# *Sustainable Temporary Adaptive Reuse*

Supported by

CITY OF SYDNEY

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2025

## STAR SDG MAPPING : TOOL 5

## Acknowledgement of Country

UTS acknowledges the Gadigal people of the Eora Nation, the Boorooberongal people of the Dharug Nation, the Bidiagal people and the Gamaygal people, upon whose ancestral lands our university stands.

## Acknowledgements

The STAR Toolkit was a collaborative effort, brought to life by the collective expertise of Professor Sara Wilkinson (UTS), Dr Gill Armstrong (UTS), Dr Robert Fleck(UTS), Dr Kusal Nanayakkara (RMIT), Mark Willers (Charter Keck Cramer), Laura West (University of Sydney), and Professor Jua Cilliers (UTS).

We extend our heartfelt gratitude to all those who generously shared their expertise, knowledge, and time to facilitate the workshops or production of STAR Tools. In particular, we would like to personally thank, in alphabetical order: Bron Belcher (Schoolhouse Studios), Dr Campbell Drake (UTS), Dr Biyanka Ekanayake (UTS), Michael Ford (UTS), Mick Fritschy (Rosella Street), Valentino Gareri (AG Atelier), Flora Georgakopoulos (UTS), David Harding (Business NSW), Alison Holloway (SGS Economics and Planning), Andrew Hoyne (Hoyne), Matt Levinson (Committee for Sydney), Javid Mousavi (UTS), Tyron Seeto (RMK Crew), Dominic Snellgrove (Cameron Chisholm Nicol), Professor Vahid Vahdat (Washington State University), Ianto Ware (City of Sydney), Laura West (University of Sydney) and the interior architecture students at Washington State University and University Technology Sydney.

We wholeheartedly thank all who participated in our research workshops, whom we cannot name individually due to Human Research Ethics Committee approval requirements. Participants included individuals from non-government organisations seeking temporary space, built environment professionals, and government departments spanning local government, building regulation certification, and strategic and town planning.

This project (2021-2024) was funded by a three-year Knowledge Exchange Grant, awarded by the City of Sydney. The views an findings expressed in the STAR Toolkit, do not necessarily reflect the views and policy positions of the funder.

## To cite our work

Wilkinson, S., Armstrong, G., Fleck, R., Nanayakkara, K., Willers, M., West, L. and Cilliers, J. (2025) Sustainable Temporary Adaptive Reuse (STAR) Toolkit. UTS. Access here.

## STAR Publications

The following open-access articles are available as part of the research project:

### Short articles in the news/professional practice magazines

- Connecting the Dots for empty office buildings and creative/fun/different tenants. *The Fifth Estate* (2023, October 17). Article link
- What to do about the hollowed-out CBDs – a call for some creative thinking and social value. *The Fifth Estate* (2023, March 10). Article link
- A new toolkit for underused space. *The Fifth Estate*. Article link
- *Sustainable temporary adaptive reuse for a COVID-19 recovery and resilient cities approach*. 10th State of Australasian Cities Conference (SOAC), 1-3 December 2021, Melbourne. Article link
- *We're gonna make you a STAR. Sustainable Temporary Adaptive Reuse in the CBD*. AIQS December. Article link
- *Repurposing Assets To Reduce Vacancy Rates*. RICS Dec 2021. Article link

### Academic publications

Armstrong, G., Wilkinson, S., & Cilliers, J. (2023) A framework for Sustainable Adaptive Reuse: Understanding vacancy and underuse in existing urban buildings. *Frontiers*. Article Link

Armstrong, G., Wilkinson, S., Nanayakkara, K., Fleck, R., Willers, M., & Cilliers, J. The Sustainable Temporary Adaptive Reuse (STAR) Toolkit: A Solution for Underused and Vacant Buildings. Chapter 8 in: Toivonen, S., Heinonen, S., Verma, I., Castaño-Rosa, R., & Wilkinson, S. (Eds) (2024). *Real Estate and Sustainable Crisis Management in Urban Environments: Challenges and solutions for resilient cities*. Taylor and Francis. Article Link

## What is this STAR Tool about?

This tool is part of the Sustainable Temporary Adaptive Reuse (STAR) Toolkit research project. It is one of several tools to normalise STAR.

The purpose of this mapping tool is to align the Sustainable Temporary Adaptive Reuse (STAR) toolkit to the UN Sustainable Development Goals (UNSDG's).

The STAR Mapping Tool has identified **5 Impact Themes** that can be aligned to the Sustainable Development Goals (SDGs).


Source: un.org/sustainabledevelopment

**STAR Impact Themes:**

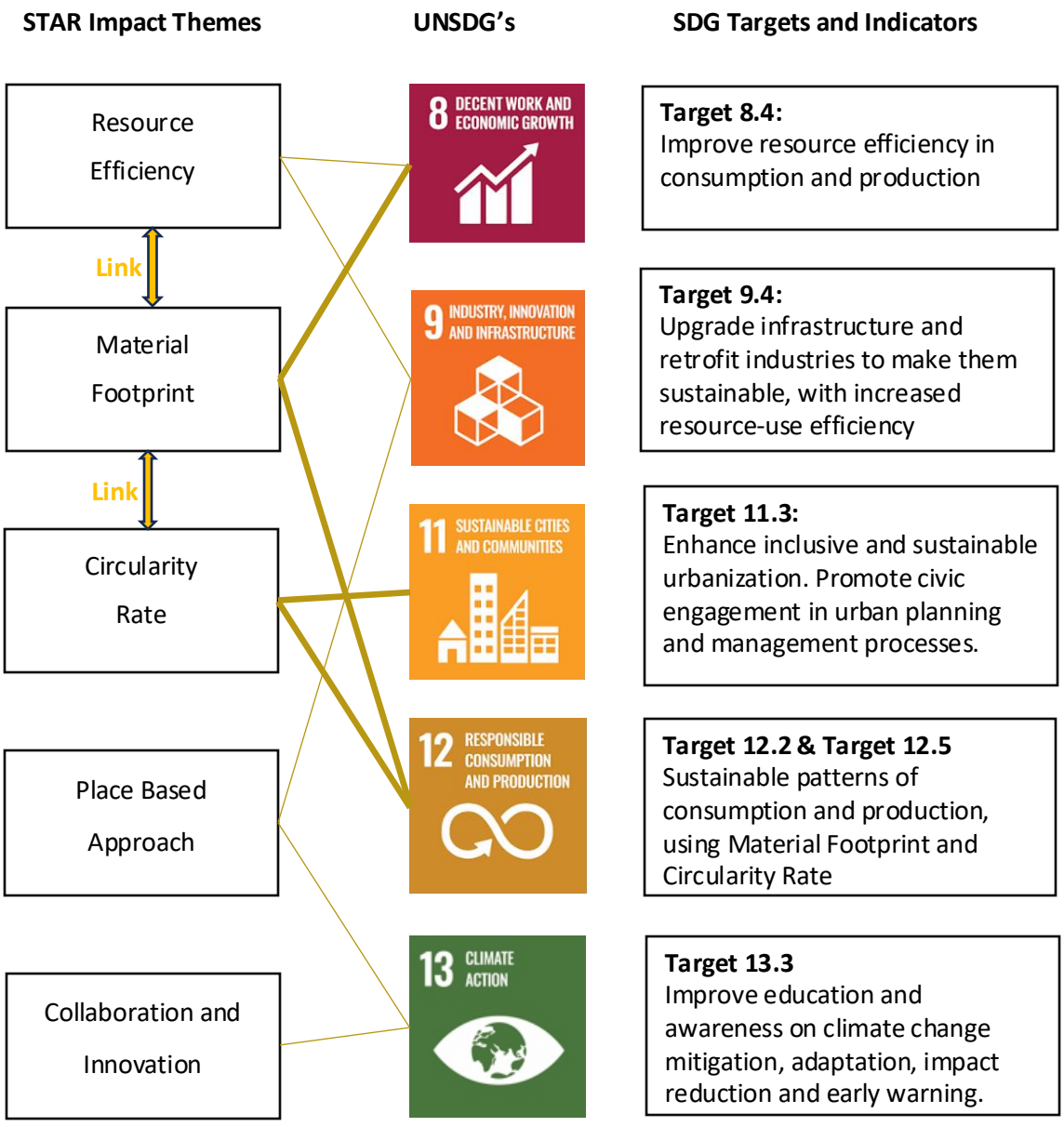
To map the STAR Toolkit to the UNSDG's, the following STAR Impact Themes have been determined:

1. Resource Efficiency
2. Material Footprint
3. Circularity Rate
4. Place-based Approach
5. Collaboration and Innovation.

Themes 1 to 3 are linked and can be measured.
Themes 4 and 5 can be addressed.

These STAR Impacts have been identified using:
- Nationally Determined Contributions NDC-SDG's *(See Appendix A)*
- SDG Progress Reports (*MSDI Transforming Australia - 2018, 2020, 2024*); and
- Circularity Indicators *(World Business Council for Sustainable Development – Circular Transition Indicators 4.0)*.

## Mapping the UNSDG Targets and Indicators to STAR Impact Themes

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# Impact Theme: Resource Efficiency

## Addressed Impact = Underutilized Commercial Space

Underutilized buildings take up valuable land in cities, contributing little to no job creation or aiding economic recovery. They can intensify the impact of Australia's material footprint, if buildings are not maximising their potential.
Adaptive reuse of assets provide environmental benefits, economic benefits, as well as community benefits. The STAR toolkit ensures that both direct and indirect stakeholders are engaged in the process of assessment.


Resource Efficiency:
By utilizing and repurposing existing commercial building spaces, it enables conservation of energy and materials.

It enables the maximum benefit from every resource. It is therefore essential to manage our resources carefully and protect them for future use.
Resource utilisation enables longer life cycles through repair, reuse and modular design.


Resource Utilisation enables:

1. Financial stability
    - Using less energy and material cost
2. Minimising waste
    - Through circular economy principles
3. Opportunities:
    - Sharing platforms
    - Collaborative consumption
    - Open-source knowledge sharing
    - Design for durability and reuse
    - Reverse logistics

The STAR Toolkit suggests that to consider maximum resource efficiency, companies can implement:

- Mapping of the process when considering a use of a space
- Eliminating unnecessary fixtures, enhancements or redundant use
- Optimise Supply Chain, ensuring minimal resource waste.

# Impact Theme: Material Footprint

**Measurable Impact = Reducing Material Footprint by 10%**

Australia's material footprint has been recorded at 31 Tons per capita. *(DCCEEW, 2024)*
It is defined as *"the total amount of raw materials required to support the country's goods and services". (ABS, 2023)*
The aim to reduce Australia's per capita material consumption requires a focus especially by the building industry to reduce the material footprint. This can be achieved through strategically reusing and repurposing current building stock and materials.


Material Footprint:
Australia's material footprint has reduced since 2010 (37.6 tonnes per capita), but the goal for 2035 is to reduce this by 10% further = **27.9 tonnes** per capita.

Using the data from ABS Statistics (2023), Table 1 is the comparison between Australia's Material Footprint (MF) and Circularity Rate (CR) using the population as of 2024, and the targets for 2035.
This is compared to similar countries, such as Finland and Norway, as well as best practice country such as The Netherlands.


Patterns of Consumption and Production
Making conscious decisions about consumption and production are essential, as we continue to use more resources than the planet can sustain.

Within the built environment, the opportunity that STAR provides addresses an innovative way to respond to patterns of consumption and production.

It provides as alternative means to using existing space and reducing the material footprint in the process.

# Impact Theme: Circularity Rate

**Measurable Impact = Double Circularity Rate by 2035**

This requires an innovative approach and finding opportunities for collaboration.
***"It offers a chance to create a shared vision for governments, businesses, investors, communities, researchers, and individuals to unite in their efforts and drive change".*** *(DCCEEW 2024)*
This can be achieved through Circular Economy initiatives, particularly the reuse of buildings.



Circular Economy Initiatives:
Ideally the rate of resource extraction should be below the rate of rate of resource consumption. As per Table 1, Australia is behind the global average in their Circular Economy rate, and aims to double this rate by 2035 from 4.6% to 9.2%

To measure Circularity, recommendations include:

1. Material Flow Analysis (MFA)
    - Provides data about material flows and stock, which can provide opportunities to discuss circular options
2. Impact Assessments
    - Environmental Impact Assessment (EIA)
        - Reduced environmental burden
        - Resource conservation
    - Social Impact Assessment (SIA)
        - Community benefit
3. Cost-benefit analysis (CBA)
    - It is important to consider the cost benefit of repurposing space when analysing the outcome of your project, including cost savings associated with:
        - Material reuse
        - Energy saving
        - Lower construction cost

# Impact Theme: Placed Based Approach / Collaboration and Innovation

## Addressed Impact = Connecting Community to Property Owners / Remaining transparent and open

The need to understand the end-user as well as property owner's needs, must coincide with understanding and connecting to the place.
The needs of urban dwellers should be matched by the services that can be provided by the cities they live in and therefore the development of a sustainable urban spaces should aim to address the living and social requirements of the community.
Underoccupied commercial buildings tend to decay and age at a faster rate than occupied buildings as they have reduced rental income for re-investment, upgrades and maintenance.
If buildings are not adapted for new uses, their space can be prematurely obsolete, in the longer-term, under-occupied or 'mothballed' buildings will result in premature demolition.

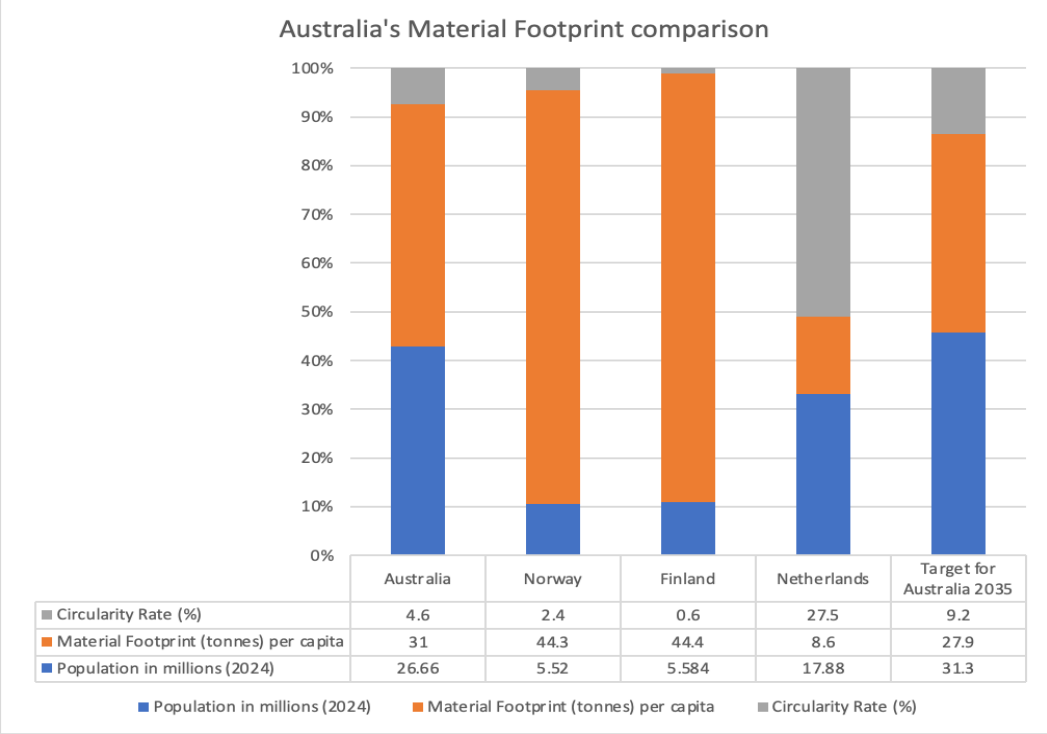

Inclusive and Sustainable :
The goal is to build an active, inclusive and equitable society and more inclusive and sustainable urban environment.

Sustainability requires a shift in the way businesses and communities think, behave, produce, and consume. Access to information, experiences, and knowledge-sharing enables everyone to understand the issues and provide solutions.


Innovative
Innovative uses of underutilized space provide opportunities for all involved and enable strategies that are necessary in changing how we design our spaces.
Opportunities such as:

- Design for reuse (resource efficiency)
- Design for disassembly (material footprint)
- Design for longevity (circular economy)

## Measurable Impact - Table 1
## Material Footprint and Circularity Rate




| | Australia | Norway | Finland | Netherlands | Target for Australia 2035 |
|---|---|---|---|---|---|
| Circularity Rate (%) | 4.6 | 2.4 | 0.6 | 27.5 | 9.2 |
| Material Footprint (tonnes) per capita | 31 | 44.3 | 44.4 | 8.6 | 27.9 |
| Population in millions (2024) | 26.66 | 5.52 | 5.584 | 17.88 | 31.3 |

Table 1: Material Footprint Comparison (Source: Author)

Material Footprint and Circularity Rate comparison

Using Table 1 as a guide, Australia's focus on improving the Circularity Rate by 2035 provides an opportunity for STAR to be utilised in this respect.
Circularity addresses:

1. Resource Efficiency
2. Reduced Material Footprint
3. Improved Circularity Rate.

STAR provides an opportunity for users to make a significant impact on these 3 areas by adapting underutilised commercial buildings and reuse of materials.

# Appendix 1 – Selection of UNSDG's to align to STAR Mapping Tool:

To align with the Paris Agreement, each country is required to submit their emissions reduction commitment known as *Nationally Determined Contributions* (NDCs). Australia will submit their second NDC to the UNFCCC later in 2025. *(DCCEEW, International Climate Action, 2022)*.

This STAR mapping tool will use the NDC's from the previous submission of 2022, to consider how to focus on the priority goals. The High Priority and Average Priority goals listed in Figure 1, have been adapted from the SDG priorities assessed by the Stockholm Environmental Institute (*SEI, 2023*) .

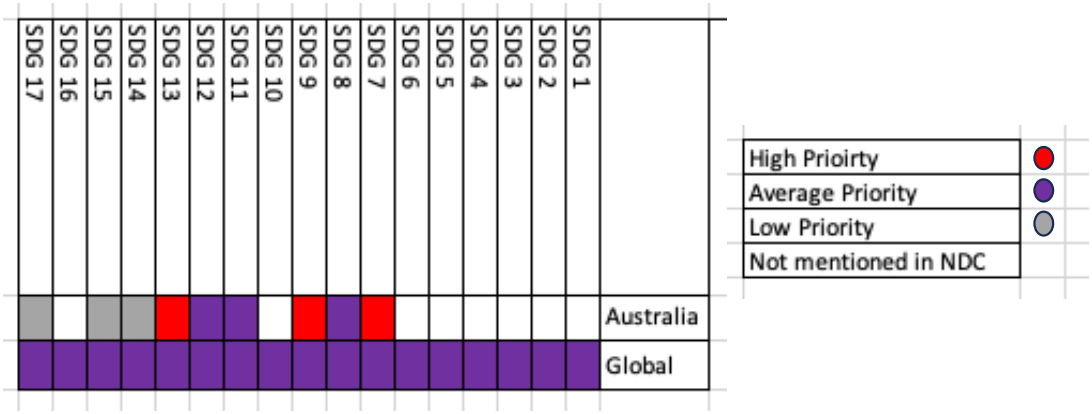



Figure 1. SDG priorities based on the NDC *(Author: Adapted from Stockholm Environmental Institute, 2023)*

# UNSDG Priorities: which Goals can STAR be mapped to:

The NDC-SDG priorities in *Figure 1*, identify the following Goals for Australia:

- High Priority Goals in RED = SDG 7, 9 and 13;
- Average Priority Goals in DARK GREY = SDG 8, 11, and 12.
- Low Priority Goals in LIGHT GREY = SDG 14, 15, and 17.

**The following 5 Goals have been identified to map to the STAR tool:**

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Material demand, and environmental and climate implications of Australia's building stock: Current status and outlook to 2060, Resources, Conservation and Recycling. /doi.org/10.1016/j.resconrec.2021.106143.

## Graphics:

**The Sustainable Temporary Adaptive Reuse (STAR) toolkit** would like to acknowledge that all UN Sustainable Development Goal graphics were sourced through the Resources section under the Brand Guidelines:

- Communications materials - United Nations Sustainable Development

- https://www.globalgoals.org/resources/#icons-for-the-goals

## Websites:

- ABS – Measuring what matters
https://www.abs.gov.au/statistics/measuring-what-matters/measuring-what-matters-themes-and-indicators/sustainable/circular-economy

- Australia's Circular Economy Framework, Department of Climate Change, Energy, the Environment and Water, Canberra, December. CC BY 4.0.

- Australian Sustainability Reporting Standards AASB1 / AASB2 (2024)
Australian Sustainability Reporting Standards AASB S1 and AASB S2 are now available on the AASB Digital Standards Portal

- Circular Transitions Indicator v4.0 – Metrics for Business, by business. (2023)
The Circular Transition Indicators v1.0, v2.0, v3.0 and v4.0, by the World Business Council for Sustainable Development are licensed under CC BY-ND 4.0 (Creative Commons Attribution-No Derivatives 4.0 International).

- Department of Climate Change, Energy, the Environment and Water (DCCEEW) Energy Efficiency: Commercial Buildings: Commercial buildings - DCCEEW

- Exponential Business Playbook. Exponential Roadmap Initiative Falk J. et al. (2025)
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- Resource Efficiency - https://fastercapital.com/startup-topic/resource-efficiency.html

- NDC-SDG Connections: Data on updated NDC submissions (V2 1.1.0) Dzebo, Adis / Aparajita Banerjee / Gabriela Iacobuţă / Raphaelle Beaussart (2024): NDC-SDG Connections: Data on updated NDC submissions (V2) (1.1.0) [Data set]. German Institute of Development and Sustainability (IDOS), Stockholm Environment Institute (SEI). https://doi.org/10.5281/zenodo.11400384

- Our City Plans (2024) – An incremental and participatory toolbox for urban planning: 4th edition. Javier Torner, Marcella Guarneri, Daniela Chong, Mariana Saraiva, Elena Balabanska, Roberta Psimenos, Abdelrahman Ibrahim, Priyasha Singh.

- The Sustainable Development Goals Report 2024: United Nations
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- Our World in Data team (2023) - "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all" Published online at OurWorldinData.org. Retrieved from: 'https://ourworldindata.org/sdgs/economic-growth' [Online Resource]

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For more STAR Toolkit content please visit:

STAR Webpage:
https://www.uts.edu.au/about/faculty-design-architecture-and-building/built-environment/research/sustainable-temporary-adaptive-reuse-star-project

This tool is part of the Sustainable Temporary Adaptive Reuse (STAR) Toolkit research project. It is one of several tools to normalise STAR. Resources from the STAR Toolkit are published as open-access and free to download.