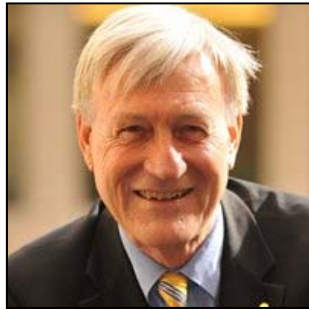


# *The development of a simple multi-nodal tool to identify performance issues in existing commercial buildings*



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# Partners

## SBEnrc Core Partners:




## Project In-Kind Partners:



green building council australia





*To provide a **low cost, low complexity tool** to assist efforts to improve the energy performance of **existing commercial buildings** and foster a productive workplace.*

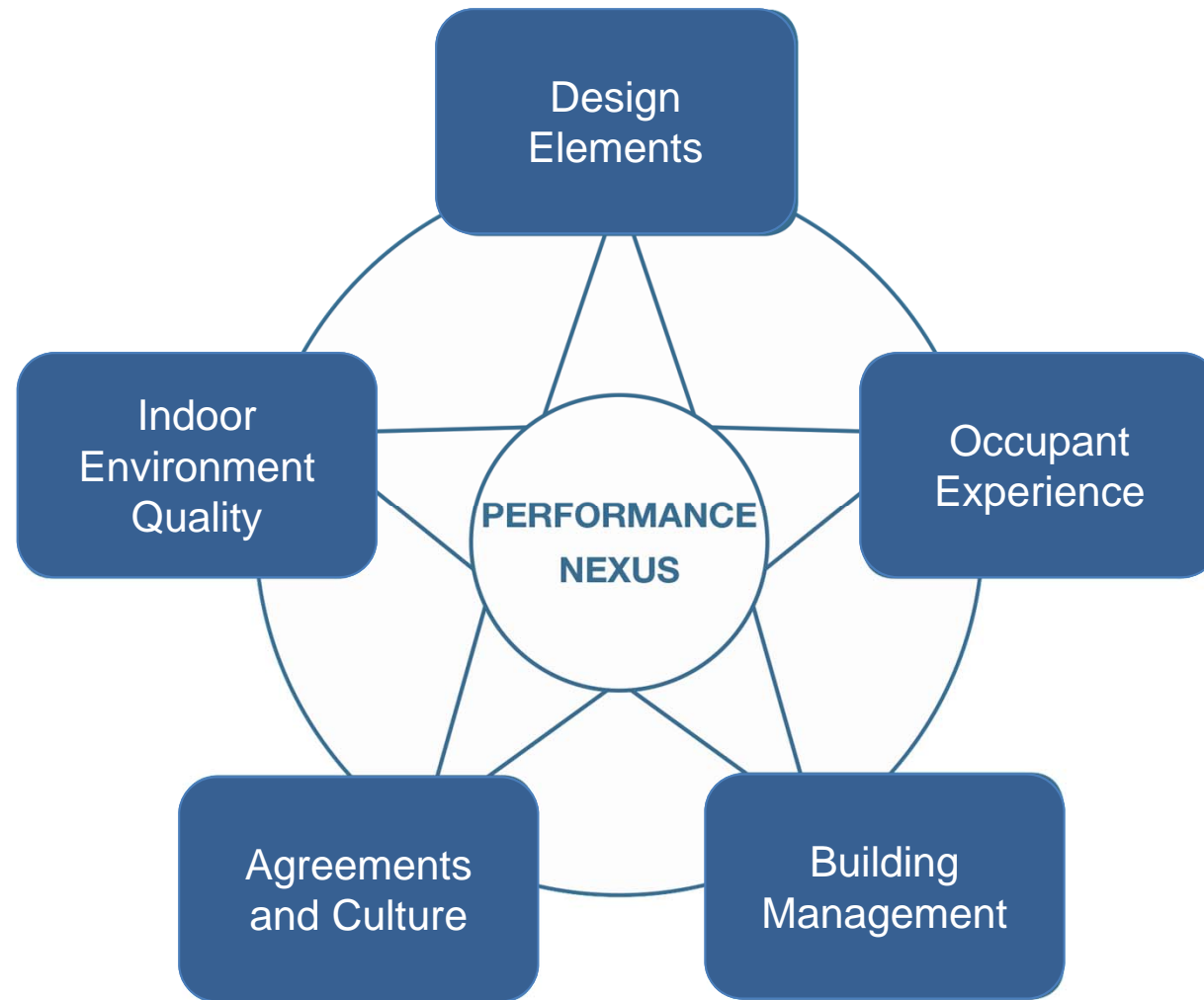
# Improving the Performance of Existing Commercial Buildings:

## Industry-led insights:

- *A focus on **existing commercial buildings***: Existing buildings represent the bulk of the stock, yet little attention on energy management. Requires a strategic approach to improving their performance
- *A **holistic** approach to energy management*: Going beyond a focus on energy management to help deliver cost effective and lasting solutions that achieve multiple benefits across the building
- *Options for **enhancing stakeholder collaboration** in buildings*: Buildings are complex systems with many stakeholders involved. Consider the various stakeholders within a building and their relative contributions to improving energy performance in a way that encourages productivity
- *Consideration of the impact of energy programs on **productivity***: Exploring the link between energy management initiatives and productivity
- *Consideration of **associated agreements***: Exploration of the various agreements that can be used to enhance energy management in buildings



# 'Performance Nexus' – basis of the Tool



# Design Elements



Monitoring &  
Control  
Technology

Lighting

HVAC

Other Plant  
and  
Equipment

Building Fabric

Tenancy  
Design and Fit  
out



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# Occupant Experience



Occupant  
Satisfaction

Perceived  
Productivity

Communication  
and Reporting

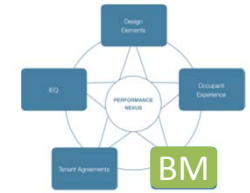
Training,  
Education and  
Guidance

Use of Controls



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# Building Management



Operation and  
Management

Reporting and  
Evaluation

Maintenance and  
Cleaning

Commissioning  
and Tuning

Management  
Personnel,  
Communication  
and Education

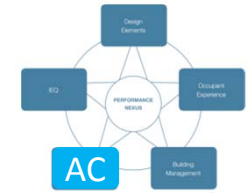
Procurement



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# Agreements and Culture



Lease  
Agreements

Organisational  
Culture

Communication  
and Education

Ratings,  
Mandates and  
Incentives

Commitments  
and Targets



# Indoor Environment Quality



Basic IEQ  
Monitoring

Advanced IEQ  
monitoring

IEQ  
Management  
Programs

Health and  
Well-being

Reporting and  
Communication  
of Results



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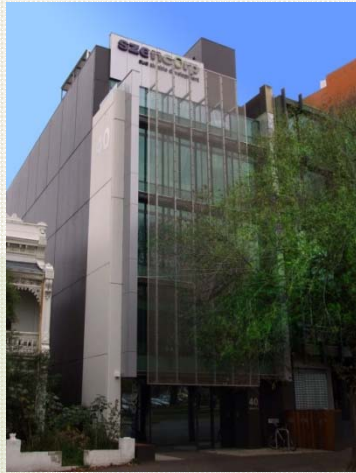
**Table 1:** Example of application of each node of the Nexus to ‘lighting’

Design Element	Indoor Environment Quality	Occupant Experience	Building Management	Agreements and Culture
<i>Is the lighting system energy efficient?</i>	<i>Are the lighting levels suitable for tasks?</i>	<i>How satisfied are occupants with light levels and controls?</i>	<i>Is there a maintenance schedule for lighting?</i>	<i>Is there a fit out guide in place for lighting systems?</i>

**Table 2:** Typical responsibilities for ‘Performance Nexus’ nodes in commercial buildings

	Design Elements	Building Management	Indoor Environment Quality	Occupant Experience	Agreements and Culture
<b>Base Building</b>	Building Owner	Building Manager	Building Manager	N/A	Building owner
<b>Tenancy</b>	Tenancy Representative	Property Manager	Tenancy Representative	Occupants	Tenancy Representative





40 Albert Rd (VIC)



250 St Georges Tce (WA)



201 Charlotte St (QLD)



187 Melbourne St (QLD)

## *Case Studies Mapped to Nexus*



60 Leicester St (VIC)



182 Capel St (VIC)



500 Bourke St (VIC)



500 Collins St (VIC)



Trevor Pearcey House (ACT)



115 Batman St (VIC)



# Design Elements



*Energy efficient design elements; occupants engaged through CitySwitch*

## Key Features

DE: efficient envelope and passive design features

- *Mixed-mode HVAC; operable windows; blinds; louvres*
- *Daylighting; clearstory windows; T5, LED, and task lighting*

TA: Commitments and Targets

- *NABERS Energy target and involvement in CitySwitch*

## Impacts

- Occupants engaged in energy reduction targets through involvement in CitySwitch
- Occupants are provided with education on correct operation of the building



## Key Outcomes

- 30% energy reduction (preliminary results)

# Indoor Environment Quality



*Indoor environment quality monitoring informing building management practices*

## **Key Features**

- Long-term indoor air quality management program
  - *On-going IAQ Management Program*
  - *Tenancy Re-fit Testing*
  - *Intervention (Fire/Flood)*
- Tenancy fit out guidelines specify re-fit IEQ testing
- IAQ Reports feed into building management processes

## **Impacts**

- Facilitates continual building performance improvement
- Improved building management practices and identification of existing and future issues
- Tenants and contractors aware of their role in IEQ management



## **Key Outcomes**

- 5 Star NABERS IE
- 5 Star NABERS Energy

# Occupant Experience



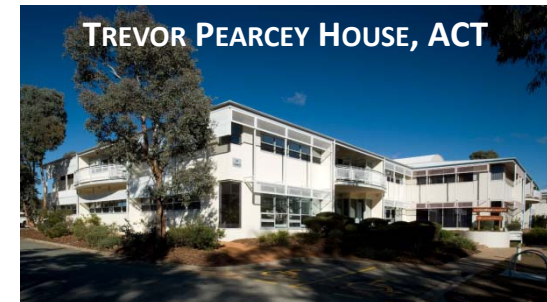
*Passive design principles; good building management; occupant education*

## Key Features

- Energy efficient design elements
  - *Passive design features, user-controllable design elements*
- Education and communication
  - *Education ensures occupants understand how to operate the building in a comfortable and energy efficient manner*
- Post-occupancy evaluation

## Impacts

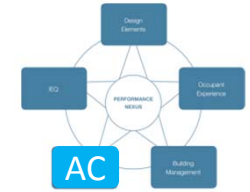
- Occupants have an active role in operating the building and understand how to correctly operate the building
- POE and staff surveys help identify potential issues
- Post-construction commissioning identified IEQ and energy-related issues



## Key Outcomes

- 52% energy reduction
- High occupant satisfaction
- High perceived productivity

# Agreements and Culture



*Major renovation - close partnership between building owner and tenant*

## Key Features

- Lease Agreement:
  - Long term lease (12 years)
- Communication:
  - Cooperation between building owner and tenant
  - Shared cost and incentive between owner and tenant
- Commitments and Targets:
  - NABERS Energy target; Green Star Design, Interiors, As Built
- Organisational culture:
  - Corporate Responsibility program; Carbon Neutral goal

## Impacts

- Helped overcome the split incentive and achieve an integrated refurbishment of base building and tenancy.

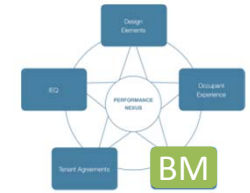


## Key Outcomes

- 50% energy reduction
- 4.5 Star NABERS Energy
- 4.5 Star NABERS IE



# Building Management



*Best-practice building management - improved energy efficiency without major plant and equipment upgrades*

## **Key Features**

- Best-practice building management practices
  - Knowledge management
  - Regular monitoring and reporting
  - On-going maintenance and tuning
- Targeted efficiency upgrades
  - Energy metering and building management system
  - Improved control strategies

## **Impacts**

- Improved performance of existing design elements and systems
- Significant energy efficiency improvement



## **Key Outcomes**

- 34% energy reduction
- 3.5 Star NABERS Energy

A diagram illustrating the Five Dimensions of Performance. At the center is a circle labeled "PERFORMANCE MEASURES". Surrounding this central circle are five colored squares, each containing a dimension: "DE" (dark red) at the top, "OE" (dark blue) at the top right, "BM" (green) at the bottom right, "AC" (light blue) at the bottom left, and "IEQ" (yellow) at the top left. These five squares are connected by a circular line, forming a pentagon around the central circle.



## Key features

- 

## Key Outcomes

- Consideration of multiple nodes and active integration between nodes facilitates continual improvement
- High perceived productivity
- Maintained high performance

# Multi-Node Approach



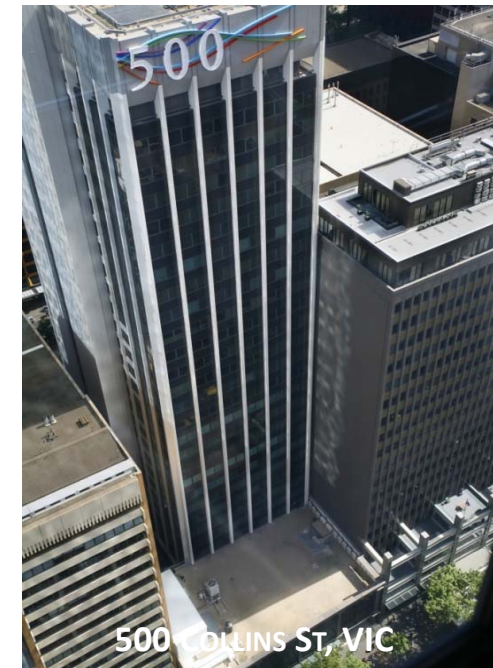
*Energy efficient retrofit; Good building management; IEQ and Occupant Survey*

## Key Features

- DE: Energy efficient design elements
  - *Efficient chillers; active and passive chilled beams; VSD*
- BM: Good building management practices
  - *Commissioning; on-going energy monitoring and review; on-site management*
- OE & IEQ: Detailed pre- and post- occupancy studies
  - *Occupant satisfaction, productivity, indoor environment quality*
- AC: non-legal agreements
  - *environmental management plan, building users' guide*

## Impacts

- Improved building energy performance
- High occupant satisfaction



## Key Outcomes

- 52% energy reduction
- High occupant satisfaction
- Productivity improvements

# Value of the Performance Nexus

*Identify key metrics and considerations for improved building performance*

*A pre- and post-retrofit evaluation tool*

*Identify areas for improvement*

*Identify where relationships between areas could be strengthened*



# Benefits of the Project for Industry

*Succinct tool to collect key performance data*

*Providing precedent of a holistic approach to  
performance improvement*

*Succinct capacity building materials*

*Supporting focus on existing buildings*

*Improving strategic positioning*

# Benefits of the Project for Government

*Informing legislation & policy development*

*Informing program and grant-funding*

*Succinct capacity building materials*

*Inform procurement policies*



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