

## 250 St Georges Tce, Perth, WA (QV1)

### Building Profile

<b>Building</b>	QV.1, 250 St Georges Terrace, Perth, WA
<b>Construction date</b>	1991
<b>Refurbishment date</b>	N/A
<b>Owner</b>	Investa Property Group Commonwealth Superannuation Corporation
<b>Building Size</b>	60,500 m <sup>2</sup> / 43 Storeys
<b>Refurbishment Team</b>	N/A
<b>Building Management</b>	CB Richard Ellis
<b>Awards</b>	<ul style="list-style-type: none"> <li>• Winner - MBA National Energy Efficiency Award for Commercial Buildings in Australia, 1999</li> <li>• Winner - Energy Efficiency Award in Commercial Buildings WA Government Office of Energy, 1997</li> <li>• Winner - Best Design for a Commercial Building, Royal Australian Institute of Architects, 1992</li> </ul>
<b>Ratings</b>	<ul style="list-style-type: none"> <li>• 5.0 Star NABERS Energy (Base Building) (excl. GreenPower)</li> <li>• 5.0 Star NABERS IEQ (Base Building)</li> </ul>

### Overview

The QV.1 Building in Perth is a 43-storey office tower constructed in 1991. The building owners have implemented a long-term indoor air quality (IAQ) management program focused on continual monitoring and improvement that has helped secure a 5 Star NABERS IE Rating. This case study highlights the benefits of creating strong links between IEQ assessment, tenant agreements and good building management practices, resulting in a high performance building.

The IAQ Management Program consists of periodic air quality assessment as well as physical inspection of HVAC plant and equipment, which helps to identify potential problems and facilitates the analysis of trends in performance over time.<sup>1</sup> Good building management practices ensure these results are used to improve maintenance and operation practices, and to guide preventive measures such as regular coil cleaning, filtration replacement, damper adjustment and cleaning practices.<sup>2</sup> This helps to improve both energy efficiency and occupant health.

Long-term carbon dioxide measurements across all floors, in combination with assessment of HVAC system operation, have also allowed building management to fine-tune outside air

<sup>1</sup> Scholz, J. (2012) *Personal Communication*, Joseph Scholz, Environmental Services Director, QED Environmental Services, 18/09/2012.

<sup>2</sup> Scholz, J. (2012) *Linking Theory to Practice – 15 Year Indoor Air Quality Management Programme for an Australian Commercial Office Building*, Proceedings of the 10th International Healthy Buildings Conference, 8-12 July 2012, Brisbane, Australia.

supply to ensure consistently lower median and peak carbon dioxide concentrations throughout the building; equivalent to a 150 per cent improvement on Australian Standard 1668.<sup>3</sup>

Additionally, tenancy fit-out guidelines specify that testing must be undertaken before and after any fit-out works to prevent negative impacts on air quality. These ensure that tenants and contractors are made aware of their individual IEQ responsibilities. A Green Committee, comprising building management staff and sustainability representatives from tenant organisations, keeps occupants informed of energy and IEQ performance and provides a forum to collaborate on future initiatives.

## ***Design Elements***

### *Monitoring and Control Technology*

Extensive energy metering is installed throughout the building, providing a high level of monitoring capability for tenancies and key building systems. Base building services are sub-metered on each floor and an on-line interface logs energy consumption at 30 minute intervals. The building is also currently undergoing an upgrade to smart-meters to facilitate real-time monitoring.

The QV.1 building has an advanced Building Management System that interfaces with a number of building systems and services. The original Building Management System is in the process of a major upgrade to a new Johnson Controls BMS.<sup>4</sup> The upgraded system will include a tenant portal, providing tenants with the ability to monitor and generate reports on energy consumption. It will also serve as an interface to control some building systems, such as after-hours HVAC operation.

### *Lighting*

The lighting system has been significantly renovated to replace old energy intensive components. Base building lighting includes T5 lighting with voltage reduction in car parks, and LED lamps for common area emergency exit signage.<sup>5</sup> Rooftop, plantroom, elevator, plaza and lobby-area lighting has also been upgraded to fluorescent lamps.<sup>6</sup> Tenancy lighting systems include C-Bus lighting systems and photosensors to facilitate advanced control of tenancy lighting.<sup>7</sup> Recessed fluorescent fittings with open parabolic lens diffuser deliver 500 lx intensity in open plan areas.<sup>8</sup>

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<sup>3</sup> Scholz, J. (2012) *Linking Theory to Practice – 15 Year Indoor Air Quality Management Programme for an Australian Commercial Office Building*, Proceedings of the 10th International Healthy Buildings Conference, 8-12 July 2012, Brisbane, Australia.

<sup>4</sup> D'Alessandro, J. (2012) *Personal Communication*, Joe D'Alessandro, Building Services Manager, CBRE, 21/09/2012.

<sup>5</sup> Investa Property Group (2008) *Sustainability Fact Sheet - QV1 250 St George's Terrace*, Investa Property Group, online: [www.qv1perth.com/Core/SiteDownloadFiles/77/4eaa5136fd594a66ac58.pdf](http://www.qv1perth.com/Core/SiteDownloadFiles/77/4eaa5136fd594a66ac58.pdf), accessed 29/08/2012.

<sup>6</sup> D'Alessandro, J. (2012) *Personal Communication*, Joe D'Alessandro, Building Services Manager, CBRE, 21/09/2012.

<sup>7</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>8</sup> QV.1 (n.d.) *Building Features*, QV.1 Building Website, online: [www.qv1perth.com.au/Core/Content/Features/Content933.aspx](http://www.qv1perth.com.au/Core/Content/Features/Content933.aspx), accessed 29/08/2012.

### *Heating, Ventilation and Air Conditioning<sup>9,10</sup>*

The QV.1 building HVAC system comprises a variable primary flow chilled water system with three 2.2 MW centrifugal chillers and a 1.5 MW Powerpax light load chiller. Each floor is zoned to improve system performance with 33-35 VAV air handling units per floor configured in perimeter, intermediate, and interior zones. Four BAC counter-flow cooling towers with energy efficient components provide central services in addition to supplementary systems in tenancy areas where required. Additional energy efficiency initiatives include:<sup>11</sup>

- an outside air economy cycle used for a significant portion of the year due to frequent favorable conditions
- a condenser water rest strategy
- variable speed drives to control major plant pumps, fans and motors
- upgraded VAV controls
- replacement of all economy dampers
- upgraded water treatment controllers to improve cycles
- upgraded chiller controls.

An ongoing energy efficiency upgrade strategy identifies opportunities for energy efficient upgrades and has resulted in continually improved building performance.

### *Other Plant and Equipment*

Energy efficient upgrades to other building plant and equipment have increased energy efficiency. Key initiatives completed include:<sup>12</sup>

- increased capacity of Power Factor Correction and Harmonic Filtration components
- provision of access to interconnecting stairs for multi-floor tenants after approval from management, providing the option to reduce elevator energy consumption
- variable speed drives installed in mechanical services, water pumps and main toilet exhaust fans.

### *Building Fabric*

The building's facade was designed by Harry Seidler to control solar gain, and has therefore had little need for upgrades. Its key features include:

- efficient glazing – double glazed and tinted outer glass
- external shading – vertical and horizontal external shading to control heat gain

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<sup>9</sup> Investa Property Group (2008) *Sustainability Fact Sheet - QV1 250 St George's Terrace*, Investa Property Group, online: [www.qv1perth.com/Core/SiteDownloadFiles/77/4eaa5136fd594a66ac58.pdf](http://www.qv1perth.com/Core/SiteDownloadFiles/77/4eaa5136fd594a66ac58.pdf), accessed 29/08/2012

<sup>10</sup> D'Alessandro, J. (2012) *Personal Communication*, Joe D'Alessandro, Building Services Manager, CBRE, 21/09/2012.

<sup>11</sup> D'Alessandro, J. (2012) *Personal Communication*, Joe D'Alessandro, Building Services Manager, CBRE, 21/09/2012.

<sup>12</sup> D'Alessandro, J. (2012) *Personal Communication*, Joe D'Alessandro, Building Services Manager, CBRE, 21/09/2012.

- orientation – longer south-east and south-west facing facades to reduce heat load from the sun.

### ***Indoor Environment Quality***

A long-term indoor air quality management program has been conducted by the building owners since 1997 to help deliver a high quality environment for occupants.<sup>13</sup> The program consists of periodic air quality assessment as well as physical inspection of HVAC plant and equipment, which helps to identify potential problems and facilitates the analysis of trends in performance over time.<sup>14</sup> Quarterly audits are conducted to monitor key IEQ parameters throughout the building, including:<sup>15</sup>

- temperature
- relative humidity
- air velocity
- carbon dioxide
- carbon monoxide
- particulates (PM<sub>10</sub>)
- formaldehyde
- volatile organic compounds
- airborne microbials.

A 4.5 Star NABERS Indoor Environment Base Building Rating was achieved in 2010, indicating very high indoor environment quality across the NABERS Indoor Environment categories (see Table 1).

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<sup>13</sup> Scholz J (2011) *NABERS Indoor Environment Rating – Case Study for QV.1 Tower*, Pre-Loved Buildings Conference 2011, May 23-24, Perth, Australia, online: [www.airah.org.au/imis15\\_prod/Content\\_Files/Conferences/Joseph\\_scholz.pdf](http://www.airah.org.au/imis15_prod/Content_Files/Conferences/Joseph_scholz.pdf), accessed 29/08/2012.

<sup>14</sup> Scholz, J. (2012) *Personal Communication*, Joseph Scholz, Environmental Services Director, QED Environmental Services, 18/09/2012.

<sup>15</sup> Scholz, J. (2012) *Linking Theory to Practice – 15 Year Indoor Air Quality Management Programme for an Australian Commercial Office Building*, Proceedings of the 10th International Healthy Buildings Conference, 8-12 July 2012, Brisbane, Australia.

Table 1: QV.1 NABERS IE Results (Base Building), 2010<sup>16</sup>

RATING INPUTS		DATA COLLECTED	
Category	POINTS		Median Value units
Thermal Comfort	7/15	TEMP – Temperature	22.8 degC
		RH – Relative Humidity	40.2 %
		Air Velocity	0.04 m/s
Air Quality	15/15	PM <sub>10</sub> – particulates	4 µg/m <sup>3</sup>
		CO – carbon monoxide	<0.1 ppm
		CO (OA) – carbon monoxide	<0.1 ppm
		CO <sub>2</sub> - carbon dioxide	575 ppm
		CO <sub>2</sub> (OA) - carbon dioxide	357 ppm
		Microbials	300 cfu/m <sup>3</sup>
		Microbials (OA)	900 cfu/m <sup>3</sup>
Acoustic Comfort	15/15	Acoustics	35 dB
<b>NABERS IE Rating</b>		4.5 Stars	

Performance has improved further since 2010, with the building achieving a 5.0 Star NABERS Indoor Environment Rating (Base Building) in 2012.<sup>17</sup> A number of initiatives contributed to the performance improvements, including the addition of continuous temperature monitoring through the Building Management System in accordance with the NABERS protocol. This enables more accurate determination of thermal comfort conditions throughout the year.

## ***Building Management***

### *Operation and Management Practices*

Good building management practices have contributed to improved energy efficiency and indoor environment quality. A number of initiatives have been implemented, including:<sup>18</sup>

- automated monitoring and controlling building energy and water use at a frequency that ensures faults causing excessive consumption are detected and rectified promptly
- good knowledge management processes to ensure transfer of knowledge and information
- maintenance procedures that follow relevant Australian Standards and are guided by industry best practice

<sup>16</sup> Scholz J (2011) *NABERS Indoor Environment Rating – Case Study for QV.1 Tower*, Pre-Loved Buildings Conference 2011, May 23-24, Perth, Australia, online: [www.airah.org.au/imis15\\_prod/Content\\_Files/Conferences/Joseph\\_scholz.pdf](http://www.airah.org.au/imis15_prod/Content_Files/Conferences/Joseph_scholz.pdf), accessed 29/08/2012.

<sup>17</sup> NABERS (2012) NABERS Rating: QV.1 250 St Georges Tce.

<sup>18</sup> D'Alessandro, J. (2012) *Personal Communication*, Joe D'Alessandro, Building Services Manager, CBRE, 21/09/2012.

- improved economiser strategy to provide greater control of the system for improved energy efficiency and occupant comfort.

### *Reporting and Evaluation*

Reports from the IAQ Management Program are used to improve maintenance and operation practices. Reports are presented to the building management team at quarterly intervals and set out scaled recommendations which the building management team acts upon.<sup>19</sup> Building management personnel also communicate the results to maintenance contractors and meet with contractors monthly or as necessary to ensure items are acted upon and recommendations from IAQ reports are addressed.

### *Maintenance and Cleaning<sup>20</sup>*

A range of management procedures and guidelines have been developed to ensure that building systems and components are operating optimally. Preventive maintenance practices for key building systems contribute to high performance building operation. These are also informed by the IAQ Management Program, which guides preventive measures such as regular coil cleaning, filtration replacement, damper adjustment and cleaning practices.<sup>21</sup> Physical inspection of HVAC components also provides assurance that HVAC contractors have used good cleaning and maintenance procedures.<sup>22</sup> This improves both energy efficiency and occupant health. Planned maintenance strategies are also monitored and tracked through the Building Management System. For example, preventive re-lamping is carried out to prevent light reduction in base building areas.<sup>23</sup>

## ***Agreements and Culture***

### *Tenant Agreements*

Tenancy fit-out guidelines specify that indoor environment quality testing will be undertaken before and after any fit-out works to prevent negative impacts on air quality. This ensures that tenants and contractors are made aware of their individual IEQ responsibilities. IEQ testing is carried out by professional contractors and includes air quality assessment and inspection of HVAC ducts, to ensure that proper precautions prevent negative impacts on base building environment quality from particulates, hazardous materials or chemical

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<sup>19</sup> D'Alessandro, J. (2012) *Personal Communication*, Joe D'Alessandro, Building Services Manager, CBRE, 21/09/2012.

<sup>20</sup> Scholz J (2011) *NABERS Indoor Environment Rating – Case Study for QV.1 Tower*, Pre-Loved Buildings Conference 2011, May 23-24, Perth, Australia, online: [www.airah.org.au/imis15\\_prod/Content\\_Files/Conferences/Joseph\\_scholz.pdf](http://www.airah.org.au/imis15_prod/Content_Files/Conferences/Joseph_scholz.pdf), accessed 29/08/2012

<sup>21</sup> Scholz, J. (2012) *Linking Theory to Practice – 15 Year Indoor Air Quality Management Programme for an Australian Commercial Office Building*, Proceedings of the 10th International Healthy Buildings Conference, 8-12 July 2012, Brisbane, Australia.

<sup>22</sup> Scholz, J. (2012) *Personal Communication*, Joseph Scholz, Environmental Services Director, QED Environmental Services, 18/09/2012.

<sup>23</sup> D'Alessandro, J. (2012) *Personal Communication*, Joe D'Alessandro, Building Services Manager, CBRE, 21/09/2012.

pollutants. Sampling of airborne chemicals prior to occupancy helps to maintain occupant health and well-being.<sup>24</sup>

Investa, co-owner of the QV.1 building, also developed a set of standard lease inclusions as part of its EcoSpace program to use tenancy leases to improve environmental performance. Standard lease inclusions set minimum standards for materials such as low-VOC paints and carpets, and state of the art lighting and lighting controls.<sup>25</sup>

### *Education and Communication*

Investa has created an initiative called Ecospace that offers new tenants tools and incentives for a lower impact fit-out and tenancy. Some of the initiatives include energy efficient lighting and controls, low emission paints, low emission carpet tiles, waterless urinals and a green lease. The green lease takes the form of a schedule of environmental practices to help both the business and Investa to improve environmental performance.<sup>26</sup> These are not legally binding, but rather are a checklist for tenants to assess and practise to the level they deem appropriate.

Investa provides tenants with building environmental performance data through an interactive database that supplies energy, greenhouse gas emissions, water, and waste statistics. Investa is seeking to make this information more accessible, especially in graphic form, in order to transform how people interact with buildings and how they are managed.<sup>27</sup>

Sustainability and efficiency improvement programs also contribute to reduced energy consumption.<sup>28</sup> A sustainability committee was formed, and this developed strategies for tenants to improve energy efficiency, including ensuring that computers and tenancy lighting was turned off after-hours. Many tenants have focused on improving lighting systems as lighting typically comprises as much as of 60 per cent of their electricity bill. Tenants are also encouraged to initiate their own energy efficiency programs, and meetings are held to support tenants to develop ways to do this.

A Green Committee, made up of building management staff, key facilities management personnel, and sustainability representatives from tenant organisations, keeps occupants informed of energy and IEQ performance data and provides a forum to collaborate on future

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<sup>24</sup> Scholz J (2011) *NABERS Indoor Environment Rating – Case Study for QV.1 Tower*, Pre-Loved Buildings Conference 2011, May 23-24, Perth, Australia, online: [www.airah.org.au/imis15\\_prod/Content\\_Files/Conferences/Joseph\\_scholz.pdf](http://www.airah.org.au/imis15_prod/Content_Files/Conferences/Joseph_scholz.pdf), accessed 29/08/2012.

<sup>25</sup> PRI (2010) PRI Reporting and Assessment survey 2010 – Investa Property Group, Principles for Responsible Investment Initiatives, United Nations Environment Program, online: [www.unpri.org/report10/2010\\_PDFs/PRI%202010%20-%20Full%20Responses%20for%20publication%20-%20Investa%20Property%20Group%20%28001700000N7cxO%29.pdf](http://www.unpri.org/report10/2010_PDFs/PRI%202010%20-%20Full%20Responses%20for%20publication%20-%20Investa%20Property%20Group%20%28001700000N7cxO%29.pdf), accessed 05/09/2012.

<sup>26</sup> Investa Property Group (2008) *Sustainability Fact Sheet - QV1 250 St George's Terrace*, Investa Property Group, online: [www.qv1perth.com/Core/SiteDownloadFiles/77/4eaa5136fd594a66ac58.pdf](http://www.qv1perth.com/Core/SiteDownloadFiles/77/4eaa5136fd594a66ac58.pdf), accessed 29/08/2012.

<sup>27</sup> PRI (2010) PRI Reporting and Assessment survey 2010 – Investa Property Group, Principles for Responsible Investment Initiatives, United Nations Environment Program, online: [www.unpri.org/report10/2010\\_PDFs/PRI%202010%20-%20Full%20Responses%20for%20publication%20-%20Investa%20Property%20Group%20%28001700000N7cxO%29.pdf](http://www.unpri.org/report10/2010_PDFs/PRI%202010%20-%20Full%20Responses%20for%20publication%20-%20Investa%20Property%20Group%20%28001700000N7cxO%29.pdf), accessed 05/09/2012.

<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.

initiatives.<sup>29</sup> Additionally, a sustainability portal for the building website provides information for tenants.

### ***Occupant Experience***

No formal occupant satisfaction surveys have been identified.

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

#### *Key lessons to inform the Performance Nexus concept*

- A long-term indoor air quality management program has contributed to excellent indoor environment quality and a high NABERS Indoor Environment rating.
- On-going indoor environment quality monitoring and analysis provides the optimal means of maintaining high indoor environment quality (as opposed to once-off or sporadic analysis). This facilitates the analysis of trends in performance over time and the continual refinement of building systems to achieve high performance outcomes.
- Long-term carbon dioxide measurements in combination with physical assessment of HVAC system operation has allowed building management to fine-tune HVAC systems to ensure consistently lower carbon dioxide concentrations throughout the building, providing occupants with improved air quality.<sup>30</sup>
- Good communication from building management personnel means that contractors and tenants are informed of IEQ issues and testing procedures, ensuring all stakeholders are aware of their individual IEQ responsibilities.
- The provision of fit-out guidelines and active tenancy fit-out management practices, backed up by physical IEQ testing of tenancy spaces, supports improved indoor environment quality outcomes.
- An engaged and active building management team has been integral in improving the energy efficiency of the building. Energy efficiency opportunities are continually identified and prioritised, and progress is monitored regularly by building management.
- Good building management practices ensure indoor environment quality results are actively used to improve maintenance and operation practices and guide preventive maintenance measures.<sup>31</sup> This improves both energy efficiency and occupant health.

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<sup>29</sup> D'Alessandro, J. (2012) *Personal Communication*, Joe D'Alessandro, Building Services Manager, CBRE, 21/09/2012.

<sup>30</sup> Scholz, J. (2012) *Linking Theory to Practice – 15 Year Indoor Air Quality Management Programme for an Australian Commercial Office Building*, Proceedings of the 10th International Healthy Buildings Conference, 8-12 July 2012, Brisbane, Australia.

<sup>31</sup> Scholz, J. (2012) *Linking Theory to Practice – 15 Year Indoor Air Quality Management Programme for an Australian Commercial Office Building*, Proceedings of the 10th International Healthy Buildings Conference, 8-12 July 2012, Brisbane, Australia.



- Physical inspection of HVAC plant and equipment by professional environmental services contractors helps to identify potential problems and facilitates the analysis of trends in performance over time.<sup>32</sup>
- Good knowledge management processes are in place to ensure high performance building operation. Automated monitoring of building energy consumption occurs sufficiently frequently to ensure that faults that would have caused excessive consumption are detected and rectified promptly. Maintenance procedures follow relevant Australian Standards and are guided by industry best practice. Protocols are in place to ensure transfer of knowledge and information between building management personnel and external contractors.
- Indoor environment quality analysis is conducted before and after tenancy fit-out works to ensure fit-out materials and construction practices do not reduce indoor environment quality in the building.

**Acknowledgements:**

Joe Scholz, Director QED Environmental Services

Joe D'Alessandro, Building Services Manager, QV.1

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<sup>32</sup> Scholz, J. (2012) *Personal Communication*, Joseph Scholz, Environmental Services Director, QED Environmental Services, 8/09/2012.