

# Recommendations for Routes to Sustainable Exploitation of CFRP Materials

Review of Life Cycle Assessments of Carbon  
Fibre Reinforced Materials

*Frida Hermansson, Matty Janssen & Magdalena  
Svanström*

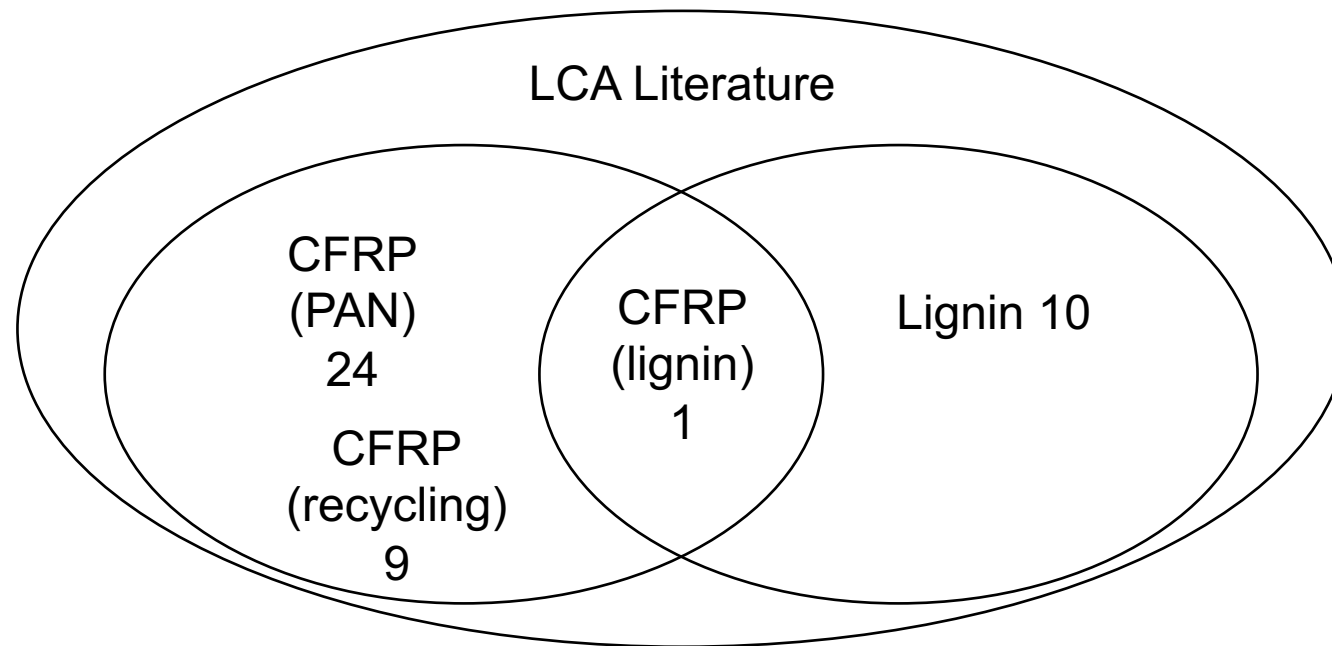
*Chalmers University of Technology*

# Agenda

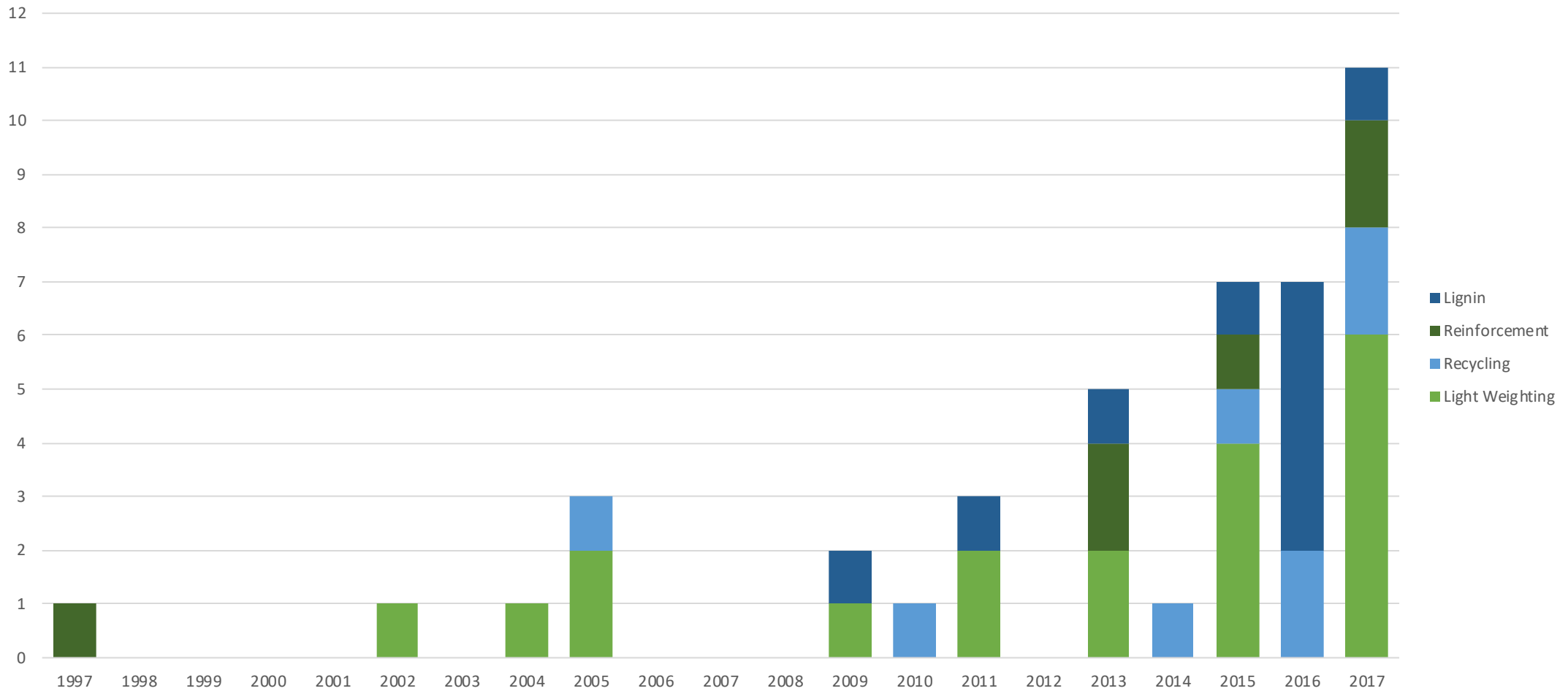
- Literature review
- Results: Comparing results for climate impact from different studies
- Results: Transitioning from PAN to lignin as precursor for carbon fibres in CFRP
- Results: Energy savings from reusing carbon fibres
- Conclusion and future work

# Literature review

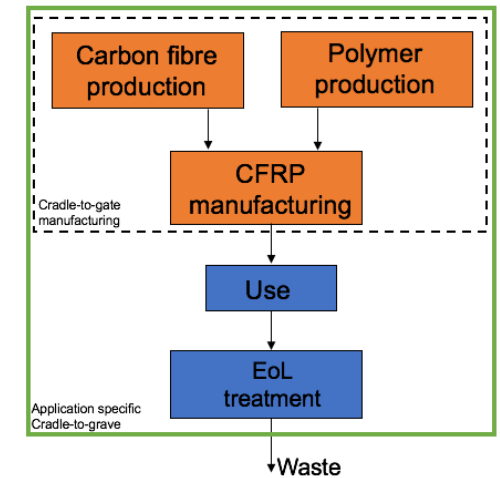
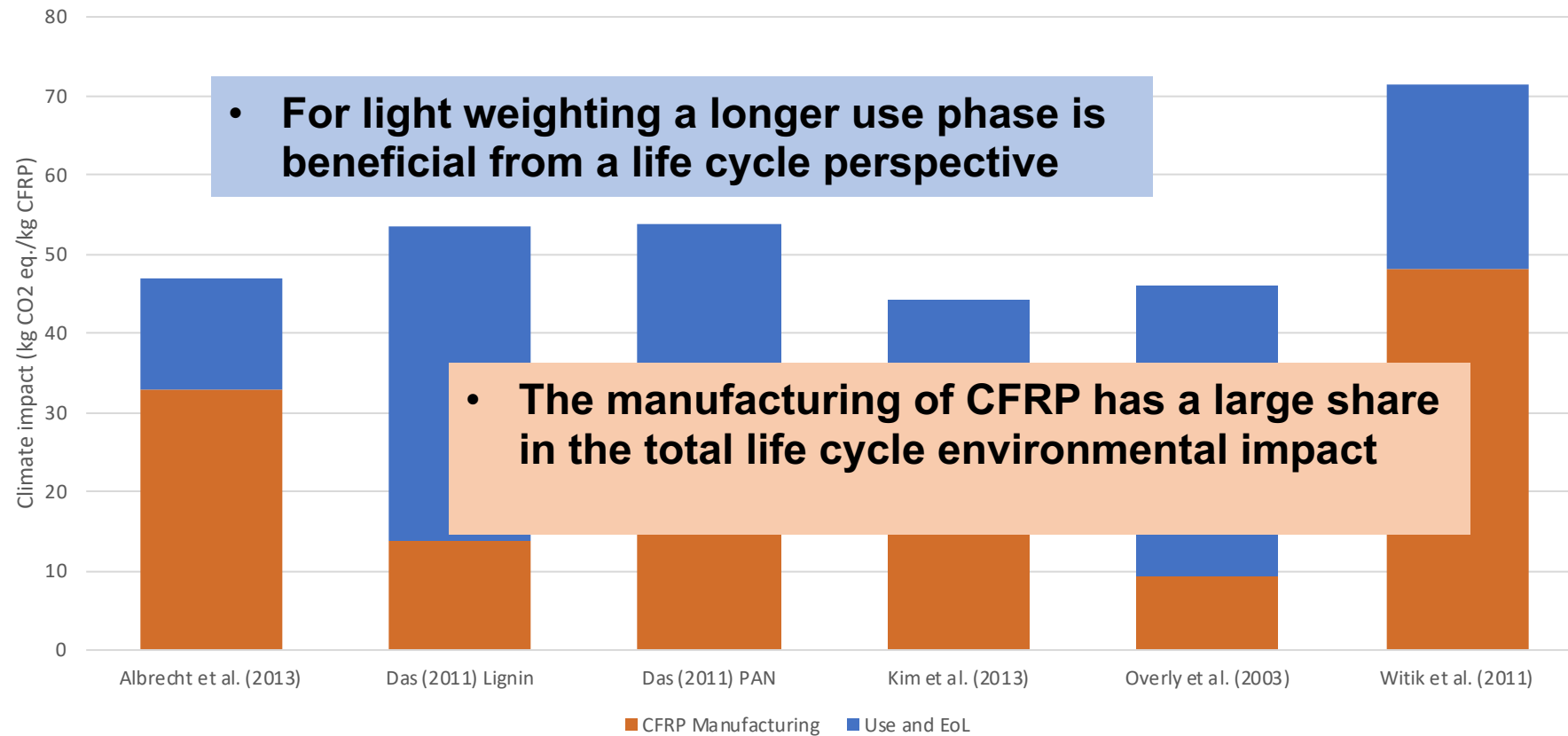
- **33 LCAs of CFRP was found**
  - **Only one study (Das, 2011) assessed lignin based carbon fibres**
    - **The literature review was expanded to also include LCA of lignin (10)**



# Literature review

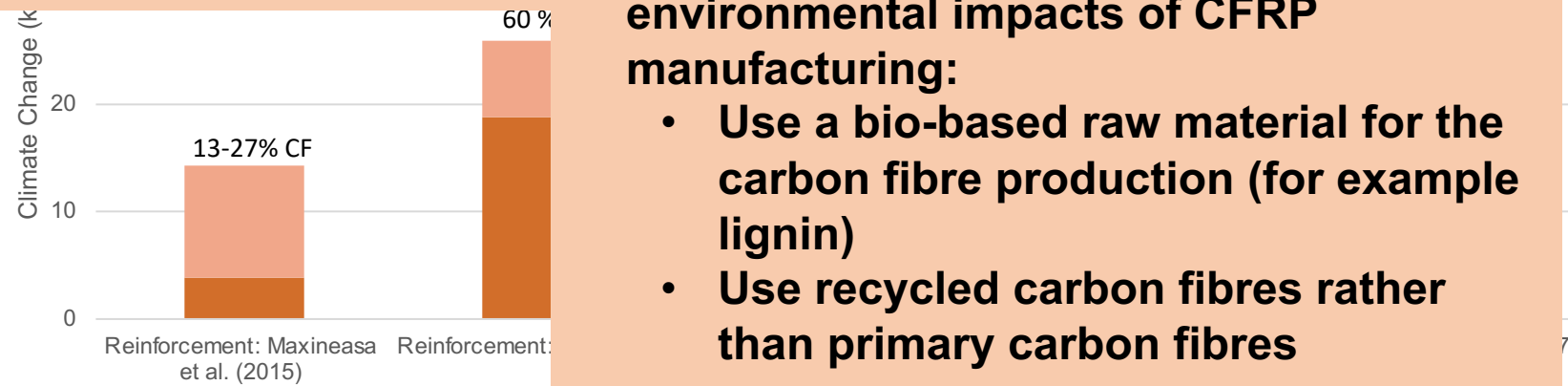


- Results: Light weighting climate impact**

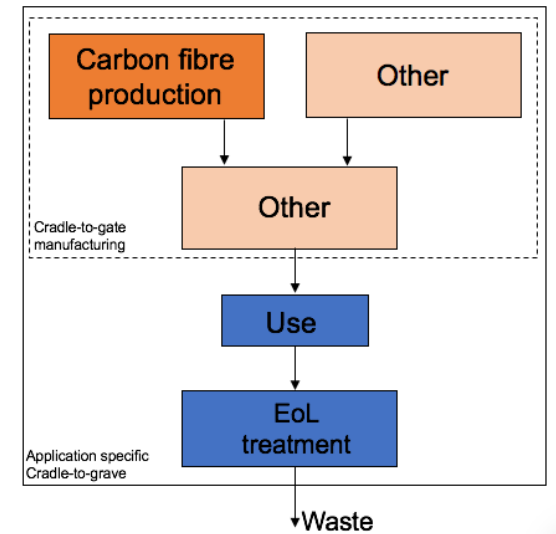


## • Results: Materials and manufacturing climate impact

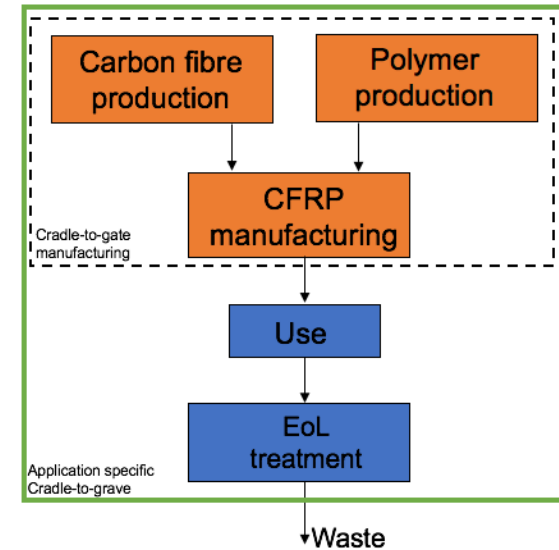
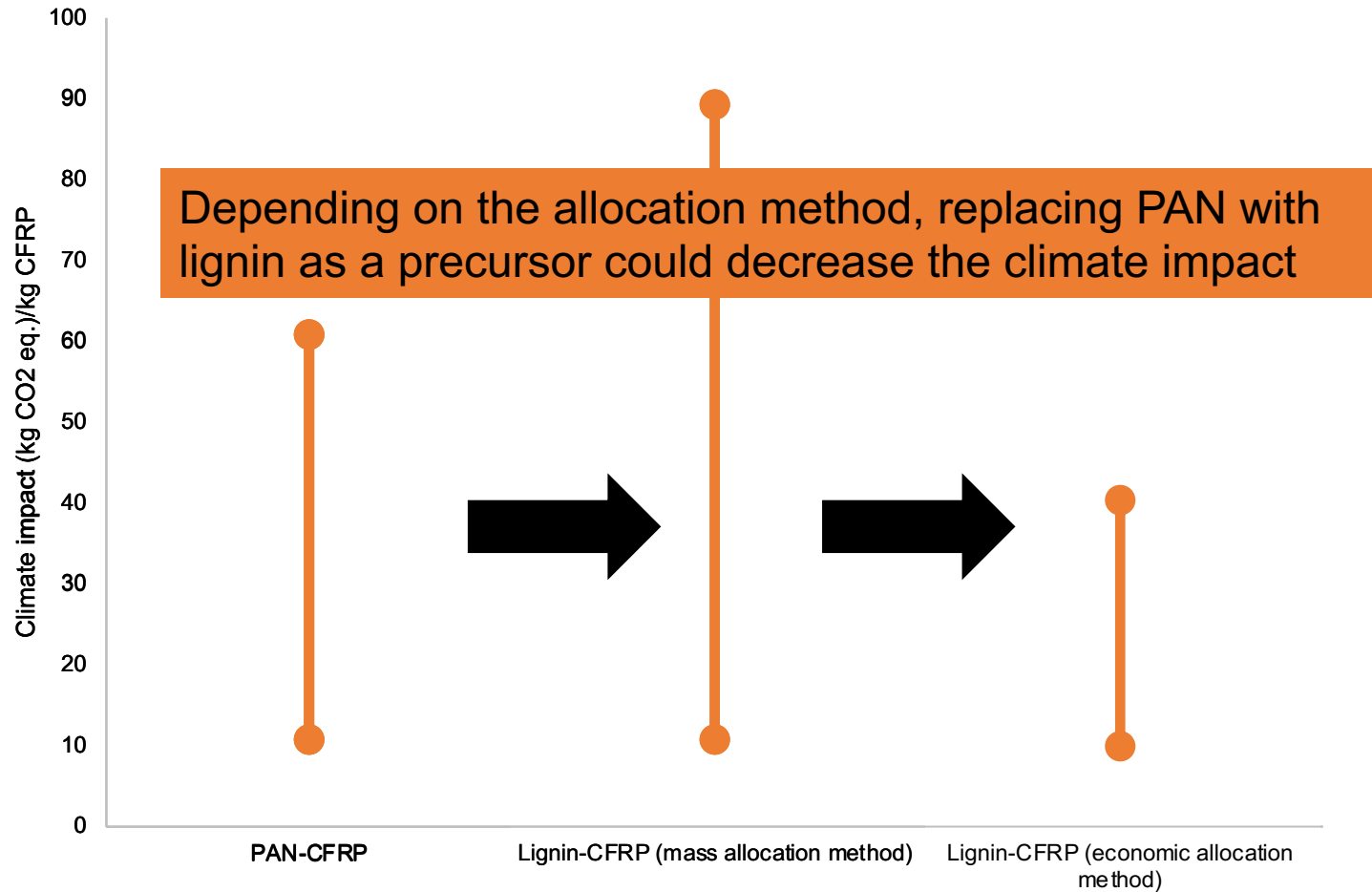
- **Most obvious way to decrease the environmental impact of CFRP is to decrease the amount of carbon fibre in matrix**
  - **might not be possible due to structural requirements**



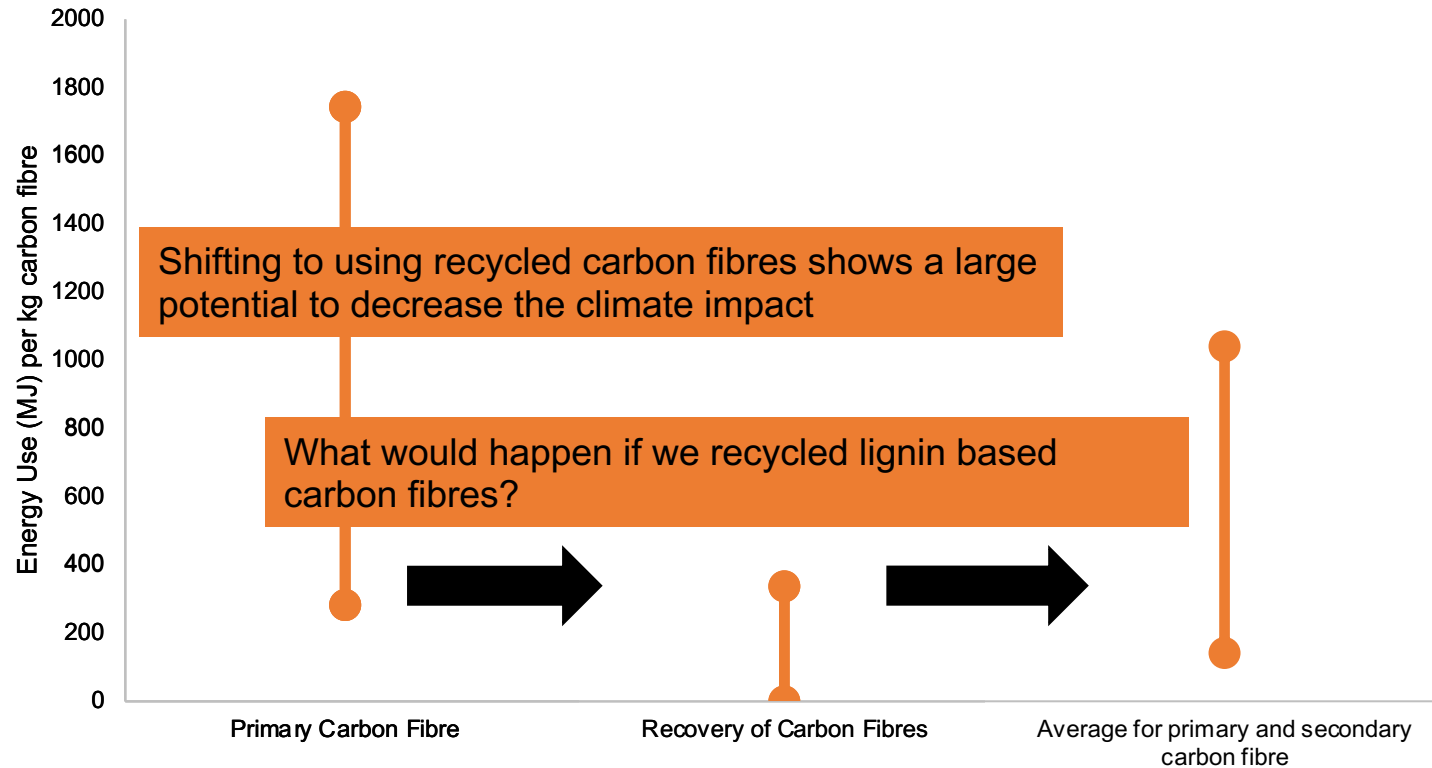
- **Two other concepts of reducing the environmental impacts of CFRP manufacturing:**
  - **Use a bio-based raw material for the carbon fibre production (for example lignin)**
  - **Use recycled carbon fibres rather than primary carbon fibres**



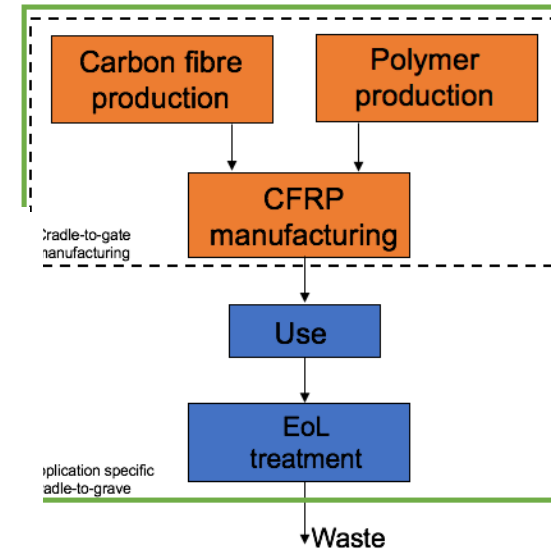
- Results: Materials and manufacturing – Replacing PAN with lignin**



# Results: Demonstrated gains from recycling



*(Includes only 2 PAN-CFRP studies)*





# Conclusions

- **Three main aspects need to be considered to decrease the environmental impact of CFRPs**
  - **Decrease amount of carbon fibre in matrix**
  - **Prolong the life time of the product (mileage in light weighting)**
  - **Decrease the environmental impact of the production for the CF by for example shifting to a bio based precursor**
  - **Look into recycling opportunities to reuse carbon fibres/CFRP**

# Future work

- **Life Cycle Assessment of lignin based carbon fibres**
  - Comparing different lignin and polymer blends
- **Carbon fibre=> CFRP=> in applications**
  - Addressing challenges in going assessments in early stages of material development
- **By this review we have mined the literature from whatever we can learn for or own LCA. Three methodological challenges are:**
  - Allocation of lignin: Waste or a by-product?
  - Allocation when including recycling of CFRP
  - Comparing a fossil-based material to a bio-based material

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**Thank you all for your attention!**