

Assessing the impact of buildings and construction across scales using the Australian IELab

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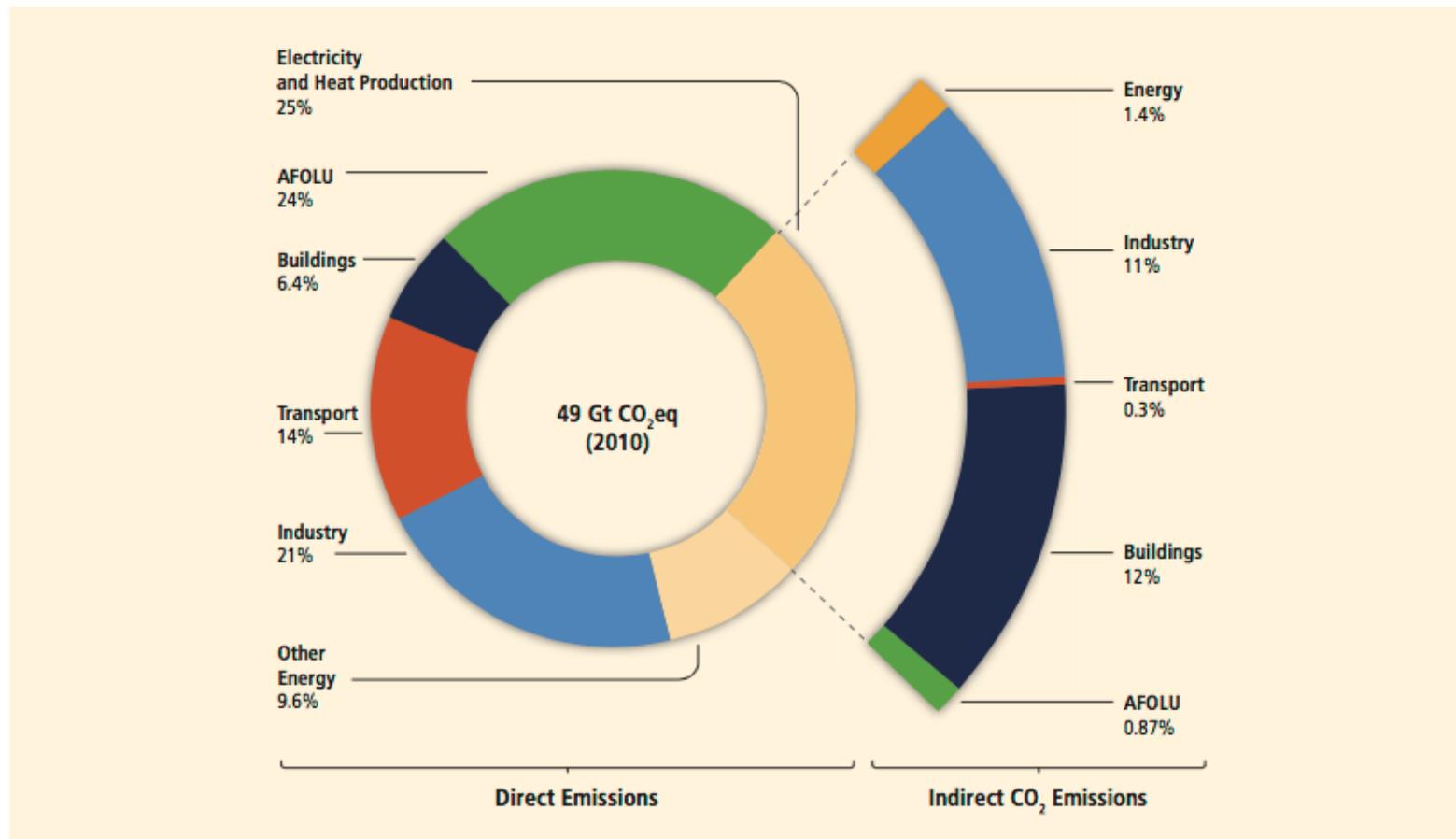
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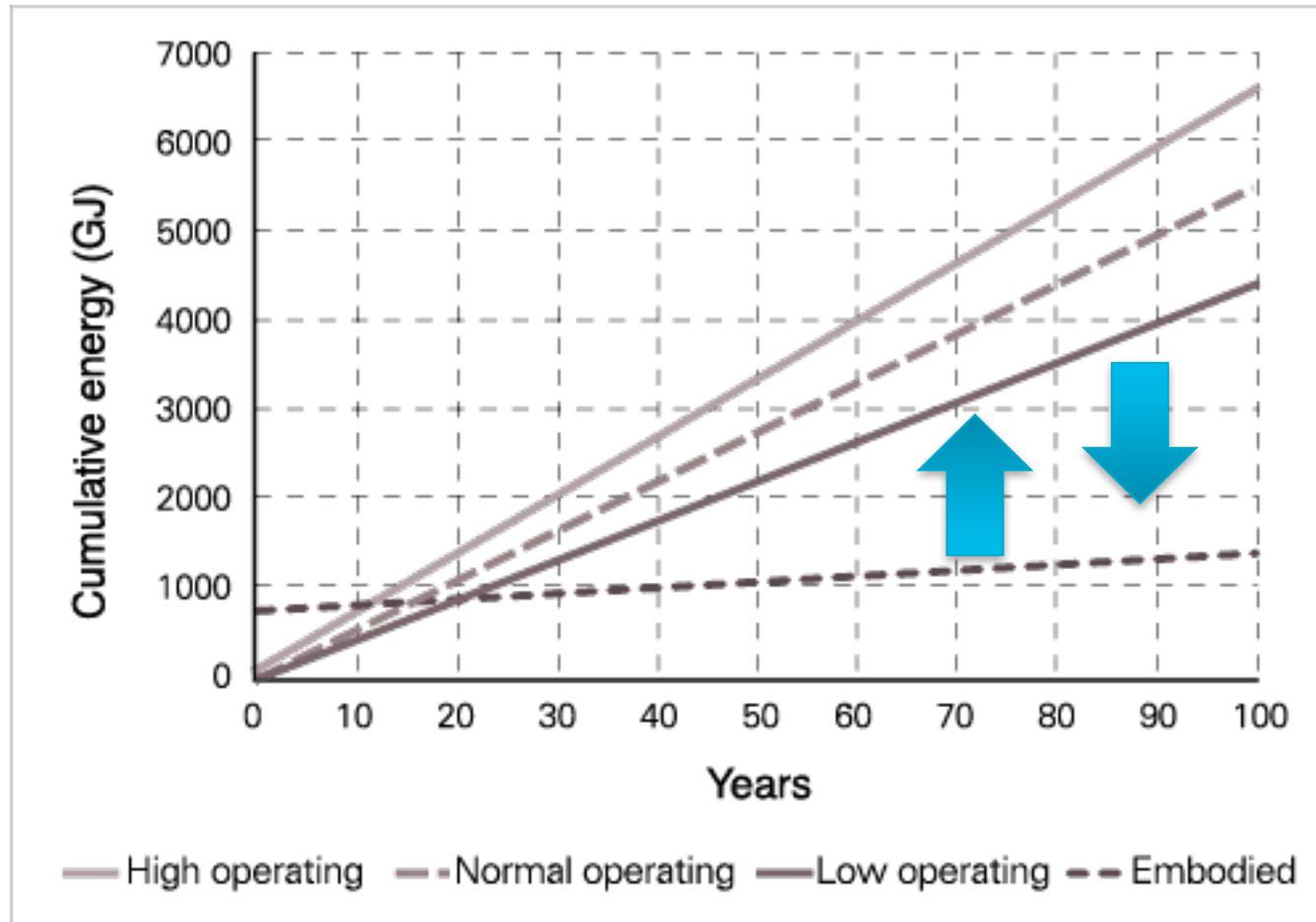
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Global Emissions From Buildings, Industry and Transport



IPCC (2014) WG3 Summary for Policy Makers Figure SPM 2

Importance of Embodied Energy in Buildings



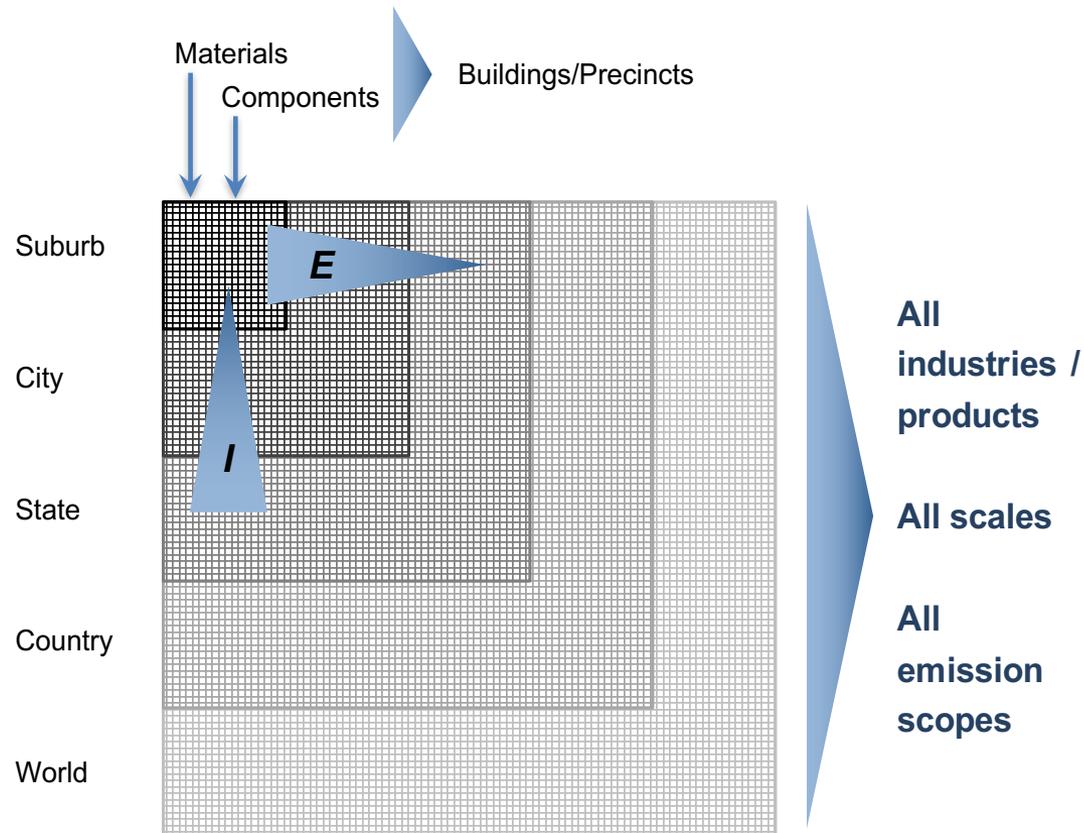
Adams, E, Connor, J and Ochsendorf, J. 2006

NHBC Foundation (2011)

Why the IE Lab is well positioned to respond?

- Comprehensive Scope
 - Includes all sectors – economy wide
 - Can be disaggregated to 1284 products and 2214 regions AND connected to flows to/from the rest of the world.
- Rigorous
 - Mathematically tractable – direct connection to data
 - Standardised downscaling, harmonisation and concordance
- Flexible

Flexible



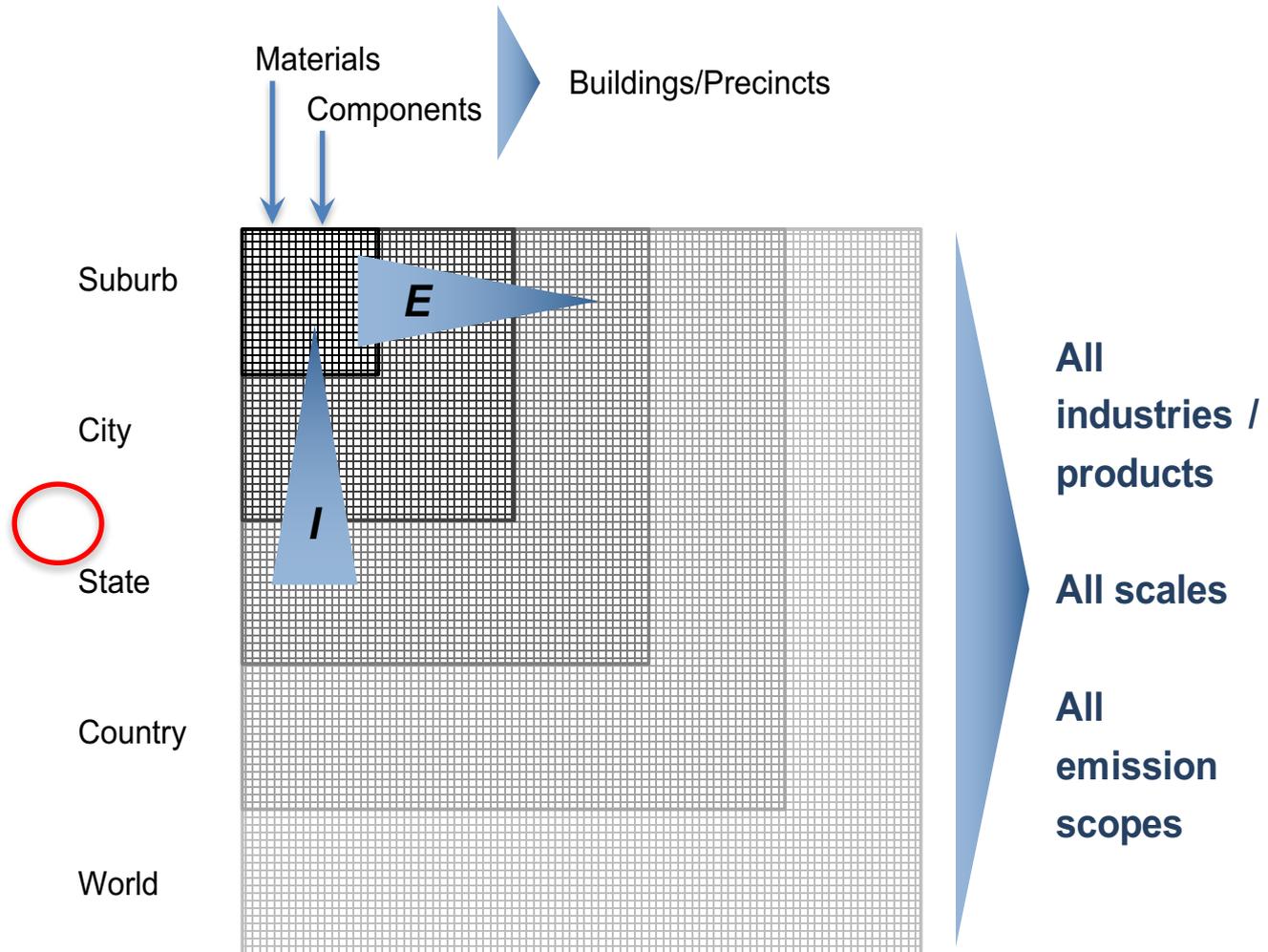
Nested emissions accounting framework where Imports (I) to any scale are located in columns, exports (E) in rows. Embodied emissions from entities below the suburban scale (buildings and precincts) are accounted for by adding their constituent materials and components (from [Wiedmann et al. \(2013\)](#)).

...also Wiedmann, Chen, Barrett *J. Ind Ecol* (2015)

Why the IE Lab is well positioned to respond?

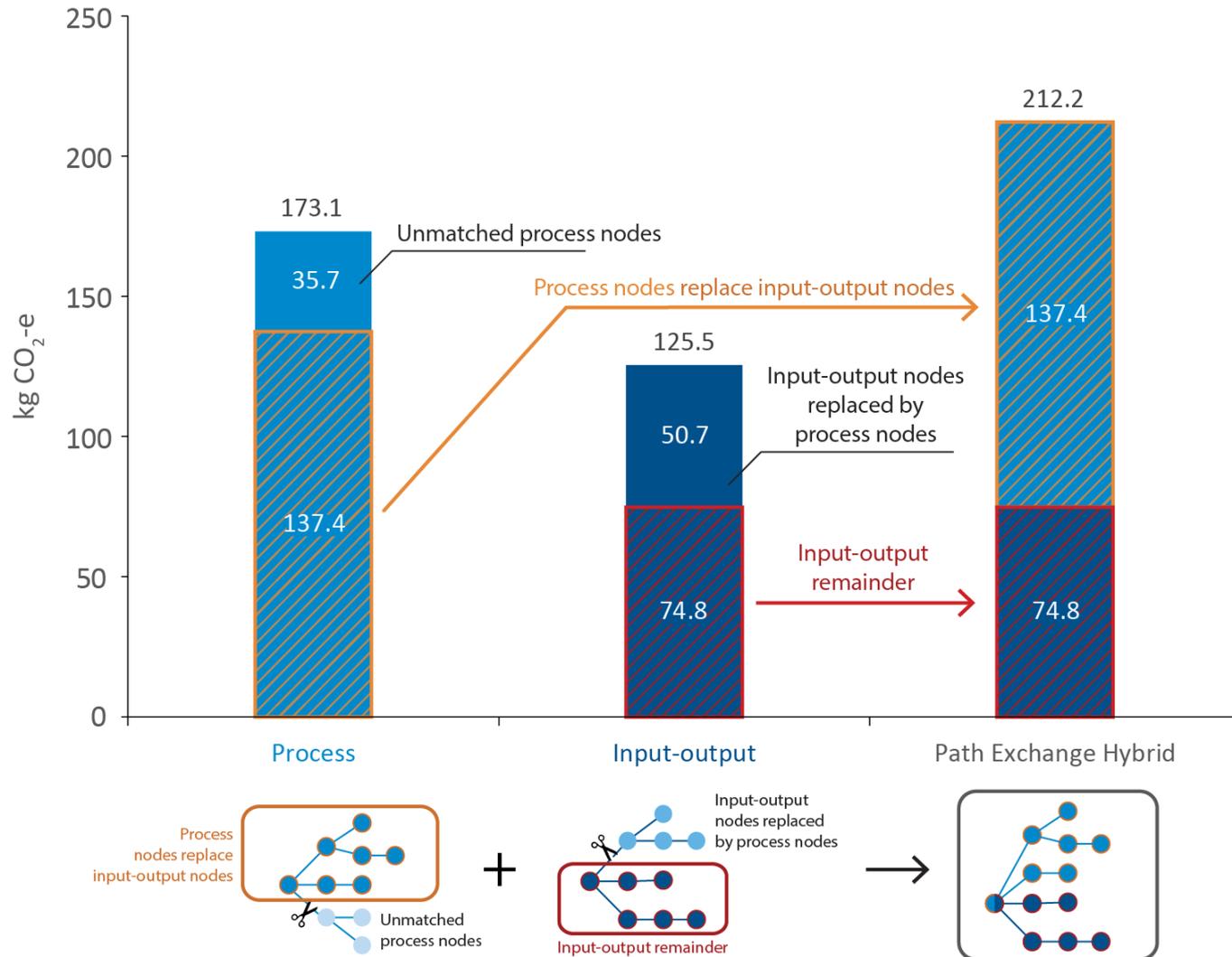
- **Comprehensive Scope**
 - Includes all sectors – economy wide
 - Can be disaggregated to 1284 products and 2214 regions AND connected to flows to/from the rest of the world.
- **Rigorous**
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- **Flexible**
 - Can apply across scale: the entire construction sector, a master planned precinct, a building, a component or a product used in a building component
 - Can hybridize with life cycle analysis to represent precision not inherently in the input output tables or satellite data

Case Study of an Aluminium Framed Window



Path Exchange Hybrid Method

Figure 2: Overview of hybridisation process for calculating embodied GHG emissions of case study window.



For the math see: Lenzen and Crawford *Env. Sci. Tech* (2009)

Results for Aluminium Framed Window Component

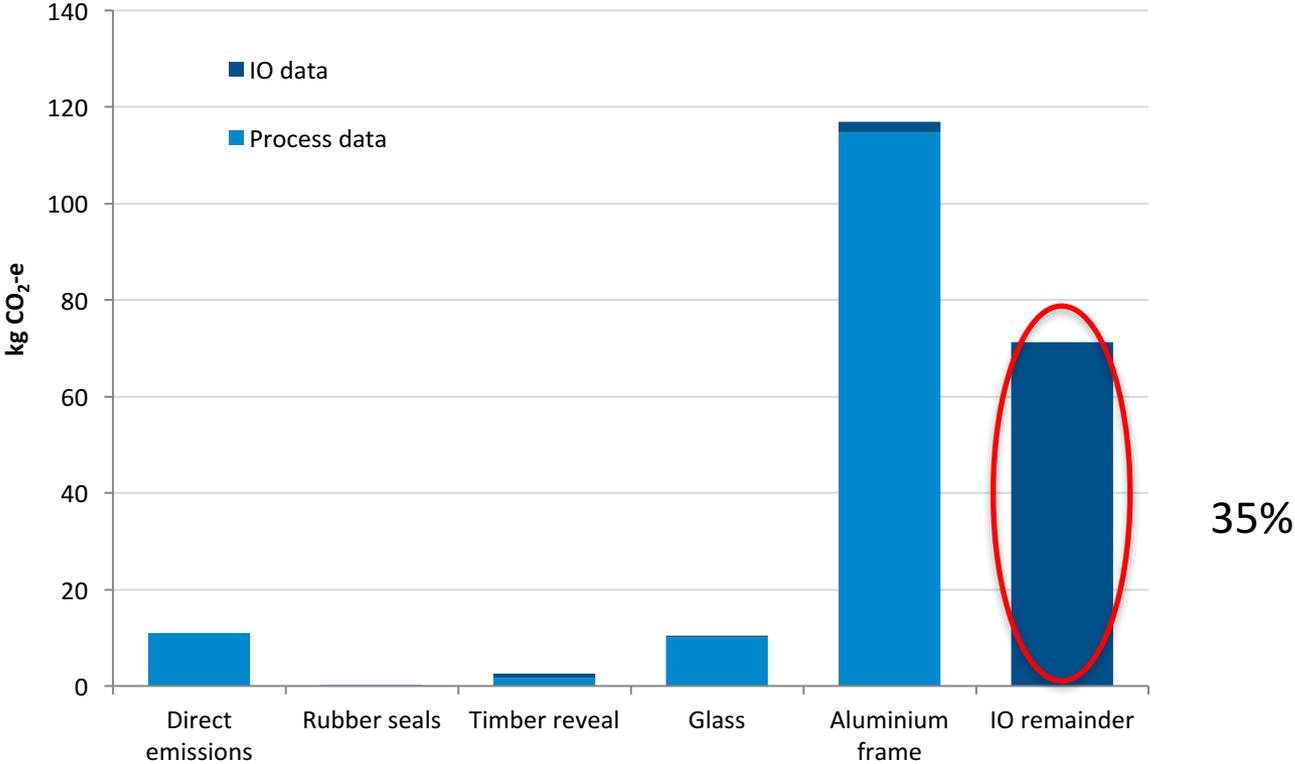
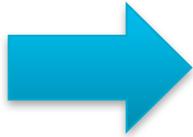


Figure 3: Embodied GHG emissions of 1 m² window, by element and LCI data type.

Extensions

IELab responds to a 'grand challenge': to avoid problem shifting across dimensions of sustainability by having:

- multiple, internally consistent accounts that
 - are used within the one analytical tool
-
- | | | |
|--|---|--|
| <ul style="list-style-type: none">• Water• Energy• Materials• Waste |  | <ul style="list-style-type: none">• Water and Energy• Energy and Emissions• Materials and Waste• All of the above |
|--|---|--|

How to write a paper like this:

- Set it up like a project with delegated section leaders, give clear instructions, regular communication and meetings (even virtual ones) that end with a “to do” list.
- Work with an excellent group of knowledgeable, dedicated, hard working contributors.
- Use something like Google Docs or Drop Box to organize records, segregating sections but knowing they’ll have to be coordinated into a single doc later on.
- Edit with diplomacy, understanding and an iron fist

Some conclusions

- Specific results from the IELab have appeared in > 40 publications
- This is more of a paper about general capabilities of IELab itself
- ... with a bonus building related case study!
- IELab responds to the expressed intent in policies:
 - Measuring real progress toward zero carbon buildings
 - Consistency across scales and topics
 - Representing the trade-offs along the way

This is also a paper that would not be possible without the IELab community – we are more than a bunch of researchers who use the same tool. IELab is also a collection of many skills & expertise.