The Next Wave
Retrofitting Victoria’s Office Buildings
Summary Report
The Next Wave

Retrofitting Victoria’s Office Buildings – Summary Report

This summary report is a condensed version of The Next Wave. For further details on any of the aspects discussed in this summary refer to the full version which is available from www.sustainability.vic.gov.au.

Prepared for

Sustainability Victoria by Davis Langdon Australia Pty Ltd

Contact

Sustainability Victoria
sustainability.vic.gov.au
Ph: +61 3 8626 8700

The Next Wave © Sustainability Victoria 2013

While reasonable efforts have been made to ensure that the contents of this publication are factually correct, Sustainability Victoria gives no warranty regarding its accuracy, completeness, currency or suitability for any particular purpose and to the extent permitted by law, does not accept any liability for loss or damages incurred as a result of reliance placed upon the content of this publication. This publication is provided on the basis that all persons accessing it undertake responsibility for assessing the relevance and accuracy of its content.

The Next Wave should be attributed to Davis Langdon Australia Pty Ltd.

The Next Wave is licensed under a Creative Commons Attribution 3.0 Australia license. In essence, you are free to copy, distribute and adapt the work, as long as you attribute the work and abide by the other license terms. To view a copy of this license, visit: http://creativecommons.org/licenses/by/3.0/au/
1.0 Key Findings

The key findings of this study are:

- Buildings constructed between 1960 and 1999 would yield the most success from a targeted performance-based retrofitting scheme, due to the large numbers of these buildings spread across CBD, metropolitan and regional areas.

- Lower grade buildings in the B, C and D grades represent 80% of the City of Melbourne office market. Due to a lack of data the exact ratio of lower grade building stock in metropolitan and regional areas cannot be determined. However, limited data from metropolitan areas, in tandem with building age, size and type, enable some insights into the nature of the lower grade buildings in these markets.

- Although D grade buildings represent 20% of the office buildings in the City of Melbourne, they account for only 6% of the total office Net Lettable Area (NLA) so may require a different approach to larger office buildings.

- It is estimated that the City of Melbourne is the largest emitter of carbon emissions cumulatively contributing an estimated 1,127,000 tonnes (46%) of base building carbon, while the metropolitan Melbourne market (excluding City of Melbourne) emits a similar amount at 1,094,000 tonnes (45%), and regional areas emit 215,000 tonnes of carbon (9%).

- Based on Gross Floor Area (GFA), Commercial Building Disclosure thresholds currently capture 690 existing buildings across Victoria with a GFA greater than 2,000m². If the threshold for disclosure was lowered from 2,000m² NLA to 500m² NLA, it would capture an additional 2,100 buildings across the state, enabling the encouragement of retrofits in a broader market.

- Key barriers to market transformation identified in the report include financial risks, disruption to tenants, lack of tenant demand, capital constraints and industry risks.

- Key drivers for retrofits include the establishment of interactive education tools for tenants and building managers, government procurement changes and easier access to finance for building retrofits.

- A heritage buildings retrofit strategy to address the considerable proportion of buildings affected by heritage overlays in the Victorian office market would have a significant impact in metropolitan and regional centres.
2.0 Scope

This study was commissioned by Sustainability Victoria to deliver a greater understanding of the size and impact of lower-grade commercial office buildings across Victoria. The main goals of this report are:

- to provide analysis of Victoria’s office stock segmentation and provide insights into the various office markets in which these buildings operate
- to inform the future direction of policy and initiatives enabling decision makers to achieve the highest possible environmental and economic return.

In place of state-wide or national initiatives, targeted campaigns using this evidence base will enable the Victorian government to refine initiatives to better target lower grade (B, C and D grade) buildings.

Traditionally, retrofitting initiatives and research have been focussed on the Melbourne CBD, where the highest volume of investment grade building stock resides. This report takes a state-wide view of lower grade building stock, incorporating metropolitan Melbourne and regional Victoria, presenting a more holistic and opportunity rich portrait of Victoria’s current market.

In addition to the significant opportunities found in this report, there were also notable gaps in the availability of some data on Victoria’s lower grade office market. Future studies would benefit from further research, particularly in relation to building grades, ownership and actual environmental performance.

3.0 Market Analysis

3.1 Victorian Office Market Summary

This report segmented the Victorian office market into three distinct zones: City of Melbourne, Metropolitan (excluding the City of Melbourne) and Regional. As detailed in the table below, an analysis on the location of office building across the three zones found an almost equal share of GFA between the City of Melbourne (46%) and the Metropolitan regions (45%). However, only 18% of total buildings are located in the City of Melbourne in comparison to 65% in Metropolitan regions.

Table 1 Victorian Office Market Summary

<table>
<thead>
<tr>
<th>Region</th>
<th>Total GFA (m²)</th>
<th>Total Number of Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Melbourne</td>
<td>5,298,443 (46%)</td>
<td>4,420 (18%)</td>
</tr>
<tr>
<td>Metropolitan (Ex Melbourne)</td>
<td>5,144,030 (45%)</td>
<td>16,115 (65%)</td>
</tr>
<tr>
<td>Regional</td>
<td>1,012,216 (9%)</td>
<td>4,169 (17%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11,454,689</strong></td>
<td><strong>24,704</strong></td>
</tr>
</tbody>
</table>

Source: Davis Langdon Research, Valuer General Victoria 2010

Figure 1 Victorian Office Market by Number of Buildings and GFA

Source: Davis Langdon Research, Valuer General Victoria 2010
Figure 2 Victorian Municipalities by Total GFA
Valuer General Victoria (VGV) data provided information on the office market in Victoria. These figures provide a useful snapshot of the nature and size of the overall Victorian office market.

**Figure 3  Office Market by Floor Area Range (≥2,000m²) – Victoria**

*The Commercial Building Disclosure Program applies to office buildings with a NLA over 2,000m². As the VGV only provides GFA data, this figure should be used as an indicative number only.

Source: Davis Langdon Research, Valuer General Victoria 2010

Figure 3 and Figure 4 show the distribution of the Victorian office buildings by GFA range. Figure 3 represents the number of buildings with a total GFA greater than or equal to 2,000m², while Figure 4 shows the number of buildings with a total floor area less than 2,000m². These demonstrate that there is a greater concentration of buildings in the lower GFA ranges.

**Figure 4  Office Market by Floor Area (<2,000m²) – Victoria**

Note: 82 office buildings have an unclassified GFA.

Source: Davis Langdon Research, Valuer General Victoria 2010
VGV data also provides a construction date for the majority of Victorian office buildings. This data forms a timeline of construction work in Figure 5 and indicates the age of the office buildings in Victoria. It should be noted that construction dates were missing for 1,897 buildings in the VGV data.

![Figure 5 Office Market by Construction Year – Victoria (Excluding City of Melbourne)](source)

No buildings are listed in VGV data as being constructed in the period from 1809 to 1840.

Note 1 – During the 1980s and 1990s a reversal in the long term trend occurred resulting in greater office area constructed relative to the number of buildings. This was predominantly associated with decentralisation of Victoria’s office market outside of the CBD and primarily into the inner North, West and Eastern suburbs. Refer to Appendix I for regional data.

The relationship between the number of buildings constructed and the total area of office space added each year gives a good indication of the scale of these buildings. For example, 1,891 buildings were constructed during the 1990s, considerably fewer than the previous decade but totalling 1,088,508m² in floor area – the largest area of office space constructed in Victoria during any decade. Since the average life cycle of building services is 20 years and fit out are 5 to 10 years, and a significant amount of the Victorian office market (in terms of m²) was constructed between 1980 and 1999, a considerable proportion will require upgrading soon.
3.2 City of Melbourne

The City of Melbourne's Census of Land Use and Employment (CLUE) provides a comprehensive office market database for this area. As such, this section of the report uses CLUE data instead of VGV data. CLUE data is gathered by the City of Melbourne every two years from businesses in the municipality. The CLUE data in this report is drawn from the 2008 census because the 2010 figures were not finalised at the time of compilation.

Figure 6 CLUE Region Map

3.2.1 Market Size

CLUE data segregates the City of Melbourne into 16 precincts, as shown in Figure 6. The Melbourne CBD represents 39% of buildings and 67% of total NLA in the City of Melbourne office sector. The data (explained further in the full version of The Next Wave) also indicates the relative densities of each of these precincts. Carlton and North Melbourne represent 13% and 15% of office buildings (respectively), but only occupy 4% (Carlton) and 3% (North Melbourne) of total NLA. Conversely, the Docklands represents 2% of office buildings but is the third highest precinct in terms of NLA with 6% of total space in the City of Melbourne.
3.2.2 Building Age

Of the 1,795 buildings in the City of Melbourne, 882 do not have a PCA grade associated with them in the CLUE records. Figure 7 shows the distribution of the graded buildings broken down by each decade from 1850 to 2009\(^1\). The data suggests a loose connection between PCA Grade and age, 82% of A Grade buildings were built from 1980 to 2009 and 81% of B Grade buildings were built post 1950, whereas 70% of D Grade buildings were built before 1950. The correlation is not as clear with C Grade buildings where data indicates a 50:50 split between C Grade buildings that were constructed before and after 1950.

Figure 7 Number of Buildings by Construction Year and PCA Grade – City of Melbourne

![Figure 7](image)

Source: Davis Langdon Research, City of Melbourne CLUE 2008

Figure 8 shows the distribution of the NLA of office buildings with a PCA grade and the decade they were constructed. The correlation between PCA grade and age is not as clear when looking at the percentage of NLA for each grade built in various decades. For example, while 70% of D Grade buildings were built before 1950, only 53% of the total NLA of D Grade buildings were constructed in this period – indicating that buildings of that grade constructed post-1950 were of a larger size than those built before 1950. The same applies to B and C Grade buildings with 87% and 57% (respectively) of their total NLA built post 1960.

Figure 8 NLA by Construction Year and PCA Grade – City of Melbourne

![Figure 8](image)

Source: Davis Langdon Research, City of Melbourne CLUE 2008

\(^1\) Figures in this section exclude buildings missing a construction date or PCA Grade in the CLUE database.
3.2.3 PCA Grade

Figure 9  NLA by Precinct and PCA Grade – City of Melbourne

Note: No office buildings in South Wharf and South Yarra had a PCA grade and so have been omitted from this chart.

CLUE location data also provides a geographical distribution of office NLA by grade across the City of Melbourne. 699,699m² (14% of the total office area in the City of Melbourne) does not have a PCA grade listing in the current CLUE data. Excluding this building stock and, by using the buildings with an associated PCA grade, analysis of some of the typical locations of these certain grade buildings can be undertaken as shown in Figure 9.

3.2.4 Ownership

In the 1200 Buildings Segmentation Study commissioned by the City of Melbourne (CoM), nine ownership types are identified in the Melbourne CBD.

1) Governments – government departments, for e.g. local councils, state government departments, consulates and embassies.

2) Out of Government – departments of organisations that have come out of or are held accountable to state or federal governments, for e.g services boards and corporations, commissions, national foundations and trusts.

3) Corporate – large corporations and companies, for e.g. publicly listed and multinational companies

4) Businesses – medium-sized to smaller companies and businesses, for e.g. investment firms, hotels, real estate management firms

5) Individual and Family Owned / Small Businesses and Investors – individual investments, for e.g. small property investments, family-owned businesses, trusts, holdings, nominees.

6) Owners Corporation – a group that manages the property investment of the owner on their behalf

7) Not for Profit – for e.g. community groups, religious groups, charities and support services

8) Professional Associations – associations that represent professionals

9) Other – other significant groups, for e.g. hospitals, universities, sporting associations and private clubs,

In the segmentation study there is no correlation between ownership type and PCA grade. The relationship between the number of owners compared to NLA shows that although the number of owners in the individual and family owned category is the highest, they occupy 41% less floor space than the buildings owned by Corporates.
This represents an opportunity to target performance improvement campaigns towards a small number of owners representing a significant ratio of floor area. The upside of this approach would be a higher environmental return with lower upfront costs.

Figure 10 Ownership Type by NLA and Number of Buildings – City of Melbourne

Source: 1200 Buildings Segmentation Study - Arup 2009
3.3 Metropolitan (excluding City of Melbourne)

There are 31 municipalities classified as ‘metropolitan’ by the Victorian Department of Planning and Community Development (DPCD), including the City of Melbourne (which has been analysed separately) and is not included in this section of the report. The remaining 30 municipalities have been grouped into the following five geographical regions: City Fringe, South East, Inner East, Outer East and North & West (shown in Figure 11).

<table>
<thead>
<tr>
<th>Region</th>
<th>Municipalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>City Fringe</td>
<td>Port Phillip (Melbourne CBD has been analysed separately)</td>
</tr>
<tr>
<td>South East</td>
<td>Bayside, Cardinia, Casey, Frankston, Glen Eira, Greater Dandenong, Kingston,</td>
</tr>
<tr>
<td></td>
<td>Mornington Peninsula</td>
</tr>
<tr>
<td>Inner East</td>
<td>Banyule, Boroondara, Darebin, Stonnington, Yarra</td>
</tr>
<tr>
<td>Outer East</td>
<td>Knox, Manningham, Maroondah, Monash, Nillumbik, Whitehorse, Yarra Ranges</td>
</tr>
<tr>
<td>North and West</td>
<td>Brimbank, Hobsons Bay, Hume, Maribymong, Melton, Moonee Valley, Moreland,</td>
</tr>
<tr>
<td></td>
<td>Whittlesea, Wyndham</td>
</tr>
</tbody>
</table>

Figure 11 Metropolitan Melbourne Office Market Regions

Source: Davis Langdon Research, Municipal Association of Victoria
3.3.1 Market Size

According to VGV data, the metropolitan (excluding CoM) office market has a total GFA of 5,144,030m² and comprises of 16,115 buildings. The Inner East region represents the largest office market with 33% of the total GFA and 34% of the total office buildings. Figure 12 plots the relationship between GFA and number of buildings in each of the regions, and shows that the Outer East and City Fringe have higher density office stock than the South East and North West.

Figure 12 Office Market by Region – Metropolitan

3.3.2 PCA Grade

There is limited information available on the PCA Grades for office buildings in suburban regions. The DPCD has a database of information for selected suburbs gathered by the Municipal Association of Victoria (MAV) for the department’s Central Activity District (CAD) studies of Dandenong, Footscray and Frankston. These suburbs differ in profile due to their proximity to the Melbourne CBD, trends in population growth and access to transport infrastructure such as roads and public transport. This CAD data is used in Figure 13 to show the distribution of PCA grades in these suburbs. The vast majority of this stock is B Grade, except in Footscray where there is a higher proportion of C and D Grade space. Data on the number of buildings in this region is unavailable.

Figure 13 Office Market Floor Area by PCA Grade – Selected Metropolitan Suburbs

Note: Information on the number of buildings in these CADs is not available.
3.4 Regional Victoria

The municipalities classified as rural by the Department of Planning and Community Development (DPCD) have been grouped into the following ten regions: Corangamite, East Gippsland, Glenelg Hopkins, Goulburn Broken, Mallee, North Central, North East, Port Phillip and Westernport, West Gippsland and Wimmera. These regions also represent Victoria’s Catchment Management Regions and each have distinguishing climatic and land form attributes. For the purposes of this report we have reclassified these areas as ‘regions’, and larger towns as ‘Regional Centres’.

Figure 14 Map of Rural Regions in Victoria

Table 3 shows the total area that these regions cover, the proportion of Victoria’s total area (measured in square kilometres) and the municipalities they comprise. In several cases municipalities partially cross over two or three of the regions. For the purpose of this report they have been grouped under the region that covers the majority of the area in the municipality. In this report, the region of Port Phillip and Western Port does not include any metropolitan municipalities. For a summary of the population, climatic conditions and office markets in each region see the full version of The Next Wave.
### Table 3  Summary of Regional Centres in Victoria

<table>
<thead>
<tr>
<th>Region</th>
<th>Municipalities</th>
<th>Total Area (km²)</th>
<th>Percentage of Victoria’s Total Area</th>
<th>Number of Office Buildings</th>
<th>Total GFA of Office Market (m²)</th>
<th>Average Office Building Size (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corangamite</td>
<td>Colac Otway, Corangamite, Golden Plains, Greater Geelong, Queenscliff, Surf Coast</td>
<td>13,300</td>
<td>6%</td>
<td>878</td>
<td>233,961</td>
<td>266</td>
</tr>
<tr>
<td>East Gippsland</td>
<td>East Gippsland</td>
<td>20,800</td>
<td>9%</td>
<td>122</td>
<td>26,739</td>
<td>219</td>
</tr>
<tr>
<td>Glenelg Hopkins</td>
<td>Ararat, Ballarat, Glenelg, Moyne, Pyrenees, Southern Grampians, Warrambool</td>
<td>27,000</td>
<td>12%</td>
<td>644</td>
<td>175,478</td>
<td>272</td>
</tr>
<tr>
<td>Goulburn Broken</td>
<td>Benalla, Greater Shepparton, Mansfield, Mitchell, Moira, Murrindindi, Strathbogie</td>
<td>24,300</td>
<td>10%</td>
<td>490</td>
<td>116,155</td>
<td>237</td>
</tr>
<tr>
<td>Mallee</td>
<td>Buloke, Mildura, Swan Hill</td>
<td>39,300</td>
<td>17%</td>
<td>291</td>
<td>53,705</td>
<td>185</td>
</tr>
<tr>
<td>North Central</td>
<td>Campaspe, Central Goldfields, Gannawarra, Greater Bendigo, Hepburn, Loddon, Mount Alexander, Northern Grampians</td>
<td>30,000</td>
<td>13%</td>
<td>618</td>
<td>158,942</td>
<td>257</td>
</tr>
<tr>
<td>North East</td>
<td>Alpine, Indigo, Towong, Wangaratta, Wodonga</td>
<td>19,800</td>
<td>8%</td>
<td>328</td>
<td>51,436</td>
<td>157</td>
</tr>
<tr>
<td>Port Phillip and Western Port *</td>
<td>Bass Coat, Macedon Ranges, Moorabool</td>
<td>12,785</td>
<td>5%</td>
<td>182</td>
<td>25,409</td>
<td>140</td>
</tr>
<tr>
<td>West Gippsland</td>
<td>Baw Baw, Latrobe, South Gippsland, Wellington</td>
<td>17,164</td>
<td>7%</td>
<td>514</td>
<td>151,043</td>
<td>294</td>
</tr>
<tr>
<td>Wimmera</td>
<td>Hindmarsh, Horsham, West Wimmera, Yarriambi</td>
<td>30,000</td>
<td>13%</td>
<td>102</td>
<td>19,349</td>
<td>190</td>
</tr>
</tbody>
</table>

*Excludes metropolitan municipalities in the following analysis.

Source: Davis Langdon Research, Department of Primary Industries Victoria, Valuer General Victoria 2010
3.4.1 Market Size

Figure 15 represents the relationship between the GFA and number of buildings across each regional area. Corangamite has the largest number of office buildings and GFA with 878 buildings and approximately 233,961m² GFA of office space.

![Figure 15 Regional Office Market by Region](image)

*Not including metropolitan Melbourne

Source: Davis Langdon Research, Valuer General Victoria 2010

Figure 16 represents the top five regions as measured by GFA: Greater Geelong, Greater Bendigo, Ballarat, Latrobe and Greater Shepparton. When combined, these regions account for 60% of the GFA and 49% of the total number of buildings in the regional office market. All contain large regional cities with individual office market GFAs of over 50,000m² – larger than the total market in other regions, such as East Gippsland, Port Phillip and Western Port (excluding metropolitan Melbourne) and Wimmera. Due to their size, these municipalities will be excluded from the analysis of their wider region, assessed separately and referred to as Regional Centres. Refer to the full version of *The Next Wave* for an analysis of each regional municipality’s GFA and number of office buildings.

![Figure 16 Office Market GFA – Regional Centres](image)

Source: Davis Langdon Research, Valuer General Victoria 2010,
Figure 17 shows the same data as Figure 15, but excludes the top five Regional Centres. A large range of office market sizes remains, but the sub-markets contained within these regions are of similar sizes, allowing for more accurate analysis.

Figure 17 Regional Office Market by Region (excluding Regional Centres)

*Not including metropolitan Melbourne

Source: Davis Langdon Research, Valuer General Victoria 2010
4.0 Energy and Water Performance

Given the lack of comprehensive data on energy and water use in Victorian office buildings, this report has used a statistical approach to estimate typical total emissions and water use in each region of the state. Refer to the full version of The Next Wave for an explanation of this methodology.

Figure 18 Typical Victorian Office Market Emissions based on Theoretical Modelling

![Graph showing emissions by region](source)

Note: These are typical estimates of emissions for base building use only. Tenancy related emissions are not included here.

These theoretical estimates point to a similar opportunity for emissions savings in the remainder of the Metropolitan office market when compared to the City of Melbourne. As the chart above demonstrates, at 1.09 billion kgCO₂ of base building emissions per year in the Metropolitan market, there is comparable scope for emissions savings as in the City of Melbourne where there is the potential for 1.13 billion kgCO₂ savings.

The combined office markets of the five Regional Centres would also present emissions savings on par with the North West and South East suburban markets – in the vicinity of 120 million kgCO₂ of base building emissions per year.

These estimates suggest that retrofitting schemes targeting the Metropolitan regions have just as much potential to reduce emissions as in the CBD. They also show the concentrated potential present in the Regional Centres for emissions savings. It should be noted that these findings are based on a theoretical understanding of the Victorian office market emissions – further detailed study is required to gather actual performance data in this area.

The Commercial Building Baseline Study, project managed by the Department of Climate Change and Energy Efficiency (DCCEE) and discussed further in the full version of The Next Wave, aims to provide actual figures for greenhouse gas emissions in the commercial building sector. As of February 2012, the data for the study had been sourced from a variety of datasets. At this stage the building stock and energy components were complete and are currently being integrated to form the overarching model. The report is on track to be delivered before the end of the 2011-12 financial year.
Figure 19 Theoretical Modelling of Typical Victorian Base Building Office Market Emissions

VICTORIAN OFFICE MARKET EMISSIONS

Regional Centre Office Market Emissions

Metropolitan Office Market Emissions

City of Melbourne

Greater Geelong

Greater Bendigo

Ballarat

Latrobe

Greater Shepparton

Regional Centres

Other Regional

Note: These are typical estimates of emissions for base building use only. Tenancy related emissions are not included here.
5.0 Retrofit Decision Making Process

The decision making process for undertaking an energy efficient retrofit on office buildings can be influenced by ownership type, the physical attributes of a property and the economic capacity for investment in the region.

5.1 Ownership Type

In Arup’s 1200 Buildings Segmentation Study for the City of Melbourne, various ownership groups were identified in the Melbourne CBD along with factors that influence their retrofit decision making process. Of these nine owner groups (described in section 3.2.4 of this summary paper), the majority of the NLA in the CoM belongs to three groups: Corporate (41.6%), Individual and Family Owned / Small Businesses and Investors (24.4%) and Owners Corporations (22.9%). Due to the nature of large corporations and their traditional preference for offices in a CBD location, it could be assumed that the proportion of buildings under corporate ownership would decrease significantly in suburban and regional areas with Individual and Family Owned / Small Businesses and Investors expected to be more prominent.

Figure 20 Total Number of C & D Grade Office Buildings Adapted 1998 to 2008 by Owner Type

Market research consultants, The Klein Partnership conducted interviews with various building owners and owners corporation managers about the 1200 Buildings Program to provide a greater understanding of their decision making processes. They divided respondents into two broad categories - Corporates and Non-Corporates as shown in Figure 21.

Figure 21 Building Ownership Types
From the interviews conducted, they found that the Corporates were often more engaged in sustainability and energy efficiency issues, whereas the Non-corporates were more driven by timing, including capital costs, asset management and reducing pay back periods\(^2\) (discussed further in the full version of *The Next Wave*). Corporates and Non Corporates also share a common interest in payback periods for new plant equipment. A Citigroup Global Markets report found that a ‘key argument for green office buildings is to ‘future-proof’ the portfolio,’\(^3\) however as the Klein Partnership pointed out, Corporates were more likely to ‘see the linkage between the sustainability of the building and future income, while Non-corporate were ‘less likely to sacrifice income for future cashflow.’

Several Non-corporate participants in the Klein Partnership study described the process for obtaining government grants as too onerous and said they ‘didn’t have the time’ to do it.\(^4\) These considerations are important to the lower grade building office market – particularly in the suburban regional areas of Victoria where anecdotal evidence would suggest owners are predominately Non-corporate. Non-corporate building owners in the Victorian office market could also be deterred by taxation or government incentives that do not cater to certain owner types – such as trusts.

### 5.2 Tenant Type / Structure

The nature of an office building’s tenant or tenants can also have a major impact on the retrofitting decision making process. In a study conducted by Sara Wilkinson from Deakin University on C and D Grade buildings that had undergone a retrofit (not necessarily an ESD upgrade) from 1998 to 2008 in the Melbourne CBD it was found that buildings with sole tenancies were more likely to have been retrofitted (see Figure 22).\(^5\)

**Figure 22** Number of C and D Grade office buildings adapted in Melbourne CBD 1998 to 2008

\[^5\] Wilkinson et al, ‘Delivering sustainability through the adaptive reuse of commercial buildings: the Melbourne CBD challenge, 2009.'
Although information on tenure length is currently not available (CoM began collecting this information in their 2010 survey), anecdotal evidence suggests that many tenants in lower grade buildings are either relatively longstanding (in lease terms not tenure) and there is inertia in the status quo and few imperatives for change. CLUE data for the CoM provides information on the number of different tenant types in each office building. Figure 23 shows the distribution of the number of tenants across the different PCA grades.

According to CLUE data, by number of buildings, sole tenancies are the most common tenant structure in the City of Melbourne and most of these are in D Grade buildings. This data indicates that the higher PCA grade buildings are less likely to have sole tenants. Combined, B and C Grade buildings represent a high proportion of office stock with a high number of tenants. These two grades represent 71% of buildings with greater than twenty tenants. In regard to the most common tenant structure by NLA, sole tenant buildings also represent the largest floor area (26%) followed closely by those with greater than twenty tenants (22%). As shown in Figure 24, Premium Grade buildings represent the largest area of buildings with greater than twenty tenants.

The number of tenants in a building can have a significant impact on the retrofit decision making process because ‘in existing multi-tenant commercial buildings, any sustainability retrofit or technology upgrade requires the cooperation and participation of a wide range of stakeholders (ie. owners, managers, occupants and contractors) who often must reside in the building during the potentially disruptive retrofitting process.’6 A higher number of occupants will only add to the number of stakeholders and increase the risk of dispute. This means that the retrofit process can take additional time while all stakeholders are consulted.

---

5.3 Property Attributes

The physical attributes of a property also influence the decision to adapt or retrofit a building. Wilkinson has conducted research on 978 retrofits in 197 C and D Grade buildings (indicating many retrofits occur across several floors in high rise buildings) in the Melbourne CBD from 1998 to 2008 to ascertain the typical characteristics of this stock. Figure 25 shows the property attributes that appear more often in building retrofits. These also point to some of the barriers, drivers and retrofitting opportunities associated with low grade buildings.

As shown in Figure 25, 72% of retrofits undertaken during the study period were on buildings with brick facades and envelopes, which is not surprising as Wilkinson points out that there is great potential to overclad brick facades and envelopes to improve thermal performance. However, she also comments that given the typically good condition of external envelopes, owners will need encouragement to undertake such works.¹

Figure 25 Attributes Present in C and D Grade Melbourne CBD Office Building Retrofits (1998-2008)

The presence of heritage listings or overlay issues also appears to have a major impact on the likelihood of whether a building owner decides to undertake a retrofit. Only 32% of C and D Grade buildings with these attributes undertook a retrofit during the study period (as seen in Figure 26). Heritage Overlays are in place to protect places of heritage significance to a locality. They are contained within local council planning schemes and assist in protecting the heritage of a municipality. Heritage Overlays include places of local significance as well as places included in the Victorian Heritage Register.

Due to the large percentage of buildings aged between 26 and 50 years undertaking a retrofit, the attributes of these buildings are also important. As shown in Figure 26 the most common attributes of buildings aged between 26 and 50 during this period is the absence of a heritage listing (80%), the building having multiple service core locations (76%) and having office as its sole use (60%).

**Figure 26** Attributes Present in C and D Grade Melbourne CBD Office Building Retrofits aged between 26 and 50 Years (1998-2008)

Regional office markets in particular have an older office building stock when compared to the CBD which means that although many of them may fall into the 26 to 50 year age group (at the time of renovation), they are also more likely to have heritage listings or overlay issues which could limit the retrofitting options for the building.
The maps shown in Figure 27 illustrate the prominence of these Heritage Overlay planning controls in the Regional Centres. Of these five Centres, a considerable proportion of the CBD in Bendigo, Ballarat and Geelong is subject to a Heritage Overlay, with Latrobe and Shepparton affected to a smaller extent (further maps are available in the full version of *The Next Wave*). Since these five regional municipalities account for approximately 53% of the total GFA of the regional office market, these planning controls alone could be having an effect on building owners decision making processes because they have a major impact on the retrofitting options available.

Some of these issues were highlighted during an attempt to refurbish an art deco heritage building at 99 Macquarie Street in Sydney with a more efficient and sustainable lighting system. Even though the refurbishment was ultimately successful, those involved commented that ‘retrofitting a heritage listed building such as this one can be complicated and detailed’ and ‘the project required a large amount of careful strategic integration with all services, the heritage architect and the heritage office.’\(^8\) Limitations in areas such as façade design, passive design, potential to alter walls and add insulation are other common impediments faced when attempting a retrofit on a heritage building. These obstacles constitute a significant deterrent to building owners contemplating a heritage building retrofit.

It should be noted that the retrofits conducted in Wilkinson’s study were not necessarily sustainable upgrades but since 73% were classified as extensive retrofits\(^9\) it shows the potential for policy makers to influence building owners to adopt more sustainable practices when undertaking major retrofits on commercial office buildings.

Building size will also have a major impact on the potential for energy efficient retrofits. The lower grade commercial office market is made up of a range of different sized buildings so it is important to understand some of the factors that may influence the decision making process. In the 1200 Buildings Segmentation Study, Arup identified three major design attributes that are considered to have a significant impact on potential emissions reductions and retrofit options:

- **Building Services** – the building services are influenced by the size of a building as it will have an impact on the type of HVAC systems in place, which in turn impacts on the potential improvements that retrofit may have.

- **Building height** – the larger the building the more floors it is likely to have so building height is an indicator of magnitude of lift energy. It also gives an indication on the influence of ground and ceiling

---


heat loads so roof insulation will have a much greater proportional energy reduction for smaller low-rise developments then high rise buildings.

- **Lighting** – In smaller buildings lighting and less power use make up a much greater portion of energy use. Furthermore, in smaller buildings there is likely to be less common area lighting.\(^{10}\)

These results from the 1200 Buildings Segmentation Study are also reinforced in a study conducted in Melbourne in 2010 of thirty office buildings that had recently undergone a ‘green refurbishment’\(^{11}\). The purpose of the study was to:

- Investigate and display the range and type of ESD refurbishment techniques.
- Report the energy efficiency results these refurbishments are achieving.
- Identify if different refurbishment techniques are used for different climatic conditions.
- Determine whether a ‘standard’ or ‘normal’ green refurbishment may be emerging.

![Figure 28 Areas of Improvements for Sustainable Upgrades in Melbourne CBD](http://www.prres.net/papers/Heywood_Normal_sustainability_upgrades_to_office_buildings.pdf)

Figure 28 shows the percentage of buildings from this sample that adopted particular upgrade techniques. Considering the potential for high emissions savings, it is not surprising that new HVAC systems were the most common area of improvement. Efficient lighting was another popular upgrade technique with 50% of the sample buildings choosing to adopt this.

The different building and property attributes identified in the 1200 Buildings Segmentation Study all influence the retrofit decision making process and if the decision is made to perform an energy efficient upgrade they can have a considerable impact on the types of upgrades an owner will choose in order to reduce energy emissions.

\(^{10}\) Arup, *City of Melbourne 1200 Buildings Segmentation Study*, 2009.

5.4 Retrofitting Cycles

Retrofitting cycles in low grade commercial office buildings can be influenced by a large range of factors. These factors can act as triggers for when property owners decide to undertake retrofits. In order to encourage sustainable building upgrades and retrofits it is important to target building owners who may already be considering a retrofit because of a building element reaching the end of its life cycle, economic factors (trying to minimise vacancies) and legislative requirements.

5.4.1 Building Elements

Different elements in a building each have their own life span and will require upgrades at different points of time. Some of these elements and their typical life cycle are shown in Table 4. These will also depend on other factors such the lease terms and operational life cycle management.

<table>
<thead>
<tr>
<th>Building Element</th>
<th>Typical Life Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior fit out (tenancy dependent)</td>
<td>5-10 years</td>
</tr>
<tr>
<td>Building services</td>
<td>20 years</td>
</tr>
<tr>
<td>Building envelope or skin</td>
<td>60 years</td>
</tr>
<tr>
<td>Structure</td>
<td>80-100 years</td>
</tr>
</tbody>
</table>

Source: Wilkinson et al 2009
6.0 ESD Planning and Upgrades

6.1 Overview

The improvement of the environmental performance of an existing office building, in particular lower grade buildings which generally are single building owners and possibly self managed, requires an understanding of the cycle or process. This ensures that an economical and environmentally sound improvement of the building can be achieved.

The term ‘cycle’ is referenced as an existing commercial office building will constantly evolve and its stakeholders will seek to improve the environmental performance of the building throughout its operational life.

This process, as shown in Figure 29, starts with education, planning and budget.

Once the plan and budget are established an understanding of the building’s current performance is necessary. This is achieved by gathering real time environmental data such as energy, water and waste. The collated data will aid the setting of environmental benchmarks.

Once the environmental benchmarks are set (including aspirational targets) Ecological Sustainable Design (ESD) initiatives can be evaluated to determine the optimum solution for your asset. At the completion of the upgrade works it is important that the performance of any upgrade is regularly monitored and the predicted environmental improvement in a building is validated against actual real time data.

This final phase will close the loop on the cycle of improving the environmental performance of an existing building, and will allow the building stakeholders to begin the process to seek further improvements of the building based on the knowledge gained through the experience of the first cycle.

Figure 29 Environmental Building Performance Improvement Process
6.2  Impact of Climate Across Victorian Regions

The focus of this report is state-wide analysis of B, C and D grade office building stock, therefore consideration of the impact of Victoria’s climatic regions on initiatives is crucial to tailoring targeted suites of initiatives (individual and integrated) that will result in improved return on investment. Climatic conditions impact on sustainable design, types of materials used and determine initiatives that would be amenable to a particular region.

Key recommendations include selective installation of grey and black water treatment plants depending on the amount of rainfall in a region and adopting passive design improvements to lower heat load in regions with above average temperatures. Each of these climate regions have been identified and assigned rankings to a family of initiatives. An integrated approach to targeting building owners should be a key consideration in addressing the impact of climate on retrofitting initiatives.

Figure 30  Mean Monthly Temperature (°C) Difference – Key Victoria Towns

Source: Bureau of Meteorology

Figure 31  Mean Monthly Rainfall – Key Victoria Towns

Source: Bureau of Meteorology

Details of each sustainability option by level of relevance for each climatic region is shown in the full version of *The Next Wave*. 
7.0 Recommendations

7.1 Market Data Insights

Several common attributes in the Victorian lower grade office market emerged from the market data analysed. This section identifies some of these common characteristics so that any future schemes or programs focusing on these types of buildings can be tailored appropriately for target markets and therefore achieve maximum return on resources or applied funding.

7.1.1 Construction Year

A clear trend emerging from the data was the large proportion of the lower grade office market constructed between 1960 and 1999. As shown in Figure 32, 70% of the total B, C and D Grade office NLA in the City of Melbourne was constructed during this period and 43% of the total number of buildings.

Figure 32 Distribution of Low Grade (not including Premium and A Grade) Office Buildings by Construction Year – City of Melbourne

![Figure 32 Distribution of Low Grade (not including Premium and A Grade) Office Buildings by Construction Year – City of Melbourne](chart.png)

Note: All buildings listed as Premium, A Grade, not graded or missing a construction date are not included. These represent 824 buildings with a combined NLA of 3,073,754m².

*104 buildings (118,105m² NLA) built in this period have not been given a PCA grade and 22 buildings (654,735m² NLA) are classified as A grade which explains the seemingly small number of buildings constructed during this period in the chart.

Source: Davis Langdon Research, City of Melbourne CLUE 2008

A similar trend in building age is evident in the metropolitan and regional office markets shown in Figure 33. In terms of office market GFA, 66% of metropolitan stock was constructed between 1960 and 1999 and 54% of regional office stock.
This data points to an opportunity to focus future retrofit schemes on these buildings constructed during 1960 and 1999. Also, since major retrofits are generally only required every 20 to 30 years (due predominately to the life cycle of services), these buildings represent an excellent opportunity to encourage the uptake of sustainable initiatives as part of their required retrofits in the near future.

As shown in Figure 32 and Figure 33, buildings constructed before 1960 represent a much smaller target group. Table 5 shows some of the attributes and examples of buildings constructed in the City of Melbourne during different time periods. Buildings constructed from the year 2000 onwards typically have higher standards in design of plant and equipment and the life expectancy of these components is yet to expire – therefore retrofits replacing this equipment would not be considered optimal.

Table 5  City of Melbourne Built Environment Evolution Summary

<table>
<thead>
<tr>
<th>Age of Building</th>
<th>Attributes</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1890</td>
<td>- Designed for natural ventilation</td>
<td>Parliament House, Treasury, Melbourne Town Hall and GPO</td>
</tr>
<tr>
<td></td>
<td>- Thick, solid, masonry walls</td>
<td></td>
</tr>
<tr>
<td>1890-1920</td>
<td>- Higher thermal mass</td>
<td>State Library, QV Hospital and Flinders Street Station</td>
</tr>
<tr>
<td></td>
<td>- Higher infiltration</td>
<td></td>
</tr>
<tr>
<td>1920-1930</td>
<td>- Lower rise</td>
<td>Capitol House, Myer, AMP House and Manchester Unity building</td>
</tr>
<tr>
<td></td>
<td>- Lower glass area</td>
<td></td>
</tr>
<tr>
<td>1930-1955</td>
<td>- More cellular in internal layout</td>
<td>RMIT Buildings 5, 6, and 7, Russell St Police Headquarters, Century Building, FAI Insurance Building, 412 Collins Street</td>
</tr>
<tr>
<td></td>
<td>- Lower occupancy density</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Retrofitted with refrigerant based or water based conditioning and heating system (fan coil units).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 40m height restriction introduced in the mid 1920s</td>
<td></td>
</tr>
<tr>
<td>1955-1980</td>
<td>- Standardised aluminium curtain walling begins to appear</td>
<td>Royal Insurance, BP House, ICI House, 369 Collins Place and BHP House</td>
</tr>
<tr>
<td></td>
<td>- Abolition of 40m height limit and the introduction of plot ratios</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Commercial buildings were sealed and the reliance on artificial climate and comfort control began</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Constant volume AC systems</td>
<td></td>
</tr>
<tr>
<td>1980-2000</td>
<td>- Improvements in glass performance and insulation</td>
<td>Rialto Towers, Melbourne Central Tower, Bourke Place and 101, 530 and 120 Collins Street</td>
</tr>
<tr>
<td></td>
<td>- Automatic controls</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- VAV systems</td>
<td></td>
</tr>
<tr>
<td>2000-</td>
<td>- BCA Section J</td>
<td>CH2, BHP Headquarters, Southern Cross Station</td>
</tr>
<tr>
<td></td>
<td>- ABGR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Green Star</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Climate Change</td>
<td></td>
</tr>
</tbody>
</table>

Source: Davis Langdon Research, Valuer General Victoria 2010
7.1.2 Building Size

The market data gathered shows that schemes targeting a minimum building size would cover a greater concentration of floor space. This is evident in the CoM lower grade building area highlighted as the ‘Target Market’ in Figure 34. In theory, such a scheme would also be simpler to administrate as it would involve fewer building owners.

As shown in Figure 34, in the B, C and D Grade building office market in the City of Melbourne, 82% of the total GFA is in buildings greater than 2,000m² NLA. Therefore it is recommended that in the City of Melbourne, these buildings are targeted first, and hopefully create a flow on effect to the smaller buildings, by creating increased awareness through exemplar projects.

Figure 34 Distribution of CoM Lower Grade Office Buildings by NLA Range

*Note: Buildings listed as Premium, A Grade and not graded are not included.

Source: Davis Langdon Research, City of Melbourne CLUE 2008

The metropolitan (not including the City of Melbourne) and regional office markets do not have as many buildings over 2,000m² in GFA. In order to adapt to these smaller office markets it is recommended that office buildings in metropolitan and regional areas that are larger than 500m² GFA form another target market for future government initiatives. As shown in Figure 35, in the metropolitan office market (not including the City of Melbourne), 60% of the total GFA and 10% of buildings have a GFA greater than 500m².

Figure 35 Distribution of Metropolitan (not including CoM) Office Buildings by GFA Range

* Buildings that do not have a designated floor area in the Valuer General Victoria database are included within the 0-99m² range. There are 75 buildings with no GFA specified.
The regional office market in Victoria is much more diverse in terms of building size than the CoM and Metropolitan markets. However, as shown in Figure 36, if all buildings with a GFA over 500m² were targeted they would represent 39% of the total regional office market GFA. The 100-199m² GFA buildings would also constitute a sizable proportion of the regional market’s GFA (22%).

Figure 36 Distribution of Regional Office Buildings by GFA Range

* Buildings that do not have a designated floor area in the Valuer General Victoria database are included within the 0-99m² range. Therefore this figure should be used with caution or excluded from decision making processes.

7.1.3 Regional Centres

The concentration of the Victorian regional office market into the top five Regional Centres is a significant finding in this report and should also be a focus for any initiative encouraging the upgrade of lower grade buildings. 60% of the regional office market GFA is located in the Regional Centres of Greater Geelong, Greater Bendigo, Greater Shepparton, Ballarat and Latrobe, which all have an office market over 50,000m² GFA.

Figure 37 Regional Office Market, including Municipalities with a GFA over 50,000m²

Source: Davis Langdon Research, Valuer General Victoria 2010
The dominance of these Regional Centres is represented in Figure 37 where these individual municipalities are represented separately. Although some of these other Victorian regions are comprised of up to eight different municipalities, these Regional Centre individual municipalities still exceed the size of any other region. Therefore, in an initiative aimed at upgrading lower grade buildings in regional Victoria, it is recommended that several (if not all) of these Regional Centres should be targeted. This should lead to a better return on investment from a more concentrated geographical area.

7.1.4 Heritage Buildings

Heritage buildings pose several challenges in building upgrades due to restrictions on implementing certain office building upgrades. As shown in Figure 25, of all the C and D Grade buildings that underwent an extensive retrofit between 1998 and 2008 in the Melbourne CBD, only 32% of them were in buildings with heritage listings or overlay issues12. Heritage buildings face limitations in areas such as façade design, passive design, potential to alter walls and add insulation.

Although it is difficult to estimate the total GFA of office buildings subject to heritage overlays, the planning map of the Melbourne CBD in Figure 38 indicates that there are a considerable number of areas subject to this overlay. As shown in the full version of The Next Wave there is also a high concentration of heritage overlays in Greater Geelong, Greater Bendigo and Ballarat. It is recommended that future schemes targeting these Regional Centres be sensitive to the heritage restrictions building owners may encounter in lower grade building retrofits.

Figure 38 Heritage Overlays (coloured pink) in the Melbourne CBD

Source: DPCD 2011

---

8.0 Maximising Returns on Government Investment

Future policies that target building retrofits should be tailored to specific building demographics and regions in order to achieve the maximum return on invested resources (administration) and allocated funds.

Victorian building owners enthusiastically embraced the Green Building Fund; in stream A, 52 Victorian projects successfully collected over $22 million in grant funding over the three rounds (out of the total $90 million). As detailed in the appendix list of approved projects (listed in the full version of *The Next Wave*), these were all located in the Melbourne CBD and inner metropolitan areas.

The average Green Building Fund grant per project was $423,000 (which must be matched dollar for dollar by the owner) which indicates, from an expenditure perspective, that the majority of projects were larger in terms of project scope and were most readily adopted in office buildings greater than 2,000m² NLA.

From a catchment perspective the Green Building Fund program meets the federal government’s mandatory disclosure objectives of targeting office buildings over 2,000m², which this report estimates will capture 690 office buildings across Victoria, most of which are concentrated in the Melbourne CBD and city fringe.

It is acknowledged that the federal government’s commercial building disclosure program excludes a significant portion of the office market. In order to achieve Sustainability Victoria’s objective of encouraging retrofits more broadly, if the threshold was lowered to 500m², the program would capture an additional 2,107 buildings across the state (see Figure 4). As seen in Figure 35, this lower threshold would ensure a large proportion of the metropolitan office market (60% of total GFA) would be included in this scheme.

State-wide incentive policies, smaller in scale to the Green Building Fund, could also be introduced to better enable retrofits.