

# The Absolute Angle On Assessing Climate Change for Buildings

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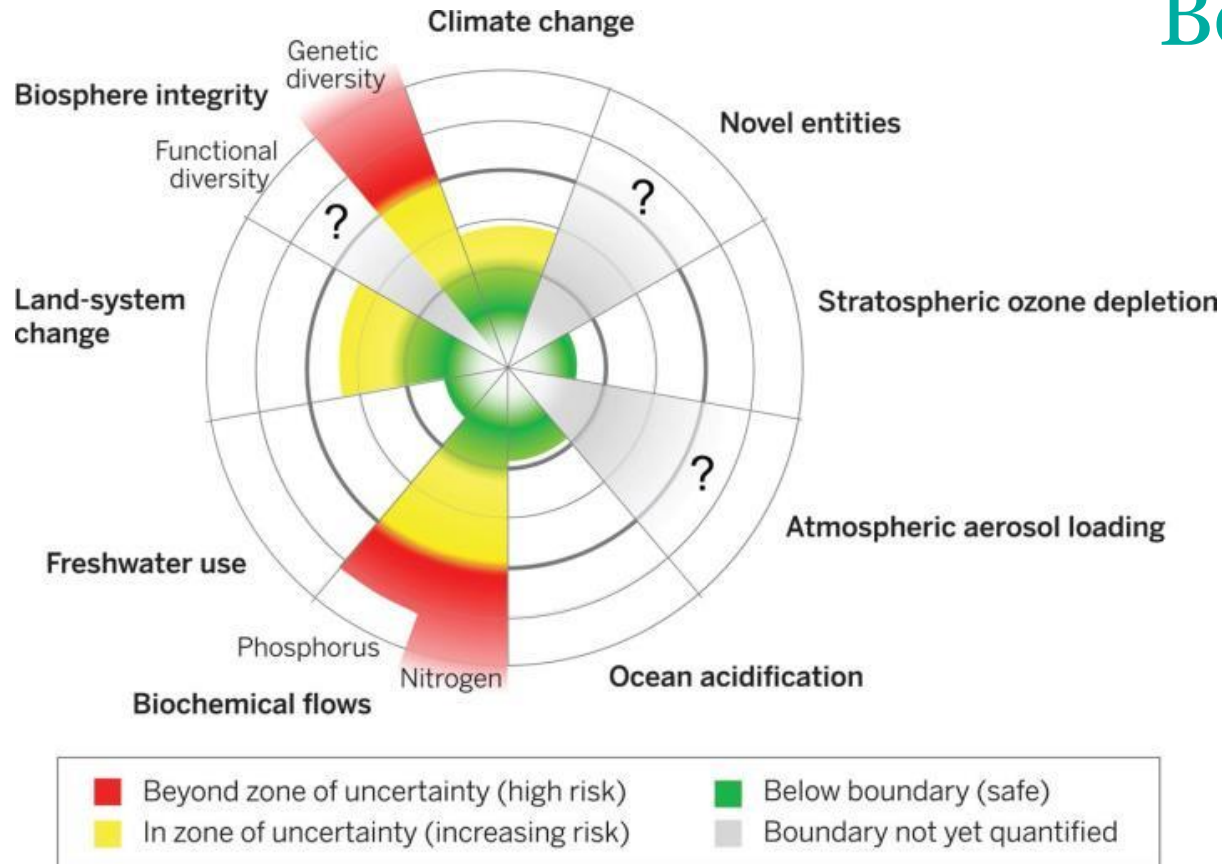
# Overview

- Absolute versus relative approaches in environmental sustainability
- Life cycle approach for buildings
- Introducing the absolute sustainability angle
- Case study of domestic buildings in New Zealand

Current status of the control variables for seven of the planetary boundaries.

The green zone is the safe operating space, the yellow represents the zone of uncertainty (increasing risk), and the red is a high-risk zone.

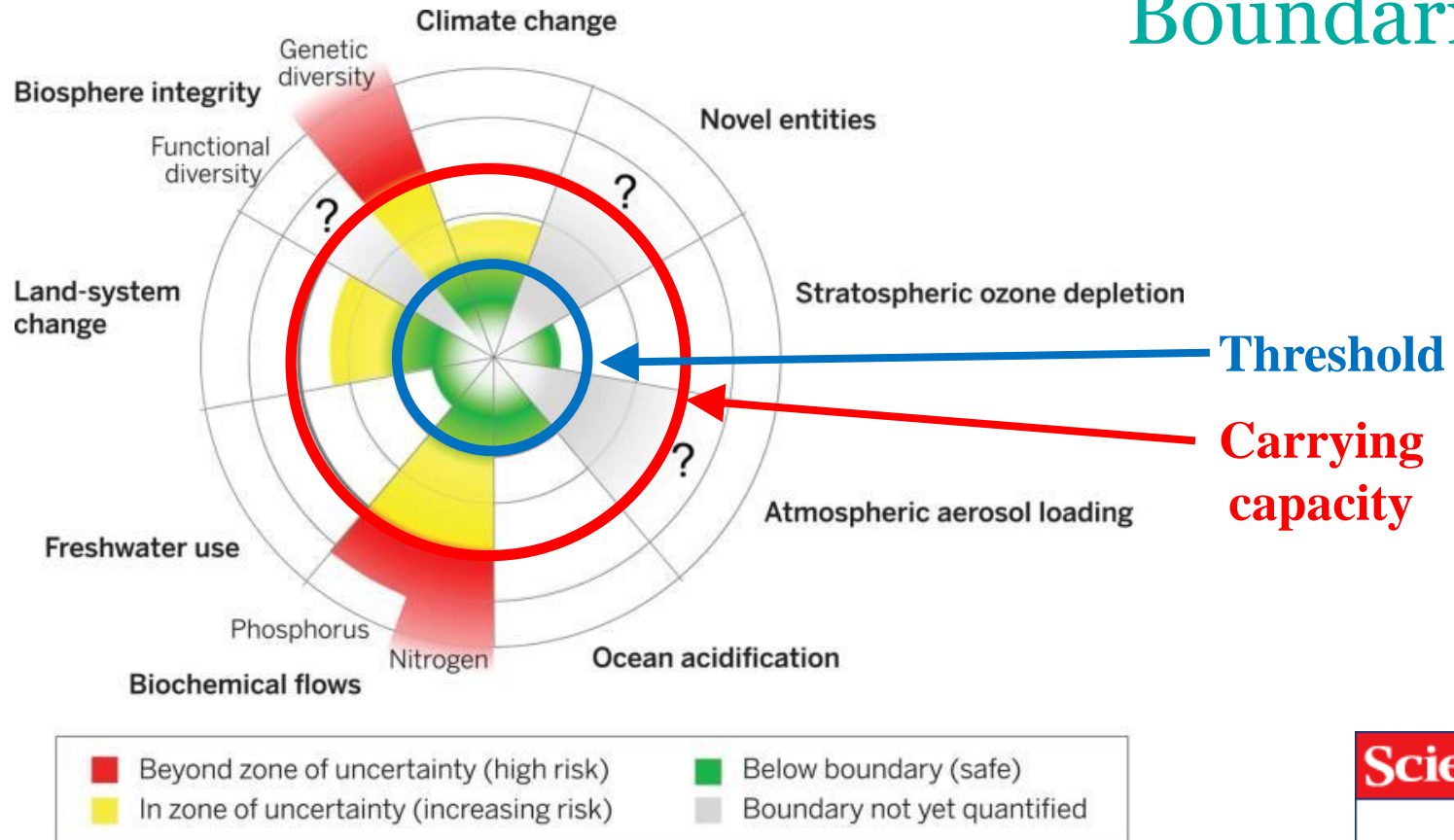
# Planetary Boundaries



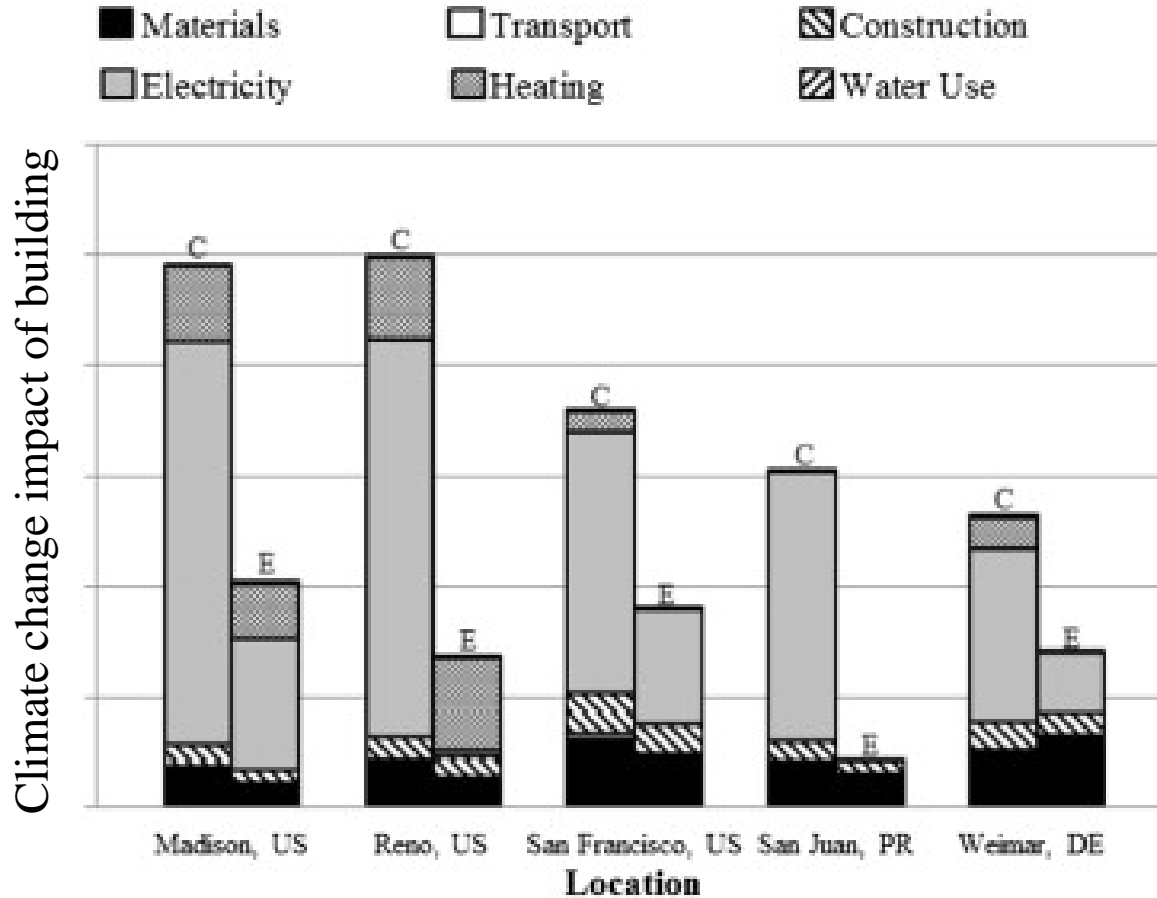
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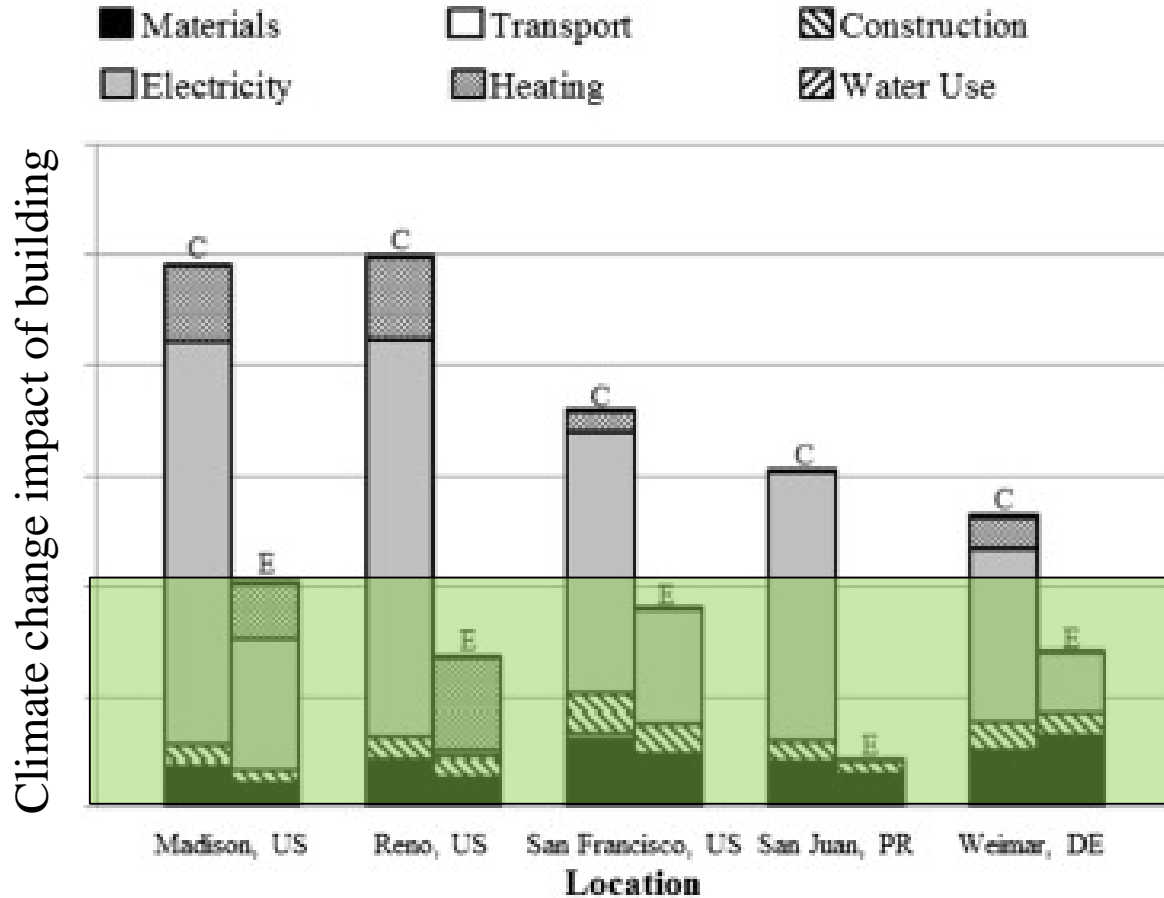


# LCA study of low energy buildings: a relative approach

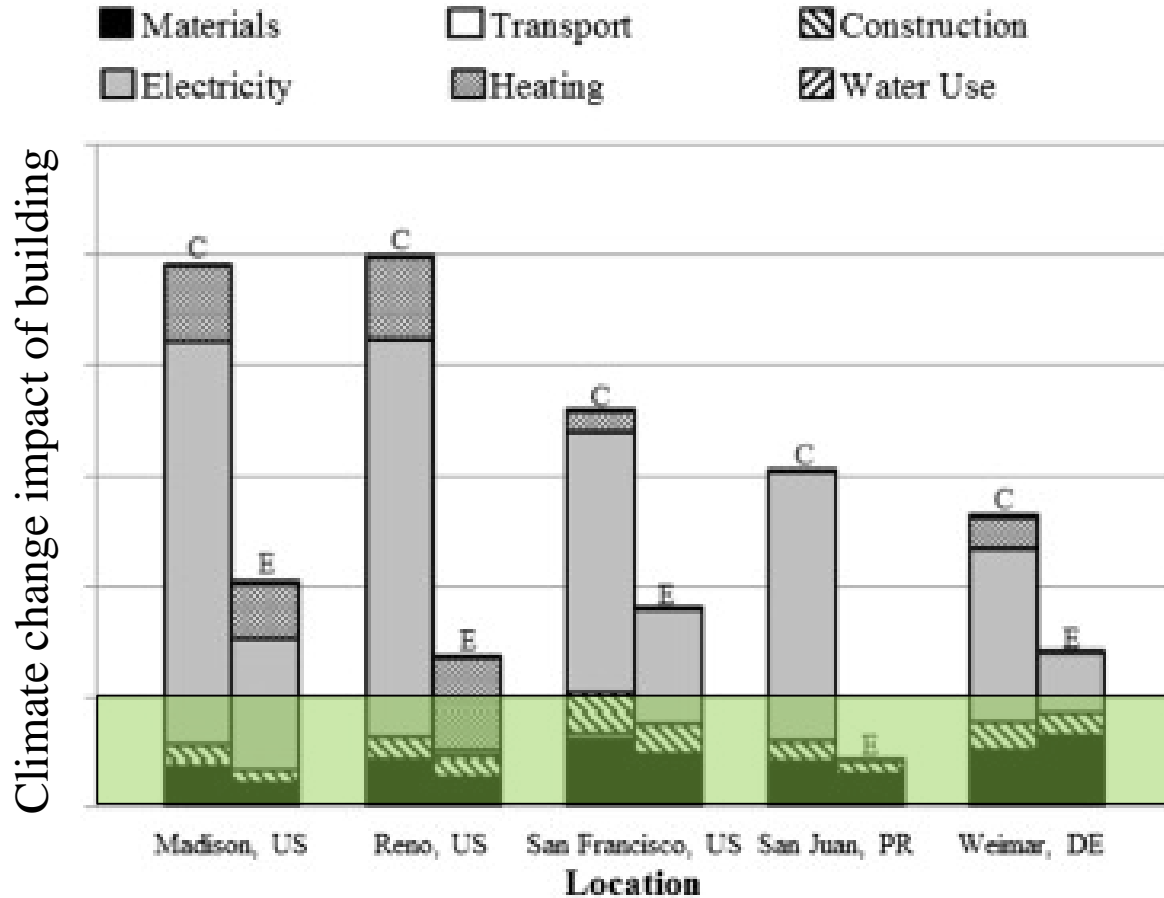


Source: Russell-Smith et al., 2015

# LCA study of low energy buildings: a relative approach



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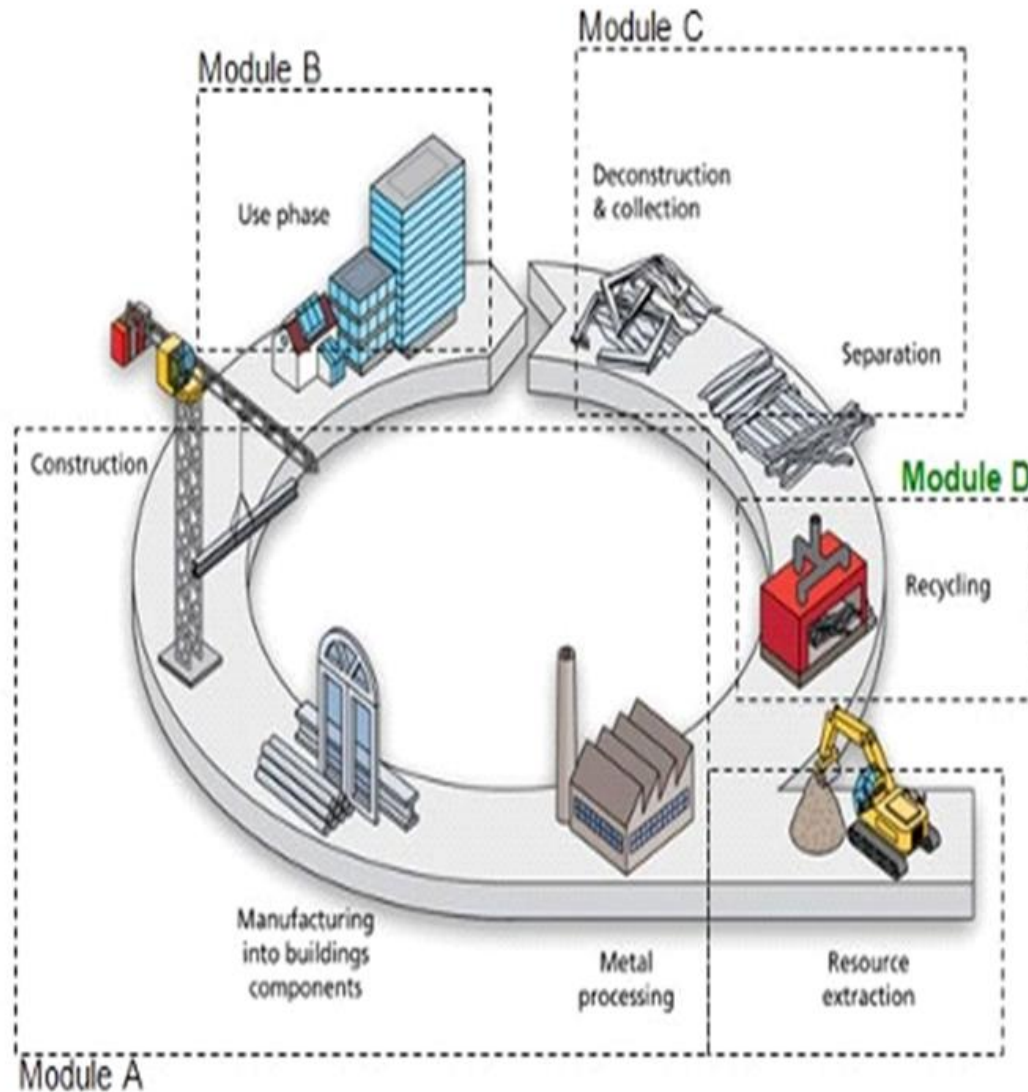


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# Life Cycle Assessment of Buildings (EN15978)



## WHOLE BUILDING WHOLE OF LIFE FRAMEWORK

Welcome to the New Zealand whole building whole of life framework ('framework').

The purpose of the framework is to provide information and resources to facilitate more consistent calculation of potential environmental impacts of New Zealand buildings across the building life cycle using a technique called **Life Cycle Assessment** (LCA). The focus of initial work has been on early design of new-build offices.

The framework is based on international building sustainability standards, with available resources structured as

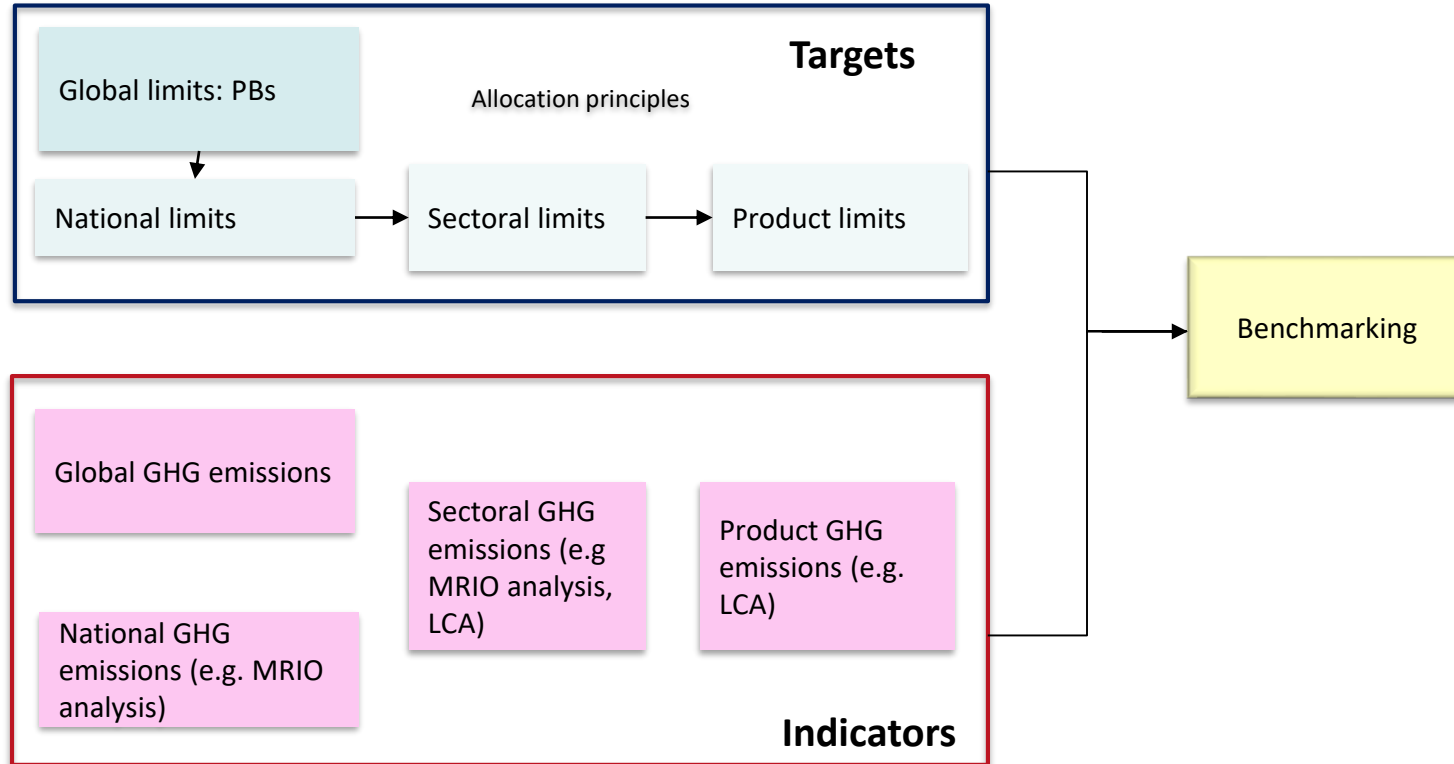




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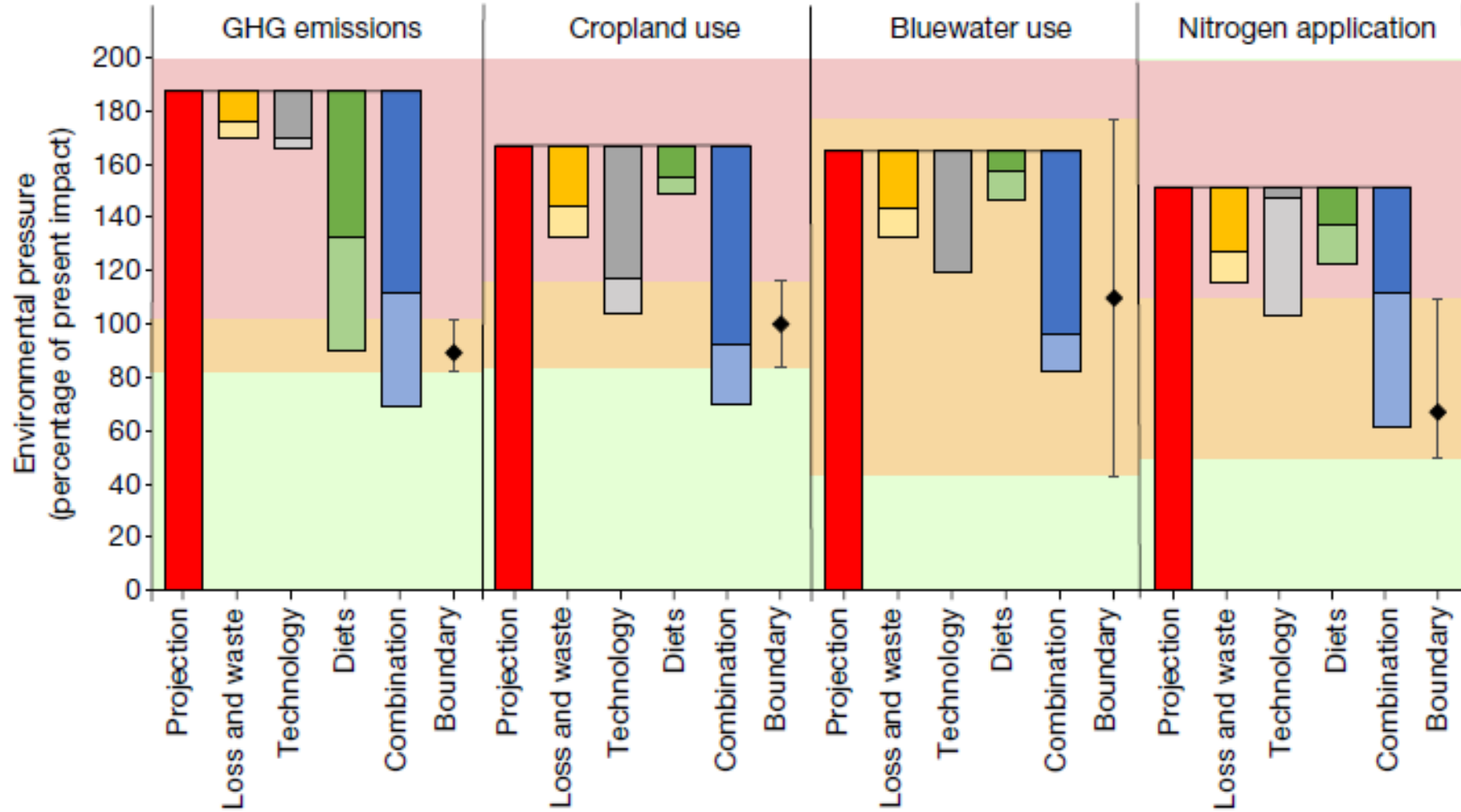
# Absolute Environmental Sustainability Assessment (AESA) method





# Benchmarking global food systems

Source:  
Springmann et  
al., 2018



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# Method for Residential Dwellings



## Total housing:

- Dwelling types: detached house (149m<sup>2</sup>), townhouse (115m<sup>2</sup>), apartment (99m<sup>2</sup>)
- Stock size: NZ Stats (stock in 1990 and approved consents thereafter to 2050)

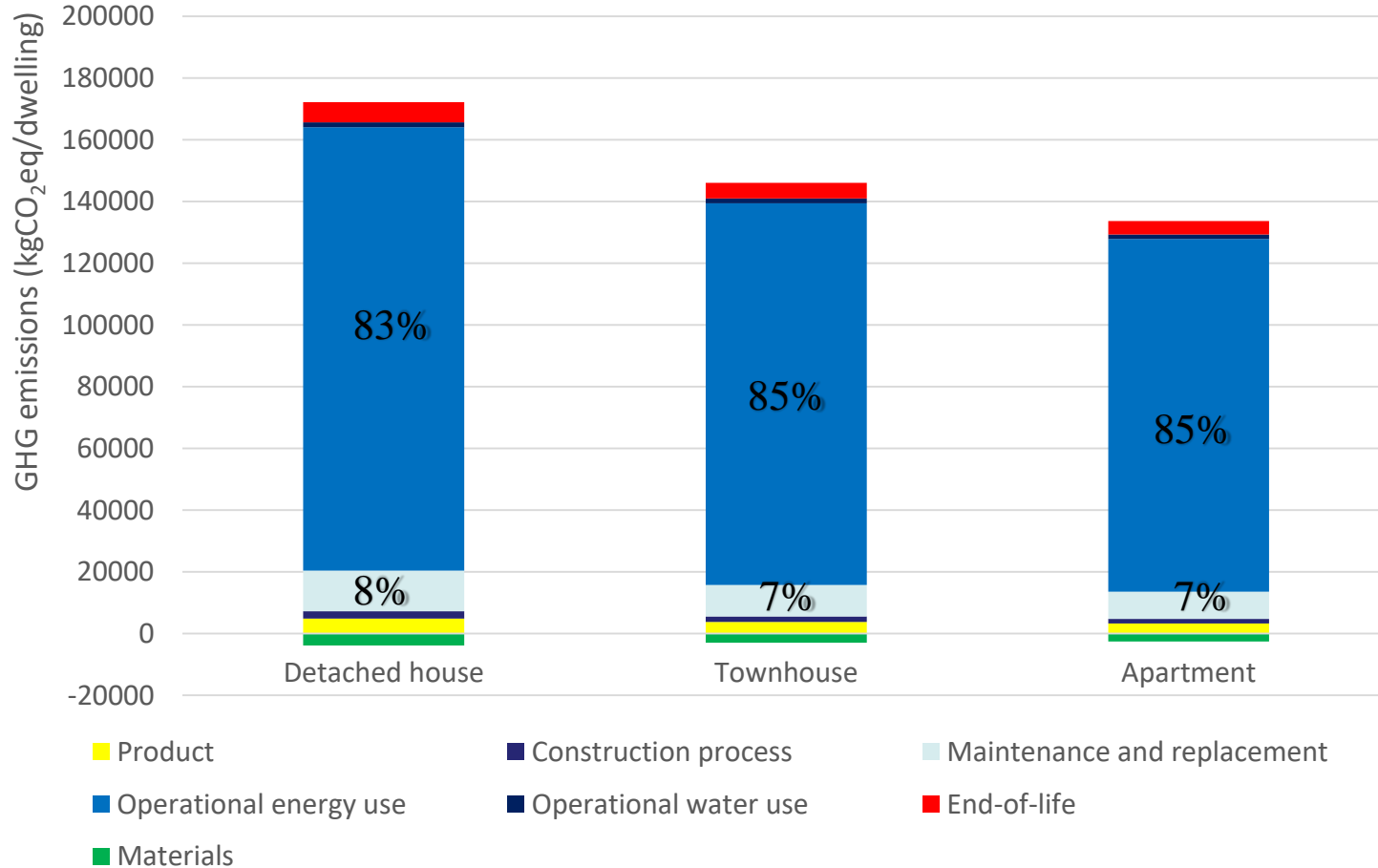
## Carbon footprint of different dwellings

- Materials, energy and activities: NOWHome<sup>®</sup> allocated by floor area to different dwelling types except use phase for appliances/cooking/water heating
- Carbon footprint of dwelling: LCA data from Dowdell (2018, *pers. comm.*), and energy consumption values for Auckland

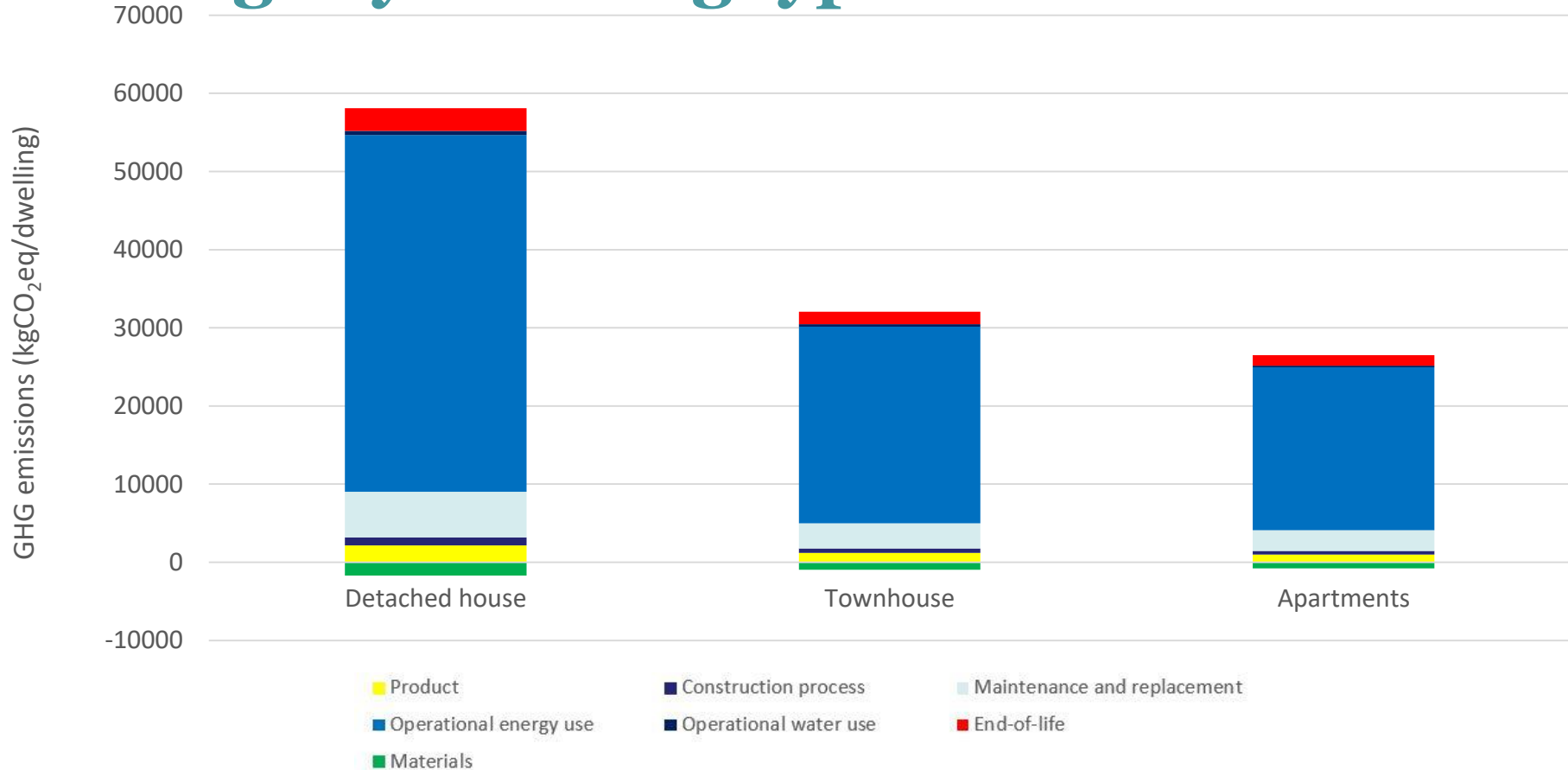
## Carbon budget for new dwellings

- Carbon budget per capita and grandfathering principle, then partition for dwellings (2018-2050)

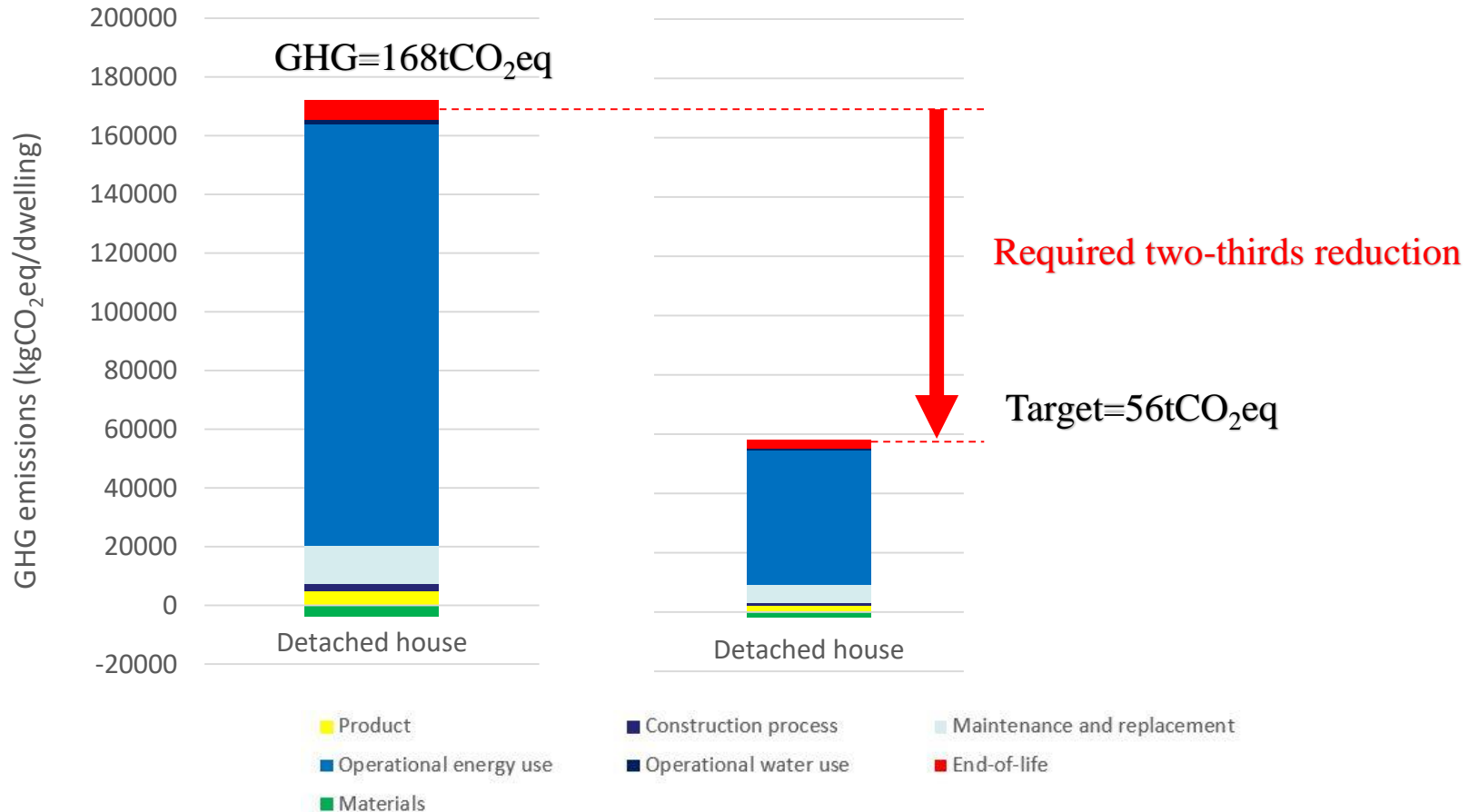
# Draft results by dwelling type



# Draft carbon budget for new buildings by dwelling type



# Sustainability gap for detached dwelling



# Conclusions

- Greater scale of change required than currently envisaged in building design and management
- Further research:
  - Update the analysis using actual carbon footprints of townhouse and apartments
  - Sensitivity analysis for global carbon budget, sharing principles
  - Scenarios for different climate zones, electricity mixes, functional units
- Potentially this approach can stimulate disruptive change in sectors by refocusing attention on the scale of change required to limit the future impacts of climate change