

## *500 Collins Street, Melbourne, Victoria*

### *Building Profile*

<b>Building</b>	500 Collins Street, Melbourne, Victoria
<b>Construction date</b>	1970
<b>Refurbishment date</b>	2003 - 2011
<b>Owner</b>	Kador Group, Kamirice Pty Ltd
<b>Building Size</b>	25,500 m2 (NLA) / 28 Levels
<b>Refurbishment Team</b>	<ul style="list-style-type: none"> <li>- Peddle Thorp Architects</li> <li>- Sustainable Built Environments</li> <li>- Bovis Lend Lease</li> <li>- Robert Bird Consulting</li> <li>- Umow Lai &amp; Associates</li> <li>- Napier &amp; Blakeley/DCWC</li> </ul>
<b>Building Management</b>	Savills Australia
<b>Awards</b>	<ul style="list-style-type: none"> <li>- Winner – Australia Property Institute Excellence in Property Awards 2007 - Environmental Development Award</li> <li>- Finalist - Property Council of Australia Innovation &amp; Excellence Awards 2007 - Sustainable Award for Developments</li> </ul>
<b>Ratings</b>	5 Star Green Star Office Design v1

### *Overview*

500 Collins St in Melbourne is a high-profile retrofit that has resulted in significant energy efficiency improvements, good indoor environment quality, improved occupant satisfaction and perceived productivity gains. Energy efficient design elements are supported by excellent building management practices, including a 12-month commissioning process and quarterly review. An Energy Management Committee, representing key building stakeholders and energy performance contractors, meets monthly to evaluate energy consumption in the building. Additionally, detailed pre- and post-occupancy studies have been conducted with the assistance of two tenants, and these show high levels of occupant satisfaction and perceived productivity improvements. Furthermore, a comprehensive environmental management plan and building users' guide have been developed, providing new tenants with ESD guidelines for the design of interior fit-outs.

500 Collins St was constructed in the 1970s and has attracted high-profile tenancies for much of its history, but by 2002 it was classified as a low B-grade building due to factors such as its age and antiquated condition. As a result the building owner, Kador Group,

decided to commission a significant sustainable refurbishment with the aims of improving efficiency and repositioning the building as A-grade office space.<sup>1</sup>

Modelling of improvements to the base building's energy consumption estimated that it could achieve a 5 Star NABERS rating,<sup>2</sup> This equated to a 52.25 percent energy saving when compared to the energy used in a standard office building tenancy<sup>3</sup> and, if realised, would reduce energy bills by about \$15,000 a year. The refurbishment was undertaken in three stages to upgrade the building and its services, and these were:<sup>4</sup>

- Stage 1: refurbishment and replacement of plant and equipment, and renovation of the building façade
- Stage 2: refurbishment of retail space and the car park
- Stage 3: tenancy upgrades, undertaken progressively as existing leases expired.

## ***Design Elements***

### *Monitoring and Control Technology*

The refurbishment entailed a complete renewal of monitoring and control systems. Tenancy-level energy metering is now provided to all tenancies and is connected to the building's central Building Management System, which was completely renewed during the refurbishment. Additionally, a carbon dioxide monitoring and control system now monitors CO<sub>2</sub> levels and interfaces with the HVAC system to adjust ventilation rates based on demand.<sup>5</sup>

### *Lighting*

The refurbishment included energy efficient T5 lighting and high frequency ballasts for base building and tenancy areas.<sup>6</sup> Refurbishment of the lighting systems is estimated to result in a 50 per cent reduction in lighting energy consumption.<sup>7</sup> Average luminance levels of 370 lx were achieved throughout the building with a low lighting power density of approximately 2.8

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<sup>1</sup> City of Melbourne (2011) *1200 Buildings Case Studies: 500 Collins Street*, 1200 Buildings Program, online: [www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500\\_Collins\\_Street\\_29\\_7\\_11\\_pdf.pdf](http://www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500_Collins_Street_29_7_11_pdf.pdf), accessed 30/05/2012.

<sup>2</sup> GBCA (n.d.) *Case Study: 500 Collins Street*, Green Building Council Australia, online: [www.resourcesmart.vic.gov.au/documents/500\\_Collins\\_Appendix\\_3.pdf](http://www.resourcesmart.vic.gov.au/documents/500_Collins_Appendix_3.pdf), accessed 29/08/2012.

<sup>3</sup> Sustainability Victoria (n.d.) *Sustainability Victoria Case Study: 500 Collins St*, Sustainability Victoria, Resource Smart, online: [www.resourcesmart.vic.gov.au/documents/500collins\\_FINAL.pdf](http://www.resourcesmart.vic.gov.au/documents/500collins_FINAL.pdf), accessed 30/05/2012.

<sup>4</sup> City of Melbourne (2011) *1200 Buildings Case Studies: 500 Collins Street*, 1200 Buildings Program, online: [www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500\\_Collins\\_Street\\_29\\_7\\_11\\_pdf.pdf](http://www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500_Collins_Street_29_7_11_pdf.pdf), accessed 30/05/2012.

<sup>5</sup> GBCA (n.d.) *Green Star Project Directory: 500 Collins Street – Category Achievements*, Green Building Council Australia, online: [www.gbca.org.au/project-directory.asp#32](http://www.gbca.org.au/project-directory.asp#32), accessed 29/08/2012.

<sup>6</sup> GBCA (n.d.) *Case Study: 500 Collins Street*, Green Building Council Australia, online: [www.resourcesmart.vic.gov.au/documents/500\\_Collins\\_Appendix\\_3.pdf](http://www.resourcesmart.vic.gov.au/documents/500_Collins_Appendix_3.pdf), accessed 29/08/2012.

<sup>7</sup> City of Melbourne (2011) *1200 Buildings Case Studies: 500 Collins Street*, 1200 Buildings Program, online: [www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500\\_Collins\\_Street\\_29\\_7\\_11\\_pdf.pdf](http://www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500_Collins_Street_29_7_11_pdf.pdf), accessed 30/05/2012.

W/m<sup>2</sup> per 100 lx.<sup>8</sup> The system also facilitates the installation of photosensors in perimeter areas during tenancy fit outs in order to further reduce maintained lighting levels.<sup>9</sup>

### *Heating, Ventilation and Air Conditioning*

Upgrades to the building HVAC system entailed new energy efficient chillers with variable speed drives, cooling tower upgrades, and installation of gas-fired boilers. A combined cooling system was installed, employing passive chilled beams in interior zones and active chilled beams assisted by fans in perimeter zones.<sup>10</sup> The chilled beam system is estimated to use approximately 30 per cent less energy than a conventional system.<sup>11</sup>

Fresh air is provided through ducts to each floor of the building at a level 50 percent above that required by Australian Standards.<sup>12</sup> Chilled-beam air conditioning systems are designed to use less energy than traditional HVAC systems and deliver improved comfort through reduced drafts.<sup>13</sup> Installation of the chilled beam system required pressure testing to analyse building envelope airtightness, as moisture problems and suboptimal performance can result from poor airtightness.

### *Other Plant and Equipment*

An array of thirty solar hot water panels for heating domestic hot water meet 25 percent of hot water demand, reducing energy consumption for hot water by an estimated 15 per cent.<sup>14</sup> Waterless urinals, flow restricting devices on all fixtures, and 3/6 litre dual flush cisterns have been installed to improve water efficiency. To further improve this, spray baffles were fitted on the cooling towers in order to prevent aerosol.<sup>15</sup> Additionally, rainwater and condensate are captured in large basement tanks and used for landscape irrigation. Variable speed drives were installed on all major plant and equipment and lift controls were upgraded to solid-state controls.<sup>16</sup>

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<sup>8</sup> DEWHA (2009) *ESD Operations Guide: for owners, managers and tenants*, Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia, online: [www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf](http://www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf), p 72, accessed 29/08/2012.

<sup>9</sup> DEWHA (2009) *ESD Operations Guide: for owners, managers and tenants*, Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia, online: [www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf](http://www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf), p 72, accessed 29/08/2012.

<sup>10</sup> City of Melbourne (2011) *1200 Buildings Case Studies: 500 Collins Street*, 1200 Buildings Program, online: [www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500\\_Collins\\_Street\\_29\\_7\\_11\\_pdf.pdf](http://www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500_Collins_Street_29_7_11_pdf.pdf), accessed 30/05/2012.

<sup>11</sup> Sustainability Victoria (n.d.) *Sustainability Victoria Case Study: 500 Collins St*, Sustainability Victoria, Resource Smart, online: [www.resourcesmart.vic.gov.au/documents/500collins\\_FINAL.pdf](http://www.resourcesmart.vic.gov.au/documents/500collins_FINAL.pdf), accessed 30/05/2012.

<sup>12</sup> Sustainability Victoria (n.d.) *Sustainability Victoria Case Study: 500 Collins St*, Sustainability Victoria, Resource Smart, online: [www.resourcesmart.vic.gov.au/documents/500collins\\_FINAL.pdf](http://www.resourcesmart.vic.gov.au/documents/500collins_FINAL.pdf), accessed 30/05/2012.

<sup>13</sup> Sustainability Victoria (2012) *500 Collins Street Case Study*, Sustainability Victoria, Government of Victoria, online: [www.resourcesmart.vic.gov.au/for\\_businesses\\_3661.html](http://www.resourcesmart.vic.gov.au/for_businesses_3661.html), accessed 30/05/2012.

<sup>14</sup> City of Melbourne (2011) *1200 Buildings Case Studies: 500 Collins Street*, 1200 Buildings Program, online: [www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500\\_Collins\\_Street\\_29\\_7\\_11\\_pdf.pdf](http://www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500_Collins_Street_29_7_11_pdf.pdf), accessed 30/05/2012.

<sup>15</sup> City of Melbourne (2011) *1200 Buildings Case Studies: 500 Collins Street*, 1200 Buildings Program, online: [www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500\\_Collins\\_Street\\_29\\_7\\_11\\_pdf.pdf](http://www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500_Collins_Street_29_7_11_pdf.pdf), accessed 30/05/2012.

<sup>16</sup> 500 Collins (n.d.) *The Path to Renewal*, 500 Collin St, Melbourne, online: <http://500collins.com.au/about/renewal/>

## ***Building Management***

### ***Commissioning and Tuning***

A commissioning engineering review was undertaken early in the refurbishment process to identify key issues and guide the commissioning process.<sup>17</sup> Following this, a 12-month commissioning building tuning period was instigated, supported by a quarterly review and final re-commissioning after 12 months of operation.<sup>18</sup> An independent commissioning agent (ICA) was appointed to work throughout the construction stage and beyond project completion to ensure optimal building performance.<sup>19</sup> Additionally, the Building Operations Manager was included in commissioning meetings from an early stage to ensure good knowledge transfer and a thorough understanding of building systems. The commissioning process also included pre-commissioning of the chilled beams prior to installation in order to adjust them for maximum operational performance.<sup>20</sup> Monitoring and control systems were commissioned on an ongoing basis as each new floor was refurbished.<sup>21</sup>

### ***Monitoring and Reporting***

Energy metering was installed for tenancies to allow accurate monitoring of energy consumption by each tenancy. This energy data is recorded by the Building Management System and is used in the building energy management plan.<sup>22</sup>

### ***Maintenance and Cleaning***

The refurbishment resulted in reduced maintenance costs due to a number of factors, including:<sup>23</sup>

- reduced plant and equipment
- energy efficient plant and equipment
- improved monitoring.

Good cleaning practices contribute to improved indoor environment quality. Daily cleaning services for common areas are coordinated by the operations managers and inspected

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<sup>17</sup> DEWHA (2009) *ESD Operations Guide: for owners, managers and tenants*, Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia, online: [www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf](http://www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf), p 72, accessed 29/08/2012.

<sup>18</sup> GBCA (n.d.) *Case Study: 500 Collins Street*, Green Building Council Australia, online: [www.resourcesmart.vic.gov.au/documents/500\\_Collins\\_Appendix\\_3.pdf](http://www.resourcesmart.vic.gov.au/documents/500_Collins_Appendix_3.pdf), accessed 29/08/2012.

<sup>19</sup> City of Melbourne (2011) *1200 Buildings Case Studies: 500 Collins Street*, 1200 Buildings Program, online: [www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500\\_Collins\\_Street\\_29\\_7\\_11\\_pdf.pdf](http://www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500_Collins_Street_29_7_11_pdf.pdf), accessed 30/05/2012.

<sup>20</sup> DEWHA (2009) *ESD Operations Guide: for owners, managers and tenants*, Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia, online: [www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf](http://www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf), p 72, accessed 29/08/2012.

<sup>21</sup> City of Melbourne (2011) *1200 Buildings Case Studies: 500 Collins Street*, 1200 Buildings Program, online: [www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500\\_Collins\\_Street\\_29\\_7\\_11\\_pdf.pdf](http://www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500_Collins_Street_29_7_11_pdf.pdf), accessed 30/05/2012.

<sup>22</sup> DEWHA (2009) *ESD Operations Guide: for owners, managers and tenants*, Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia, online: [www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf](http://www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf), p 72, accessed 29/08/2012.

<sup>23</sup> City of Melbourne (2011) *1200 Buildings Case Studies: 500 Collins Street*, 1200 Buildings Program, online: [www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500\\_Collins\\_Street\\_29\\_7\\_11\\_pdf.pdf](http://www.melbourne.vic.gov.au/1200buildings/CaseStudies/Documents/500_Collins_Street_29_7_11_pdf.pdf), accessed 30/05/2012.

fortnightly.<sup>24</sup> Cleaning contractors use ‘environmentally friendly’ products in order to avoid negative impacts on health as well as on the environment.<sup>25</sup> This contributes to improved indoor air quality and reduces occupant exposure to chemical compounds. Additionally, a cleaner is onsite daily during office hours, which helps to reduce energy consumption from after-hours light and power usage.

### *Management Personnel, Communication and Education*

A key component of the successful refurbishment has been the services of a full-time on-site Operations Manager, who has been associated with the building for over 30 years.<sup>26</sup> The experience of the Operations Manager has proved invaluable in coordinating the multi-stage project with minimal disruption to tenants. He was involved in the planning, design, and construction meetings for the project, as well as in the implementation of new technologies to upgrade the building to a 5 Star Green Star rating.

## **Agreements and Culture**

### *Organisational Culture*

There has been a commitment to sustainability from the board of directors of Kador Group down to the contractors employed for the refurbishment works.<sup>27</sup> A number of environmental initiatives implemented by the building owners and management help encourage awareness of environmental issues and promote more sustainable behaviour. For example, the number of car parking spaces has been reduced as a part of the building refurbishment, while parking for small cars and motorbikes has been introduced. The building provides secure bicycle storage and other ‘end of trip’ facilities for cyclists, such as change rooms, showers and lockers.<sup>28</sup> Additionally, a comprehensive environmental management plan has been developed.

### *Communication and Education*

Communication and education material was prepared to provide occupants with information about the building. A Building Users’ Guide provides them with information about the building’s features and contains ESD guidelines for the design of tenancy fit-outs. These guidelines are not mandatory, but adherence is encouraged.

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<sup>24</sup> 500 Collins St (n.d.) *500 Collins St: Amenities and Services*, online: <http://500collins.com.au/about/amenities/>, accessed 29/08/2012.

<sup>25</sup> DEWHA (2009) *ESD Operations Guide: for owners, managers and tenants*, Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia, online: [www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf](http://www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf), p 72, accessed 29/08/2012.

<sup>26</sup> Sustainability Victoria (n.d.) *Sustainability Victoria Case Study: 500 Collins St*, Sustainability Victoria, Resource Smart, online: [www.resourcesmart.vic.gov.au/documents/500collins\\_FINAL.pdf](http://www.resourcesmart.vic.gov.au/documents/500collins_FINAL.pdf), accessed 30/05/2012.

<sup>27</sup> Sustainability Victoria (n.d.) *Sustainability Victoria Case Study: 500 Collins St*, Sustainability Victoria, Resource Smart, online: [www.resourcesmart.vic.gov.au/documents/500collins\\_FINAL.pdf](http://www.resourcesmart.vic.gov.au/documents/500collins_FINAL.pdf), accessed 30/05/2012.

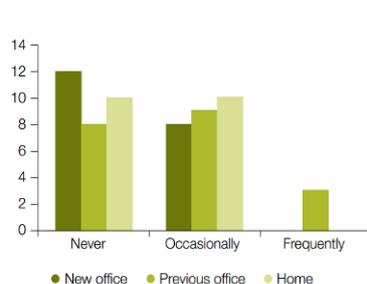
<sup>28</sup> DEWHA (2009) *ESD Operations Guide: for owners, managers and tenants*, Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia, online: [www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf](http://www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf), p 72, accessed 29/08/2012.

## Occupant Experience

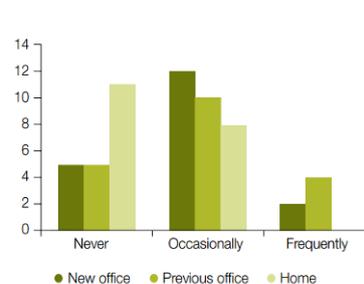
After the refurbishment of 500 Collins Street, a post-refurbishment evaluation study of two tenancies was conducted to determine the impacts of the office environment on occupant health and productivity. The study was commissioned by Sustainability Victoria and the Kador Group and conducted by an independent firm. It involved the examination of sick leave records, lawyers' billable hours and secretary typing analysis.<sup>29</sup> The outcomes revealed some improvements in both individual and overall organisational performance. The table below shows the prevalence of perceived health and well-being indicators for the two tenancies following the refurbishment.<sup>30</sup> Figure 1 shows a comparison of perceived well-being indicators in the office building compared to occupants' homes.

**Table 1: Perceived health and well-being indicators**

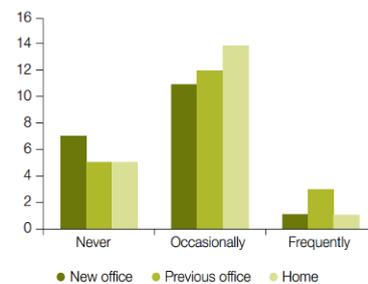
IEQ-related symptoms	Tenant 1 (Oakley Thompson)	Tenant 2 (Lonsec)
Cold and Flu	21% decrease	24% decrease
Fatigue	26% decrease	16% decrease
Poor Concentration	20% decrease	5% decrease
Headache	7% decrease	20% decrease
Sore eyes	25% increase	8% decrease



**Figure 19 – Frequency of headaches in the office or at home**  
(Source: Bevege, 2006)



**Figure 20 – Frequency of poor concentration in the office and at home**  
(Source: Bevege, 2006)



**Figure 21 – Frequency of cold and flu in the office and at home**  
(Source: Bevege, 2006)

**Figure 1: Comparison of well-being and productivity in office and at home<sup>31</sup>**

<sup>29</sup> Sustainability Victoria (n.d.) *Employee Productivity in a Sustainable Building, Pre- and Post-Occupancy Studies in 500 Collins Street*, online: [www.resourcesmart.vic.gov.au/documents/500\\_Collins\\_Productivity\\_Study.pdf](http://www.resourcesmart.vic.gov.au/documents/500_Collins_Productivity_Study.pdf), accessed 29/8/2012.

<sup>30</sup> Sustainability Victoria (2012) *500 Collins Street Case Study*, Sustainability Victoria, Government of Victoria, online: [www.resourcesmart.vic.gov.au/for\\_businesses\\_3661.html](http://www.resourcesmart.vic.gov.au/for_businesses_3661.html), accessed 30/05/2012.

<sup>31</sup> DEWHA (2009) *ESD Operations Guide: for owners, managers and tenants*, Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia, online: [www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf](http://www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf), p 72, accessed 29/08/2012.

Staff surveys of employee productivity in 500 Collins Street pre- and post-refurbishment reveal the following.<sup>32</sup> As indicated in Figure 2, when staff were asked to rate air quality within a range from ‘stuffy’ to ‘fresh’, the results showed a dramatic improvement in staff perceptions of air quality in the refurbished office. Based on this response, the fresh air index improved from –10 before the refurbishment to +9 after it (Figure 3).

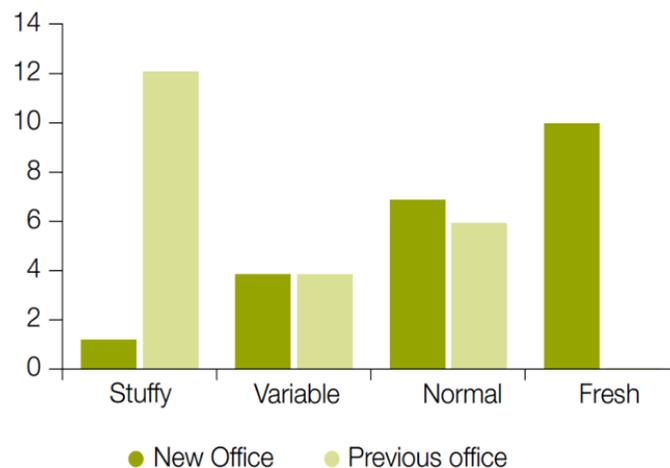


Figure 2: Occupant responses for perceived air quality before and after refurbishment<sup>33</sup>

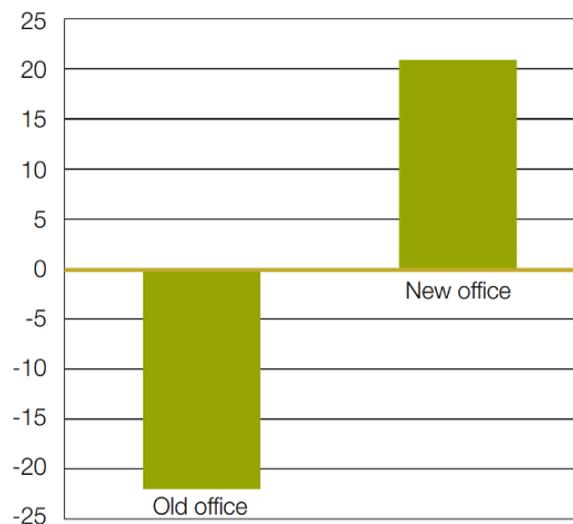


Figure 3: Fresh air index in the office space before and after refurbishment<sup>34</sup>

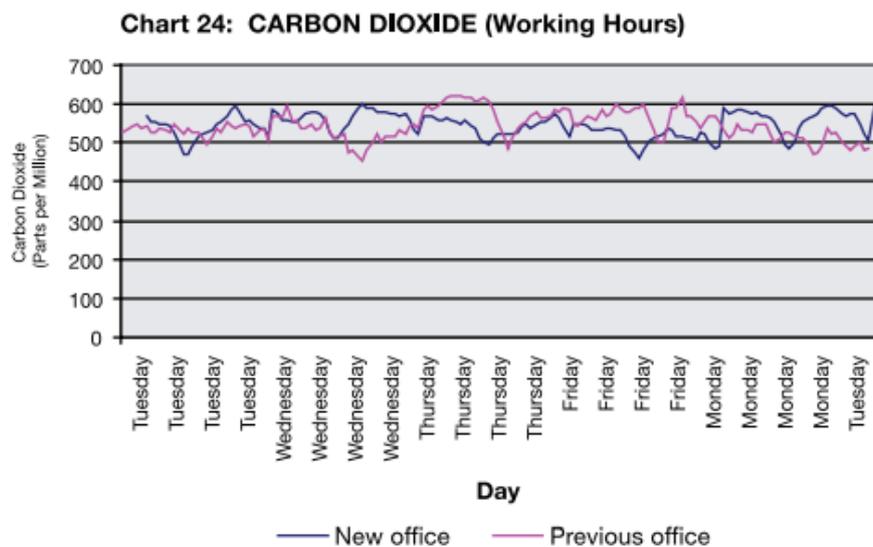
<sup>32</sup> Sustainability Victoria (n.d.) *Employee Productivity in a Sustainable Building, Pre- and Post-Occupancy Studies in 500 Collins Street*, online: [www.resourcesmart.vic.gov.au/documents/500\\_Collins\\_Productivity\\_Study.pdf](http://www.resourcesmart.vic.gov.au/documents/500_Collins_Productivity_Study.pdf), accessed 29/8/2012.

<sup>33</sup> DEWHA (2009) *ESD Operations Guide: for owners, managers and tenants*, Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia, online: [www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf](http://www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf), p 72, accessed 29/08/2012.

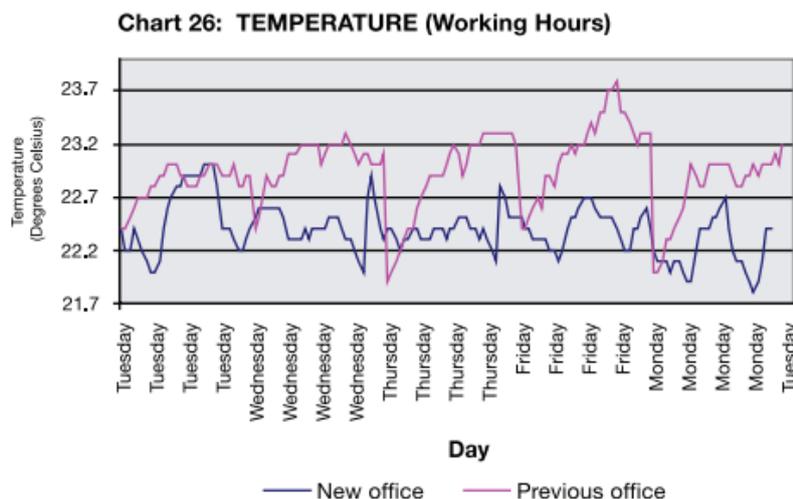
<sup>34</sup> DEWHA (2009) *ESD Operations Guide: for owners, managers and tenants*, Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia, online: [www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf](http://www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf), p 72, accessed 29/08/2012.

### Indoor Environment Quality

Indoor environment quality analysis was performed in the building pre- and post-refurbishment, including sampling of key IEQ parameters such as carbon dioxide, carbon monoxide, temperature and humidity.<sup>35</sup> Carbon dioxide measurements show that levels were low in both the pre- and post-retrofit offices, showing no statistically significant difference between the two.<sup>36</sup>



Likewise, recorded temperature and humidity levels were within acceptable limits in both the pre- and post-retrofit offices.<sup>37</sup>

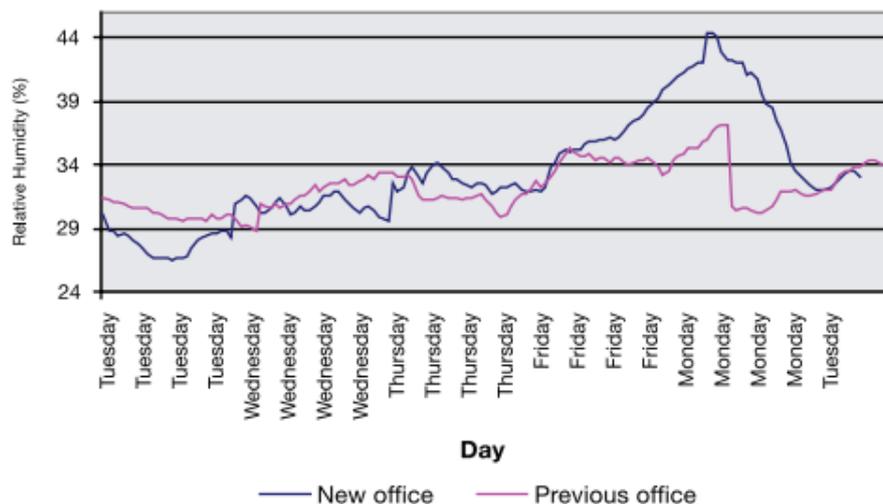


<sup>35</sup> Sustainability Victoria (n.d.) *Employee Productivity in a Sustainable Building, Pre- and Post-Occupancy Studies in 500 Collins Street*, online: [www.resourcesmart.vic.gov.au/documents/500\\_Collins\\_Productivity\\_Study.pdf](http://www.resourcesmart.vic.gov.au/documents/500_Collins_Productivity_Study.pdf), accessed 29/8/2012.

<sup>36</sup> Sustainability Victoria (n.d.) *Employee Productivity in a Sustainable Building, Pre- and Post-Occupancy Studies in 500 Collins Street*, online: [www.resourcesmart.vic.gov.au/documents/500\\_Collins\\_Productivity\\_Study.pdf](http://www.resourcesmart.vic.gov.au/documents/500_Collins_Productivity_Study.pdf), accessed 29/8/2012.

<sup>37</sup> Sustainability Victoria (n.d.) *Employee Productivity in a Sustainable Building, Pre- and Post-Occupancy Studies in 500 Collins Street*, online: [www.resourcesmart.vic.gov.au/documents/500\\_Collins\\_Productivity\\_Study.pdf](http://www.resourcesmart.vic.gov.au/documents/500_Collins_Productivity_Study.pdf), accessed 29/8/2012.

**Chart 34: RELATIVE HUMIDITY (Working Hours)**



### ***Performance Nexus Summary***

*Key lessons to inform the Performance Nexus concept:*

- Good building management practices have contributed to the improved performance of the building, including a 12-month commissioning period supported by quarterly review and final re-commissioning after 12 months of operation.
- A key component of the successful refurbishment has been the services of a full-time on-site Operations Manager, who has a long association with the building.<sup>38</sup> The Operations Manager was involved in the planning, design, and construction meetings of the project as well as the implementation of new technologies to upgrade the building to a 5 Star Green Star rating.
- Concurrent Occupant Surveys and Indoor Environment Quality analysis allow for comparison of results and indicate that the building performs at a high standard.
- A comprehensive environmental management plan and a building users' guide contribute to occupant satisfaction. The building users' guide was designed to assist tenants in maximising the benefits of the building's infrastructure, and it also provides new tenants with ESD guidelines for the design of their interior fit-outs.

### **Acknowledgements:**

Egan Smith, Savills Australia

<sup>38</sup> Sustainability Victoria (n.d.) *Sustainability Victoria Case Study: 500 Collins St*, Sustainability Victoria, Resource Smart, online: [www.resourcesmart.vic.gov.au/documents/500collins\\_FINAL.pdf](http://www.resourcesmart.vic.gov.au/documents/500collins_FINAL.pdf), accessed 30/05/2012.