WOI-TUD event 17-10-23

Onderzoeks-uitdagingen, circulariteit & installaties

prof. dr. ir. Atze Boerstra

chair building services innovation

faculty of Architecture and the Built Environment

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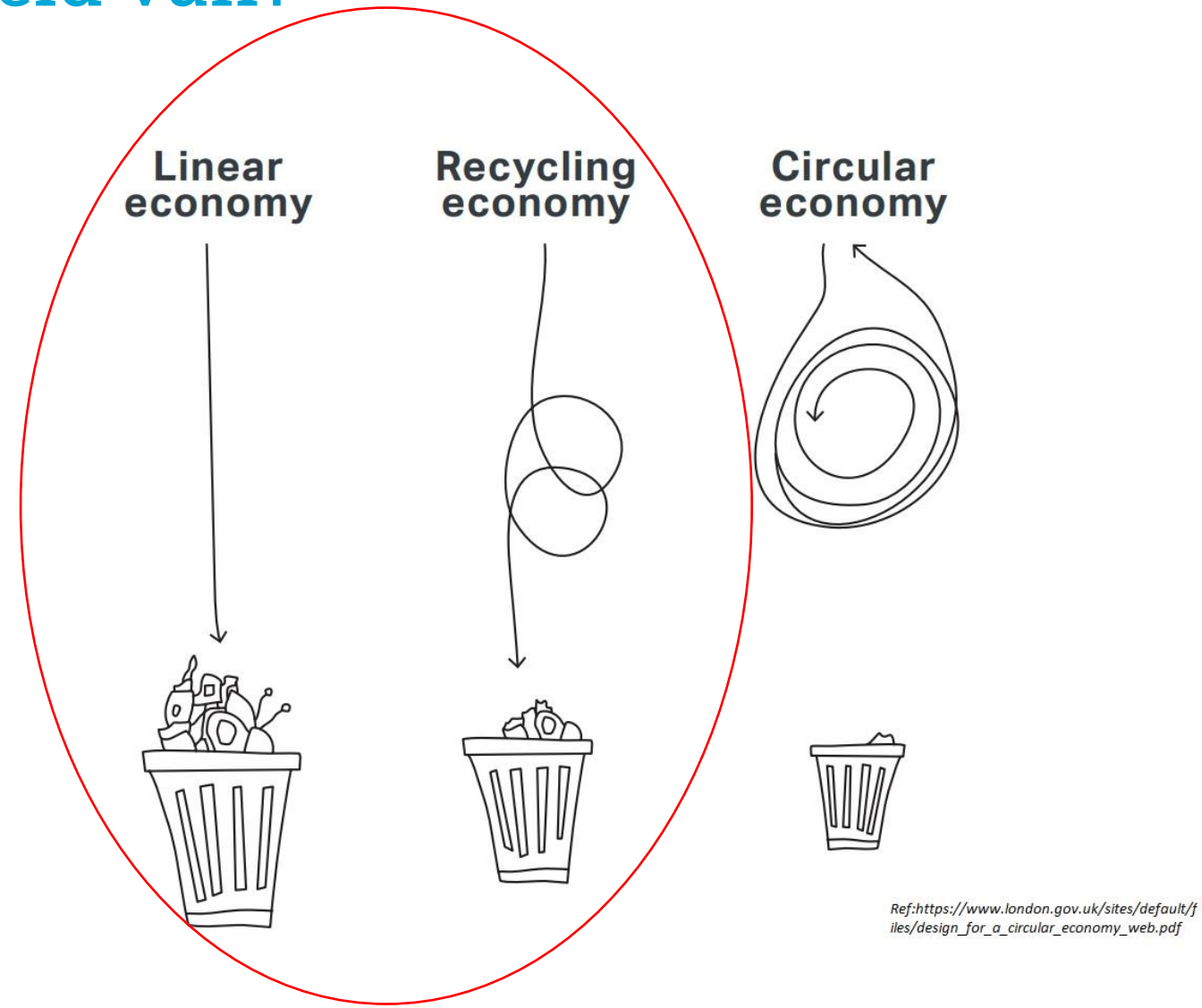
Typisch voorbeeld van?



Ref:https://www.london.gov.uk/sites/default/files/design_for_a_circular_economy_web.pdf

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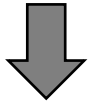
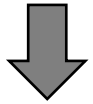
Systems design approaches Norman

TECHNOLOGY-CENTERED DESIGN



USER- OR HUMAN- CENTERED DESIGN



HUMANITY-CENTERED DESIGN

Based upon: Norman, 2005

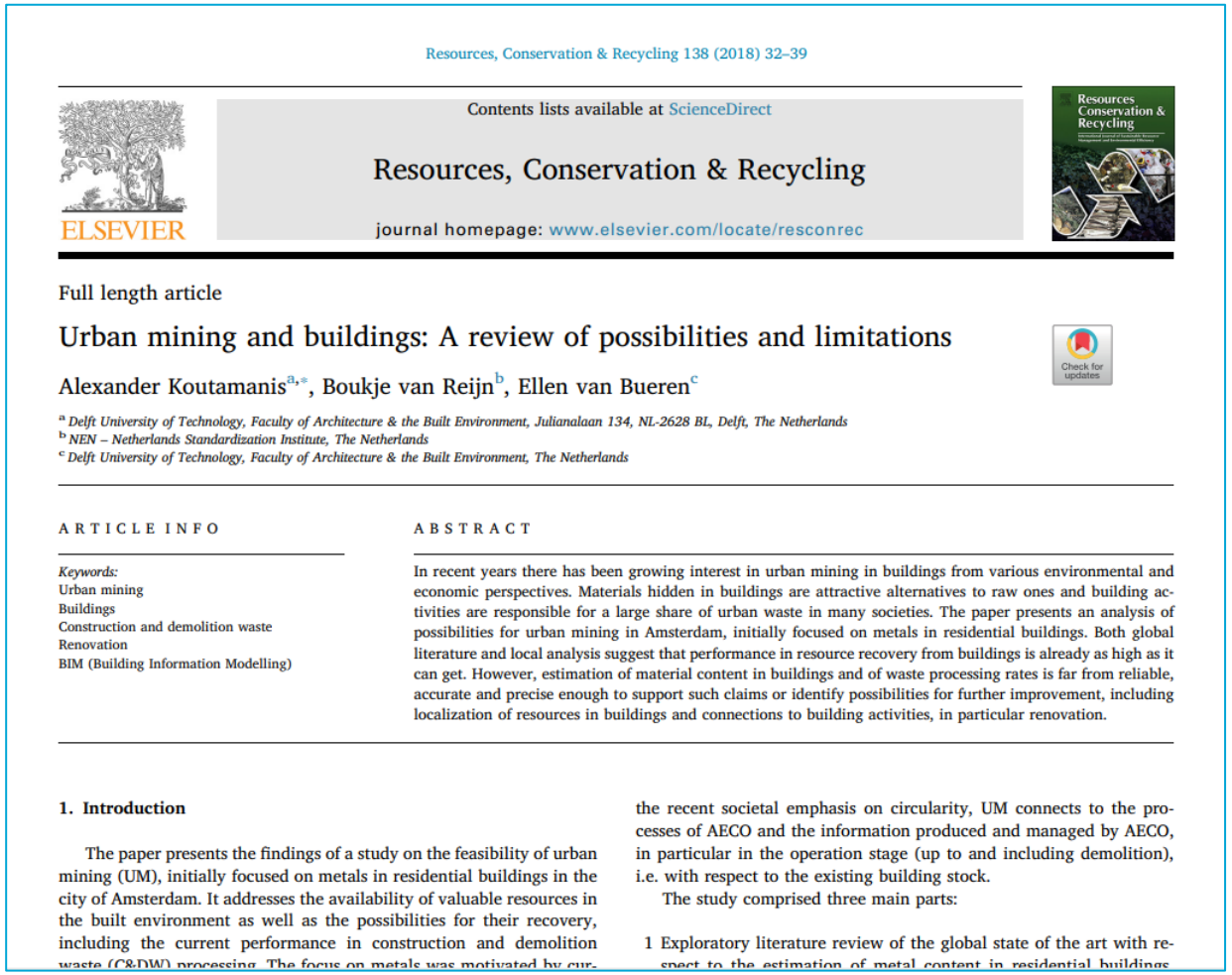
TU Delft & circulariteit

- Circular Built Environment Hub website TU Delft:

  "*The Circular Built Environment (CBE) is a system designed for closing resource loops at different spatial-temporal levels by transitioning cultural, environmental, economic & social values towards a sustainable way of living (thus enabling society to live within the planetary boundaries)“*

- Scales to Aspects model (Tillmann Klein et al.):

Voorbeeld TU Delft / BK onderzoek



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Full length article

Urban mining and buildings: A review of possibilities and limitations

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Construction and demolition waste
Renovation
BIM (Building Information Modelling)

ABSTRACT

In recent years there has been growing interest in urban mining in buildings from various environmental and economic perspectives. Materials hidden in buildings are attractive alternatives to raw ones and building activities are responsible for a large share of urban waste in many societies. The paper presents an analysis of possibilities for urban mining in Amsterdam, initially focused on metals in residential buildings. Both global literature and local analysis suggest that performance in resource recovery from buildings is already as high as it can get. However, estimation of material content in buildings and of waste processing rates is far from reliable, accurate and precise enough to support such claims or identify possibilities for further improvement, including localization of resources in buildings and connections to building activities, in particular renovation.

1. Introduction

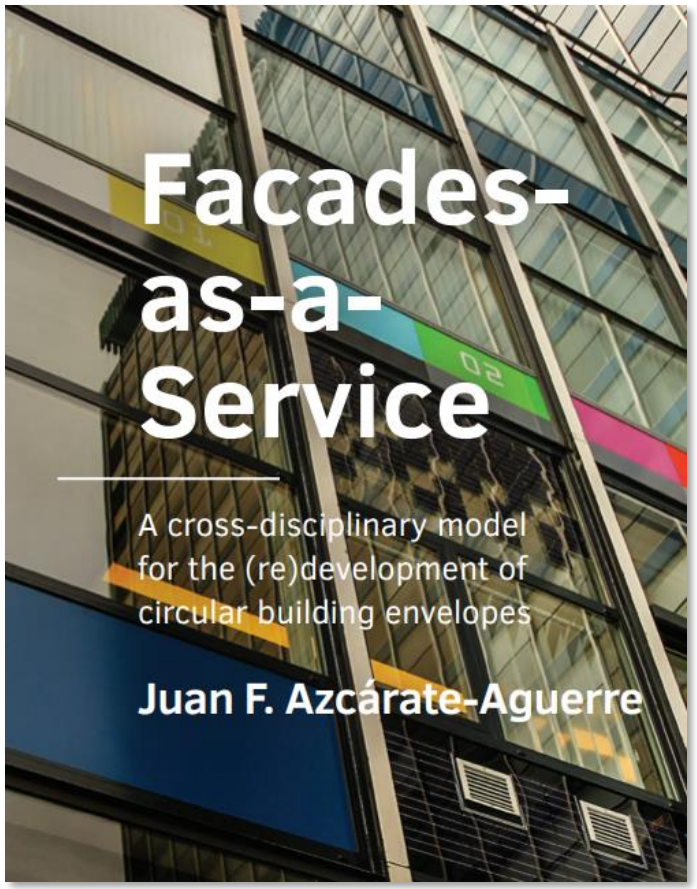
The paper presents the findings of a study on the feasibility of urban mining (UM), initially focused on metals in residential buildings in the city of Amsterdam. It addresses the availability of valuable resources in the built environment as well as the possibilities for their recovery, including the current performance in construction and demolition waste (C&DW) processing. The focus on metals was motivated by current the recent societal emphasis on circularity, UM connects to the processes of AECO and the information produced and managed by AECO, in particular in the operation stage (up to and including demolition), i.e. with respect to the existing building stock.

The study comprised three main parts:

1 Exploratory literature review of the global state of the art with respect to the estimation of metal content in residential buildings

Nog een voorbeeld

- ‘Circular Façade as a service’

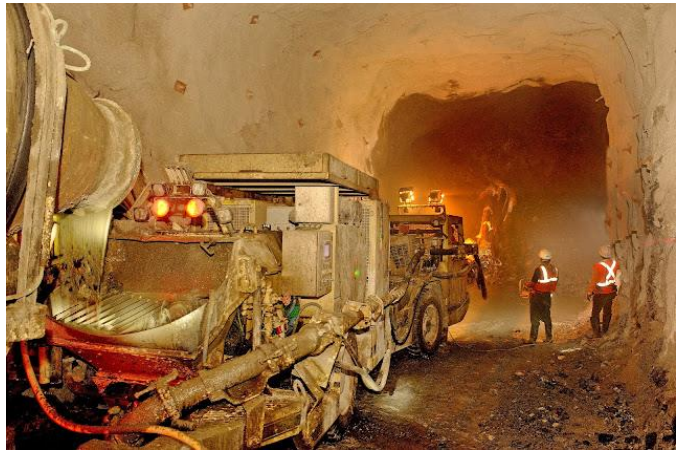


Source: https://repository.tudelft.nl

Installaties, materialen en circulariteit

The big 7 (?):

- Staal
- Zink
- **Koper**
- **Aluminium**
- Chroom
- **Nickel**
- ICT metals (zilver, goud**, palladium, …)**



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Kritieke grondstoffen volgens EU & David Peck

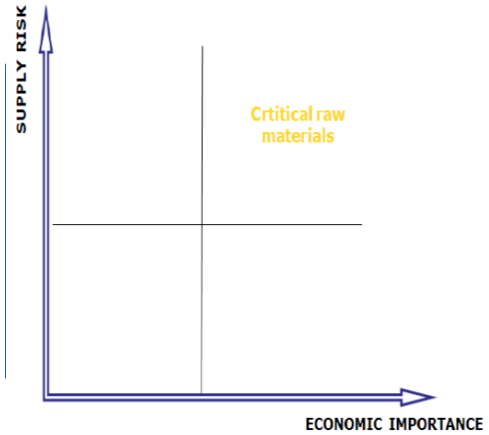
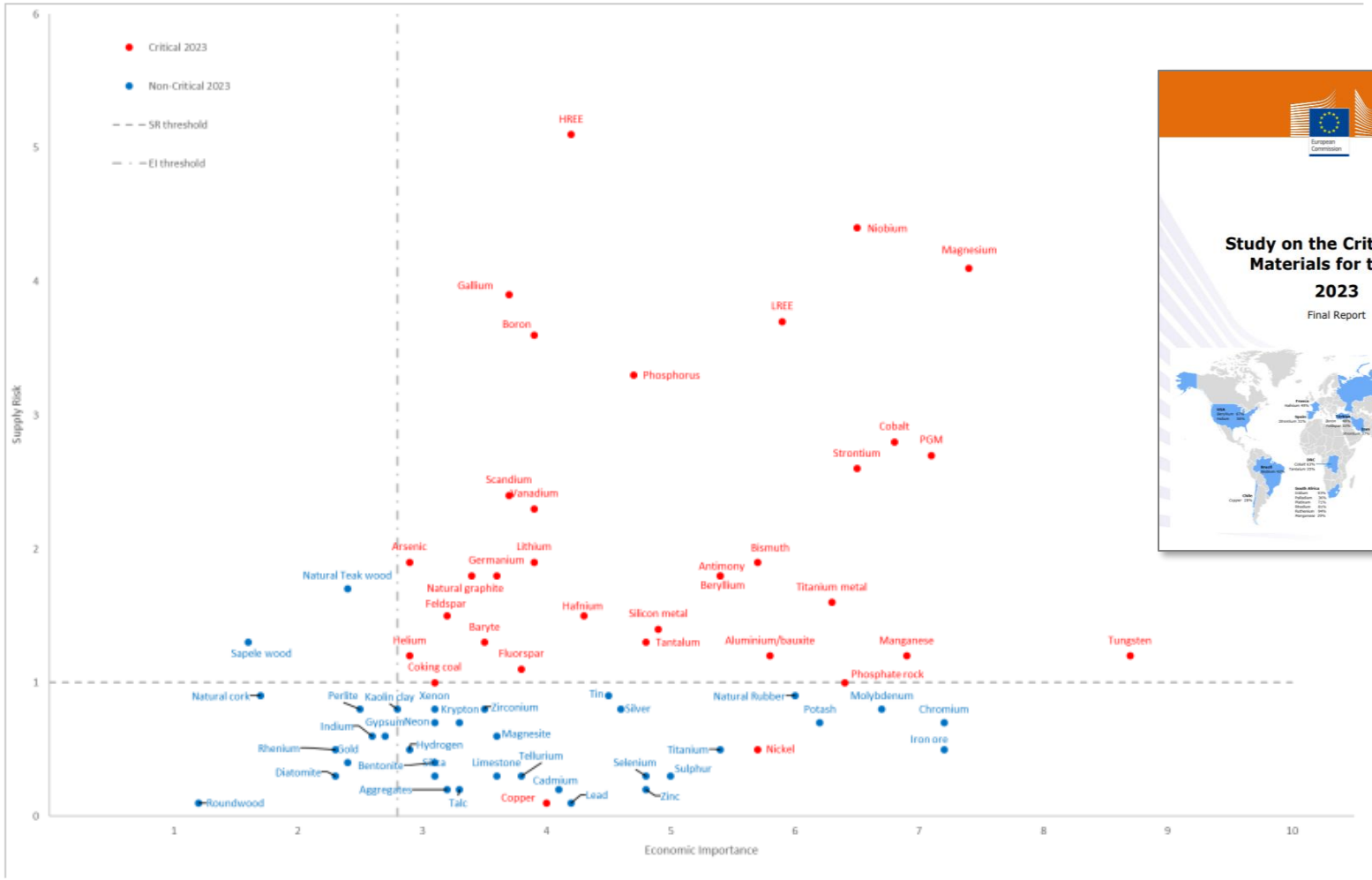
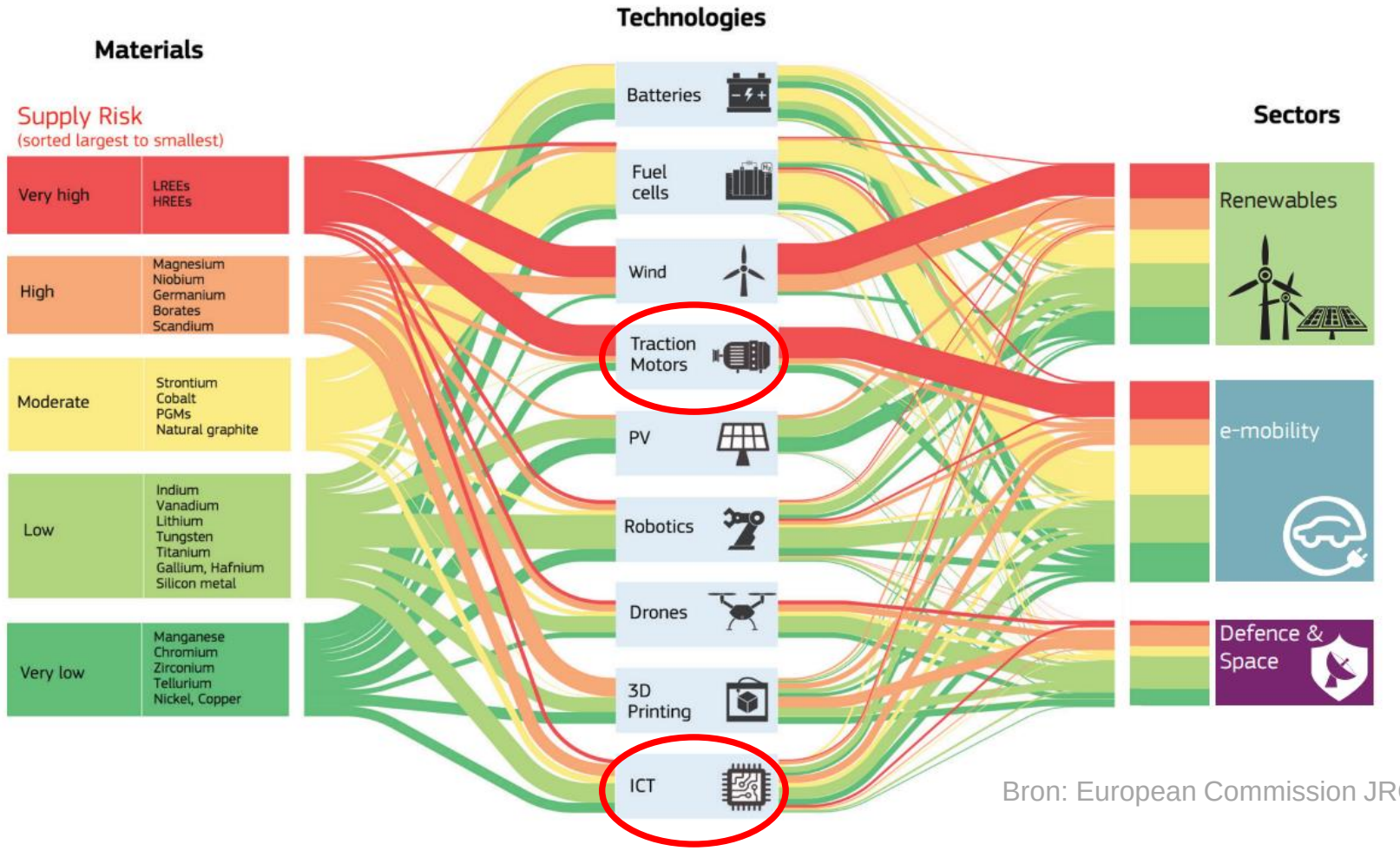


Figure A: Results of the 2023 EU criticality assessment[5]

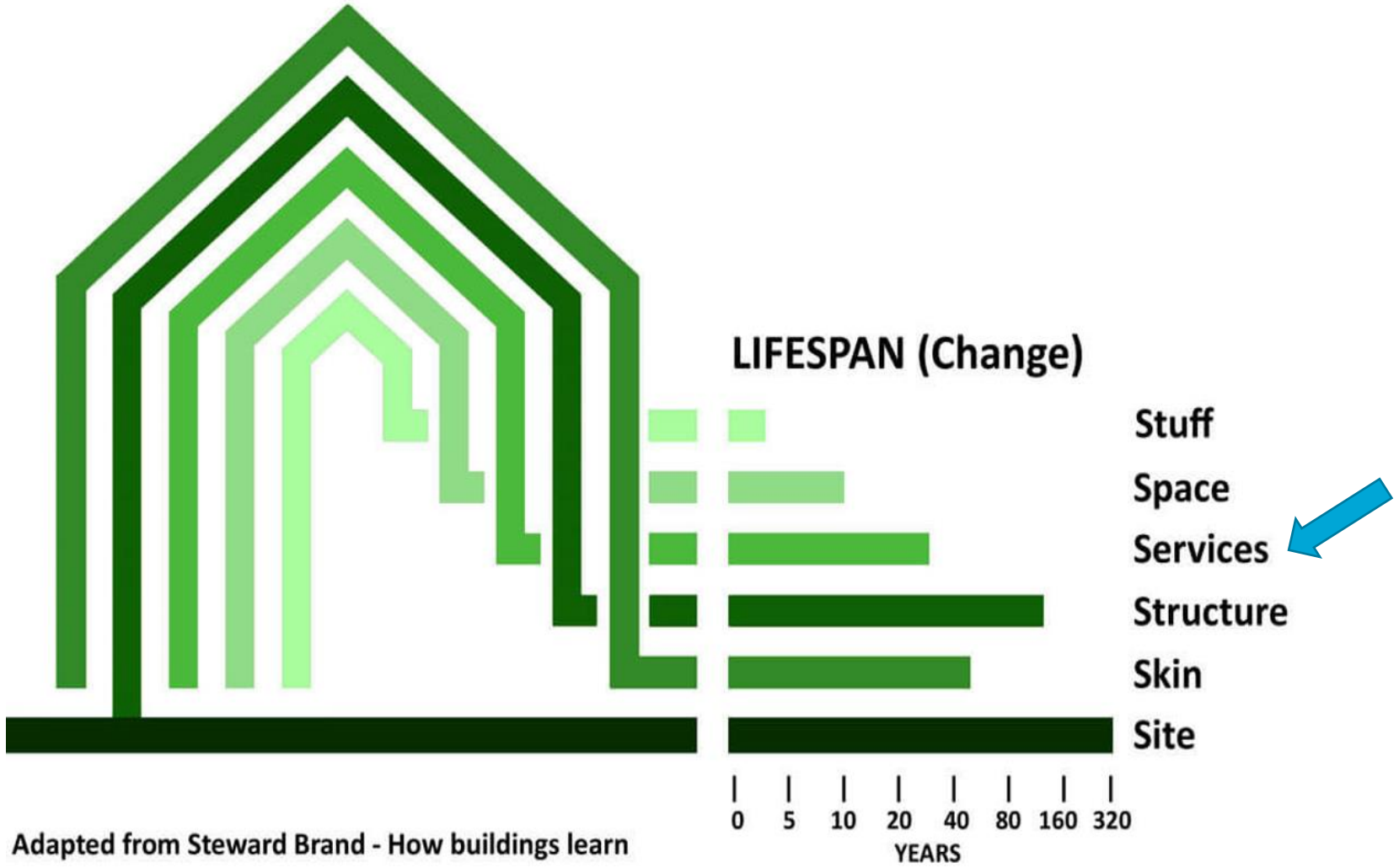


Impact op sectoren volgens EU



Bron: European Commission JRC, 2020

Kansen & uitdagingen irt levensduur installaties



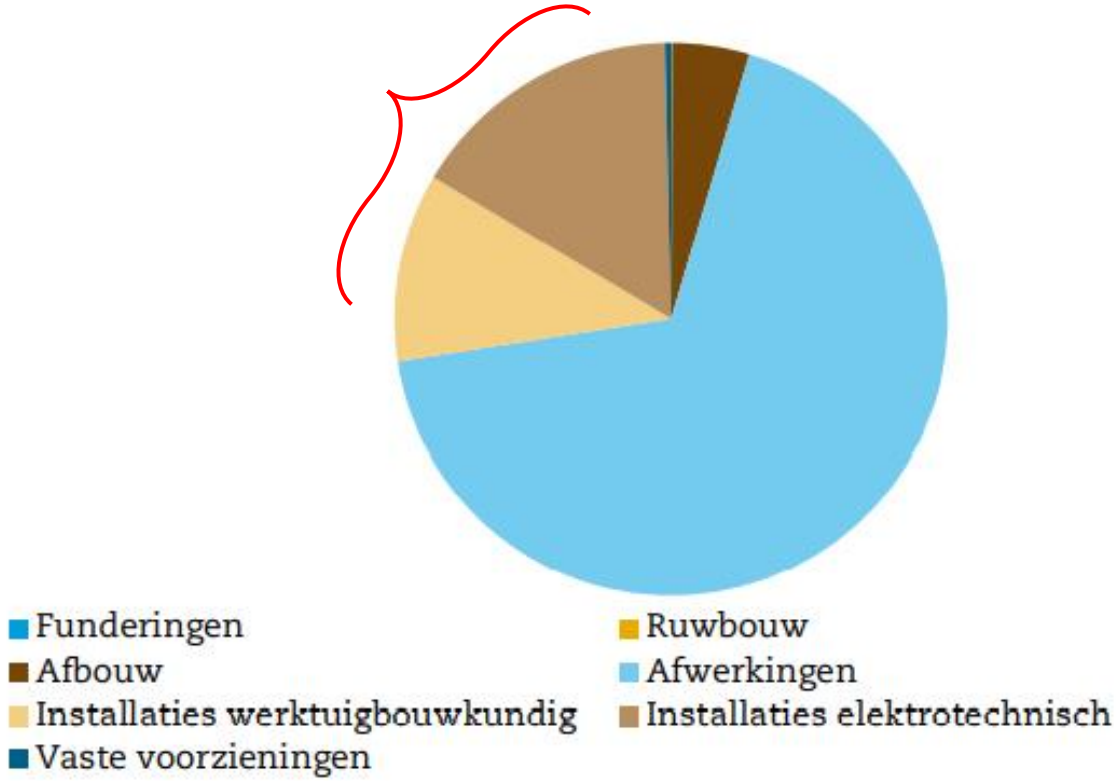
Levensduur installatiecomponenten vs. .....

Figure 3. Average lifespans of components within an office building. Source: Sturgis Associates LLP (2009)

Source: Croxford et al / UCL, 2018

Milieu-impact installaties (vb. renovaties)

- Relatieve bijdrage w- en e-installaties (gemiddeld) milieu-impact bij renovatie van utiliteitsbouw: **27%**



Bron: Metabolic, 2020

Milieu-impact categorieën (volgens NEN-EN 15804)

Milieu-impactcategorie	Indicator	Eenheid
Klimaatverandering - totaal	GWP-totaal	kg CO2-eq.
Klimaatverandering – fossiel	GWP-fossiel	kg CO2-eq.
Klimaatverandering – biogeen	GWP-biogeen	kg CO2-eq.
Klimaatverandering - landgebruik en verandering in landgebruik	GWP-luluc	kg CO2-eq.
Ozonlaagaantasting	ODP	kg CFC11-eq.
Verzuring	AP	mol H+-eq.
Vermesting zoetwater	EP-zoetwater	Kg P-eq.
Vermesting zeewater	EP-zeewater	kg N-eq.
Vermesting land	EP-land	mol N-eq.
Smogvorming	POCP	kg NMVOC-eq.
Uitputting van abiotische grondstoffen mineralen en metalen	ADP-mineralen&metalen	kg Sb-eq.
Uitputting van abiotische grondstoffen fossiele brandstoffen	ADP-fossiel	MJ, net cal. val.
Watergebruik	WDP	m3 world eq. deprived
Fijnstof emissie	Ziekte door PM	Ziekte-incidentie
Ioniserende straling	Humane blootstelling	kBq U235-eq.
Ecotoxiciteit (zoetwater)	CTU ecosysteem	CTUe
Humane toxiciteit, carcinogeen	CTU humaan	CTUh
Humane toxiciteit, non-carcinogeen	CTU humaan	CTUh
Landgebruik gerelateerde impact / bodemkwaliteit	Bodemkwaliteitsindex	Dimensieloos

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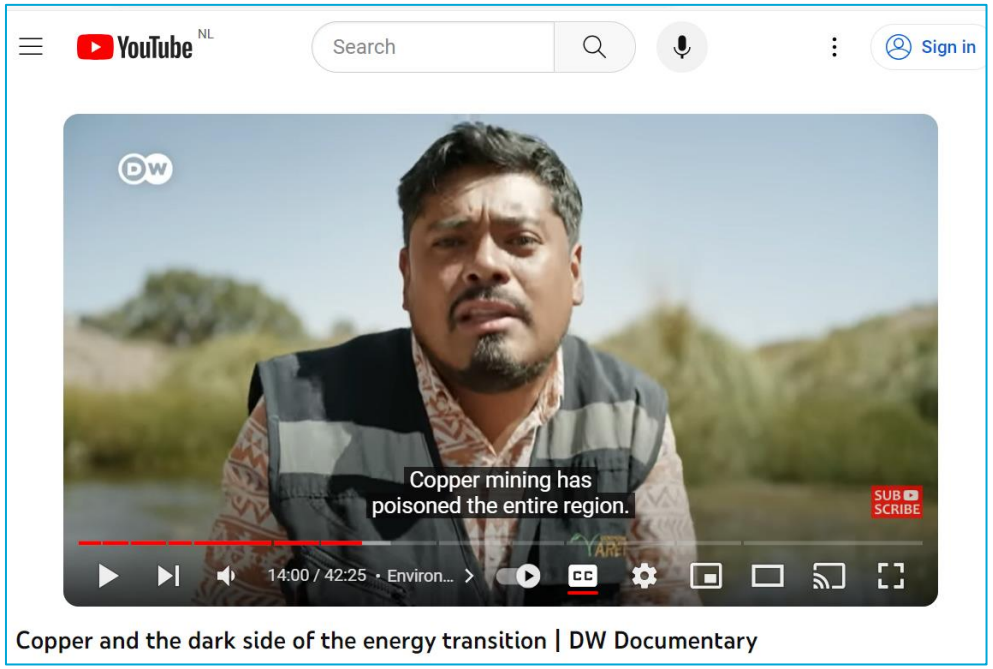
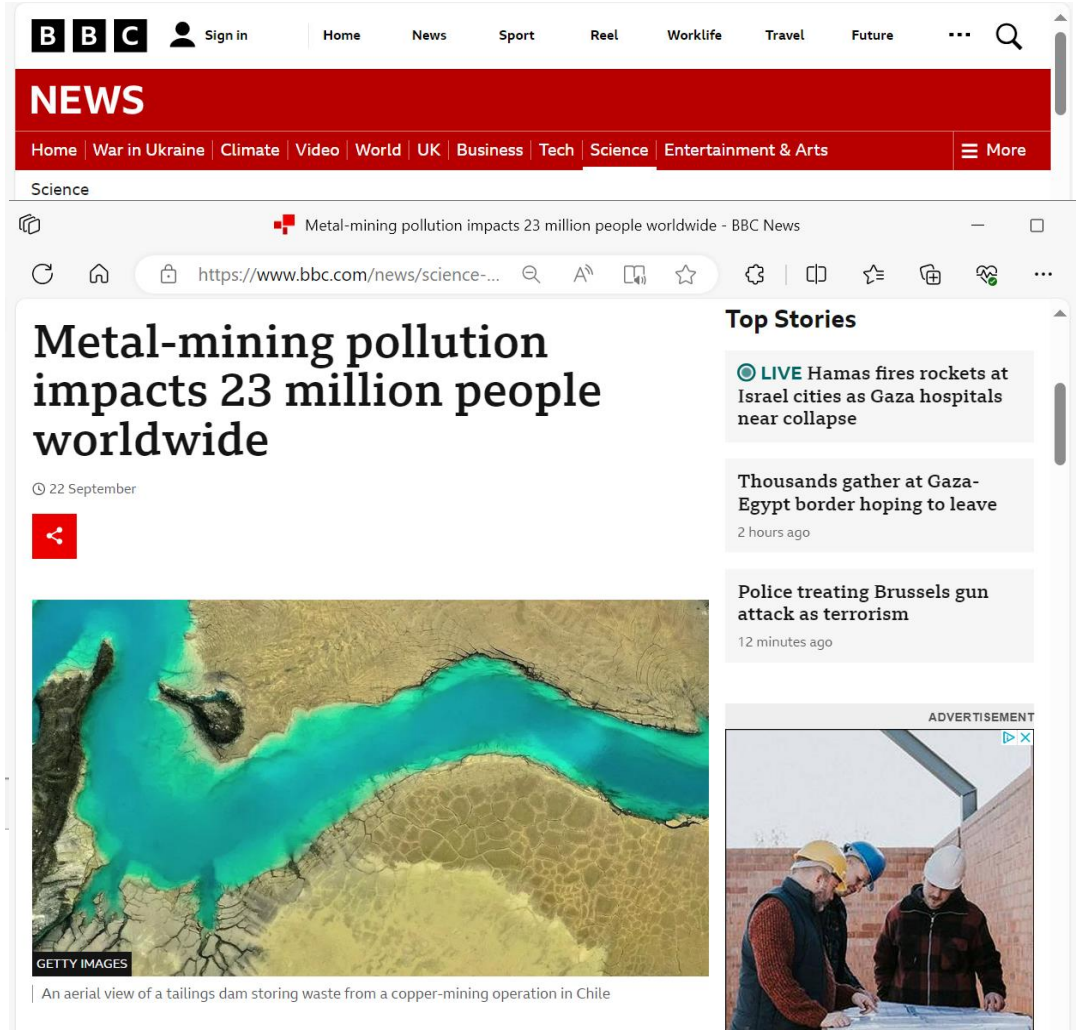
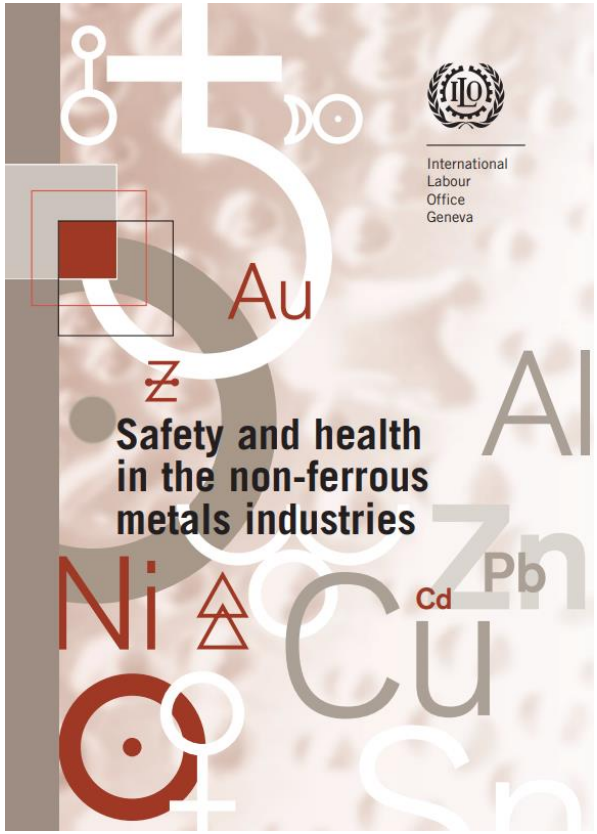
Verdere issues met metaal-mijnbouw….





SOCIALE duurzaamheid en de installatiesector?



FAIRTRADE ®

BOLIDEN

Boliden's Indigenous People commitment

Boliden's vision is to be the most climate friendly and respected metal provider in the world.
Respected and responsible mining companies engage with the communities where they operate, building strong relationships based on trust.
A large proportion of the focus areas for Boliden operations from exploration, project development to operations are located within areas like Sapmi the land area where the Sami and reindeer herding has specific rights. Access to land is of crucial importance to both mining and reindeer husbandry.

Boliden is committed to:

1. Engage with potentially impacted Indigenous Peoples with the objectives of: (i) ensuring that the development of mining and metals projects fosters respect for the rights, interests, aspirations, culture and natural resource-based livelihoods of Indigenous Peoples; (ii) designing projects to avoid adverse impacts and minimizing, managing or compensating for unavoidable residual impacts; and (iii) ensuring sustainable benefits and opportunities for Indigenous Peoples through the development of mining and metals projects.

2. Understand and respect the rights, interests and perspectives of Indigenous Peoples regarding a project and its potential impacts. Social and environmental impact assessments or other social baseline analyses will be undertaken to identify those who may be impacted by a project as well as the nature and extent of potential impacts on Indigenous Peoples and any other potentially impacted communities. The conduct of such studies should be participatory and inclusive.

3. Agree on appropriate engagement and consultation processes with potentially impacted Indigenous Peoples and relevant government authorities as early as possible during project planning,

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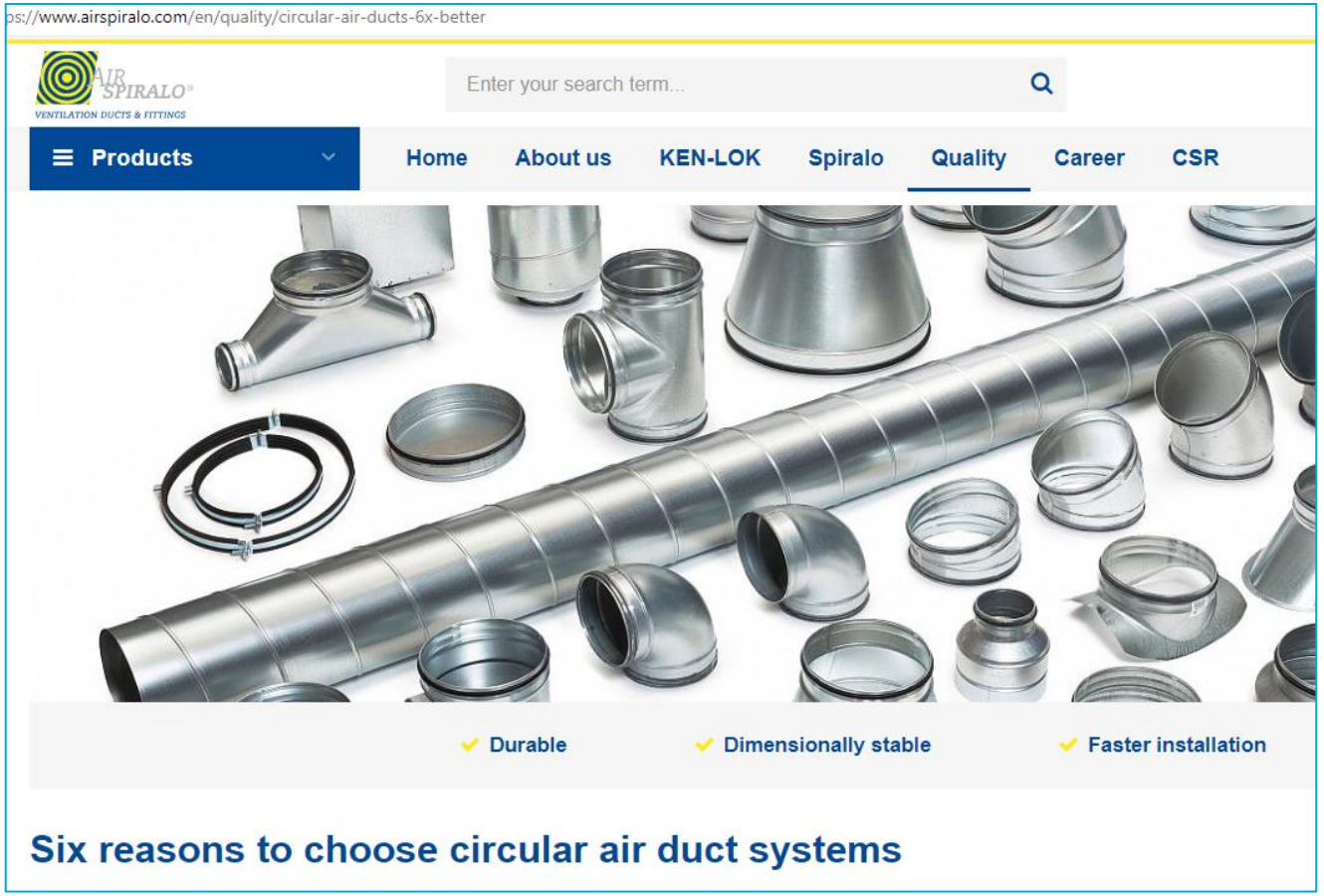
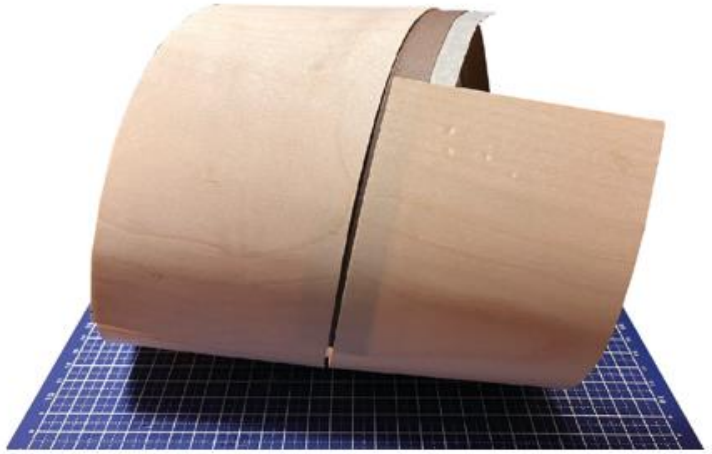
Status quo installatie sector?

Google maar eens op ‘circular ventilation systems’:



Bio-based air ducts project TUD Master student

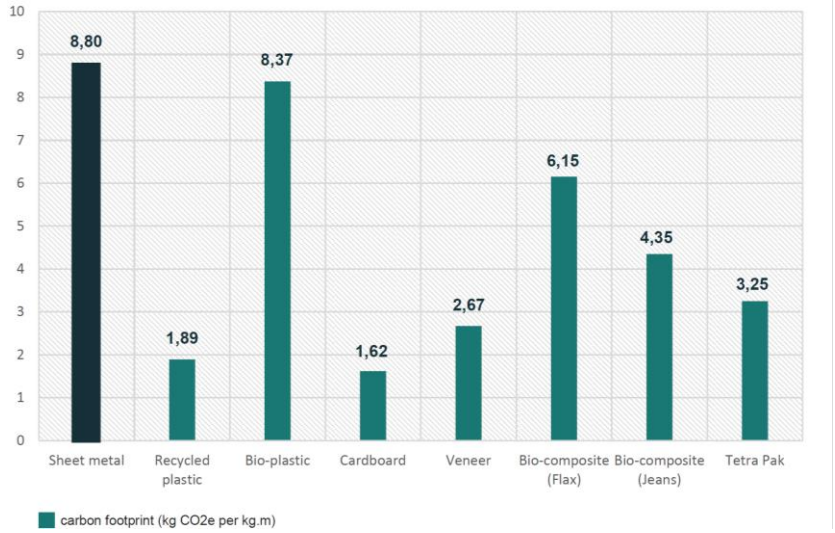


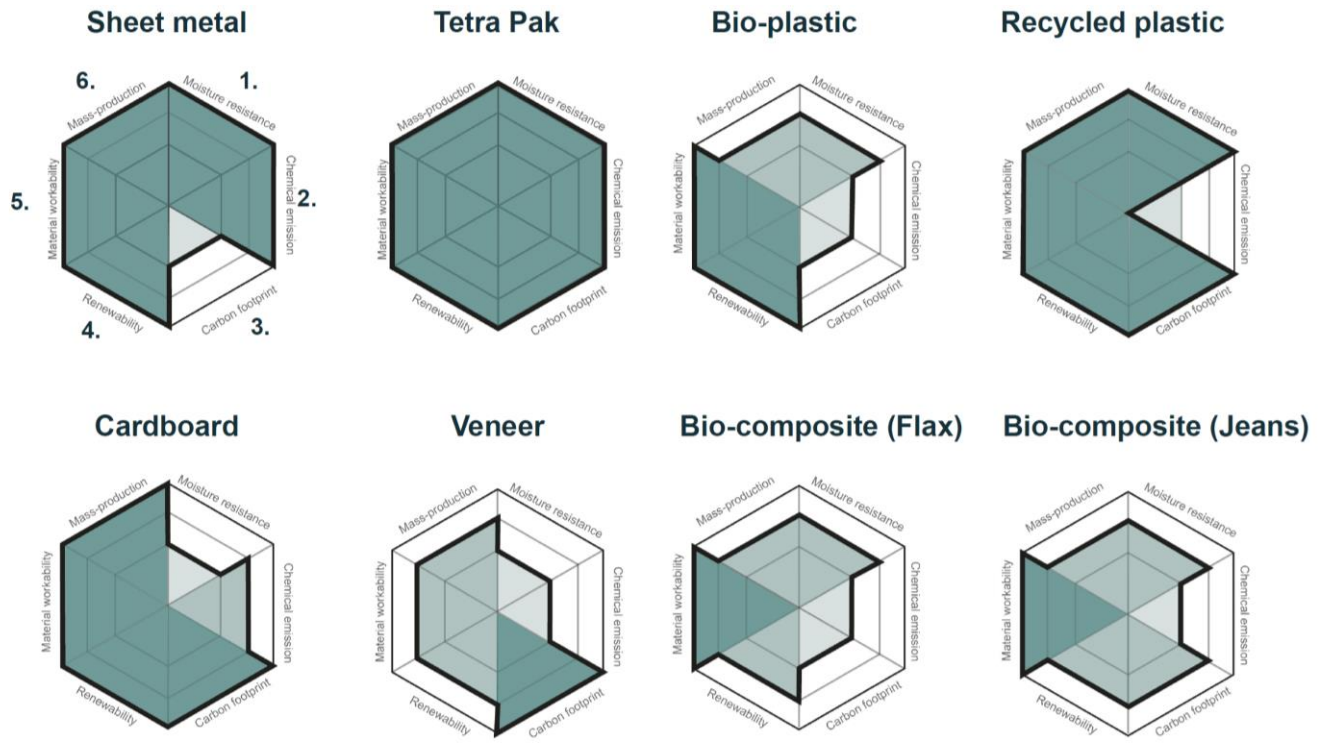
Veneer

Bio-Composite

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

Analysis



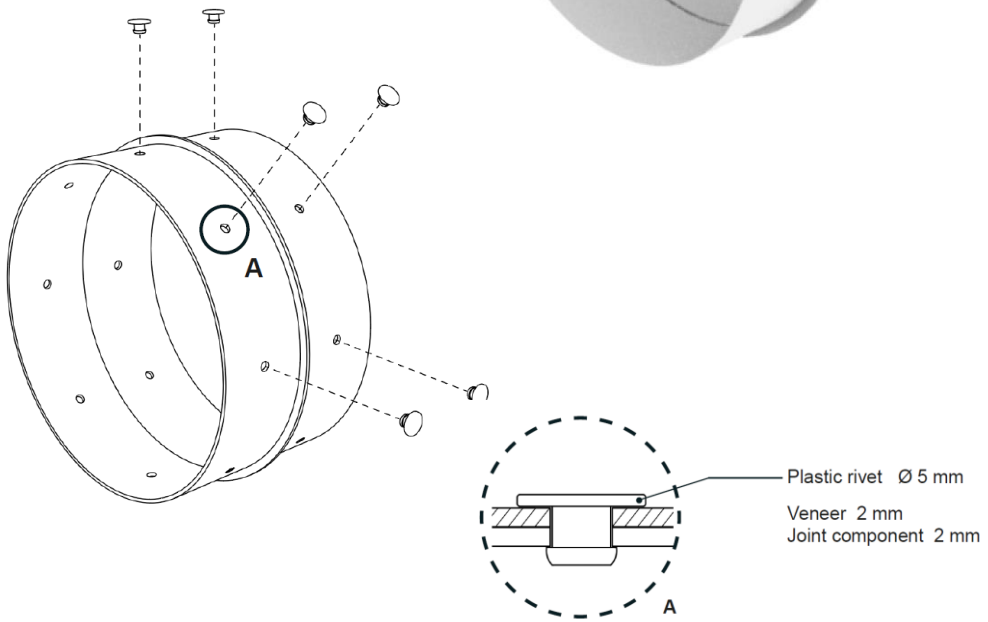


Source: : https://repository.tudelft.nl

Final recommendation Tetra Pack & Recycled plastics

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

Joints: recycled plastics



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Project Masterstudent Alina Wagner

Informele circulariteit interviews met:

Een paar quotes

„We should further explore circularity-as-service and leasing options for end-users.”

„When it comes to fans we should look more into recycling of magnets“

„„By changing traditional building installation products, health & safety aspects in regards of indoor air quality might be arising“ “

„„Instead of only assessing the carbon footprint of a building product, we need better metrics to objectify circularity in the broader sense.“

„Circularity starts in the design stage of a building product“

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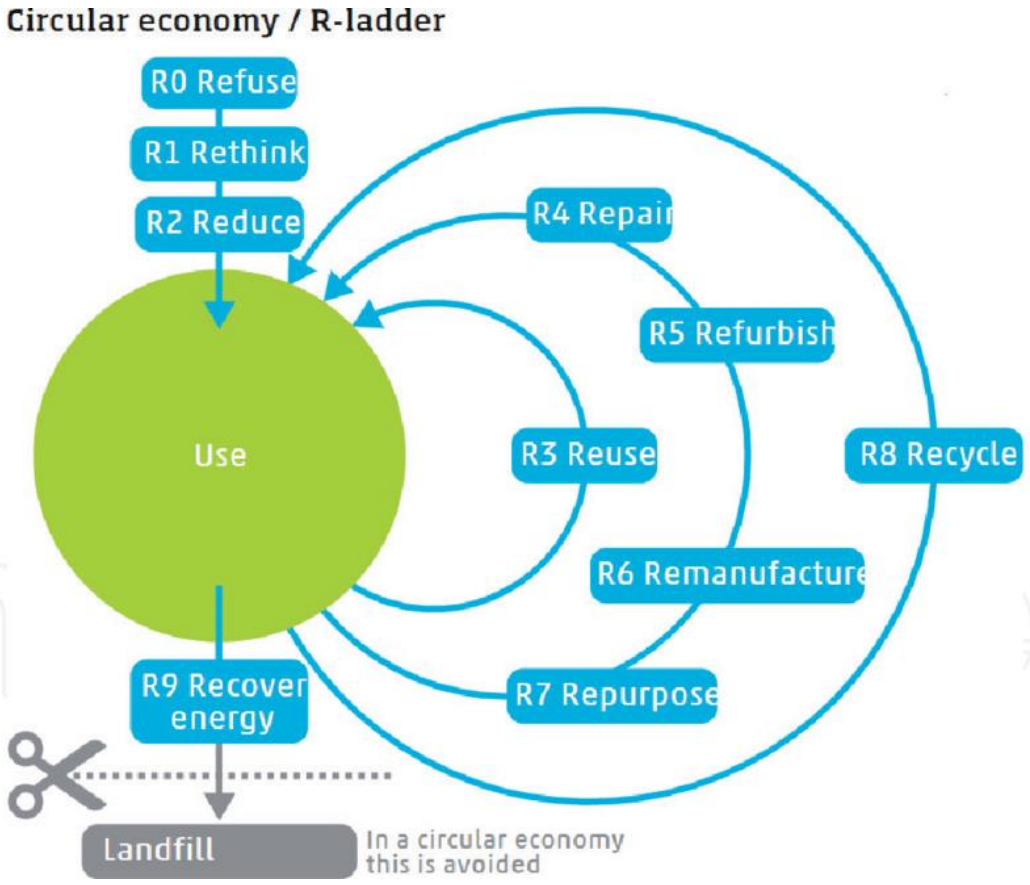
Circulaire ontwerp- strategieën

Voorbeelden:

1. Installatiearm bouwen/renoveren
2. Hergebruik al aanwezige componenten
3. Reconditioneren bestaande elementen
4. Biobased material waar mogelijk
5. Detailleren op losmaakbaarheid
6. Gebruik van xx% gerecycled metal
7. …..



Voorbeeld ontwerpstrategie

Natuurlijk als het kan, mechanisch als het moet (‘building physics first!’)

(photo’s: Christian Richters & Esther Claussen; architects: Hamzah/Yeang & Mecanoo)

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Ter afsluiting

- omslag in het (installatie)denken is nodig
- o.a. omdat we (deels) in de kritieke materialen hoek zitten
- systemische aanpak is daarbij nodig
- met rol voor zowel praktijk als wetenschap