



SSbD4Chem

# Is time-explicit LCA useful?

A vehicle eco-design case study

Thomas Arblaster<sup>1</sup>, Jeroen Guinée<sup>1</sup>, Carlos Felipe Blanco Rocha<sup>1,2</sup>, Ivana Burzic<sup>3</sup>, Claudia Preschuh<sup>3</sup>, and Nils Thonemann<sup>1</sup>

<sup>1</sup>Institute of Environmental Sciences (CML), Leiden University, Leiden, the Netherlands

<sup>2</sup>Circularity and Sustainability Impact Group, Netherlands Organisation for Applied Scientific Research (TNO), Utrecht, the Netherlands

<sup>3</sup>Wood K plus — Kompetenzzentrum Holz GmbH, Linz, Austria



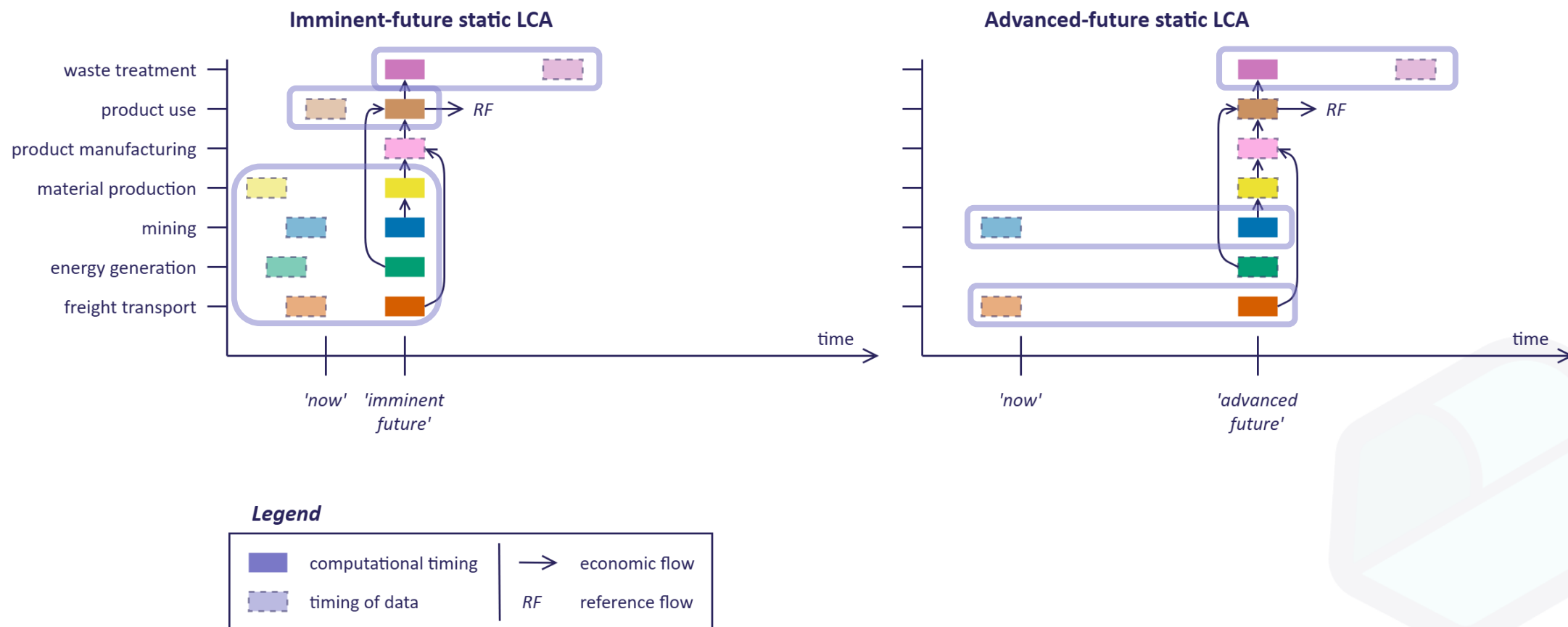
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# Context

- The engineering design process should be conscious of environmental harm → eco-design, SSbD
  - The things we're designing don't exist yet → ex ante
  - Futures and (social) consequences of design choices are complex and indeterminate → development & uptake of forecasting tools
- 
- **Prospective LCA:** any LCA which includes a representation of an imagined future

# Flavours of pLCA



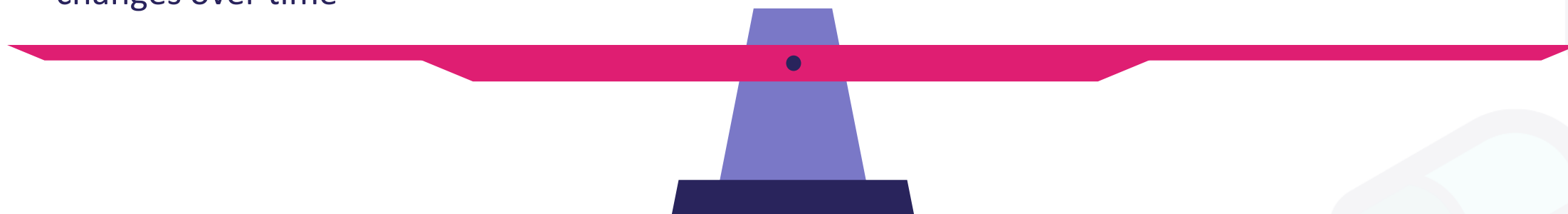
# Differentiating across time

## Time-explicit LCA: why?

- A system occurs across a changing timespan
- The relevance of environmental flows changes over time

## Time-explicit LCA: why *not*?

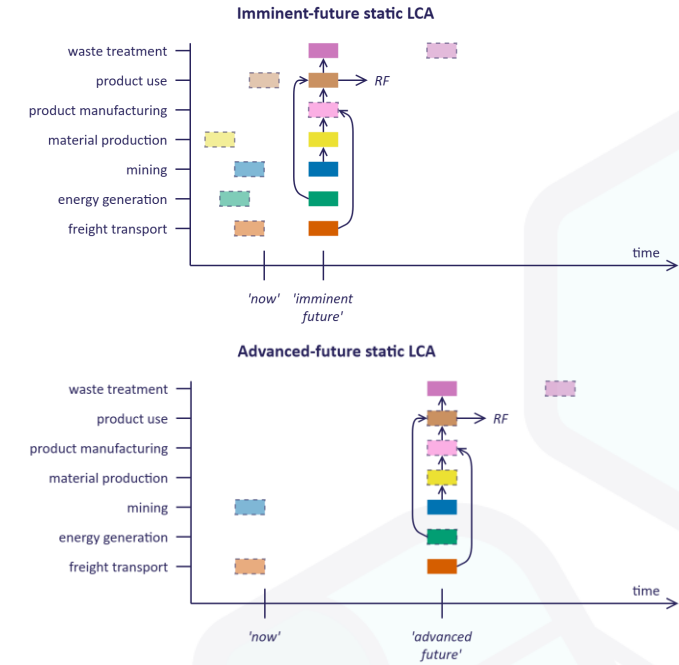
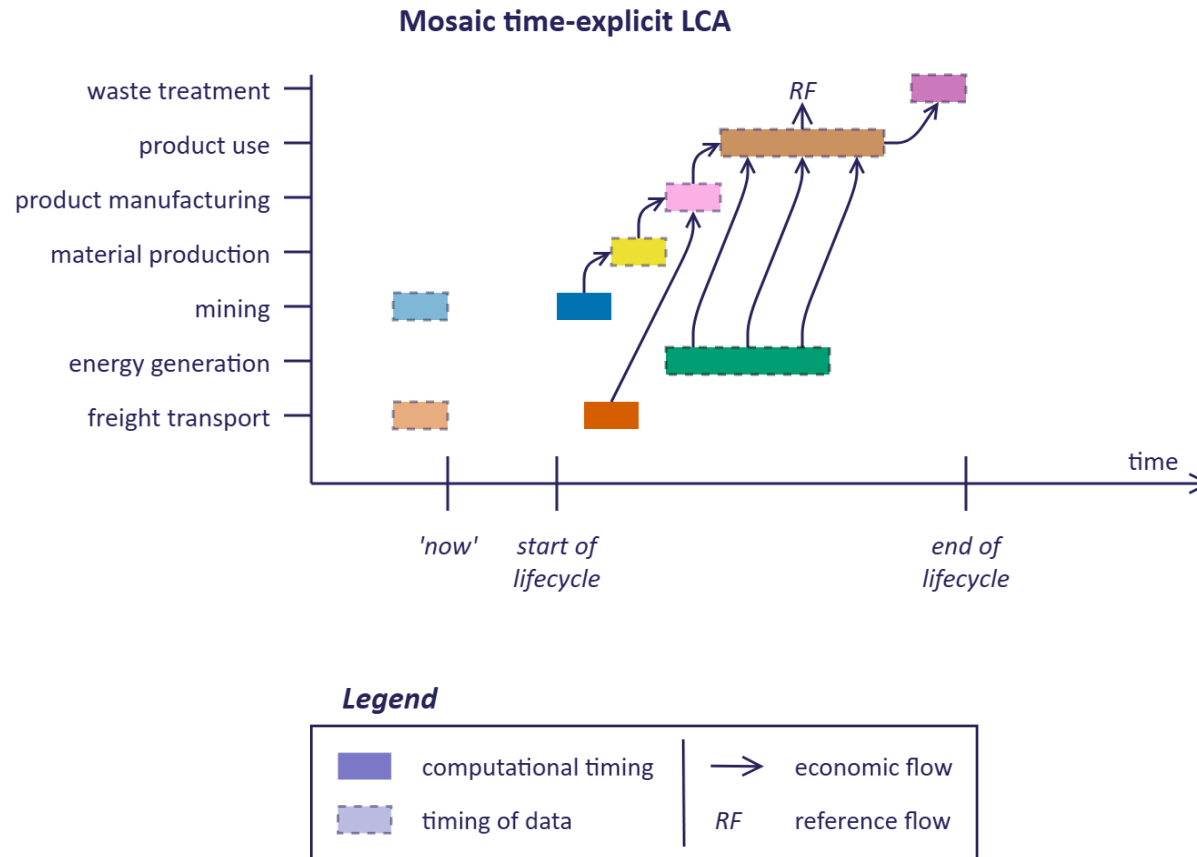
- Effort
- Lack of support



## Questions to address

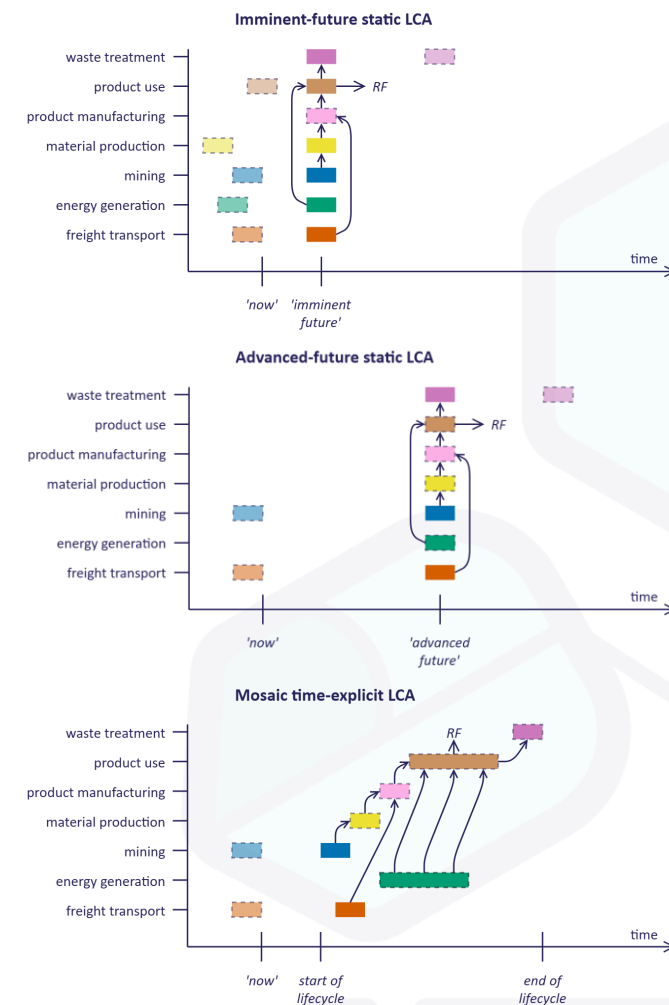
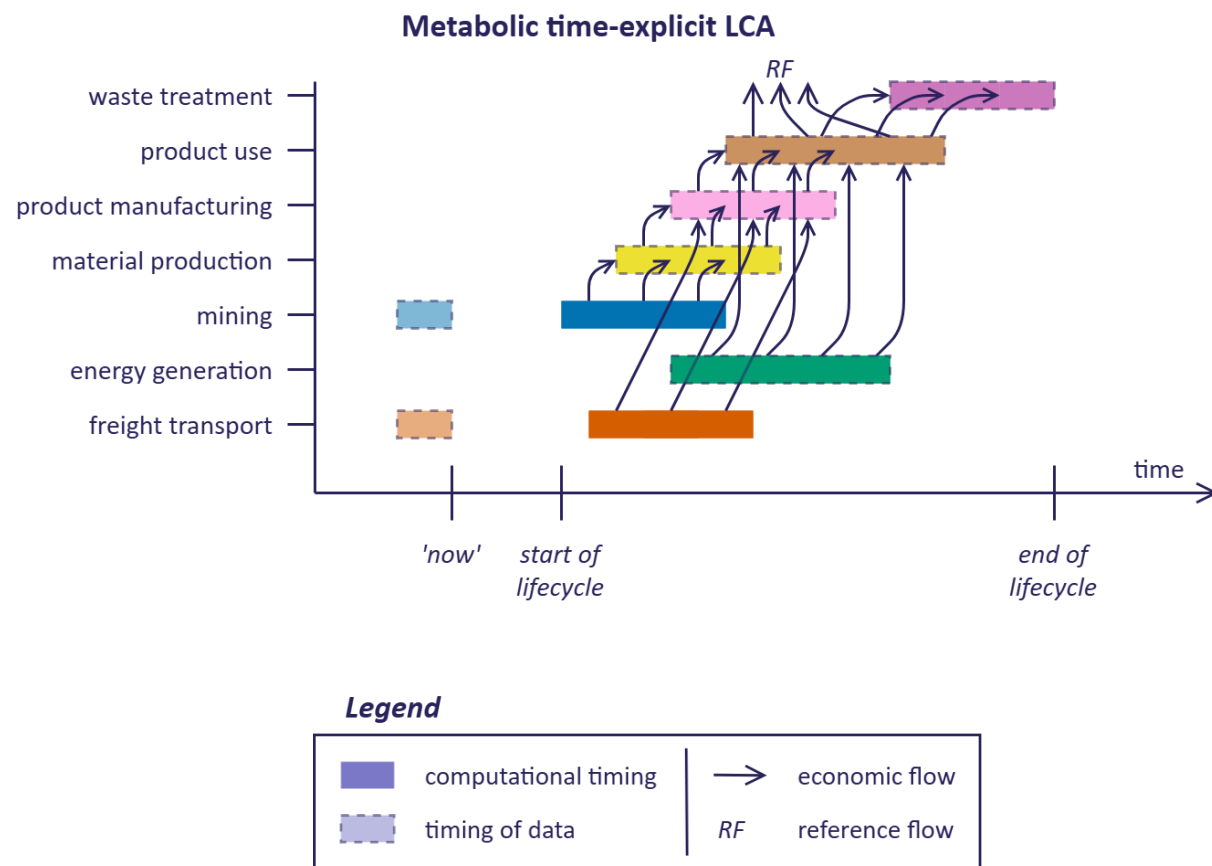
- Is it worthwhile to conduct time-explicit LCA?
- Should we invest in reducing this effort & developing this support?
- **Does time-explicit LCA enable novel insights?**

# Time-explicit systems





# Time-explicit systems



# Automotive case study

- **Alternatives:** interior trims based on plastic composites
  - Talc-polypropylene (incumbent)
  - Softwood-polypropylene (novel)

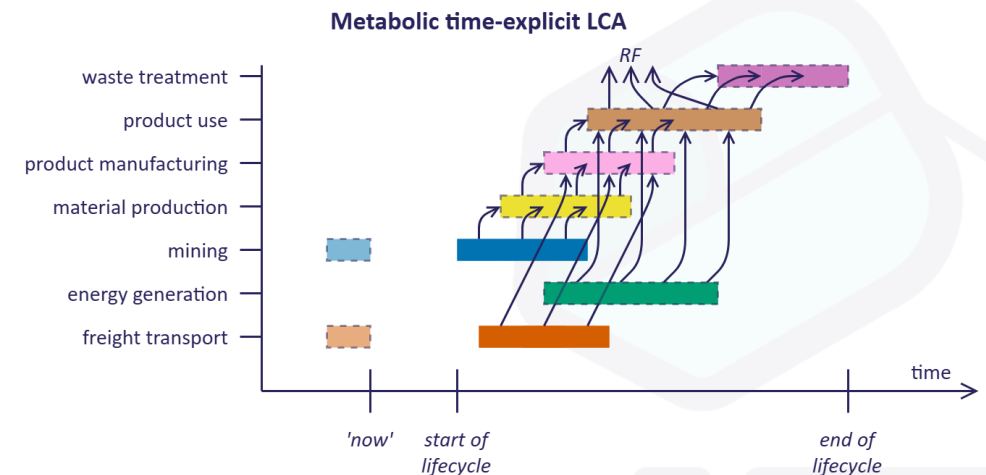
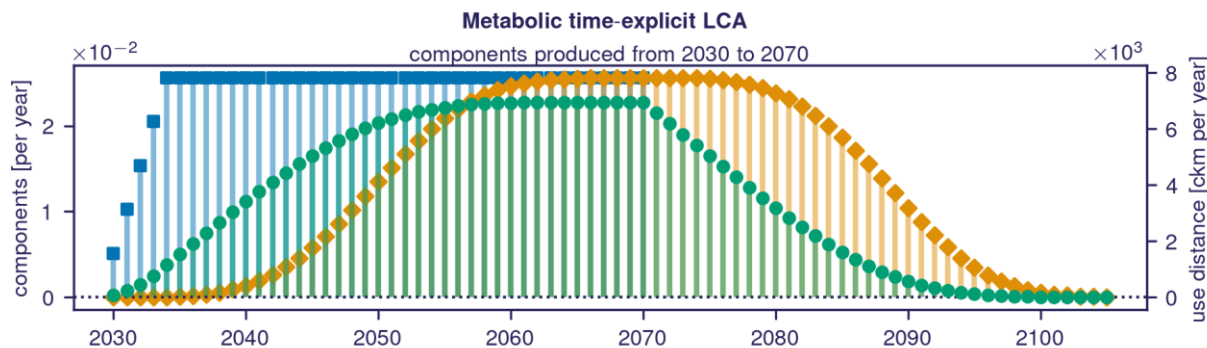
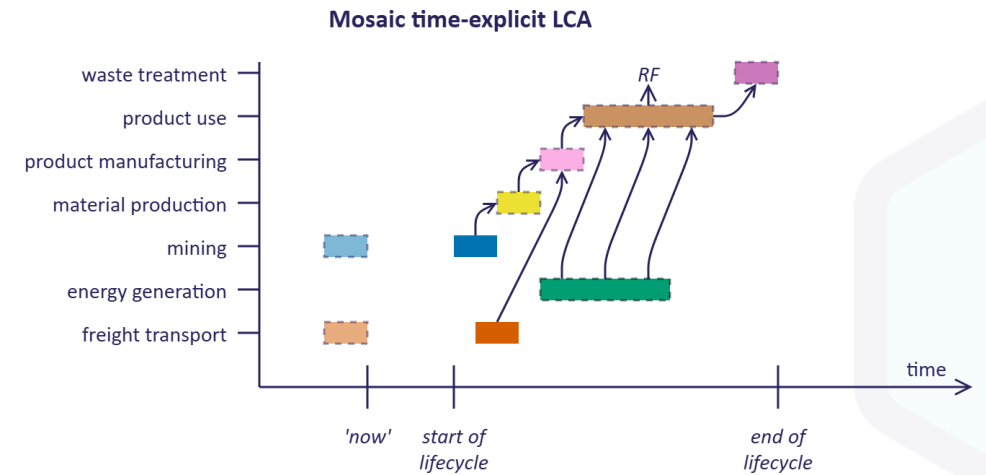
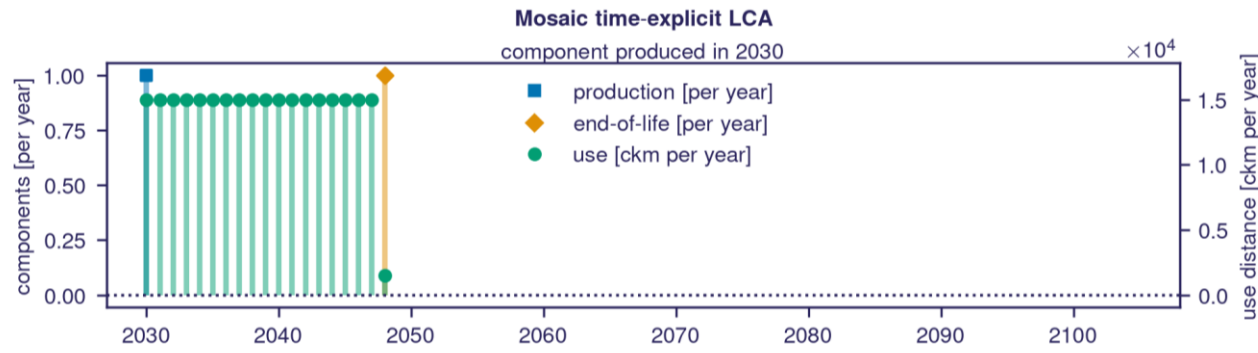


- **Imminent future**
  - Before recycling and use of secondary materials is fully implemented
  - Background database reflects 2030 *ecoinvent v3.10*

- **Advanced future**
  - A lot of recycling and use of secondary materials
  - Background database reflects 2070 *using premise (Sacchi et al., 2022)*

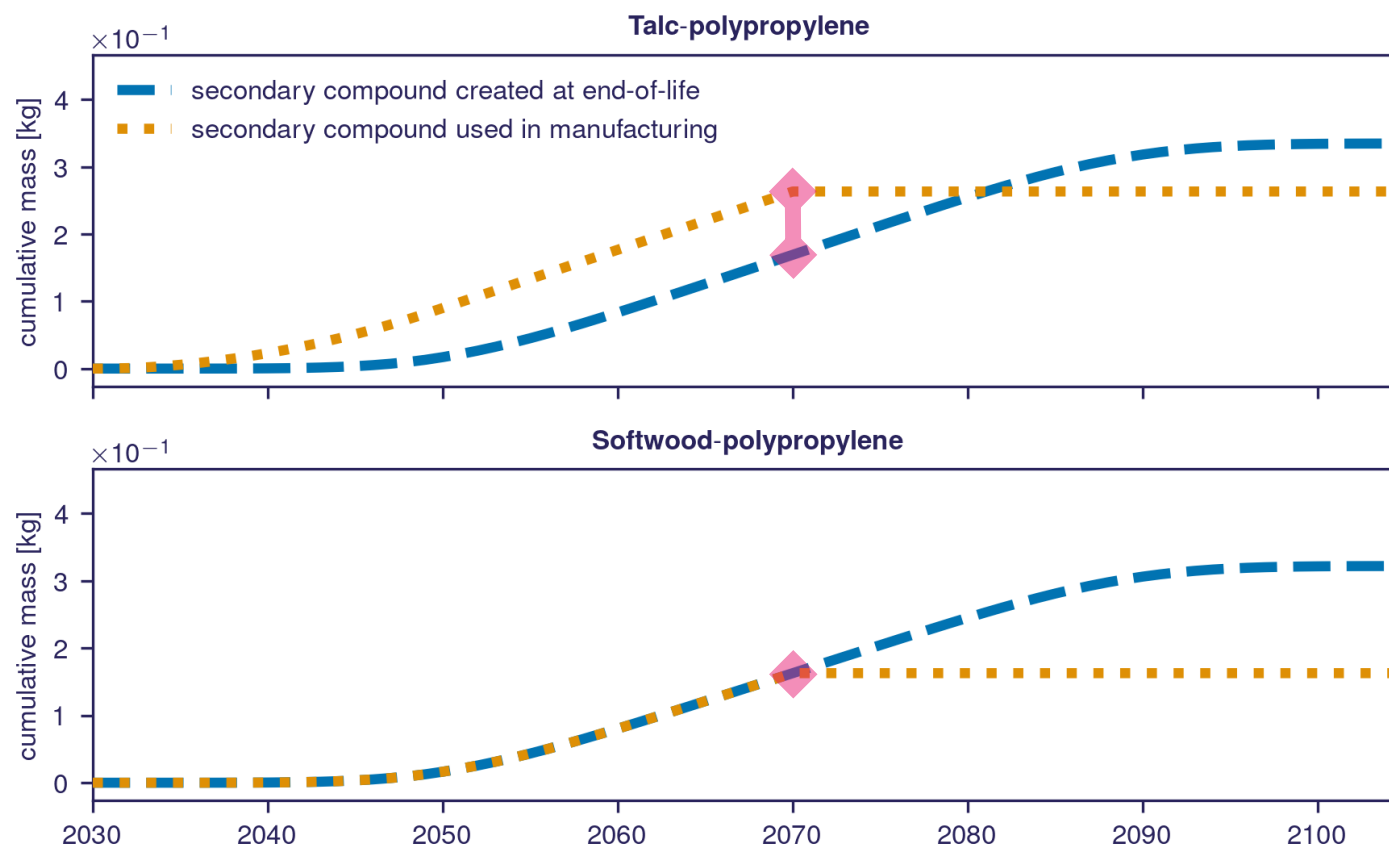
Sacchi et al. (2022) PRospective EnvironMental Impact asSEment (premise): A streamlined approach to producing databases for prospective life cycle assessment using integrated assessment models.  
<https://doi.org/10.1016/j.rser.2022.112311>

# Automotive case study

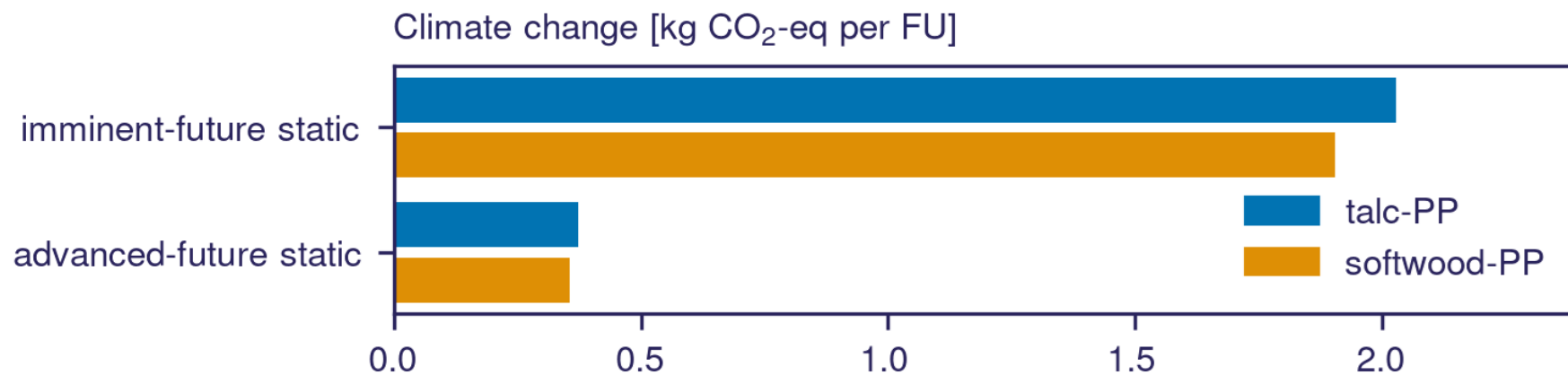




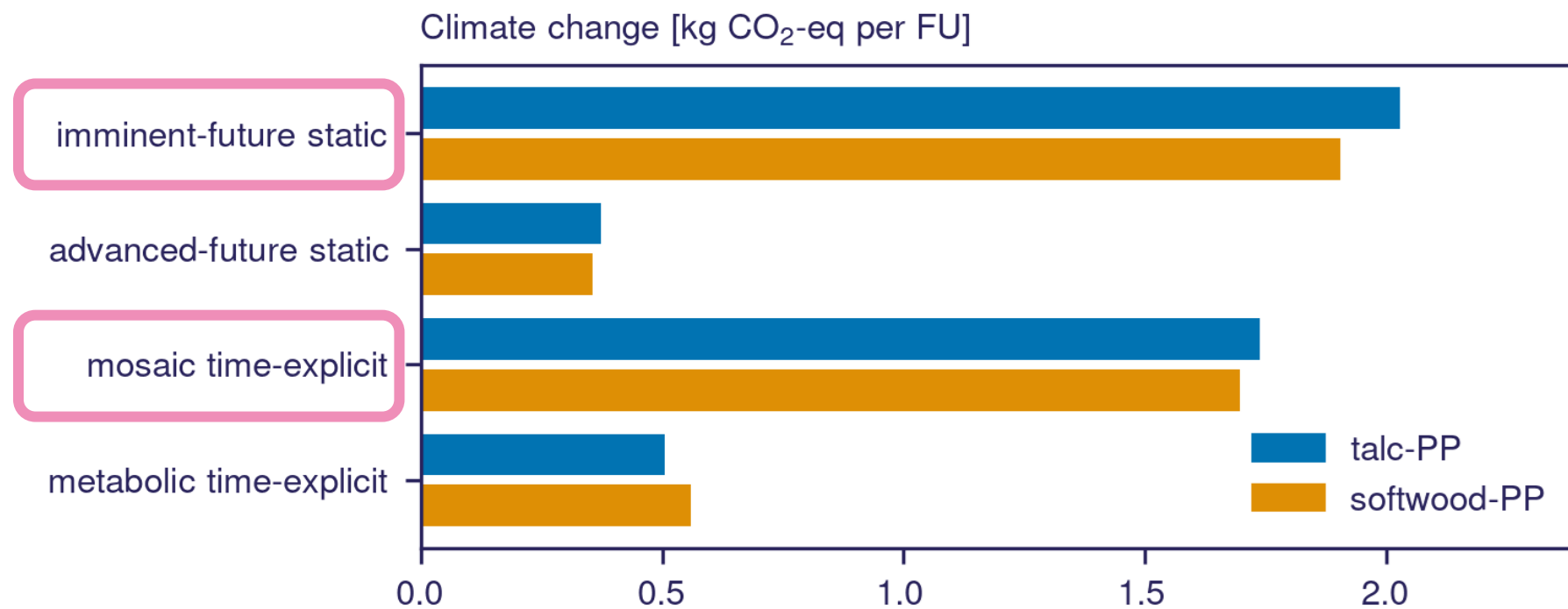
# Automotive case study



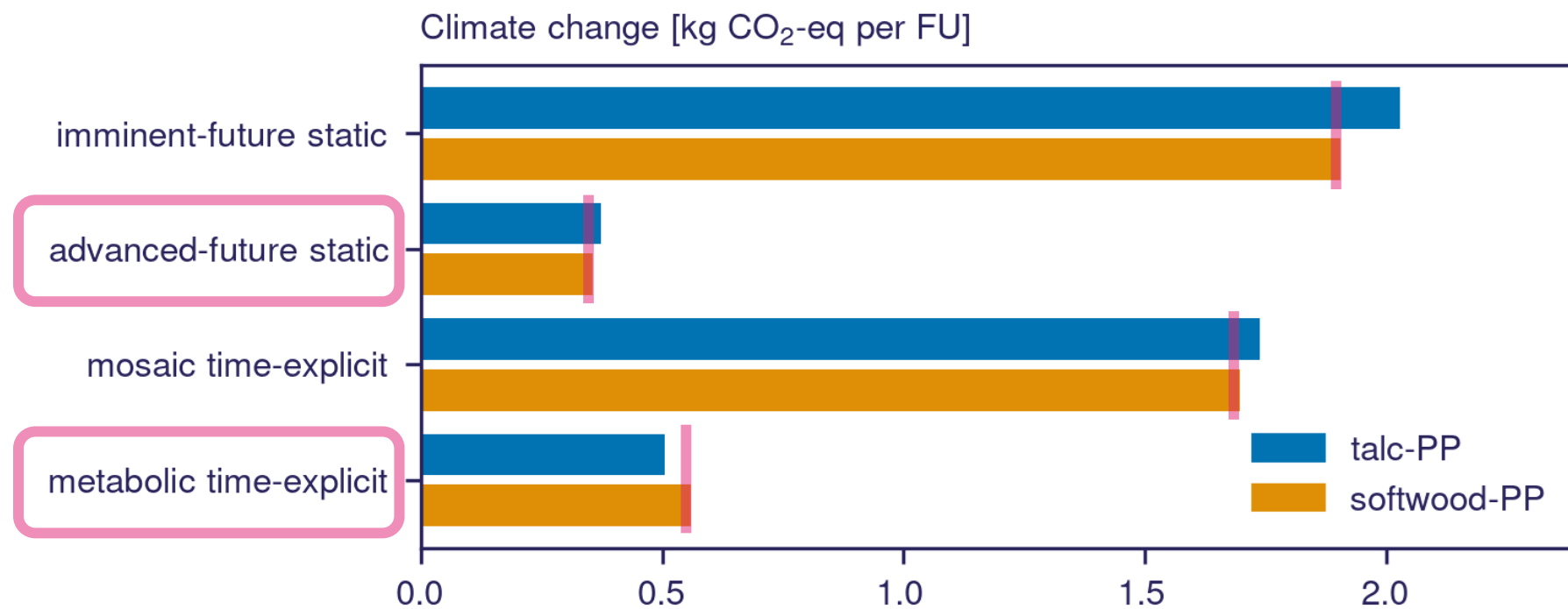
# Results



# Results



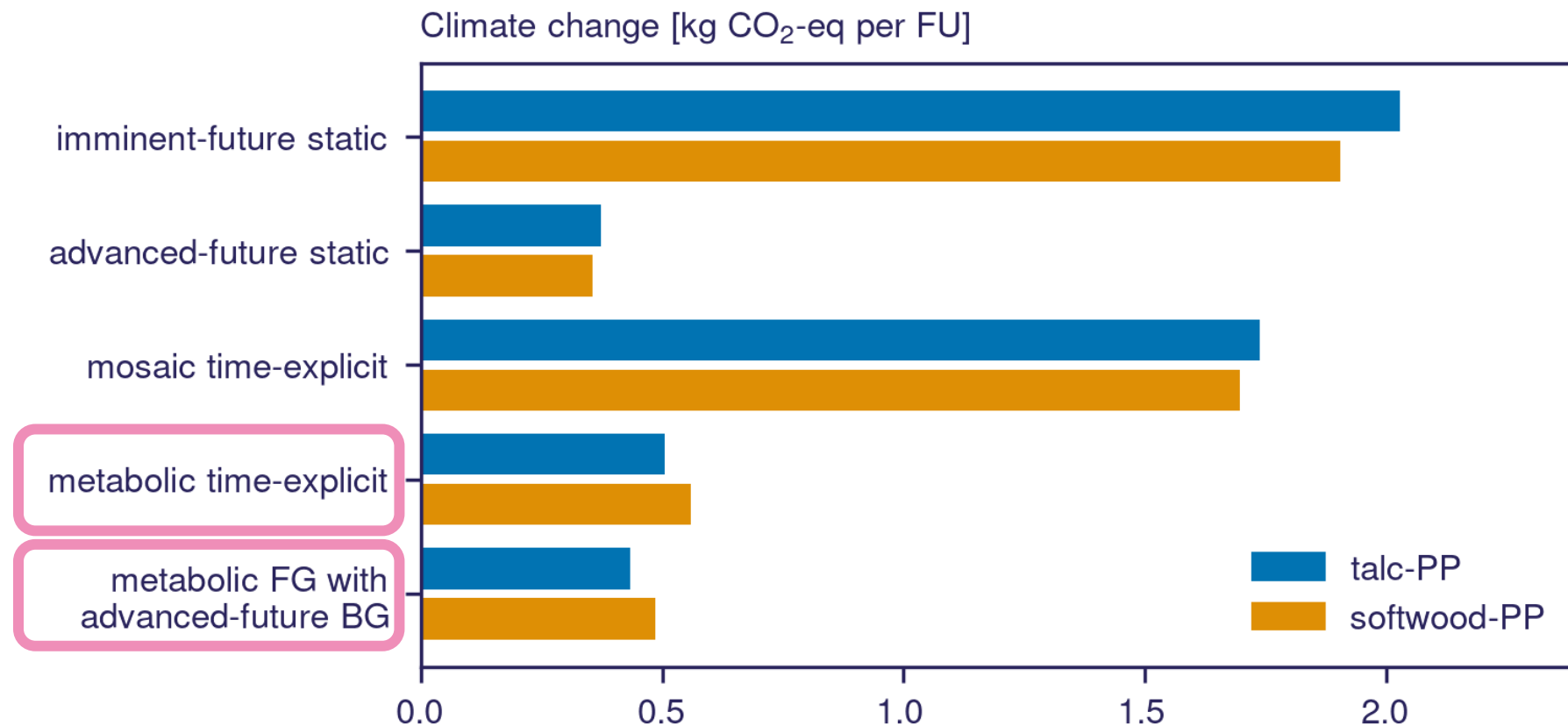
# Results



# What now?

- **Implications for case study**
  - To what extent might the softwood filler disrupt circularity?
  - How much secondary material might be used? Could we increase this?
  - Robust conclusions require robust understanding of future (secondary) plastics
- System definition: **steady state** vs **dynamic**
  - A static perspective can still be valuable
  - We can assess transformative change with (metabolic) time-explicit LCA
- Computational structure: **conventional** vs **time-explicit**
  - Metabolic thinking is useful, but still difficult to fully implement

# The fifth option





# The fifth option

## Advantages

Added value within constraints of conventional software

## Disadvantages

No explicit temporal differentiation

- Limits interpretation of socio-technical system
- Prevents time-explicit impact assessment

We lack fundamental contributions

- Future functions
- Future environmental flows

## Project partners



Thank you for  
your attention

Preprint access



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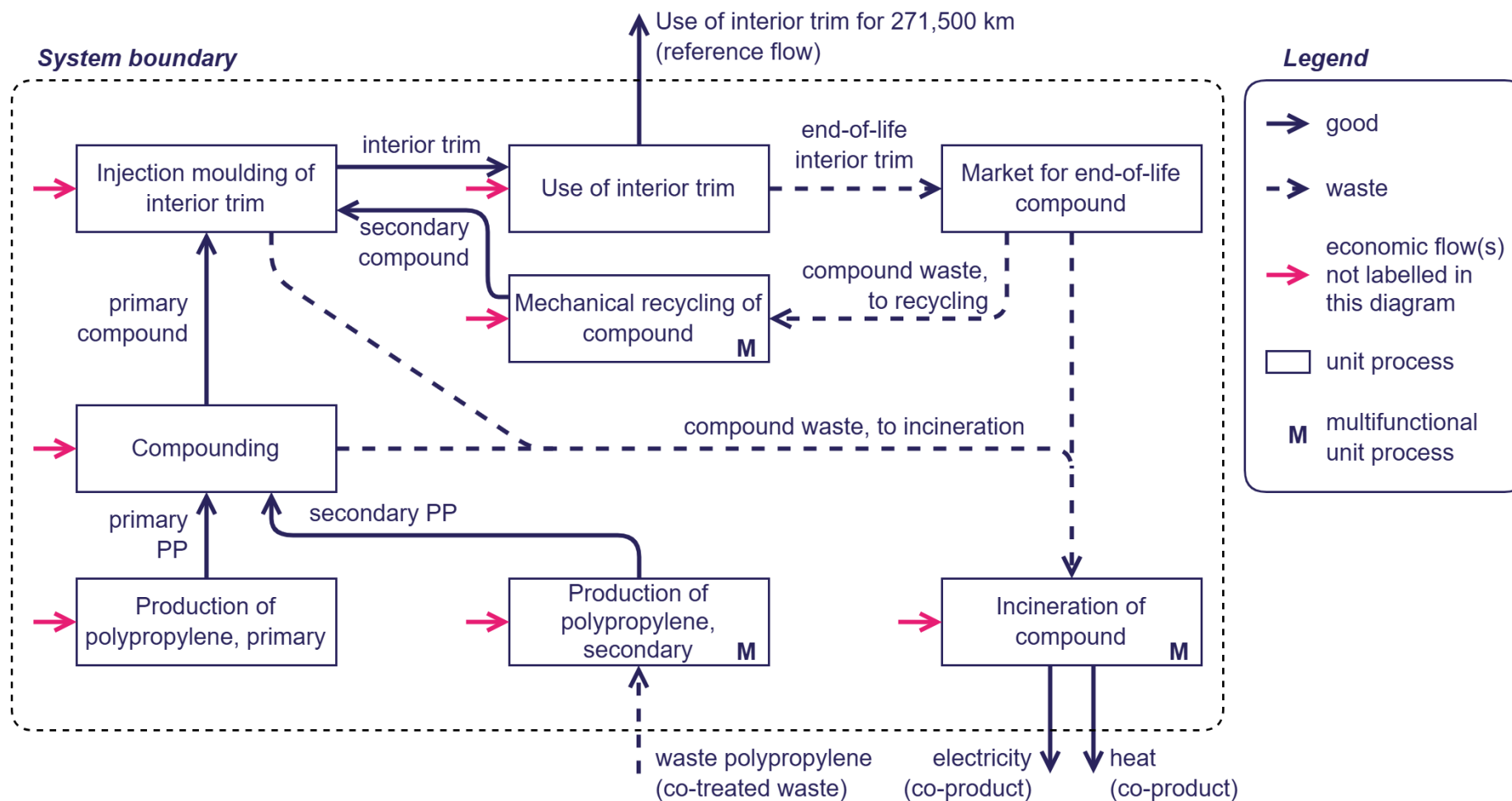
# Back-up slides



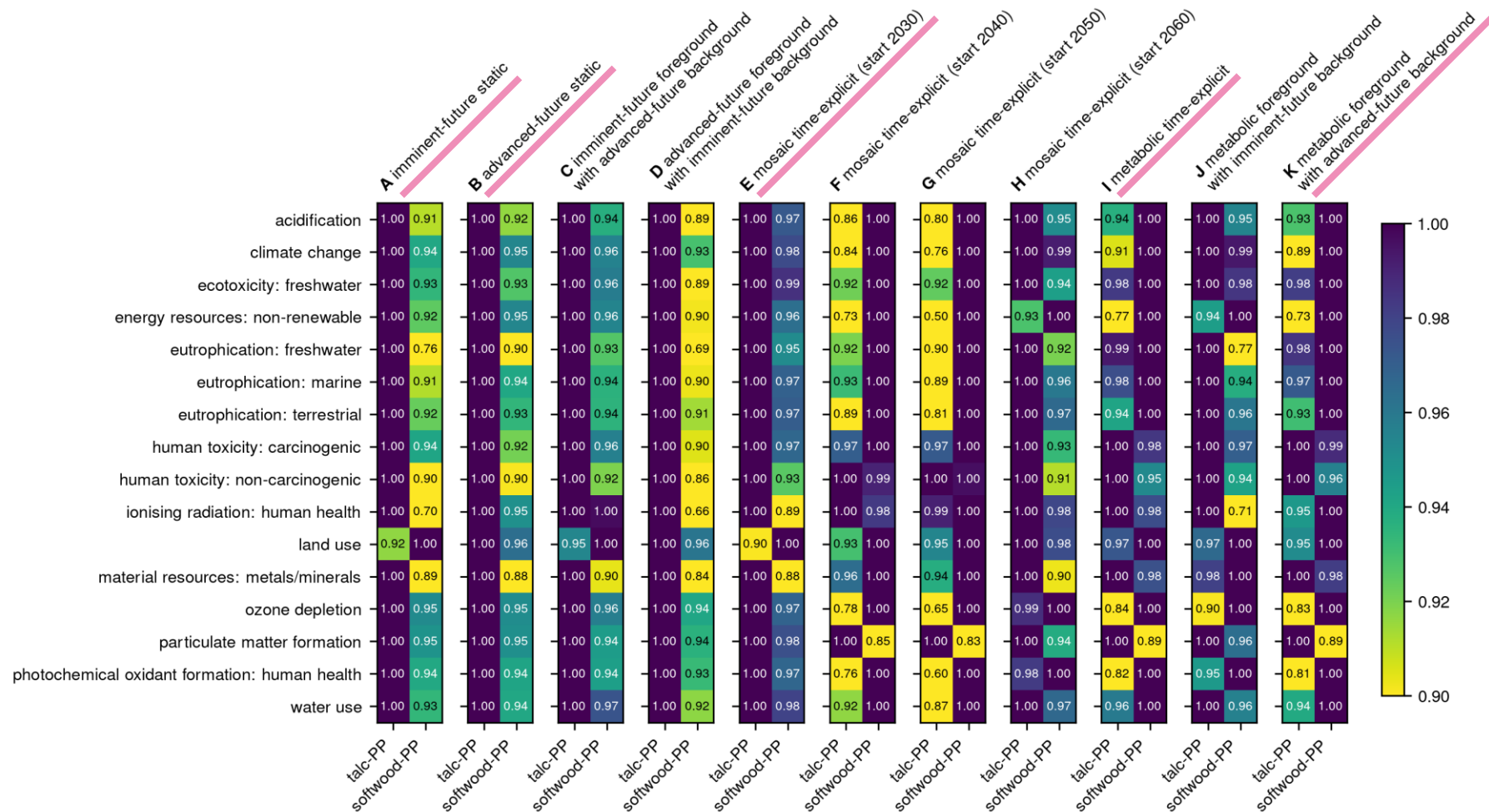
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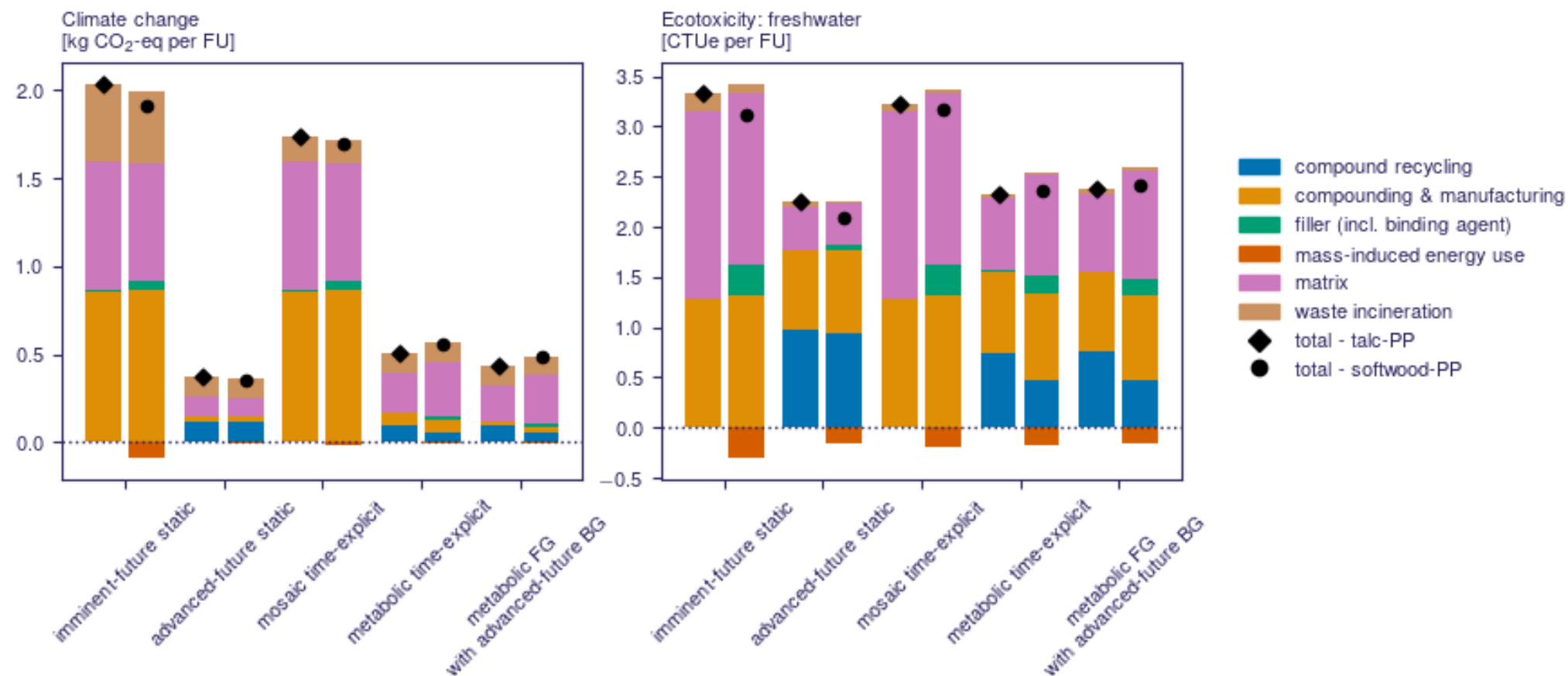
# Product system diagram



# Internal normalisation



# Contribution analysis





# Waterfall

