

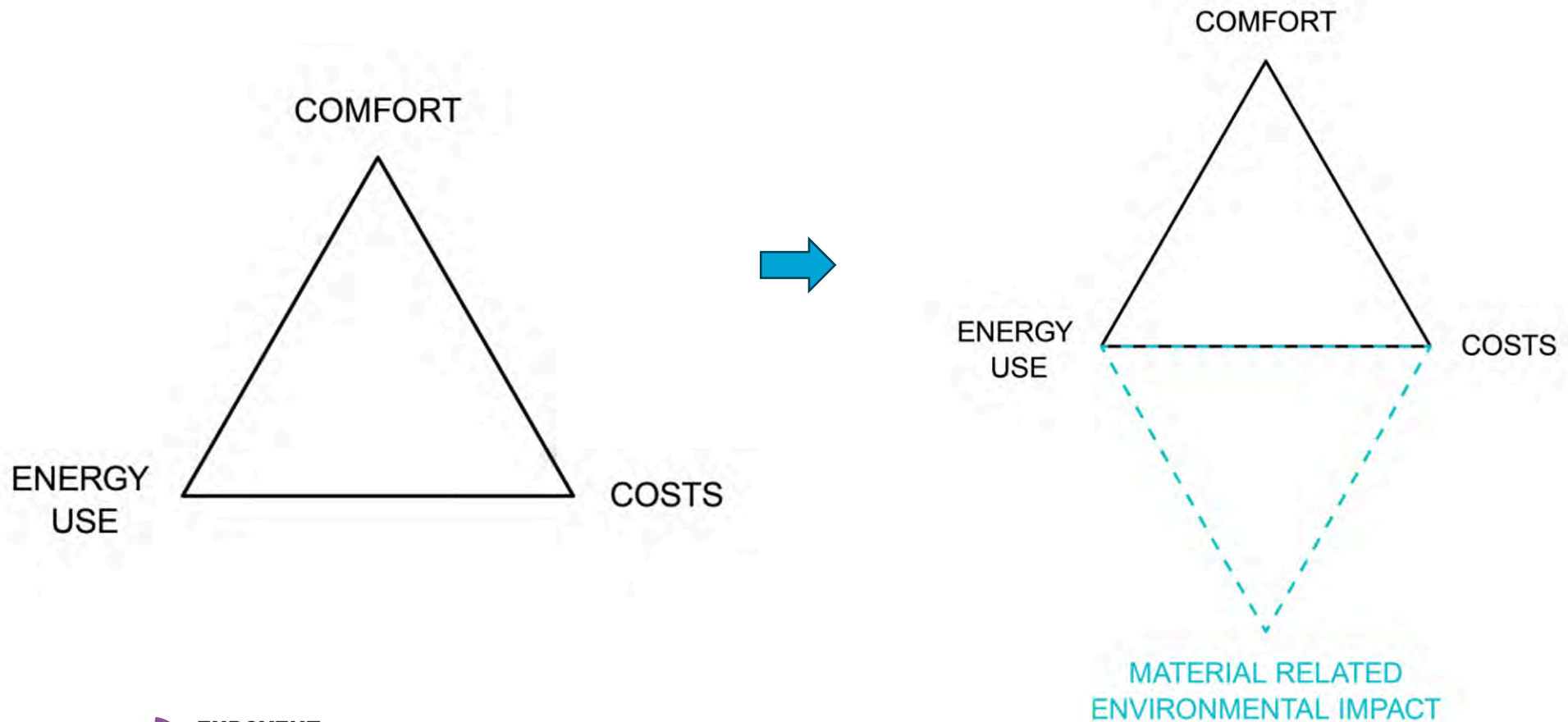
Circular building installations: Myth or reality?

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'Standard' vs ideal approach HVAC system design



Take-Make-Waste approach still around....



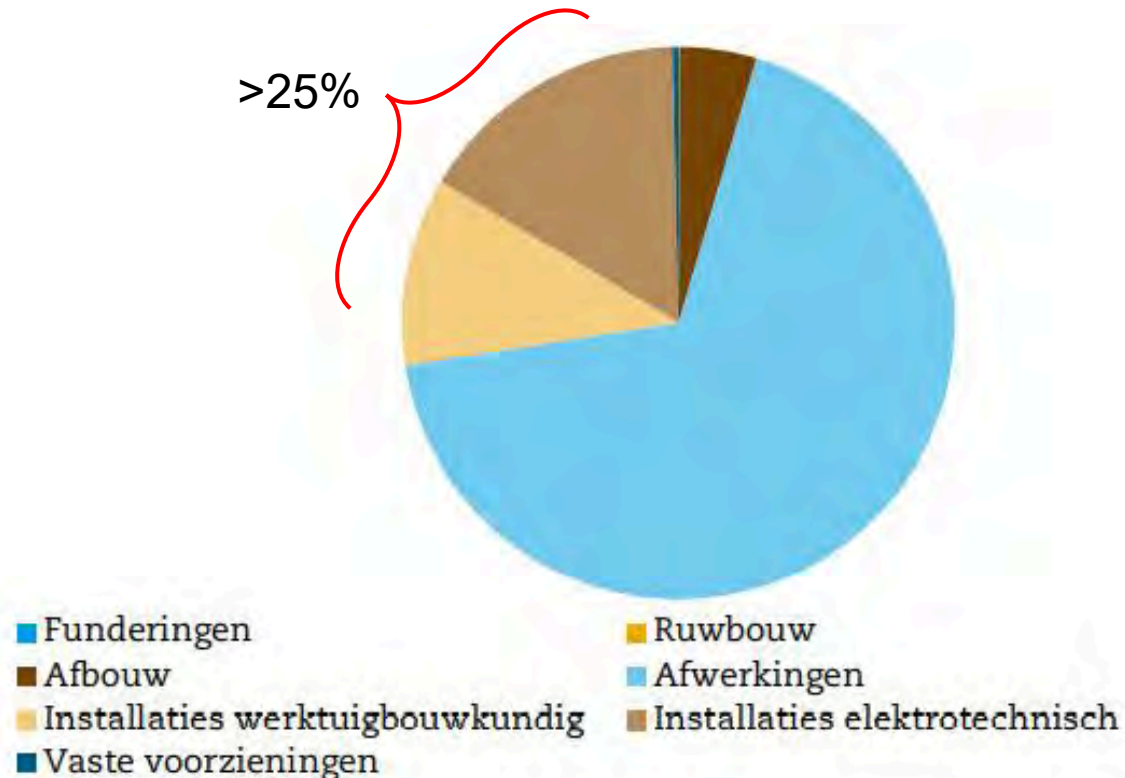
Standard reaction to the idea of circular HVAC

- *‘Sector is already very circular. No need for further actions / regulations.’*
- *‘We use mostly recycled metals (e.g. in ventilation ducts), heat recovery nowadays is standard and fans for example are already ultra-energy efficient.’*

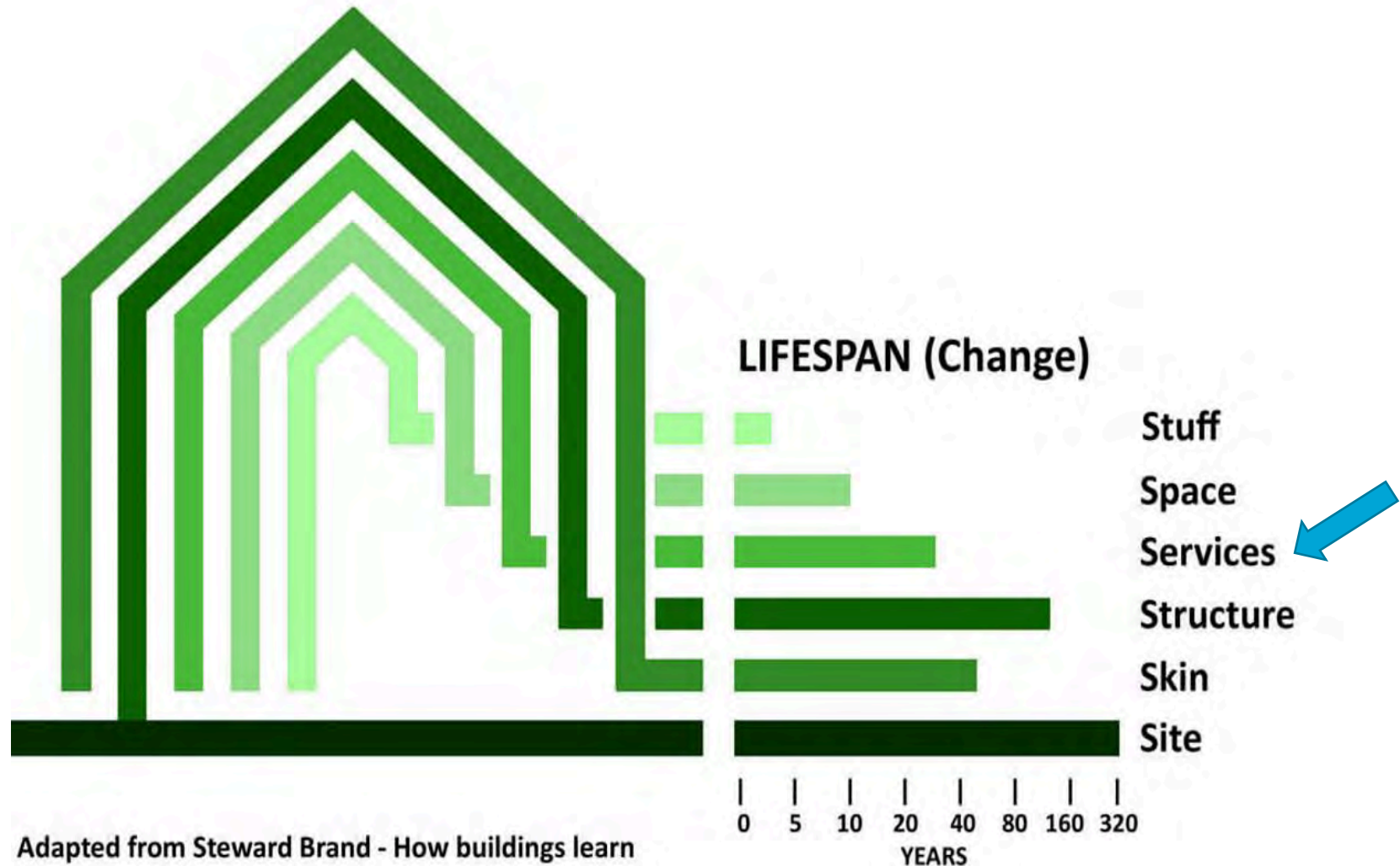


Relative environmental impact HVAC systems

- Relative environmental contribution of mechanical & electrical installations when renovating Dutch office buildings:



Lifespan installations vs lifespan other components



Installations in the news (heat pump example)

‘Calculated environment impact of heat pumps much higher than anticipated; difference partially due to ‘forgotten’ effects related to use of refrigerants and electronics for system controls’



HVAC systems > relatively metal- & CRM-intensive



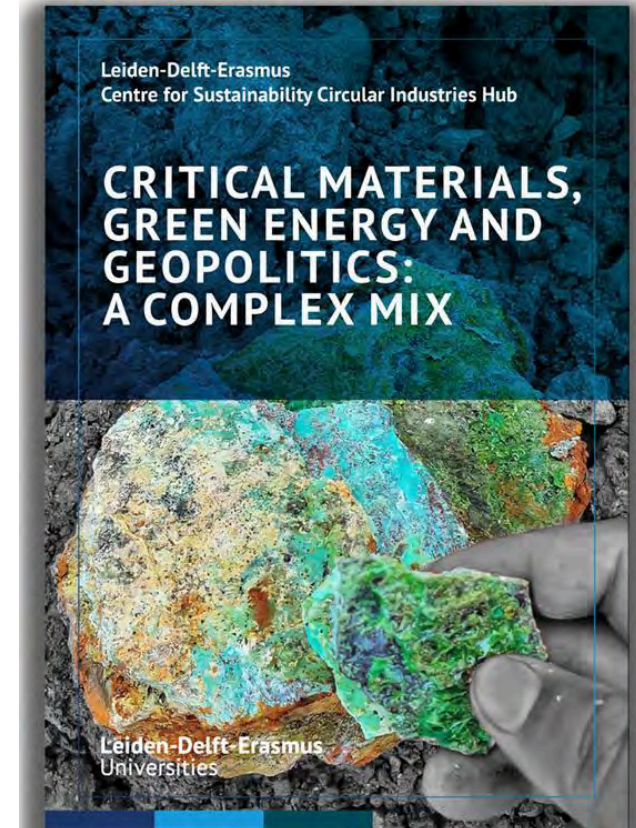
PRESS RELEASE | Mar 25, 2025 | Brussels | 3 min read

Commission selects 47 Strategic Projects to secure and diversify access to raw materials in the EU

From fossil fuels to rare earth metals

- At the core of the present transition is a switch from fossil fuels to metals such as copper, lithium and rare earth metals.
- These metals are needed for producing the required wind turbines, solar panels, heat pumps, batteries etc.
- Making them critical materials for achieving the energy transition.
- Currently, the EU must import the bulk of these materials, making us very dependent on other countries...

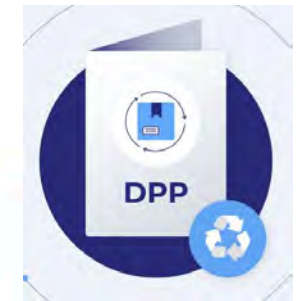
For more information, read the TU Delft & et al. whitpaper: 'Critical materials, green energy and geopolitics; a complex mix.' [Critical Materials LDE White Paper DEF20220627.pdf](#)



ESPR 2024: Ecodesign for Sustainable Products Regulation

- This regulation supports the EU Green Deal and Circular Economy Action Plan.
- Art. 16 ESPR: *'New ecodesign requirements are meant to improve product durability, reliability, repairability, upgradability, reusability and recyclability, improve possibilities for the refurbishment and maintenance of products, ..., increase the energy and resource efficiency of products, with regard to the possibility of recovery of critical raw materials, while enabling remanufacturing and high-quality recycling and reducing carbon and environmental footprint.'*

For more information, see:
[Ecodesign for Sustainable Products Regulation - European Commission](#)



Solution is 'no-installation buildings'?!



'INSTALLATION-EXTENSIVE' = better idea....

Some Dutch market-initiatives

Remanufacturing (e.g. circulation pumps)

Reconditioning (e.g. air handling units)



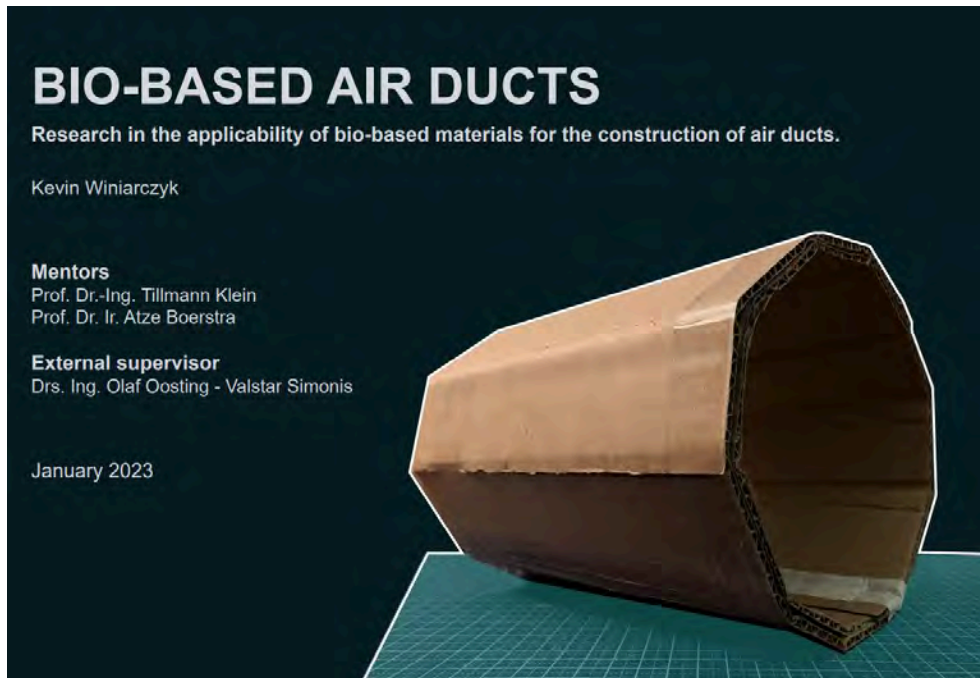
Example project Dutch Government

‘Kantoor vol Afval’ (KAVA) of Rijksvastgoedbedrijf (Dutch Governmental Buildings Agency @ airfield Valkenburg) with e.g. ‘2nd hand’ climate ceilings & ditto Air Handling Units from donor building



TU Delft graduation project 2022

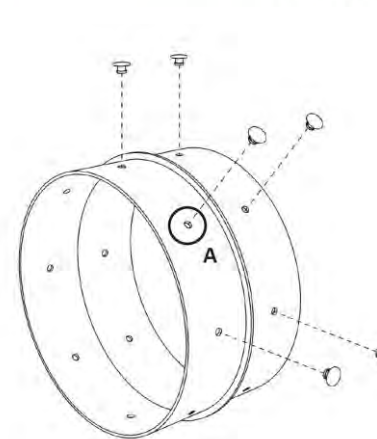
(BK graduation project Kevin Winiarczyk; supervisors Tillmann, Olaf Oosting & yours truly)



Bio-Composite



Veneer



Sheets of Tetra Pak - 95% bio-based
Recycled plastic

Source: : <https://repository.tudelft.nl>

Example 'rethink' project TU Delft 2025

(BK graduation project of Wei Wei, supervisors Alessandra Luna Navarro & yours truly)

Couteract overheating problems in dwellings, schools and offices via indirect cooling with ceiling fans (as alternative for 'airconditioning'); leads to factor 10 less impact



25 ° C + still air =

28 ° C + constant vertical airspeed of 0,8 m/s

(source: NEN-EN 16798-1, ASHRAE standard 55, Tanabe & Kimura, 1996)

Roadmap circular climate installations

(Routekaart Circulaire Klimaatinstallaties)

Initiative of NL Government RVO / Thomas Wellink related to the National Program Circular Economy

Linked to 2,5 year / 2,5 Mio euro project 'circular installations' with involvement of e.g. TNO, TU Delft, Dutch Green Building Council, several NL companies, etc

Objectives:



25% ECI* reduction

50% lifespan extension

100% high-quality recycling

* ECI = Environmental Cost Indicator



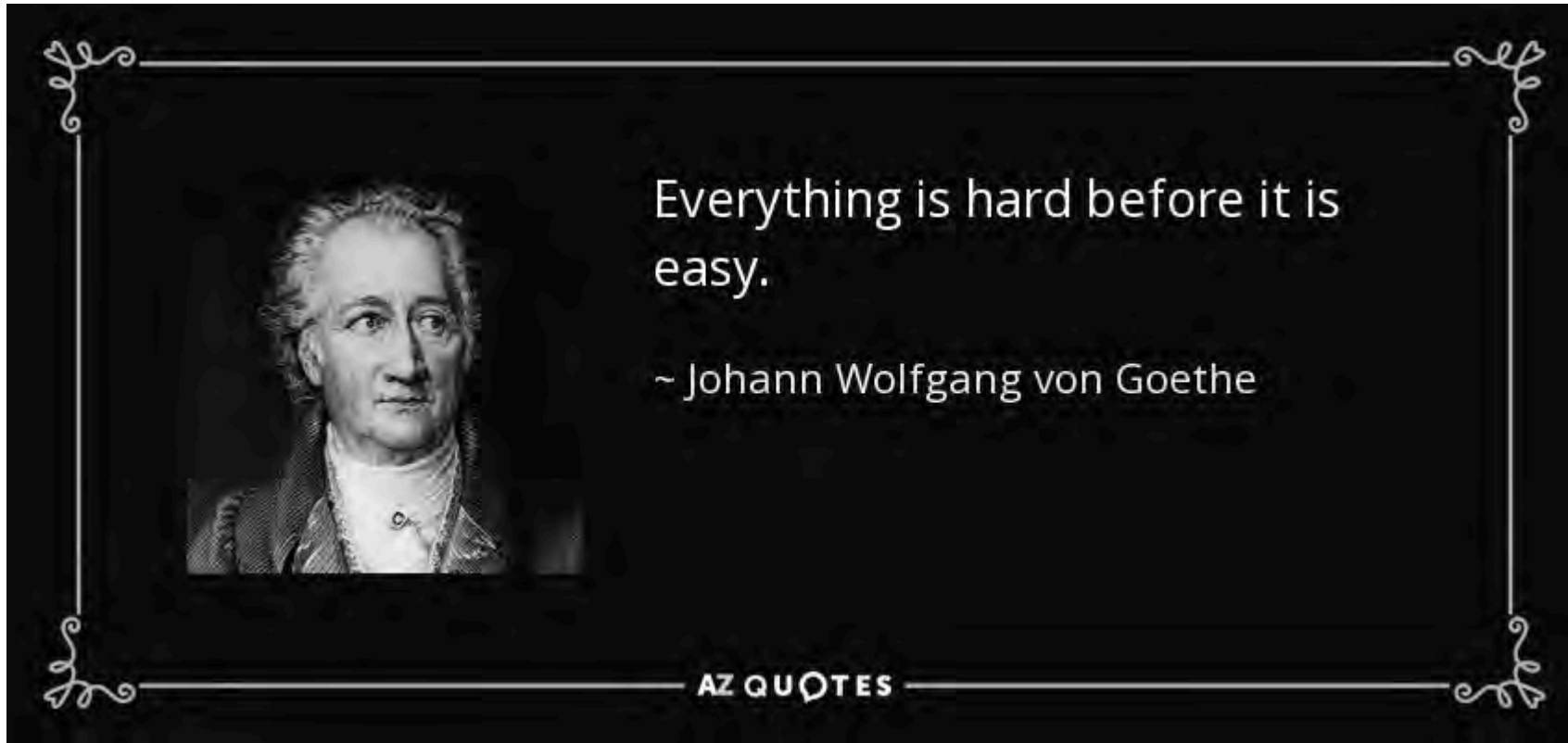
Not just a purely technical challenge

- Literature study Itanola et al., 2024
- Barriers encompass technical, economic, legislative, and organisational aspects.
- The analysis enabled the development of strategies that address design issues, business models, policy, product information, warranties, life cycle costing, digital technology, education, collaboration, and transparency.



Take home messages & closing remarks

- It is high time to (also) address resource efficiency and material-related environmental impact, and to look beyond just energy, comfort and costs of HVAC systems and components.
- It is reality, not a myth; recent EU regulations (especially ESPR 2024) will enforce this
- Complex subject! Still a lot of challenges e.g. related to definitions, calculation methods, environmental data and materials
- Opportunity for early adopters like manufacturers / consultants that embrace C-HVAC
- Impact on industry will be considerable e.g. in terms of new business models, general logistics and organisation of (re)manufacturing processes



RIGHT THING TO DO

BUSINESS OPPORTUNITY