

One Shelley Street, Sydney, Australia

One Shelley Street is a 355,000-sq.ft. (33,000 sq.m.) commercial office building located in Sydney. Owned by Brookfield and constructed by Brookfield Multiplex, the 6-Star Green Star Office "Design" v2 and 6-Star Green Star Office "As Built" v2 building was completed in February 2009 in collaboration with the building's sole tenant, Macquarie Group. The building comprises 2,300 sq.m. (24,750 sq.ft.) of retail on the ground level, five levels of underground parking, 10 levels

of office accommodation and a central atrium.

The completion of One Shelley Street also marked the completion of Brookfield's nine-year redevelopment of the King Street Wharf precinct. King Street Wharf is a neighborhood in the Sydney central business district, providing a waterfront location with commercial office space, residential, retail and restaurants.

A defining aesthetic element, the external diagonal steel grid structure wraps all the way around the glass façade and maximizes the interior space flexibility.



ONE SHELLEY STREET, Sydney, New South Wales, Australia

The sole office tenant, Macquarie Group's Banking and Financial Services group, was the driving force behind bringing a new way of working to One Shelley Street, called Activity Based Working (ABW). ABW is a program that challenges more traditional ways of working, by seeking to empower workers with the ability to choose a work setting that is most aligned to their particular needs for each day. Each floor also features a themed community space, effectively a shared break-out area, accommodating up to 100 employees. A central staircase winds its way through the atrium connecting the different work zones, contributing to the focus on transparency, light and space. The atrium contains 26 cantilevered, cube-shaped meeting rooms that project over the atrium, with seating options ranging from traditional tables and chairs to more casual built-in benches.¹

ABW is a relatively new concept by Dutch consultant Veldhoen & Co. Through ABW, space efficiency is also improved in comparison to a traditional office environment; the same workforce can be accommodated in approximately 20 percent less total space.

Employees are encouraged to reduce paper use. Mail is scanned and distributed electronically, decreasing the need for file storage, "follow-me" printing is used throughout the building, many meeting spaces are set up with wireless presenter technology for ease of sharing documents, and the building is fully wireless, supporting the mobility of staff who all work from laptops.

Designed by architects Fitzpatrick + Partners, the building's glass façade is wrapped with a diagonal steel grid—a diagrid—making it one of Sydney's most recognizable buildings. This exoskeleton eliminates the need for perimeter columns by minimizing the top-end weight and distributing weight through the exterior walls, allowing for maximum flexibility of interior floor space. The steel diagrid's pattern con-

sists of repeated six-by-six-meter (20-foot square) parallelograms.² The ability to enter the building by walking between the ground level diagrids is an intentional design feature that involves occupants in the building's structural elements.³

For this project, Built Ecology produced a detailed design brief before the design consultants even started.⁴ The design brief was based on a large modeling, benchmarking, and targeting exercise, which virtually defined what the building would become, before many other consultants were engaged. This brief defined systems, materials, energy expectations and represented a 200-page version of the "Owner's Project Requirements," an essential first step for eventual building commissioning.

A holistic set of sustainable design features, innovative use of technology and forward thinking work practices contributes to a reduction in overall energy use by 50 percent.⁵ High-performance components include: passive chilled beams, 100 percent fresh outside air with no recycling or heat recovery, CO₂ monitoring for fresh air ventilation, energy monitoring, high-performance glass, extensive daylighting, low-flow fixtures and provision for rainwater harvesting.

Instead of water-intensive cooling towers, One Shelley Street uses water from Sydney Harbour for heat rejection. A passive chilled beam system circulates cool air throughout the office space via pipes in ceiling spaces containing medium temperature chilled water supplied at 15°C (59°F). The chilled water plant is split into low and medium temperature chillers with more than 60 to 70 percent of cooling provided by the more-efficient medium temperature chillers. Low-temperature chilled water is used for dehumidification when required. The system rejects heat from the condenser water and returns it to the harbor via a series of titanium heat exchangers. Compared to conventional air-conditioning systems, passive chilled beam systems use approximately 30 percent less elec-

One Shelley Street is testimony to Brookfield's commitment to owning and developing prime office assets with strong focus on sustainability and shows that we work to incorporate sustainable practices from design through to construction and the ongoing operation of the finished building.

Kurt Wilkinson, Chief Operating Officer
Brookfield Office Properties Australia



Courtesy of Brookfield

The interior design of One Shelley Street supports Activity Based Working, a way of working where employees are not assigned a permanent office, but instead they may choose a different work environment each day.

tricity. A single-pass air system provides 100 percent fresh air, resulting in higher indoor air quality.⁶

Natural daylight serves 80 percent of the floor plan.⁷ In the entryway and atrium space, the lighting designers applied LED technology in different and original ways. The goal was to maintain lighting power density at less than 2W per sq.m. while providing 100 lux, and to secure an overall power density under 9 W per sq.m. The result exceeded these targets, achieving 1.58 W per sq.m. per 100 lux with overall power density just over 5 W per sq.m.⁸

Donn Salisbury, with Lincolne Scott engineers and Vision Design, the lighting designers, noted that “If we typically

spend more time in our workplaces than any other environment, why not make them exciting and fun? The tricky bit is making this happen in an efficient way, both in cost and energy. Emerging technologies have taken us so far over the last decade and will keep accelerating at an alarming rate, but knowing their purpose and using them in ways that work is critical to successful design. The architecture transforms what could have been just another office building into an engaging, community-inspired working environment. The lighting design then needed to follow their lead in providing an atmosphere that works with the structure’s openness and the external environment’s vast influence.”⁹

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With a 6-Star Green Star Office “Design” v2 rating from the Green Building Council of Australia—the highest rating available—Brookfield’s One Shelley Street achieved “World Leadership” in the high-performance building realm. “To achieve a Green Star “Design” rating requires a commitment to innovation and a holistic approach to green building design. By backing this up with a 6-Star Green Star “As Built” v2 rating, Brookfield confirmed that the sustainable design intentions were implemented during the construction process,” said Romilly Madew, Chief Executive at GBCA.¹⁰

Other key high-performance features at One Shelley Street include the following:¹¹

- Significant energy uses are separately metered to facilitate ongoing management of energy consumption. (This is a major requirement to progress from the “Design” rating to the “As Built” top Green Star rating.)
- Landscape irrigation uses 90 percent less potable water (compared to traditional landscapes).
- The ventilation system provides more than double the fresh air volume required by Australian standards.
- Carbon-dioxide monitors linked to the building management system keep the floors supplied with fresh air as needed.
- Dual pipe work was installed for future gray and black-water recycling.
- Public artwork doubles as exhaust systems.
- Reduced PVC use by more than 60 percent.
- Siphonic stormwater piping system.

OCCUPANCY EVALUATION

An independent, comparable and comprehensive pre- and post-occupancy evaluation and Indoor Environment Quality (IEQ) study was undertaken in collaboration with Brookfield Multiplex and Macquarie Group by University of New South Wales and University of Technology, Sydney (UTS). The study draws on data from a benchmark occupant survey, focus groups, site visits, and interviews with key stakeholders. The

survey results indicate that One Shelley Street occupants are in the top three percent of the Australian benchmark for satisfaction, comfort and overall performance.¹²

ENERGY USE

One Shelley Street was designed to achieve a NABERS energy base building rating of four and a half stars with predicted potential to achieve five stars. The tables below compare actual energy use and modeled (predicted) energy use. The building uses about two-thirds more energy than predicted, which is related to the complexity of the systems and the need for the engineers and building management to stay better connected throughout the first few years of occupancy. This is a common issue in any new modern office building with adventurous energy performance goals. Nevertheless, the actual energy use is still an excellent result and well within the range of other world-class large modern office buildings.

ACTUAL ENERGY USE

(November 2010 – October 2011)

	Total (kWh/year)	Intensity (kWh/sq.m./year)
Electricity	3,181,811	102.9
Gas	413,348	13.4
Total	3,595,159	116.3

PREDICTED ENERGY USE

	Total (kWh/year)	Intensity (kWh/sq.m./year)
Electricity	1,927,717	62.4
Gas	228,434	7.4
Total	2,156,151	69.8

An energy monitoring report was prepared in October 2011 by the consulting firm AECOM, which states:

The results above show a significant discrepancy between the [engineer's] simulation results and actual building performance, though energy use appears to be closing this gap. Continued reduction in 2011 year-to-date gas and electricity use has provided the best result so far despite a reduction in the number of rated operating hours. *It is evident that re-commissioning and programming of certain [physical] plant, starting in May 2010, has contributed to the decrease in energy use.* The building's ability to achieve its potential is primarily hampered by the continuous operation of the Harbour Heat Rejection Pumps. (p. 35; italics ours)

WATER USE

Water use in the building, for the 12 months ending April 2011, is in line with Australian best practices for large offices, in our experience.¹³

Water Use: 15,011 kL (3,965,918 gallons)

Water Use Intensity: 490 L/sq.m.; 11.9 gallons/sq.ft.

AT A GLANCE

Name: One Shelley Street

Location: Sydney, New South Wales, Australia

Completion: February 2009

Size: 33,000 sq.m. / 355,000 sq.ft.

Distinction: 6-Star Green Star - Office "Design" v2 and 6-Star Green Star – Office "As Built" v2 ratings

Program: Corporate Office

PROJECT TEAM

Owner: Brookfield Office Properties

Tenant: Macquarie Group

Property Services: Brookfield Office Properties

Construction Contractor/Developer: Brookfield Multiplex

Architect: Fitzpatrick + Partners

Structural Engineers: Arup & Robert Bird Group

Services Engineer: Lincolne Scott

Interior Design: Clive Wilkinson Architects, Woods Bagot

Sustainability: Built Ecology unit at Lincolne Scott, Brookfield Multiplex and Brookfield

LESSONS LEARNED

One Shelley Street needed to be designed and constructed within the base footprint of a previously planned residential development; the previous scheme was built to ground floor slab level when the program shifted from residential to commercial. The new commercial development had to transfer its loads through the existing structure, without any loss of basement amenity. This was a huge challenge for the design and construction team, but one that was well executed.¹⁴ Early contractor and tenant involvement and collaboration were keys to the successful delivery and operation of the building.

As a result, most services at One Shelley Street are located in the basement rather than in a rooftop plant. The need for ground-level exhaust led to an innovative solution: commissioned public art pieces double as exhaust risers.

Actual energy use was 67 percent more than the modeled use, as shown in the tables. Energy efficiency upgrades through April 2012 are expected to reduce use by about 5.6 percent, but energy use will still be greater than modeled by 57 percent. A detailed consultant's report shows that there is a need for large, complex modern office buildings to receive "continuous commissioning," at least for the first two to three years of operation. Chapter 5 highlights this issue in discussing the need for post-occupancy evaluations.

(ENDNOTES)

- 1 www.clivewilkinson.com/feature/mac_description17.html, accessed November 9, 2011
- 2 Andrew Metcalf, "The Diagonal Principle," *Architectural Review*, April 2009, pp. 77-85.
- 3 "One Shelley Street" Macquarie Group," November 24, 2010, <http://designbuildsource.com.au/one-shelley-street-macquarie-group>, accessed November 9, 2011.
- 4 *Ibid.*
- 5 www.contemporist.com/2010/03/28/one-shelley-street-office-interior-by-clive-wilkinson-architects/, accessed November 7, 2011.
- 6 "One Shelley Street, NSW," *ibid.*
- 7 Philips, "One Shelley Street: Office lighting gets six stars," www.lighting.philips.com/main/subsites/dynalite/projects/office/one_shelley_street.wpd, accessed November 7, 2011.
- 8 "One Shelley Street, Sydney," *Mondo*, Issue 54/May 2010, www.mondoarc.com/projects/commercial/458219/one_shelley_street_sydney.html, accessed November 7, 2011.
- 9 "One Shelley Street, Sydney," *ibid.*
- 10 http://www.brookfieldmultiplex.com/newsfeed/view/6_star_green_star_rating_for_one_shelley_street_2011_09_01
- 11 Advanced Environmental, "King Street Wharf – 1 Shelley Street Building Users' Guide," December 16, 2008.
- 12 Brookfield Multiplex, "Building Outperformance Research Fact Sheet."
- 13 See, for example, Jerry Yudelson, *Dry Run: Preventing the Next Urban Water Crisis*, p. 60.
- 14 Brookfield Multiplex, "API NSW Excellent in Property Awards-Estate Master Property Development Award One Shelley Street, Sydney NSW," 2009.