Designing for Future Climate

Quentin Jackson
Principal, Sustainability

20 September 2022

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Timing is everything.

There is still a path to a better future. Just.

Bringing ideas to life

- It's going to take an all-of-society approach.
- It's going to mean shifting from fossil fuels to clean energy sources on a massive scale.
- Energy transition alone won't be enough to hold warming to 1.5 degrees – we need carbon removal technology too.
- Acting on climate and accelerating energy transition will make life better – and be cheaper than the alternative.
- Wealthy nations have to step up and support developing countries at much higher levels than are currently pledged.
- The future of billions in developing nations depends on rapid energy transition and ambitious climate action.
- Perhaps most important, **many of the tools we need for rapid emissions cuts are in our hands today.**

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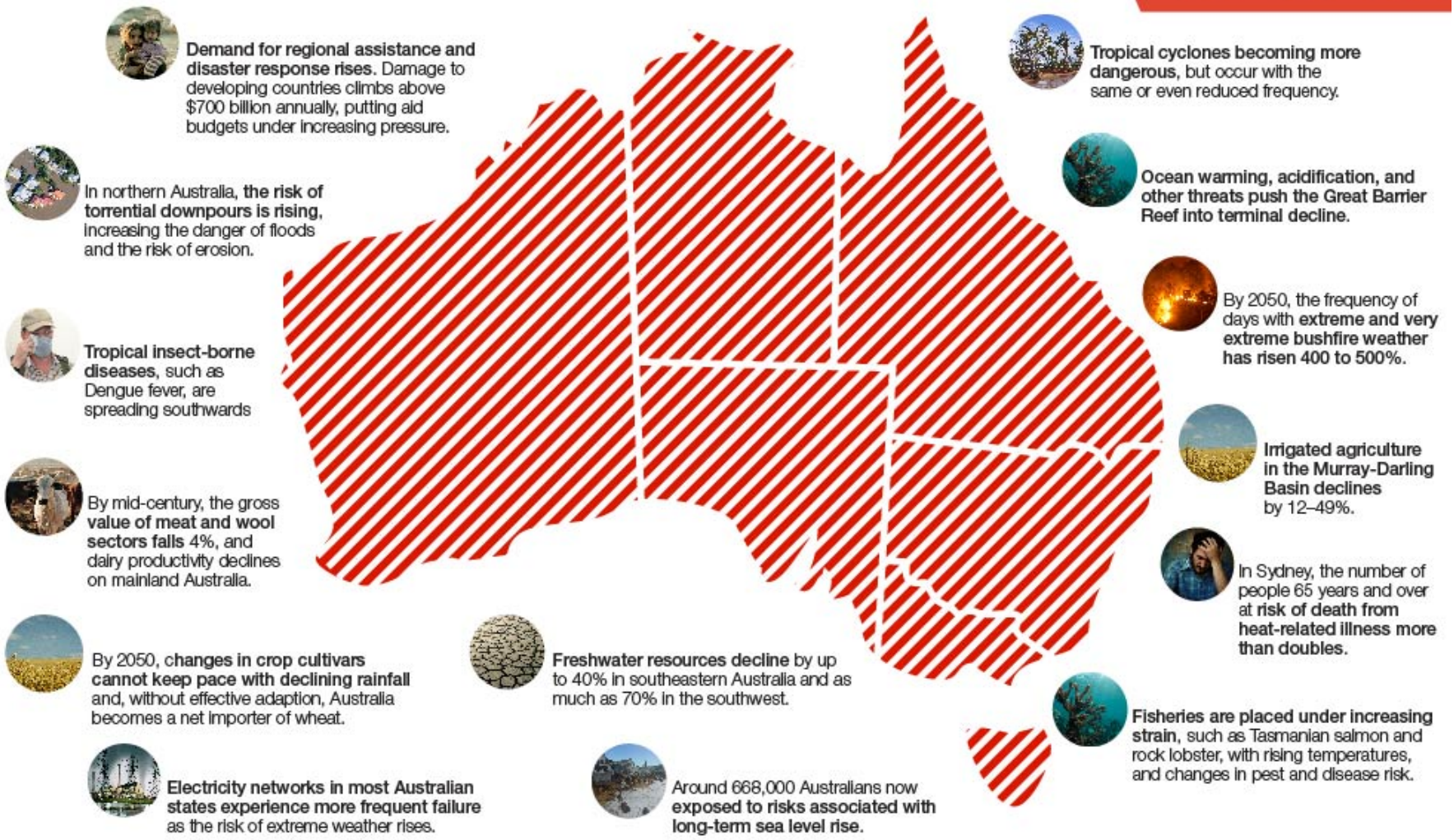
Should we care?

Australia's Climate is changing



http://www.climateinstitute.org.au/verve/_resources/Impacts-Graphic-square.jpg

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Australian Gas Prices are surging

According to the Australian Energy Marker Operator (AEMO), **wholesale energy prices were up 141 per cent** in the first quarter of 2022 compared with last year

Energy market operator, AEMO, intervenes as Victoria's gas reserves fall

Posted Tue 19 Jul 2022 at 11:04am, updated Tue 19 Jul 2022 at 8:45pm

AEMO is intervening after gas reserves at a facility in Victoria's south-west caused concern. *(Pixabay)*

Gas supply problems 'driven by greed'

Ms D'Ambrosio said Victoria had more than enough gas supply to meet demand, and that the price cap would not be removed.

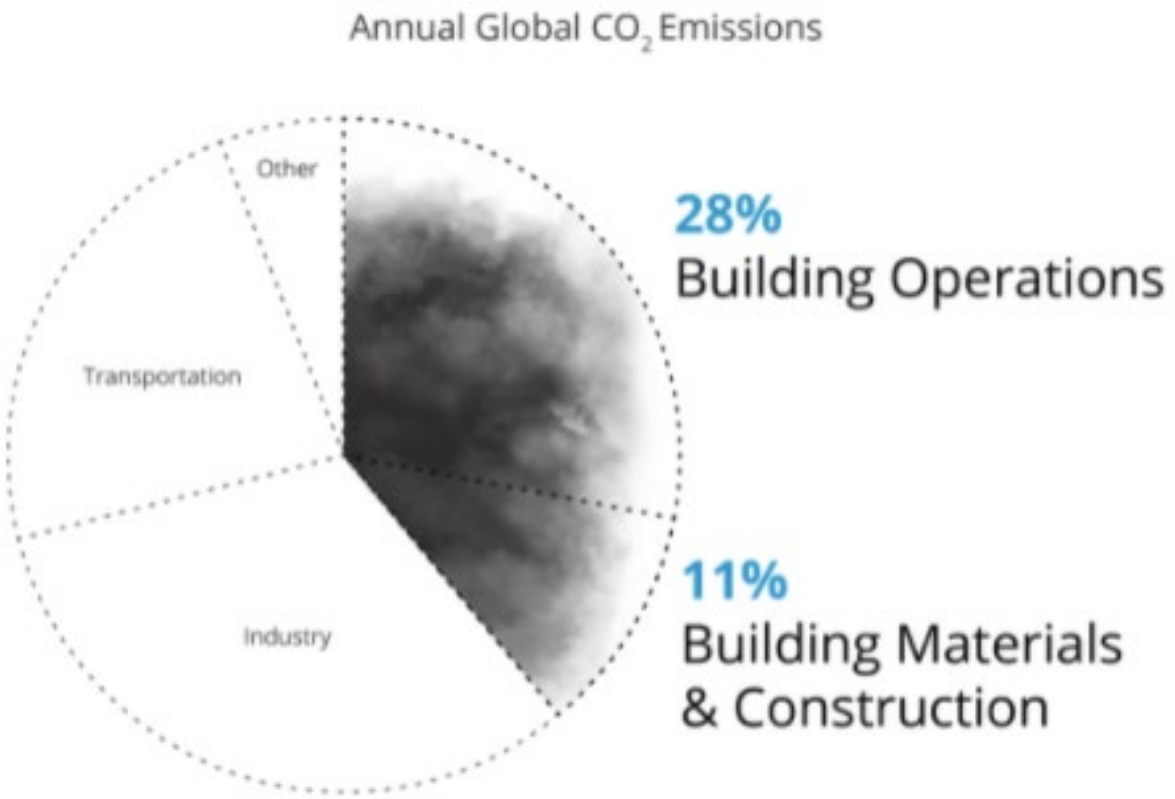
"A lot of this is driven by greed across gas producers. They will follow the dollar, and we're about protecting consumers, making sure that they pay no more than what is deemed to be a fair price and that's why that price cap is there," she said.

"Frankly, a fair price should be paid for gas. We've got more than enough supply to be able to meet our needs and it should be provided at a fair price."

Lily D'Ambrosio says Victoria's problems are being driven by greed from gas producers. *(Channel 9)*

The continued installation of unabated fossil fuel infrastructure will ‘lock-in’ GHG emissions

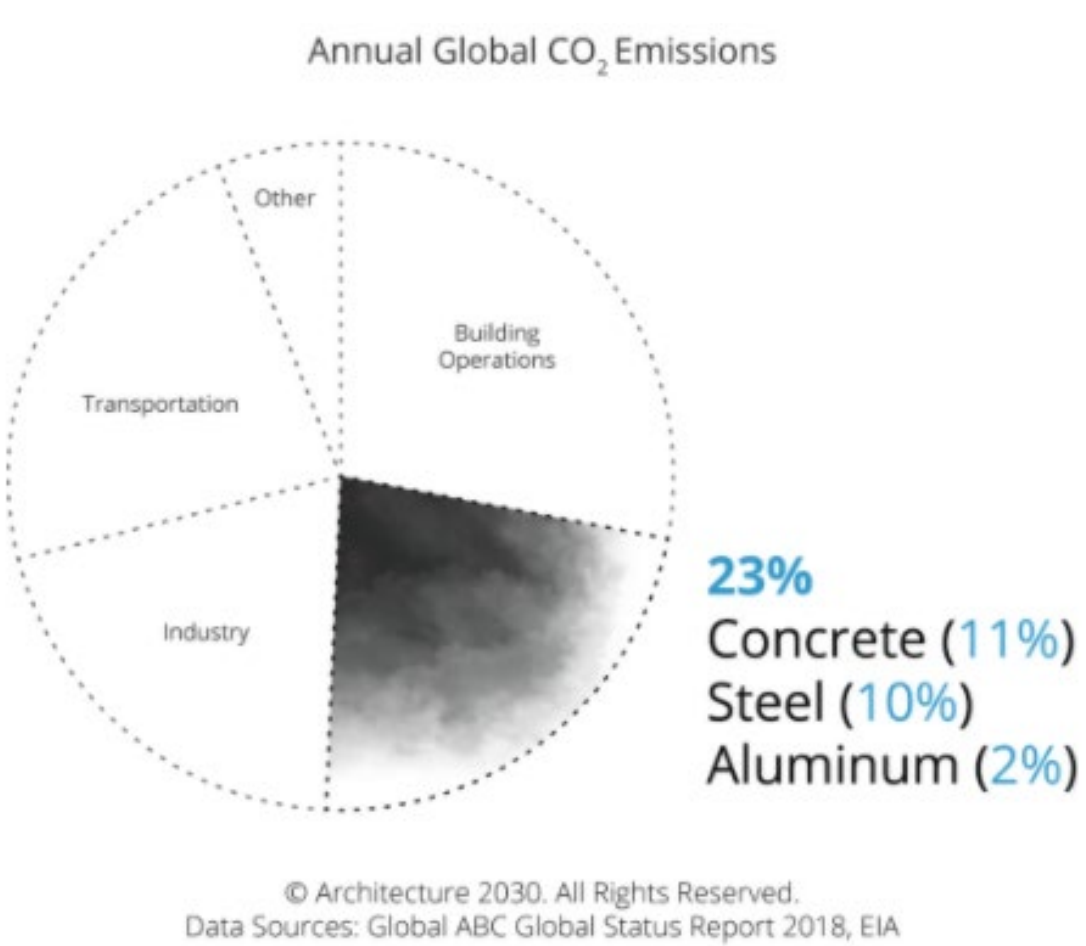
The impact of buildings on Global Carbon Emissions



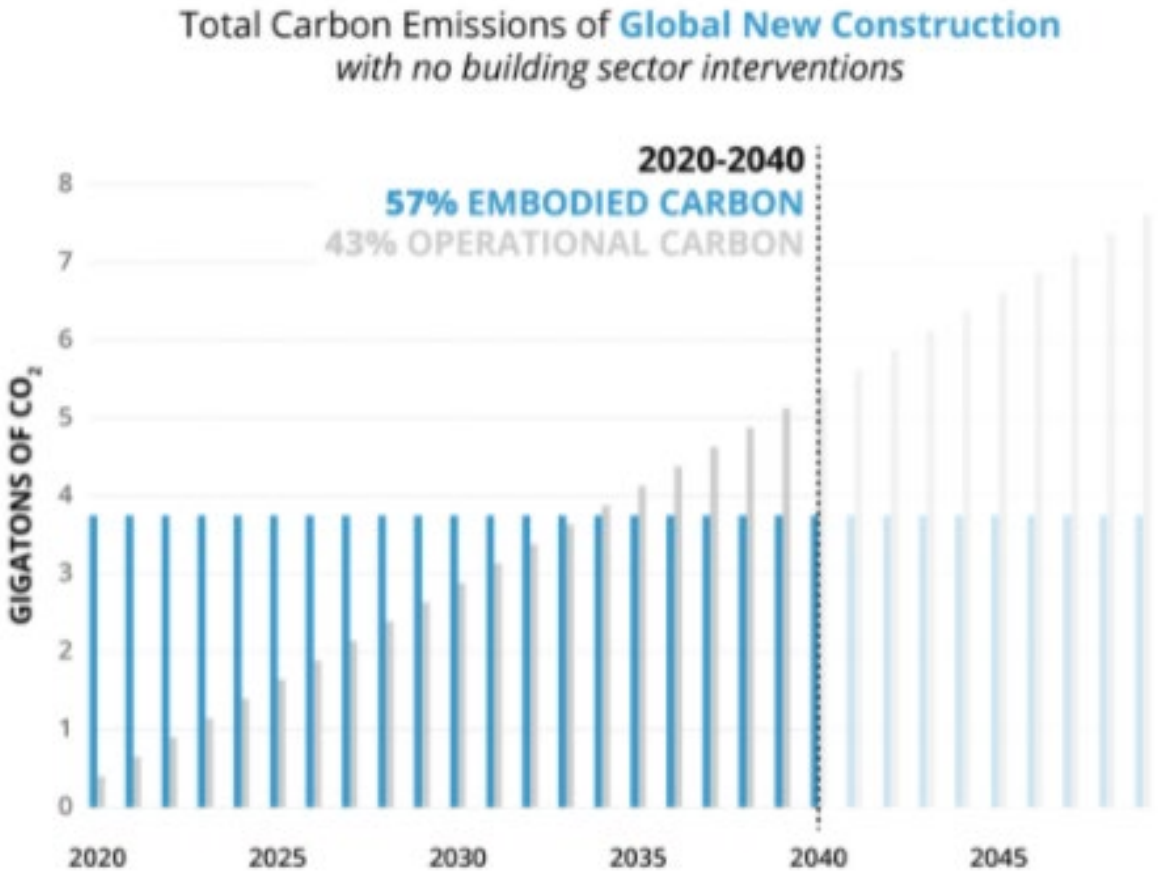
Data Sources: Global ABC Global Status Report 2018, EIA

Data Sources: Global ABC, Global Status Report 2017

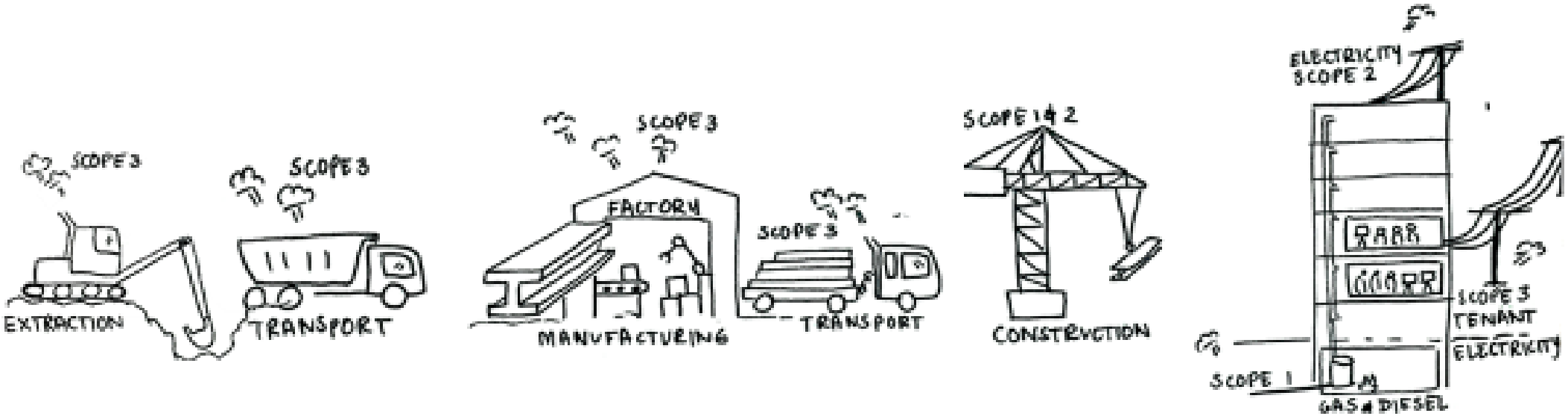
Embodied carbon in buildings is growing impact



Data Sources: Global ABC Global Status Report 2018, EIA



Data Sources: UN Environment Global Status Report 2017; EIA International Energy Outlook 2017



Embodied Carbon

Operational Carbon

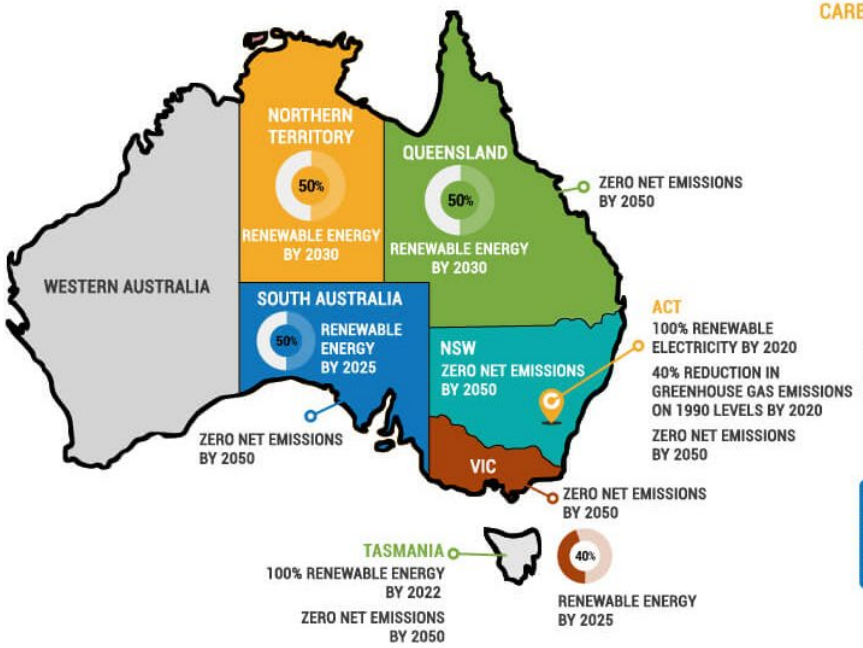
Around the world in ANZ

Bringing ideas to life

AUSTRALIA

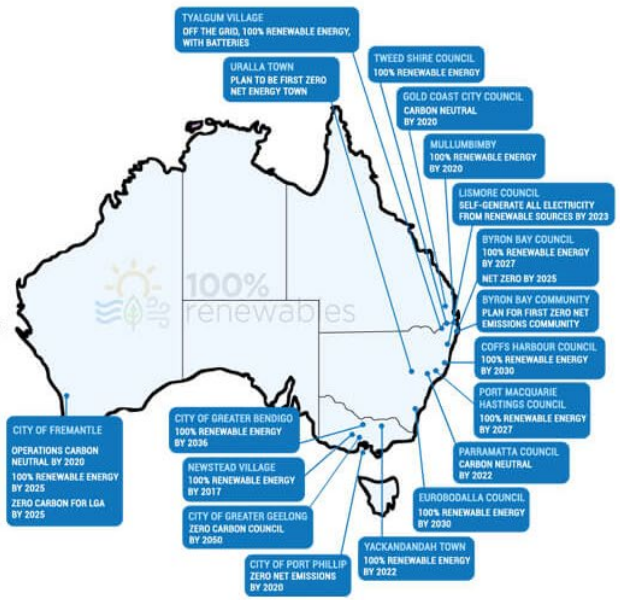
RENEWABLE SOURCES BY 2030

EMISSIONS REDUCTION FROM 2005 LEVELS BY 2030



CARBON REDUCTION AND RENEWABLE ENERGY COMMITMENTS OF STATES AND TERRITORIES

CARBON REDUCTION AND RENEWABLE ENERGY COMMITMENTS OF CAPITAL CITIES



AMBITIOUS CARBON REDUCTION AND RENEWABLE ENERGY COMMITMENTS OF REGIONAL COUNCILS, TOWNS AND AREAS

CARBON REDUCTION AND RENEWABLE ENERGY COMMITMENTS OF CAPITAL CITIES

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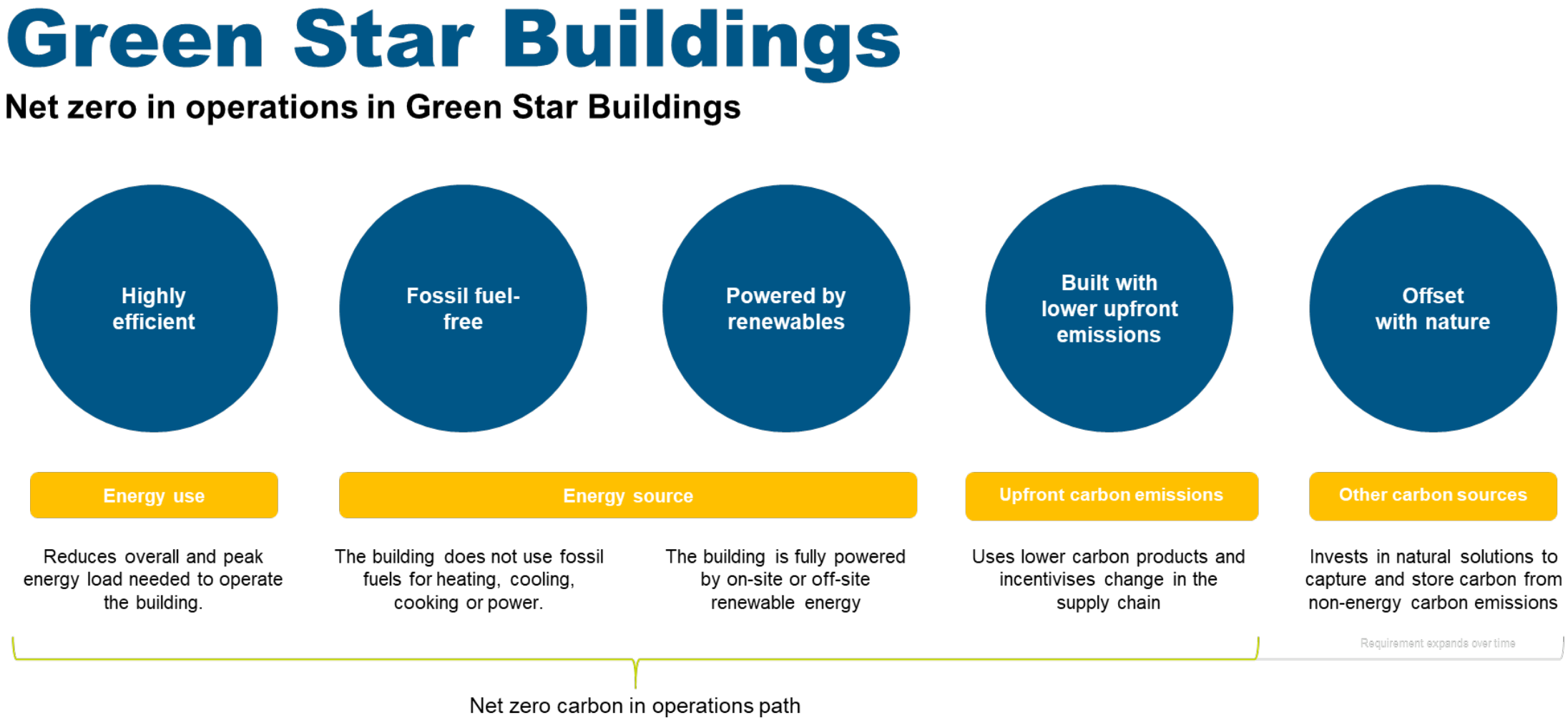
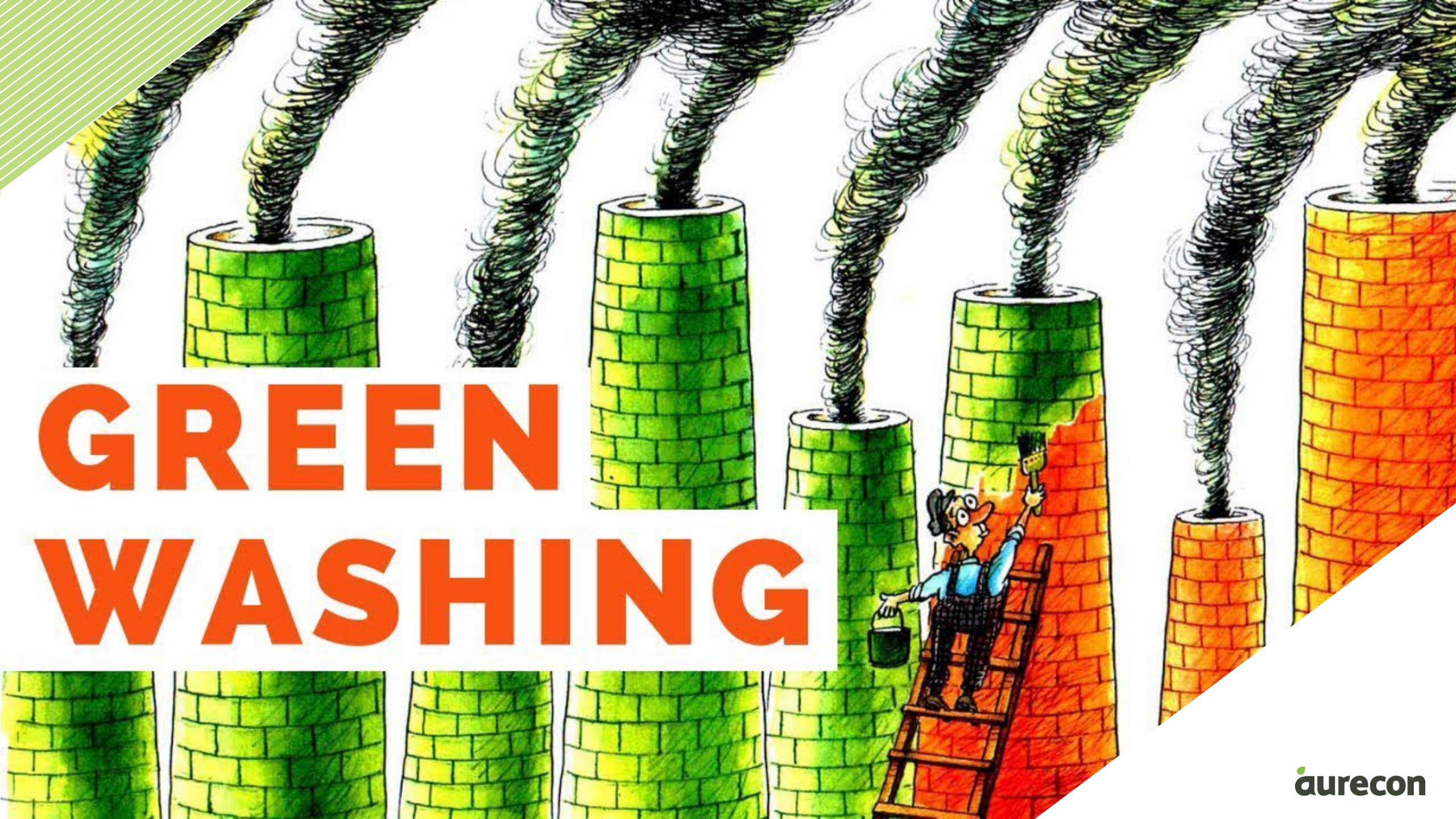
Tool #1: Rating Tools





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Meets the Paris Agreement targets

Green Star Buildings requires 6 Star Green Star rated buildings to be net zero carbon in operations and sets the path for every building to follow.

Legal compliance

Good Practice

4 star

Best Practice

Net zero in operations

Buildings that register from 2026 onwards that seek this rating will need to achieve this goal.

5 star

Australian Excellence

Net zero in operations

Buildings that register from 2023 onwards that seek this rating will need to achieve this goal.

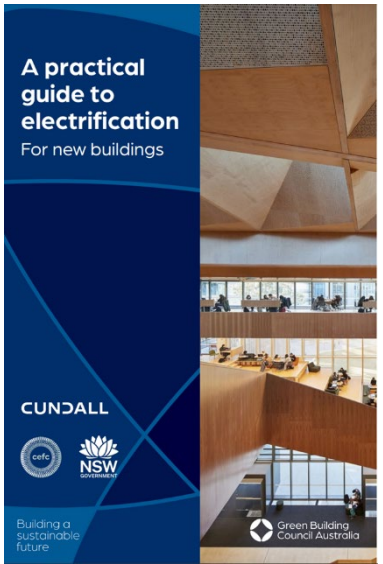
6 star

World Leadership

Powered by renewables

Net zero in operations

Buildings that register from 2020 onwards that seek this rating will need to achieve this goal.



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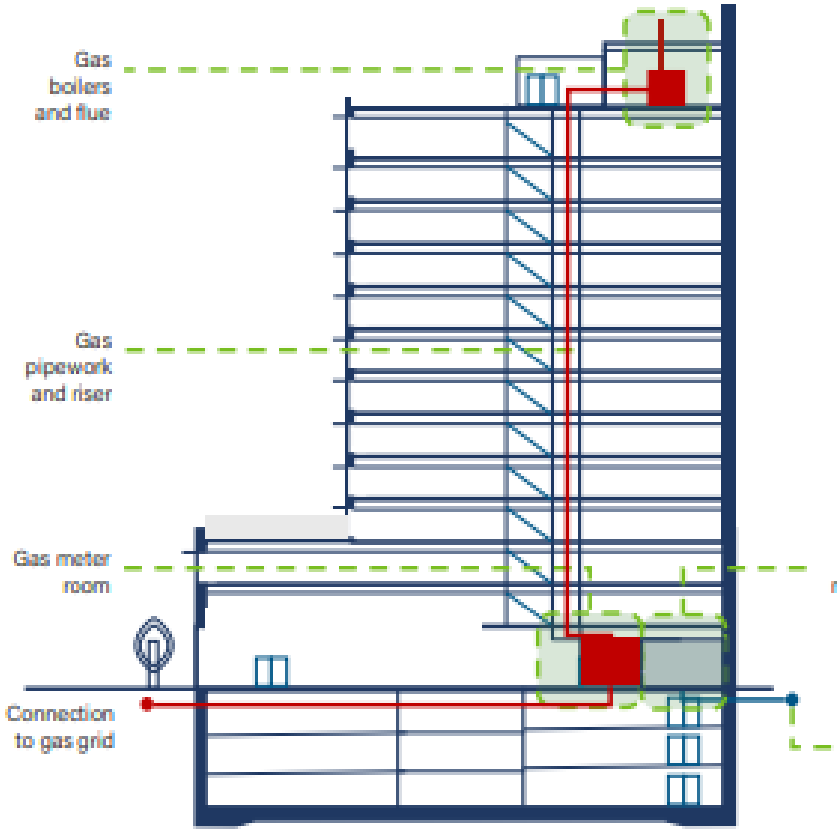
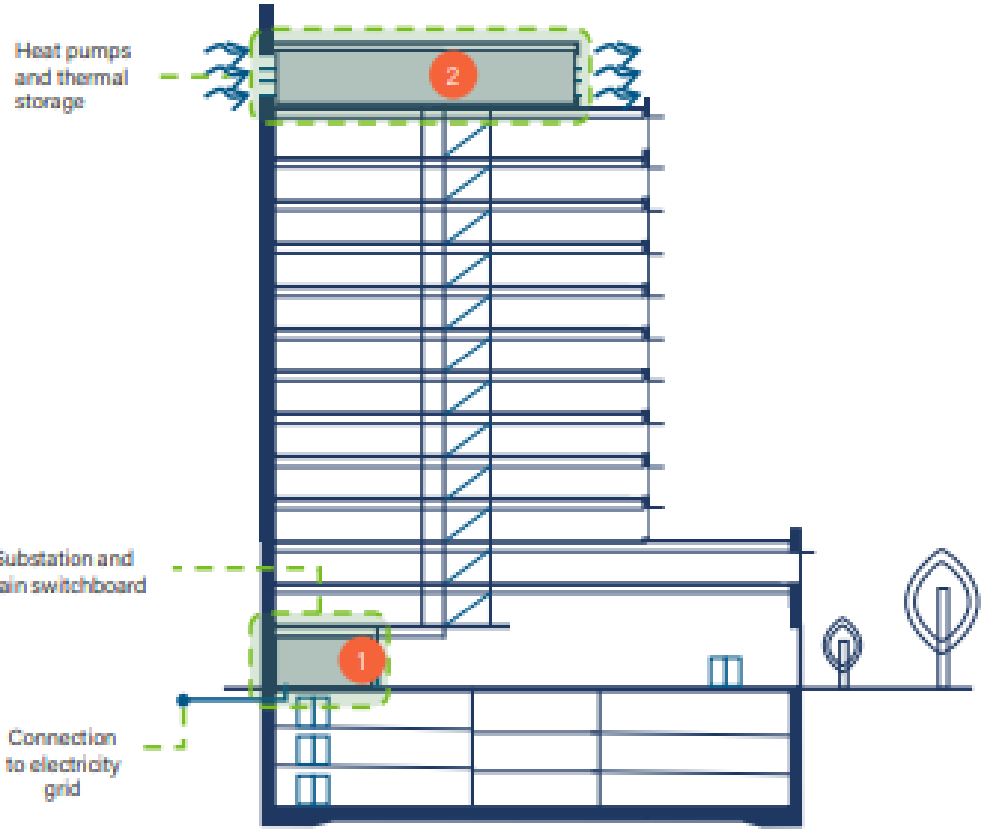
Tool #2: All-electric buildings

Bringing ideas to life



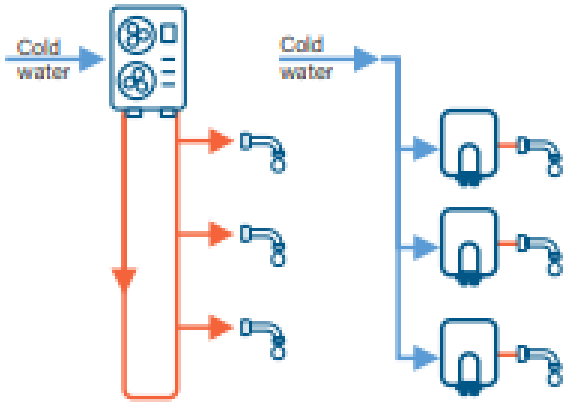
Gas equipment in a typical building
The items in red are not needed in an all-electric building



Equipment and considerations in an all-electric building

Local or central hot water systems

In buildings with low distributed demand for domestic hot water, local electric point of use heaters can be considered. Local systems can result in an increase in peak electrical demand compared to a central system. When evaluating the cost-benefits also consider the energy efficiency of heat generation, pumping energy, pipework and standing losses, and peak electrical demand.



Central heat pumps

Localised heating

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Tool #2: All-electric buildings

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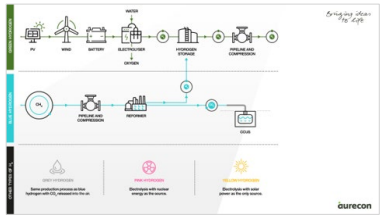
Backup and Emergency Power Alternatives

Biofuel Generation

Battery Storage

Hydrogen Fuel Cell



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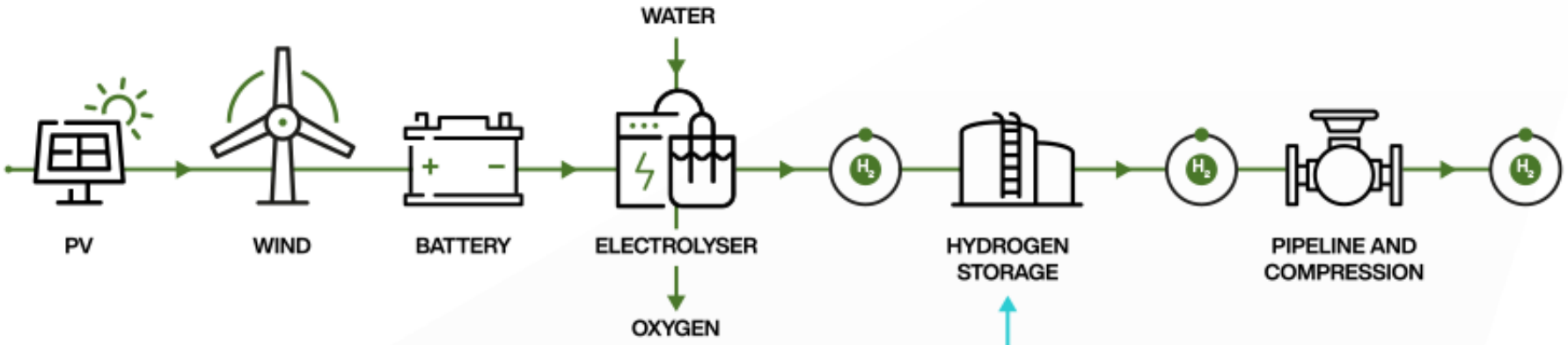
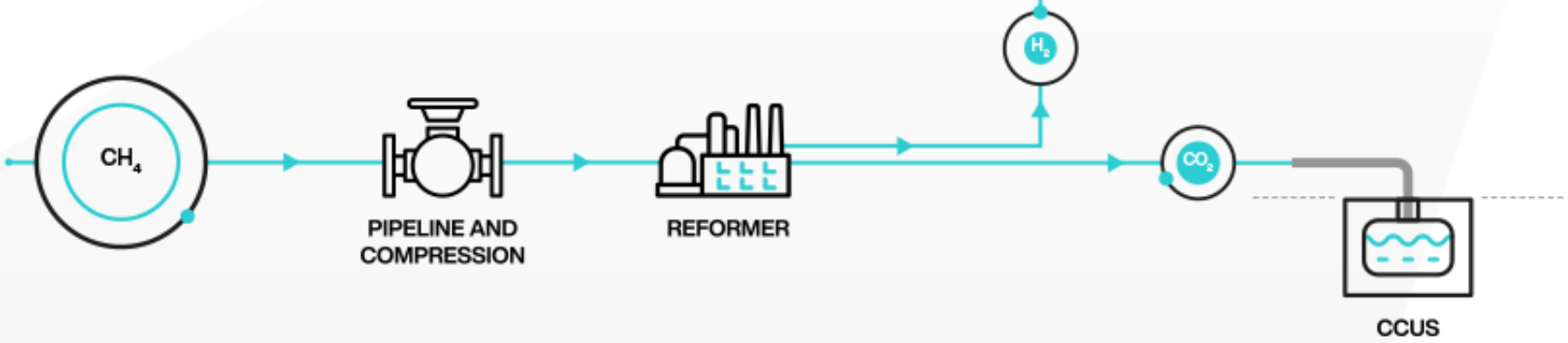
Bringing ideas to life

GREEN HYDROGEN



BLUE HYDROGEN



OTHER TYPES OF H_2

GREY HYDROGEN

Same production process as blue hydrogen with CO_2 released into the air.

PINK HYDROGEN

Electrolysis with nuclear energy as the source.

YELLOW HYDROGEN

Electrolysis with solar power as the only source.

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Critical Step – Pair electric buildings with renewable energy

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- Generated on-site or off-site
- Power Purchase Agreements (PPAs) already allow 100% GreenPower
- Embedded networks may offer opportunity to share generation to tenants etc

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What's your role in electrification?

Authorities	Review policies and procedures to ensure they don't encourage or mandate that natural gas has to be provided to buildings or precincts.
Electricity Utilities	Support building owners/developers and designers to deliver all electric buildings, including measures for grid stability and avoiding over-design of electrical capacity.
Professional services	Design the buildings with all-electric systems and be familiar with different design solutions and emerging technologies. Advocate for zero carbon solutions.
Builders & Trades	Challenge design assumptions that assume fossil fuels are required. Prepare alternative all-electric solutions when bidding.
Leasing & Sales Agents	Engage with potential tenants and purchasers to advocate for all-electric cooking solutions. Be prepared with evidence to demonstrate the benefits.
Facilities Manager	Ensure that the building is running to its maximum potential, creating a comfortable environment and managing the peak energy demands of the building.
Tenants & Occupants	Ask for fossil fuel free solutions. For retail F&B look at the benefits of switching to all-electric for cooking. Electrification is consistent with the net zero carbon targets that many corporates and governments have now committed to.
Owners	Promote the benefits of electric buildings, and seek to own new electric buildings. Ensure any owned existing assets are electrified as promptly as possible.

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Tool #3: Net Zero Carbon Buildings will need less glass

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CNN style

Are architects turning their backs on glass skyscrapers?

London 'should follow New York' in banning glass towers

Everyone needs to stop building giant glass skyscrapers right now

Towering glass structures are an environmental nightmare. And there's a growing consensus that we should stop building them

By SOPHIA EPSTEIN

Monday 11 November 2019

Credit: Shomos Uddin / WIRED

ArchDaily > Articles > How Architecture is Contributing to the Increase of the Temperature of the World

How Architecture is Contributing to the Increase of the Temperature of the World

Save this article

Written by Marília Matoso | Translated by Diogo Simões

3 days ago

Are glass towers heating up the streets? If so, what can we do?

Share 182 Tweet

Photo by Christian Wiediger on Unsplash

Poppy Johnston | 26 November 2019

SPECIAL FEATURE: Tackling the urban heat island effect is a big burly challenge with so many interrelated factors it's enough to make anyone's head spin. Every street microclimate has its own set of challenges – dark pavements, lack of airflow, and now, mirror-like glass facades are a growing, and rather contentious, concern. So does this spell the end of glitzy fully-glazed glass towers in hot sunny cities like Sydney and Brisbane? *The Fifth Estate* investigates.

Experts call for ban on glass skyscrapers to save energy in climate crisis

Air conditioning is used to avoid greenhouse effect but cooling buildings adds to carbon emissions

People sit on deckchairs near the Lloyds of London building during the heatwave. Photograph: Dominic Lipinski/PA

Leading architects and engineers are calling for all-glass skyscrapers to be banned because they are too difficult and expensive to cool.

"If you're building a greenhouse in a climate emergency, it's a pretty odd thing to do to say the least," said Simon Sturgis, an adviser to the government and the Greater London Authority, as well as chairman of the Royal Institute of British Architects sustainability group. "If you're using standard glass facades you need a lot of energy to cool them down, and using a lot of energy equates to a lot of carbon emissions."

Glass skyscrapers: a great environmental folly that could have been avoided

May 14, 2019 10.46pm AEST

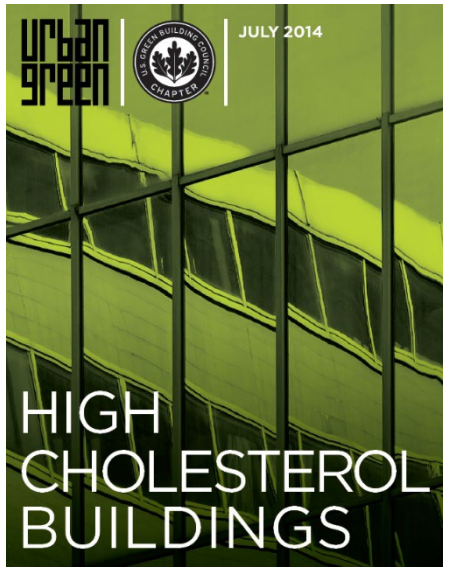
New York restricts the growth of glass skyscrapers. Shutterstock

Email Twitter Facebook LinkedIn 46

New York Mayor Bill de Blasio has declared that skyscrapers made of glass and steel "have no place in our city or our Earth anymore". He argued that their energy inefficient design contributes to global warming and insisted that his administration would restrict glassy high-rise developments in the city.

Poor Fabric Performance of Contemporary Buildings

Bringing ideas to life

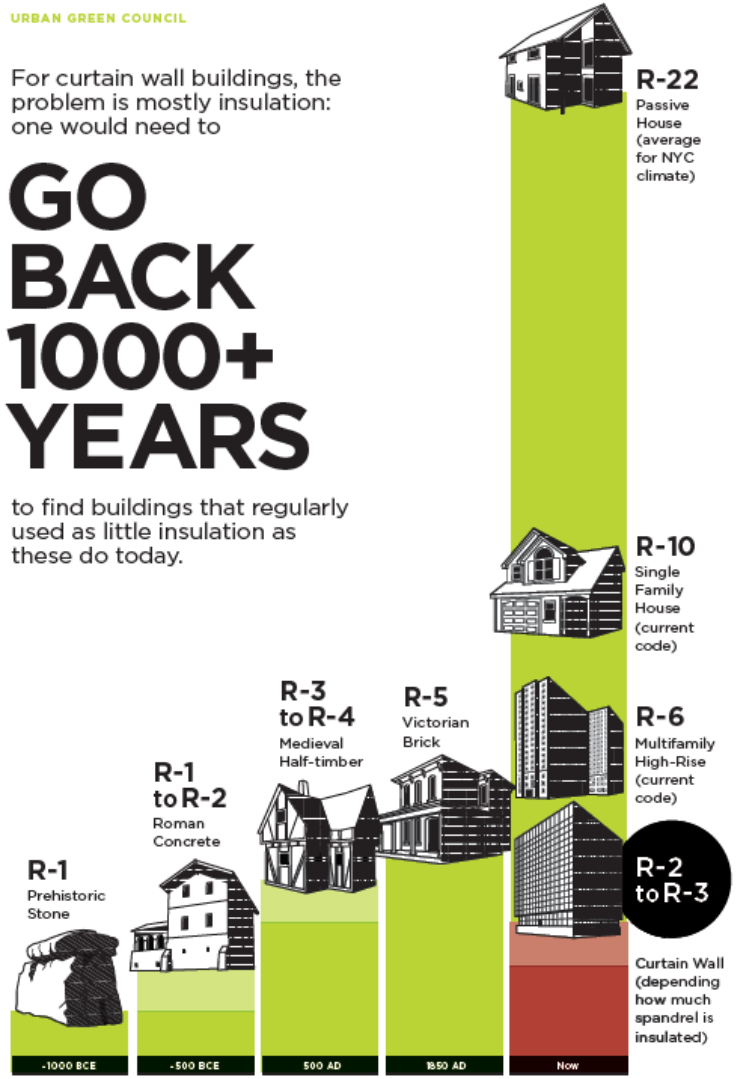


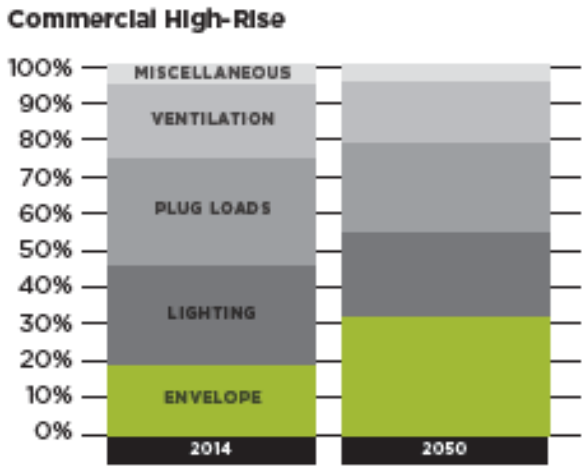
URBAN GREEN COUNCIL

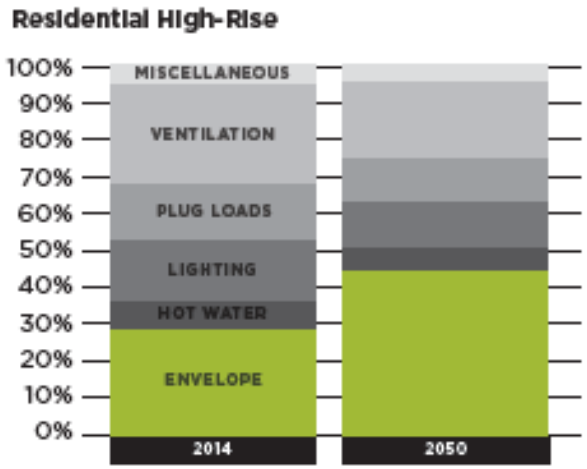
For curtain wall buildings, the problem is mostly insulation: one would need to

GO BACK 1000+ YEARS

to find buildings that regularly used as little insulation as these do today.







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"I think (glass) is a symbol for energy-guzzling buildings, and we need to move to a much more energy-conscious environment to try and save resources,“

Ken Shuttleworth Make Architects (Architect of “ the Gherkin”)

How do we improve the fabric performance of contemporary buildings?

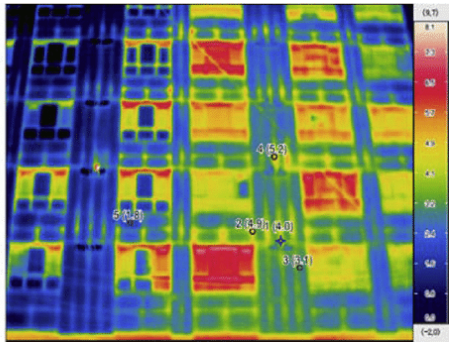
Bringing ideas to life

A view of New York's stunning skyline... and its rooftop equipment, water towers, and wiring.

With something as straightforward as a windowsill, we are able to capture views we find beautiful while leaving out those we'd rather avoid.

Rendering Provided by Skidmore, Owings & Merrill LLP

1. Better Glass and Framing Systems
2. Better Design - More Appropriate Glass to Window Ratios and / or External Shading
3. Better training of contractors with respect to insulation & airtightness
4. Air Tightness Testing and Thermography
5. Better Codes and Standards



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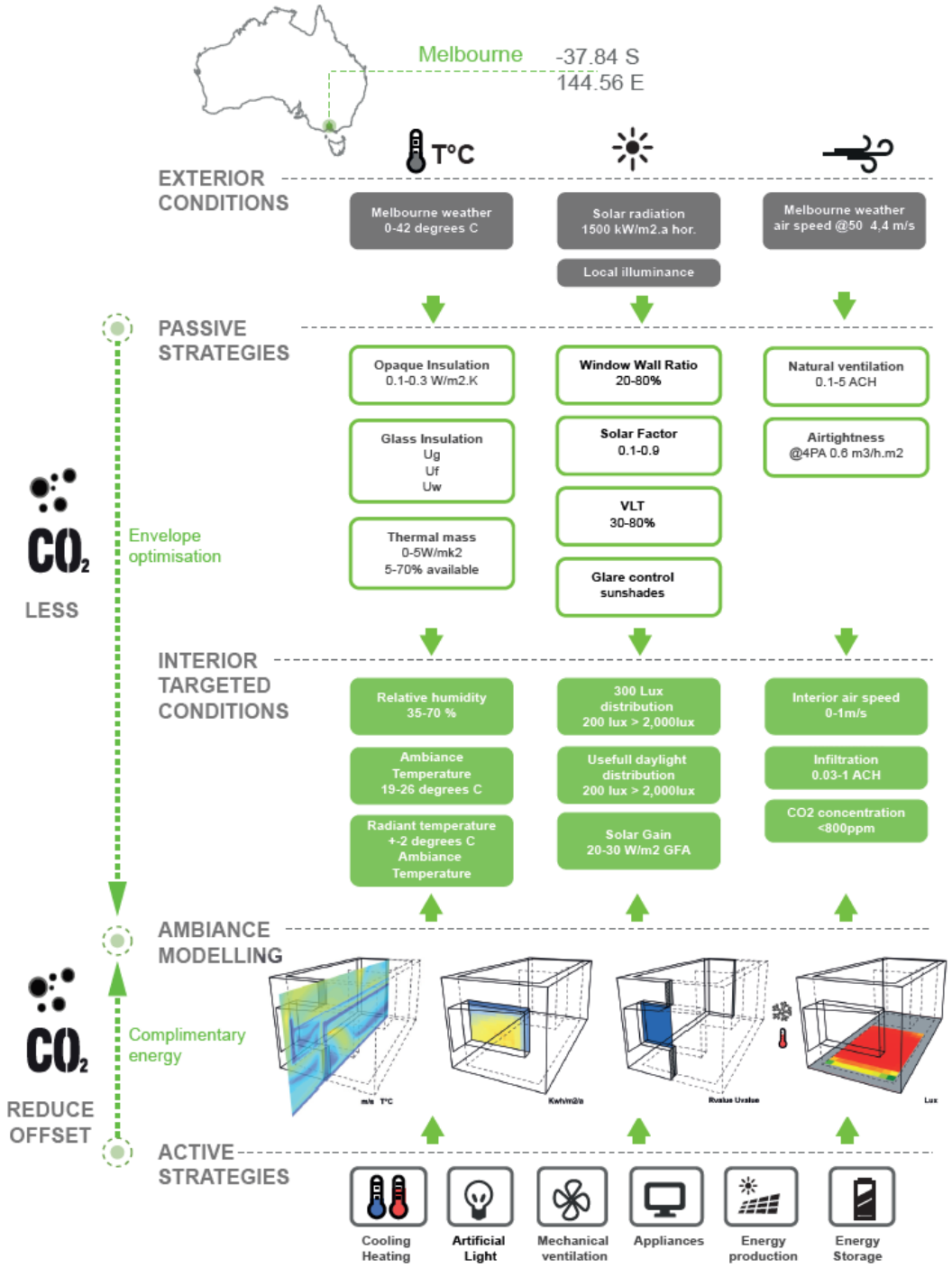
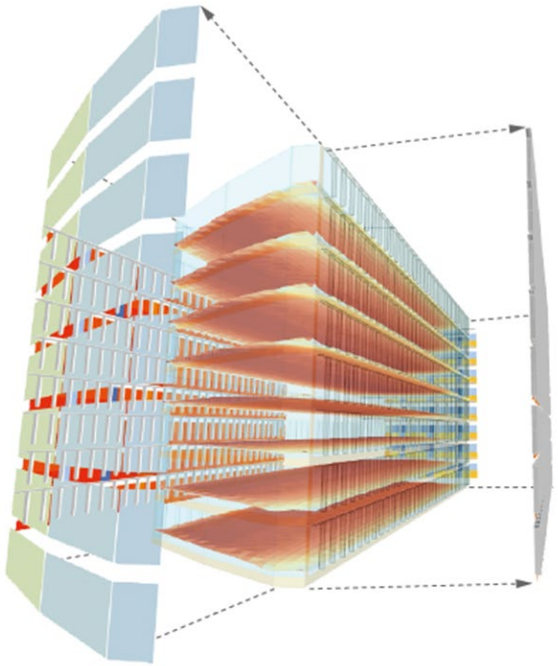
Fabric first, low energy & high comfort



Tool #4: Parametric Design

Bringing ideas to life



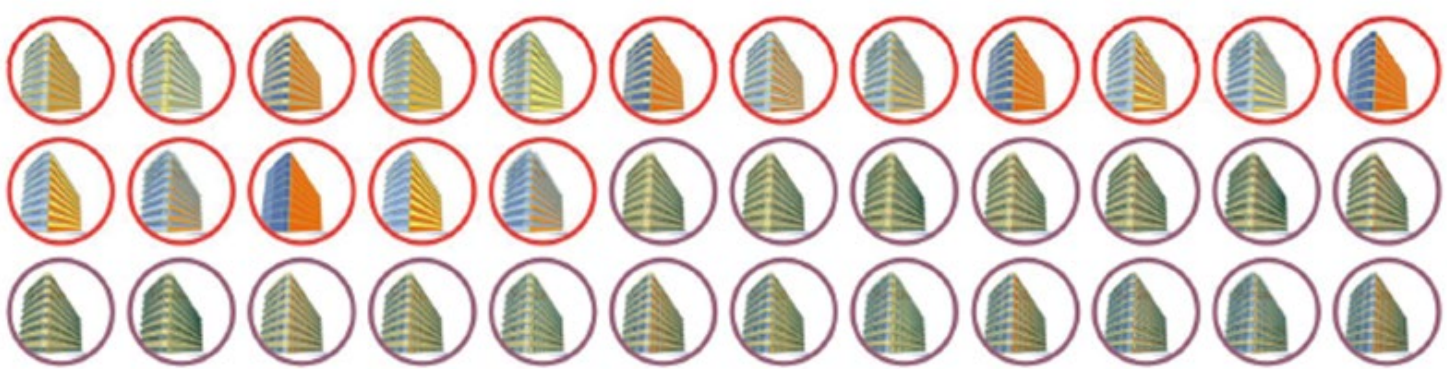
40 kWh/m2.a projected — Energy Production

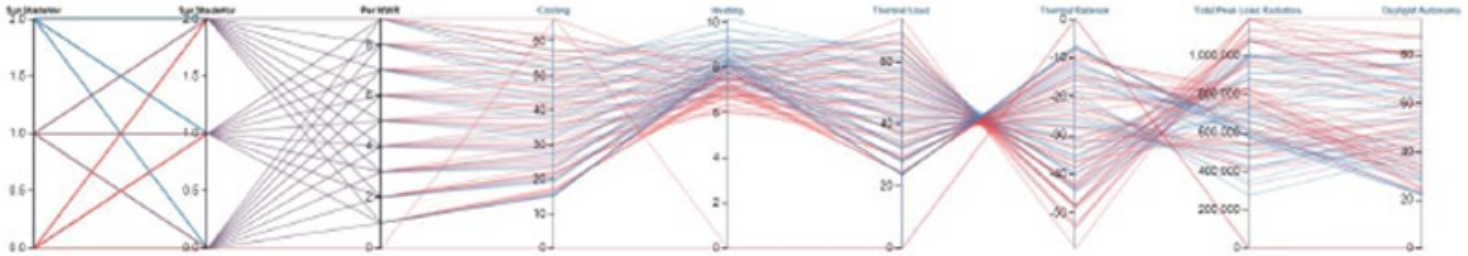
71 % — Daylight Autonomy

67 W/m2 — Radiation Peak Load

23 kWh/m2/ — Heating Demand

12 kWh/m2/a — Cooling Demand





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Parametric Design paired with Integrated Design

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Integrated Design Process		Conventional Design Process
Inclusive from the outset	vs	Involves team members only when essential
Front-loaded — time and energy invested early	vs	Less time, energy, and collaboration exhibited in early stages
Decisions influenced by broad team	vs	More decisions made by fewer people
Iterative process	vs	Linear process
Whole-systems thinking	vs	Systems often considered in isolation
Allows for full optimization	vs	Limited to constrained optimization
Seeks synergies	vs	Diminished opportunity for synergies
Life-cycle costing	vs	Emphasis on up-front costs
Process continues through post-occupancy	vs	Typically finished when construction is complete

Integrated design process (Source: Roadmap for the Integrated Design Process)

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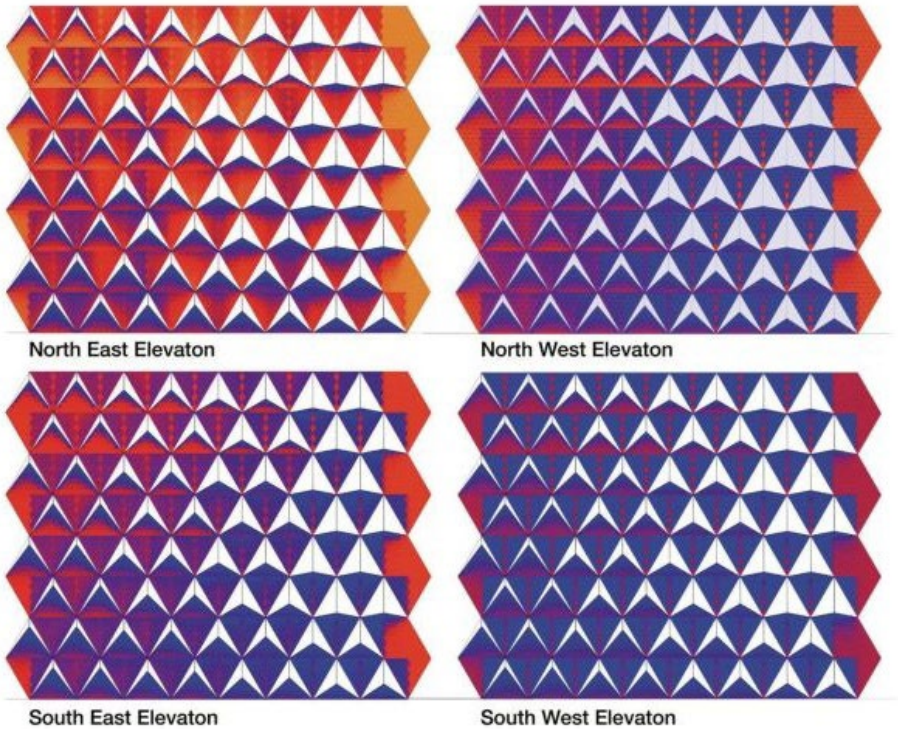
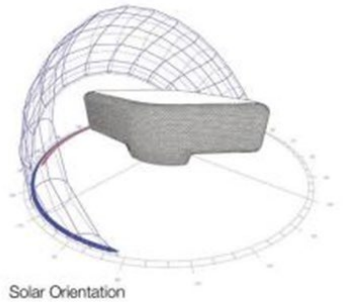
South Australian Health and Medical Research Institute
Architect **Woods Bagot**





175	175	175	175
250	500	750	1000
350	350	350	350
250	500	750	1000
525	525	525	525
250	500	750	1000
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250	500	750	1000

Panel Variation Parameters			
Offset			
Closure			

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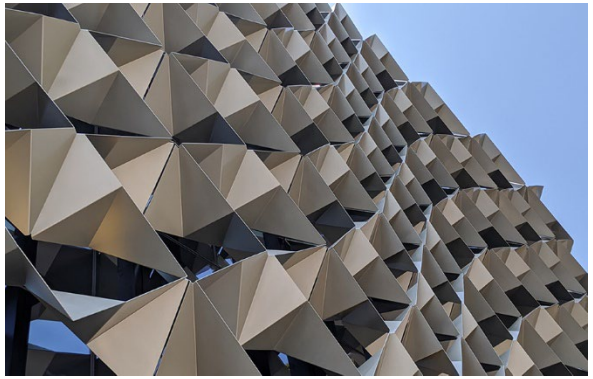

Monash Chancellery
Architect **ARM Architects**

Monash University's Woodside Building For Technology and Design

Design for Future Climate

Tip #1: Rating tools

Tip #2: All Electric Buildings

Tip #3: Net Zero Carbon Buildings will need less glass

Tip #4: Parametric Design

quentin.jackson@aurecongroup.com

https://www.linkedin.com/in/qjaurecon/

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