not distinguished.

Other partial data sources are available - such as program-based data (NABERS, CBD), and some state-based data, but again these sources fall short of a complete description of the non-residential building stock and its energy consumption.

The key approach adopted in the quantitative elements of this report is to estimate building energy intensity by fuel (electricity and gas) and class (NCC) and jurisdiction - including an estimated split between the ACT and NSW, and correcting for known discontinuities - and matching this to estimate annual floor area by class, and validating the resulting model to ensure that total electricity and gas use (in the commercial and service sector) balances with known aggregates at the jurisdiction level in AES.

This methodology provides reasonably high confidence about the average energy intensities, and total fuel consumption by state. However, there is lower confidence about the energy intensities by building class. These are estimated, drawing on the other partial data sources named, and then validated at the total jurisdiction level.

### 7.2 Descriptions of the policy options modelled

The process of consultation and analysis that led to the selection of the following measures, for the purposes of high-level benefit cost analysis, is discussed above. They are not the only measures that could be imagined or modelled, and each measure below could be modelled with differing input assumptions, or differing scope, and the outcomes would necessarily be different. The intention is to help the reader to gain an appreciation of the likely order of magnitude of costs and benefits, given the manner in which each measure is specified. Where possible, we point out where changed assumptions would make a more or less material difference to the results. In effect, we model six measures:

#### 7.2.1 Clarify and enforce Code provisions

**Code Application and Enforcement:** a campaign to raise awareness with the building (and regulatory) community regarding the existing energy performance requirements in the National Construction Code that may be triggered in specific circumstances, such as when a building is converted from one Class to another, or when it undergoes a major refurbishment. Stakeholder feedback confirmed that there is confusion within industry regarding these requirements, differences between jurisdictions, and little enforcement. The measure is not applied in NT, as Section J energy performance requirements are not applied there.

#### 7.2.2 HVAC inspection and certification

**Mandatory HVAC inspection and certification:** this measure is envisaged as a new requirement in the National Construction Code - but could also be given effect in particular jurisdictions under state building laws and regulations. It would require that owners of buildings more than 5 years old, with central HVAC systems, would achieve an expert inspection and certification of HVAC condition, noting critical maintenance requirements and tuning opportunities. This requirement would apply to all building classes, with certification required at not more than 5-year intervals. A low-cost 'no work required' certification option could exist and be applied to professionally and regularly maintained buildings, to minimise compliance costs.
7.2.3 Universal, low-cost, mandatory disclosure

This measure would apply to all buildings other than offices >1,000 sqm, which are covered by CBD.60 All such buildings over a minimum size threshold (to be determined, but here we assume than the smallest buildings, representing 30% of non-residential floor area, are excluded) are required to undertake a low-cost annual disclosure of their annual consumption of fuels, and a small number of other key data points (for example, building address, building type, gross floor area). To minimise time and cost, a web-portal with simple input fields would be provided, along with user support and guidance. The same portal could be used by owners, lessees (for example, for benchmarking purposes), by researchers (for policy development), and by energy service companies (to target the most cost-effective upgrade opportunities). Legislation could require disclosure in annual reports or in other defined circumstances.

7.2.4 Government procurement

This measure is modelled as being applied by all governments with respect to their office procurement, whether owned or leased.61 They are assumed to implement a target of only occupying 5.5-star offices, in major capitals, or 5-star offices, in other areas, by 2030. This could be achieved by upgrading owned buildings and/or by seeking progressive upgrades of leased ones. In addition, the measure assumes that all governments agree to apply a requirement that hotels utilised for government accommodation and events hold a current NABERS or equivalent rating, in the first instance, with minimum rating requirements introduced and gradually increased over time.

7.2.5 Financial incentives

This measure is modelled as a ‘generic’ financial incentive, as there are very many options that jurisdictions could choose. However, what they all would have in common is the intent to incentive and realise energy efficiency upgrades in a greater numbers/degrees than would otherwise have been expected. It is modelled as potentially applying to all buildings other than government-owned buildings and new buildings (less than 5 years old). We assume that governments provide 25% of the capital investment undertaken, noting that caps or other criteria may in practice be applied to limit fiscal risks.

7.2.6 Enhanced standards for commercial appliances, equipment, building elements

This measure is conceived of as an expansion of the existing GEMS program but could conceivably be undertaken by alternative means. It would involve setting minimum energy performance (and potentially labelling) requirements for specific commercial equipment and is designed to be additional to those already covered, or planned to be covered, by GEMS.62

7.3 Input data sheets and key assumptions

<table>
<thead>
<tr>
<th>Table 9: Input Data Sheets by Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Policy Measure</strong></td>
</tr>
<tr>
<td>Enforcement of Existing Code Measures upon</td>
</tr>
</tbody>
</table>

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60 Indeed, this measure could also apply to offices, or to other buildings covered by CBD in future, offering a lower-cost compliance option. However, it is modelled as excluding large offices.
61 Note that we show no additional savings for NSW, as this measure parallels current policy in that state, at least in the aspects noted.
62 Noting that this set changes regularly, as potential new opportunities are explored, and therefore we cannot be certain regarding additionality.

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<table>
<thead>
<tr>
<th>Policy Measure</th>
<th>Key Assumptions</th>
<th>Average economic life</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion and Major Upgrades</td>
<td>area is assumed not to be upgraded to current Code. EE improvement is set at 40%, as eligible stock is likely to be older and jump to current Code significant. NT excludes as it does not apply Section J.</td>
<td></td>
<td>administrative costs (for example, a campaign), $5m per year for 10 years, minor ($1m/year) thereafter.</td>
</tr>
<tr>
<td>Mandatory HVAC inspections, certification</td>
<td>Applies to all classes but excluding new builds (only those 5+ years old), with centralised HVAC (80% of total), minimum size threshold eliminates 20% of floor area. Certification period 5 years, so 20% of remaining stock inspected or certified annually. Assume that 20% of buildings require no maintenance/tuning, rising by 1%/year (learning impact of measure). Of the balance, assume 10% initially take corrective action following inspection, leading to maintenance/tuning investment. This investment is assumed to improve EE by 10% on average.</td>
<td>10 years</td>
<td>Investment costs from EY cost curve. Inspection/certification costs, 8 hrs @ $200/hr, except for the 'good' 20+, where certification only required (2hrs @ $200/hr). Govt. admin costs $5m/year to 2050.</td>
</tr>
<tr>
<td>Universal, mandatory, low-cost disclosure of energy performance</td>
<td>Applies to all stock except offices &gt;1,000sqm and major shopping centres (CBD/NABERS). Minimum size threshold eliminates 30% of floor area. Take up rate (% of those disclosed who invest) is set conservatively at only 1% in year 1, rising by 1.5% per year to 2050. EE savings for those who do act assumed to average 18% (half of observed average for offices in NABERS).</td>
<td>15 years</td>
<td>Investment costs from EY cost curve. Reporting costs allow 16 hrs @ $150/hr for first report; 4 hrs @ $150/hr for subsequent. Allowance for govt admin, $5m per year to 2050.</td>
</tr>
<tr>
<td>Government procurement standards for offices</td>
<td>Applies to government offices - owned or occupied: offices ~23% of the stock; assume that 20% of this is influenced by the measure. EE standards are set at 5.5 star NABERS (whole building) for major capitals, 5 star elsewhere. Assume that the stock meets the target 10% per year, or 100% after 10 years. EE savings based on NABERS reverse energy calculator vs projected average office EE (separately for electricity and gas). NSW excluded as this measure would not be additional to GREP. For hotels, we assume a requirement, from 2022, that government hotel accommodation is in NABERS rated hotels, regardless of rating. This could be signalled in advance, to allow time for ratings to occur. The number of rated hotels is assumed to grow only slowly over time, by about 20/year until 2030, and then about 100/year thereafter. Energy savings realised are also assumed to increase slowly over time, from 0% in the first two years, to 25% after 2030.</td>
<td>15 years</td>
<td>Investment costs from EY cost curve. Allowance for govt admin, $5m per year for 10 years. For Investment costs from EY cost curve. Allowance for govt admin, $5m per year for 10 years. For hotels, ratings costs of $850/building, based on NABERS online, are assumed; EE cost curves apply to hotel efficiency upgrades; and an allowance of $2.5 million/year for government costs is made.</td>
</tr>
<tr>
<td>Financial incentives</td>
<td>Applies to all buildings except new and government-owned. 25% of investment cost is met by govt. Take-up rate 1% in</td>
<td>15 years</td>
<td>Investment costs from EY cost curve. Allowance for govt admin, $5m per year to 2050. Note that the</td>
</tr>
</tbody>
</table>
### 7.4 Results

#### 7.4.1 Code Enforcement

The key drivers of the modelling results for this measure (and other measures) is set out in Table 9 above. The key assumptions are that around 0.5% of the non-residential floor area undergoes either conversion or major refurbishment annually. This is likely a conservative estimate, as at this rate, it would take 200 years for the whole stock to be converted/refurbished. This equates to around 2.6 million sqm of floor area in FY2021. We then assume that 25% of this floor area (or some 650,000 sqm in FY2021) is not brought up to the relevant Code standard, prior to this measure, but is brought up to that standard due to this measure. If this did occur, a cumulative total of 3% of the 2050 building stock would have been upgraded thanks to this measure, or a cumulative total of around 26 million sqm.

We assume that the energy performance of each sqm is upgraded substantially, by 40% on average, given that there is likely to be a significant energy performance gap between the then-current Code requirements, on the one hand, and the average energy performance of the building being upgraded, on the other hand. Indeed, this gap could even be larger, to the extent that older buildings, with higher than average energy intensity, are being converted/refurbished. However, we adopt a more conservative assumption here. With respect to costs, a requirement to comply with current Code requirements could - as for new buildings - be met in any number of ways, as it is a performance-based rather than prescriptive requirement. Therefore we use EY cost curves that are constructed from a range of upgrade options, for both electricity and gas, as described above. As this measure is conceived of as raising the awareness of industry regarding existing requirements, and then ensuring that those requirements are enforced, we assume that its impact is largely achieved within 10 years. We allow $5 million per year for the first 10 years for administration, and then $1 million per year through to 2050 to enable minor reinforcement of the messages.

On these assumptions, and excluding the Northern Territory, the measure would be expected to realise electricity and gas savings over time with a present value (7% real discount rate) of over $1.2 billion, while capital costs with a present value of just over $496 million, and administrative

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63 Building owners could choose to follow deemed-to-satisfy requirements but are free to choose any solution that is ‘at least equivalent’.
costs with a present value of a little over $33 million, would be incurred, giving a present value of total costs of around $547 million. This generate a national net present value of some $704 million and a national benefit cost ratio (BCR) of 2.3. The details are shown by jurisdiction in Table 10.

### Table 10: Code Enforcement: Summary of Benefit Cost Analysis

<table>
<thead>
<tr>
<th></th>
<th>FY2021 real $ million</th>
<th>PV of Costs</th>
<th>PV of Benefits</th>
<th>Net Present Values</th>
<th>Benefit Cost Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW</td>
<td>$146.6</td>
<td>$364.4</td>
<td></td>
<td>$217.9</td>
<td>2.5</td>
</tr>
<tr>
<td>VIC</td>
<td>$132.7</td>
<td>$286.2</td>
<td></td>
<td>$153.5</td>
<td>2.2</td>
</tr>
<tr>
<td>QLD</td>
<td>$139.6</td>
<td>$255.5</td>
<td></td>
<td>$115.9</td>
<td>1.8</td>
</tr>
<tr>
<td>WA</td>
<td>$61.5</td>
<td>$156.5</td>
<td></td>
<td>$95.0</td>
<td>2.5</td>
</tr>
<tr>
<td>SA</td>
<td>$29.8</td>
<td>$108.4</td>
<td></td>
<td>$78.6</td>
<td>3.6</td>
</tr>
<tr>
<td>NT</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>TAS</td>
<td>$16.5</td>
<td>$33.6</td>
<td></td>
<td>$17.0</td>
<td>2.0</td>
</tr>
<tr>
<td>ACT</td>
<td>$20.3</td>
<td>$46.8</td>
<td></td>
<td>$26.5</td>
<td>2.3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$547.0</td>
<td>$1,251.3</td>
<td></td>
<td>$704.4</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Cumulatively over the period to 2030, the measure would be expected to save almost 10 PJ of energy and avoid 2.1 Mt CO$_2$-e of greenhouse gas emissions – see Table 11.

### Table 11: Code Enforcement: Summary Impacts

<table>
<thead>
<tr>
<th></th>
<th>Cumulative, FY21 - FY30:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2021</td>
</tr>
<tr>
<td>Electricity savings</td>
<td>PJ</td>
</tr>
<tr>
<td>Gas savings</td>
<td>PJ</td>
</tr>
<tr>
<td>GHG emissions savings</td>
<td>Mt CO$_2$-e</td>
</tr>
</tbody>
</table>

Overall, we note that this measure is highly cost effective. The BCR would be quite insensitive to the amount the amount of administrative expenditure that might be deemed necessary to deliver the outcome. Doubling or quadrupling the expenditure allowance would have little impact. For a RIS, it is possible that some compliance cost might be modelled for industry time associated with consuming information or training materials. However, given that measure only seeks to enforce the existing law, in principle any such costs should be being incurred by industry already, and are attributable to the original policy requirement, and not to this potential program.

While both the floor area impacted and the extent of non-compliance at present are uncertain, the costs and benefits shown can be expected to move in a reasonably linear manner. If these values are under-estimated, then both benefits, costs and NPVs will be higher than shown, but BCRs are likely to change little. Conversely, if these values are over-estimated, then costs, benefits and NPVs will be lower than shown, but BCRs little changed. This would remain true unless the opportunity here could be shown to be much smaller than estimated, and too small to justify the modest administrative costs involved. At the other end of the scale, if the degree of energy performance upgrades required were larger than assumed, then it possible that the cost curve employed here would no longer hold, and a separate investigation of expected costs would need to be undertaken.

### 7.4.2 Mandatory HVAC Inspection and Certification

Following the assumptions noted in Table 9, this measure would apply some 62 million sqm, or around 12,300 buildings in FY2021, and growing to around 21,000 buildings by 2050. However, we would expect a growing percentage of the floor area certified annually to a) require no additional maintenance or tuning over time (as industry adjusts practices in response to the measure), and b) act on the reports provided – by conducting HVAC maintenance and/or tuning. Here we assume that, in the first instance, 20% of the floor area certified requires no maintenance or tuning (and
therefore realises no savings), with that figure increase by 1 percentage point per year. We assume that 10% of those receiving reports act on them in the first year (as discussed below), with that figure rising slowly by 0.5 percentage points per year. Both assumptions reflect learning and (slowly) changing practices over time in response to the measure. The floor area modelled to be upgraded therefore starts at less than 5 million sqm in FY2021. By 2050, a cumulative total of some 120 million sqm, or less than 14% of the expected 2050 floor area, will have received maintenance and tuning upgrades thanks to this measure.

We note that the range and scale of technical maintenance and tuning requirements, and therefore costs and benefits, will be wide. It will range from none at all (as noted above), through to large savings where, as one professional put it during consultations: “you walk into a plant room full of screaming pumps”. We represent average savings, and associated costs, of 10% of both electricity and gas. We assume a conservative economic life of the maintenance and tuning expenditure of just 10 years, which reflects an expectation that building controls in particular, and more short-lived components, such as pumps and fans, are most likely to be affected. So, for example, the 120 million sqm referred to above, as being tuned due to this measure in FY2050, is the cumulative floor area treated over the period FY2041 - FY2050. It is reasonable to assume that the same buildings may receive maintenance and tuning investments multiple times over the 30-year analysis timeframe.

Table 12 summarises the expected impacts associated with this measure over the FY2021 - FY2030 period (recalling that all measures are modelled through to FY2050). It shows a cumulative total of over 20 PJ of energy and 3.1 Mt CO$_2$-e of greenhouse gas emissions abatement over this period.

Table 12: HVAC Inspection and Certification

<table>
<thead>
<tr>
<th>Cumulative, FY21 - FY30</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
<th>2029</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity savings PJ</td>
<td>16.1</td>
<td>0.26</td>
<td>0.53</td>
<td>0.82</td>
<td>1.11</td>
<td>1.42</td>
<td>1.73</td>
<td>2.06</td>
<td>2.39</td>
<td>2.74</td>
</tr>
<tr>
<td>Gas savings PJ</td>
<td>4.1</td>
<td>0.07</td>
<td>0.14</td>
<td>0.22</td>
<td>0.29</td>
<td>0.37</td>
<td>0.45</td>
<td>0.52</td>
<td>0.60</td>
<td>0.68</td>
</tr>
<tr>
<td>GHG emissions savings Mt CO$_2$-e</td>
<td>3.1</td>
<td>0.05</td>
<td>0.10</td>
<td>0.16</td>
<td>0.22</td>
<td>0.27</td>
<td>0.33</td>
<td>0.41</td>
<td>0.47</td>
<td>0.54</td>
</tr>
</tbody>
</table>

In terms of financial costs and benefits, tuning/maintenance costs are modelled with reference to EY’s electricity and gas cost curves. For compliance costs (inspection and certification), we differentiate ‘better’ buildings – that already have sound maintenance and tuning arrangements in place, for example, through existing building services contracts or other means, from other, less-well-managed buildings. For the first category, we allow an average certification cost of $400, based on 2 hours @ $200/hr, which would primarily comprise inspection of documentation only.

For the second, we allow an average of 8 hours at $200/hr, or $1,600, for an HVAC inspection and report. Given the large number of buildings involved, the compliance cost is significant, with a present value of $229 million. In addition, we allow $5 million per year in government administration costs, including to help raise awareness of the measure, of its requirements, and to conduct random audits or other enforcement activity. In total the present value of all costs is $844 million.

On the benefit side, the assumptions noted above generate energy savings with a present value of more than $1.8 billion, leading to a net present value of just over $1 billion and an average BCR of 2.2 - see Table 13. As with the previous measure, this is comfortably cost effective, indicating that there would be significant capacity to assume higher compliance and/or administrative costs, if justified, with the measure remaining cost-effective. On the other hand, if the conservative assumptions made above for average energy savings realised, or the take-up rate (the percentage of buildings certified inspected that act on reports and realise maintenance/tuning investments), were in fact higher, then capital, benefits and NPVs would be higher, with the BCR expected to remain around the same level.
7.4.3 Mandatory, Universal, Low-Cost Disclosure

Consistent with its ‘universal’ conception, this measure is modelled as applying to a large share (62%) of the non-residential building stock, equivalent to 321 million sqm in FY2021, or over 64,000 buildings (with an average size of 5,000 sqm each). Clearly, it would be critical to keep costs low for the measure to be cost-effective. We envisage a simple web-based form, with perhaps as little as 5 – fields, to be entered by a facility manager, or a person with access to annual energy accounts and basic facility information. We assume that the first time an organisation (building owner) reports (for an average sized building, defined as 5,000 sqm), there would be search and learning costs, and additional time associated with assembling the required information, and potentially requiring internal clearances for the reporting, estimated at 16 hours @ $150/hr, or $2,400. For subsequent reports, we allow 4 hours @ $150/hr. While the online form may take only a few minutes to complete, there may also be internal clearances required and/or some staff ‘refresher’ time. These are average costs – they may be much lower for smaller facilities and potentially higher for larger ones. In practice, a key factor may be the degree to which energy accounts and facility-related information are well managed, and this will of course vary. On these assumptions, compliance costs would have a present value of $720 million. In addition, we allow $5 million per year in government administration costs, with a present value of $62 million.

In terms of capital costs, and resulting benefits, the key variables are the take-up or response rate – the percentage of buildings or floor area where owners respond to the disclosure signal by making energy performance upgrades – and the savings rate, or the extent of the upgrades made, on average. During the consultations, it was proposed that a conservative assumption would be to assume that savings are only half those actually observed under NABERS Energy for Offices. This observation – which in turn carries outcomes from the overlapping CBD program – is that, on average, offices rated 12 times have experienced 36% energy savings. On this basis we assume that those buildings that do respond to the measure on average achieve an 18% reduction in electricity and gas consumption (noting the fuel mix varies by state). In terms of the take-up rate, we assume a slow start (only 1% of the floor area disclosed in the first year), increasing by 1.5 percentage points per year.

On these assumptions, Table 14 indicates that the measure would be expected to realise cumulative energy savings over the FY2021 - FY2030 period of over 30 PJ, and cumulative greenhouse gas emissions savings of 5.5 Mt CO$_2$-e.

Table 14: Universal, low-cost, mandatory disclosure – expected impacts, FY2021 - FY2030

<table>
<thead>
<tr>
<th><strong>Electricity savings</strong></th>
<th><strong>Cumulative, FY21 - FY30:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2021</td>
</tr>
<tr>
<td><strong>Amount</strong></td>
<td>24.1</td>
</tr>
</tbody>
</table>

64 NABERS online annual report, 2017-18.
In terms of benefits and costs, compliance and administrative costs are noted above, while the take-up and savings rate assumptions are associated with capital investment costs that have a present value of just under $1.1 billion. Total costs have a present value of almost $1.9 billion, commensurate with the scale of the measure. However, the value of energy savings alone has a present value of over $3.2 billion, creating a net present value of $1.4 billion and an average BCR of 1.8 – see Table 15.

Table 15: Universal, low-cost, mandatory disclosure – summary of benefit cost analysis

<table>
<thead>
<tr>
<th>FY2021 real $ million</th>
<th>PV of Costs</th>
<th>PV of Benefits</th>
<th>Net Present Values</th>
<th>Benefit Cost Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW</td>
<td>$501.5</td>
<td>$926.6</td>
<td>$425.1</td>
<td>1.8</td>
</tr>
<tr>
<td>VIC</td>
<td>$478.0</td>
<td>$730.8</td>
<td>$252.8</td>
<td>1.5</td>
</tr>
<tr>
<td>QLD</td>
<td>$387.4</td>
<td>$650.3</td>
<td>$262.9</td>
<td>1.7</td>
</tr>
<tr>
<td>WA</td>
<td>$220.6</td>
<td>$399.6</td>
<td>$179.0</td>
<td>1.8</td>
</tr>
<tr>
<td>SA</td>
<td>$113.6</td>
<td>$278.1</td>
<td>$164.5</td>
<td>2.4</td>
</tr>
<tr>
<td>NT</td>
<td>$46.7</td>
<td>$76.5</td>
<td>$29.8</td>
<td>1.6</td>
</tr>
<tr>
<td>TAS</td>
<td>$49.6</td>
<td>$85.6</td>
<td>$36.0</td>
<td>1.7</td>
</tr>
<tr>
<td>ACT</td>
<td>$65.5</td>
<td>$121.7</td>
<td>$56.2</td>
<td>1.9</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$1,862.9</td>
<td>$3,269.1</td>
<td>$1,406.2</td>
<td>1.8</td>
</tr>
</tbody>
</table>

While this measure is not as cost effective as the previous two, it should be recalled that this above analysis ascribes no benefit to avoided greenhouse gas emissions or avoided electricity network infrastructure costs. Also, the scale of the energy and emissions savings is larger than for the two previous measures.

It may be noted that there is some variation in the degree of cost-effectiveness of this and other measures by jurisdiction. While there can be more than one effect causing this, a general effect is that the fuel mix varies by state, with a higher share of gas in Victoria in particular, and low shares of gas in NT and TAS. Since gas is less expensive/valuable than electricity, for any given level of energy savings, a higher gas share means that less valuable energy savings result, in financial terms, and this translates into generally lower BCRs in Victoria, while we tend to see higher BCRs in TAS and NT, given their greater reliance on electricity. The BCR is highest in SA where higher electricity prices are assumed.

7.4.4 Government Procurement

This measure is smaller in scale than the others, as it only applies government use of offices and hotels. We note that the office floor area likely to be affected by the measure is somewhat larger than the floor area actually occupied by governments, as many private building owners will want to ensure that their buildings meet the government procurement standards, in order to have the potential to win government tenants, whether they do so or not. On the assumptions noted in Table 9, the potential floor area impacted is around 24 million sqm in FY2021 rising to around 40 million sqm in FY2050. As noted, we assume the targets are met linearly, 10% per year, and thus 100% of the target stock is upgraded to these levels after 10 years. For scale, this equates to 4.6% of the national building stock in 2030, or around 480 buildings (of 5,000 sqm) being upgraded in FY2021, and about 570 buildings in FY2030.

We split the floor area into that in Perth, Adelaide, Melbourne, Sydney and Brisbane, on the one hand, and regional capitals and other areas, on the other. We estimate that 50% of the relevant office floor area in NSW, VIC, QLD, WA and SA is likely to be in the relevant major cities (assuming a ‘greater city’ approach, and 50% elsewhere (for example, regional centres), while 100% of the office floor area in other states is allocated to the ‘other’ or ‘regional centre’ category. We assume that
higher targets (5.5-star NABERS) are more likely to be commercially achievable (or reasonable) in major cities due to the higher value of buildings, while a 5-star target is assumed for other areas.

The degree of building upgrade is modelled as the difference between the average office electricity and gas intensity in each state and the electricity and gas intensities calculated as relevant for 5.5 star and 5 stars in each state, using the NABERS reverse energy calculator and a standardised set of assumptions. As an indication, the simple average electricity intensity improvement is modelled as 192 MJ/m².a, for the 5.5 star regions in FY2021, and only 74 MJ/m².a for the 5 star regions. These gaps shrink over the 10-year period, as the baseline efficiency of office is expected to improve over time, thus narrowing the gap to the target efficiencies. The simple average gas intensity improvement is 43 MJ/m².a in FY2021 in the 5.5 target areas, and 32 MJ/m².a in the 5-star areas, and again falling over time.

As noted in Table 16, the measure is expected to realise cumulative energy savings over the FY2021 - FY2030 period of just over 19 PJ, and 2.8 Mt CO₂-e.

Table 16: Government Procurement: Summary of Impacts

<table>
<thead>
<tr>
<th></th>
<th>Cumulative, FY21 - FY30:</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
<th>2029</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity savings</td>
<td>PJ</td>
<td>14.5</td>
<td>0.30</td>
<td>0.59</td>
<td>0.87</td>
<td>1.13</td>
<td>1.38</td>
<td>1.62</td>
<td>1.84</td>
<td>2.05</td>
<td>2.26</td>
</tr>
<tr>
<td>Gas savings</td>
<td>PJ</td>
<td>4.6</td>
<td>0.10</td>
<td>0.20</td>
<td>0.29</td>
<td>0.38</td>
<td>0.45</td>
<td>0.52</td>
<td>0.59</td>
<td>0.65</td>
<td>0.70</td>
</tr>
<tr>
<td>GHG emissions savings</td>
<td>Mt CO₂-e</td>
<td>2.8</td>
<td>0.04</td>
<td>0.08</td>
<td>0.12</td>
<td>0.15</td>
<td>0.19</td>
<td>0.22</td>
<td>0.43</td>
<td>0.48</td>
<td>0.53</td>
</tr>
</tbody>
</table>

These energy savings have a present value of just over $1 billion, while upgrade capital costs have a present value of $415 million. Allowing for administrative costs of $5 million per year over 10 years, (present value $35.1 million), for office procurement, and $2.5 million per year for government accommodation, plus ratings costs for hotels (present value of $5.4 million), this creates an NPV (or economic surplus) of $596 million, and an average BCR of 2.3. Note that we exclude NSW from the office procurement measure on the grounds that it would not be additional to its recently-updated GREP targets.

Table 17: Government Procurement – Summary of Benefit Cost Analysis

<table>
<thead>
<tr>
<th>FY2021 real $ million</th>
<th>PV of Costs</th>
<th>PV of Benefits</th>
<th>Net Present Values</th>
<th>Benefit Cost Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW</td>
<td>$14.4</td>
<td>$26.7</td>
<td>$12.2</td>
<td>1.8</td>
</tr>
<tr>
<td>VIC</td>
<td>$206.9</td>
<td>$395.6</td>
<td>$188.7</td>
<td>1.9</td>
</tr>
<tr>
<td>QLD</td>
<td>$95.1</td>
<td>$224.9</td>
<td>$129.7</td>
<td>2.4</td>
</tr>
<tr>
<td>WA</td>
<td>$78.4</td>
<td>$184.9</td>
<td>$106.5</td>
<td>2.4</td>
</tr>
<tr>
<td>SA</td>
<td>$54.2</td>
<td>$178.8</td>
<td>$124.7</td>
<td>3.3</td>
</tr>
<tr>
<td>NT</td>
<td>$6.0</td>
<td>$8.7</td>
<td>$2.7</td>
<td>1.4</td>
</tr>
<tr>
<td>TAS</td>
<td>$11.3</td>
<td>$27.4</td>
<td>$16.1</td>
<td>2.4</td>
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<tr>
<td>ACT</td>
<td>$10.6</td>
<td>$26.7</td>
<td>$16.1</td>
<td>2.5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$477.0</td>
<td>$1,073.5</td>
<td>$596.6</td>
<td>2.3</td>
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</tbody>
</table>

7.4.5 Financial Incentives

As noted, this measure could be available for a significant share of the non-residential building stock. We assume that the take-up rate is limited to 1% of the eligible stock, in the first year, and increasing by 1% each year (that, an additional 1% of the stock is added annually, so the cumulative

---

65 i.e. 5,000 sqm NLA; 90/10 electricity/gas fuel mix (except in VIC and ACT (25% gas), and QLD, TAS and NT, 0% gas); 20 sqm per computer, 60 hours operation per week; capital city postcodes.
upgraded totals are just under 1% of the total stock in FY2021, rising to almost 21% by FY2050. It is entirely likely that the take-up of incentives may need to be deliberately limited, by administrative means and for fiscal reasons, but of course this would be a matter for governments to determine. Given the take-up rate noted, around 1,000 buildings would be upgraded annually supported by this measure, or some 4.9 million sqm in FY2020, rising to almost 8 million sqm in FY2050. Assuming governments covered 25% of the required capital investment costs, and that average savings realised were 15%, this would translate to a total cost to governments for the subsidies of around $16 million per year. We also allow for $5 million per year in government administrative costs, bringing the present value of total costs to $843 million.

The measure would be expected to realise energy savings over the FY2021 - FY2030 period of some 25.5 PJ and 4 Mt CO$_2$-e in avoided greenhouse gas emissions – see Table 18.

Table 18: Financial Incentives – Summary Impacts

<table>
<thead>
<tr>
<th></th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
<th>2029</th>
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<tr>
<td>Electricity savings</td>
<td>20.3</td>
<td>0.36</td>
<td>0.73</td>
<td>1.10</td>
<td>1.47</td>
<td>1.84</td>
<td>2.21</td>
<td>2.59</td>
<td>2.97</td>
<td>3.35</td>
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<tr>
<td>Gas savings</td>
<td>5.2</td>
<td>0.10</td>
<td>0.20</td>
<td>0.29</td>
<td>0.39</td>
<td>0.48</td>
<td>0.57</td>
<td>0.66</td>
<td>0.75</td>
<td>0.84</td>
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<tr>
<td>GHG emissions savings</td>
<td>4.0</td>
<td>0.07</td>
<td>0.14</td>
<td>0.21</td>
<td>0.28</td>
<td>0.36</td>
<td>0.42</td>
<td>0.51</td>
<td>0.58</td>
<td>0.66</td>
</tr>
</tbody>
</table>

These savings would have a present value of over $2.6 billion, reflecting the significant scale of the program. The total capital expended has a present value of $769 million. Allowing for administrative costs of $5 million per year, or $62 million in present value terms, the overall net present value is relatively high, at $1.8 billion, and the average net present value is also relatively high at 3.2. Note that present value of the subsidies, around $192 million (or around $16 million per year), is not additional to the capital costs noted, but rather represents a transfer of one quarter of that cost from building owners to governments, as inducement to undertake the investment.

Table 19: Financial Incentives – Summary of Benefit Cost Analysis

<table>
<thead>
<tr>
<th>FY2021 real $ million</th>
<th>PV of Costs</th>
<th>PV of Benefits</th>
<th>Net Present Values</th>
<th>Benefit Cost Ratios</th>
</tr>
</thead>
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<tr>
<td>NSW</td>
<td>$212.9</td>
<td>$749.4</td>
<td>$536.5</td>
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<tr>
<td>VIC</td>
<td>$201.1</td>
<td>$590.3</td>
<td>$389.3</td>
<td>2.9</td>
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<tr>
<td>QLD</td>
<td>$200.7</td>
<td>$525.7</td>
<td>$325.0</td>
<td>2.6</td>
</tr>
<tr>
<td>WA</td>
<td>$91.7</td>
<td>$322.9</td>
<td>$231.2</td>
<td>3.5</td>
</tr>
<tr>
<td>SA</td>
<td>$44.8</td>
<td>$224.8</td>
<td>$180.0</td>
<td>5.0</td>
</tr>
<tr>
<td>NT</td>
<td>$25.9</td>
<td>$61.7</td>
<td>$35.7</td>
<td>2.4</td>
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<tr>
<td>TAS</td>
<td>$23.8</td>
<td>$69.1</td>
<td>$45.4</td>
<td>2.9</td>
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<tr>
<td>ACT</td>
<td>$30.1</td>
<td>$98.0</td>
<td>$67.9</td>
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<tr>
<td>TOTAL</td>
<td>$831.0</td>
<td>$2,641.9</td>
<td>$1,811.0</td>
<td>3.2</td>
</tr>
</tbody>
</table>

It should be noted that, consistent with the high-level nature of this benefit cost analysis, we have not attempted to calculate the extent to which there is likely to be free-riding on any subsidy scheme. Free-riding is the phenomenon whereby those who may have made upgrade investments without the provision of subsidies are now able to access subsidies. The subsidy will induce some additional building owners to upgrade, who would not otherwise have done so, but it is generally impossible to determine which applicants are ‘additional’, and so subsidies must be provided to all (that meet relevant criteria). Neither the provision of subsidies, nor the extent of free-riding, changes the underlying social benefit cost analysis to any significant degree: this is driven by the productivity of the underlying investments, at least primarily. What is at stake is the distribution of costs between the public and private sectors, and also the productivity of government program expenditure. If free-riding were very high, for example, the additional energy/emissions savings per...
unit of government expenditure could be low, and potentially lower than for other alternative uses for those government funds.

### 7.4.6 Enhanced standards for commercial appliances, equipment, building elements

Compared to the other measures, this measure is modelled in a more ‘top-down’ manner. This is because the scope of equipment/building elements covered, which ones are considered additional to the current GEMS program, and the stringency of potential new standards, are all in play. In practice, careful RIS-style analysis would be performed for each potential ‘candidate’ product, and this would determine potential benefits and costs. However, such analysis is outside of our scope for the current exercise, and so we are largely dependent upon existing analyses of potentials and estimates of associated costs. Clearly, it would be possible to deepen and refine this analysis, but that would be a significant undertaking in its own right.

In practice, we have relied on a) internal estimates of potential savings associated with high-performance glazing standards, and b) estimates of the ‘as yet unrealised’ potential of the GEM program, in the commercial sector, prepared by or for the Department of the Environment and Energy.

The product classes considered here include:

- Chillers
- Commercial refrigeration
- Commercial catering equipment
- Glazing.

The latter is estimated in a top-down manner by SPR. Taking HVAC energy consumption as around 50% of total non-residential energy consumption, and assuming the impact of higher glazing standards in Australia were to reduce HVAC energy consumption by 10% on average, then this would translate to an estimate of 5% total energy savings. We assume that this savings would be realised by the major refurbishment stock portion noted above, or only 0.5% of the stock annually. Of course, a windows standard would also enhance energy savings in new buildings, but that is not considered here.

Adding estimated windows savings to those estimated by or for the Department of the Environment and Energy for the other products noted, cumulative energy savings over the FY2021 - FY2030 period would be very significant - over 64 PJ - which is larger than for any of the other measures considered. This would equate to a cumulative total over this period of 12.2 Mt CO$_2$-e in avoided greenhouse gas emissions – see Table 20.

<table>
<thead>
<tr>
<th>Table 20: Enhanced Product Standards - Impacts Summary</th>
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<tbody>
<tr>
<td><strong>Cumulative, FY21 - FY30:</strong></td>
</tr>
<tr>
<td>Electricity savings PJ</td>
</tr>
<tr>
<td>Gas savings PJ</td>
</tr>
<tr>
<td>GHG emissions savings Mt CO$_2$-e</td>
</tr>
</tbody>
</table>

Incremental capital costs associated with the three equipment classes noted above are also drawn from studies prepared by or for the Department of the Environment and Energy, while glazing costs have been estimated based on a conservative BCR of 1.5. In reality, regulation impact assessment would be required for each product class to confirm cost-effectiveness before a MEPS would apply for any product class. At the same time, we note that there may be other commercial equipment or...
building element classes – not considered above - for which MEPS could be effective and cost-effective but confirming the extent of this is not within the scope of the current project.

On this basis, Table 21 should be considered as indicative only. However, the analysis confirms that MEPS remain an important and cost-effective policy option, including for existing commercial buildings. The relatively high BCR and large/valuable energy savings, when compared to other measures, is driven by the MEPS for the three commercial product classes, with commercial catering equipment expected to contribute the largest and most cost-effective savings. We estimate the NPV of the three potential MEPS would be around $8.8 billion, with an average BCR of 8.8. This BCR is reduced somewhat by the inclusion of glazing where a lower BCR is estimated (but could be tested through specific studies).

Table 21: Enhanced Product Standards – Indicative Benefit Cost Analysis

<table>
<thead>
<tr>
<th></th>
<th>PV of Costs</th>
<th>PV of Benefits</th>
<th>Net Present Values</th>
<th>Benefit Cost Ratios</th>
</tr>
</thead>
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<tr>
<td>NSW</td>
<td>$683.2</td>
<td>$3,439.8</td>
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<td>VIC</td>
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<td>QLD</td>
<td>$512.8</td>
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<td>WA</td>
<td>$267.9</td>
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<td>SA</td>
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<td>NT</td>
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<td>$283.9</td>
<td>$227.9</td>
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</tr>
<tr>
<td>TAS</td>
<td>$69.1</td>
<td>$392.1</td>
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<td>ACT</td>
<td>$82.6</td>
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<td>TOTAL</td>
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<td>$11,921.4</td>
<td>$9,477.8</td>
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Appendices
### Appendix A  Common energy efficiency policies identified in Australian and international literature

<table>
<thead>
<tr>
<th>9.3.1 Minimum standards</th>
<th>9.3.2 Ratings and disclosure</th>
<th>9.3.3 Energy efficiency obligation schemes</th>
<th>9.3.4 Fiscal and tax incentives</th>
<th>9.3.5 Government procurement</th>
<th>9.3.6 Information and capacity building</th>
<th>9.3.7 Data sharing</th>
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<tr>
<td><strong>COAG Energy Council, Trajectory for Low Energy Buildings, 2018</strong></td>
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<td><strong>Energy Action, Strategy, Policy, Research, Achieving Low Energy Commercial Buildings in Australia, 2018</strong></td>
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<tr>
<td><strong>Australian Sustainable Built Environment Council &amp; ClimateWorks, Low Carbon, High Performance – How Buildings can make a major contribution to Australia’s emissions and productivity goals, 2016</strong></td>
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<td><strong>CRC Low Carbon Living, Best Practice Policy and Regulation for Low Carbon Outcomes in the Built Environment, 2017</strong></td>
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<td><strong>Australian Sustainable Built Environment Council &amp; ClimateWorks, Built to Perform an Industry led pathway to a zero carbon ready building Code, 2018</strong></td>
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<td><strong>COAG Energy Council, National Energy Productivity Plan, 2015</strong></td>
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<td><strong>Savills (for Sustainability Victoria), Mid-Tier Offices Investment Performance Study, 2017</strong></td>
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<td><strong>AECOM (for Sustainability Victoria), Next Wave Refresh, 2017</strong></td>
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<td><strong>Sustainability Victoria, Energy Efficient Office Buildings: Transforming the Mid-Tier Sector, 2016</strong></td>
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<td><strong>Australian Building Codes Board, Upgrading Existing Buildings Handbook, 2016</strong></td>
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<td><strong>ACIL Allen Consulting, Commercial Building Disclosure, Program Review, 2015</strong></td>
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<tr>
<td>9.3.1 Minimum standards</td>
<td>9.3.2 Ratings and disclosure</td>
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<td>9.3.4 Fiscal and tax incentives</td>
<td>9.3.5 Government procurement</td>
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<td>9.3.7 Data sharing</td>
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<td>Buildings Performance Institute of Europe, <em>Renovation in Practice, Best Practice Examples of Voluntary and Mandatory Initiatives across Europe</em>, 2015</td>
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<td>de Oliveira et al, <em>Ex post evaluation and policy implementation in the European building sector</em>, 2018</td>
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<td>ACIL Allen, <em>CBD review</em>, 2016</td>
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<td>Australian Sustainable Built Environment Council, <em>Feedback - Trajectory for Low energy efficient Buildings</em>, 2019</td>
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<td>Property Council of Australia, <em>Election Recommendations</em>, 2019</td>
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<td>Nadel et al, <em>Energy Saving Obligations Across Three Continents: Contrasting Approaches and Results</em>, 2017</td>
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<td>Global Carbon Capture and Storage Institute, <em>Financial and fiscal incentives</em>, 2019</td>
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<td>9.3.1 Minimum standards</td>
<td>9.3.2 Ratings and disclosure</td>
<td>9.3.3 Energy efficiency obligation schemes</td>
<td>9.3.4 Fiscal and tax incentives</td>
<td>9.3.5 Government procurement</td>
<td>9.3.6 Information and capacity building</td>
<td>9.3.7 Data sharing</td>
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<td>Industrial Efficiency Policy Database, JP-5: Fiscal incentives for energy efficiency, 2019</td>
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<td>Government of the Republic of Trinidad and Tobago, Renewable energy and energy efficiency fiscal incentives, 2019</td>
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<td>Aussie Greenmarks, Victorian Energy Upgrades (Formerly VEET Scheme), 2019</td>
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<td>Shergold &amp; Weir, Building confidence: Improving the effectiveness of compliance and enforcement systems for the building and construction industry across Australia, 2018</td>
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<td>International Partnership for Energy Efficiency Cooperation, Building energy efficiency task group’s zero energy building definitions and policy activity: An international review, 2018</td>
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<td>World Green Building Council, From thousands to billions: Coordinated action towards 100% net zero carbon buildings by 2050, 2017</td>
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<td>Property Council of Australia, Toolkit spreadsheet literature review, 2019</td>
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<td>Green Building Council of Australia, A carbon positive roadmap for the built environment, 2017</td>
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<td>UK Department for Business, Energy &amp; Industrial Strategy, Improving buildings’ energy performance: The UK government’s tools and policies to address the challenges, 2018</td>
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<td>The Centre for International Economics, Independent review of the Commercial Building Disclosure Program, 2019</td>
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TOTAL COUNT

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Appendix B  Phase 1 Report

8. Barriers to energy efficiency

There are a range of barriers to achieving energy and emissions savings in commercial buildings. These can be classified under the following constraints: Diversity and availability and data, capital constraints, capacity constraints, motivation, split incentives, and tenure.

8.1 Overview of Barriers by Selected Building Classes

The table below provides a high-level indication of some of the main barriers for some specific types of commercial building types. A cross does not necessarily indicate that a barrier never applies but rather indicates that it is not regarded to be a main barrier.

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<tr>
<th></th>
<th>Offices</th>
<th>Data Centres</th>
<th>Retail</th>
<th>Hotels</th>
<th>Hospitals</th>
<th>Education</th>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Split incentives</td>
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<td>×</td>
<td>✓</td>
<td>✓</td>
<td>×</td>
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<td>Capital constraints</td>
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<td>✓</td>
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<td>✓</td>
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<tr>
<td>Capacity constraints</td>
<td>✓</td>
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<td>×</td>
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<td>✓</td>
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</tbody>
</table>

8.2 Diversity of commercial buildings and availability of data

There are a variety of challenges to the uptake of energy efficiency in the commercial buildings sector. This includes a broad diversity of building classes, types, sizes, age, location, etc. The data availability for such a diverse range of buildings can also be patchy, particularly for the so far ‘harder to reach’ building types where data and policies have been lacking, such as for hotels, mid-tier offices, data centres, health and education. This can lead to information asymmetry, which creates a barrier to implementation of energy efficiency projects. It also makes it more challenging to design policies and strategies over such a diverse range of building profiles.

Considerations and potential barriers to the uptake of energy efficiency in existing commercial buildings, relating to the diversity of buildings, can include:

► The nature of building use and ease of access. For example, there are practical challenges with accessibility to upgrade data centres or hospitals that run 24 hours per day.

► Understanding ownership and management. From work with the City of Sydney targeting specific markets - offices, accommodation and entertainment - we know that the keys are to know a) who owns the buildings b) how are they managed? c) how competitive is the market? Strategies will be differentiated around these key considerations.

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66 Marquez, Leorey et.al., 2015, Barriers to the Adoption of Energy Efficiency Measures for Existing Commercial Buildings, available at: https://www.researchgate.net/publication/275036077_BarrIers_to_the_Adoption_of_Energy_Efficiency_Measures_for_Existing_Commercial_Buildings

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Market value of buildings and location. An issue for national policy coordination is that markets are different across Australia, although there are some similarities within typologies like ‘central business district’, ‘regional centres’, etc. Investment decisions are likely to differ between these typologies.

Grade, age, size and design of building, which can influence investment decisions. For example, is a rational owner more likely to knock down a building and replace it with something better, rather than refurbish it?

Interactions with building and equipment life-cycles. Whether it is or isn’t ‘time’ to refurbish the overall building, might impact on the timing of decisions for specific energy efficiency upgrades.

The nature of facility management and facility management contracts. To what extent does this address energy efficiency, and what ‘need’ is there for this?

The presence or absence of signals from NABERS and CBD. The absence of this would include education, carparks and warehouses, manufacturing, and where NABERS has some (although low) coverage health care, hotels, and data centres.

8.3 Split incentives

Split incentives occur when the occupier of a building is not the owner, which is common in commercial building arrangements. The result is that the annual cost savings may be split between the building user in the short term, and the owner (and future tenants) in the longer term. The longer the investment payback relative to the lease period, the more of a potential barrier this can be. Furthermore, the profitability of energy efficiency opportunities can be strongly impacted by the energy tariffs that businesses negotiate. Some commercial tenants, such as those in shopping centres, may have little financial incentive to reduce their energy consumption as electricity usage is traditionally included in rental payments.\(^{67}\)

8.4 Capital constraints

Capital costs are a common barrier to implementing energy efficiency in existing buildings. While some lower cost technologies such as lighting are better understood and generally implemented, there are many opportunities for energy savings that are foregone. Particularly for more capital intensive (and potentially higher impact) investments; especially when this is combined with non-price barriers such as are discussed below.

Policies that help to reduce the costs of investment, or improve access to financing, can help to increase the uptake of energy efficiency measures\(^ {68}\). The Victoria Energy Upgrades scheme is an example of a government program that has enabled subsidised investment costs and increased investment. Not surprisingly, the program has been most effective with lighting, however it also applies to a range of other technologies.

For low and medium cost opportunities in commercial buildings, financing has been shown to be a key inhibitor (and enabler) for investment. An example of an option to address this is the free finance facility service such as the Environmental Upgrade Agreements (EUA) mechanism in Victoria which has since been essentially replicated in NSW and South Australia.

The education and health sectors, which largely come under the government’s control and property estate, have different business models and drivers to other commercial services. Special vehicles

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\(^{67}\) ClimateWorks Low Carbon Growth Plan for Australia, 2011

\(^{68}\) Milne, C., Introducing a bill for commercial building energy efficiency, 2009

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for investment such as Energy Performance Contracts can be effective for government property estates.

Commercial buildings that have less of a commercial market and tenant demand, such as universities, schools, hospitals, art galleries etc. may not have the same demand for energy efficiency qualities as a more readily tenanted retail or office buildings. Therefore, the barriers to investment may be higher, which could require a combination of policy options to address beyond support with fronting up the capital.

8.5 Capacity constraints

Businesses are commonly faced with a lack of capacity in terms of awareness, capability, time and resources when it comes to identifying and implementing energy efficiency projects. Even for large businesses this can be a common issue, and therefore can be a significant barrier to implementation for small to medium sized businesses.

Other barriers include inadequate metering and energy consumption data, lack of expertise and broader lack of awareness about the non-energy benefits such as enhanced indoor environment quality and increased productivity. This can also extend to professionals, installers and specific trades workers other than the actual decision-maker. This barrier of inadequate skills on the frontline blunts certain policy options such as minimum standards or fiscal incentives seeing as a supply shortage of people to physically install and implement energy efficiency measures slows minimum standard compliance, the benefits achievable from financial support or whatever other end outcome such policy options are targeting.

Research suggests that specific company attributes enable energy efficiency opportunities to be implemented. These attributes include large company size or corporate scale, as this often gives rise to the necessary capital, awareness and skills, and leadership from the top, as this can provide motivation to enact the required changes.

Ownership and management arrangement differ widely for commercial buildings, from high end institutional ownership where capacity, motivation and tenant demand can be higher for energy efficiency. Compared to say private owners including mi-tier, foreign owned buildings, etc. Where the capacity and motivation may be much less. The tenancy market also varies. For example, schools have a less competitive market than offices or retail.

8.6 Motivation

Energy saving projects can be a low priority for many businesses due to it being non-core to their business model, strategy, products and services. Even with rising energy prices in recent years having risked putting large companies out of business, low cost energy efficiency opportunities can be overlooked. It may also sit outside of any one person's job description, with higher priority tasks constantly meaning that energy efficiency is left at the bottom of the list. An example of this can be hospital and aged care buildings, where builder user demands, and basic facility management requirements keep the facility manager too busy to have time focus on bigger picture opportunities. This also stems up to the Finance Director level, where energy efficiency is likely to be prioritised beneath a list of other projects. There may also be a perception that the cost is not controllable, particularly for tenants, while owners generally pass energy costs to tenants, so they have little motivation to seek energy efficient solutions.

Some stakeholders have identified a lack of trust in the findings of studies and energy audits which prevents investment in energy efficiency upgrades. For example, lightening upgrades and solar projects are common investments whereas the business case for other energy efficiency projects is viewed as comparatively complex see less up-take. Energy performance contracts can address this as contractors guarantee the energy saving delivered by projects and have proven effective in some cases.
Triggers such as points of leasing or sale for competitive commercial building markets, such as offices, are not present for schools, universities, hospitals, art galleries, etc. In the absence of these then synthetic triggers may need to be created such as through periodic mandatory ratings and disclosure.

8.7 Tenure

There are over 1 million non-residential buildings in Australia. Take-up of energy efficiency opportunities in each is highly dependent on a diversity of factors. One of those factors is the tenure of occupants and their corresponding values, policies and knowledge.

Table 23 - Leased and Owner-occupied barriers to energy efficiency and the relevance of policy options

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Leased buildings</th>
<th>Owner-occupied buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Most leased, non-residential buildings are affected by the split incentive, to varying degrees with exceptions from premium office market (and some premium retail). The split incentive means that the owner’s interest in energy efficiency is indirect. Tenant value, rental value and capital value drivers.</td>
<td>While there is no split incentive, there is some evidence to suggest that owner occupied buildings tend to be less energy efficient than institutionally-owned buildings (for example, City of Sydney Sector Sustainability Plans). Due to: lack of motivation, energy costs being a low % of total costs, perceptions of energy being a fixed cost (with little controllability) and lack of awareness and access to capital.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Policy option:</th>
<th>Mandatory disclosure</th>
<th>Mandatory disclosure can help to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory disclosure</td>
<td>Establishing a link between lease costs and energy efficiency (so tenants pay more where high energy performance justifies it)</td>
<td>► Increase management awareness (of building energy performance – relative and absolute)</td>
</tr>
<tr>
<td></td>
<td>Incentivising owners with vacancies to upgrade energy performance</td>
<td>► Motivate management to acquire expertise and improve building performance</td>
</tr>
<tr>
<td></td>
<td>o Impact of disclosure will be less in less competitive markets where there’s long lease terms</td>
<td>► Build upon existing Corporate Social Responsibility, organisational values, environmental policies, annual reporting obligations, motivating management to acquire expertise and improve building performance</td>
</tr>
<tr>
<td></td>
<td>o However, developing mandatory disclosure into a broader program, such as with targeted Guidance and Training on Energy Management for Hospitals, Schools, etc. including sign posting to Financing mechanisms, could help to navigate this.</td>
<td>► Can be used to build a business case, set targets, gauge the impact of investments, track progress</td>
</tr>
<tr>
<td></td>
<td>o Whereas low cost disclosures are more likely to be cost-effective</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Policy option:</th>
<th>Regulation (e.g. Building Code and MEPS for appliances)</th>
<th>Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation can be effective for most buildings (beyond the premium end of the market):</td>
<td>► As the ‘minimum performance’ can cut through the split incentive</td>
<td>► Will be at least as effective as in the leased segment, assuming they are enforced.</td>
</tr>
<tr>
<td></td>
<td>► Would expect to lead to additional savings</td>
<td>► Potentially more effective, as owner-occupied segment has a much smaller ‘premium’ end that is already motivated by EE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Policy option:</th>
<th>Financial incentives</th>
<th>Financial incentives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial incentives:</td>
<td>May make some difference at the smaller end of the market, otherwise limited impact: access to/cost of finance is not a major barrier in Australia. Especially with low interest rates currently.</td>
<td>Expect much bigger relative impact for owner-occupied compared to leased buildings.</td>
</tr>
<tr>
<td></td>
<td>► The real-world effect may be to draw attention to an opportunity that was already cost-effective (but not addressed)</td>
<td>► As owner-occupiers generally face poorer access to capital (e.g. government buildings may be constrained by internal policies/funding)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Policy option:</th>
<th>Information and capacity building (awareness raising, education, training)</th>
<th>Information and capacity building</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information and capacity building:</td>
<td>Can be an important capacity building option, to support other policy options e.g. financial incentives, mandatory disclosure, and regulations.</td>
<td>May be relatively more effective (evidence is not readily available), but more likely to be effective when linked to specific programs or triggers, not a scatter-gun approach.</td>
</tr>
<tr>
<td></td>
<td>► Not needed at the top end of the market</td>
<td></td>
</tr>
<tr>
<td></td>
<td>► Tenants can be hard to reach</td>
<td></td>
</tr>
</tbody>
</table>
9. Literature and policy map

An assessment of Australian and international literature related to energy efficiency policies was conducted to identify common approaches and lessons learned applicable to the Australian context. The most common policy options identified were:

► **Minimum standards**: regulatory requirements stipulating the minimum acceptable energy and carbon performance.

► **Building energy ratings and disclosure**: both voluntary and mandatory schemes that provide an easily interpreted metric representative of carbon and energy performance which can be used for comparison (in the case of ratings) and a list of metrics and values which must be published (in the case of disclosures).

► **Energy efficiency obligation schemes**: compulsory schemes that require liable entities (typically energy retailers who can pass costs on to consumers) to purchase a certain amount of energy efficiency savings, often through tradeable, audited certificates.

► **Tax and other financial incentives**: policies which affect the taxation form that companies pay or direct financial support for energy and carbon performance.

► **Government procurement**: internal policies applied by government to their energy procurement and inhabited buildings.

► **Information and capacity building**: programs targeted at building capacity, awareness and the required skills to make effective decisions over energy and carbon performance.

► **Data sharing**: policies that improve the quality and availability of energy data in a secure manner to allow decision makers to undertake more informed and evidence-based decisions over their building stock energy and carbon performance.

An overview of the literature consulted and the frequency of mentions of the above policy options is provided in Appendix A.

9.1 Policy criteria and effectiveness

Attributes of leading practice policies to address energy efficiency have been summarised by the United Nations (UN)\(^\text{69}\):

► **Firstly**, *significant outcomes*, i.e. An ability to contribute to a large energy demand reduction and result in significant and multiple benefits. Leading practices are those policies that have demonstrated that they produce or are essential to delivering significant quantifiable outcomes

► **Secondly**, they will exhibit *complementarity*, that is, attributes that make integration with state-wide, regional and or international efforts, this also helps implementation

► **Thirdly** best practice will have ‘*Political Alignment.*’ Ensuring policies fit under all jurisdictions and have support at all levels of government is essential to ensure they are effective

► **Finally**, the policies must be *marketable*. To ensure their uptake the policies must be attractive to decision makers.

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\(^{69}\) United Nations Economic Commission for Europe, Best policy practices in energy efficiency, 2009

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In conjunction to this, the International Renewable Energy Agency (IRENA), has prescribed a suite of criteria and indicators for the evaluation of renewable energy deployment policies and distilled them down into the following evaluation factors:

- **Effectiveness**: this refers to whether the policy achieves its specified objectives. Such as energy and emissions savings.
- **Efficiency**: this refers the cost-effectiveness of the policy.
- **Equity**: this refers to the fairness of the policy with consideration given to the distribution of costs and benefits arising from the policy.
- **Institutional Feasibility**: this refers to the ability of the policy to integrate with and be accepted by existing systems and organisations.

Combining these two sets of criteria from the UN and IRENA has allowed the following set of criteria to be developed for use in this report:

1. High impact in terms of energy/emissions savings. And other co-benefits (e.g. economic - job creation, social, environmental - air quality, etc.).
2. Cost effective (e.g. costs, savings versus costs, jobs created versus costs).
3. Specific (e.g. to a building class).
4. Complementarity and alignment with the broader policy landscape - such as at national, and state levels.

These criteria can provide a lens for reviewing policy options. The first two criteria, emissions reduction and cost effectiveness, are summarised further in the table below based on a qualitative comparison of policy options by the UN.

The economics of energy efficiency programmes, including their costs and benefits, have been subject to academic debate for several decades. However, robust data on the cost-effectiveness of different types of energy efficiency policy instruments is still scarce. A 2017 investigation into economic instruments supporting energy efficiency, supported previous findings by the International Energy Agency, that very few thorough evaluations of economic instruments in energy efficiency policy are available that would facilitate benefit-cost ratio comparisons.

The effectiveness of policy options is summarised in the table below. This is based on a qualitative rather than quantitative assessment of effectiveness.

<table>
<thead>
<tr>
<th>Policy Type</th>
<th>Emission Reduction Effectiveness</th>
<th>Cost Effectiveness</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum appliance standards</td>
<td>High</td>
<td>High</td>
<td>Factors for success: periodical update of standards, independent control, information, communication, education</td>
</tr>
<tr>
<td>Building Codes</td>
<td>High</td>
<td>Medium</td>
<td>Only effective if enforced. No incentive to improve beyond target.</td>
</tr>
<tr>
<td>Energy Efficiency obligation/white certificate schemes</td>
<td>Medium</td>
<td>High</td>
<td>Continuous improvements necessary: new energy efficiency measures, Transaction costs can be high, Institutional structures needed</td>
</tr>
</tbody>
</table>

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71 European Council for an Energy Efficient Economy, Costs and benefits of energy efficiency obligations: a review of European programmes, 2017
72 United Nations, Submission of the United Nations Environment Programme (UNEP) Sustainable Building Initiative (SBCI) to the AWG LCA Working Group, 24 April 2009
73 United Nations, Sustainable Buildings and Climate Initiative, 2009. Adapted by EY

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9.2 Global policy coverage

Over recent decades, the predominant tool used across all levels of government years to reduce emissions from the built environment has been energy efficiency programs and measures. This has been popular because it also helped governments achieve other policy goals, including conserving energy; reducing generation through improving energy delivery costs; and reducing the volatility and impact of energy price increases.

Energy efficiency policy for buildings continued to progress in 2018, although at slower rate than in 2017, reflecting an overall slowing trend in energy efficiency policy globally. According to the IEA’s Buildings Clean Energy Progress Report, about 40% of energy use in buildings was covered by policies in 2018, only a slight improvement from the 38% coverage in 2017.

The slowdown is due in part to market changes, as growth in energy demand is shifting from China – where policy coverage improved substantially in the last two decades – to other emerging economies, where policies cover a smaller share of buildings energy use.

Lighting, which was the bright spot of energy policy improvement in the past decade, appears saturated at about three-quarters of energy use covered by energy efficiency policies in 2018. While the major push to phase out incandescent lamps since 2008 has helped improve coverage, annual improvements in 2017 and 2018 were less impressive.

9.3 Policy types

This section of the report outlines the literature related to common policy options. There is a focus on the Australian context with international experiences also incorporated, framed by research by the CRC for Low Carbon Living and other sources. The assessment of the literature found an absence of quantifiable benefits and costs by policy type with the exception of improving the National Construction Code (NCC).

9.3.1 Minimum standards

Improving minimum standards appears one of the most effective and widely discussed energy efficiency policy levers for decarbonising existing commercial buildings. This is split into separate schemes with the National Construction Code (NCC) and improving the Greenhouse Emissions Minimum Standards (GEMS).

The NCC, although it applies directly to new buildings, is indirectly incredibly impactful on the overall efficiency of the building stock, as new buildings transition to existing buildings over time. This is particularly relevant when considering the trajectory towards carbon readiness in existing
mid-tier commercial buildings by 2050. Stronger standards for new buildings today will reduce lock-in of higher than necessary energy consumption (and bills) and emissions in the future and reduce need for costly refurbishments.

Code minimum standards apply to 'new building work', and in principle this should include major refurbishments of existing buildings, as well as extensions and additions to existing buildings. Also, current building Code requirements in principle should be applied when an existing building is converted from one class to another (e.g., office to serviced apartments or hotel). However, in practice, there is considerable uncertainty about the extent to which these requirements are implemented and, related, regarding the ‘triggers’ or ‘thresholds’ that are applied in practice to such questions. It is understood that building surveyors exercise considerable discretion in determining when Code requirements are required to be complied with, and that there is a lack of clarity and understanding of the requirements. Clarifying these arrangements, including for building professionals, and ensuring they are consistently applied, could in itself amount to a significant policy measure that would lift the energy performance of the existing building stock over time.

Minimum standards for appliances and equipment, delivered through the Greenhouse and Energy Minimum Standards (GEMS) program aim to reduce energy consumption in existing commercial buildings. Key issues limiting the impact of this policy measure relate to compliance, coverage and contemporariness. Increasing the coverage of energy efficiency technologies is paramount as a means to increase the impact and bring the policy up-to-date. Literature has found that Minimum Energy Performance Standards (MEPs) and/or labelling should be expanded to cover all significant building components, as well as including high-performing glazing and heat recovery ventilation systems.\(^{76}\)

An extension of minimum standards policies to encourage best practice could include the introduction of high-performance energy stands (HEPS) which could be set by product to provide context for ‘stretch-Code’ or ‘above-Code’\(^{77}\). Greater compliance with minimum standard policies can be improved by post construction verification of building Code as-built energy standards and potentially when there a change of owner to ensure performance has not deteriorated\(^{78}\). Additionally, greater resources are required to ensure better compliance with the scheme. Mechanisms for this tend to be capital intensive and include different types of reporting software, physical inspections and design of what constitutes compliance. It has been found that the GEMS program currently delivers approximately $1 billion in avoided energy costs across Australia which translates into emissions reductions of 1.5%.\(^{79}\)

Overall, minimum standard policies appear to rank highly against the applied criteria with the literature finding them highly cost effective and impactful in terms of energy and emissions savings. Minimum standards policies such as the NCC are quite specific as they apply to new buildings and major renovations with GEMS and MEPS being somewhat broader in their impact as many of the appliances and equipment covered in them are used in other applications. Additionally, these types of policies tend to fit well within the existing policy frameworks as the conclusions from the literature tend to recommend maintaining the existing structures with increased targets and broader scopes.

9.3.2 Building ratings and disclosure

Building rating and disclosure schemes, both voluntary and mandatory, have been useful in improving building energy performance through increasing awareness, providing a platform for

\(^{76}\) International Partnership for Energy Efficiency Cooperation, Building energy efficiency task group’s zero energy building definitions and policy activity: An international review, 2018

\(^{77}\) Property Council of Australia, Toolkit spreadsheet literature review, 2019

\(^{78}\) Shergold and Weir, Building confidence: Improving the effectiveness of compliance and enforcement systems for the building and construction industry across Australia, 2018

\(^{79}\) DataBuild, Greenhouse and Energy Minimum Standards (GEMS) review, 2015

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comparison and monitoring and realising benefits of energy efficiency. Examples of such voluntary rating schemes in the commercial building domain include NABERS and Green Star.

There is an important distinction, however, between voluntary and mandatory disclosure. Voluntary disclosure is most likely to occur for ‘good’ buildings, as a means of drawing attention to high standards of energy performance. However, this also means that poor and average buildings are unlikely to be rated, or those ratings disclosed. This creates a ‘selection bias’ in the market, with owners of poor buildings having an incentive to conceal that poor performance. Mandatory disclosure overcomes the selection bias and informs consumers about both more and less energy efficient buildings, enabling more informed choice. This in turn creates incentives for owners of all buildings – and particularly the poorly performing ones – to invest and lift their performance. Also, there is evidence of very low take-up of some NABERS ratings tools, such as hotels, on a voluntary basis. The highest take-up is in offices, where mandatory disclosure applies (see the CBD scheme, below).

A core area of improvement for existing buildings ratings - and in particular NABERS - lies in broadening the types of buildings covered, and this is already planned by the NABERS team. Furthermore, greater adoption of such third-party verification tools complements mandatory disclosure and the NCC by providing a platform for recognising high performance for government and industry leaders.

Similar opportunities for broadening the coverage of mandatory disclosures exists in the form of expanding the current Commercial Building Disclosure (CBD) schemes to more building classes, such as retail and apartments blocks as well as lowering the minimum floor area threshold below 1000m². This is in light of the recent lowering in 2017 from 2000m² to 1000m². Benefits of mandatory disclosure have been found for both tenants and building owners. In effect, and for the time being at least, expansion of the CBD program is limited to classes for which NABERS ratings tools already exist. Alternatively – and as discussed further below – different forms of disclosure could be envisaged.

Another issue with the NABERS and CBD schemes is that they measure the total change in energy efficiency over time. This is valuable information to have, however, it tells us nothing about the causation. i.e. whether a drop-in energy intensity over time was caused by one of, or more likely combination of, NABERS/CBD, technology change, market changes, other policy measures including the Building Code, retailer obligation schemes, GEMS, etc. A lot more work would need to be done to demonstrate, conclusively, what incremental impacts are attributable to each of these schemes – particularly voluntary schemes where there is little leverage, but even mandatory but non-prescriptive schemes, like CBD.

Ownership and management arrangement differ widely for commercial buildings, from high end institutional ownership where capacity, motivation and tenant demand for energy efficiency is higher. For non-premium and mid-tier buildings, as noted, there is likely to be a much lower focus on energy efficiency. These buildings may be competing in smaller markets, for tenants with less ‘brand’ interest in efficiency, and these buildings may also be owned by smaller or foreign entities, with less professional building management arrangements in place. Building markets also vary considerably across the building classes. For example, schools have a less competitive market than offices or retail. An added benefit of making ratings mandatory for less competitive buildings is that it can effectively push building owners into action, which can then flow into better governance in terms of corporate responsibility and risk management, for harder to reach building classes.

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80 Australian Government, Changes to the commercial Building Disclosure Program, 2019
81 That is, the building owner is free to determine whether to respond to the disclosure signal or not and, if so, how they respond and to what degree.
A recent preliminary review of the CBD program for the DoEE\(^8\) made the following recommendations to the design of the policy which relate to improving the energy performance of the commercial building stock:

- Clearer defining of the objectives
- Changing to a periodic trigger
- Adjusting the size threshold to account for the whole building rather than just the office space
- Expanding the program to shopping centres, hotels, co-location data centres and private data centres

International experiences provide insight into effective and efficient implementation techniques of such as the rating and disclosure schemes listed above. Extensive stakeholder engagement is advised to maximise buy-in as well as provide readily accessible support and guidance to assist building owners in making optimal decisions. There is also a place for communication and awareness measures to inform and motivate action in interested parties. Standardised procedures that allow adaptability to different applicant needs, can help to facilitate ease of use through repeatability. Finally, it is critical to have an ambitious and increasing stringent criteria with regular review to increase certainty and maintain a cutting-edge standard. Politically, simple rating and disclosure performance tend not to be very controversial and have proven to be acceptable.

Building ratings and disclosures appear to rank highly against the applied criteria, with the literature finding mandatory options to be highly cost effective and impactful in terms of energy and emissions savings. Voluntary rating schemes are evaluated similarly, though with less cost-effectiveness compared to mandatory building disclosures due to their uptake. These policy levers can be targeted with the ability to even distinguish between different commercial building types. Furthermore, they fit smoothly within existing frameworks as the consensus in the literature is to expand current schemes rather that create new and competing schemes.

### 9.3.3 Energy efficiency obligation schemes (EEOSs)

Obligatory energy efficiency savings schemes have proven to be a successful and effective mechanism for capturing the societal benefit associated with energy efficiency in addition to the intrinsic cost savings. In Australia this comes in the varied form of a ‘white certificate’ system in Victoria (VEU) and New South Wales (ESS). Distinct from the EEOSs in ACT (EEIS) and South Australia (REES).

Considerable benefits could be achieved by with greater harmonisation of the current state-based schemes into one national scheme that covers all states and territories, including those not currently using a scheme.

Most of the existing schemes offer a ‘NABERS upgrade’ activity and have a generic ‘project-based’ method that in theory can be applied to any efficiency upgrade, with appropriate measurement and verification before and after.

Commercial lighting upgrades have been the predominant project type for these schemes. However, with LED lighting becoming the industry standard, support for lighting upgrades is generally being phased out (as non-additional). This makes it less clear what specific activities are likely to dominate the savings generated by these schemes in future.

A broader consideration of projects such as refrigeration, fan and pump tuning, retro-commissioning and recommissioning would increase coverage whilst still maintaining a focus on

\(^8\) The Centre for International Economics, Independent review of the Commercial Building Disclosure Program, 2019

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high energy saving activities where they are not already included\(^\text{83}\). It is worth noting that the VEU has a voluntary component which allows large energy users to opt in, who were historically excluded from the former VEET due to their participation in the past EPA Victoria’s past Environment and Resource Efficiency Plans (EREP). This allows firms to create certificates when implementing eligible energy efficiency improvements.

A stable pathway of energy efficiency targets into the future is important to provide certainty to encourage constant and increasing investment and implementation. Market uncertainly due to the at times volatile certificate prices can provide a disincentive for organisations looking for a secure cashflow. Particular areas of improvement lie in reducing red-tape where practical and broadening the types of projects eligible for certificates. In certain schemes, more could be done on engaging with regional stakeholders such as targeted accreditation subsidies, information campaigns and greater dialogue with regional industry associations.

EEOs extend beyond the borders of Australia with a strong international precedent in Europe and America. Currently in the EU, there is an obligation that Member States have an EEO or similar measure while in the USA these EEOs take the form of Energy Efficiency Resource Standards (EERSs) and are in place in 26 states despite no federal mandate as of June 2017\(^\text{84}\). The core learnings of the Europe’s experience with EEOs are public policy discipline in ambition and consistency of goals, flexibility between jurisdictions, patience for results, and regular and rigorous program assessments and evaluations. Similar themes appear when reflecting on the lessons learned in the US with clearly defined ramp up periods in ambition to account for regulatory lag, target ambition and stakeholder consultation.

A review of different EEOs in Europe found that all of the schemes had a net positive impact on energy cost\(^\text{85}\) with significantly cheaper cost of energy under the EEO compared to standard retail pricing. A snapshot from this work is shown in Table 25.

Table 25 Comparative weighted energy costs under European EEOs and standard retail pricing

<table>
<thead>
<tr>
<th>Country</th>
<th>Time period of scheme</th>
<th>Weighted average EEO cost of lifetime energy savings (Eurocent/kWh)</th>
<th>Weighted average retail prices of comparable energy supply for relevant sectors (Eurocent/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>2008-2012</td>
<td>1.1</td>
<td>10</td>
</tr>
<tr>
<td>Denmark</td>
<td>2015</td>
<td>0.5</td>
<td>13</td>
</tr>
<tr>
<td>France</td>
<td>2011-2013</td>
<td>0.4</td>
<td>9</td>
</tr>
<tr>
<td>Italy</td>
<td>2014</td>
<td>0.7</td>
<td>9</td>
</tr>
<tr>
<td>Austria</td>
<td>2015</td>
<td>0.5</td>
<td>8</td>
</tr>
</tbody>
</table>

The International Energy Efficiency Scorecard, which in 2018 ranked Australia worst for energy efficiency in the developed world, finds the core two issues in some of the Australian state schemes relate to 1) price opacity due to bilateral trading, as opposed to the possibility of all certificates traded on a spot market and 2) an avoidance of deeper savings due to the mechanism required for registering energy savings\(^\text{86}\). However, recent rule changes in 2016 are expected to rectify this in NSW. NSW’s ESS was estimated to deliver 11TWh of electricity lifetime savings with corresponding lifetime cost of $1.6bil as of April 2015\(^\text{87}\).

\(^{83}\) Australian Institute of Refrigeration, Air Conditioning and Heating, NSW Energy Savings Scheme review - Issues paper, 2014  
\(^{84}\) Nadel et al., Energy Saving Obligations Across Three Continents: Contrasting Approaches and Results, 2017  
\(^{85}\) Rosenow and Bayer, Costs and benefits of energy efficiency obligations: a review of European programmes, 2017  
\(^{86}\) ACEEE, The International Energy Efficiency Scorecard, 2018  

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Department of the Environment and Energy
Upon application of EY’s evaluation criteria to the diverse collection of literature, EEOSs appear highly impactful in terms of energy and emissions savings as well as very cost effective. However, they possess a low level of specificity to the commercial building sector as EEOSs typically apply to all energy consumers above a certain energy consumption threshold. Such schemes have the ability to interact well within the broader energy policy landscape though the consensus in the literature to amalgamate the current state-based schemes into a national one. This effectively translates into removing the current EEOSs and creating a new national scheme which would have material transitional implications.

9.3.4 Financial incentives

Fiscal incentives can provide an opportunity to reduce the capital expenditure required and encourage commercial uptake of energy efficiency equipment. Linking financing incentives to specific energy efficiency technologies is a method to allow technological banding and direct resources to more efficient options. Additional to this is the opportunity to link financing to certain energy performance ratings or minimum standard policies to ensure high quality and performance.

Financial incentive opportunities also exist such as subsidies for energy efficiency audits or investment, soft loans, grants and subsidies\(^\text{88}\) though do come with an associated high cost for government. It is notable that there is potential for overlap across state and federal jurisdictions of government and hence it is important for coordination to achieve coverage of the right areas and avoid double-counting.

Commercial leasing arrangements can also be improved with greater disclosure of energy performance in leasing agreements, including in gross leases where energy costs are included\(^\text{89}\).

Over two thirds of all countries have been found to have economic measures for energy efficiency as of almost a decade ago highlighting the maturity of energy efficiency technology\(^\text{90}\). To provide perspective, the IEA\(^\text{91}\) has found that globally, investment will need to increase by approximately 65% to meet their faster transition scenario which involves an energy-related emissions reduction of 75% by 2050 and a decrease in carbon intensity for end-use sectors of 65% by 2050.

There appears a growing trend for such policy instruments in Australia with Bank Australia recently announcing financing for the upscaling of the Victorian Environmental Upgrade Agreement (EUA) to a national level. The EUA is a fixed-rate, loan for up to 20 years covering the capital for energy efficiency upgrades with the payback coming out of energy savings and most importantly, it doesn’t need to be repaid if the building is vacated\(^\text{92}\). Other funding sources include the Clean Energy Finance Corporation.

The education and health sectors, in which buildings largely come under government control, have different business models, tenant and demand, and business drivers to other commercial services. Specific funding vehicles and purposes for government energy efficiency projects can be effective. Energy Performance Contracts have proven to be successful vehicles for funding (and guaranteeing savings) for large energy efficiency investments. For example, the Department of Health and Human Services in Victoria is undertaking EPCs across hospitals in Victoria, with multi-million dollar investments, via funding secured from Treasury. There are numerous EPCs successfully delivered in local government, federal government and Hospitals in the UK since 2010 such as through the London REFIT program.

Overall, fiscal incentive policy instruments have enormous potential for large energy and emissions reductions, largely due to the significant barrier to capital which they help to overcome. From a cost perspective, there is obviously a proportional burden imposed on the government from such

\(^{88}\text{American Council for an Energy-Efficient Economy, Financial incentives for energy efficiency, 2016}\)
\(^{89}\text{Low Carbon Living CRC, Best Practice Policy and Regulation for Low Carbon Outcomes in the Built Environment, 2017}\)
\(^{90}\text{Global Carbon Capture and Storage Institute, Financial and fiscal incentives, 2019}\)
\(^{91}\text{International Energy Agency, Perspectives for the Clean Energy Transition: The Critical Role of buildings, 2019}\)
\(^{92}\text{Poppy Johnston, EUAs get a new name and go national – at last, 2019}\)
policies though this directly improves the cost effectiveness for energy efficiency implementers, often with the ability to overcome the motivation barrier often faced.

9.3.5 Government procurement

There is a significant opportunity for increasing the energy efficiency of existing commercial buildings tenanted and owned by government.

A key issue is that most government procurement policies were established several years ago and, with exception on NSW, have not been updated to keep pace with market trends.

Government buildings – particularly government-owned buildings, including institutional buildings like hospitals, universities, galleries, etc. typically lack strong market drivers for efficiency. Premium offices would be an exception – as noted, these are likely to be owned by large institutions and very professionally managed. However, the majority of government owned or occupied building will not be premium office spaces. Therefore, standards are likely to be necessary to substitute for market forces – particularly in ‘non-traded’ buildings (schools, hospitals, etc.).

The NSW’s recently updated Government Resource Efficiency Plan (GREP) seeks to reduce the NSW government’s operating costs and lead by example in increasing the efficiency of its resource use. The policy focuses on four main areas - energy, water, and waste and air emissions - and ensures that government agencies are empowered to address rising resource costs, use their purchasing power to drive down the cost of new technologies and services and also show leadership in their decision making. This includes minimum NABERS ratings for owned and leased offices and data centres; minimum standards for new electrical appliances and equipment; minimum standards for new buildings and fit-outs; and energy savings targets across government. However, challenges have arisen in gaining approval (mainly financing), which have inhibited much of the energy efficiency project implementation while the NABERS benchmark of 4.5 stars may no longer be leading practice93. There have also been issues regarding keeping minimum standards for appliances and equipment updated given the evolving market. Greenpower purchasing mandates and solar PV installation targets have not been problematic due to the ease of compliance and falling costs respectively.

The property sector, through the PCA, has recommended that the government set net-zero emissions targets in government buildings by 2030 with increased requirements surrounding transparency and performance of government owned and leased buildings94.

Green leases for government tenanted (and owned) buildings could be applied. This could also extend to the private sector through groups like CitySwitch or the Better Buildings Partnership. Owner occupied buildings might be an example where this could be limited.

Mechanisms and targets for government procurement of greater energy efficiency within existing commercial buildings could include:

► Adopting building upgrade processes such as Victoria's Greener Government Buildings program
► Setting up a public register of the NABERS ratings for all government buildings
► Displaying the voluntary energy rating scheme (primarily Green Star and NABERS) in a public space within government buildings

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93 Office of Environment and Heritage, First review of the NSW Government Resource Efficiency Plan (GREP), 2018
94 Property Council of Australia, Election Recommendations, 2019
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Committing to align government office tenancy ratings with the base building ratings to improve operational performance.

- Only occupying NABERS 5+ star buildings
- Improved NABERS Energy and Green Star tenancy ratings from education and behaviour change (CitySwitch programs).
- NABERS Energy and Green Star ratings for government owned and occupied buildings disclosed on a government website.
- Preference for hiring event floorspace at hotels with higher efficiency ratings

**9.3.6 Information and capacity building**

Lack of information and awareness of potential energy efficiency opportunities remains an issue for some commercial building owners and/or tenants. Improvements that address this literacy barrier include the development of more effective information platforms, awareness campaigns and the development of tools which allows building operators to make better decisions.

The two core pillars of this are basic information relating to energy efficiency and web-based tools that empower users to utilise what energy data and information they have access to. These can take the form of websites which with general information, such as NSW's Sustainability Advantage program, or more specialist information, as is the case for Victoria’s ResourceSmart which is tailored to schools. The education challenge is compounded in smaller, mid-tier existing commercial buildings due to the lack of scale and resources for training qualified professionals.

There is limited literature available as to the effectiveness or lack thereof of energy and building management policies. This is likely due to the fact that they are very building specific and there is little to no government jurisdiction as to individual buildings management. However, cost evaluations undertaken for the NSW government of the NSW Energy Saver Program (ESP), which subsidised energy audits and assisted with energy efficiency business case development, found it to be a lower cost policy option relative to others run by the government. This did however, stand in contrast to the Energy Efficiency for Small Business Program (EESBP) which provided subsidised targeted action plans and energy efficiency planning assistance to small business and was found to be a mid-range cost policy option.

The increasing consideration of climate risk when assessing a broader risk profile presents an opportunity in the building sector for lower insurance premiums for more energy efficient buildings. There is scope for government to introduce fiscal policies incentivising this though potentially more impactful is the possibility of informational programs about what the market offers or cooperation with lenders and insurers to inform consumers.

Education and awareness policies are difficult to evaluate as the impact they have can be difficult to quantify. With this in mind, there appears to be consensus in the literature that they are worthwhile given the market failures of information access and limited rationality that affects energy efficiency so prominently. Education and awareness raising appear moderately impactful and cost-efficient with high degrees of specificity possible depending on the design of the policy. The focus of these polices, similar to that of government procurement options, translates into a smooth integration with other policy systems.

**9.3.7 Data sharing**

A lack of reliable data relating to building energy consumption and energy saving opportunities inhibits the reduction of emissions in existing commercial buildings. This challenges large

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95 Jacobs (for the NSW Office of Environment and Heritage), NSW energy efficiency programs cost benefit analysis, 2014
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organisations of all types, including government, where there is significant scope for greater data sharing and cooperation between agencies and across different levels of government.

There is a general lack of data on commercial building energy intensities and implemented savings projects, beyond well traded building classes such as for large office and retail buildings. A greater emphasis could be placed on improving the quality of data\textsuperscript{96}, and there is scope for investing in better data collection and sharing, possibly linked to existing voluntary schemes such as NABERS, Green Star and toolkits such as are being developed by the Property Council of Australia.

The Canadian government for example, has invested in collecting energy audit data, recognising the public value in capturing such information. Whilst there are plenty of energy audit programs initiated through government support programs in Australia, EY analysis shows that only a few datasets are useful in terms of having recorded % savings and capitals costs. Which are needed to leverage the data for application and comparison with other buildings, regions etc. This could be easily remedied by having a common agreed basis upfront, amongst government departments, for recording the results from energy audit reports.

9.3.8 Market transformation

A market transformation approach would combine regulations and incentives discussed above. For example, linking under-utilised technologies with minimum standards or ratings schemes, to ensure maximum benefits from both policies. A performance standard could be introduced using the future ‘top runner’ approach, such as has been used by the Japanese government. Every 3 years, the most efficient product in the market is chosen as the ‘top runner’. Then in 3 years’ time the minimum standards are set in line with that top runner. Market transformation may also include taking a wider perspective to identify opportunities. For example, high performance glazing is expensive and niche partly as we don’t manufacture it in Australia. Encouraging local manufacturing might help to drive market transformation in the supply chain.

9.4 Regional policy mapping

This section outlines the current policies in place for improving the carbon and energy performance of the commercial building stock in Australia.

9.4.1 Current energy and emissions targets

The table below summarises targets relevant to energy efficiency and emissions in place in each jurisdiction.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>Net zero emissions by 2045 (on 1990 level)</td>
</tr>
<tr>
<td></td>
<td>Emissions reductions of 40% by 2020, 50-60% by 2025, 65-75% by 2030, 90-95% by 2040</td>
</tr>
<tr>
<td></td>
<td>100% renewable energy by 2020</td>
</tr>
<tr>
<td>NSW</td>
<td>Net zero emissions by 2050</td>
</tr>
<tr>
<td></td>
<td>Achieve 16,000 GWh in energy savings by 2020</td>
</tr>
<tr>
<td></td>
<td>Assist 50% of NSW commercial floor space to achieve a 4star NABERS rating by 2020</td>
</tr>
<tr>
<td></td>
<td>Support 220,000 low income households to reduce energy use by up to 20% by 2014</td>
</tr>
</tbody>
</table>

\textsuperscript{96} Green Building Council of Australia. A carbon positive roadmap for the built environment, 2017
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Department of the Environment and Energy
<table>
<thead>
<tr>
<th>State</th>
<th>Emissions Targets</th>
</tr>
</thead>
</table>
| VIC   | Net zero emissions by 2050  
50% renewable energy target by 2030  
Under the VEET scheme, achieve 6.5 Mt CO₂-e in energy savings by 2020 |
| SA    | 60% emissions reductions by 2050 (on 1990 levels) |
| WA    | None evident |
| QLD   | Net zero emissions by 2050  
50% renewable energy target by 2030 |
| TAS   | Net zero emissions by 2050  
Currently achieving net zero emissions, with a downturn in forest harvesting |
| NT    | 60% emissions reductions by 2050 relative to 1990 |
9.4.2 Current policies

Australia has a blend of federal policies and regional policies administered at a state (or council) level of government. The prominence of state-based policies creates a disparity at a federal level between the different policy ecosystems within Australia. The map below displays the various polices, relevant to energy and emissions efficiency, currently operating in Australia, by jurisdiction.

Fig. 34 - Existing policing affecting energy and carbon performance in mid-tier commercial buildings in Australia

National

The nation-wide focus for commercial buildings is centred on ratings and disclosure policies. NABERS, a voluntary operational energy performance rating scheme, is currently effective as a comparison tool for developers and tenants alike, but there is an opportunity to turn it into a compulsory rating system and enforce minimum standards by a target year.

This is a somewhat similar concept to the UK’s minimum level of energy efficiency required to let non-domestic property. Since 1 April 2018, it has been unlawful for landlords of non-domestic private rented properties (including public sector landlords) to grant a tenancy to new or existing tenants if their property has an EPC rating of band F or G (shown on a valid Energy Performance Certificate for the property). From 1 April 2023, landlords must not continue letting a non-domestic property which is already let if that property has an EPC rating of band F or G.
With NABERS already operational, the cost of the roll-out would be lower than a completely new scheme. There are similar views regarding expanding the CBD program to include smaller buildings below the current 1000m² threshold.

The following defines the core policies the federal government currently has in place:

- National Construction Code (NCC): stipulates the legal minimum standards required for the design and construction of new buildings and new building work in existing buildings with respect to safety, health, amenity and sustainability
- National Australian Built Environment Rating System (NABERS): can be used to measure a building’s energy efficiency, carbon emissions, as well as the water consumed, the waste produced and compare it to similar buildings. It is a voluntary ratings system that can be used for comparison
- Commercial Building Disclosure (CBD): a mandatory regulatory program that requires energy efficiency information to be disclosed in most cases when an office space of over 1000m² are offered for lease or sale.
- More broadly, Australia has committed under the Paris Agreement to reduce emissions to 26-28 per cent on 2005 levels by 2030.

The other predominant national energy efficiency policy that applies across Australia is the MEPS program within the GEMS legislation which sets minimum energy efficiency standards for equipment and appliances. This more broadly falls within Australia's E3 Energy Productivity plan. It is currently effective though the equipment to which it applies could be broadened in conjunction with raising the minimum energy performance to reflect improving technology.

Historically, the National Solar Schools Program (NSSP), which granted up to $50,000 if a school installed a grid-connected solar PV system of minimum 2kW capacity, was a reasonably effective fiscal policy. The program closed in June 2013 with overall outcomes of over $217mil provided to 5,310 (or 60%) of Australian schools and the generation from the solar PV installed equating to enough electricity to power 4600 average households.

**Victoria (VIC)**

Victoria has multiple schemes for improving the energy and carbon performance of existing commercial buildings. The VEU (formerly VEET) has been highly successful with commercial lighting as well as other projects. The scheme has evolved beyond its initial phase in the residential sector to cover a broad range of energy savings projects, with a project-based methodology for measurement and verification of energy savings. A review is currently underway to determine post-2020 targets.

Victoria has the largest proportion of mid-tier office buildings without a NABERS rating97. Hence, there is an opportunity to improve energy efficiency through enforced ratings. Sustainability Victoria found that ownership is a key driver on whether buildings are NABERS rated. Institutionally owned buildings have the highest likelihood of rating followed by privately owned, with strata-owned buildings the least likely. This acts as evidence that the national CBD program is having some effect. Buildings that are leased are also more likely to be NABERS rated and have environmentally sustainable design (ESD) features installed.

The following lists some of the key policies that the Victorian government currently has in place:

- Greener Government Buildings: In FY18 it funded over $15 million in energy efficiency upgrades across existing government buildings including several hospitals and educational facilities in both metro and regional areas. These projects each has a payback period of 97 Savills (for Sustainability Victoria), Mid-Tier Offices Investment Performance Study, 2017

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less than 5 years and have been aggregately estimated to achieve at least $3 million in energy savings and reduce over 12,000 tonnes of greenhouse gas emissions per annum.

► Better Commercial Buildings Program: (administered by Sustainability Victoria) provides grants up to $30,000 to have energy audits, efficiency measures implemented, or efficiency measured

► Environmental Upgrade Finance (EUF): A council-based financing mechanism that assists businesses with access to capital for energy efficiency projects.

► Victorian Energy Upgrades (VEU) scheme: assists consumers to improve energy efficiency and reduce greenhouse gas emissions by giving businesses (and households) access to discounted energy-efficient products and services. Accredited providers that deliver these financial incentives can generate Victorian Energy Efficiency Certificates (VEECs). The number of certificates generated is based on the greenhouse gas savings that are associated with the product or service. The level of incentive or discount received by households and businesses varies depending on the market activity and certificate price. Participants that are accredited under the program, referred to as ‘Accredited Persons’ can offer discounts on selected energy saving products that have also been accredited under the program. VEECs are generated through the reduction in energy use and liable parties such as electricity retailers purchase the VEECs. One VEEC is equivalent to one carbon tonne of carbon abated and a target of 6.5 million tonnes has been set for 2020. Approximately, 20,000 businesses received financial assistance to undertake an upgrade in FY18.

► ResourceSmart: A Sustainability Victoria initiative that teaches schools how to be more energy efficient through an energy audit and curriculum activities followed by a state-wide competition to reduce energy consumption.

► Local Government Energy Saver Program: A capacity building program operated by the State Government for regional local councils to provide assistance with technical competency, prioritisation and implementation of energy efficiency projects.

► Take2 Pledge: a voluntary and non-binding pledge program that allows individuals, businesses, councils, community organisations and education facilities to pledge action against climate change.

New South Wales (NSW)

NSW has a varied set of policy options in place. The Energy Saving Scheme (ESS), an energy efficiency obligation scheme, is working well and currently under review. There is also a minimum requirements scheme in use for government buildings which ensures they meet energy efficient criteria. Additionally, the NSW government has found NABERS and the CBD program very useful. For future policies they would like to expand on current ratings systems, such as NABERS. There also appears a focus on exploring specific policy options for low-to-mid tier buildings as these have been the hardest to reach through existing policies, primarily due to their lack of capital or incentive to make changes.

The following defines the core policies that the NSW government currently has in place:

► ESS scheme: creates financial incentives for organisations to invest in approved energy savings projects by receiving certificates for each MWh of energy avoided with a mandated quantity target effectively setting the certificate price through the market.

► Government Resource Efficiency Policy (GREP): sets minimum standards for appliances, lighting, NABERS ratings, energy reduction targets, solar PV deployment compulsory for all government agencies with above 100 employees.
Sustainability Advantage: provides medium to large businesses in NSW with advice, training, education and networking opportunities to develop their environmental sustainability practices and reduce operational costs.

NSW is currently undertaking a review of post-2020 targets under ESS.

**Tasmania (TAS)**

Tasmania currently has no obligatory energy efficiency scheme though does have an interest loan scheme for households and small businesses, which is being looked to as an example by other States. The Tasmanian Energy Efficiency Loan offers small businesses with medium (up to $10,000) to larger (up to $40,000) loans for energy efficiency investments. Eligible technologies cover a range of energy efficiency options.

It also has a program for energy efficiency audits. However, both of these schemes have historically had a poor uptake rate. Therefore, a government procurement policy, which could for example specify minimum NABERS requirements, could have a significant impact.

Tasmania has stated an interest in further policies focussed on information and capacity building, with the aim to improve availability of information on the benefits of energy efficiency upgrades outside of common ratings and disclosures, to both tenants and owners. They have indicated this could increase the uptake of energy efficient products. Furthermore, there appears to be a focus on enforcement options rather than purely financial incentives though low-interest finance is worth exploring.

The following defines the core policies the Tasmanian government currently has in place:

- **Mandatory Government Emissions Reporting:** software is being developed which must be used by all departments, to identify projects which could achieve emissions savings. Additionally, all departments must have emission reduction plans with progress publicly disclosed on an annual basis.

- **Power$mart businesses:** 70% of the cost of an energy audit can be subsidised by the Tasmanian government for large businesses

- **Tasmanian Energy Efficiency Loan Scheme (TEELS)** - The Tasmanian government, in partnership with Aurora Energy, committed up to $20 million towards no-interest loans for Tasmanian small businesses to install energy efficient equipment and appliances.

**Queensland (QLD)**

Queensland is still in the early stages of developing climate response policies, including for the building sector and for Government’s operational emissions including buildings-related energy use. Across government, there has been consideration of concepts such as setting trajectories or ‘transition plans’ to reach our emission reduction targets.

Queensland has a range of energy efficiency policies in place with its ‘ecoBiz’ program their most successful to date. ‘ecoBiz’ provides grants to small businesses and payback for medium and large organisations. Though this initiative did reap positive results, it was found to be far too resource intensive to be implemented on a large scale.

There is potential for the existing NABERS rating system to be better leveraged within government operations, possibly through minimum requirements or compulsory disclosure. The ability to compare across the state and nationally is also of great interest. A lack of relevant and useful data plagues the state with greater data sharing across state jurisdictions and appealing option.

The following defines the core policies the Queensland government currently has in place:
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► ecoBiz: designed to improve energy efficiency through grants of up to $3000 for small businesses, with reimbursement for energy saving measures available to energy retailers and larger businesses contingent on the project payback

► Advancing Clean Energy Schools (ACES) program: $97mil investment over three years to reduce energy costs across QLD through solar and other energy efficiency measures. The initiative commenced in 2018 and is set to run until 2021.

Western Australia (WA)

WA currently has little in terms of policy for energy and carbon performance in existing commercial buildings and thus has a significant opportunity for improvement. The national CBD and NABERS policies are in action, and the WA government have recently announced plans for an emissions policy for large projects assessed by the Energy Protection Authority. There are also some energy efficiency policies relating to the procurement of new buildings and tenancies, including the Government Office Accommodation Policy, which directs general government agencies to procure, fit-out, refurbish and manage office accommodation in accordance with the policy.

South Australia (SA)

South Australia has the Retailer Energy Efficiency Scheme (REES) in place. REES obligates electricity and gas retailers to audits to ensure they meet their required energy efficiency targets. The scheme is currently under review. South Australia has also found that hot water standards have worked well historically.

The following defines some of the key policies the South Australian government currently has in place:

► Retailer Energy Efficiency Scheme (REES): the REES is a South Australian government energy efficiency scheme that provides incentives for South Australian businesses (and households) to reduce their energy consumption. The mechanism for this is through establishing energy efficiency and audit targets to be met by electricity and gas retailers with penalties for non-compliance. A review is currently underway to determine whether or not REES will continue beyond 2020 and, if so, what targets will apply.

► Sustainable Schools Program (SSP): the SSP provides up to $250,000 for solar PV installations and/or $25,000 for LED lighting upgrades to selected schools

Historically, The South Australian Energy Productivity Program provided approximately $30m to large businesses to incentivise investment in energy productivity measures in the form of two components – an audit grant program and an implementation grant program. It was available to businesses consuming more than 160MWh of energy per year with grants equal to 75% of the cost of a Level 2 audit available.

Building Upgrade Finance (formerly Environmental Upgrade Finance): a mechanism which helps building owners to access loans to improve the energy, water and environmental efficiency of existing commercial buildings (including retrofitting).

Australian Capital Territory (ACT)

The ACT has three principal energy and carbon performance schemes for existing commercial buildings which act in addition to national schemes such as the E3 Energy Productivity Plan. There are the Actsmart Energy Programs, Energy Efficiency Improvement Scheme (EEIS) and Next Generation Energy Storage Program (primarily household though applies to smaller commercial buildings). It is also worth noting that the ACT’s commitment to carbon neutral electricity by 2020 significantly reduces the emissions performance of buildings though does not affect the energy performance.
The following defines the core policies the ACT government currently has in place:

- Energy Efficiency Improvements Scheme (EEIS): a form of EEOS which was harmonised with its counterparts in SA, NSW and VIC in 2016.
- Actsmart Energy Programs: forms an education platform that covers the residential, commercial, education and broader community sectors.
- Next Generation Energy Storage Program: an $825/kW rebate up to 30kW on batteries for new grid-connected PV systems

9.4.3 International policies

Global Overview

Global building emissions have been steadily rising by approximately 1% p.a. since 2010. Within this, coal and oil use have remained relatively constant, gas has matched the 1% p.a. increase whilst electricity consumption has grown at 2.5% p.a. on average (greater than the average 0.5% p.a. improvement in CO₂e emissions intensity from electricity).

Promisingly, global building energy intensity declined by 1.3% p.a. between 2010 and 2014, largely due to increasing adoption and enforcement of building energy Codes and efficiency standards. Yet progress has not been fast enough to offset growth in floor area (3% per year globally) and increasing demand for energy services in buildings.

While global energy use per person has remained relatively constant since 1990 at less than 5MWh per person per year, OECD per capita energy use has begun to decline from a peak of 12MWh in 2010 (which may be partly climate/weather related). Critically, to meet the 2-degree scenario, average building energy use per person globally must decrease by a minimum of 10% to less than 4.5MWh by 2025.

Denmark

Denmark has a long-term goal for the entire energy supply (electricity, heating, industry and transport) to be covered by renewable energy by 2050. In March 2012 a historic new Energy Agreement was reached in Denmark with a wide range of ambitious initiatives, bringing Denmark a good step closer to the target of 100% renewable energy in the energy and transport sectors by 2050. Part of the Agreement is a Strategy for Energy Renovation of Buildings, which the government expects to reduce heat consumption in existing buildings by 35% before 2050. The Agreement includes:

- Initiatives aimed at office buildings and public buildings
  - Advance energy renovation of larger buildings through guaranteed offering
  - Advance energy renovation of commercial leases
  - Advance energy-efficient public buildings

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98 ACT Government, How the scheme works, 2018
99 The ACT Government, actsmart, 2019
100 International Energy Agency, Tracking Progress Buildings, 2017

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Initiatives aimed at strengthening competences and innovation to advance energy renovation
- Strengthen development of education and competences within energy renovation
- Strengthen research, innovation and demonstration of energy renovation

Initiatives aimed at all building segments
- Upgrade energy standards for the building envelope, windows, installations in buildings
- Ensure increased compliance with building regulation rules
- Introduce voluntary energy classes for existing buildings
- Upgrade energy standards for new buildings
- Improve information and communication about energy renovation and energy efficiency in buildings
- Target energy companies’ energy saving efforts.
- Ensure an effective and targeted energy labelling scheme for buildings
- Ensure better data and tools decisions pertaining to energy renovation
- Advance good financing frameworks for energy renovation

In addition, the ‘Energimærkning’ information disclosure program represents best practice with:
- Support tools for industry such as a consultant’s handbook which is considered best practice
- Integration of rating scheme and building Code, including setting future minimum Code revisions and aligning with rating categories
- Requirement for onsite energy audit by an accredited organisation and inclusion of detailed costed recommendations for measures to improve building performance. For new buildings and significant upgrades under the Code, this may trigger requirements to undertake cost effective upgrades beyond the original design
- An empirical analysis undertaken on the program in 2010 suggested that a green rating (i.e. A to C in an A to G scale) is associated with a 3.7% higher sale price.

United Kingdom (UK)

The Energy Act of 2011 committed the government to bring into force regulations making it unlawful to let (lease) properties in England and Wales which do not meet a prescribed minimum energy performance standard (MEPS) by April 2018. All rental properties, both residential and commercial, which require an Energy Performance Certificate (EPC) in accordance with the Energy Performance of Buildings Regulations 2012 are within the scope of this regulation. The Energy Efficiency (Private Rented Property) (England and Wales) Regulations 2015 require that from April 2018 all rented premises within scope will be expected to meet a minimum energy standard of an

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102 Low Carbon Living CRC, Best Practice Policy and Regulation for Low Carbon Outcomes in the Built Environment, 2017 Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings Department of the Environment and Energy
EPC rating of ‘E’, meaning that any properties with a rating of “F” or “G” will not be allowed to be re-leased from April 2018 without some required energy upgrades.

The Soft Landings Framework was launched by the Building Services Research and Information Association (BSRIA) and the Usable Buildings Trust (UBT) in 2009. It has a focus on the handover of new buildings, such that energy efficiency design ratings are realized through effective understanding and management of the building during its operation. Although the focus is initially on new buildings, it also applies to the operation of new ‘existing’ buildings and can be an effective way to drive energy/emission savings in the future building stock.

The framework has attracted interest and support, including from central government who launched their own version, Government Soft Landings (GSL) in 2016. Government Soft Landings was first trailed on a Primary School in Reading, followed by roll out across the £60m Education Capital Programme in Hampshire. Between 2016 and 2018 it was used for Education and Adult Services capital projects in Hampshire worth a further £85m.

The single biggest barrier to adoption of Soft Landings has been the perception that it creates an additional level of complexity and therefore additional cost. However, the long term, whole life cost benefits of adoption have been estimated to far outweigh the very modest sums of additional fee. Anecdotal estimates of the contribution Soft Landings can achieve in terms of annual energy savings are up to £350k per annum on a large secondary school. The problem with this is that these savings are usually realised by the end user, and therefore the challenge of split incentives appears.

The Local Government Association notes that the quantitative benefits of running Soft Landings are hard to define, firstly because the main way of testing performance is by undertaking a Post Occupancy Evaluation (P.O.E.) at around 12 months, which can be resource intensive. Secondly, there are many factors in terms of scale, complexity, site, form of contract etc. that make it difficult to form a clear picture of quantifiable benefits. It suggests a better approach is to study longer term impacts of adoption from a wide variety of sources, and Hampshire council is building a database of this.

California, US

Rebates and incentives capture a wide range of energy users, sectors and technologies, as demonstrated by the California’ Energy Efficiency Incentive Program. In particular, the program serves as an example for driving emissions savings within small businesses, schools, shopping centres, healthcare, hospitality, retail and office buildings.

California passed Assembly Bill 802 in 2015 requiring utilities to provide whole-building energy use information to building owners, significantly simplifying the process of data collection. It mandated Californian utilities (including electric, gas, steam, and fuel oil) maintain 12 consecutive months of energy usage data and provide this data within four weeks of a request by any building owner.

Disclosure is satisfied through the development and disclosure of reports generated by uploading building energy usage data to the ENERGY STAR Portfolio Manager website. Practically this is done by setting up an account on the website and authorizing the utility company to release data. This represents best practice in regard to utility data access, streamlining the process significantly for building owners.

Canada

Commercial and institutional buildings accounted for 11% of final energy use and 9% of emissions in 2014. While energy use in non-residential buildings increased 32% between 1990 and 2014, it would have increased an additional 29% without energy efficiency efforts. Over the same period, energy efficiency saved Canadians $4.4 billion in building energy costs. Commercial and institutional buildings accounted for 11% of final energy use and 9% of emissions in 2014. While energy use in non-residential buildings increased 32% between 1990 and 2014, it would have increased an additional 29% without energy efficiency efforts. Over the same period, energy efficiency saved Canadians $4.4 billion in building energy costs.

104 Canadian Government, National Energy Use Database, 2016
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institutional buildings saved 10 Mt of emissions, and energy intensity per square meter improved by 11% between 1990 and 2014. This period featured improvements to new building requirements for Canada’s building Code. Other notable programs are discussed below.

The U.S. Environmental Protection Agency’s ENERGY STAR Portfolio Manager benchmarking tool was adapted to meet Canadian requirements and was officially launched in Canada in 2013. The free on-line tool provides building owners with an ongoing review of their building’s energy consumption to track performance over time in comparison to other buildings and prompts them to make improvements where necessary.

As of March 2016, almost 14,400 Canadian buildings, representing nearly 21% of commercial and institutional building floor space, were registered with the tool. This means that 169 million m\(^2\) of floor space are tracked by the benchmarking tool, six times more than the floor space originally targeted through the program. The improved management resulting from the information provided by the tool has generated an estimated $37 million per year in energy cost savings for building managers, owners and operators, starting in April 2016\(^ {105}\).

Local government hold some powers in terms of planning requirements for commercial developments and retro fits, which could be explored in Australia as a tool for leveraging emissions reductions. British Columbia’s Energy Step Code for local government serves as an example program to give local government a best practice standard for promoting energy efficiency in building fit outs.

EU

The EU has set a target of 20% energy savings by 2020 (compared to projected energy use in 2020) and 27% or greater by 2030. To meet these targets the EU has issued two Directives in relation to building energy performance: The Energy Performance of Buildings Directive 2010; and the Energy Efficiency Directive 2012.

The Directives are laws, which individual countries are required to transpose into national law\(^ {106}\).

Under the Energy Performance of Buildings Directive 2010:

- energy performance certificates are required for the sale or rental of all buildings (mandatory disclosure)
- countries must establish HVAC inspection programs or put in place equivalent measures
- all new buildings must be nearly zero energy buildings by 31 December 2020 (public buildings by 31 December 2018)
- countries must set minimum energy performance requirements for new buildings, for the major renovation of buildings and for the replacement or retrofit of building elements (heating and cooling systems, roofs, walls, etc.)
- countries have to draw up lists of national financial measures to improve the energy efficiency of existing buildings

Under the Energy Efficiency Directive 2012:

- countries make energy efficient renovations to at least 3% of buildings owned and occupied by government

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\(^ {106}\) Low Carbon Living CRC, Best Practice Policy and Regulation for Low Carbon Outcomes in the Built Environment, 2017

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Department of the Environment and Energy
governments should only purchase buildings which are highly energy efficient

countries must draw up long term national building renovation strategies

Under these Directives, countries are required to draw up National Energy Efficiency Action Plans every 3 years.

The European Commission provides support programs:

- Concerted Action EPBD - a forum to promote dialogue and the exchange of best practices between countries
- BUILD UP Skills - provides training to increase the number of qualified workers able to undertake energy efficient building renovations and build nearly zero energy buildings
- BUILD UP Portal - provides a forum in which experts share information on best practice

The EU has set up financing schemes:

- EU Horizon 2020 - supports research, demonstration and market up-take of energy efficient technologies
- Project development assistance facilities to support the development and launch stages of ambitious and replicable energy efficient projects.
- European Energy Efficiency Fund (EEEF) - €265 million fund, provides debt and equity instruments to local, regional and national public authorities
- Private Financing for Energy Efficiency instrument (PF4EE) - financial instrument which co-funds energy efficiency programmes in EU countries
- European Structural and Investment Funds (ESIF) - more than €27 billion to support the shift towards a low-carbon economy
- Energy Efficiency Financial Institutions Group (EEFIG) - set up with UNEP Finance Initiative to engage with financial institutions to address challenges in accessing long-term financing for energy efficiency
- Investor Confidence Project - Europe - aims to develop a set of best practice standards for renovating buildings so as to reduce transaction costs and make risk manageable for investors
9.4.4 Policy gaps

The table below provides a summary of the types of policies existing in each jurisdiction. This shows:

- Mandatory national schemes applied across the states - minimum energy performance standards through GEMS and energy ratings through the CBD
- Fiscal and tax incentives and energy efficiency obligation schemes are also widely applied
- Government procurement schemes appear limited to Victoria and New South Wales
- Some evidence of education and awareness programs Victoria, New South Wales and Queensland

Table 27 Existing Policy Options across Jurisdictions

<table>
<thead>
<tr>
<th>Policy Option/Jurisdiction</th>
<th>National Minimum standards (i.e. GEMS, MEPS and NCC)</th>
<th>National Energy Ratings (i.e. NABERS and CBD)</th>
<th>Energy efficiency obligation schemes</th>
<th>Fiscal and tax incentives</th>
<th>Government procurement</th>
<th>Information and capacity building</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia (Federal)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Victoria</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>New South Wales</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tasmania</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Australia</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Queensland</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Western Australia</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern Territory</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* NSW and VIC have white certificates associated with the obligation schemes.
10. Preliminary Analysis

Assumption and limitations on use

There is considerable uncertainty in relation to key inputs into the quantitative analysis presented in this report. Key assumptions and limitations to the analysis are noted below:

► The absolute size of the non-residential building stock - whether measured in building numbers by class, or floor area by class - is not measured directly. We utilise a stock model that is informed by a number of sources; primarily the 2012 Commercial Building Baseline Study and Geoscience Australia’s NEXIS database and others. Each of these sources has known limitations, and work on an updated Baseline Study has recently commenced.

► Key elements of stock turnover are not known, including the number of new buildings constructed annually, the floor area constructed, the floor area demolished, and the floor area refurbished, either by building class or in total.

► The annual energy consumption of commercial buildings is not known with precision. Australian Energy Statistics (AES) provides state-wide observations of annual fuel consumption by ANZSIC sector and state. However, the correlation between ‘commercial and services’ energy consumption and commercial building energy consumption is approximate. There are known data issues, with the AED model, including discontinuities, and NSW/ACT are not distinguished.

► Other partial data sources are available - such as program-based data (NABERS, CBD), and some state-based data, but again these sources fall short of a complete description of the non-residential building stock and its energy consumption.
10.1 Stock turnover and energy model

10.1.1 Overview

We have begun preparing a non-residential building stock and energy use model, firstly to provide ‘top-down’ or reference average energy intensities for the existing building stock - by jurisdiction, building type and over time. Second, this model will support further analysis in Stage 2 of additional policy opportunities, and the benefits and costs associated with those opportunities.

The model estimates the total floor area and electricity and gas consumption of each non-residential building class by jurisdiction and year (FY2001 - FY2050). As such, it provides estimates of the average fuel intensities and how they are evolving over time. This top-down approach is complementary to the bottom-up observations available into the efficiency of certain building classes, or subsets of classes, through program-specific datasets - for example, from the NABERS program, Commercial Building Disclosure and NSW and Victorian governments.

The model is based on the reference or ‘business as usual’ scenario from the COAG Energy Council Trajectory for Low Energy Buildings work. In particular, SPR contributed the stock, energy and cost-benefit analysis for Achieving Low Energy Commercial Buildings in Australia. This approach is designed to ensure that the analysis of opportunities in the existing commercial building stock in the current project is consistent with the work already done for new commercial buildings. In particular, the model assumes the same stock size and growth rates by year and jurisdiction. In terms of energy use, it agrees firstly with actual historical electricity and gas consumption values in Australian Energy Statistics, and for the projection period to FY2050, it agrees with the ‘business as usual’ scenario from Achieving Low Energy Buildings in Australia.

The model takes into account the expected volume of new construction work in future and assumes that NCC2019 provisions will apply to that floor area through to the end of 2050. This ‘frozen policy’ assumption is consistent with the BAU convention. For the balance of the stock (generally denoted as ‘pre-2021 buildings’ to minimise confusion), we again model ‘business as usual’ energy consumption, making allowances for:

- Autonomous or natural energy efficiency improvement
- The impacts of existing policy measures
- Historical fuel switching

The intent is that the resulting projection of the energy use of ‘existing’ or pre-2021 buildings through to 2050 is as realistic as possible, assuming no new policy interventions. The potential for these will be explored, in a quantitative sense, in Stage 2.

That said, the limitations of any set of projections to 2050 should be borne in mind. Apart from applying an assumed rate of autonomous energy efficiency improvement (see details below), it is not possible to fully anticipate future technological changes, which may include efficiency breakthroughs, but may also include new end-uses for energy that are difficult to envisage today. The model does not take into account the potential impact of embedded solar generation on buildings, but this aspect could be explored in Stage 2. Also, the model does not anticipate the likely impact of climate change on net energy consumption in buildings.

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107 COAG Energy Council, Trajectory for Low Energy Buildings, 2018
109 Table F, 2018. Note that each edition of AES involves revisions of past values, in some cases going back up to 5 years. Also, we have adjusted early AES values (FY 2001 and 2002) - in consultation with the Office of the Chief Economist - to compensate for a discontinuity in AES values that occurs between FY2002 and FY2003. Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings Department of the Environment and Energy
More generally, there are significant uncertainties about key aspects of this analysis, which are generally linked to data limitations.

First, the overall size of the non-residential building stock is (highly) uncertain, with estimates from different sources disagreeing by 100% or more. The Australian government is expected to commission an updated Commercial Building Baseline Study that, along with advances in geospatial tools, may reduce this uncertainty in future.

Second, the rate of non-residential building stock turnover – including demolitions, refurbishments, conversions (from one class to another) and new construction – is not known. The ABS Building Activity series provides quarterly observations of the ‘value of construction work done’, but no indication as to the productivity of that work, including the net change in floor area, the type of work done (demolition, new construction, etc.) or for which building classes.

Finally, the energy consumption of non-residential building type is highly uncertain, particularly by climate zone or region, as energy consumption data is only published by ANZSIC Code and by jurisdiction. ANZSIC Codes map poorly to building types, and therefore we do not have direct statistical observations of the energy use of specific buildings types. As noted, certain programs do capture and can provide data on the energy use of certain buildings, but this data must be interpreted with caution. Many programs do not offer neutral or statistically unbiased samples but may instead suffer from different types of selection bias. Such data is extremely useful, however, for deeper insights into the particular building types, and inferences can be drawn, at least in some cases, by examining the differences between these top-down and bottom-up data sets.

### 10.1.2 Stock Turnover

The chart below provides an overview of the estimated gross floor area of the non-residential building stock by jurisdiction based on the assumptions discussed in Section 10.1.1.

![Graph showing total historical and projected non-residential stock by jurisdiction, FY2001 - FY2050](image)

**Figure 35** - Total Historical and Projected Non-Residential Stock by Jurisdiction, FY2001 - FY2050

The chart below presents the same data but organised by building class in alignment with NCC building classes.
As noted, these stock projections derive from the COAG Trajectory work. The starting point value (291 million sqm gross floor area) aligns with a DEWHA (now Department of the Environment and Energy) stock model previously developed and used for regulation impact studies, supplemented by observations from the Commercial Building Baseline Study.\footnote{COAG NFEE, Baseline Energy Consumption and Greenhouse Gas Emissions of Commercial Buildings in Australia, 2012 Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings Department of the Environment and Energy}

The growth of the stock over time is estimated based on analysis of changes in the chain volume indices of building activity over time, from the Australian Bureau of Statistics Building Activity series. Chain volume measures are proportional to the volume, rather than the value, of building construction work done noting - as above - that this 'work' is likely to include some demolitions or refurbishments or conversions that do not increase the net total of floor area. We then construct ratios of the change in volume of construction work to the change in Gross State Product (GSP), by state and territory. This reflects an assumption that non-residential construction activity is primarily driven by economic growth, rather than population or other possible drivers.

Both chain volume construction activity and GSP indices are volatile - reflecting economic and building cycles, amongst other factors - and they are therefore smoothed over 5 years. Stock growth rates are then projected over the 2019 - 2050 period. We make the assumption that stock growth rates will tend to be lower in future than those estimated to have been experienced in the past. This is due to factors such as increasing intensity of use of commercial floor area, increasing work-from-home trends, and the shift towards online vs in-person shopping. Figure 37 indicates both the historical volatility in modelled stock growth by jurisdiction, significant differences from one jurisdiction to the next, and finally the lower assumed future growth as compared to derived historical values.
10.1.3 New and Existing Building Stock Shares

We examine the split between new and existing buildings starting from FY2021. First, this is the year when NCC2019 is likely to take full effect. Second, any new policy measures targeting existing buildings are unlikely to take effect until around this time. The figure below shows that, on the assumptions noted above, over 65% of the total floor area expected to be standing in FY2050 will have been constructed, or substantially refurbished, to ‘new building’ (post-2020) standards, but still over 312 million square meters of pre-2021 building floor area is expected to be standing. Of course, some of this floor area will be upgraded every year due to a combination of market forces, new technological and economic opportunities, and existing policy incentives.
10.1.4 Energy consumption by fuel and jurisdiction

Next, we estimate the consumption of electricity and gas (including small amounts of LPG and, in the past, ‘town gas’) by jurisdiction and building type. As noted, the reference fuel consumption data is sourced from Australian Energy Statistics (2001 - 2017), and this source does not include any consumption of self-generation electricity, such as from solar panels or cogeneration.\textsuperscript{111}

By way of overview, Figure 39 shows historical and estimated ‘business as usual’ future consumption of electricity and gas in non-residential buildings in Australia. These estimates include allowances for energy savings attributable to:

- New construction work as influenced by energy performance requirements in the National Construction Code in the past, and including NCC2019 (from 2021 - 2050)
- National measures including Greenhouse and Energy Minimum Standards (GEMS), NABERS and Commercial Building Disclosure
- State energy savings schemes in New South Wales, Victoria and South Australia.

In addition, the projections reflect historical fuel switching, generally from gas to electricity (not apparent in the above figure, but shown below), and include an allowance of 0.4% energy efficiency improvement per year for autonomous or natural energy efficiency improvement – through to 2050. This value was experimentally derived, using values from the 2001 - 2017 period, as we have not been able to find relevant research that documents this value for Australian commercial buildings.

![Figure 39 - Total Energy Consumption by Fuel, Non-Residential Buildings, Australia](image)

We have not conducted new or updated analyses of the impact of the existing measures noted, but rather reproduced the analysis from the COAG Trajectory project. These savings are summarised in Figure 40 below. Note that savings are shown to reduce after 2025. This reflects (current) information about future targets under state energy savings schemes. Post-2020 targets for most schemes are under review at the present time, and this may lead to higher targets being set, and therefore higher savings in future years than shown below.

\textsuperscript{111} Energy generation from such sources relocated to Division D (electricity, gas, water and waste).

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10.1.5 Average Energy Intensities

The current average energy intensity of non-residential buildings in Australia is not known with precision. For some classes, such as offices in particular, there is more data available, due to programs such as NABERS and Commercial Building Disclosure (CBD). However, neither of these cover the whole of the offices sector and their energy intensity data may carry statistical biases. This is even more true of other building types, where NABERS data reflects only those buildings voluntarily disclosed, and these are likely to be significantly more efficient than the average building. For these and indeed other building types not covered by NABERS, there is no statistically valid source of energy intensity data.

That said, we can gain a reasonable picture of the average energy intensity of non-residential buildings, by class and jurisdiction, by reconciling bottom-up data sources – including NABERS, CBD and others – with top-down data sources. The latter include Australian Energy Statistics, for jurisdiction-wide energy consumption by fuel and year, and our estimates of the building stock by class. While we cannot be certain that the averages shown below are correct for all fuels, jurisdictions and classes, we know that the implied total electricity and gas consumption balances with the actual historical consumption of these fuels in each jurisdiction. An updated Commercial Building Baseline Study, planned for FY2020, will assist in validating these estimates. Reference electricity and gas energy intensity values by building class and jurisdiction are set out in the tables below.

Table 28: Reference Average Electricity Energy Intensities by Building Class and Jurisdiction, 2018

<table>
<thead>
<tr>
<th>MJ/sqm.a</th>
<th>NSW</th>
<th>VIC</th>
<th>QLD</th>
<th>WA</th>
<th>SA</th>
<th>NT</th>
<th>TAS</th>
<th>ACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 2 common areas</td>
<td>63</td>
<td>166</td>
<td>140</td>
<td>80</td>
<td>120</td>
<td>174</td>
<td>279</td>
<td>124</td>
</tr>
<tr>
<td>Accommodation</td>
<td>512</td>
<td>723</td>
<td>825</td>
<td>650</td>
<td>671</td>
<td>750</td>
<td>600</td>
<td>550</td>
</tr>
<tr>
<td>Offices</td>
<td>675</td>
<td>525</td>
<td>710</td>
<td>590</td>
<td>550</td>
<td>750</td>
<td>595</td>
<td>560</td>
</tr>
<tr>
<td>Retail</td>
<td>665</td>
<td>665</td>
<td>995</td>
<td>484</td>
<td>553</td>
<td>1623</td>
<td>957</td>
<td>1021</td>
</tr>
<tr>
<td>Warehouses</td>
<td>199</td>
<td>210</td>
<td>305</td>
<td>204</td>
<td>164</td>
<td>365</td>
<td>186</td>
<td>286</td>
</tr>
</tbody>
</table>

112 SPR drawing on Australian Energy Statistics
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Department of the Environment and Energy
Turning to future trends, the figures below are based on ‘business as usual’ expectations, including taking account of existing national and sub-national energy efficiency measures, and expected fuel switching, as mapped for the COAG Energy Council Code Trajectory research released in February 2019. The chart below indicates the expected trajectory of electrical energy intensity to FY2050 under this scenario. The implied reduction in average energy intensity is 1.3% per year, including taking into account some further expected fuel switching from gas to electricity over this period.

Table 29: Reference Average Gas Energy Intensities by Building Class and Jurisdiction, 2018

<table>
<thead>
<tr>
<th>Building Class</th>
<th>NSW</th>
<th>VIC</th>
<th>QLD</th>
<th>WA</th>
<th>SA</th>
<th>NT</th>
<th>TAS</th>
<th>ACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 2 common areas</td>
<td>14</td>
<td>106</td>
<td>26</td>
<td>49</td>
<td>120</td>
<td>23</td>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>Accommodation</td>
<td>89</td>
<td>422</td>
<td>27</td>
<td>173</td>
<td>256</td>
<td>29</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>Offices</td>
<td>88</td>
<td>215</td>
<td>16</td>
<td>95</td>
<td>145</td>
<td>0</td>
<td>22</td>
<td>175</td>
</tr>
<tr>
<td>Retail</td>
<td>116</td>
<td>363</td>
<td>125</td>
<td>177</td>
<td>227</td>
<td>42</td>
<td>22</td>
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<tr>
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<td>26</td>
<td>108</td>
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<td>23</td>
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<td>Laboratories</td>
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<td>68</td>
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<td>Healthcare</td>
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<td>887</td>
<td>198</td>
<td>550</td>
<td>733</td>
<td>185</td>
<td>37</td>
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<td>Education/Assembly</td>
<td>83</td>
<td>209</td>
<td>121</td>
<td>176</td>
<td>216</td>
<td>130</td>
<td>14</td>
<td>78</td>
</tr>
<tr>
<td>Aged care</td>
<td>97</td>
<td>271</td>
<td>113</td>
<td>294</td>
<td>429</td>
<td>447</td>
<td>15</td>
<td>212</td>
</tr>
</tbody>
</table>

Figure 41 - Average electrical energy intensity projections by jurisdiction (BAU Scenario)\textsuperscript{113}

\textsuperscript{113} SPR
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The same projection but for average gas intensity is shown in the chart below. This implies a faster rate of reduction in gas energy intensity than for electricity. The primary reason for this is expected fuel switching from gas to electricity, rather than gas efficiency improvement. The implied average reduction gas intensity is 3.7% per year.

Figure 42 - Average gas energy intensity projections by jurisdiction (BAU Scenario)\(^{114}\)

### 10.2 Data map

The table below outlines the information available within each dataset that has been assessed as part of this analysis. The most useful data in terms of providing actual recorded energy intensities are the NABERS and CBD datasets.

<table>
<thead>
<tr>
<th>Building class</th>
<th>NABERS dataset</th>
<th>CBD dataset</th>
<th>Core Logic Cityscape dataset</th>
<th>EY Hospital Data</th>
<th>EY Office Data</th>
<th>Nexus Geoscience</th>
<th>SPR building stock model</th>
<th>EY energy audit dataset</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Offices, hospitals, retail/shopping centres, hotels, data centres</td>
<td>Offices</td>
<td>Offices, retail</td>
<td>Hospitals</td>
<td>Offices</td>
<td>All construction types</td>
<td>All classes</td>
<td>Offices, retail, warehouses and manufacturing</td>
</tr>
<tr>
<td>Floor area</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Energy consumption</td>
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<td>✓</td>
<td>x</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Building age</td>
<td>x</td>
<td>x</td>
<td>✓</td>
<td>x</td>
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<td>✓</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Tenure (ownership)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Location</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Coverage</td>
<td>National</td>
<td>National</td>
<td>National</td>
<td>Victoria</td>
<td>New South Wales</td>
<td>National</td>
<td>National</td>
<td>National with Vic. &amp; NSW focus</td>
</tr>
</tbody>
</table>

\(^{114}\) SPR

Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
Department of the Environment and Energy
10.3 Analysis of energy consumption and intensities across Australia

Data extracted from the SPR building stock model was analysed by EY to produce an energy intensity breakdown across Australia by building class and by state.

The figures below show that overall, Australian energy consumption will see slight growth over the next few decades, mostly due to the growth in consumption in offices. However, energy intensity is projected to decline across all building sectors, mostly in electricity but gas will see efficiency improvements as well, meaning improved energy efficiency across the entire building stock.

![Energy consumption by building class to 2050](image)

**Figure 43 - Energy consumption by building class to 2050**

<table>
<thead>
<tr>
<th>Limitations</th>
<th>NABERS dataset</th>
<th>CBD dataset</th>
<th>Core Logic Cityscape dataset</th>
<th>EY Hospital Data</th>
<th>EY Office Data</th>
<th>Nexus Geoscience</th>
<th>SPR building stock model</th>
<th>EY energy audit dataset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratings activity captured on top tier buildings may not be representative of activity for mid-tier buildings</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sample skewed towards larger offices</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Missing energy intensity</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Limited sample size</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Missing energy intensity</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Data uncertainties as described in Section 7.1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>More useful for quantifying bottom up (technology specific) opportunities</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Building height</th>
<th>Warehouses</th>
<th>Retail</th>
<th>Offices</th>
<th>Laboratories</th>
<th>Healthcare</th>
<th>Education/Assembly</th>
<th>Class 2 common areas</th>
<th>Aged care</th>
<th>Accommodation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building grade</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Energy efficiency and solar technology specific savings and costs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Figure 44 - Australia-wide historical and projected electricity intensity by building class

Figure 45 - Australia-wide historical and projected gas intensity by building class
The figure below outlines projected consumption by jurisdiction to 2050. It shows that Victoria will remain the largest consumer of energy, followed by New South Wales and Queensland, and all states will remain relatively stable or experience slight growth in their energy consumption.

10.4 Analysis of energy intensities from NABERS and CBD data

This section of the report analyses actual energy intensity data reported via the NABERS and CBD programs.

10.4.1 Overview of NABERS data

The NABERS dataset includes information on office buildings, shopping centres, hotels and data centres. Public Hospitals are also rated although there are restrictions on its use. The sample sizes of non-office or shopping centre buildings are low, reflecting the voluntary nature of ratings and the different markets for different building classes. This should be kept in mind when viewing the energy intensities below. There are also some discontinuities in the CBD dataset that reflect policy changes related to CBD - i.e. its commencement in 2011 and then threshold change from July 2017.

Offices and Shopping Centres have the most ratings and best data coverage. There is a trend over time towards reducing energy intensity and higher energy ratings. This is likely to be influenced by the nature of the commercial property market. i.e. top tier property investors in city centres are more likely to a) obtain NABERS ratings and b) seek to improve their buildings NABERS ratings because the market values it. Compared to mid-tier buildings where this is less of a market for energy efficient buildings and so this tier may be under represented in the NABERS data.

Hotel data is limited with only 6 hotels rated in FY19. This contrasts to FY12 when 30 hotels were rated, with larger property investors often obtaining multiple NABERS Hotels ratings for different assets. The reasons for this are unclear though there is a perceived view that industry prefers tools developed by the hotels sector. There was a gradual improvement in the energy star ratings from FY12 (average 3.6 stars) to FY18 (average 4 stars). There were 10 Data centres rated in the year...
up to April 2019. Data is collected differently, excluding floorspace but focussing on PUE. Average energy star ratings improved from 3.5 stars in 2014, up to 4.15 stars in 2019.

Despite its limitations, the NABERS data is useful for showing energy intensities and energy star ratings by state and building type. Average Energy Star ratings (electricity and gas) for the different building types are displayed in Figure 47. The chart shows that offices tend to be the most highly rated with some variations by state. The low sample size for some states should be kept in mind when comparing across the states. Data centre information was not available for ACT, NT, SA and TAS.

The figure below shows average energy intensity by fuel source across the different building types. Hotels stand out as being particularly energy intensive. Energy audits on hotels, such as on the Park Hyatt Melbourne\(^{116}\), have shown that 30 - 40% of the time rooms can be unoccupied, providing opportunities for large energy savings such as through BMS and HVAC control upgrades, installing a guest room management system, and lighting replacement.

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\(^{115}\) EY Analysis of NABERS data, 2009-2019.

\(^{116}\) Enman, 'Improving Energy Efficiency in a Business Hotel A case study', 2011

Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
Department of the Environment and Energy
10.4.2 Overview of CBD data

The CBD dataset covers office buildings >1000m² across all states and territories. Figure 49 and Figure 50 provide a break down energy intensities.

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**Figure 48** - Energy intensity by fuel source (MJ/M²) and building type

**Figure 49** - Whole building total energy intensity (across all fuel sources) over time by state

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118 EY Analysis of CBD dataset 2012-2018

Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings

Department of the Environment and Energy
10.4.3 Retail

Class 6: typically shops, restaurants and cafés. Search for retail, restaurant, cafe, shop

The sample size used for retail buildings is shown in Table 31.

Table 31 - Retail buildings sample size by state

<table>
<thead>
<tr>
<th>Retail</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>14</td>
</tr>
<tr>
<td>NSW</td>
<td>356</td>
</tr>
<tr>
<td>NT</td>
<td>7</td>
</tr>
<tr>
<td>QLD</td>
<td>235</td>
</tr>
<tr>
<td>SA</td>
<td>35</td>
</tr>
<tr>
<td>TAS</td>
<td>14</td>
</tr>
<tr>
<td>VIC</td>
<td>215</td>
</tr>
<tr>
<td>WA</td>
<td>92</td>
</tr>
</tbody>
</table>

Energy intensity by fuel source

Figure 51 shows the average electricity consumption intensity over each NABERS certification year as new buildings join the certification scheme. Peaks in the chart can be explained by new buildings joining the scheme which have unusually high energy intensities, therefore raising the average for that year. For example, in 2018, ACT had a peak in both electricity and gas intensity (see Figure 51 and Figure 52 due to only one new building being rated that year which had an unusually high energy intensity. WA also has a peak in electricity intensity in 2010 (Figure 51), which is due to 4 new buildings joining the scheme that year, one with very high electricity intensity which brought the average up.

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119 EY Analysis of CBD dataset 2012-2018
Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
Department of the Environment and Energy
States with lower numbers of ratings such as SA, WA and TAS tended to have less data on gas consumption for shopping centres.

Size of buildings

The NABERS data can be used to break down average energy intensities across all fuel types by building size however once again limitations in the datasets exist due to small sample sizes. In contrast office buildings, where there is generally decreasing energy intensity with increasing building size, this chart suggests that retail buildings are less energy intensive if they are between 15,000-30,000m2, but are more energy intensive above or below that threshold.

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120 EY Analysis of NABERS dataset 2010-2019
121 EY analysis of NABERS dataset 2010-2019
Figure 53 - Retail building's average total energy intensity (across all fuel sources) by building size

The figure below indicates an increase in energy intensity as the building size increases, an opposite trend to office buildings which are typically less energy intensive as building size increases.

![Average energy intensity (MJ/m²) by building size](image)

Figure 54 - Retail buildings' total energy intensity (across all fuel sources) by floor area

Retail sector opportunities

CBD

Currently, energy efficiency information is not required to be provided when retail spaces are offered for sale or for lease. This can create a barrier to investors incorporating energy efficiency concerns in their purchasing or leasing decisions. It also reduces the motivation for current owners to increase the energy performance of their buildings. An expansion of the CBD to include retail spaces, or the inception of a mandatory retail energy performance disclosure scheme, would increase transparency and potentially turn periods of sale and lease changeovers into trigger points for upgrades and retrofits. Given that many retail tenancies are small, it would be important to

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122 EY analysis of NABERS dataset 2010-2019
123 EY analysis of NABERS dataset 2010-2019
Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
Department of the Environment and Energy
ensure a low threshold for disclosure, and/or build on initiatives like NABERS Co-Assess that reduce barriers to assessing smaller tenancies.

Ratings and disclosure

Split incentives present a significant barrier to renovations in the commercial retail sector. There may be little incentive for landlords to improve energy efficiency if the financial benefits will be gained by the tenants. In such cases, rating and disclosure schemes can be used to highlight energy efficiency, and signal opportunities for renovations. Other potential solutions include EUAs in the case of energy efficiency improvements.

Other opportunities

In other cases, rent for commercial retail spaces will include energy costs and so the reverse split incentive problem exists: tenants have little incentive to reduce their energy use, nor support planned renovations and upgrades. For owners, gaining tenant support for upgrades to central services infrastructure (e.g. HVAC, insulation, lighting fittings) is often difficult despite the financial benefits it will cause due the interruption of business activity often associated with the upgrades. This issue is particularly difficult in retail spaces due to the fact there are often large number of tenants, which can fragment decision making. Timing central service infrastructure upgrades (e.g. HVAC, insulation, lighting fittings) to already planned periods of retail shut down may aid in reducing this barrier, as may sharing data and information with tenants regarding the long-term benefits of the upgrade, both environmental and economic.

Capacity and capital constraints also present barriers to retrofits and upgrades in the retail sector. For tenants, energy efficiency improvements often compete with other priorities – e.g. improving customer experience, improving products, making aesthetic changes. This competition for capital is especially present in the case of purchasing specialised equipment, such as commercial refrigeration and ovens in food retail spaces. Efficiency is often not a major criterion in these buying decisions and purchases often already carry a large capital investment and longer payback periods.

As in other commercial types, minimum standards for equipment, the increased provision of information on energy efficiency performance at the time of purchase, extended MEPS and labelling systems with increased stringency, and incentives to purchase efficient equipment and retire old equipment, will all aid in the uptake of energy efficient appliances and other equipment.

10.4.4 Office buildings

Class 5 buildings are office buildings that are used for professional or commercial purposes

Office buildings are found to contribute approximately 25-30% of total energy consumption in the existing commercial building stock and offices and retail buildings represent the largest proportion of energy saving opportunities in the commercial sector. The primary office building datasets analysed are the CBD and NABERS data which provide a large amount of data relative to other building classes.

Energy intensity by fuel source

The NABERS dataset contains information on energy consumption by the different fuel types including gas and electricity. Figure 55 shows the average gas consumption intensity over each NABERS certification year as new buildings join the certification scheme. Peaks in the chart can be explained by new buildings joining the scheme which have unusually high energy intensities, therefore raising the average for that year. For example, VIC has a peak in Figure 55 in 2016, due

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124 ClimateWorks Australia, Low Carbon Growth Plan for Australia: Retail Sector Summary Report, 2011
125 ClimateWorks Australia, Australian Carbon Trust Report: Commercial buildings emissions reduction opportunities, 2010
126 ASBEC, Low Carbon, High Performance, 2016

Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
Department of the Environment and Energy
to 10 new buildings joining the scheme, 2 with significantly higher energy intensities (above 25,000MJ/m²), therefore bringing the average up for that year.

Gas consumption is generally higher in the cooler climates of the southern states of SA and VIC. Small sample sizes affect some of the trend lines such as for WA.

Electricity intensity is higher in the warmer climates of Queensland and Northern Territory, possibly due to high cooling loads.

---

127 EY analysis of NABERS dataset 2012-2019
128 EY analysis of NABERS dataset 2012-2019

Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
Department of the Environment and Energy
Building size (Floor area) versus energy intensity

From the CBD data analysis, lower rise buildings (with smaller floor areas) displayed higher energy intensities than taller and larger buildings. This indicates that mid-tier commercial buildings have the most room for improvement in energy performance while larger commercial office buildings tend to achieve better energy performance. This performance across floor areas is visible in the tables below whilst a more granular analysis is required to clearly view the negative correlation between energy intensity and building height as in Figure 59.

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129 EY analysis of NABERS dataset 2012-2019
130 EY analysis of NABERS dataset 2012-2019
Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
Department of the Environment and Energy
Table 32 Energy intensities across different building heights

<table>
<thead>
<tr>
<th>Energy Intensity (MJ/m²)</th>
<th>Average MJ/m² Across All Heights</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 stories</td>
<td>619</td>
</tr>
<tr>
<td>3-6 stories</td>
<td>690</td>
</tr>
<tr>
<td>&gt; 6 stories</td>
<td>514</td>
</tr>
</tbody>
</table>

Table 33 Energy intensities across different floor areas

<table>
<thead>
<tr>
<th>Energy Intensity (MJ/m²)</th>
<th>&lt; 5,000m²</th>
<th>5001-15000m²</th>
<th>15,001-30,000m²</th>
<th>&gt; 30,000m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average MJ/m² Across All Floor Areas</td>
<td>639</td>
<td>646</td>
<td>460</td>
<td>405</td>
</tr>
</tbody>
</table>

Source: EY analysis of CBD dataset

Figure 59 Office energy intensity across building heights from 2012 to 2018

Larger buildings tend to have more centralised plant with some efficiencies of scale, and with possibly younger age. Additionally, larger buildings may tend to be owned by larger corporate property firms which have higher standards in the procurement of their buildings, a more competitive market with demand for energy efficient buildings, and with greater oversight in building energy performance.

Certain states tend to exhibit variation in energy intensity. Specifically, TAS, SA and VIC tended to have higher energy intensities while WA, the ACT and QLD displayed lower energy performance as seen in aggregate in Table 34. This does not take into account normalisation for temperature which does inherently impact upon the building heating and cooling loads. We also note that market effects will be relevant e.g. a competitive market in Sydney, and less so in Hobart.

Table 34 - Office total energy intensity (across all fuel sources) variation by state

<table>
<thead>
<tr>
<th>State</th>
<th>Energy Intensity (MJ/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>568</td>
</tr>
<tr>
<td>NSW</td>
<td>586</td>
</tr>
</tbody>
</table>

131 EY analysis of CBD dataset
132 EY analysis of CBD dataset
133 EY analysis of CBD dataset
134 EY Analysis based on CBD 2019 dataset

Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
Department of the Environment and Energy
Building rating types and energy intensity

The NABERS and CBD data enables analysis of energy intensities by office building rating types, including whole building and base building ratings. Base building ratings typically cover just central services and common areas such as car parks and foyers, while whole building ratings also include tenancy areas, so cover the entire building.

Mid-tier buildings

While initiatives such as ratings and disclosure, as well as GRESB, Green Star and Better Building Partnerships, have contributed to significantly improved energy performance in the top tier of the office market (defined as Premium and A Grade assets), progress in the mid-tier office market (e.g. B, C and D-grade office buildings) has been more limited.

Mid-tier buildings make up the majority of office assets around Australia, comprising around 80% of office buildings, equivalent to 50% of floor space. Challenges facing energy efficiency improvements in the mid-tier include a fragmented market across diverse building sizes and business priorities, market failures such as split incentive between building owners and tenants, and limited capacity amongst owners and operators to improve energy performance, but only where there was reasonable competitive pressure in rental markets. In markets that have low vacancy rates, owners may be able to lease spaces regardless of energy performance.

There have been some attempts to draw a correlation between building grade, age and size; office buildings built between 1960-1980 (before the introduction of energy efficiency regulations) are more likely to be considered ‘mid-tier’ and exhibit poorer energy performance. Office buildings

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135 EY analysis of NABERS dataset 2012-2019
136 ASBEC, Low Carbon, High Performance, 2016
138 Sustainability Victoria, The Next Wave Refresh, 2018
Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
Department of the Environment and Energy
constructed prior to 1960 tend to be smaller and more distributed geographically, so could be more challenging to target with specific policies and programs. Expansion of the CBD program to smaller office buildings may further motivate mid-tier building owners to improve energy performance.

Numerous organisations are working to improve energy performance of mid-tier office buildings. Past and present initiatives include:

- Opportunity Knocks: Accelerating energy efficiency for mid-tier office buildings, a policy roadmap developed by an alliance across industry and government including Green Building Council of Australia, AIRAH, Energy Efficiency Council and Property Council of Australia;
- Mid-tier commercial office building in Australia: A national pathway to improving energy productivity, a framework for collaboration led by the Green Building Council of Australia with support from the Commonwealth Department of Industry; and
- Energy Efficiency Council and NSW Office of Environment’s Building Retrofit Toolkit, a program to build business skills and capacity of mid-tier building owners to improve energy performance.

Other office sector opportunities

As noted earlier in this report, rating and disclosure programs have demonstrated impact in improving energy performance of office buildings. Voluntary rating tools such as the Green Building Council of Australia’s Green Star certification provide third-party verification for a corporation’s sustainability credentials, whether they own, operate or lease office spaces. The Green Star rating will further leverage ambition and competition between corporates by incorporating more ambitious energy performance targets into future revisions; for example, by 2030, all existing buildings seeking a Green Star rating will be required to use 100% renewable energy and be 40-50% more energy efficient than today's building Code requirements\(^\text{139}\). Past success of the CBD program has also led to expansion of mandatory disclosure to smaller building footprints, and potentially other building sectors.

The split incentive is a major barrier for tenanted office buildings. The building owner generally takes control of operating central building services (including HVAC and lifts) while tenants can influence energy consumption within their own office space (including lighting and plug-in equipment). If savings from improved energy efficiency flow through to tenants via reduced energy bills, this can prove a disincentive for owners to invest in these improvements. Disclosure and ratings through programs such as CBD can assist with overcoming this barrier, as tenants may be attracted to buildings with higher energy ratings and lower operational costs.

However, as CBD only covers the energy performance of central building services, this provides little incentive for owners to improve tenancy energy consumption\(^\text{140}\). In addition, smaller tenants may lack the data, capacity and capital to invest in energy efficiency improvements within their scope of influence, such as lighting upgrades. Efforts by NABERS to encourage uptake of tenancy energy ratings through the Co-Assess initiative may go some way in addressing these barriers\(^\text{141}\). This and other tenant actions are promoted via CitySwitch, although this program is purely voluntary and therefore lacks leverage.

Plug-in equipment such as computers and printers can contribute close to half of an office building’s energy consumption built to modern building Code requirements\(^\text{142}\). Given the relatively high turnover rate of office equipment, minimum standards for new equipment are likely to be effective in reducing plug-in loads across the entire office sector. Strengthening minimum energy efficiency standards for appliances through GEMS, with a forward trajectory for how standards will

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139 Green Building Council of Australia, A Carbon Positive Roadmap for the building environment - Stage 1: Commercial, institutional, and government buildings and fit outs, 2018
140 ClimateWorks Australia, Australian Carbon Trust Report: Commercial buildings emissions reduction opportunities, 2010
142 ASBEC and ClimateWorks Australia, Built to Perform – An industry led pathway to a zero-carbon ready building Code, 2018
evolve over time, would also provide confidence for appliance manufacturers to invest in more energy efficient technology.

The motivations of building owners and tenants when renovating office buildings and tenancies can vary from business to business. Motivations can also encompass a whole range of outcomes including access to views and natural daylight, layout (e.g. of amenities and meeting rooms) and aesthetics, which may compete with energy efficiency objectives. Strengthening the minimum energy requirements for major renovations via the building Code would be an effective mechanism for ensuring energy efficiency is addressed.

Furthermore, development and deployment of a Building Retrofit Toolkit would support the industry to follow an energy efficiency pathway for the mid-tier retail sector.\(^\text{143}\)

**Triggers for renovation**

CBD assessments are ‘triggered’ when a space is put up for sale, lease or sub-lease. It is interesting that energy intensity is higher for buildings being put up for sale as opposed to being leased or sub-leased as shown over time in Figure 61. This might indicate a trend of selling assets with higher energy intensities as companies move to reduce the carbon intensity of their property portfolio.

![Figure 61 - Total energy intensity (across all fuel sources) across time by CBD trigger.](image)

**10.4.5 Data centres**

The sample sized using for data centres is shown in Table 35.

<table>
<thead>
<tr>
<th>Data centres</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW</td>
<td>22</td>
</tr>
<tr>
<td>QLD</td>
<td>4</td>
</tr>
<tr>
<td>VIC</td>
<td>14</td>
</tr>
<tr>
<td>WA</td>
<td>5</td>
</tr>
</tbody>
</table>

Preliminary research suggests there are approximately 60,000 data centres across Australia though there is a possibility of this decreasing over time as data storage moves to the cloud. Hence,
it is worth noting from this that the sample for analysis (~0.06%) may not be representative of broader trends across Australia.

Although NABERS data is limited, it does allow us to analyse the energy star ratings and energy intensities of data centres by state. Only four states had available information on data centres; NSW, QLD, VIC and WA shown in Figure 62.

Figure 62 - Data centre building's average energy star ratings by state

Figure 63 shows the energy intensity of data centres by state. Energy intensity for data centres is normalised using Power Usage Effectiveness (PUE), which is a ratio that describes how efficiently a data centre runs, given its processing capacity. Queensland appears to have the most energy intensive data centres based on currently available data, which could be due to a warmer climate and increased cooling loads, and Victoria the lowest where the climate is cooler.

Figure 63 - Data centre buildings' average energy intensity (PUE) by state

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145 EY analysis of NABERS dataset 2015-2019
146 EY analysis of NABERS dataset 2015-2019

Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
Department of the Environment and Energy
Data centre opportunities

Most larger data centres are dedicated, purpose-designed facilities, where the biggest energy related issue is cooling. Innovative design strategies can lead to higher energy efficiency, such as with rack and server design. Cooling equipment can operate more efficiently where there are no people (most of the time), with less lighting needed, and there can be higher operating temperatures than needed for human comfort.

The 24-hour, energy-intensive nature of data centres, with significant energy loads from IT equipment and cooling, means these facilities face unique barriers compared with other commercial building types. These barriers may include:

► Split incentives, if procurement teams responsible for purchasing and operating IT equipment to meet technical data handling requirements are separated from operational staff responsible for cooling infrastructure and energy bills; and
► Potentially significant costs associated with operational downtime while energy efficiency upgrades are undertaken on a building or the equipment.

A combination of knowledge sharing and strengthening of minimum standards could help address these barriers by ensuring development and procurement of energy efficient equipment (both IT and cooling systems) while providing a forum for businesses to share practical lessons on upgrading the energy efficiency of data centre facilities.

10.4.6 Hotels

The sample size used for hotel analysis is shown in Table 36.

<table>
<thead>
<tr>
<th>Hotels</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>6</td>
</tr>
<tr>
<td>NSW</td>
<td>82</td>
</tr>
<tr>
<td>NT</td>
<td>8</td>
</tr>
<tr>
<td>QLD</td>
<td>22</td>
</tr>
<tr>
<td>SA</td>
<td>7</td>
</tr>
<tr>
<td>TAS</td>
<td>1</td>
</tr>
<tr>
<td>VIC</td>
<td>28</td>
</tr>
<tr>
<td>WA</td>
<td>10</td>
</tr>
</tbody>
</table>

Energy intensity by fuel source

NABERS data for hotels is patchy in some places, as shown by the discontinued annual data in Figure 64 and Figure 65. The hotel data in the NABERS dataset is limited, so there are gaps in the charts for certain years and states.

Peaks in the chart below can be explained by new buildings being rated which have unusually high energy intensities, therefore raising the average for that year. For example, Figure 64 shows a peak for VIC in 2014, which is due to new buildings being rated that had higher than average gas consumption intensities, therefore bringing the average up for the year. Additionally, when the CBD ratings for office buildings was initially launched in 2010, there was a strong indication that it would extend to other buildings including hotels, causing many hotels to begin voluntarily signing up to ratings schemes in order to prepare for the mandatory reporting. However, in 2012 there was a change of government, and in 2014 the government confirmed that CBD would not extend to

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147 Pitt&Sherry, Data Centre Energy Product Profile, 2009
Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
Department of the Environment and Energy
other building types, which corresponds with a decrease in new hotel buildings joining the rating schemes that can be seen in Figure 64 and Figure 65.

Figure 64 - Gas consumption intensity for hotel buildings by state according to the NABERS certification year

Figure 65 - Electricity consumption intensity for hotel buildings by state according to the NABERS certification year

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148 EY analysis of NABERS dataset 2009-2019

Trajectory for Low Energy Buildings: Coordinated Policy Options for Existing Commercial Buildings
Department of the Environment and Energy
Energy intensity by state

![Energy intensity by state graph]

Figure 66 - Hotel building’s total energy intensity (across all fuel sources) by state\textsuperscript{149}

Tasmania’s hotels appear to be the most energy intensive, however the source data only contains one hotel for Tasmania, so this representation may not be accurate for Tasmanian hotels in general. Western Australia has the least energy intensive hotels and had the highest energy star ratings for hotels as well. An assumption of average room floor area for hotels was to calculate the energy intensity. This was done by assuming that the average hotel room size was 30 square metres\textsuperscript{150} which was applied as a conversion factor to the number of rooms per hotel provided in the NABERS data.

Overall, however, it is clear that hotels, on average, have much higher energy intensity than many other commercial building types.

Hotel size

Our analysis found that hotels with higher numbers of rooms and floor areas had higher energy intensities. The explanation for this may relate to hotel quality ratings, with larger and higher-quality rated hotels offering more services (pools, conference facilities, embedded retail areas, etc.) and therefore showing higher energy intensities.

\textsuperscript{149} EY analysis of NABERS dataset 2009-2019
\textsuperscript{150} https://www.usatoday.com/story/travel/roadwarriorvoices/2015/11/04/hotel-rooms-20-years-ago-were-twice-as-large-as-some-of-todays-offerings/83847338/
Figure 67 - Total energy intensity (across all fuel sources) of hotel buildings by size\(^{151}\)

Figure 68 confirms the trend of increasing energy intensity as building floor area increases. There is an outlier with an energy intensity of around 17,000 MJ/m\(^2\), which is unusual for hotel buildings included in this analysis but is not significant when compared to the office building data.

Hotel sector opportunities

Hotels represent a class of commercial buildings diverse in age, type, location and size. In most cases, Australian hotels are owned by (often international) owners and leased to management groups under medium-to-long term leases\(^{153}\). There are currently no mandatory disclosure schemes for energy performance data across the hotel class and the lease clauses and provisions for individual hotels may differ in arrangements and responsibilities when it comes to energy use, impacting the feasibility of different upgrade options and their financing.

These factors present barriers to the uptake of energy efficiency opportunities. The disparate nature of hotel buildings and the differing management and ownership structures make the

\(^{151}\) EY analysis of NABERS dataset 2009-2019
\(^{152}\) EY analysis of NABERS dataset 2009-2019
\(^{153}\) Folkestone, Australian Hotel Sector Outlook, 2015
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development of policies and strategies to increase energy efficiency difficult. Greater knowledge of who owns hotel buildings, how they are managed, how competitive the market is, will assist policymakers, while data sharing policies that improve the availability of hotel energy data will benefit hotel owners in their strategic decision making.

The long lease periods and lack of mandatory disclosure means hotels can lack the usual ‘triggers’ for renovation that come at the end of a lease or when selling. Mandatory reporting of energy performance in hotel lobbies or on hotel websites, for example, may reduce this barrier, as would an increased competitive incentive for hotels to have positive reputation signals such as a high NABERS rating.

Split incentive problems can also be present in hotels. Hotel residents are less likely to be energy efficient in their behaviours compared to when at home or other places in which they bear the energy costs. Residents are also less likely to put pressure on building owners to upgrade their facilities if only staying for short periods of time. As above, mandatory reporting of energy performance and the increased prevalence of voluntary ratings may drive demand toward more efficient hotels. Government procurement policies (e.g. only staying in X+ Star NABERS hotels), and encouraging corporations to implement similar policies, will also shift demand.

Capital and capacity constraints can also limit the uptake of energy efficient retrofits in hotels. As is the case in retail and office spaces, hotels have many priorities other than energy efficiency when it comes to major refurbishments. Aesthetics, increased customer experience, and the desire for shorter payback periods on investments can all influence decision-making away from the most energy-efficient options.

Strengthening the building Code is one solution to raising the general energy efficiency of Australia’s hotels when undertaking major renovations. Another is the provision of tax and other financial incentives to the industry, which may raise the prioritisation of energy efficiency by hotel management and owners.

Education and greater awareness are also of major importance in the hotels sector, especially for smaller hotels who may not have the scale and resources to research and train staff in the energy efficiency options available. The fact, however, that it is Australia’s largest hotels that have the highest average energy intensity suggests that the benefits of scale are not currently being employed by large hotel owners.
10.4.7 Health

Class 3 buildings including ‘care’ buildings such as child care and aged care (though age care facilities are class 9c).

Class 9a public buildings such as hospitals, clinic, day surgery.

Energy intensity by fuel source

Energy intensity has been analysed over three financial years – FY15, FY16 and FY17. The average energy intensity (incorporating all fuel sources) was taken across all hospitals in the dataset, showing that hospital energy intensities have been increasing, as seen in Figure 69 which is related to hospital building’s increasing use of energy. The dataset did not include any data from FY18, so we cannot determine if this trend has continued.

![Figure 69 - Hospital average energy intensity across all fuel sources](image)

Building size (Floor area) vs energy intensity

Hospital buildings were found to have higher energy intensities if the floor area was higher, however the trend was more scattered than was found in office, retail and hotel buildings. Most hospitals in the dataset are under 50,000m2 in size, and range in intensity from 100 to 4000 MJ/m2, which could potentially demonstrate the different age and efficiency of existing hospitals. Also, energy intensity will vary greatly between large teaching hospitals, rural and regional hospitals offering fewer medical services, and smaller health clinics that may be more akin to offices. The dataset is limited in that there are a relatively small number of hospitals, so analysing a larger dataset may reveal a clearer trend.

The figure below shows average energy intensity for each building over FY15, 16 and 17 (as was available in the dataset) to demonstrate how building size and energy intensity are related in hospitals.
Figure 70 - Hospital energy intensity by floor area

It is possible that energy intensity in health buildings may be more than shown in the data due to the farming out of energy intensive medical facilities to office buildings (pathology, x-ray, MRI). This would not get captured in the data for commercial buildings because health facilities are excluded from NABERS ratings. Public hospitals are also more likely to have highly energy intensive medical facilities, whereas private hospitals are more likely to outsource them to office buildings.

**Opportunities is the Health sector**

Public-owned assets such as some hospitals and schools avoid many of the barriers faced by the rest of the commercial buildings sector. These buildings are usually owner-occupied, which simplifies the split incentive issue, and public entities generally have lower costs of capital than private companies, meaning there is less pressure to achieve high and quick returns on energy efficiency investments.

Publicly-owned assets however have their own barriers to energy efficient retrofits. Upgrades to hospitals and schools are often limited by capital constraints as budgetary spending is often prioritised to projects with direct societal impact, rather than internal cost impacts. Additionally, hospitals are difficult to access for upgrades due to the 24-hour operating times. In practice, the schools and hospitals may have very little, or rationed, access to the low-cost capital that governments could, in principle, make available to them, due to government-wide policies and budget constraints. It is important that governments set ambitious energy efficient targets and act as role models for these targets in their publicly-owned assets. Special vehicles for investment such as Energy Performance Contracts can be effective for reducing capital constraints and sharing clear cost/benefit data of retrofits will assist with business cases. More generally, innovative and off-budget financing strategies may be important for these buildings – but care would need to be taken to ensure that such strategies are allowed by state treasuries.

In lieu of the renovation triggers for commercial buildings that occur at points of sale and lease, public sector asset managers require different motivations. Using government assets as role models is one such motivation, while others include governments setting more stringent minimum standards for buildings that they lease or build/purchase. Increasing energy use measurement and disclosure will also assist in increasing energy efficiency, as without such checks in place there is little incentive for end users of energy in hospitals and schools to reduce their energy use. Also,
publications of objective performance data provide useful information to the energy services sector, which is then better placed to identify good targets for efficiency upgrades.

Information and capacity building may also play an important role in hospitals and schools, as there may not be people specialised in building management in local public entities. Victoria’s free ResourceSmart program assists schools in increasing sustainable practices and saving resources through online modules, providing case studies, and hosting awards for high-achieving schools.

Increased education and knowledge sharing may also address the logistical barriers to retrofits at hospitals. Their 24-hour nature limits the degree to which services can be interrupted for renovation, and restrictions exist for certain parts of hospitals (e.g. HVAC systems in operating theatres). Knowledge sharing between hospitals may provide replicable solutions to such issues.

10.4.8 Other building classes

Other commercial building classes where there is less information includes:

► Class 7a carparks and Class 7b buildings which are typically warehouses, storage buildings or buildings for the display of goods (or produce) that is for wholesale.
  o Under NABERS, carparks are not part of the NLA, and so are excluded from the Rated Area. Considering that most tall office buildings have basement carparks, there is an opportunity to capture more information on carparks to improve data on energy intensity. Lighting would be a major energy efficiency opportunity for carparks.

► A Class 1b building is a boarding house, guest house or hostel that has a floor area less than 300 m², and ordinarily has less than 12 people living in it.
  o Most of the hotels that report on NABERS appear to be larger than 300m². However, as NABERS for Hotels develops and potentially expands, further information on small buildings could be collected.

► Class 8: a factory, including for manufacturing, assembly, laboratory or workshop
  o EY possesses access to a large amount of energy audit data on commercial buildings including some manufacturing buildings. This focuses on capital costs and savings for a range of energy efficiency technologies and solar PV. It often excludes floor area and energy intensities.

► Class 9b buildings are assembly buildings in which people may gather for social, theatrical, political, religious or civil purposes. They include schools, universities, childcare centres, pre-schools, sporting facilities, night clubs, or public transport buildings.
  o There is a limited amount of data publicly available on energy consumption for schools and universities. There could be an opportunity to collect such data in partnership with the States and Territories. While energy consumption will be recorded, floor area may be less readily available, and it may require some coordination to collect this information.
10.5 Summary of energy intensity analysis

The available data confirms that the energy efficiency of the existing building stock is generally improving over time. This trend is clear for large offices where data is more widely available, except in smaller states/territories where the take-up of NABERS and CBD is lower.

For other building types, much less data is available. Also, there are significant data limitations in analysing building energy performance by building age, height, ownership type or many other relevant factors. This is one reason why a new Commercial Building Baseline Study is expected to be commissioned next year.

Some of the observations from the analysis are that:

► The majority of energy savings attributable to existing building measures projected into the future are due to GEMS as per the COAG Trajectory project.

► Non-residential electricity and gas intensities have been decreasing historically (despite significant YoY variability) and are expected to continue to decrease into the future.

► Retail and hotel building types have tended to have a lower NABERS star rating than offices, with hotels having much larger electricity and gas intensities than office and retail buildings.

► Larger buildings have tended to display lower energy intensities across the retail and office building sectors, the opposite is true for hotels.

► Tasmania, South Australia and Victoria displayed higher energy intensities in their office building stock whole Western Australia displayed a lower energy intensity (however this does not account for temperature normalisation).
11. Policy Options

The initial list of potential policy options are outlined below, from the phase 1 of this work and based on example interventions that could improve the energy and carbon performance of existing commercial buildings. The policy options that currently appear most optimal for implementation are described below and would put forward to stakeholders during the stakeholder engagement phase.

11.1 Minimum standards

Opportunities for a broadening of Australia's minimum standards policies for greater impact in existing non-residential buildings include:

► Expand GEMS to include newer energy efficiency technologies, technologies not already covered, and to increase existing minimum standards to the maximum extent cost-effective. For example, glazing, framing and ducting have previously been explored for potential inclusion within GEMS, while LED lighting standards, higher standards for packaged air conditioners, chillers, electric motor drive systems, office equipment and others would all contribute to lifting the efficiency of energy use in existing non-residential buildings over time.

► Further to this increase in the minimum standard threshold, is a need for a forward-looking trajectory of improvement to increase business certainty and energy productivity. Additionally, it is important for a greater focus on compliance through greater verification and resources where needed. Setting a cost-effective level of GEMS, to encourage optimal levels of take up, is part of the design of the policy option.

► Minimum energy performance standards in the building Code currently apply to 'new building work' which includes refurbishment work. Also, new building standards should apply when a building is converted from one class to another (e.g. hotel to office or vice versa). However, there is considerable confusion within the construction industry about the circumstances in which refurbishment and conversion work should trigger Code energy performance requirements. Relatedly, the states should explore how they each call-up the NCC in the relevant legislation to ensure consistency and clarity – not necessarily to harmonise diction but rather to explore what wordings can be leveraged to ensure a better understanding around refurbishments. Also, in practice, building surveyors exercise considerable discretion in assessing when compliance is necessary for a particular development, and that discretion may err in favour of Code provisions not being applied, particularly where there is uncertainty. There is an opportunity for the Australian Building Codes Board and/or state building authorities to clarify the intended application of the Code. Once that is done, then a campaign to raise awareness of the provisions, backed by enhanced monitoring and Code enforcement, would be likely to realise additional energy savings. Relatedly, to the extent that different interpretations and triggers apply in different states and territories, these could be harmonised to minimise industry confusion and search costs.

► A more difficult, but potentially very significant, opportunity would be to consider the progressive introduction of energy performance requirements in the Code for existing buildings. The first step, as noted above, could be to clarify, communicate and enforce existing provisions relating to major refurbishments and conversions of buildings from one class to another. Beyond that, the Calculating Cool155 initiative and others have long drawn attention to the opportunities related to improved HVAC maintenance, and requiring periodic maintenance in the Code could be a highly cost-effective option. Third, AIRAH – Australia’s HVAC industry body – has long supported the introduction of building commissioning requirements in the Code, and these are understood to be likely to be

155 http://www.calculatingcool.com.au/#/home
considered again in future COAG Energy Council Code determinations. Building on this, it would be possible to require periodic recommissioning or tuning of buildings as part of required maintenance schedules. Clearly different provisions may be required for different building types, and specific arrangements should be subject to consultation, as indeed all Code changes are. However, the potential for such arrangements to leverage large and highly cost-effective savings over time is likely to significant. By making such arrangements mandatory – and assuming that the provisions are enforced – this would overcome many of the barriers that currently see limited participation in energy efficiency programs and policies by mid-tier and less-commercial building types.

The table below summarises the key issues and potentials relating to mandatory standards.

<table>
<thead>
<tr>
<th>Table 37 - Minimum standards</th>
<th>Savings Potential/Impact</th>
<th>Cost-Effectiveness</th>
<th>Additionality</th>
<th>Co-Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse and Energy Minimum Standards (GEMS)</td>
<td>High - opportunity for new standards to impact on all existing buildings as equipment is replaced over time</td>
<td>High - all GEMS proposals are subject to regulation impact assessment leading to high confidence of cost-effective outcomes</td>
<td>High - additionality forms part of the RIS analysis</td>
<td>Avoided peak demand and reduced network expenditure</td>
</tr>
<tr>
<td>Clarifying and enforcing existing Code provisions</td>
<td>Potentially high - will depend upon extent of non-compliance now. Significant refurbishment work occurs each year, and additional savings could be realised if current Code performance requirements applied.</td>
<td>High - relatively little cost would be required, while returns could be large.</td>
<td>Depends upon the extent of non-compliance now, which is poorly documented</td>
<td>Reduced search costs and greater harmonisation of requirements across jurisdictions</td>
</tr>
<tr>
<td>Progressive introduction of performance requirements for existing buildings in the National Construction Code</td>
<td>High - would apply to many existing buildings, including reaching those in market segments that are not currently covered by or accessing existing measures.</td>
<td>High - evidence from Calculating Cool is that HVAC maintenance would be extremely cost effective</td>
<td>Generally high - may vary depending upon the specific provisions introduced</td>
<td>Improved occupant comfort and productivity</td>
</tr>
</tbody>
</table>
11.2 Building energy ratings

There is opportunity for voluntary and mandatory building ratings and disclosures to have a broadened coverage. Across both of these areas, this predominantly involves broadening the uptake from office buildings to other building typologies such as hotels, data centres, shopping centres and others. With regards to mandatory disclosures, of which the CBD scheme is most prominent, this expansion of coverage is equally applicable.

Central to developing voluntary rating schemes such as NABERS across sectors and over time is a forward pathway outlining increases in requirements and coverage to increase certainty for investment and demonstrate commitment. There is also the possibility to combine rating schemes such as NABERS with energy efficiency implementation under financing mechanisms such as the VEU scheme in Victoria. Green Star also presents an opportunity as a voluntary rating scheme, especially in integration with the NCC.

As rating schemes do not require building owners and/or tenants to make energy efficiency improvements – but only provide information-based incentives (for owners and tenants), there is an open question about how much impact they would have in different building segments and markets and, therefore, how cost-effective this strategy would be. Notwithstanding, there could be some economies of scale in building from the existing NABERS and CBD schemes, rather than starting from nothing. If the information from the ratings were combined with other policy options to encourage or support energy efficiency improvements, then an integrated and complementary set of options could work to drive improvements. This is an option that requires further investigation and analysis.

Retail is characterised by a wide range of energy intensities, with a large portion of buildings sitting higher than the average MJ/M2 trend line. This indicates potential opportunities for improving energy efficiency in many retail buildings, but noting that location/climate, service level provision, operating hours, the nature of the tenants and other factors will also affect the energy intensity of different retail spaces. Currently, energy efficiency information is not required, at least not through national legislation, to be provided when retail spaces are offered for sale or for lease. An expansion of the CBD to include retail spaces, or the inception of a mandatory retail energy performance disclosure scheme, would increase transparency and potentially turn periods of sale and lease changeovers into trigger points for upgrades and retrofits. Given that many retail tenancies are small, it would be important to ensure a low threshold for disclosure, and/or build on initiatives like NABERS Co-Assess that reduce barriers to assessing smaller tenancies.

Past success of the CBD program has led to expansion of mandatory disclosure to smaller building footprints. Expansion of the CBD program to smaller office buildings may further motivate mid-tier building owners to improve energy performance. The CBD could potentially also be expanded to capture hotels – to help to address their high energy intensity and the low-take up of ratings tools on a voluntary basis. Particularly for Australia’s largest hotels which have the highest average energy intensity.

For less traded, ‘harder to reach’ buildings (from a policy/program perspective), mandatory disclosure could be expected to achieve less results in terms of energy savings, due to less motivated owners and/or tenants, and potentially less professional building management. Ways to increase leverage and impact include linking building energy performance to public disclosure. For example, in the UK Energy Performance Certificates are required to be displayed to the public, such as in a foyer, for buildings over 500m2 and if it is frequently used by the public.

Table 38 - Building energy ratings

<table>
<thead>
<tr>
<th></th>
<th>Savings Potential/Impact</th>
<th>Cost-Effectiveness</th>
<th>Additionality</th>
<th>Co-Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory ratings</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>There are incremental costs (rather than Additional coverage by extending to)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 11.3 Energy efficiency obligation schemes

Opportunity for greater harmonisation of the current state-based schemes into one national scheme that covers all states and territories, including those not currently using a scheme.

This would involve legislation and should feature regular review to ensure there are not certain energy efficiency technologies excluded from the scheme that still have a significant impact opportunity for energy efficiency savings, especially as technological change is increasing in pace. It is important to acknowledge that there are institutional feasibility issues impeding such unifying measures on energy policy due to differing public perceptions towards such schemes in different states.

There is an open question about these schemes in the longer term. Firstly, they represent cross-subsidies from one consumer to another. Second, opportunities will eventually run out - in the sense that, those who are motivated to come forward may have already come forward, while increasingly over time - it may require greater incentives to lure out the laggards - mid-tier, non-commercial buildings, etc. This may well equate to diminishing returns and declining cost-effectiveness over time.

All EEO schemes in Australia are currently planning their post 2020 plans.

#### Table 39 - Energy efficiency obligation schemes

<table>
<thead>
<tr>
<th>Savings Potential/Impact</th>
<th>Cost-Effectiveness</th>
<th>Additionality</th>
<th>Co-Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy efficiency obligation schemes</td>
<td>Medium</td>
<td>Low to Medium</td>
<td>Reduced peak load and network cost savings</td>
</tr>
<tr>
<td>Constrained by the extent of State targets</td>
<td>Medium</td>
<td>Low to Medium</td>
<td>Emission savings</td>
</tr>
<tr>
<td>Limitations on applicable technologies</td>
<td>Medium</td>
<td>Low to Medium</td>
<td>Improved health and wellbeing and productivity e.g. from</td>
</tr>
<tr>
<td>Lighting has been a major focus so far, and</td>
<td>Medium</td>
<td>Low to Medium</td>
<td></td>
</tr>
<tr>
<td>Avoided peak demand costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less exposure to rising energy costs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
11.4 Financial incentives

Opportunity for a coordinated fiscal and tax incentive program across state and federal jurisdictions that improves the attractiveness of energy efficiency projects in existing commercial buildings.

Fiscal and tax incentives need to be balanced with consideration of the ‘free-rider’ problem. This has been seen with EV subsidies both within Australia and abroad, such as in California where free-riders absorbed most of the benefit. This needs to be considered when modelling the impact of the policy option.

Specific investment vehicles may need to be identified for particular commercial building classes. For example, Energy Performance Contracts are demonstrated to work with government, health and education buildings in the UK and to an extent within Australia. Other financing vehicles include:

► Green Bonds
► Environmental Upgrade Agreements
► Incentives and pathways with NABERS ratings, e.g. points awarded through the ESS scheme and the Emission Reduction Fund provides a NABERS upgrade methodology
► Revolving funds targeting green investments through ‘green’ screening criteria. Examples include Victoria's Greener Government Buildings Program as discussed in Section 9.4.2
► Sustainability Victoria’s Energy Efficient Office Building program serves as an example of funding for mid-tier buildings, with large energy savings achieved.

Table 40 - Financial and tax incentives

<table>
<thead>
<tr>
<th>Financial and tax incentives</th>
<th>Savings Potential/Impact</th>
<th>Cost-Effectiveness</th>
<th>Additionality</th>
<th>Co-Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medium to High</td>
<td>Medium to High</td>
<td>Medium to High</td>
<td>Reduced peak load and network cost savings</td>
</tr>
<tr>
<td></td>
<td>Higher for incentive for business</td>
<td>Free riding problem limits the net benefit</td>
<td>Free riding problem limits the additional benefit</td>
<td>emission savings</td>
</tr>
<tr>
<td></td>
<td>Subsidies might have a broader application e.g. government and not for profits.</td>
<td>Tax incentives are meaningful for business.</td>
<td>Improved health and wellbeing and productivity e.g. from lighting and HVAC projects</td>
<td></td>
</tr>
</tbody>
</table>

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Department of the Environment and Energy
11.5 Government procurement and leadership

Opportunity for governments to take a leading approach in the energy performance of their owned and leased buildings. A net zero emissions target year would be helpful. Otherwise this policy option can primarily take the form of increased minimum standards of government buildings validated through voluntary rating schemes such as NABERS. For example:

- Only occupying NABERS 5+ star buildings
- NABERS tenancy ratings aligned with the base building rating target and Green Star ratings for all government office tenancies
- Improved NABERS Energy and Green Star tenancy ratings from education and behaviour change (CitySwitch programs).
- NABERS Energy and Green Star ratings for government owned and occupied buildings disclosed on a government website.
- Base building and tenancy NABERS Energy, Green Star and other relevant third-party certifications displayed in the public lobbies of government buildings
- Preference for hiring event floorspace at hotels with higher NABERS ratings

There is also an important role for local councils to play in the push towards sustainability and improving building efficiency – specifically through educational campaigns, local grants and EUA partnerships. There has been somewhat lacklustre uptake from local municipalities thus far however learnings can be taken from the City of Melbourne and Greater Shepperton councils who have had success through different strategies. The City of Melbourne Council set out a Climate Change Mitigation Strategy which laid a path for action such as sourcing 100% renewable energy. The Greater Shepperton council, aside from providing valuable informational websites, partnered with the Sustainable Melbourne Fund to enable businesses to implement energy efficiency with no capital cost and repayments via quarterly property rates using the EUA mechanism.

Table 41 - Government procurement and leadership

<table>
<thead>
<tr>
<th>Savings Potential/Impact</th>
<th>Cost-Effectiveness</th>
<th>Additionality</th>
<th>Co-Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government procurement and leadership</td>
<td>Low to Medium</td>
<td>Medium</td>
<td>High</td>
</tr>
</tbody>
</table>

In NSW for example, approx. 5% of electricity consumption is government related. In smaller states, government procurement would have a higher impact.

Lowers operational energy costs

The ‘you lead they follow’ approach can raise the bar amongst the private sector

Opportunity to leverage government action, to inspire the private sector
11.6 Information and capacity building

Programs can target building capacity, awareness and the required skills to make effective decisions over energy and carbon performance. The two core pillars of this are i) basic information relating to energy efficiency and ii) web-based tools that empower users to access and utilise energy data.

For less commercial sectors e.g. hospitals, there will be opportunities to promote energy services such as smart software systems, enabling using automated building tuning. Education and awareness can play an important role in hospitals and schools, as there may not be people specialised in building management in local public entities. Development and deployment of a Building Retrofit Toolkit could support hospitals, and a number of other sectors, to follow an energy efficiency pathway.

For hotels this could be room management systems linked to the building energy management system, which have proved to be effective as saving energy. Information and capacity building could help smaller hotels who may not have the scale and resources to research and train staff in the energy efficiency options available.

The 24-hour, energy-intensive nature of data centres, with significant energy loads from IT equipment and cooling, present a challenge. A combination of knowledge sharing and strengthening of minimum standards could help address barriers, through procurement of energy efficient equipment (both IT and cooling systems) while providing more of a forum for businesses to share practical lessons on upgrading the energy efficiency of data centre facilities.

Additional to basic information and web-based tools are training, accreditation and up-skilling programs for installers, energy engineers and other relevant stakeholders. Examples of such opportunities for training and accreditation for installers include partnering with existing organisations such as ARIAH’s registered installers program or the national Electrical Contractors Association (NECA). There is scope to incentivise such activities through encouraging or mandating Continued Professional Development (CPD) points to be accrued for training. Examples in other capacities include the development of informational frameworks, such as the Soft Landings framework in the UK156, which focuses on better building handover, management and operation in closing the energy gap. This addresses the handover of new buildings, such that energy efficiency design ratings are realized through effective understanding and management of the building during its operation.

There is a general lack of data on commercial building energy intensities and implemented savings projects, beyond well traded building classes such as for large office and retail buildings. There is scope for investing in better data collection and sharing, possibly linked to existing voluntary schemes such as NABERS, Green Star and toolkits such as are being developed by the Property Council of Australia.

There are some gaps in data availability of energy consumption/intensity data together with building characteristics information. There could be some further work to combine these datasets and seek to model energy intensities such as by building age, grade, height, ownership and construction type (e.g. through Core Logic and Nexus Geoscience data).

The Canadian government for example, has invested in collecting energy audit data, recognising the public value in capturing such information. Whilst there are plenty of energy audit programs initiated through government support programs in Australia, EY analysis shows that only a few datasets are useful in terms of having recorded relative % savings and capitals costs. Which are needed to leverage the data for application and comparison with other buildings, regions etc. This

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Department of the Environment and Energy
could be easily remedied by having a common agreed basis upfront, amongst government departments, for recording the results from energy audit reports.

Education and information programs, by themselves are likely to have limited impact, and would require to be joined with other policy interventions aimed at addressing barriers to energy efficiency, particularly amongst the less competitive and harder to reach commercial building classes.

Table 42 - Information and capacity building

<table>
<thead>
<tr>
<th>General information and education programs</th>
<th>Savings Potential/Impact</th>
<th>Cost-Effectiveness</th>
<th>Additionality</th>
<th>Co-Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Medium if combined with other policy options</td>
<td>Little evaluations of information-based programs.</td>
<td>Medium if combined with other policy options</td>
<td>Low to Medium</td>
<td>Low to Medium</td>
</tr>
<tr>
<td>Premium office owners already have information.</td>
<td>With the ‘you lead they follow’ approach such that upfront costs are likely to be leveraged to help raise standards amongst the private sector</td>
<td>Coverage of an additional building class</td>
<td>Additional data could help with the current issues with lack of data on commercial buildings.</td>
<td></td>
</tr>
<tr>
<td>Mid-tier owned, government owned and smaller owner occupiers likely have less access to information.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In absence of financial incentive take-up could be low.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Expand NABERS data collection e.g. to capture carparks

<table>
<thead>
<tr>
<th>Expand NABERS data collection e.g. to capture carparks</th>
<th>Savings Potential/Impact</th>
<th>Cost-Effectiveness</th>
<th>Additionality</th>
<th>Co-Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Information could incentivise lighting and controls projects. As technologies, high % savings potential from LED lighting and sensors if not already installed.</td>
<td>Low additional cost to collect floor area and energy consumption of carpark areas</td>
<td>Coverage of an additional building class</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Expand NABERS data collection to capture energy efficient project implementation

<table>
<thead>
<tr>
<th>Expand NABERS data collection to capture energy efficient project implementation</th>
<th>Savings Potential/Impact</th>
<th>Cost-Effectiveness</th>
<th>Additionality</th>
<th>Co-Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low to Medium</td>
<td>Low to Medium</td>
<td>Low</td>
<td>Low to Medium</td>
</tr>
<tr>
<td>The information wouldn’t directly drive savings but could help industry to understand current costs/savings potential and help government to target policy interventions</td>
<td>Some time/labour cost to industry for additional reporting. Potentially low take up of reporting if voluntary.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
11.7 Market transformation

A market transformation approach would combine regulations and incentives discussed above. For example, linking under-utilised technologies with minimum standards or ratings schemes, to ensure maximum benefits from both policies. Market transformation is used in countries such as in the US and Japan with less use in Australia. The phase-out of CFL lighting with incentives and regulation was one example of a successful approach applied in Australia.

A performance standard could be introduced using the future ‘top runner’ approach, such as has been used by the Japanese government. Every 3 years, the most efficient product in the market is chosen as the ‘top runner’. Then in 3 years’ time the minimum standards are set in line with that top runner, with the market expected to meet the standards. It has also been used in Germany to expand Passivhaus. Market transformation may also include taking a wider perspective to identify opportunities. For example, high performance glazing is expensive and niche partly as we don’t manufacture it in Australia. Higher quality and efficient insulation ducting also has high costs in Australia, with large mark-ups in the supply chain. Encouraging local manufacturing might help to drive market transformation in the supply chain, with eventual cost reductions as the market becomes established. Intervention such as with subsidies could be an example of promoting such expansion.

Table 43 - Market transformation

<table>
<thead>
<tr>
<th>Savings Potential/Impact</th>
<th>Cost-Effectiveness</th>
<th>Additionality</th>
<th>Co-Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market transformation e.g. to support high performance glazing and insulation</td>
<td>Medium to high</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Potential high impact in limited niche technologies and programs</td>
<td>Potentially costly to support, though with potential high benefits</td>
<td></td>
<td>Additional benefits likely through growth of new products/markets</td>
</tr>
</tbody>
</table>

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