Welcome to BUILD UP

The European Portal for Energy Efficiency in Buildings

WEBINAR

BUILD UP The European Portal For Energy Efficiency In Buildings

Circular talks

Let's talk circular social and affordable housing

18 April 2023

10:00 - 11:30 and 14:00 - 15:30 CET

BUILD UP
The European Portal For Energy Efficiency In Buildings

DRIVE

ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA

UIPI 1923 INTERNATIONAL UNION OF PROPERTY OWNERS

HOUSING EUROPE

Architects' Council of Europe
Conseil des Architectes d'Europe
ace-cae.eu

HOUSEFUL

Drive 0 has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 841850. HOUSEFUL has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No.776708.

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Agenda: Morning Session

Supplying circularity for social and affordable housing

- Welcome: What is the DRIVE 0 project about? **Cecilia Mazzoli, Assistant Professor at the University of Bologna, Department of Architecture - UNIBO-DA** (10')
- Introduction to Circular Business **Elettra Agliardi, Full Professor at the University of Bologna, Department of Economics - UNIBO-DSE** (15')
- Interactive Poll: uptake circular solutions in social & affordable housing **Dara Turnbull, Research Coordinator at Housing Europe – HE** (7')
- Pains and gains of using circular solutions in apartment associations **Targo Kalamees, Full Professor at the Tallinn University of Technology - TalTech** (7')
- TIMBECO's circular business model **Eero Nigumann, Project Manager at TIMBECO** (7')
- WEBO's circular business model **Bart Voortman, Innovation project coordinator at WEBO** (7')
- Moderated discussion: How to better supply circularity to social & affordable housing providers **Dara Turnbull, Research Coordinator at Housing Europe - HE** (32')

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The richness of the Housing Europe Network

43,000 local housing organisations

25 countries

24,936,000 dwellings

roughly 200,000 new dwellings per year

over 200,000 dwellings refurbished per year

roughly €40bn in new investment per year

7,500+ staff employed by the federations

300,000+ staff employed by local providers

One goal
To provide decent & affordable housing for all

Our members
ALBANIA – AUSTRIA – BELGIUM – CYPRUS
CZECH REPUBLIC – DENMARK – ESTONIA – FINLAND
FRANCE – GERMANY – GREECE – IRELAND – ITALY
LUXEMBOURG – NETHERLANDS – NORWAY – POLAND
PORTUGAL – SLOVENIA – SPAIN – SWEDEN
UNITED KINGDOM – ARMENIA – SWITZERLAND

Our partners
BELGIUM – CROATIA – GREECE – FRANCE – ITALY
KOSOVO – LATVIA – EASTERN EUROPEAN REGION

#HousingEvolutions

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Welcome:

What is the DRIVE 0 project about?

Cecilia Mazzoli, Assistant Professor at the University of Bologna, Department of Architecture (UNIBO-DA)

H2020 DRIVE 0:

Driving decarbonization of the EU building stock by enhancing a consumer centred and locally based circular renovation process

The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 841850.

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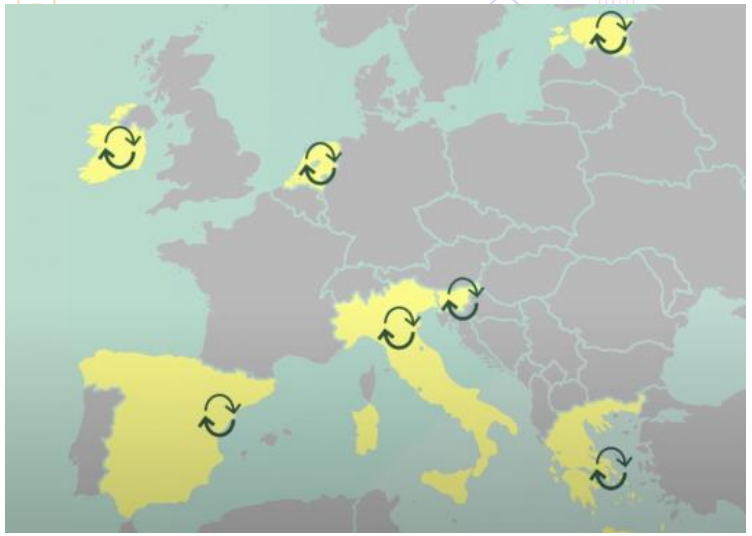
EU Horizon 2020 Project

«DRIVE 0 - Driving decarbonization of the EU building stock by enhancing a consumer centred and locally based circular renovation process»

The DRIVE 0 project deals with the promotion of strategies for the **decarbonisation of the existing building stock** through the implementation of **deep renovation interventions**. The project aims at promoting the adoption of a **circular approach** in renovation processes that, in order to be attractive and effective, must be based on the customer's actual needs.

According to the DRIVE 0 approach, circular retrofitting is based on the use of energy from renewable sources and the use of materials from biological or technical cycles, in which waste production is minimised and **end-of-life strategies with a positive impact** on the **environment** are envisaged.

DRIVE



We want to accelerate deep renovation processes by enhancing a consumer centered circular renovation process in order to make deep renovation environmentally friendly, cost effective and more attractive for consumers and investors.

DRIVE 0
Grant agreement ID: 841850

DOI
10.3030/841850

Start date
1 October 2019

End date
~~30 September 2023~~ 31 December 2023

Funded under
SOCIETAL CHALLENGES - Secure, clean and efficient energy

Total cost
€ 4 819 143,75

EU contribution
€ 3 999 505,63

Coordinated by
Huygen Installatie Adviseurs
Netherlands

https://cordis.europa.eu/project/id/841850/it

DRIVE 0 Consortium

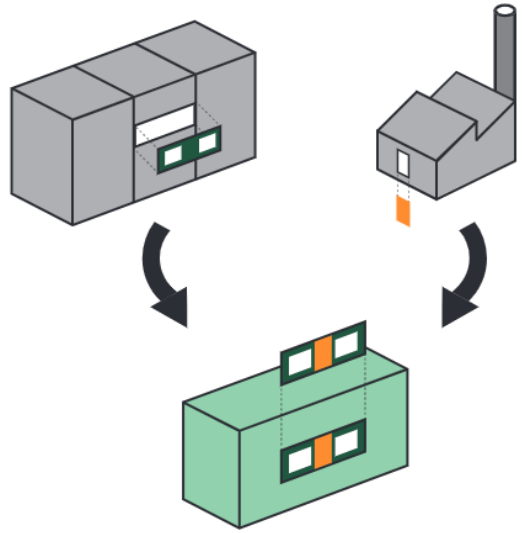
https://www.drive0.eu

Why is a circular approach needed in architecture?

- Buildings are responsible for 40% of total energy consumption in the EU
- 60% of the energy used throughout the life cycle of a building is so-called embodied energy
- 50% of the materials extracted in the EU are from buildings
- 25-30% of the total waste generated in the EU comes from construction and demolition processes

Objectives of DRIVE 0

- **Circular renovation**
  1) Re-use and recycling of locally available materials through urban-mining
  2) Use of renewable and environmentally friendly materials
  3) Combination of the two previous actions to implement a circular renovation



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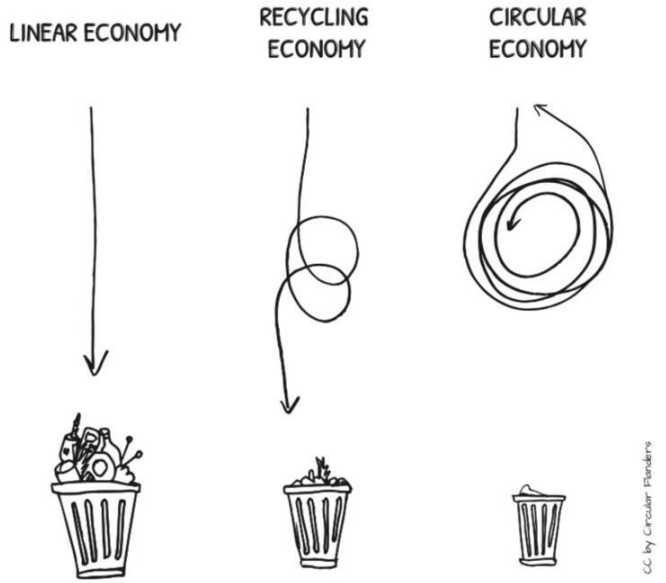
  focused on users/consumers and taking into account principles of circularity



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- **Clear information and increased awareness on energy performance**
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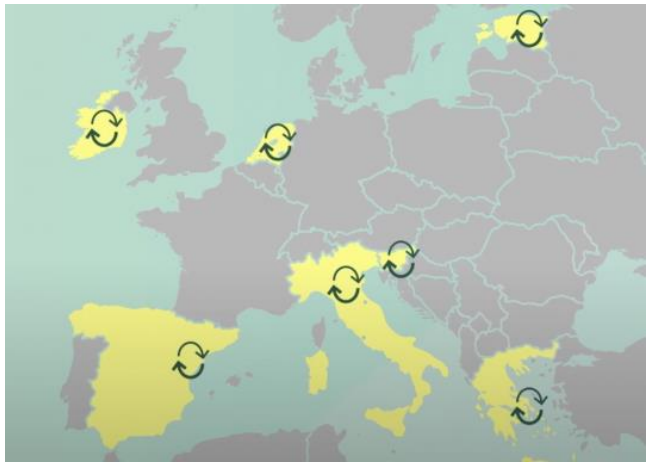
- **7 demonstration buildings**
  in Estonia, Greece, Ireland, Italy, The Netherlands, Slovenia, and Spain



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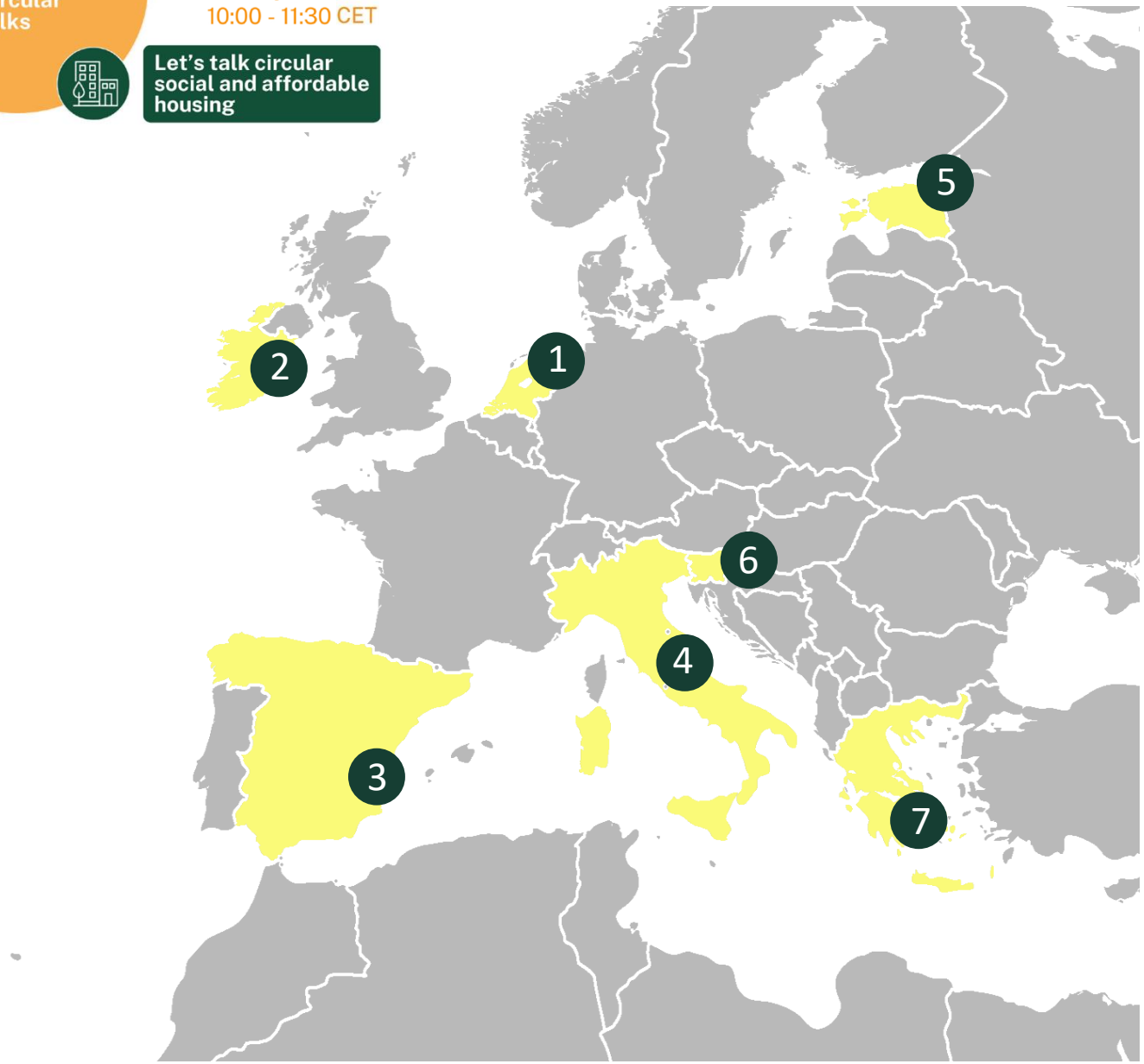

DRIVE 0
demo buildings
before the renovation

DRIVE

Welcome: What is the DRIVE 0 project about? | Cecilia Mazzoli, UNIBO

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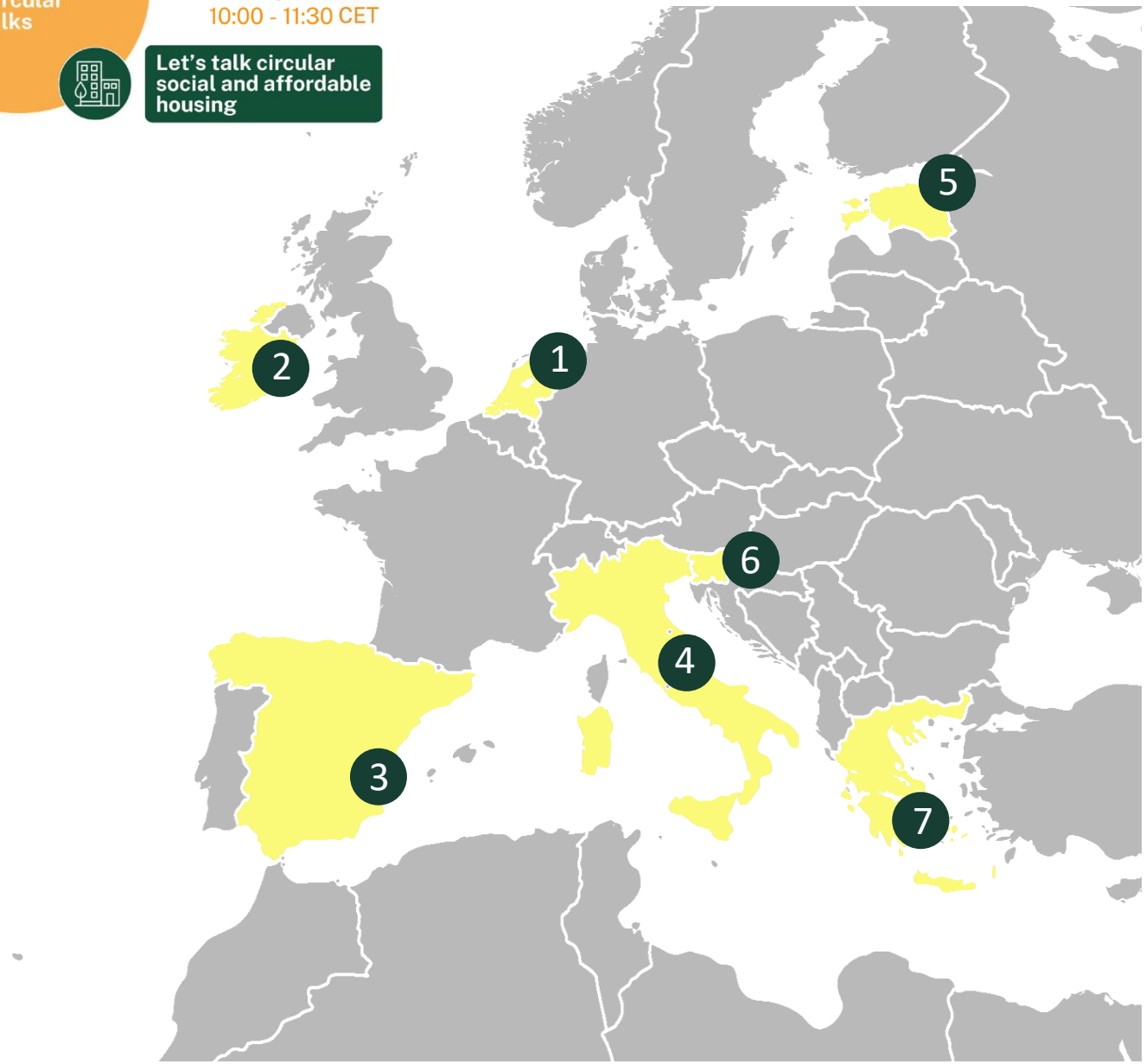

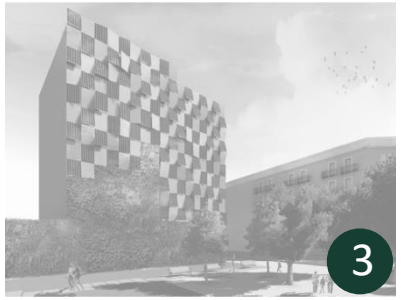

DRIVE 0
demo buildings
after the renovation

DRIVE

Welcome: What is the DRIVE 0 project about? | Cecilia Mazzoli, UNIBO

What about the other demos?

Join the next Circular Talk to know more!

Let's talk circular private housing (webinar)
co-organized by UNIBO and UIPI
> 27 April 2023 | 10:00 – 12:30 CET

More info: https://www.buildup.eu/en/events/webinar-lets-talk-circular-private-housing-uipi
Register by scanning the QR code on the left

Would you like to visit the DRIVE 0 demo buildings?

Accelerating Deep Energy Retrofit in Housing through Modular and Circular Solutions

> Conference on 11 May in Athlone (IE) including free visit to the **Irish demo building**

Register by scanning the QR code on the left
Agenda and more info at https://www.drive0.eu/athlone-conference/

UIPI and ACE Renovation Tour

> Conference on 24-25 May in Bologna (IT) including free visit to the **Italian demo building**

More info soon at https://www.drive0.eu/news/

Where to find DRIVE 0

https://drive0.eu/

https://www.facebook.com/H2020Drive0/

https://www.linkedin.com/company/h2020drive0/

https://twitter.com/Drive0_H2020

https://youtube.com/@drive_0

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Thank you for the attention!

Cecilia Mazzoli, Assistant Professor at the University of Bologna, Department of Architecture (UNIBO-DA)

cecilia.mazzoli@unibo.it

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Introduction to CIRCULAR BUSINESS

Elettra Agliardi, Full Professor in Economics, DSE, University of Bologna
E-mail: Elettra.Agliardi@unibo.it

H2020 DRIVE 0:

Driving decarbonization of the EU building stock by enhancing a consumer centred and locally based circular renovation process

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1. CIRCULAR BUSINESS MODELS: Key Elements

- Circular economy (CE) is a key objective of the European Green Deal and a priority policy in EU
- It requires innovation in the types of business models used (***business model innovation, BMI***)
- Technological and social innovation in companies and societies need to go step by step together with BMI
  - **BMI affect all stages**: product design, production and distribution, use, end-of -life,…& product characteristics: longevity, durability…..
  - **Policy enablers** should support BMI (laws, regulations, financial support, education….)

2. CIRCULAR BUSINESS MODELS: DEFINITIONS

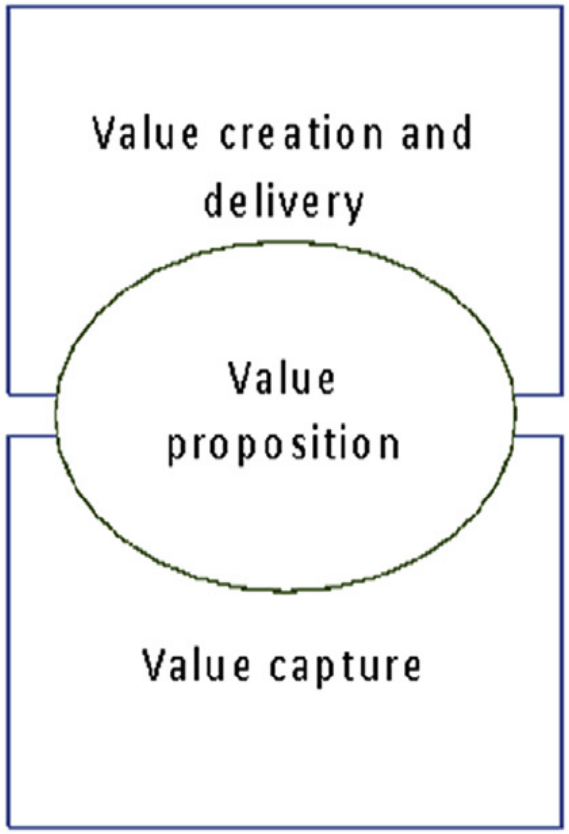
- **Business Model** = a conceptual tool to understand how a company defines its (market) strategies through the design of products or service it offers, how it differentiates from others and how it integrates its own value chain with the others'
- **Business Model Innovation (BMI)** is a key leverage to implement the circular economy on the organizational level.
- Organizations willing to implement circular economy have to rethink and build specific practices for **value proposition**, **value capture, value delivery** (e.g., customer involvement) and **value creation** (i.e. supply chain management)
- **Circular Business Model (CBM) Innovation** is crucial to meet social and environmental ambitions by leveraging circular solutions, with the objective to improve financial, social and environmental performances and also resilience and exposure to risks from their environment.

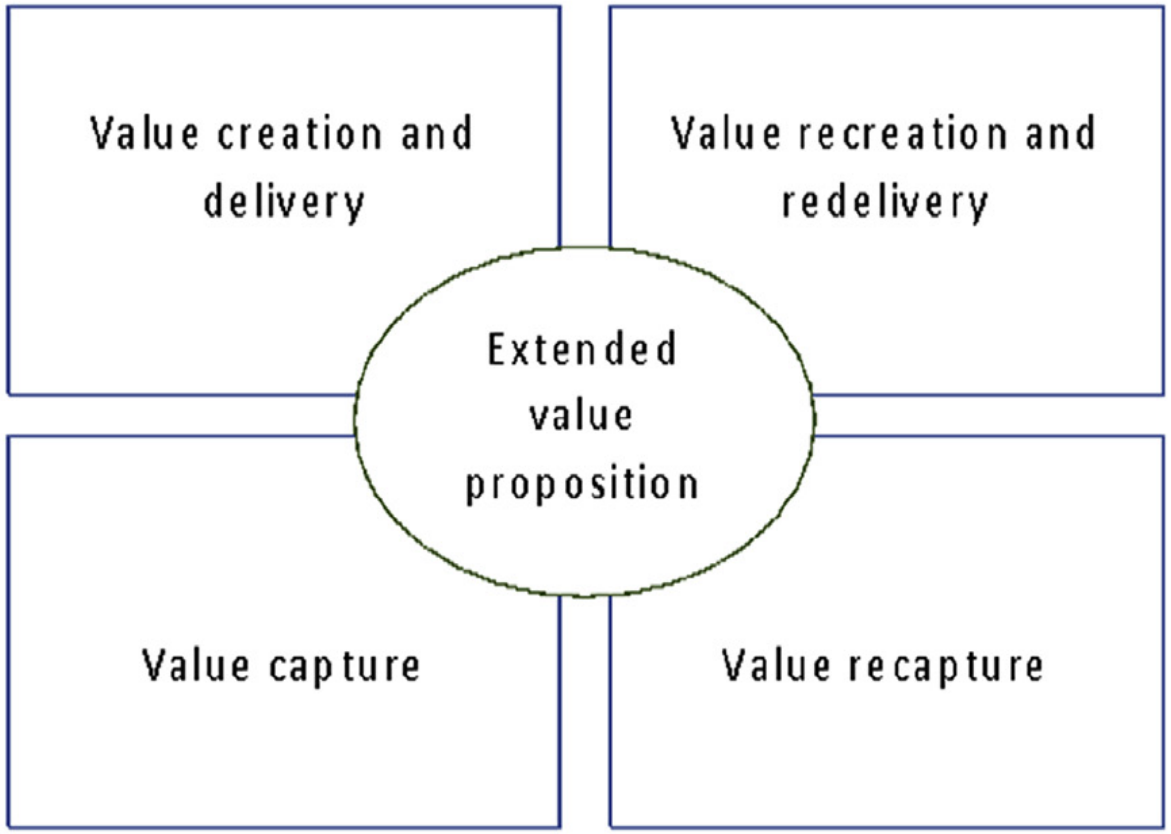
3. What do «Value Proposition/Creation & Delivery/Capture» Mean?

N.M.P. Bocken et al. / Journal of Cleaner Production 65 (2014) 42–56

Value proposition	Value creation & delivery	Value capture
Provide services that satisfy user needs without users having to own physical products. Business focus shifts from manufacturing 'stuff' to maximising consumer use of products, so reducing production throughput of materials, and better aligning manufacturers' and consumers' interests.	Delivery through product/service offerings require significant changes within the firm to deliver this and may incentivise redesign for durability, reparability and upgradability. Potentially, more direct consumer contact and consumer education to shift away from ownership. Supply chains become more integrated.	Consumers pay for the use of the service, not for ownership of products. Cost of ownership of physical products are borne by the company and/ or partners. This can enable consumers to access previously expensive products, so expanding the market potential of new innovations.

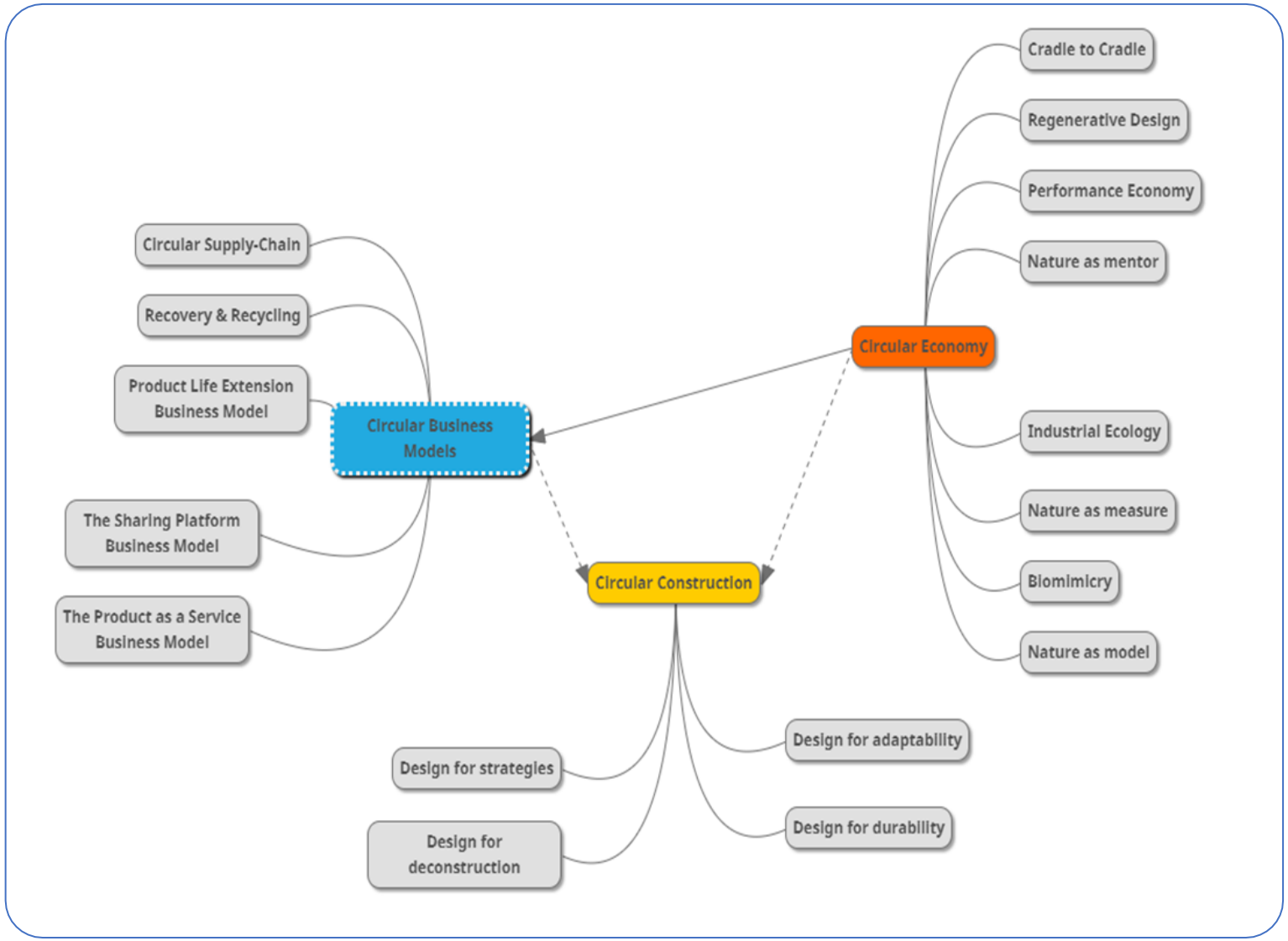
Closing the Loop in CBMs: Linear *vs* Circular





Taken from Bocken et al (2016); Guldmann et al (2020)

2. CIRCULAR BUSINESS MODELS: TYPES



The 3 main stages of circular business models
Circular procurement/design models
Circular internal production process models
Circular after-sales/after-use models

CBMs main categories (& activities)
Circular supply-chain
Recovery, repair, re-use and recycling
Product life extension
Create value from waste
Sharing platform business model
Product as a service/product lease/product renting or sharing
Consumer education rationalising demand

4. Product/service (eco) design for CUSTOMERS/USERS

- ❑ Extending product life *(avoid planned obsolescence by design: a design for disassembly, modularity, and industrialized manufacturing)*
- ❑Facilitating repair during use
- ❑Facilitating product updates/upgrades
- ❑Facilitating recycling after use *(end-of-life recovery)*
- ❑Expanding rental/leasing opportunities
- ❑Expanding sharing platforms
- ❑Reducing environmental pollution during use/by use *(energy consumption, water, soil, air or noise pollution)*

5. CBMs and Contracts for Social & Affordable Housing

SERVICE-BASED and PERFORMANCE & EFFICIENCY-BASED CBMs:

1. **Pay per Service** (provider is responsible for all costs of the product and is still encouraged to optimize the design of the product and its service; revenues tied to the use of service – periodic fees or other contract arrangements)
2. **Pay per Performance** (manufacturer keeps ownership of products and lease them to client; revenues tied to the performance of service/product)
3. **Servitization for energy retrofitting**
4. **Renting; Sharing ; Leasing; Pooling contracts**

	Value proposition • Main products/services • Customer segments/markets • Customer needs	Value creation & delivery • Key value chain elements • Core competencies • Resources • Capabilities	Value capture • Revenue streams • Cost drivers • Revenue model
Cycling • Reuse • Repair • Refurbishing • Recycling • Reverse logistics	?	?	?
Extending • Long-lasting products • Upgradability • Timeless design • Consumer education encouraging long product life • Maintenance/product support	?	?	?
Dematerialising • Software instead of hardware • Service instead of product • Rationalising consumer demand	?	?	?

6. The toolbox matrix in practice

	Value proposition	Value creation & delivery	Value capture
Cycling • **Reuse** • **Repair** • **Refurbishing** • **Recycling** • **Reverse logistics**	Re-using components might be possible for some components but will increase the risk of failure and amount of maintenance. (FACTO) New and improved technology makes it difficult to re-use old components. (FACTO) Lack of quality standards (ALIVA) The use of materials in circulation is becoming increasingly important. However, it is expected that the price of the product / service will not increase (TIMBECO) Technical legislation doesn't suit reused materials (problems of prDving technical and health impeccability). (KNAUF) lack of economic incentives for "circular" products and/or inputs that incentives the use of circular solutions (ALIVA)	Using recycled materials from local projects requires close cooperation between suppliers and us. This requires a lot of work in pilot projects (WEBO) In case components would be re-used, the CE certificate might not be valid anymore. (FACTO) lack of the production chain for reuse/recycling for some of the products/materials related to our market. This translates in a technical performance and a cost gap (ALIVA) The sales process often takes us more than 2 years. Each product offered must be at least throughout the sales process. In addition, this material must have homogeneous parameters at all times. In addition, the ingredients must be certified (TIMBECO) Logistic can be an issue, because the transport can cost more than the value of material in current conditions. (KNAUF)	Using recycled materials in our product is difficult on a cost level. In order to cut costs we would need scale. Setting up scale is difficult. (WEBO) Lack of economic incentives for "circular" products and/or inputs (ALIVA) With current melting technology we can recycle only certain % of mineral wood. (KNAUF)
Extending • **Long-lasting products** • **Upgradability** • **Timeless design** • **Consumer education encouraging long product life** • **Maintenance/product support**	Consumer education could extend the lifespan of the product (FACTO) Consumer/market education encouraging long product life is partially missing. lack of sensibility towards circularity.(ALIVA)	Durability and technical performances of circular products often inferior. Uncertainty due to lack of experience. (ALIVA)	Maintanance structure and costs (WEBO) Maintanance: nice but too expensive and huge burden (TIMBECO) Extending life of products can have an impact on revenue model that need to be changed accordingly (ALIVA)
Dematerialising • **Software instead of hardware** • **Service instead of product** • **Rationalising consumer demand**	Design opportunities (WEBO) The lifespan of our product is so long and the product is expensive that we do not see a working opportunity to offer it as a service. When offering it as a service, the price of the product should be significantly higher. (TIMBECO)	Lease model is dependent on legislation. (WEBO)	Service would be nice, but as the product is very expensive (FACTO) Switching from products to services requires business model and organizational changes (ALIVA)

T5.1. Drive 0 Questionnaire (about Value Proposition (VP) & Organizational Value (OV))

A SET of 12 Questions for VP and 8 Questions for OV where answers are scaled from Poor to Excellent regarding the move toward circularity.

To the questions that express positive factors of circularity an increasing score is assigned. The ranking is the following:

- *Poor = 0, Neutral =1, Good = 2, Excellent =3*

To the questions that express negative factors for circularity a decreasing score is assigned, that is:

- *Poor = 3, Neutral = 2, Good = 1, Excellent = 0*

The results of the scores for each answer are then added together for VP and OV. Then they are scaled to the maximum possible value (12 questions x 3= 36 for Part I; 8 questions x 3 = 24 for Part II).

In this way different combinations can be obtained, that is: a company may have a high level of value proposition and a low level of organizational value or vice versa, both can be high, or both are low, implying different degrees of achievement of circularity. We can classify a company in a given period and assess its level of circularity in that period. Different corrective actions are required depending on the upstream or downstream circularity gaps.

7. MATRIX OF THE DEGREE OF ADOPTION OF CIRCULARITY

Poor = 0, Neutral =1, Good = 2, Excellent =3

Questions representing positive factors for circularity

Poor = 3, Neutral =2, Good = 1, Excellent =0

Questions representing negative factors for circularity

Values:

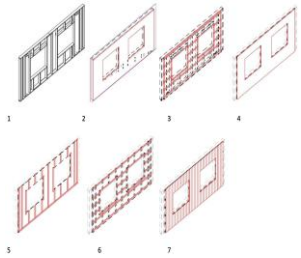
LOW if < 50%
HIGH if = or > 50%

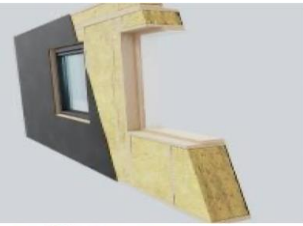
ORGANIZATIONAL VALUE	VALUE PROPOSITION H	VALUE PROPOSITION L
H	High degree of circularity (Full circularity) **COMPANY X** **(high on both values)**	Upstream circularity **COMPANY Y** **(high on org, low on prop)**
L	Downstream circularity **COMPANY W** **(low on org, high on prop)**	Low degree of circularity (Almost linear) **COMPANY Z** **(low on both values)**

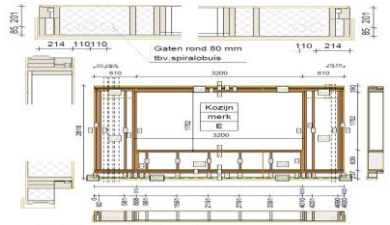
INDUSTRIAL PARTNERS	Matrix of 'Degree of adoption of circularity' results	Subjectivity in the evaluation	Assessment Results
.....			
.....			
.....			

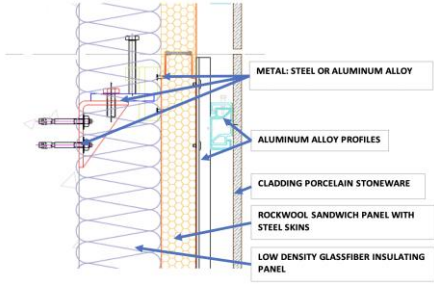
DRIVE

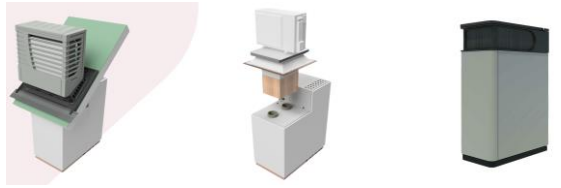
GENERAL OVERVIEW	Country	Products	Services	CE framework	Matrix of 'Degree of adoption of circularity'
T	Estonia	Prefabricated houses Modular buildings Facade elements Roof elements	Consultancy Design & construction Interior design	Complete circular structure from the beginning of its life	High degree of circularity
W	The Netherlands	Window frames Timber frame elements Scaffold-free construction	Fully automatic production & assembly; Deliver to the construction site	In transition	Upstream circularity
A	Italy	Claddings Systems Components	Rainscreen System Consultancy & design; Structural Design And Calculations; Rainscreen system supply, installation and project management	In transition	Low degree of circularity
F	The Netherlands	iCEM (integrated Climate Energy Module)	Monitoring Remote management Service maintenance	Mostly linear	Upstream circularity
K	Slovenia	Building, OEM, technical and Green solutions (roofs, insulations, facades, floors..)	Production tailor-made; Installation; Innovative development and design	In transition	Downstream circularity

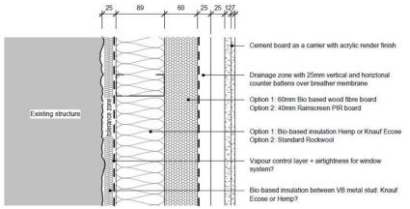












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Let's talk circular social and affordable housing

Main take-aways for authorities, facilitators, professionals and occupants

Focus on:

- Circular materials/products/service systems
- Product characteristics (life-time extensions)
- Sharing platforms
- Cooperation with customers, suppliers, and the whole circular business network
- Collective or shared ownership
--Create incentives (environmental, economic, social) to build awareness

There are already various good practices & success stories (…….*Drive 0 stories - TIMBECO; WEBO*)

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E-mail: Elettra.Agliardi@unibo.it

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Interactive Poll:

Uptake circular solutions in social & affordable housing

Moderated by Dara Turnbull, Housing Europe

The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 841850.

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Pains and gains of using circular solutions when renovating an apartment building

Targo Kalamees, Professor of Building Physics
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H2020 DRIVE 0:

Driving decarbonization of the EU building stock by enhancing a consumer centred and locally based circular renovation process

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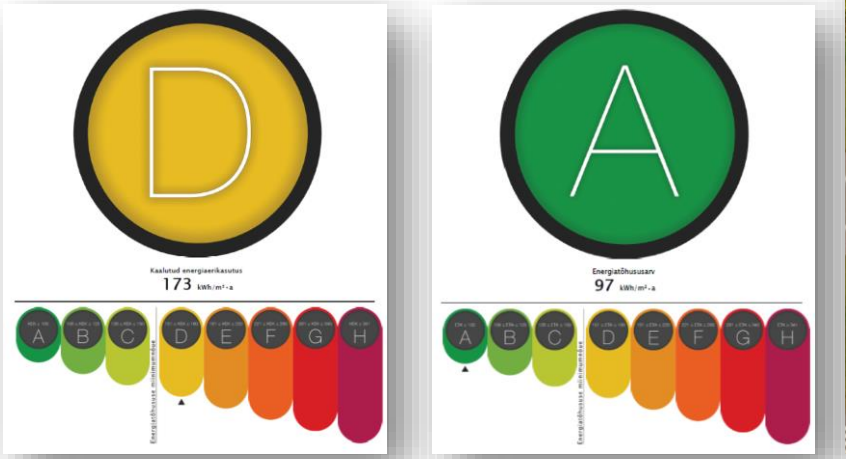
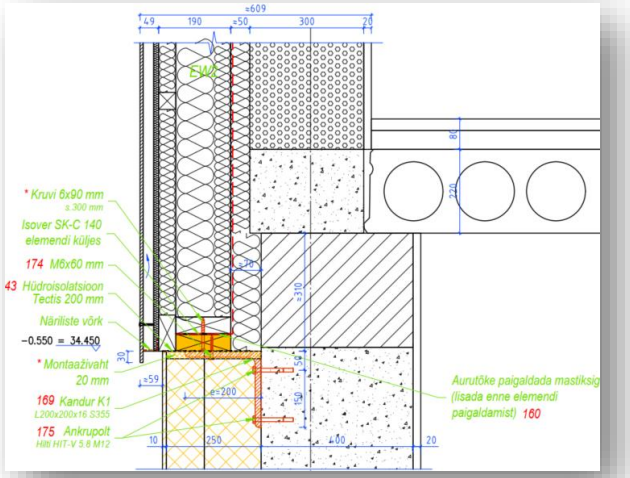
Circular renovation pilot in Estonia

3 floors
24 apartments
Construction: 1986
Net floor area: 2415m²



Prefabricated offsite renovation is key for circular renovation

- Prefabricated insulation elements for walls, triple glazing
- Balanced ventilation with VHR
- Efficient district heating, hydronic radiators
- PV on roof



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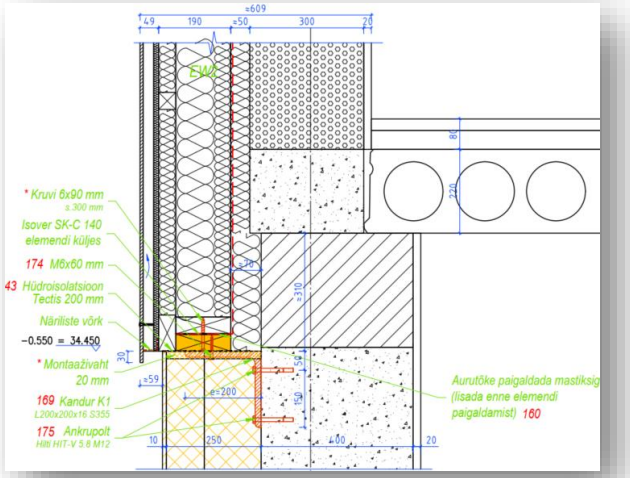


Potential for circularity

- Type and accessibility of connections, crossings and form containment showed high degree of circularity (>0.8)
- Prefabricated element with rockwool wind barrier and wooden façade cladding had the lowest embodied energy and embodied CO_2 content.

Design for disassembly [7]	**Material selection**
• Type of connections, • Accessibility of connections, • Crossings, • Form containment, • Material selection.	• Locally repaired, reused building components and materials • Bio based materials • Recycled and upcycled building components and materials • Refurbished, remanufactured materials

	Element	Type of Connection		Accessibility of connection		Crossings		Form containment		Materials	
1	Connection to existing wall	Corner and screw	0.8	No damage	0.8	Modular zoning	1.0	Overlaps on one side	0.8	-	
2	Buffer insulation (glass wool)	Screw and line	0.8	No damage	0.8	Modular zoning	1.0	Open, no inclusions	1.0	Recycled material	0.6
3	Timber framing	Screw	0.8	No damage	0.8	Modular zoning	1.0	Open, no inclusions	1.0	Biobased material	0.8
4	Insulation (stone wool)	Dry	1.0	No damage	0.8	Modular zoning	1.0	Open, no inclusions	1.0	Mainly virgin material	0.1
5	Wind barrier (stone wool)	Screw	0.8	No damage	0.8	Modular zoning	1.0	Open, no inclusions	1.0	Mainly virgin material	0.1
6	Wooden lath	Screw	0.8	No damage	0.8			Open, no inclusions	1.0	Biobased material	0.8
7	Facade cladding (fibre cement)	Screw and EPDM seal	0.8	Freely accessible	1.0	Modular zoning	1.0	Open, no inclusions	1.0	Mainly virgin material	0.1
Category average			**0.83**		**0.83**		**1.0**		**0.83**		**0.42**
Circularity indicator		**0.78**		**Medium degree of circularity**							

Finger-joined timber

Added materials to renovated building	Reuse of existing materials from the renovated building in the renovated building	Reuse of existing materials from renovated building in other building	Recycling of existing materials from renovated building	Landfill / waste

Manufacturing standard: EN 15497
Adhesive: DIN 68141; EN 301
Sorting Visual: DIN 4074-1

No pains to apartment association:
Exists production standard
Gains: lower cost (if material exists)

Blown wool insulation on attic floor

Added materials to renovated building	Reuse of existing materials from the renovated building in the renovated building	Reuse of existing materials from renovated building in other building	Recycling of existing materials from renovated building	Landfill / waste

Standards: EN 14064, EN 15101

No pains to apartment association:
Exists production standard
Gains: lower cost

Disassembling the insulation element and reuse of materials for making new insulation element

Reuse potential ~60% of materials

Added materials to renovated building	Reuse of existing materials from the renovated building in the renovated building	Reuse of existing materials from renovated building in other building	Recycling of existing materials from renovated building	Landfill / waste

No pains, no gains to apartment association

No standard exists to reuse of material / product

Reuse of old windows

Added materials to renovated building	Reuse of existing materials from the renovated building in the renovated building	Reuse of existing materials from renovated building in other building	Recycling of existing materials from renovated building	Landfill / waste

Pains to apartment association:
Material bank does not exists
No gains: no income

Reuse potential ~80% of windows in buildings without energy performance requirements

Reuse of old roof covering material

Added materials to renovated building	Reuse of existing materials from the renovated building in the renovated building	Reuse of existing materials from renovated building in other building	Recycling of existing materials from renovated building	Landfill / waste

Pains to apartment association:
Material bank does not exists
No gains: no income

Reuse potential ~80% of roof material in secondary use buildings without high requirements for water tightness

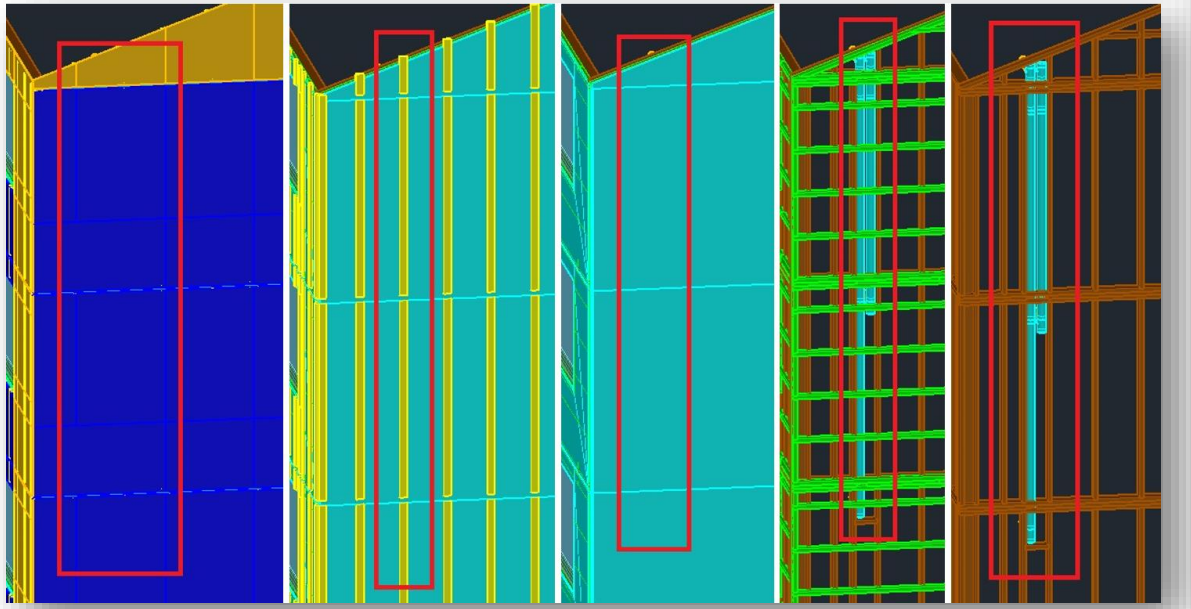



Ventilation pipes in insulation element

Added materials to renovated building	Reuse of existing materials from the renovated building in the renovated building	Reuse of existing materials from renovated building in other building	Recycling of existing materials from renovated building	Landfill / waste

No pains to apartment association: more room indoor
Requires replacement solution

Several replacement solutions exists



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Thank you for the attention!

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TAL TECH

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Timbeco's circular business model

Eero Nigumann, Project manager at Timbeco Ehitus OÜ

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Products and services

- One Stop Shop
  - Architectural design
  - HVAC, Electricity and plumbing design
  - Prefabricated timber framed panel design with laser scanning of the building
  - Construction works
  - Paperwork

Products and services

- Lower carbon footprint
  - Lower carbon footprint for the insulation system
  - Environmental management according to ISO14001
  - Reusing materials from the site (Urban mining)

Pain relievers

- Faster insulation installation
  - Design phase of timber frame elements - 14 weeks
  - Installing load bearing steel corners and base timber - 2 weeks
  - Installing timber frame elements, including demolition works and deinstalling old windows - 8 weeks.
  - Deep renovation contract actual duration 9 months. Delay was caused by unforseen events and results of COVID pandemic

Pain relievers

- Procurement of design and construction work possibility
  - Price indication before any design work has been done
  - Design solutions according to budget
  - Fewer procurements

Gain creators

- Scaffoldless installation of insulation
  - Installation was done with boomlifts and crane
  - Residents did not have live behind closed scaffolding
- Better quality through works in controlled environment (factory)
- Design for disassembly

Gain creators

- Better quality through work in controlled environment (factory)
  - Proven product quality through different certificates
    - ISO9001, ISO14001 and ISO45001
    - SINTEF
    - ETA

Gain creators

- Closing the old balconies with timber framed panels.
  - Net area of apartments was increased 5,2 or 6,7 m2
  - Net area of the apartment building increased 134,2 m2
  - Maping and legalising the changes made inside the apartments before the renovation.

Gain creators

- Design for disassembly

Gain creators

- End result

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Eero Nigumann, Project manager at Timbeco Ehitus OÜ
email address: eero@timbeco.ee

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Circular Façade Systems by WEBO

Bart Voortman, Project manager / WEBO

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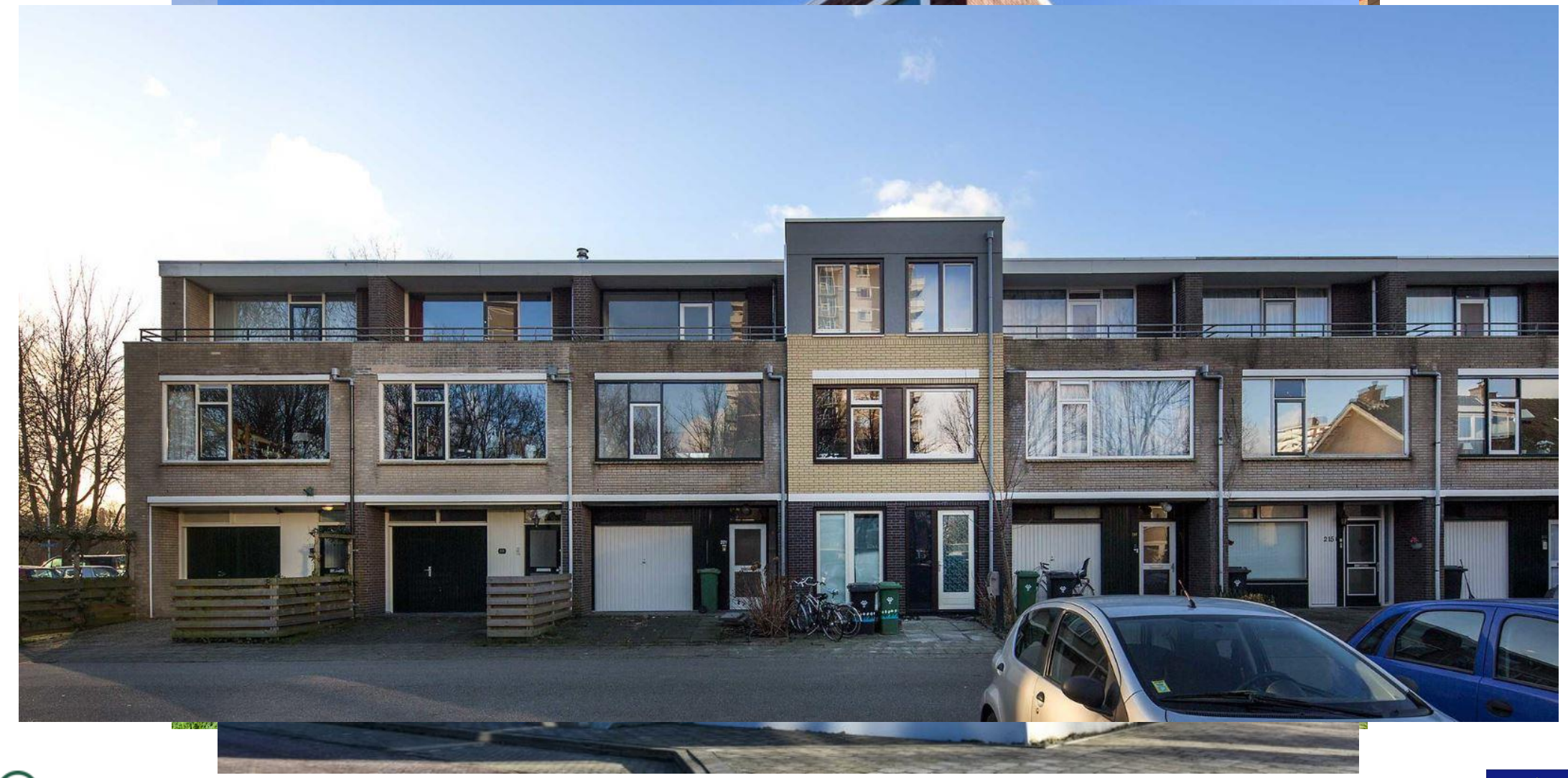
WEBO



DRIVE WEBO

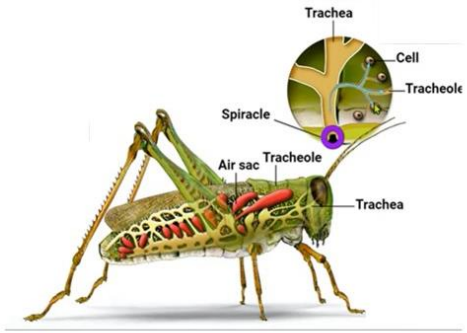
Circular Façade Systems | Bart Voortman, WEBO

REDUCE EE & ECO2 & MATERIALS(RE-)USE

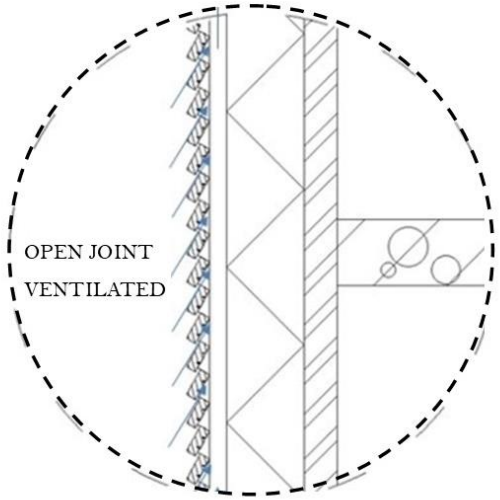
URBAN MINING

REPROCESSING CONSTRUCTION+CLADDING
RECYCLING WOODFIBRE FOR INSOLATION

COOL BODY / BUILING BY VENTILATION

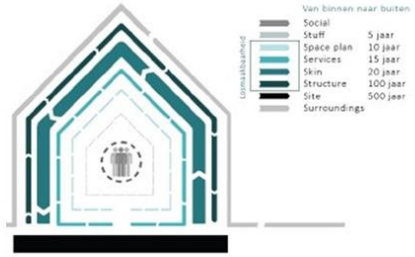


BIOMIMICRY

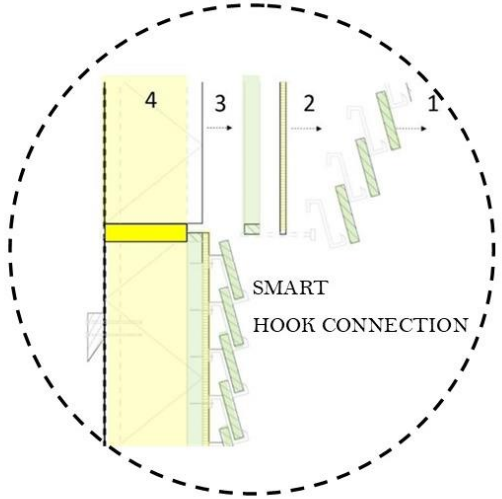


LIMITING INFLUENCE OF SUN RADIATION
BY VENTILATING BIHIND WOODCLADDING

MULTICYCLE RE-USE BY: SEPERATE LAYERS
PREFABRICATION & EASY CONNECTION



DESIGN FOR DISASSEMBLY



HIGH REUSE POTENTION ON ELEMENTLEVEL
HIGH REUSE POTENTIAL ON MATERIAL LEVEL

Urban mining

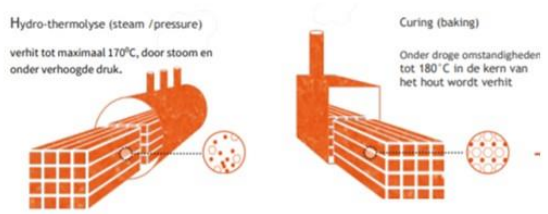
PARKSTAD ROOF-PURLINS

MEASURING QUALITY

SAWING PURLINS

RE-PROCESS CONSTRUCTION

RE-USED WOOD CLADDING

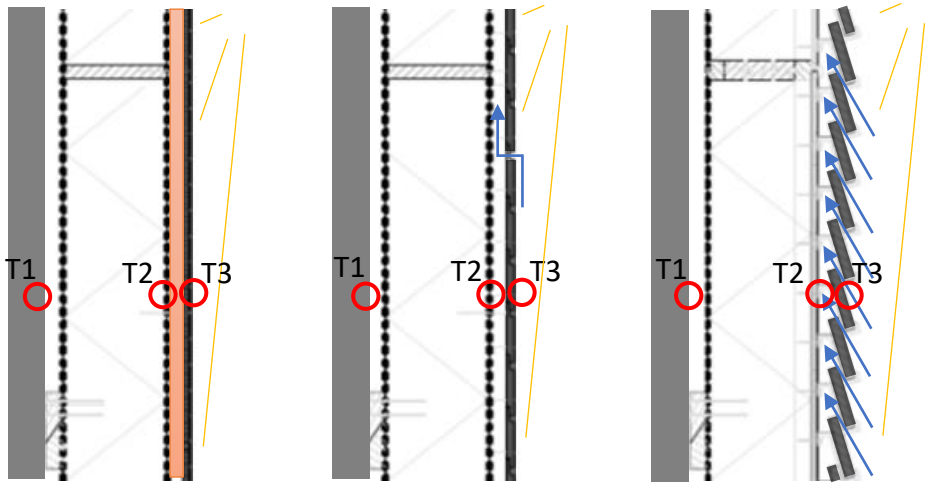


THERMAL TREATMENT

SAW DUST WASTE

RE-CYCLED WOODFIBRE INSOLATION

BIO Mimicry



Non ventilated

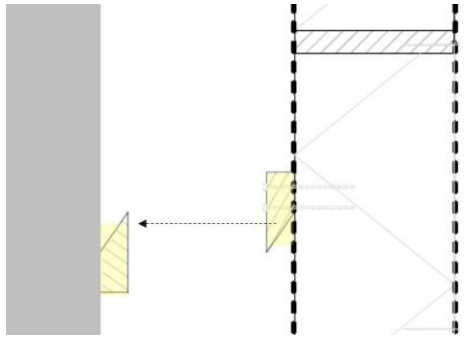
Element level ventilation

Open joint ventilation

Design for Disassembly

Goal:
All components detachable

BOLD VS HOOK CONNECTION



BOLD VS SCREW CONNECTION

HOOK VS NAIL CONNECTION

KORNOELJEFLAT GRONINGEN

MONTAGE STEIGERLOOS® GEVELELEMENTEN

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Bart Voortman, Project manager / WEBO
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Moderated discussion:

How to better supply circularity to social & affordable housing providers

Moderated by Dara Turnbull, Housing Europe

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THANK YOU!

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PAUSE

The afternoon session will begin at 14.00 CET

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