

*Bringing ideas
to life*

CIBSE ANZ SEMINAR: From Great to Good

*Bringing ideas
to life*

An aerial photograph of the Melbourne city skyline, showing a dense cluster of skyscrapers and buildings. In the foreground, there is a large green park area with trees and a winding river. A large green diagonal overlay covers the bottom right portion of the image, containing the main title text.

Re-lifeing Existing buildings

Credit: <https://www.skyscrapercenter.com/city/melbourne>

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Dealing with the past – Re-lifeing existing buildings

- Why consider it:
 - Reducing the embodied carbon of demolition and new construction
 - Reducing the operational energy consumption
 - Reducing the capital expenditure
 - Increasing occupant comfort
 - Increasing occupant health
 - Providing resilient buildings
 - Providing a sustainable building
 - Social pressure to re-use existing buildings
- Conclusion: There's value in Re-lifeing existing buildings



20%
OF ALL WATER
CONSUMPTION



25-40%
OF ALL ENERGY USE



30-40%
OF GREENHOUSE
GAS EMISSIONS



30-40%
OF SOLID WASTE
GENERATION

Existing Buildings and their potential

*“The Greenest building is
the one already built.”*

–Richard Moe President of the National Trust for Historic Preservation

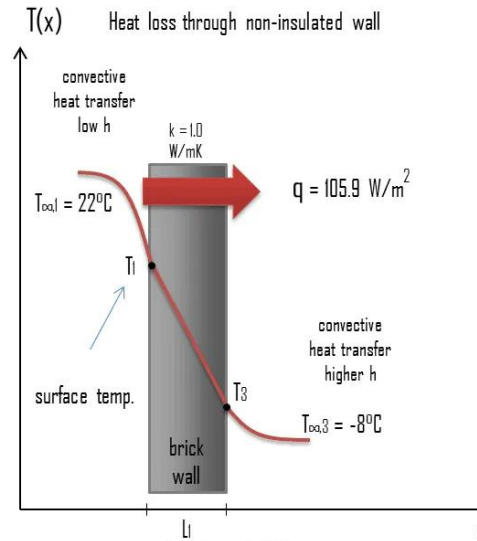
Dealing with the past – Potential to modernise existing buildings

- Existing buildings at a glance:
 - Old inefficient services:
 - Chillers with low EER
 - Gas boilers for DHW and HHW with low efficiency
 - Fans with low efficiency
 - There's room for improvement



Dealing with the past – Potential to modernise existing buildings

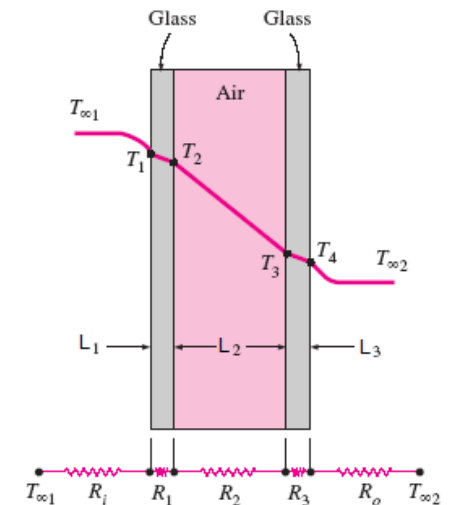
- Existing buildings at a glance:
 - Poor performing building envelope:
 - Inadequate insulation (roof, walls, floor)
 - Poor performing glazing (high U-values with thermal bridges in the frames)
 - Excessive air infiltration (uncontrolled building openings)
 - There's lots of potential to upgrade existing buildings



$$R_i = \frac{1}{h_1 A} + \frac{L_1}{k_1 A} + \frac{1}{h_2 A}$$

$$q = U \Delta T = \frac{(T_{\infty,1} - T_{\infty,3})}{\frac{1}{h_1} + \frac{L_1}{k_1} + \frac{1}{h_2}}$$

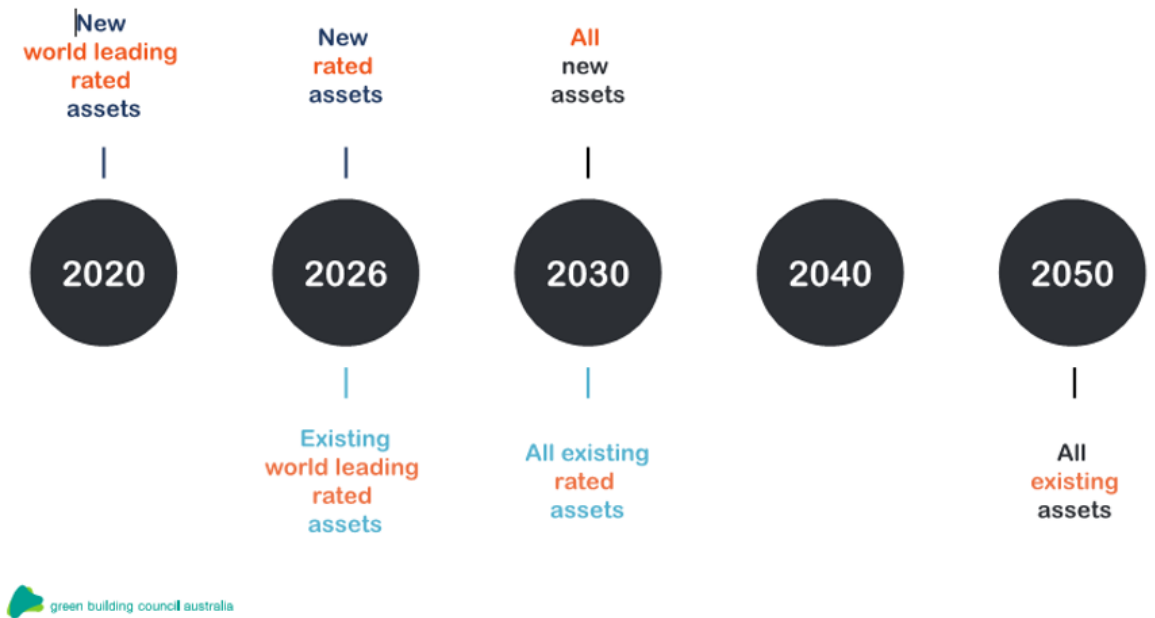
where
 q is the local heat flux [$\text{W}\cdot\text{m}^{-2}$]
 U is the overall heat transfer coefficient [$\text{W}\cdot\text{m}^{-2}\cdot\text{K}$]
 k is the materials conductivity [$\text{W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$]
 h is the convection heat transfer coefficient [$\text{W}\cdot\text{m}^{-2}\cdot\text{K}$]



Dealing with the past – Potential to modernise existing buildings

- Existing buildings services upgraded to meet latest standards:
 - Moving away from natural gas:
 - not a requirement now for Green Star
 - but will be a requirement from 2026 onwards for all energy to be from renewable sources
 - NABERS and Green Star tools are moving away from natural gas
 - Adopting Passive House Principles makes the move easier

Carbon Positive Roadmap targets



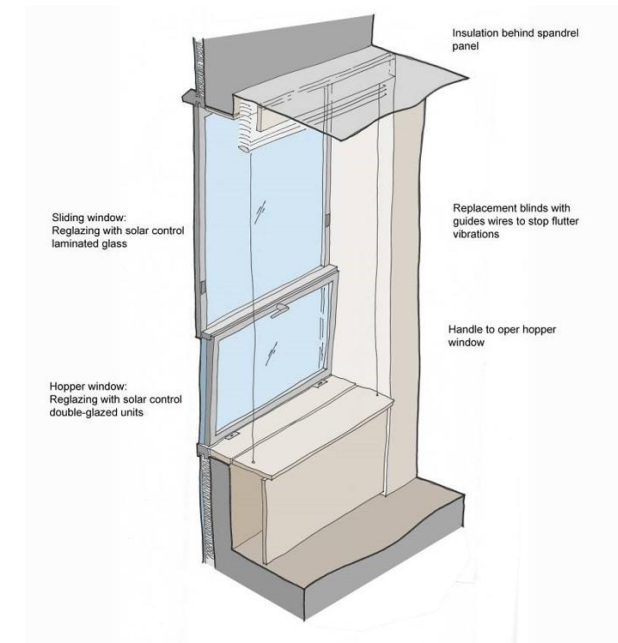
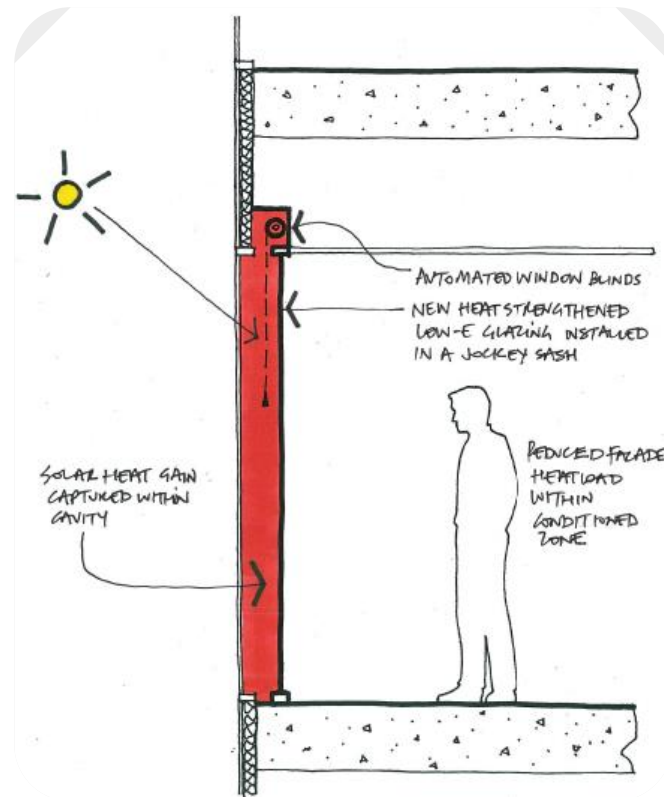
Dealing with the past – Potential to modernise existing buildings

- Existing buildings services upgraded to meet latest standards:
 - Services can be changed over with relative ease
 - New chillers and VRF technology provide increased EER
 - Air sourced Heat pumps provide heating
 - Services challenges to take into consideration:
 - Heat pump spatial requirements (HHW and DHW)
 - Existing piping infrastructure
 - Increased electrical demand for F&B



Dealing with the past – Potential to modernise existing buildings

- Existing building upgraded to meet latest standards:
 - Upgrading the building envelope requires a detailed assessment
 - All building envelopes have the potential to be upgraded
 - Existing building structures can be maintained
 - Life Cycle Carbon Assessment required
 - WUFI calculation
 - What can be done:
 - Additional/replacing insulation
 - Shading devices
 - Replacing windows or secondary glazing
 - Sealing off existing openings





How do we assess existing buildings?

How Do We Assess Existing Buildings?

- What makes a good building:
 - Practicalities:
 - Location (and existing height)
 - Good structure providing flexibility
 - Flexible floor layout
 - Quality of the façade system
 - Accessible Services Risers
 - Sufficient plant room space
 - Form factor
 - Airtightness
 - What's the ability to add on additional floors

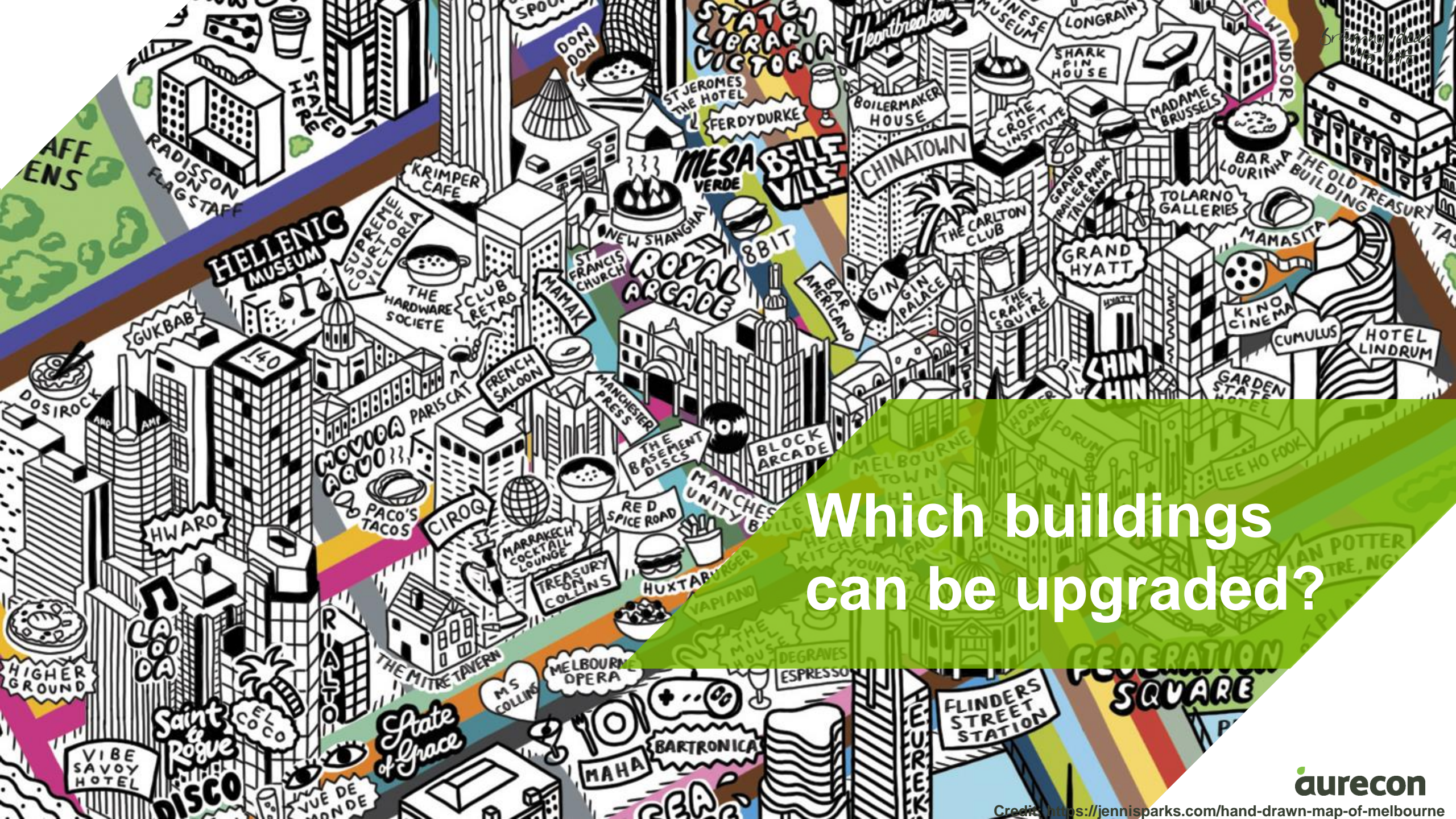


Credit: <https://unsplash.com/s/photos/melbourne-cbd>

How Do We Assess Existing Buildings?

- What makes a good building:
 - Performance Rating Tools:
 - PCA
 - Green Star: moving away from natural gas
 - NABERS : rating will improve if moving away from natural gas
 - Passive House: significantly reduced energy consumption





Which buildings can be upgraded?

Which buildings can be upgraded?

- Technically Speaking: All buildings can be upgraded
- The extent of the upgrade depends on many factors:
 - Is it fundamentally a good and safe building?
 - Carbon associated with upgrades
 - Existing operational performance
 - Existing thermal comfort and IAQ
 - Future needs of tenants
 - Capital expenditure vs operational expenditure
 - Building resilience
 - What performance rating tool is being used?
 - What is an existing building competing against?
 - Is there an ability to do the refurb with existing tenants?



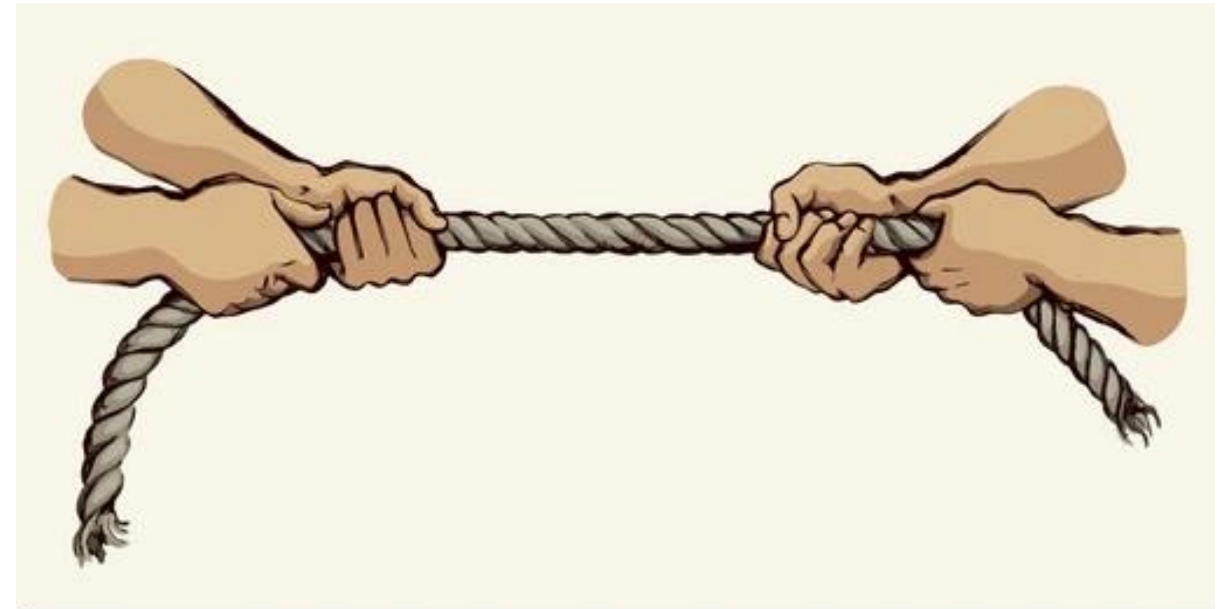
Credit: <https://bdaa.com.au/sustainability-still-comes-after-profit/>



How do we upgrade Existing buildings?

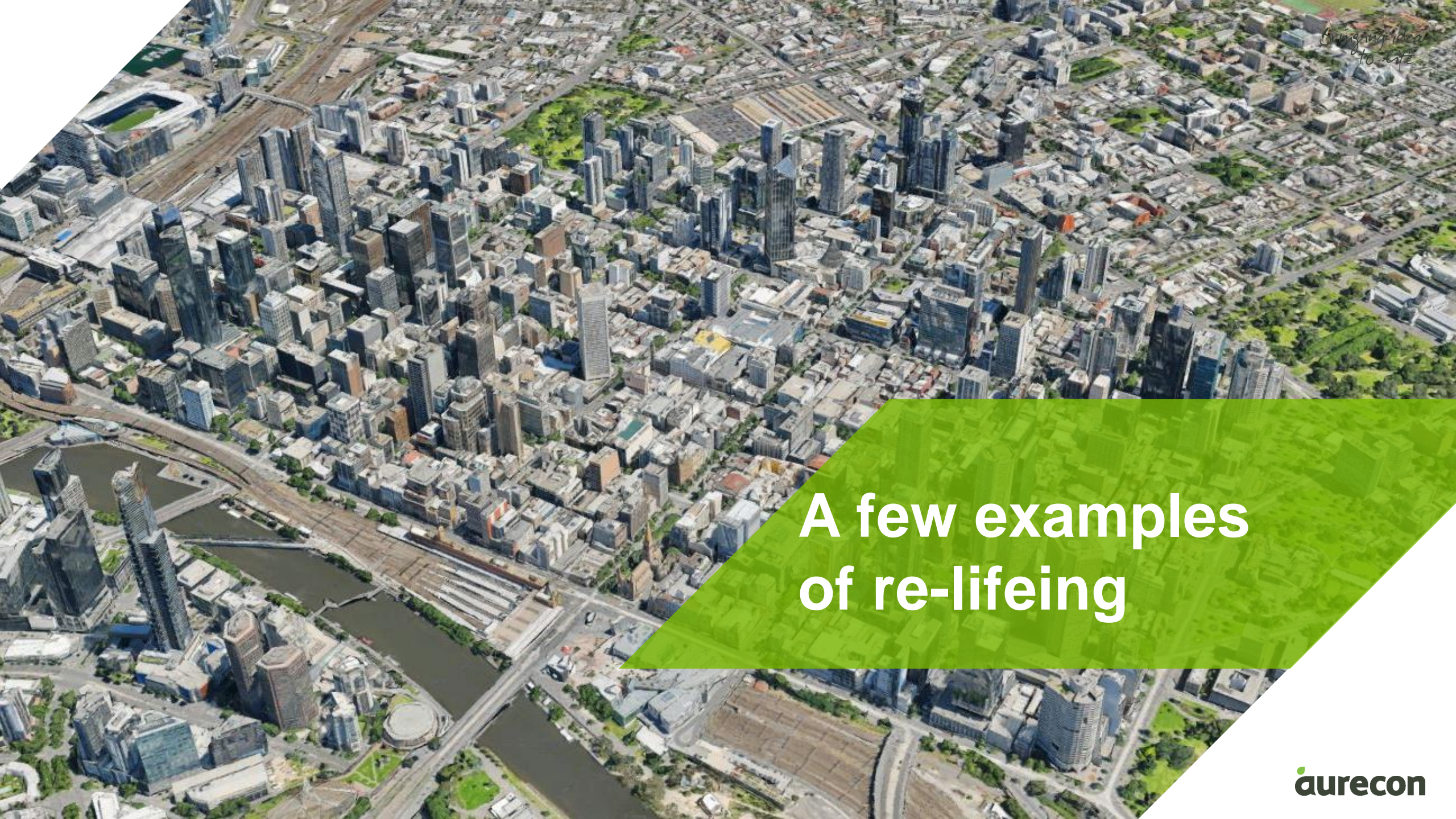
How do we upgrade existing buildings?

- What's the current state
- What do we need to do to bring it up to latest standards?
- Establish the key goal
- Take an holistic approach
 - Enhance the occupant experience
 - Increase the flexibility
 - Introduce new technologies
 - Reduce the energy consumption
 - Increase the building thermal envelope performance
 - Increase the natural daylight
 - Improve the thermal comfort and IAQ
 - Etc.
- Review the many competing factors above
- Provide an integrated design with an optimised solution



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An aerial photograph of a dense urban area, likely a city center, showing numerous skyscrapers and buildings. A large green diagonal overlay covers the bottom right portion of the image, containing the text. The city is situated near a river or waterway, with a bridge visible in the lower left.

A few examples of re-lifeing

500 Bourke Street

Melbourne CBD

The project involves the refurbishment of 36 office levels, plant rooms, the refurbishment of basement level 1 with a new end of trip facility and plaza level for a connection at precinct level.

The project is targeting a 6 Star Green Star rating, achieving a reduction in embodied carbon, through avoiding waste and emissions associated with demolishing an existing building and constructing a new one.

The base building will operate from 100% renewable energy and be carbon neutral both from day one of construction, and in operation upon completion in 2023 - without the need for carbon offsets – while targeting a 6-star Green Star and 5.5 Star NABERS energy rating.

The preliminary lifecycle assessment showed the re-living of 500 Bourke resulted in the avoidance of approximately 57,000 tonnes of carbon dioxide emissions, with 40,000 tonnes in the building's structure alone.

**This is equivalent to
the annual carbon
output of 2,400
typical Australian
homes, according to
the life cycle
assessment.**

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Monash University Uplink Building

Melbourne, Clayton

The project involves the refurbishment of a group of buildings which are undergoing degasification.

As such a modular all-electric air-sourced heat pump system design was completed allowing the air conditioning to run at optimum efficiency whilst still providing the university with modularity, flexibility and future-proofing for additional chilled and heating hot water requirements.

The building envelope upgrade includes new glazing, façade and roof insulation.

The Uplink building transforms the previous outdoor corridor into an indoor space and links the future Co-lab building (currently Building 69) with the Team Hub building (currently building 60).

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University of Melbourne Smart Campus Energy Upgrade Program

Melbourne CBD

The University of Melbourne is committed to improving their environmental performance and aspiring to be carbon neutral by 2025 and climate positive by 2030.

As part of achieving this goal, the University of Melbourne have developed a Smart Campus Energy Upgrade program, which focuses on technologies such as Building improvements, chiller upgrades and building optimization, electrification, Solar PV etc. few.

To date 11 Buildings have been optimised in terms of HVAC services and a further 7 buildings will be optimised in the near future.

The University is continuously looking for ways how to reach carbon neutrality most effectively

Thank you



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