BUILDING PRODUCT LEADERS FORUM AUG 2024

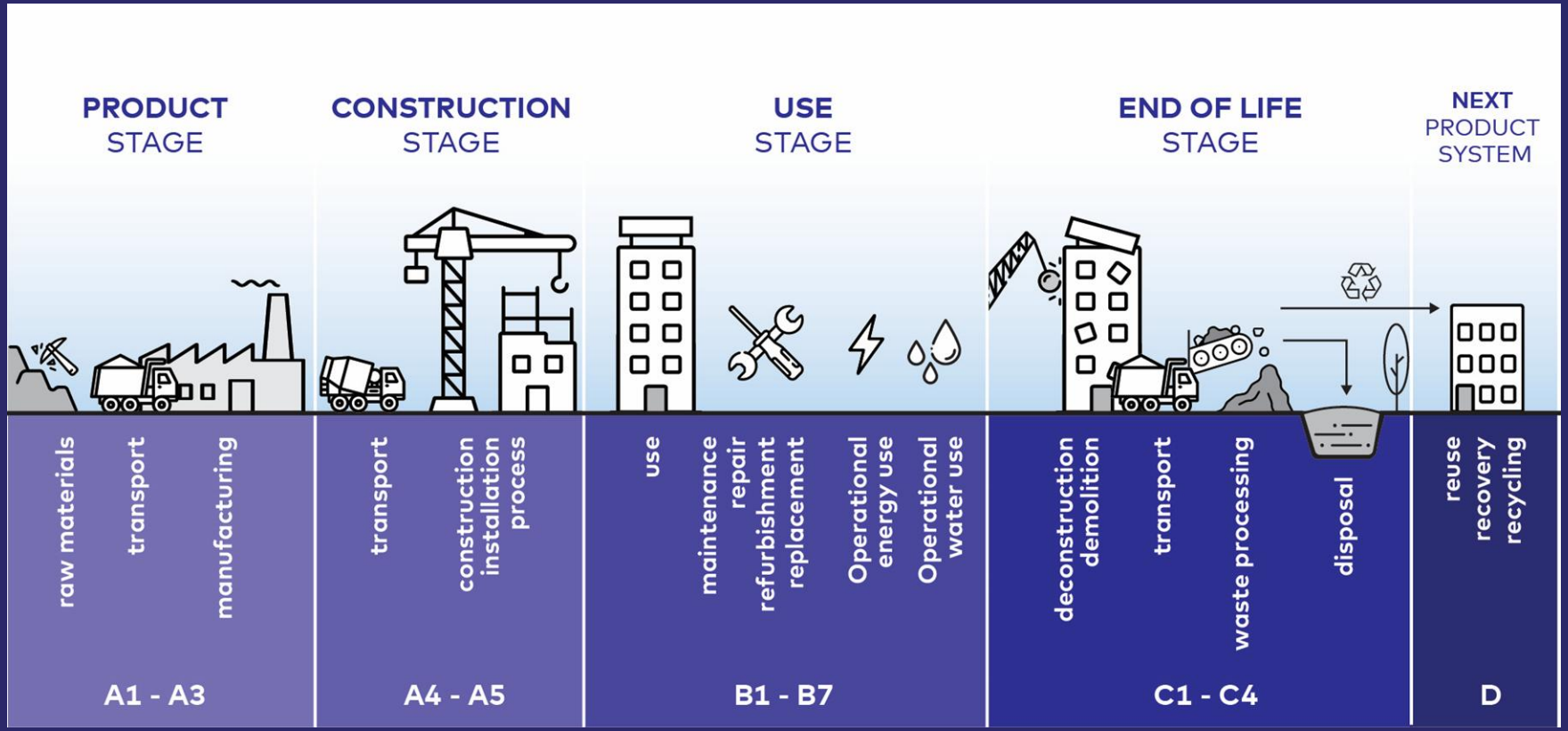
# Upfront carbon or whole-of-life carbon: the impossible choice

Stephen Mitchell

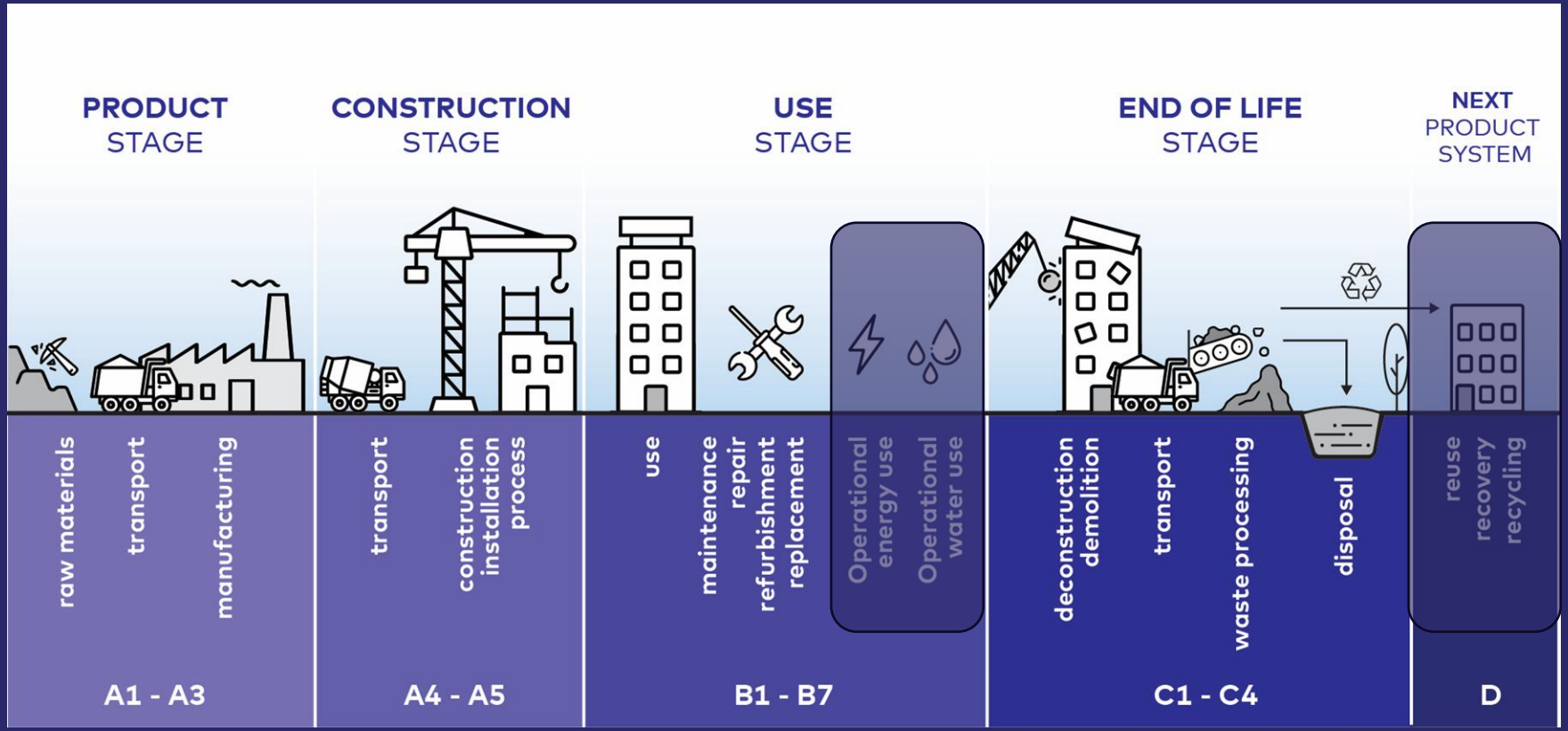
*Principal Consultant, thinkstep-anz*

# Embodied carbon in the life cycle of a building

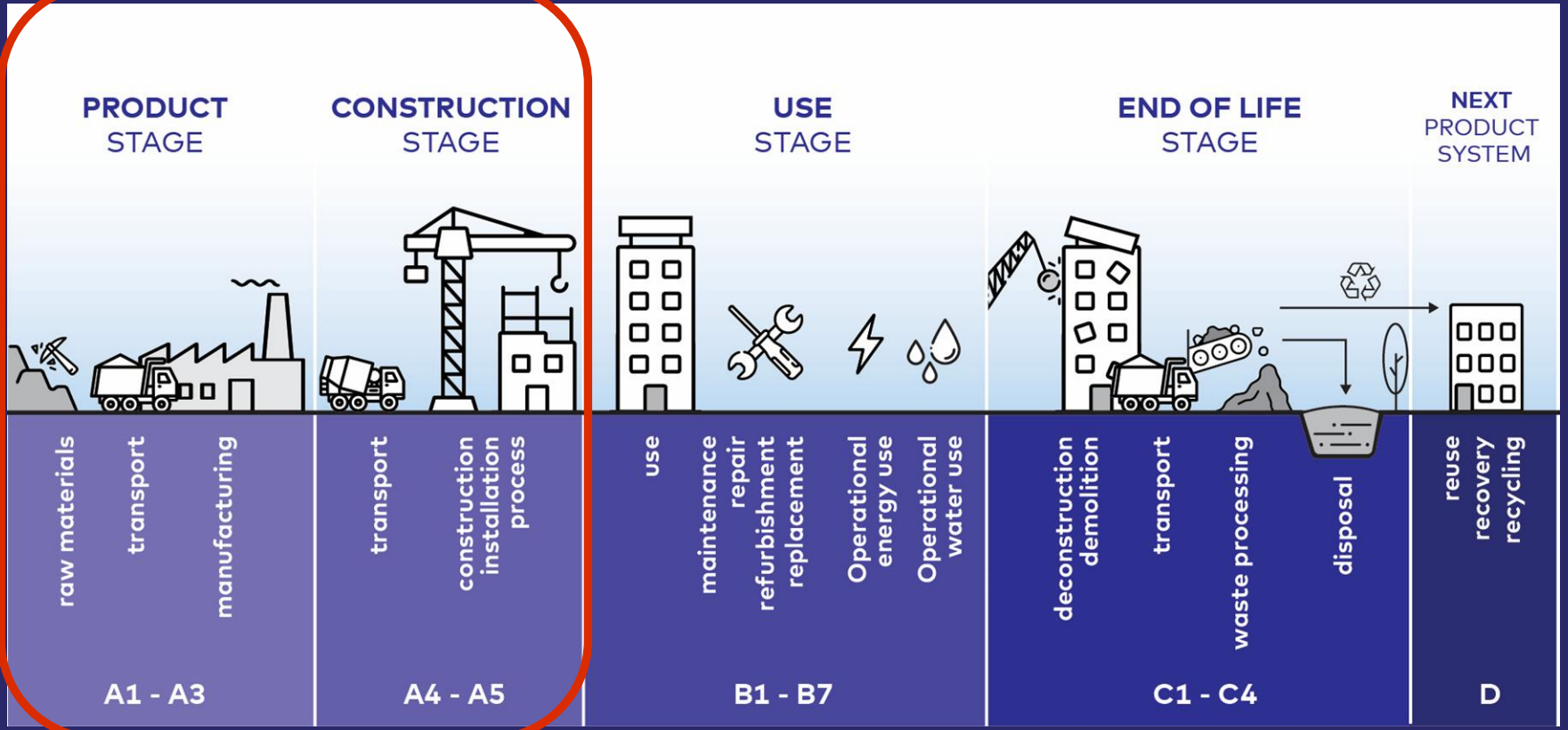
# Building life cycle



# Embodied Carbon Scope



# Upfront Carbon Scope



# What is a Life Cycle Assessment (LCA)?

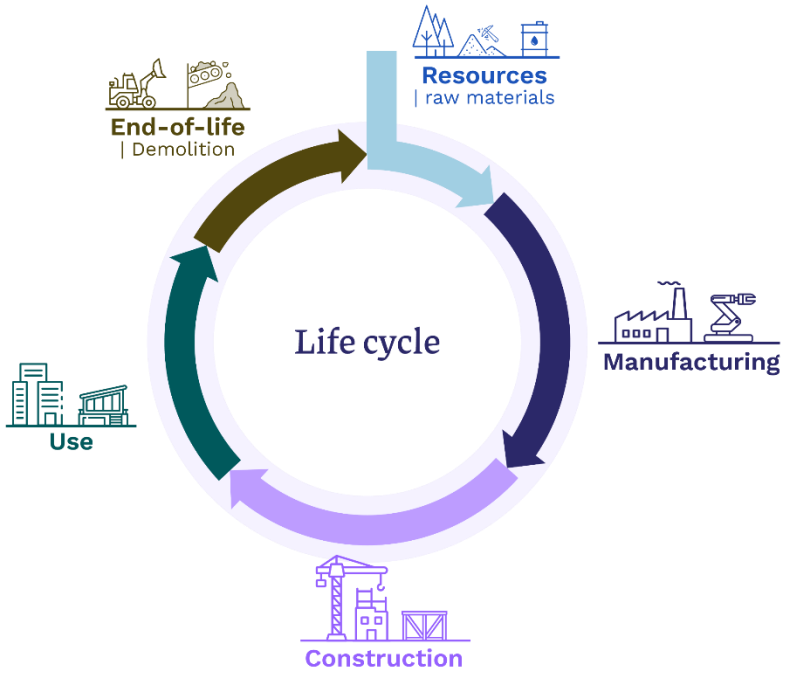
# What is a Life Cycle Assessment (LCA)?

→Full life cycle approach

→Avoids trade offs between life cycle stages and environmental impacts

→A standardised, proven methodology

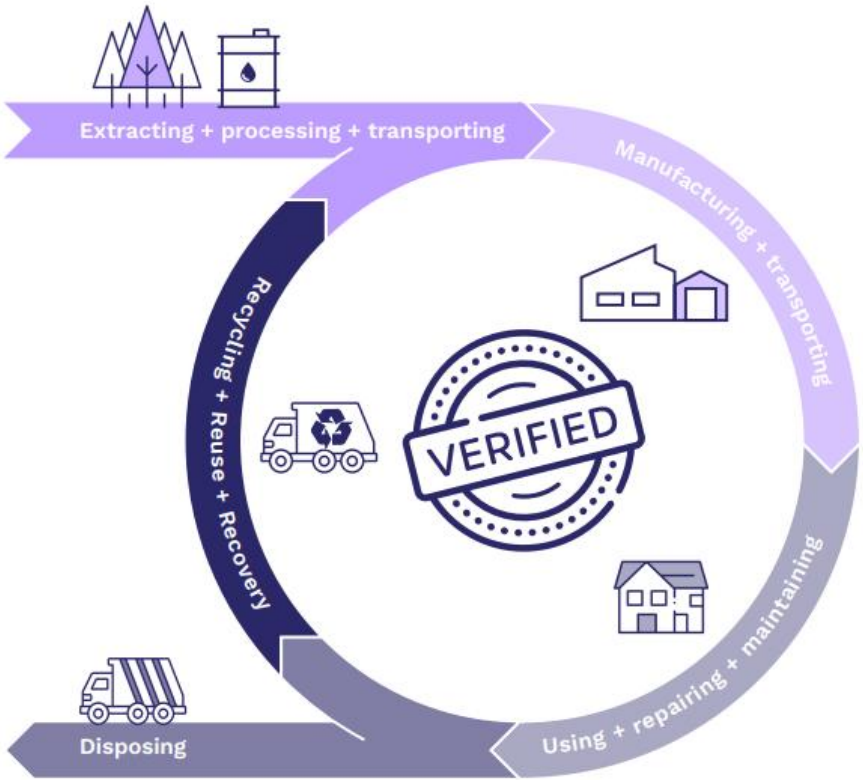
→Comparison based on functionality



Concept #1

## Building life cycle

**Cradle to grave**,
we look at all process steps
to **avoid shifting burdens**
elsewhere



# How do we measure?

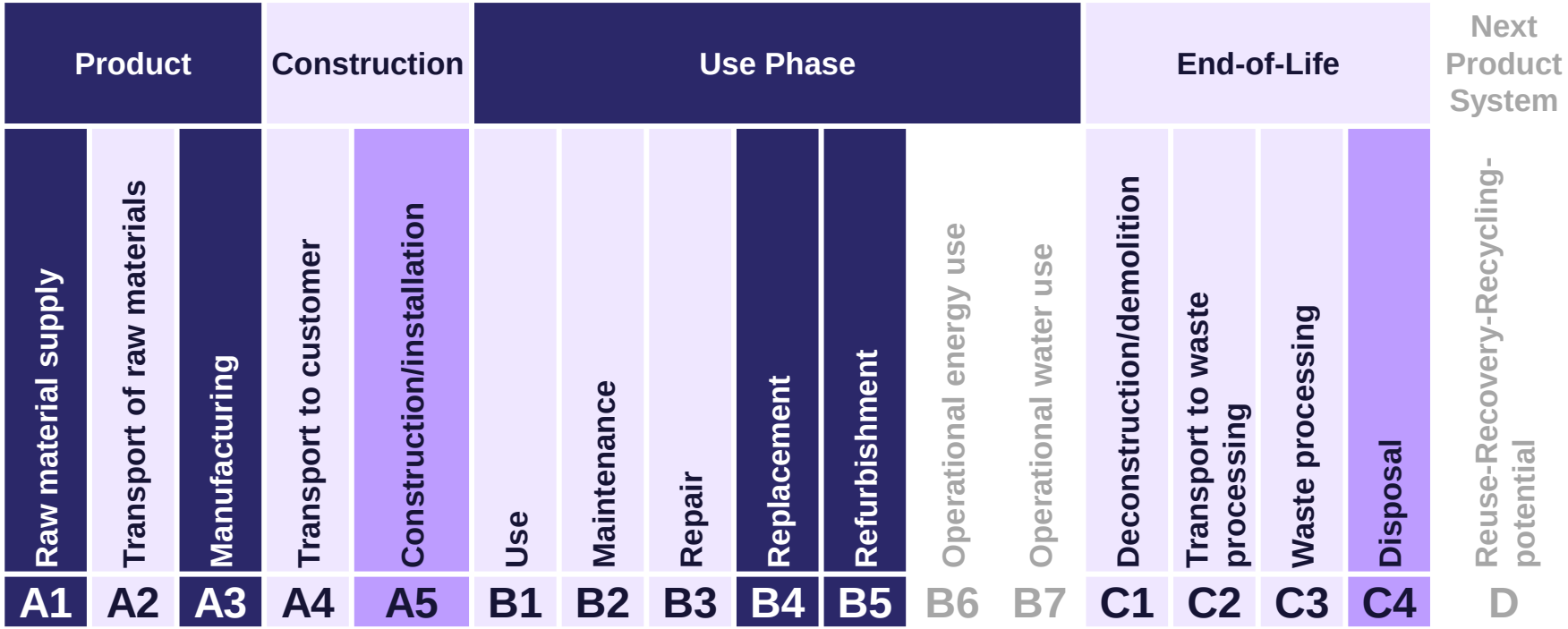
**Functional unit**

Data for products used in calculations are generally related to the function delivered

To compare, you must be fair. Focus on the need being met, not today's product

Source: Martin de Arriba Unsplash

# A typical heatmap for embodied carbon of building



# Choosing between upfront and whole-of-life carbon assessment: a case study on NABERS

# 10. Which life cycle stages will be included?

This stakeholder engagement topic relates to:
**NABERS Proposal 2:** Include only upfront emissions (A1-A5)

## 10.1. Problem statement

**Which life cycle stages should be included in the calculation method?** Are we interested in upfront emissions, whole-of-life emissions, or whole-of-life emissions including operational emissions? Are benefits from recycling and reuse included or excluded?

## 10.2. Early feedback from market

Early feedback from the market suggested that stakeholders were split, with some preferring a whole-of-life approach as it ensures the building is viewed holistically, and others wanting to focus on upfront emissions only because this focuses on the present, simplifies the analysis, and simplifies the communication.

Selected quotes:

- "We just want it to be fair, that is our primary concern. Not trying to get a leg up, just don't want to be unfairly disadvantaged. We feel the whole of life best represents fairness across different types of materials." – *Building Product Manufacturer*
- "Award for upfront carbon with requirement for calculation of whole-of-life carbon (no worse than benchmark) could be an option." – *Building Product Manufacturer*
- "The different life cycles are an equal consideration, especially end of life." – *Constructor*

## 10.3. Literature / policy research

Annex A shows little consistency between different ratings tools and policies, though most require at least A1-A5 as a minimum scope.

Prasad et al. (2021, p. 33) make an important observation about data quality, which is directly linked to NABERS' "Consistency" principle:

> *The scope for embodied carbon assessment for buildings in this guide is limited to the upfront stage (A1-A5). As the construction industry's capacity to achieve quality, consistency and completeness for upfront embodied carbon assessment increases, there will be a basis for extending benchmarks to life cycle stages B (refurbishment) and C (end of life).*

Table 10-1 Review of options against NABERS market needs for "Which life cycle stages will be included?"

| Principle | | Upfront carbon (to practical completion) (A1-A5). | Embodied carbon (A-C, excl. B6 & B7). | |
|---|---|---|---|---|
| **Impactful** | • Urgent behaviour change<br>• Big wins first | ✓ Simple and impactful | ? Future replacements are uncertain, so these are inherently a prediction. | × |
| **Consistent** | • Results are reproducible no matter who calculates them | ✓ Easiest to make consistent with a well-executed tool | ? Potential for consistency with a well-executed tool | ? |
| **Streamlined** | • Quick and easy to use | ? Can be easy to use with a good calculator | ? Can be easy to use with a good calculator | ? |
| **Collaborative** | • Considers existing methods/standards<br>• Considers what others are doing, e.g., Green Star<br>• Works alongside other NABERS tools<br>• Tries to link with existing work | ✓ Links well with Green Star and other green building rating tools | ✓ Most standards-compliant, e.g., prEN 15978:2021 (CEN, 2021) | ? |
| **Trusted** | • People have faith in the framework | ? Potential risk to trust due to exclusion of whole-of-life effects and circularity | ? Potential risk to trust due to need to forecast replacements and building end-of-life | ? |
| **Meaningful** | • Easy to understand | ✓ Meaningful with good communication. Easier to understand than the other options. | ? Meaningful with good communication. Not as easy to understand as requires a degree of prediction. | ? |

| Key | ✓ Yes, option meets principle | ? Option can meet principle if certain criteria are met | × No, option doe |
|---|---|---|---|

Based on the analysis in Table 10-1:

- Option 1: “Upfront Carbon (to practical completion) (A1-A5)” is the preferred option, having the potential to meet all NABERS market needs. Its biggest risk is to trust, due to exclusion of whole-of-life effects and therefore the potential to shift problems in time.
- Option 2: “Embodied carbon (A-C, excl. B6 & B7)” also has the potential to meet all NABERS market needs, but is more complicated and requires future project of replacement and end-of-life rates.

## 10.7. Feedback from stakeholders

There was general support, with some caveats. Generally, stakeholders showed concern about reduced durability of buildings; however, these concerns were refuted by project teams, builders and developers.

Many building product manufacturers would prefer a focus on whole-of-life carbon, even including operational carbon (as this allows trade-offs between life cycle stages to be minimised). However, some said they would accept upfront carbon only provided monitoring of potential trade-offs was done from the start.

The Supporting Consultants agreed with a focus on upfront carbon (A1-A5); however, they noted that excluding life cycle stages could discourage uptake of products that have higher upfront carbon but longer lifespan/performance benefits.

# 10.8. Revised recommendation

**We updated the recommendation as follows:**

- **Focus on upfront carbon (modules A1-A5) within the rating.** This empowers urgent behaviour change, is the easiest option to use and understand, and aligns with the Green Star Buildings rating tool.
- **Include an automated calculation of whole-of-life embodied carbon using prescribed replacement and end-of-life rates.** This should be A-C and A-D, both excluding B6 and B7 (and likely B1 too). NABERS should consider how a whole-of-life calculation can be used to track potential impacts of higher NABERS Embodied Emissions ratings on whole-of-life carbon emissions. It would not necessarily need to be included in the rating certificates and could instead be used by NABERS to check if projects targeting higher NABERS Embodied Emissions ratings are making significant trade-offs with whole-of-life carbon emissions.
- **We recommend that embodied and operational ratings are considered together where possible** for a given building. While the timing of achievement of the two ratings will be different, the absence of an operational rating is an indicator in itself. NABERS should also evaluate if trade-offs are occurring between upfront carbon and operational carbon after there is sufficient data to check.

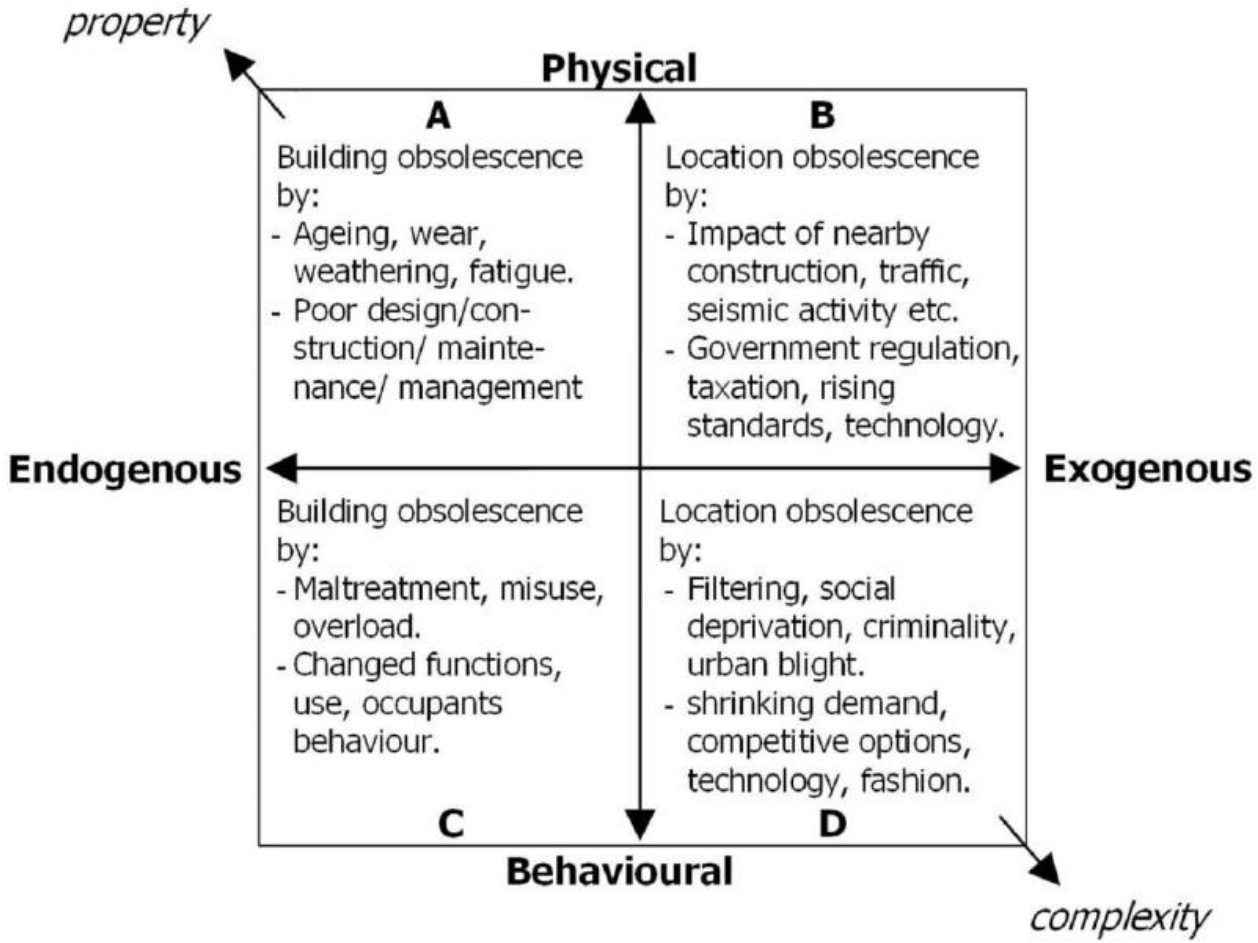
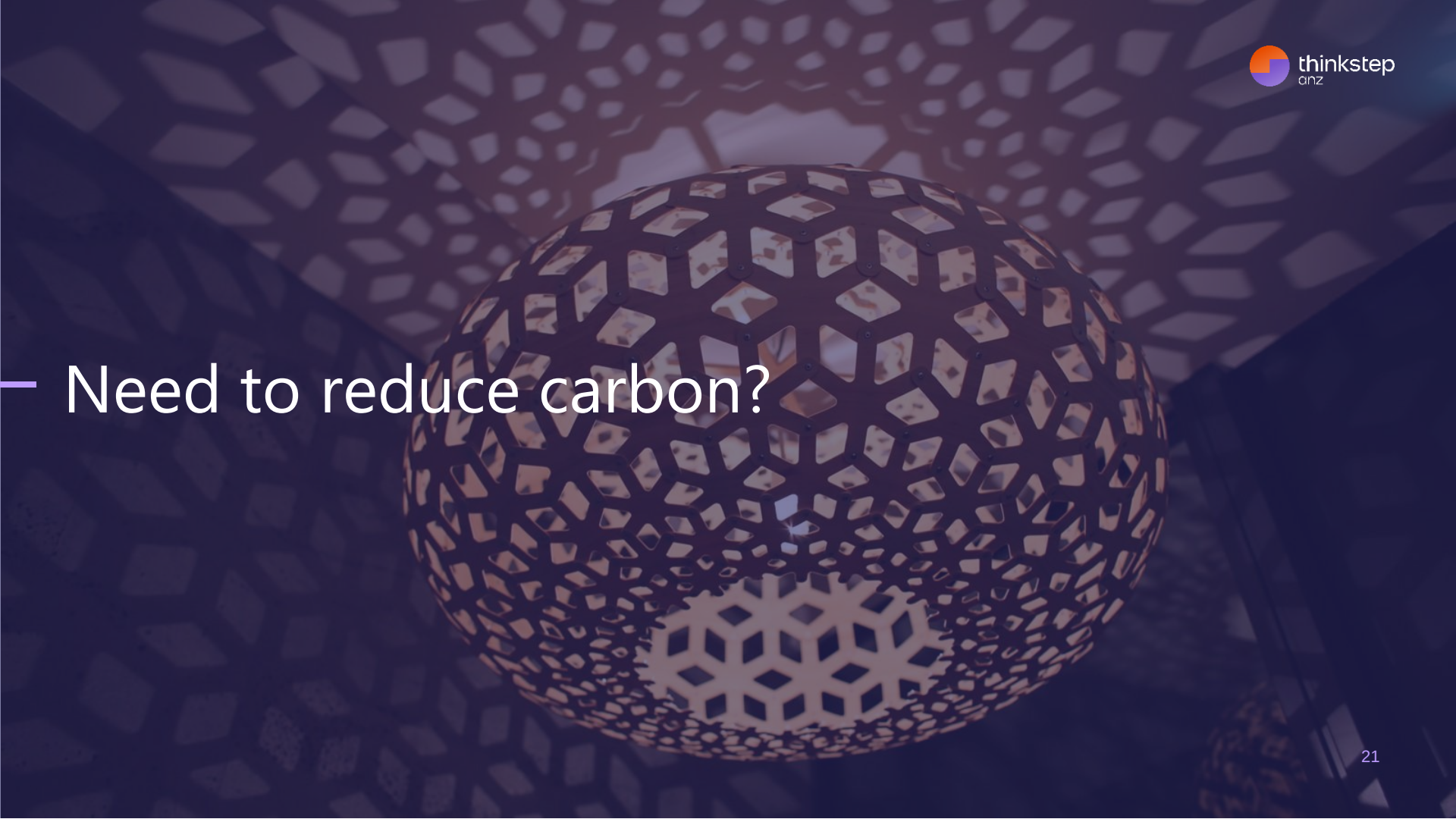



**Figure 11-1: Matrix for building obsolencence – reproduced from (Thomsen & van der Flier, 2011)**

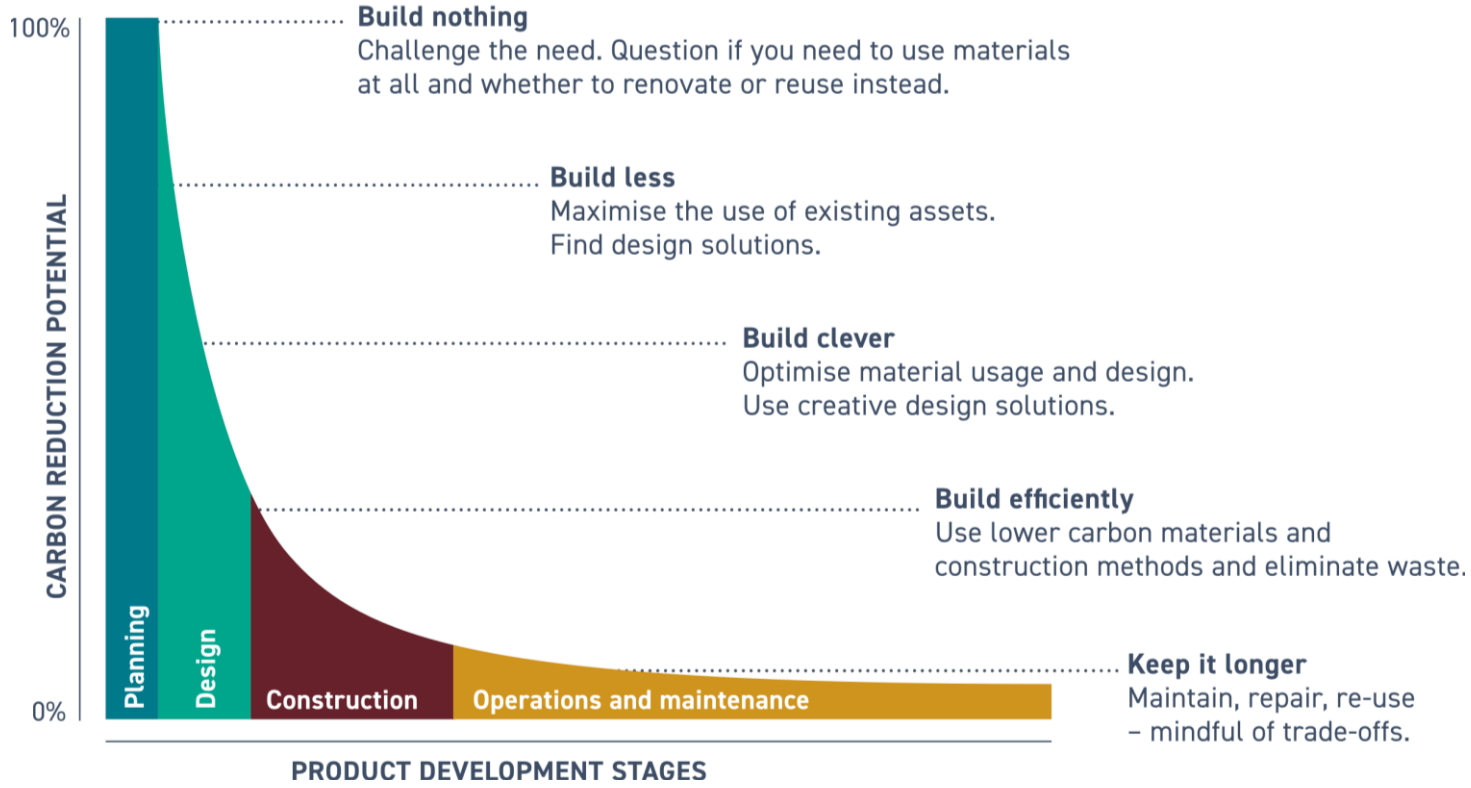
O'Connor (2004) found the following major reason for demolition given from a sample of 227 buildings demolished between 2000 and 2003 in Minneapolis–Saint Paul, USA:

- Area redevelopment (34.8%)
- Lack of maintenance (23.8%)
- Building no longer suitable for needs (22.0%)
- Fire damage (7.0%)
- Specific problem with structural or other material or system (3.5%)
- Improvements to bring to code too expensive (1.8%)
- Outdated appearance (0.9%)
- Socially undesirable use (0.9%)
- Changing land values (0.4%)
- Maintenance too expensive (0.4%)
- Other (4.6%).

# Need to reduce carbon?



# DECARBONISATION HIERARCHY



# What matters most?

**Reducing carbon!**

Ask yourself:

→ Is this a genuine reduction?

→ Are we using every lever available?

→ Are there unintended perverse consequences?

→ How can we influence long term change in the supply chain?

Don’t sweat the small stuff, get started!

# Questions?