Where Circular Economy and Climate meet:
How further uptake of circular approaches can foster the fight against climate change

William Keeling, Ana Lima, Tobias Nielsen, Niklas Nierhoff | EEA-Eionet day, 1 March 2023

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1. Introduction
2. Country experiences
3. Discussion

1. Introduction

Tobias Nielsen (EEA)

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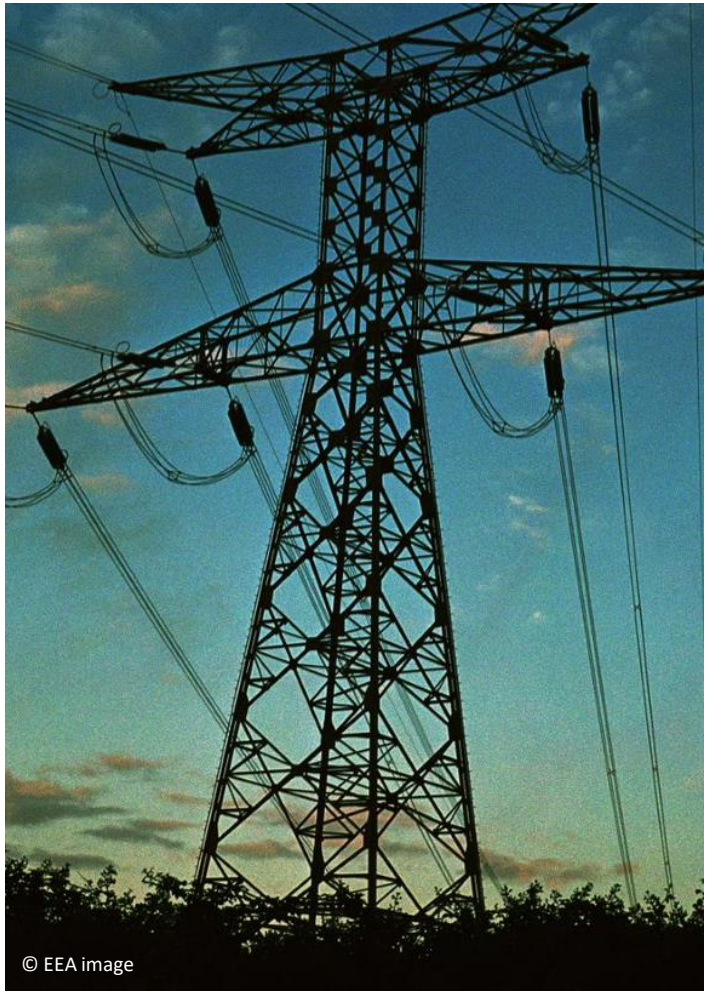
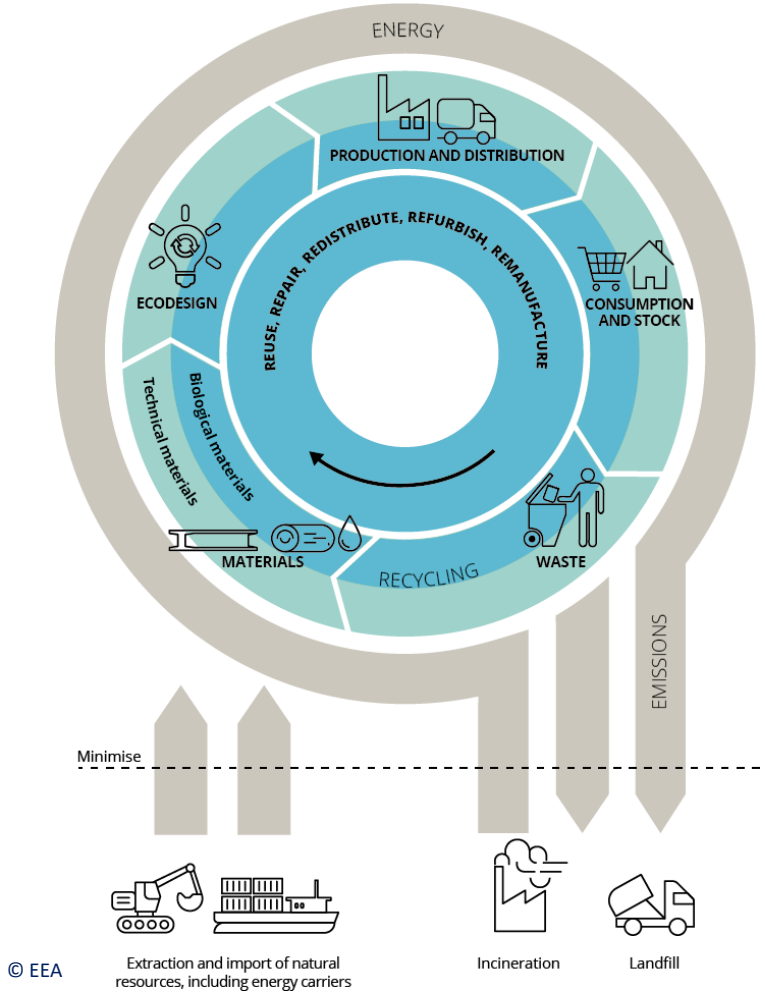
The fight against climate change is (also) circular





*6.1. Circularity as a **prerequisite** for climate neutrality*

*In order to achieve climate neutrality, the **synergies between circularity and reduction** of GHG emissions need to be stepped up.*

Source: Circular Economy Action Plan

*We will monitor progress of Europe's transition **towards a CE**, and the environment and **climate benefits** delivered.*

Source: EEA-Eionet Strategy

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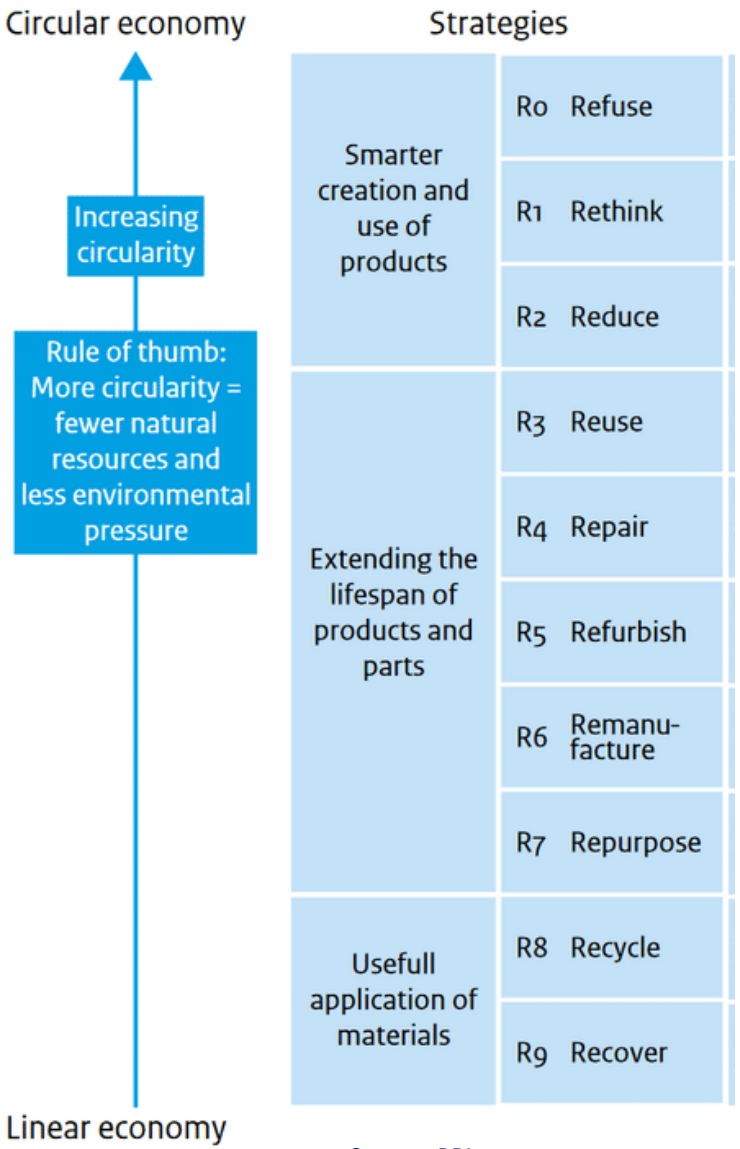
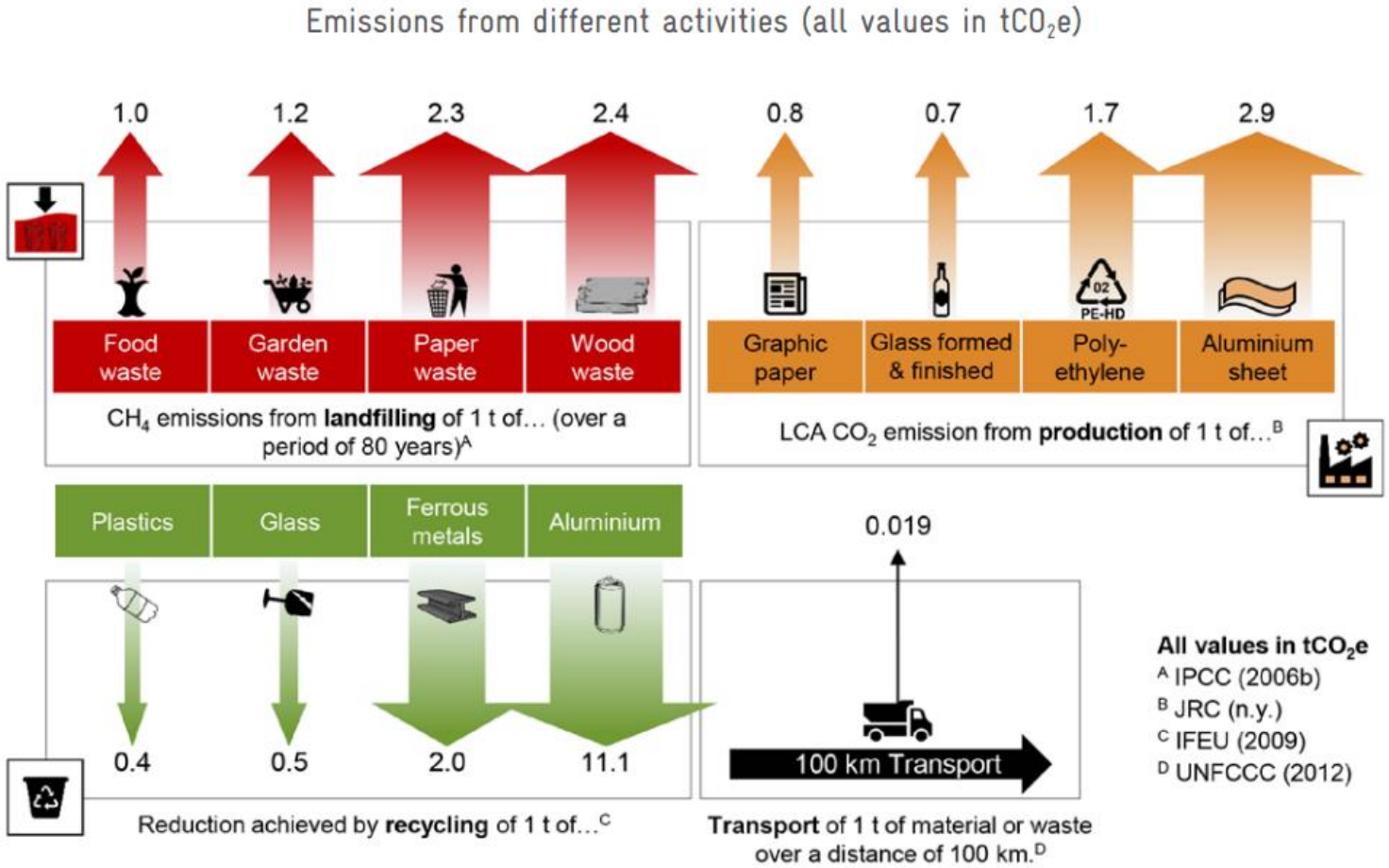
The mitigation potential of circular economy actions



Source: PBL



Source: GIZ

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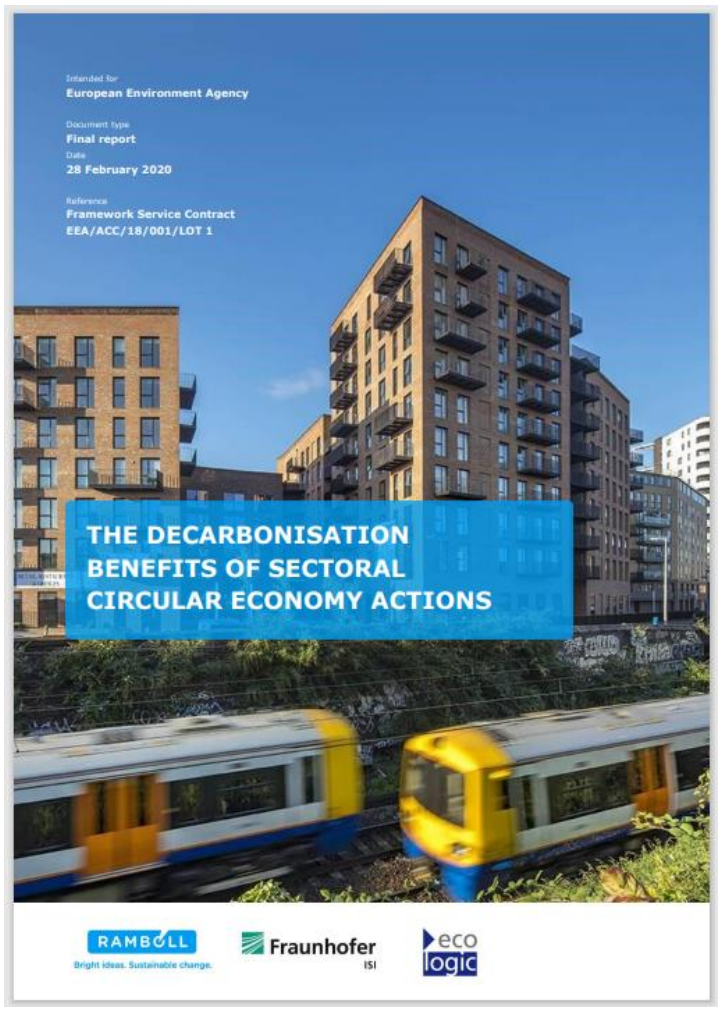
Growing interest…



EEA/ETC project

4.1.8.1 Circular economy and climate mitigation – guidance on including Circular Economy (CE) actions into Member States' (MS) climate reporting and policy making

Aim

- How to capture the benefits of the circular economy on greenhouse gas emission reduction

Timeline

- 1 year (2023)
- Eionet WSH's: Spring and Fall 2023 (date: tbd)

Eionet advisory board

- Belgium (Flanders), Denmark, Spain, Switzerland

Outcome

- ETC report & EEA Briefing
- Guideline for countries
- Supporting European Commissions work on CE-CC intersection.

How clear is the connection between circular economy and climate change to you?

What would you consider the most effective circular economy activities to reduce mitigation potential?

What would be helpful for you to better integrate circular economy into your climate reporting or climate strategies?

2. Country experiences

Ana Teresa Macas Lima, Danish Technical University (DTU), Denmark

Niklas Nierhoff, Federal Office for the Environment (BAFU), Switzerland

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CO$_2$NSTRUCT

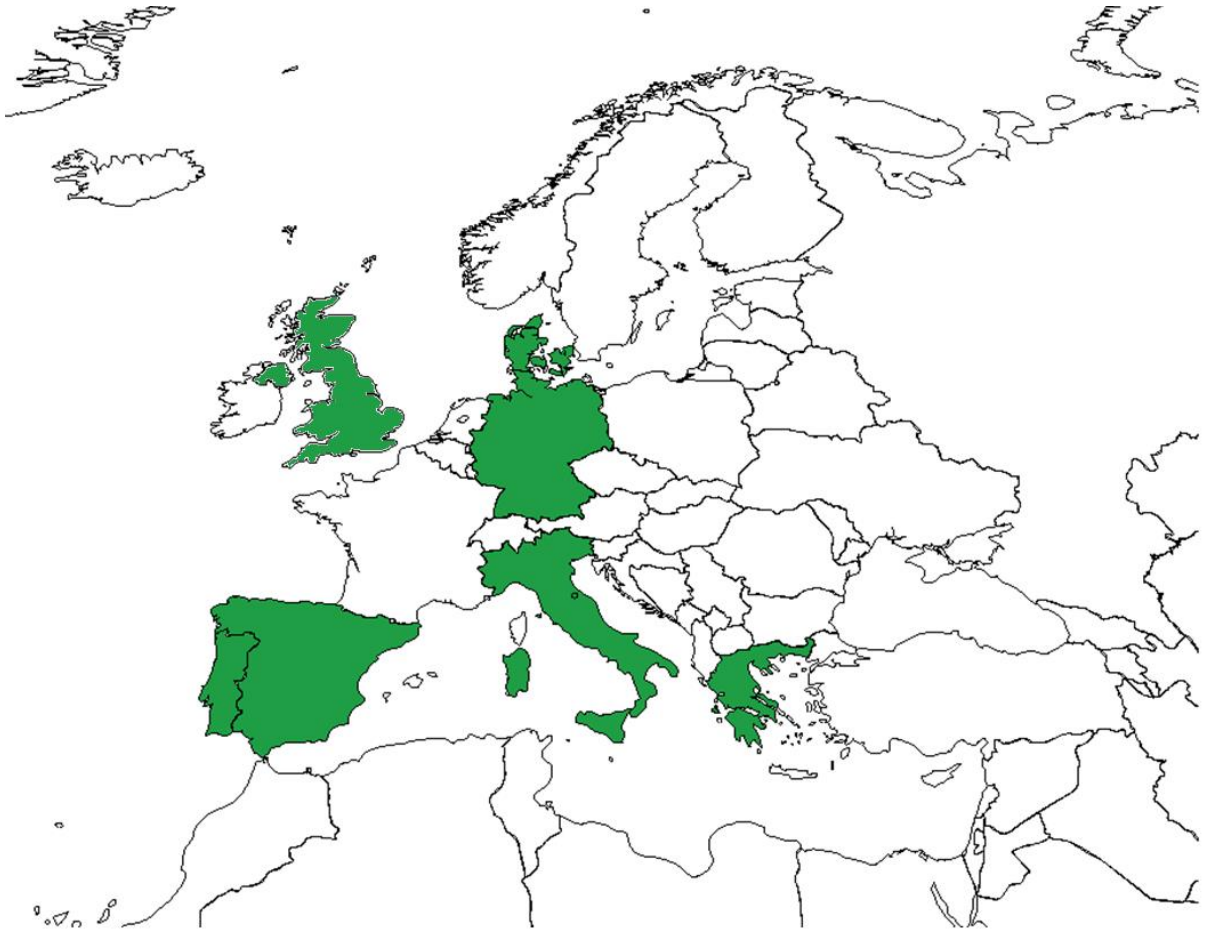
Funded by
the European Union

Modelling the role of circular economy construction value chains for a carbon-neutral Europe

DTU · RUB · Università di Pisa · The University Of Sheffield. · LNEG · Gobierno de España · Ministerio de Ciencia e Innovación · Ciemat · KAПЕ CRES

Consortium Partners

- Experts in:
  - Climate mitigation modelling
  - Circular economy
  - Construction materials
  - Citizen behaviour, co-development & stakeholder engagement processes
  - Supply and value chains
  - Rebound effects
  - Water scarcity
  - GHG externalities
  - Policy
  - Energy poverty



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3 reasons why the CO_2NSTRUCT project

1. The construction sector is one of the world's largest consumers of energy and raw materials and producers of waste.
2. A circular economy for materials plays a key role in the transition to more sustainable use of natural resources in construction and a carbon-neutral society.
3. Current climate mitigation models (e.g. JRC-EU-TIMES, PRIMES) cannot account for materials' circularity.

Our scope: From linear to circular

- To augment current linear climate mitigation models with circular economy measures for construction materials.
- To contribute to achieving the emission reduction targets set by policymakers

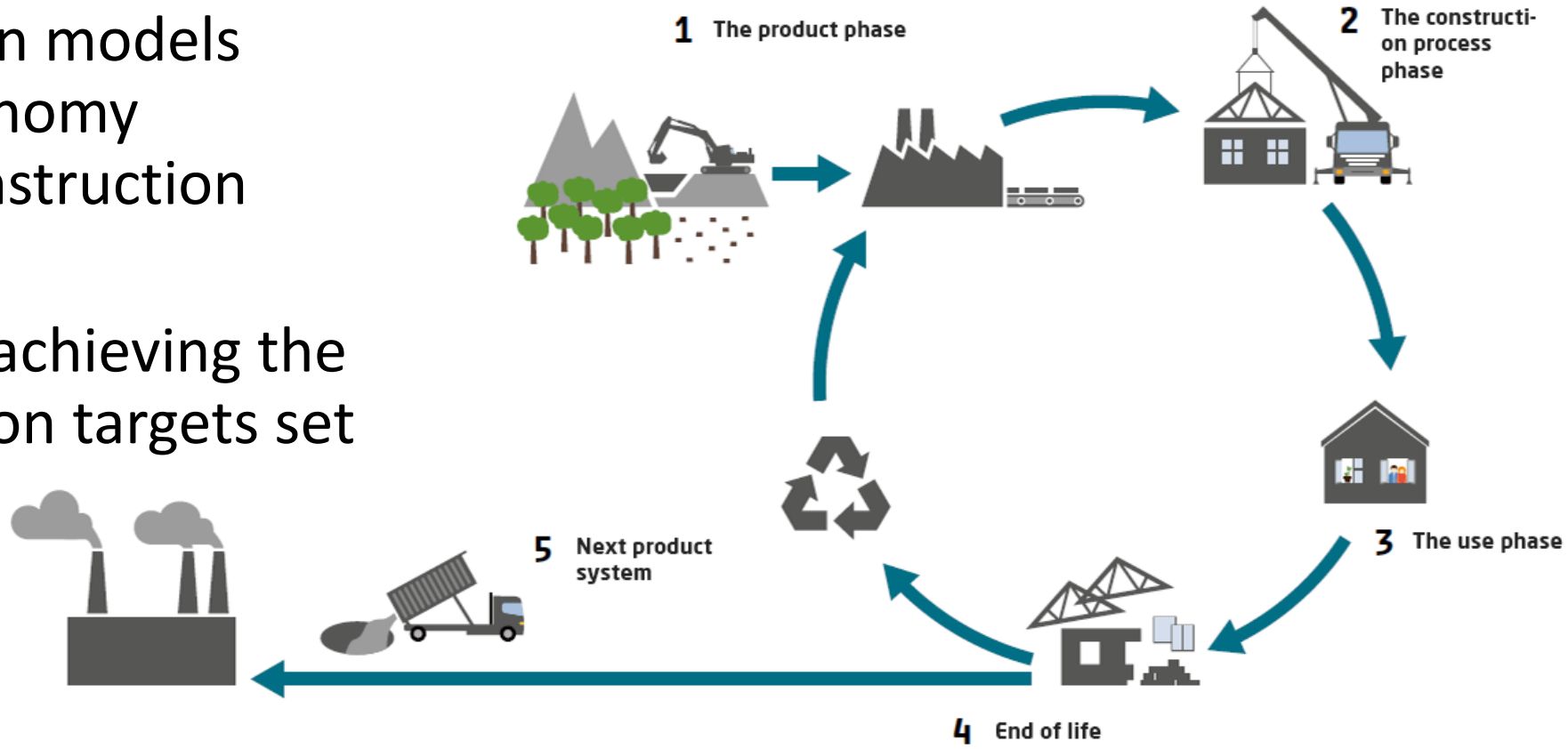


Illustration: The Danish Transport and Construction Authority

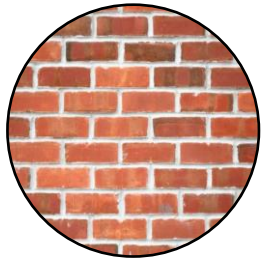
Focus on six carbon-intensive materials

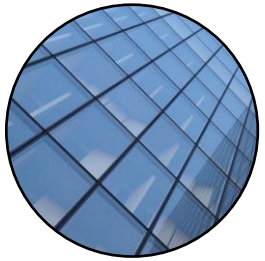
The CO2NSTRUCT project focuses on six pervasive carbon-intensive materials.

We need extensive data on the impacts of the extraction of raw materials, logistic, transformation, and consumer industries covering the whole life cycle of these materials.

- Cement
- Steel
- Brick
- Wood
- Glass
- Insulation materials








CO2NSTRUCT Framework

OUTPUTS

Policy recommendations
GHG emissions gains
Impacts on GHG abatement and on energy costs
Hotspots for CE measures that impact GHG mitigation
Labeled CE measures with GHG mitigation indicators

Cluster 1: Offshore renewable energy production

Cluster 2: Buildings

Test framework for two economic clusters, using several CE scenarios

Circular Economy (modelling) tools
(social) LCA, SFA & MFA, I-O analysis, embodied carbon footprint databases

Overall EU energy production & consumption climate mitigation modelled by TIMES

Potential mitigation technologies including the impact of circular economy

Embodied energy, water, materials & GHG emissions & (other) externalities

Rebound effects associated to CE measures

Identify, test and quantify CE impacts for climate mitigation modelling for 6 key carbon intensive materials

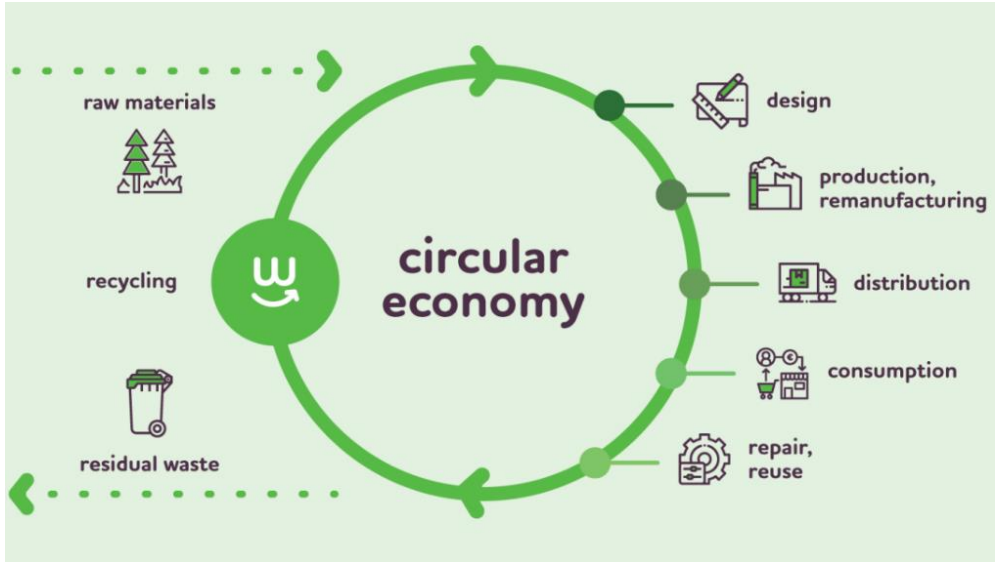
High resolution industry value chains allowing for CE modelling

CE measures with GHG mitigation indicators

Occupant/ consumer behaviour towards CE measures

CE measures & feedback loops to be modelled

Common understanding of **activities/processes** involved in the **construction materials production**



Adopting a **level of detail** suitable for identifying the benefits of **CE practices**

- Production processes
- Materials: raw materials
- Energy flows
- Water usage
- Waste
- By-products
- Emission sources
- Value and supply chains

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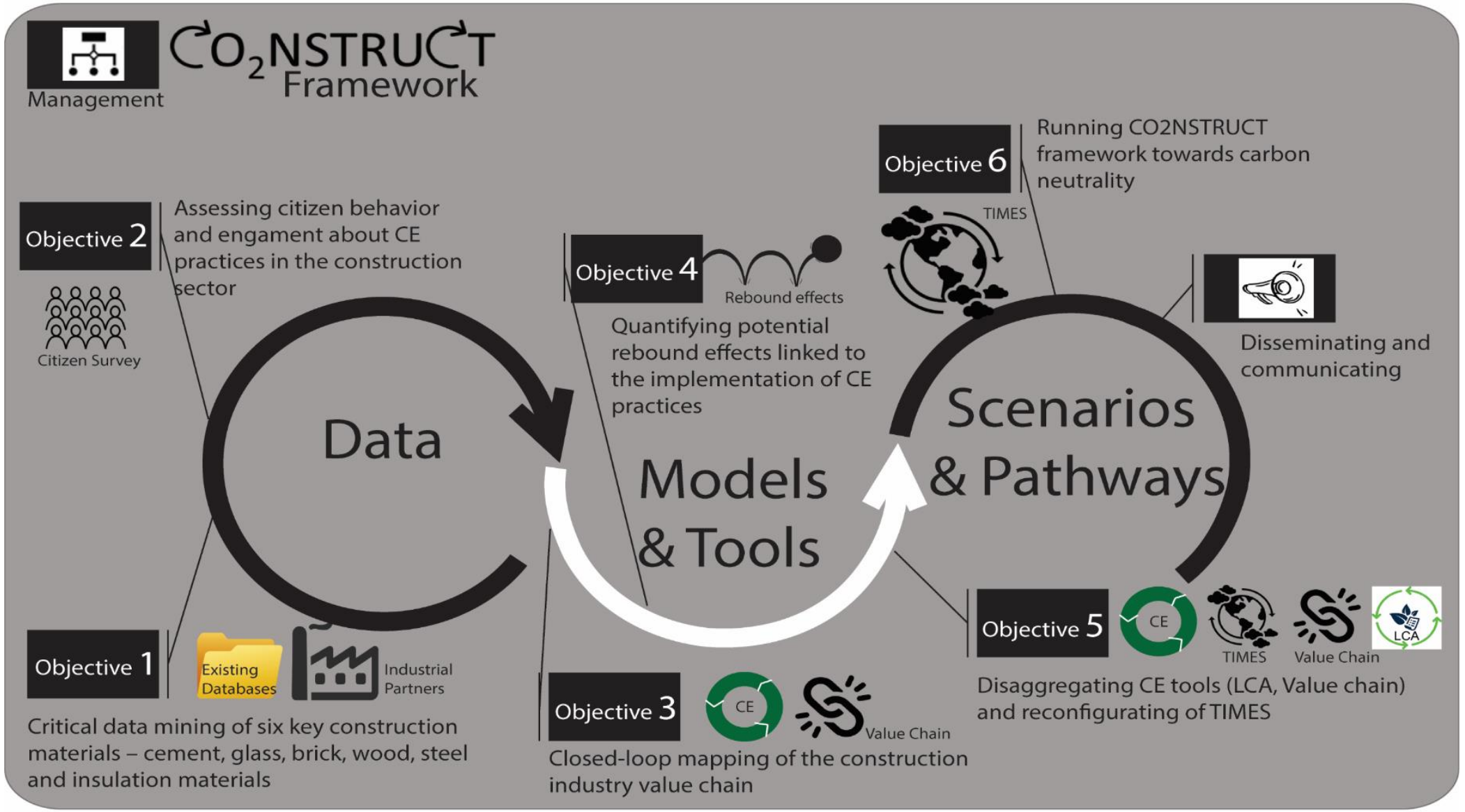
Expected impacts

- Improve the quantification of the impacts and potentials of the circular economy for climate change mitigation.
- Support the integration of the circular economy into climate action, policies and their evidence base, including externalities.
- Support the integration of the GHG emission reduction / mitigation in the circular economy criteria.

Objectives


Management
CO2NSTRUCT Framework
Objective 6
Running CO2NSTRUCT framework towards carbon neutrality
TIMES
Objective 2
Assessing citizen behavior and engament about CE practices in the construction sector
Citizen Survey
Objective 4
Rebound effects
Quantifying potential rebound effects linked to the implementation of CE practices
Disseminating and communicating
Data
Models & Tools
Scenarios & Pathways
Objective 1
Existing Databases
Industrial Partners
Critical data mining of six key construction materials – cement, glass, brick, wood, steel and insulation materials
Objective 3
CE
Value Chain
Closed-loop mapping of the construction industry value chain
Objective 5
CE
TIMES
Value Chain
LCA
Disaggregating CE tools (LCA, Value chain) and reconfigurating of TIMES

Project facts

EU funding programme: Horizon Europe

Call: HORIZON-CL5-2021-D1-01: Climate sciences and responses

Topic: HORIZON-CL5-2021-D1-01-02

Type of action: HORIZON Research and Innovation Actions

Start date: 01-06-2022

End date: 31-05-2026

Duration: 4 years

Budget: 5 million Euro

CO_2NSTRUCT partners at a project meeting in Pisa, Italy. February 2023.

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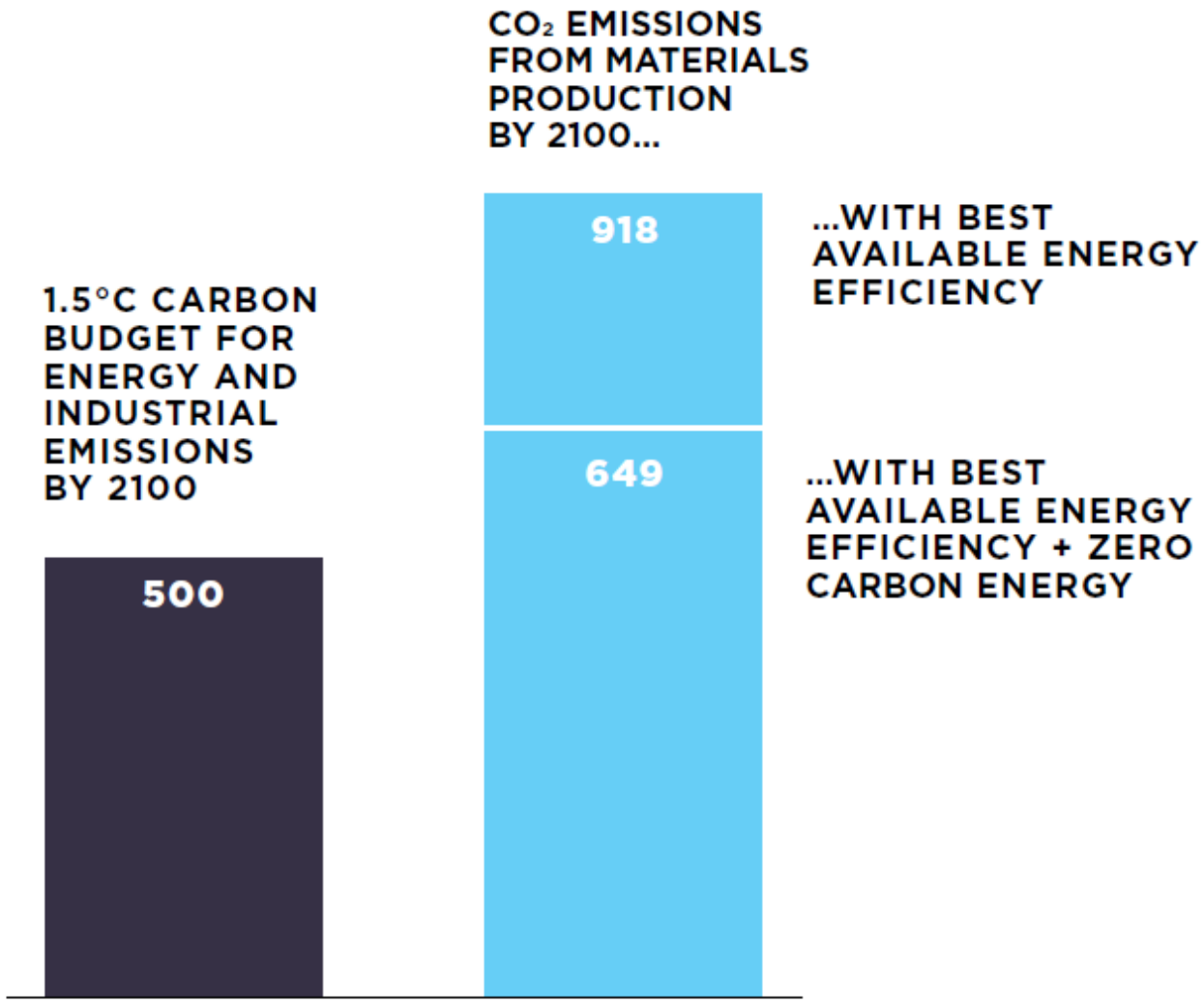
Niklas Nierhoff

Federal Office for the Environment (BAFU), Switzerland

Completing the Picture: Circular Economy Measures Needed

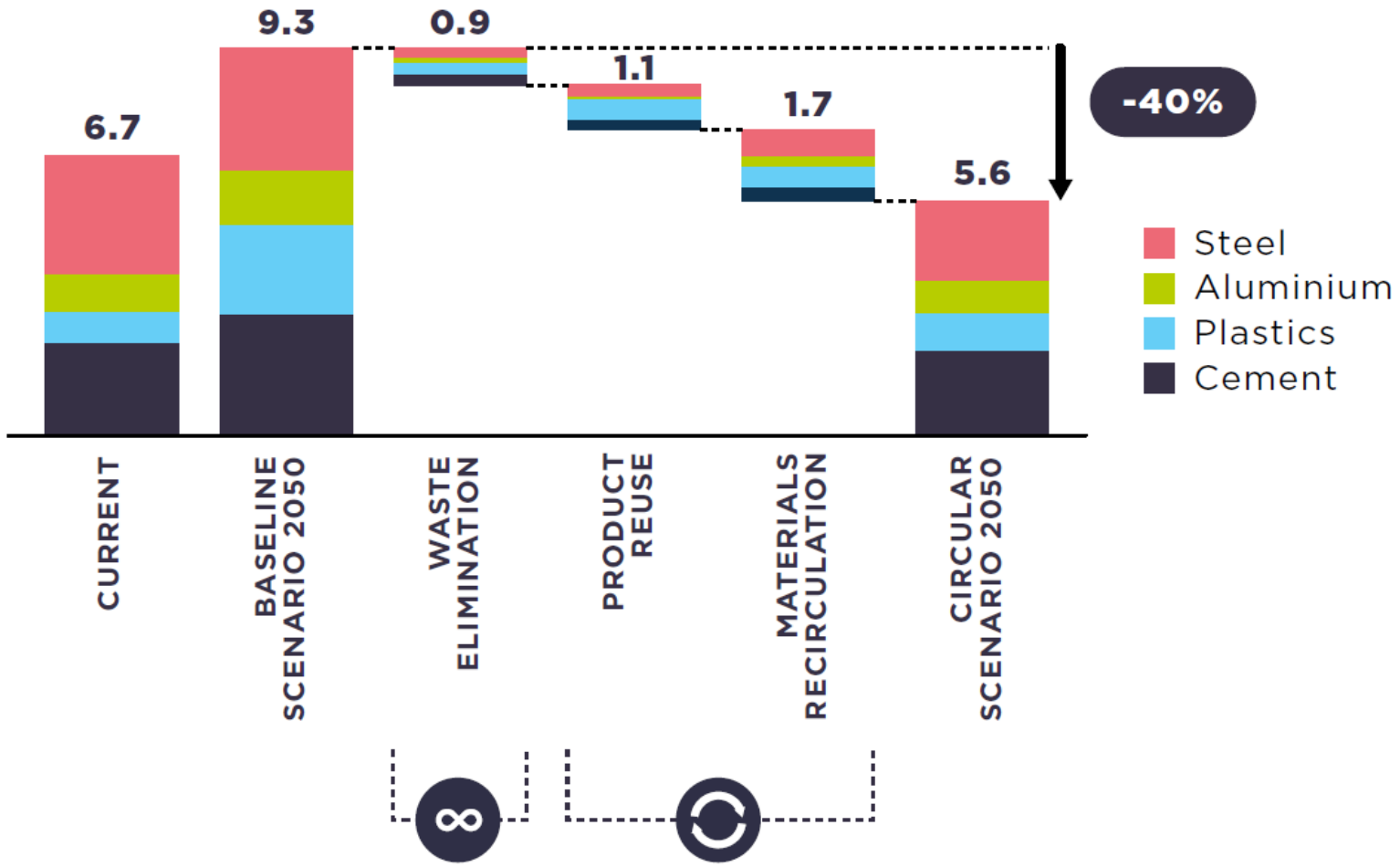


Emissions from material production will increase until 2100, even under a scenario that includes renewable energy and energy efficiency.

Source: Ellen MacArthur Foundation 2021

Completing the Picture: CE to Address Key Materials

Global emissions of four key materials production
Billion tonnes of CO2-eq / year



A circular economy could reduce annual emissions from key industry materials considerably.

Source: Ellen MacArthur Foundation 2021

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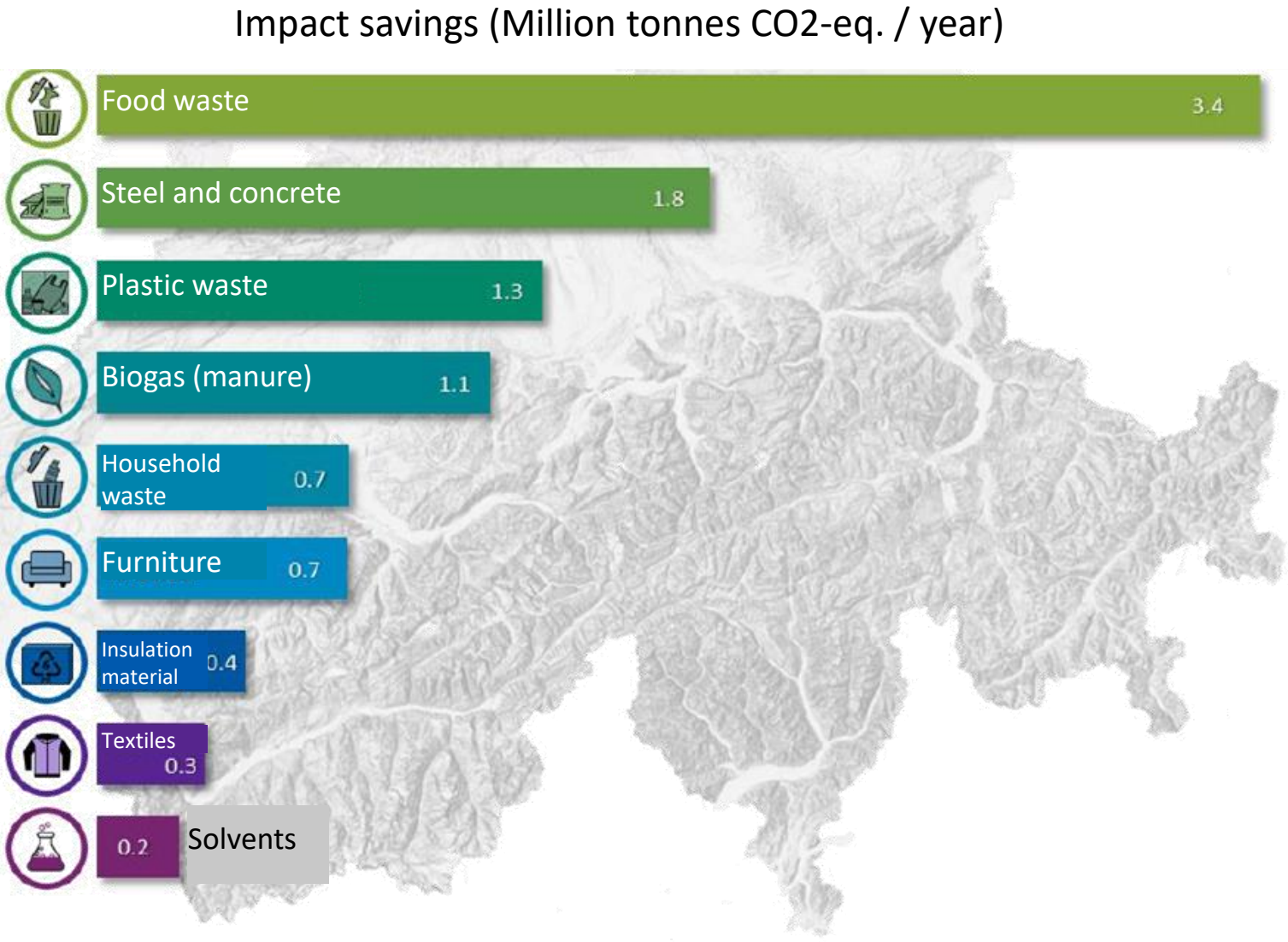
The Potential in Switzerland



- Combined scenario could potentially save 12 million t CO2-eq./a
- Compared with today's territorial emissions: - 22%
- Emission reductions take place at home and abroad

Wiprächtiger et al. 2022

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The Potential in Switzerland: Scenarios and Measures

Food Waste, 50% reduction in	• Households • Production + processing • Hospitality
Reduced use of steel and concrete via	• Reuse building structure • Use of wood • Use of C02-reduce cement
Plastic waste is increasingly	• Collected seperately • Design and recyclability improved
Collection of manure	• anaerobic fermentation • Feed into gas grid
Municipal waste (glas, alu, metals paper, cardboard)	• More/better recycling • Better recovery (i.a. reuse of bottles)

Wiprächtiger et al. 2022

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The Potential in Switzerland: Scenarios and Measures

 Furniture is	• Used longer, more reuse • More repair • Use of recycled wood
 Insulation materials are	• Collected and recycled • More usse of bio-based materials
 Textiles are	• Reused more often • Recoverd in Switzerland • Repaired, less consumed
 Solvents in the chemical industry	• More regenerated
CCS Carbon capture and storage in	• Incineration plants • Wood power plants • Cement plants

Starting position Switzerland:

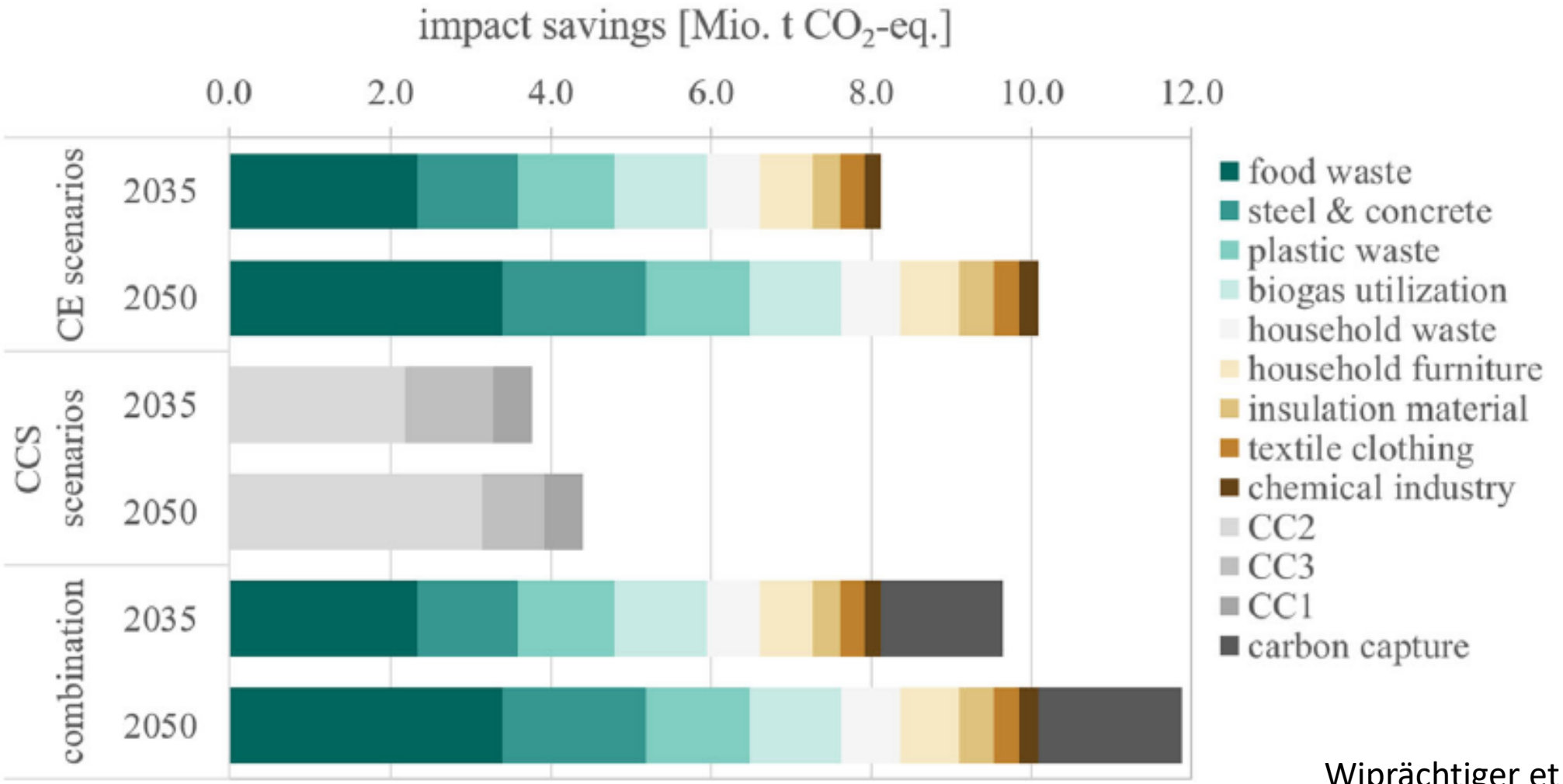
<u>Recycling-systems for</u>

- Paper and cardboard (municipalities)
- Metals (EPR)
- Glass (EPR)
- PET bottles (EPR)
- Batteries (EPR)
- Organic waste (municipalities)
- EE waste (EPR) → treatment of cooling agents!
- Textiles (private collection)

<u>Ban on landfilling of municipal waste</u>

- Incineration plants cause 5% of territorial emissions

Total Climate Change Impacts Combined CE Scenarios (Potential 2050)



Wiprächtiger et al. 2022

Looking Beyond Waste and Recycling: R-Strategies and Key Sectors

R-Strategies

Avoiding waste:
Reduce, rethink, refuse

Longer product lifespans:
Rethink, reuse, repair,…

Collection and Recycling

Incineration

Landfilling

Key Sectors

Households /
Procurement

Agriculture

Construction

Industry

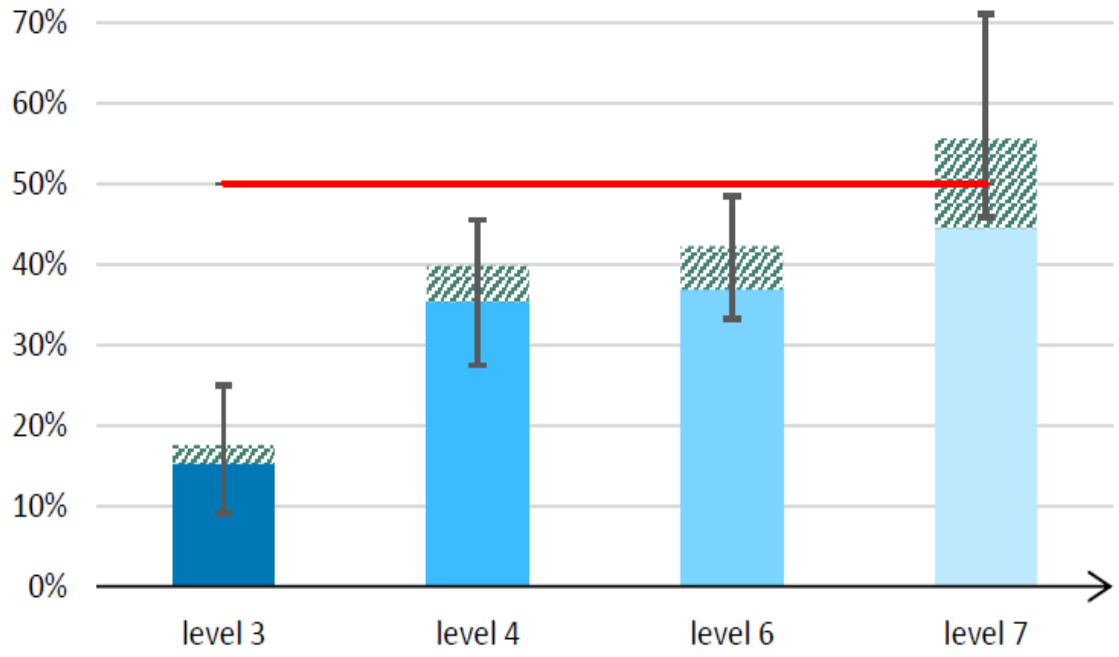
Mobility

Looking Beyond Waste and Recycling: Construction Sector

- Sufficiency and efficient design
- Build lightweight
- Reuse building components
- Use biogenic building materials
- Use recyclable materials
- Reduce GHG intensity of materials

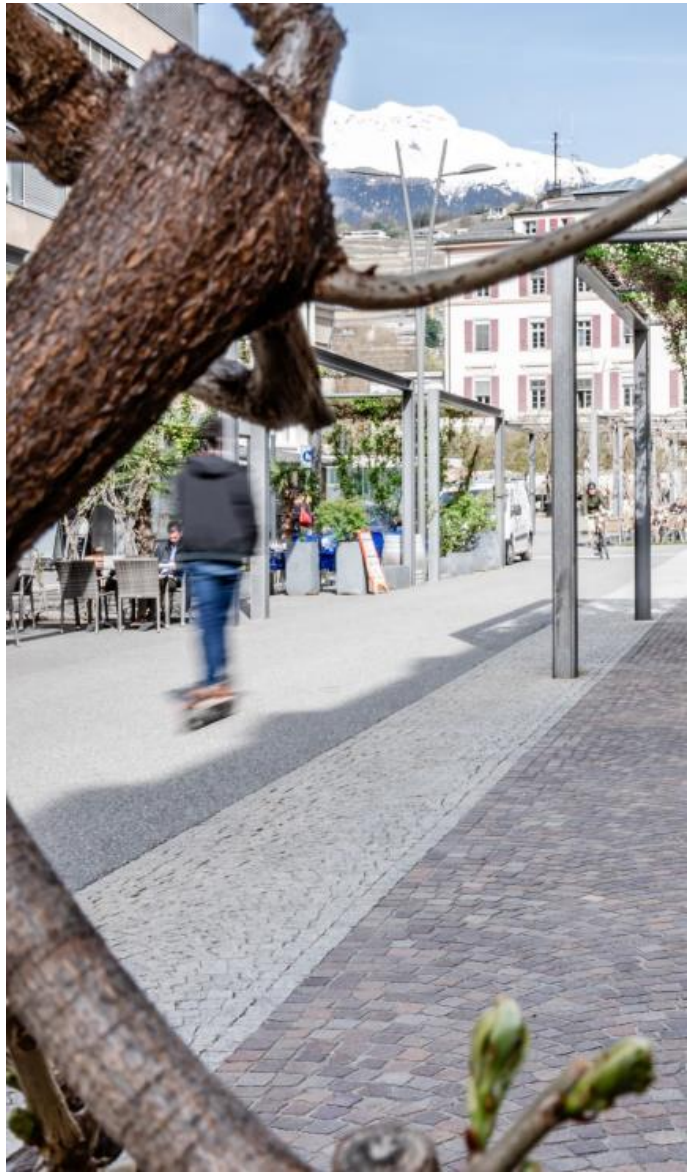
(Recycling concrete reduces GHG emissions only marginally)

Reduction Potential of combined measures, different ambition levels



Source: Nova Energie & Carbotech 2021

Using GHG Footprint as a CE Target Indicator: Opportunities



- Raising awareness for climate benefits of CE and helping its uptake
- Methods and databases for LCA exist
- Advantages over material-based targets:
  - they can be critized as planning economy
  - mass oftentimes does not correlate with impact
- Some mitigation measures increase material use, e.g. metals and insulation for energy transition
- Measuring embedded / whole life GHG allows to optimize mitigation strategies

Using GHG Footprint as a CE Target Indicator: Challenges

- CE measures reduce emissions along the whole supply chain – while Paris Agreement and reporting focused on territorial emissions
- No internationally harmonized footprint databases: need for harmonization and improvement to standardize reporting on CE measures for climate mitigation
- Emission reductions of some CE instruments are easier to quantify than others
- Making sure that there is no disproportionate increase of overall environmental effects

Importance of LCA and Complementing Indicators

- LCA is a valuable tool to analyse specific CE measures: Understanding the wider system is important to design CE measures
- Inner circles have highest environmental benefit (ecodesign, prolonging lifespan via repair, reuse etc.). However, inner circles are harder to measure, since there is a cascade of assumptions (e.g. effect of availability of spare parts)
- For some CE measures there may be low or even detrimental effects (e.g. some bio fuels; recycling of composite materials; or high but low-quality recycling rates)

Effective link of CE and climate policy: limit values for embedded GHG in buildings (FR, DK):

– technology neutral incentive for CE
– Established link to net-0

Avoiding negative effects: biofuel regulation (CH):

– GHG must be reduced by 40%
– Increase of total environ. impact < 25%
– No first generation fuels

3. Discussion

How clear is the connection between circular economy and climate change to you?

What would you consider the most effective circular economy activities to reduce mitigation potential?

What would be helpful for you to better integrate circular economy into your climate reporting or climate strategies?

Any other questions?

Thank you

William Keeling, Ana Lima, Tobias Nielsen, Niklas Nierhoff | EEA-Eionet day, 1 March 2023

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