



BAMB
BUILDINGS AS MATERIAL BANKS

BUILDING AS MATERIALS BANKS

a pathway for a circular future

slido #BAMBimpact



BEL-EVENT
Password: Bamb2019

 #BAMBimpact

Moderator

Peter Woodward



Welcome

**Barbara Dewulf, Deputy Director General,
Brussels Environment**





BEL-EVENT

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#BAMBImpact

STORY - The influence of BAMB in shaping circularity in the construction industry

**Caroline Henrotay, BAMB Project Coordinator,
Brussels Environment**





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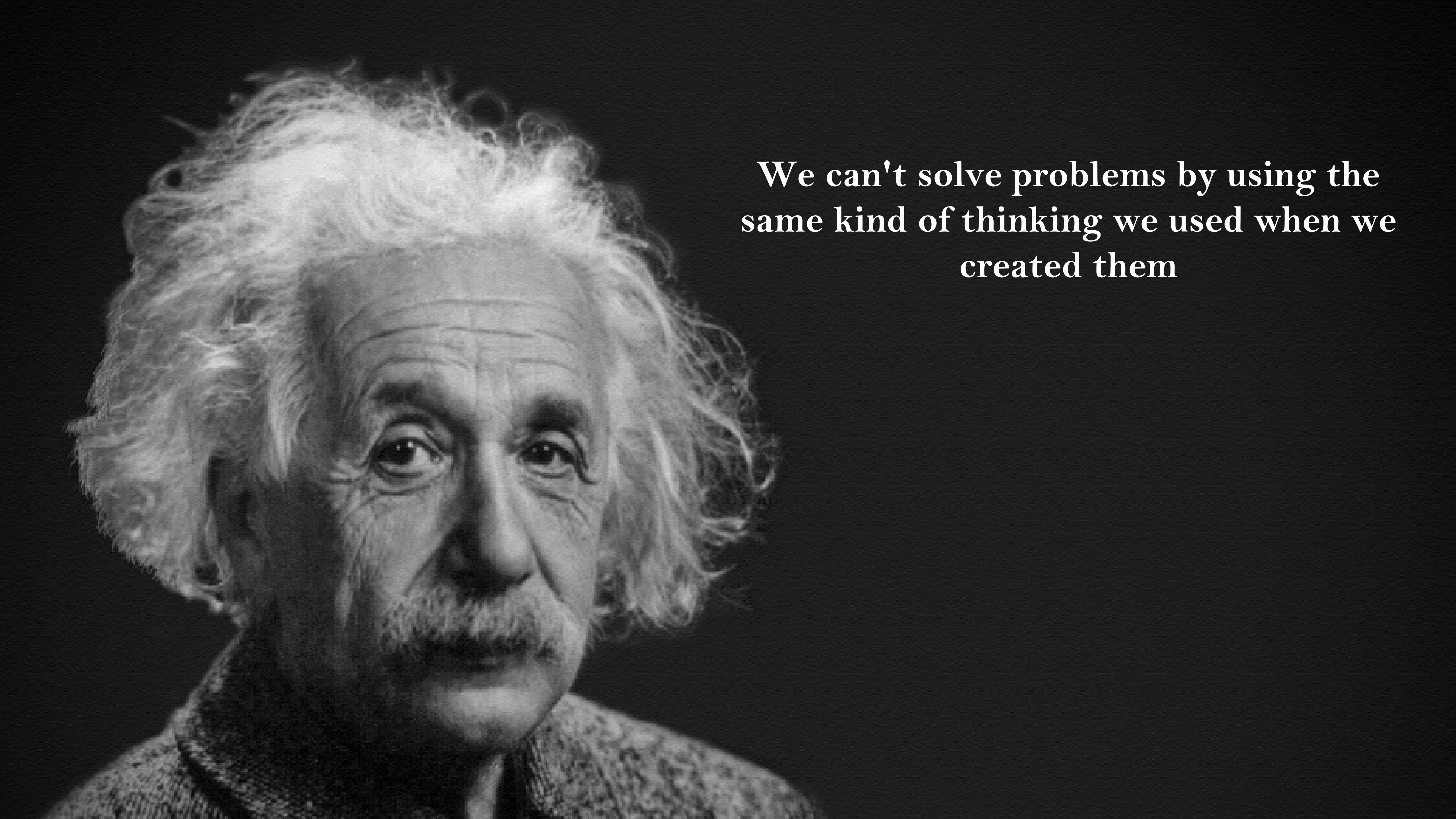
BUILDINGS AS MATERIALS BANKS

The influence of BAMB in shaping circularity
the construction industry

Caroline Henrotay - Brussels Environment





A black and white portrait of Albert Einstein, showing his characteristic wild, white hair and mustache. He is looking directly at the camera with a slight, thoughtful expression. The background is dark and out of focus.

**We can't solve problems by using the
same kind of thinking we used when we
created them**





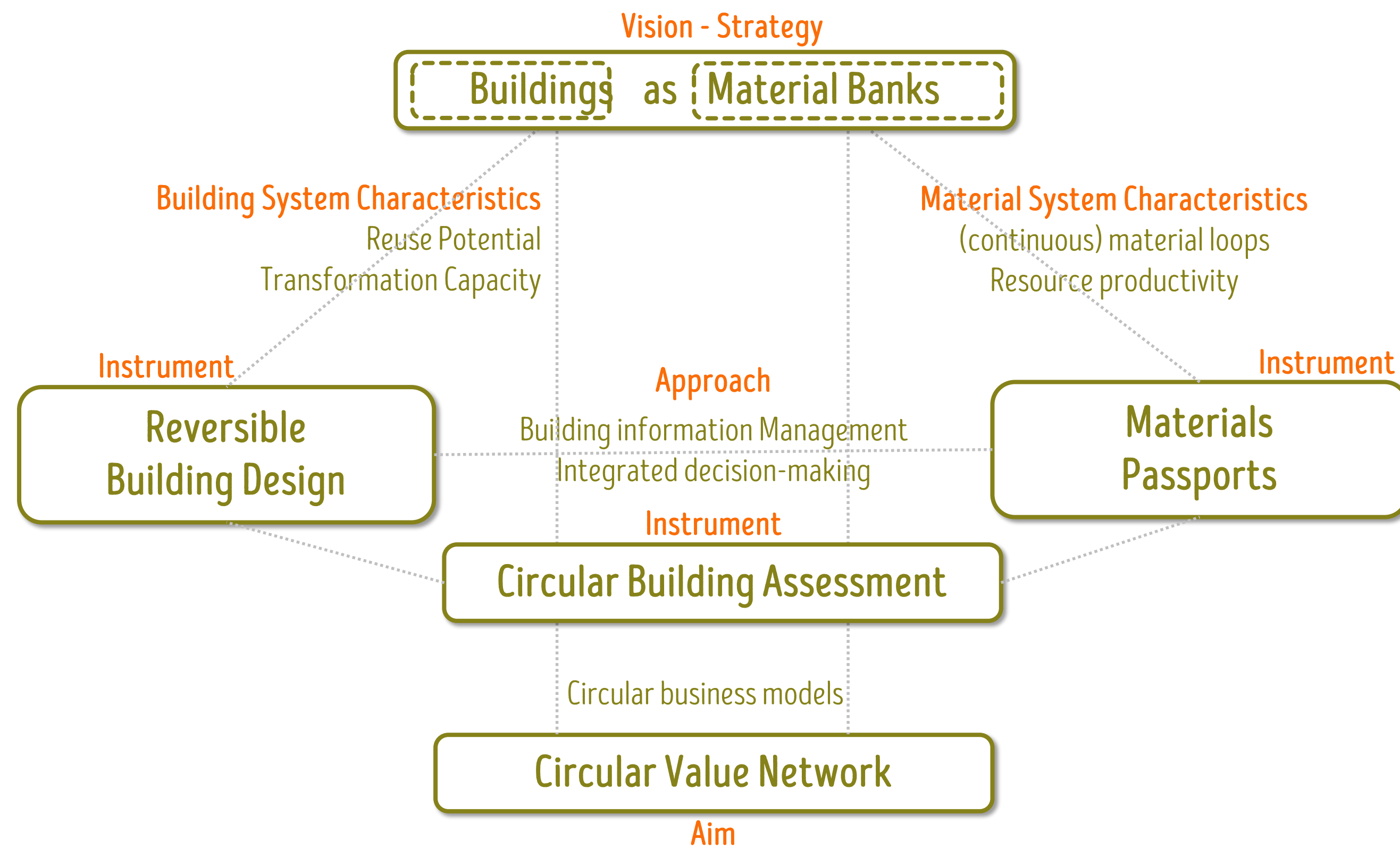


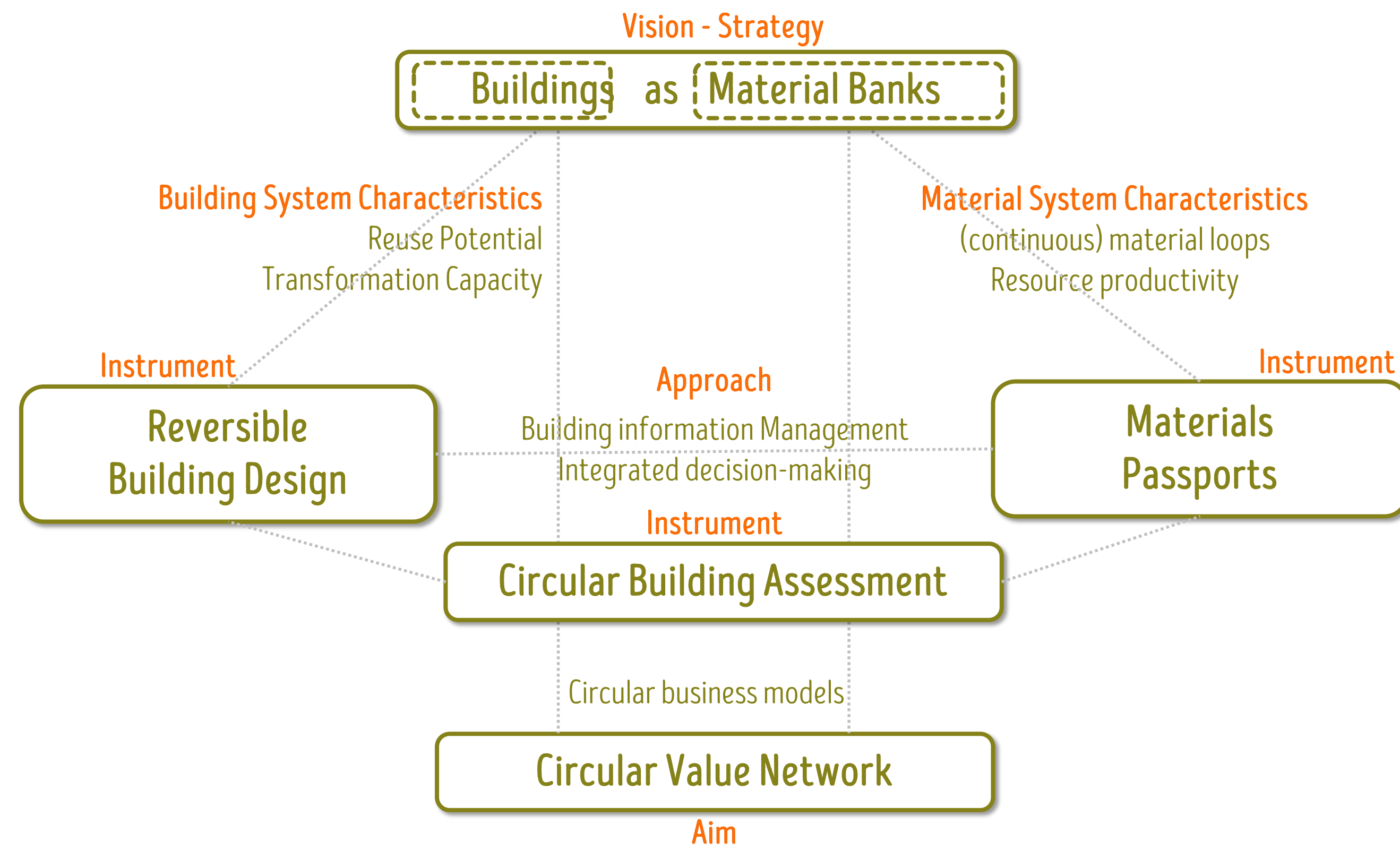
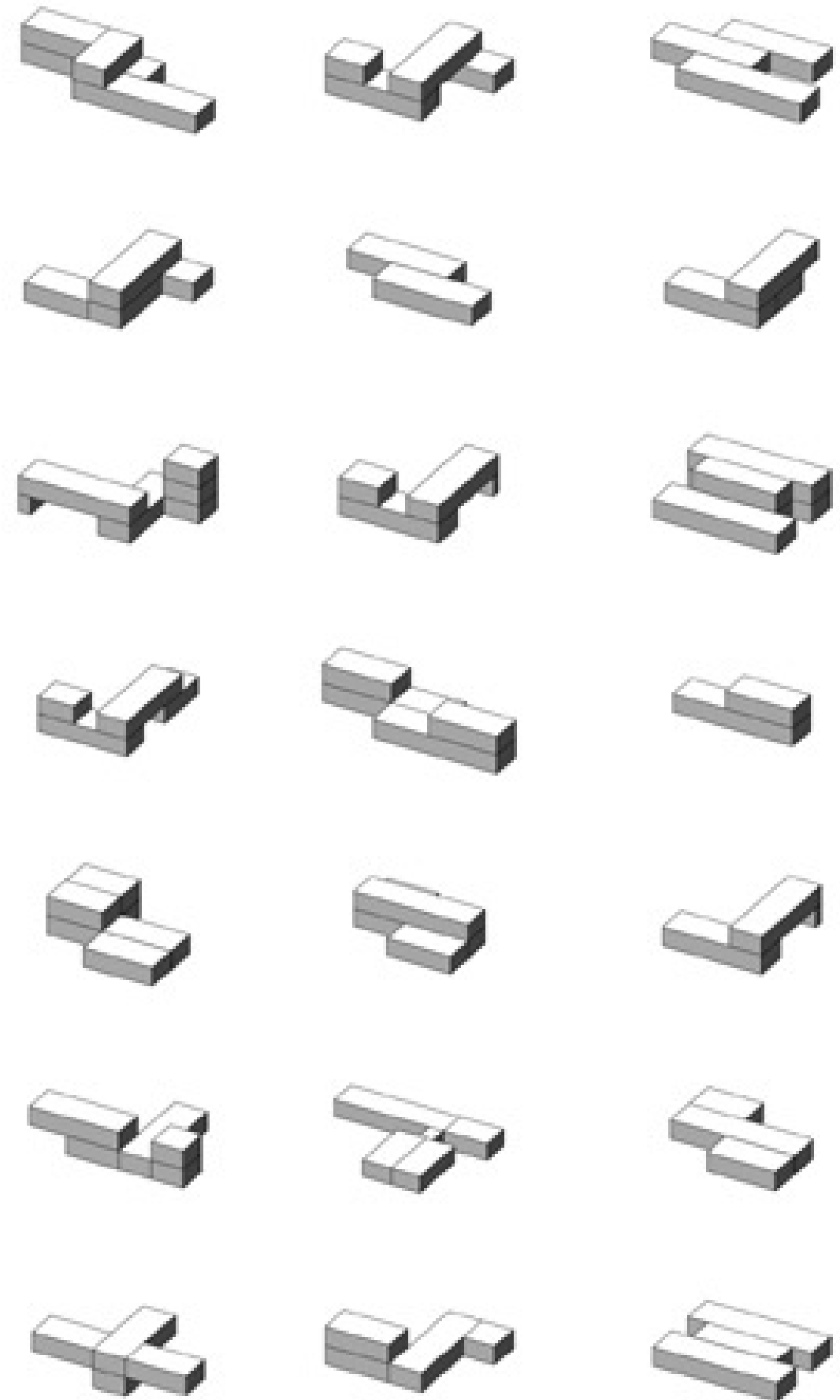
Solution 1

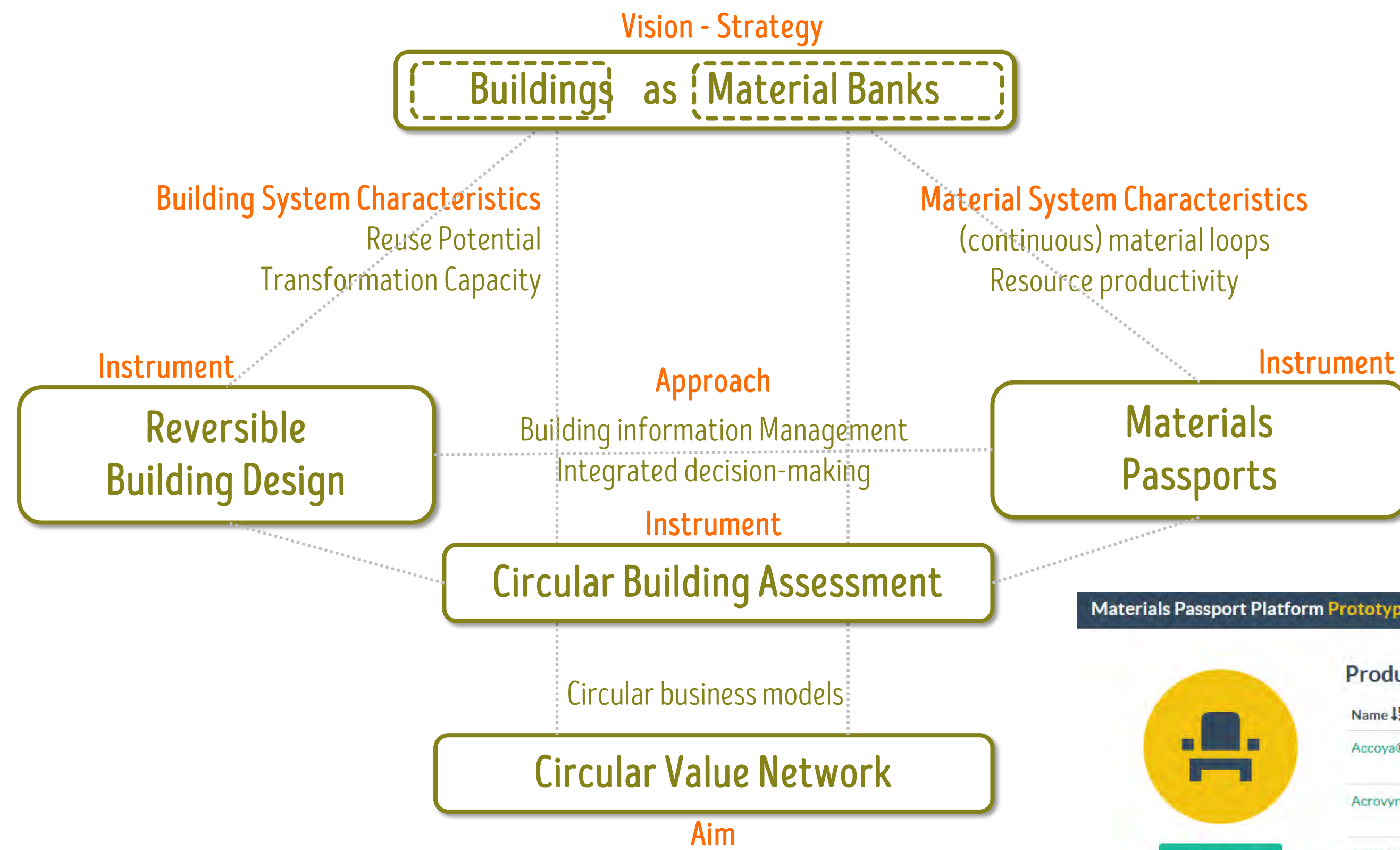
Solution 2

Solution 3









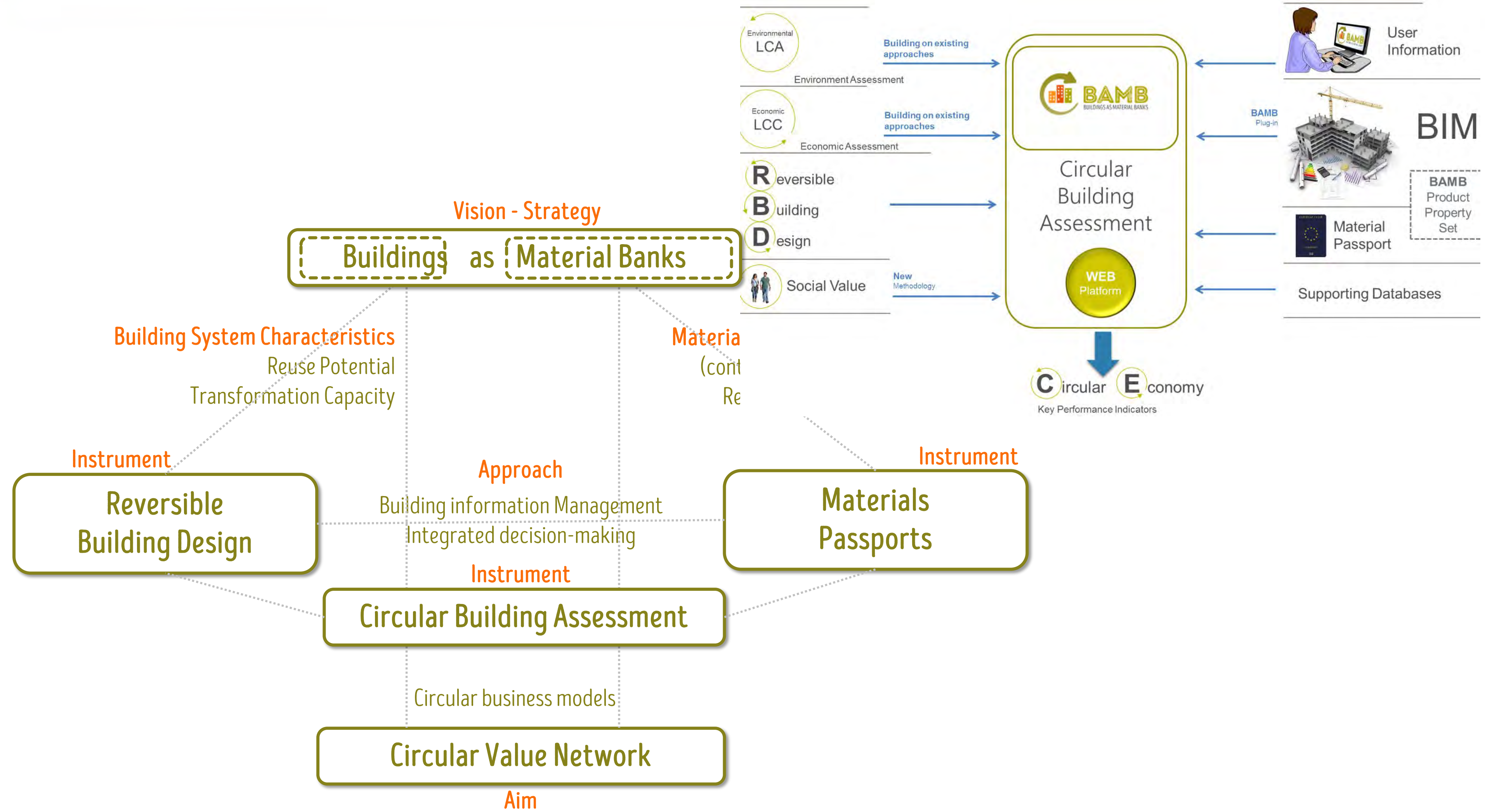
Materials Passport Platform **Prototype**

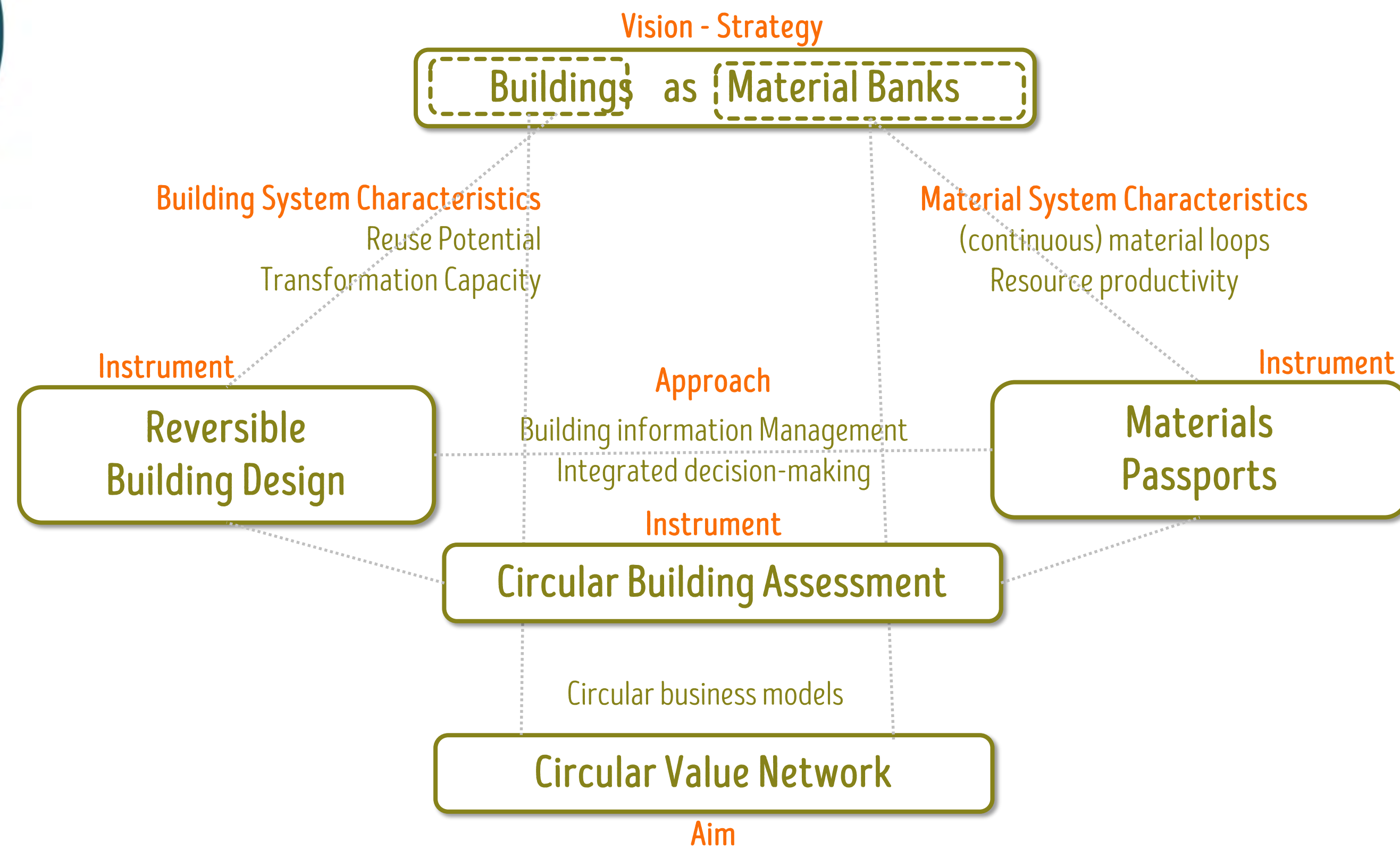
Products Buildings Instances ? Logout

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Name	Brand Name	Manufacturer	GTIN/EAN
Accoya® Wood	Accsys Technologies	Accsys Technologies	Unknown
Acrovyn® 4000 Wall Protection	Acrovyn® 4000	Construction Specialties Inc.	Unknown
airmaster	Desso	Desso	Unknown
Aluminium Door Furniture	AMI BV	AMI	Unknown

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MEER BOUWEN MET HET
CIRCULAR RETROFIT LAB

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CIRCULAR ECONOMY

CIRCULAR ECONOMY PROGRAMME

CIRCULAR CITIES

CIRCULAR HOTSPOT

CIRCULAR BY DESIGN

CIRCULAR BUILDINGS

CIRCULAR ECONOMY STRATEGY

CIRCULAR MATERIALS

CIRCULAR ECONOMY ROADMAP

CIRCULAR ECONOMY PACKAGE







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THANK YOU

chenrotay@environnement.brussels

Caroline Henrotay - Brussels Environment



Opening keynote - 'The Secret Life of Buildings'

James Drinkwater, Director of World GBC's Europe Regional Network





'The Secret Life of Buildings'

BAMB Final Event - 5 February - Brussels

James Drinkwater
Director, Europe, WorldGBC





“Although organ transplantation is today merely a clinical curiosity, it may one day have a certain practical interest”.

Dr Alexis Carel, 1902

SUSTAINABLE DEVELOPMENT GOALS



Green buildings can improve people's health & wellbeing

Green buildings can use renewable energy, becoming cheaper to run

Building green infrastructure creates jobs & boosts the economy

Green building design can spur innovation & contribute to climate resilient infrastructure

Green buildings are the fabric of sustainable communities & cities

Green buildings use 'circular' principles, where resources aren't wasted

Green buildings produce fewer emissions, helping to combat climate change

Green buildings can improve biodiversity, save water resources & help to protect forests

Through building green we create strong, global partnerships

3 GOOD HEALTH AND WELL-BEING



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



15 LIFE ON LAND



17 PARTNERSHIPS FOR THE GOALS



Construction/buildings account for:

- $\frac{1}{2}$ of all extracted materials
- $\frac{1}{2}$ of all energy consumption
- $\frac{1}{3}$ of all water consumption
- $\frac{1}{3}$ of all waste

in the EU

90%

THE BUILT ENVIRONMENT BIG IMPACTS, GETTING BIGGER

 **EUROPE**
BUILT ENVIRONMENT



 **CHINA**
BUILT ENVIRONMENT





DECARBONIZE

Advancing Net Zero



WorldGBC definition:
A net zero carbon building is highly energy efficient with all remaining energy from on-site and/or off-site renewable sources

100% of buildings must operate at net zero carbon

2050

2030

All new buildings must operate at net zero carbon

GOVERNMENT ENGAGEMENT

TRAINING & EDUCATION

CORPORATE ENGAGEMENT

CERTIFICATION

FROM THOUSANDS TO BILLIONS



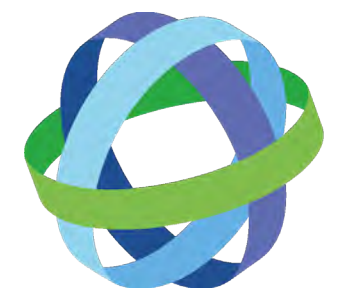
Coordinated Action towards 100% Net Zero Carbon Buildings By 2050



The Net Zero Carbon Buildings Commitment



ADVANCING
NET ZERO



WORLD
GREEN
BUILDING
COUNCIL



Globally the challenge is now to accelerate the debate around carbon emissions across the *full life cycle*



THE EMBODIED CARBON REVIEW

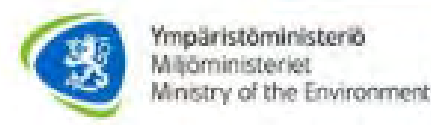
EMBODIED CARBON REDUCTION IN 100+
REGULATIONS & RATING SYSTEMS GLOBALLY

DOWNLOAD THE FREE STUDY

STATUS QUO,
SUCCESS
CASES, BEST
PRACTICES
AND OUTLOOK
FOR EMBODIED
CARBON
REDUCTION IN
CONSTRUCTION

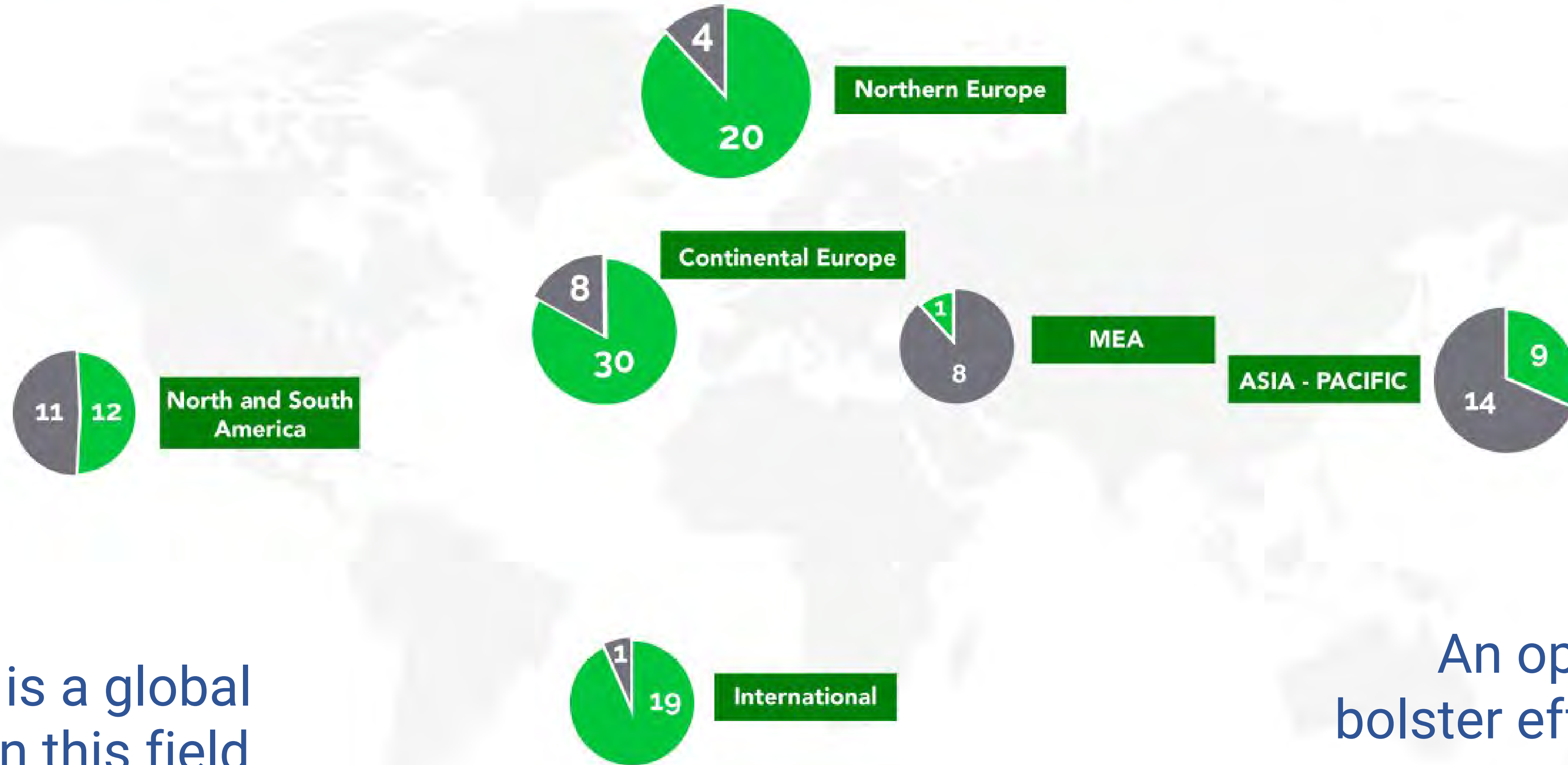
Global embodied carbon emissions from new buildings alone will exceed **100 gigatons** by 2060 if unchecked, rising to over **230 gigatons** if all renovation activity and infrastructure construction are included.

With the generous support of:



PREVALENCE OF EMODIED CARBON IN GREEN CONSTRUCTION SYSTEMS

Scope: multi-criteria building & infrastructure certifications & carbon only regulations



Europe is a global leader in this field

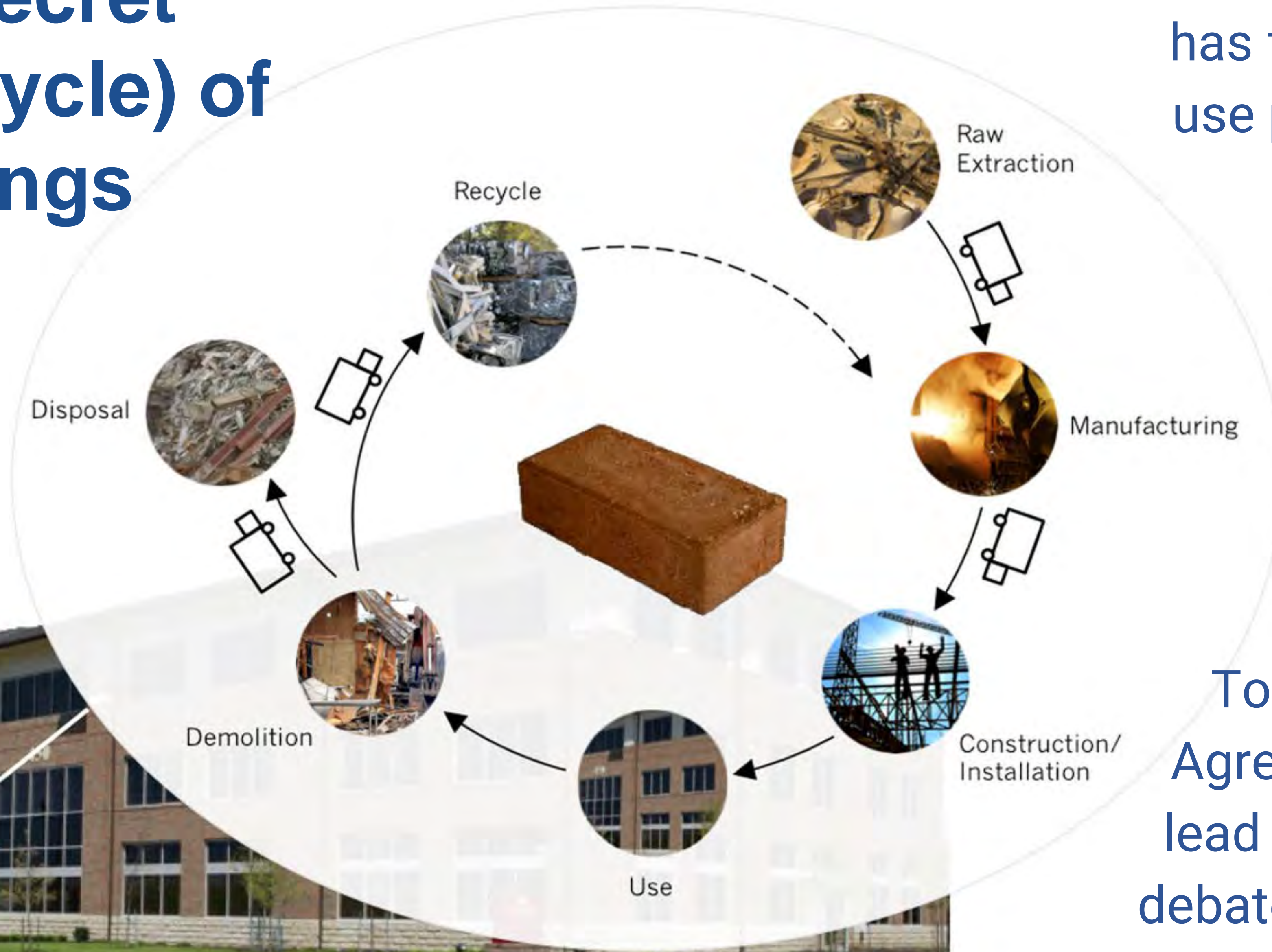
An opportunity to bolster efficiency and competitiveness

Source: Bionova

■ Embodied carbon in scope

■ Embodied carbon not in scope

The Secret Life(Cycle) of Buildings

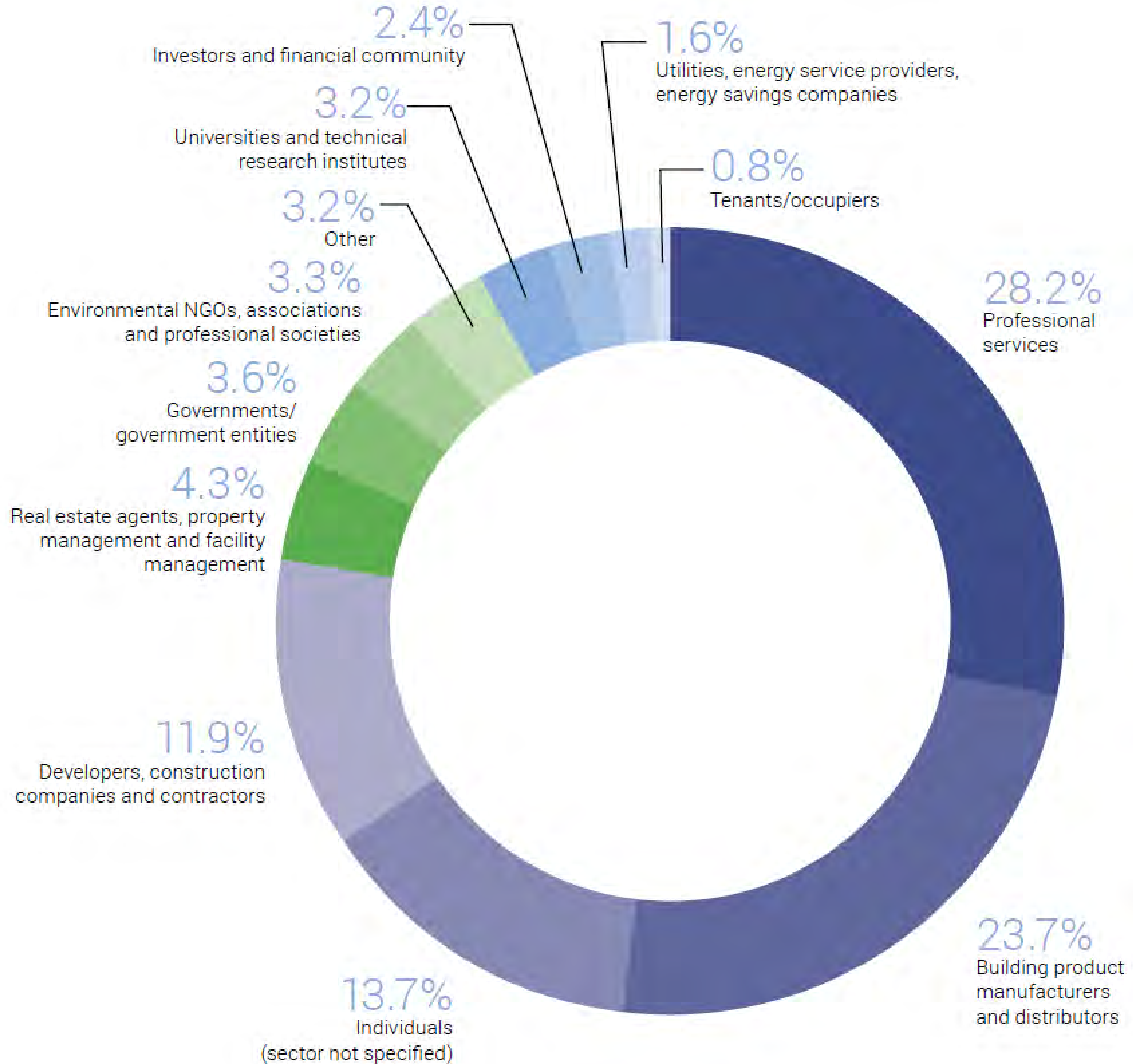


To date EU buildings policy has focused on tackling use phase / operational emissions.

To achieve the Paris Agreement the EU must lead a shift in the global debate towards the *full life cycle*.

The added complexity of our value chain

Many different perspectives, drivers, metrics, data tools...





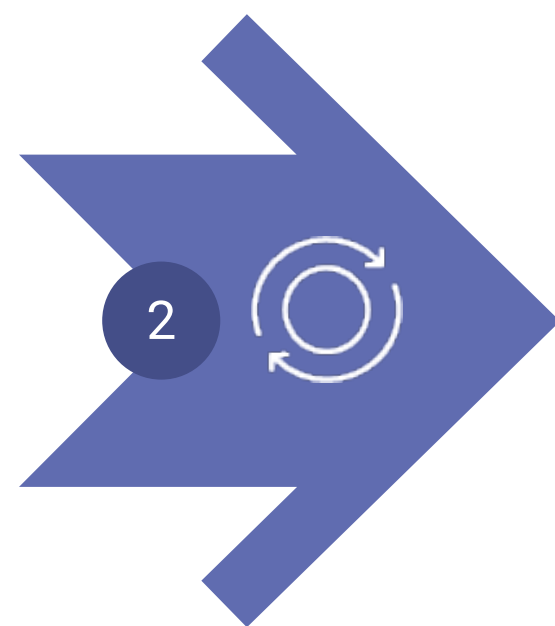
Level(s)

Building sustainability performance

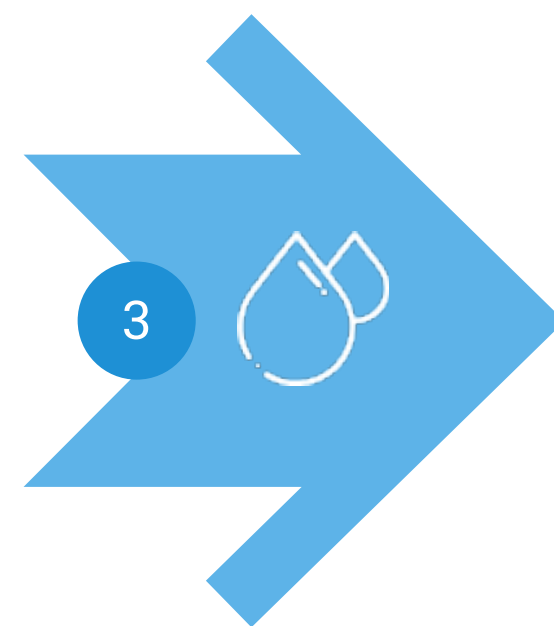
Level(s): Shifting the Debate To Life Cycle and Circular Thinking



1
GHG
Emissions



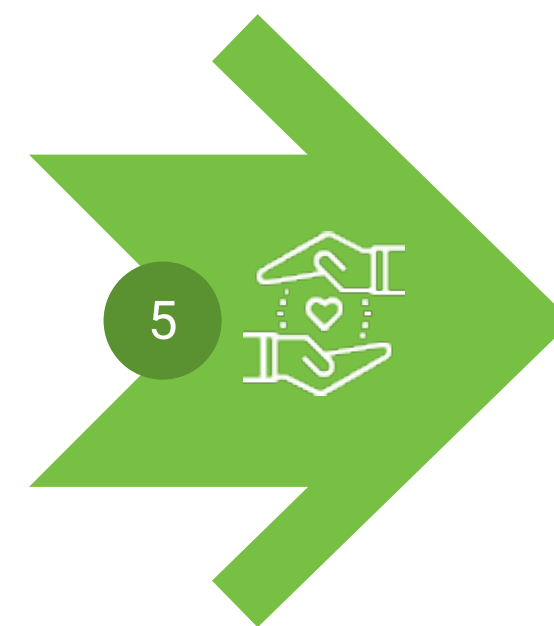
2
Resource
Efficiency &
Circularity



3
Water
Efficiency



4
Adaptation
& Resilience



5
Health &
Wellbeing



6
Value &
Cost

We need a **common language** across the **whole value chain**

... focused on **performance** across the **full life cycle**

... that provides **robust** and **comparable data** to enable decisions

Level(s) can be the foundations of future building sector policy in the EU, and help establish a *world leading* approach to circular and life cycle thinking







Yes I donate
ORGAN DONATION

EUROPE REGIONAL NETWORK



WORLD GREEN BUILDING COUNCIL

europa@worldgbc.org
www.worldgbc.org

ASSA ABLOY

 **BASF**
We create chemistry

e-on

KNAUF INSULATION


SAINT-GOBAIN

SKANSKA


storaenso

 **United Technologies**

HOW - The BAMB tools and findings
lay the foundation for a pathway
towards a circular future





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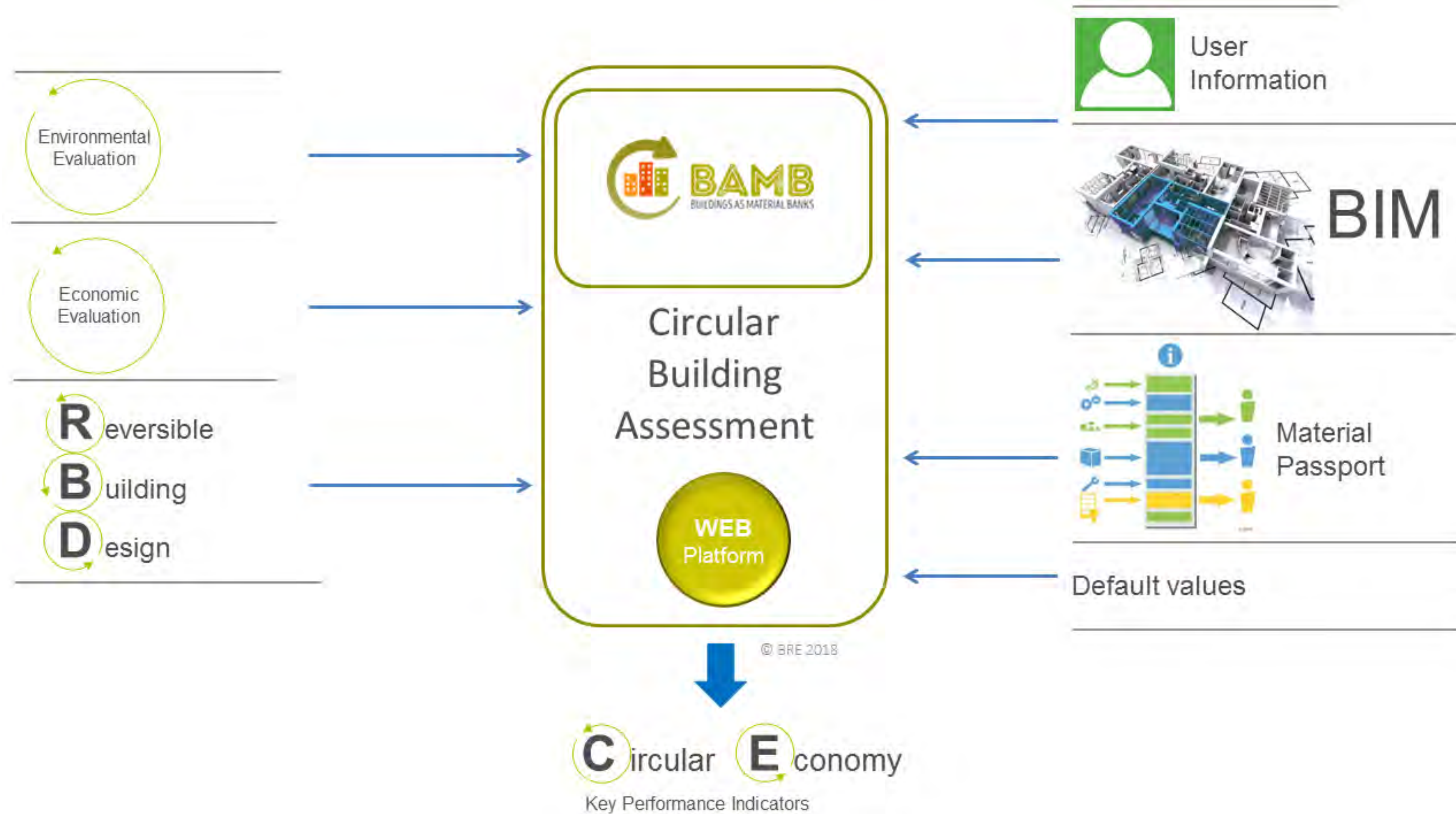
MAKING THE RIGHT DECISION FOR CIRCULARITY

BRE & SundaHus workshop

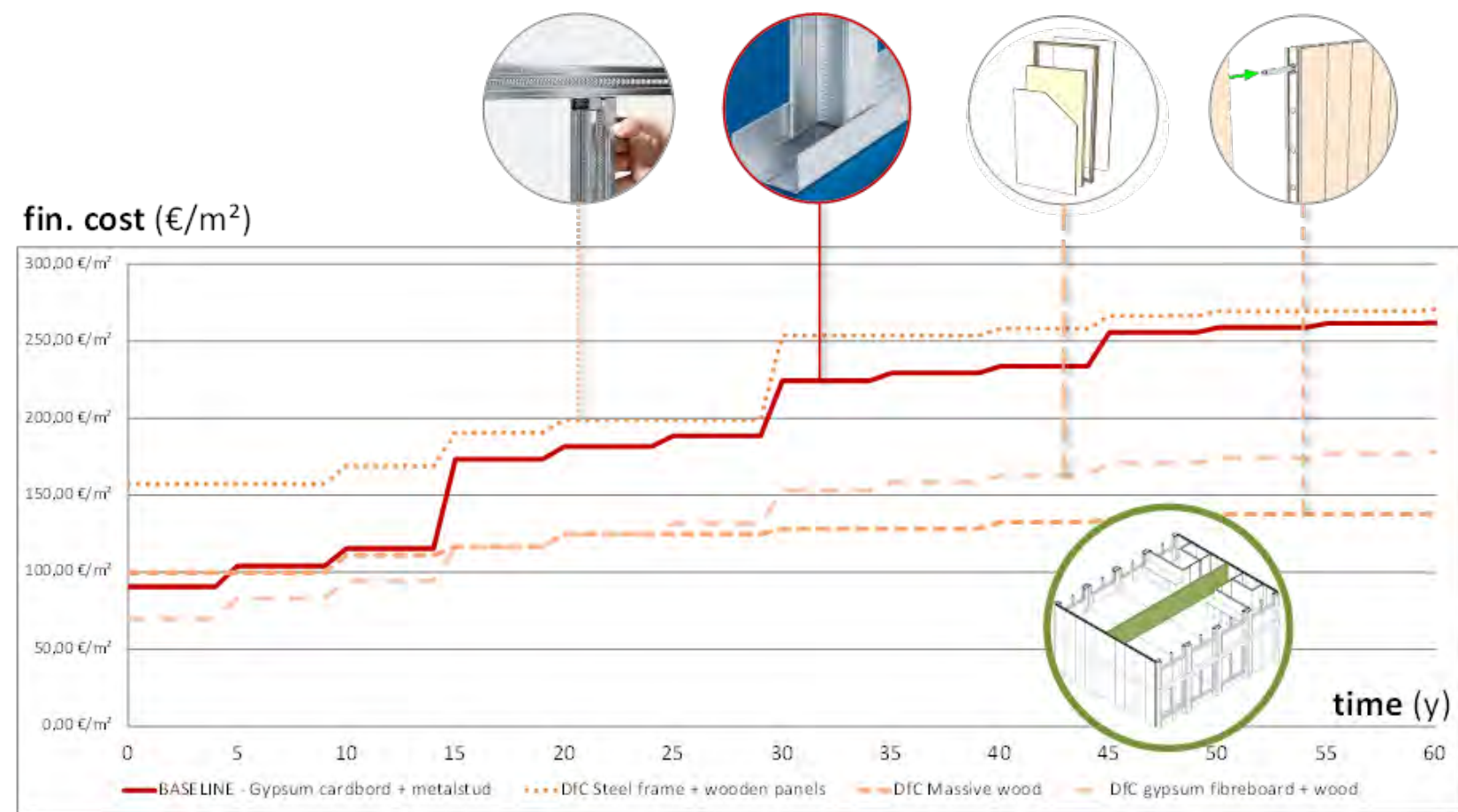
Gilli Hobbs | BRE



CIRCULAR BUILDING ASSESSMENT (CBA) - OVERVIEW



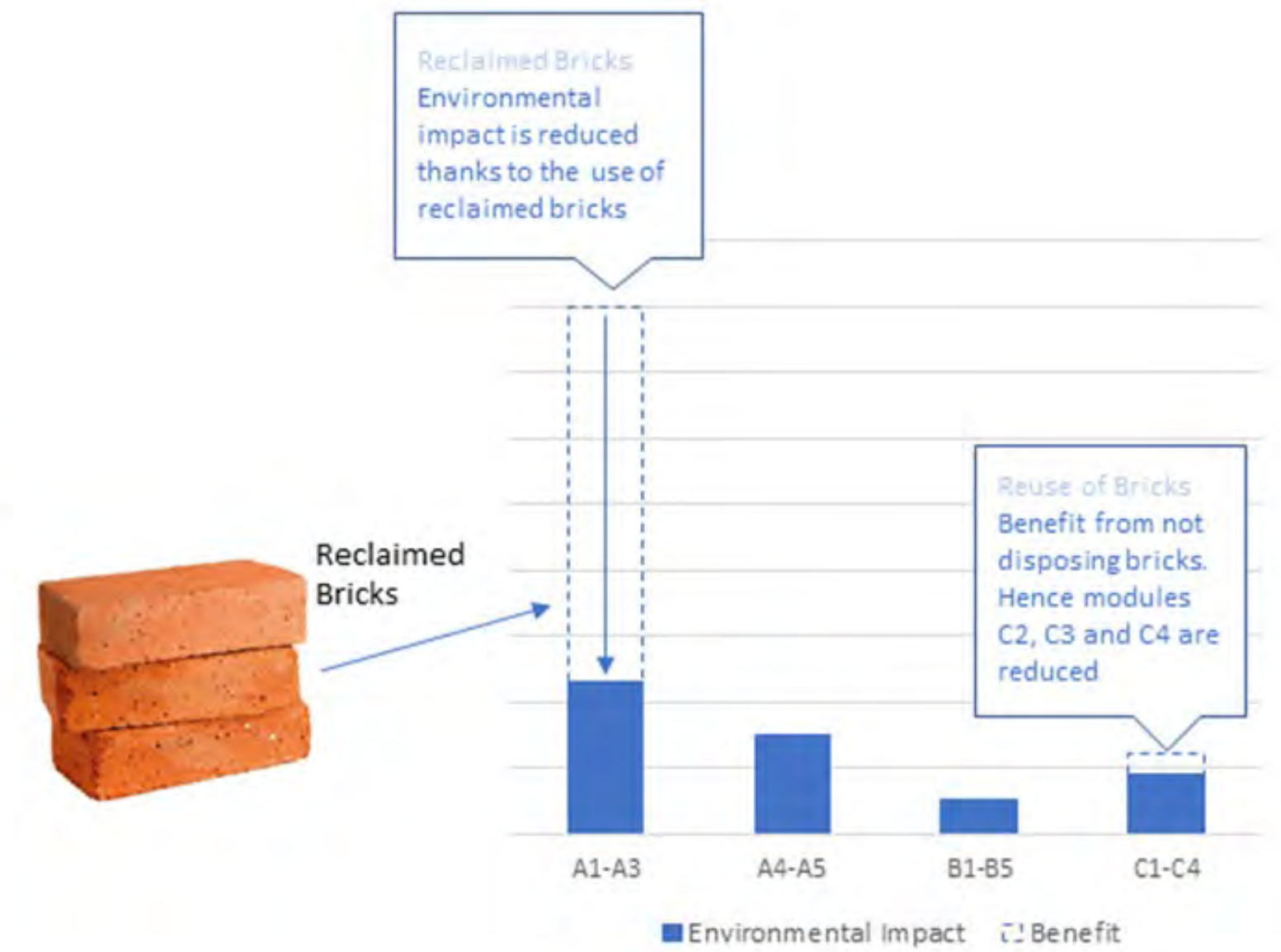
SUPPORT FOR DECISION MAKING



Economic



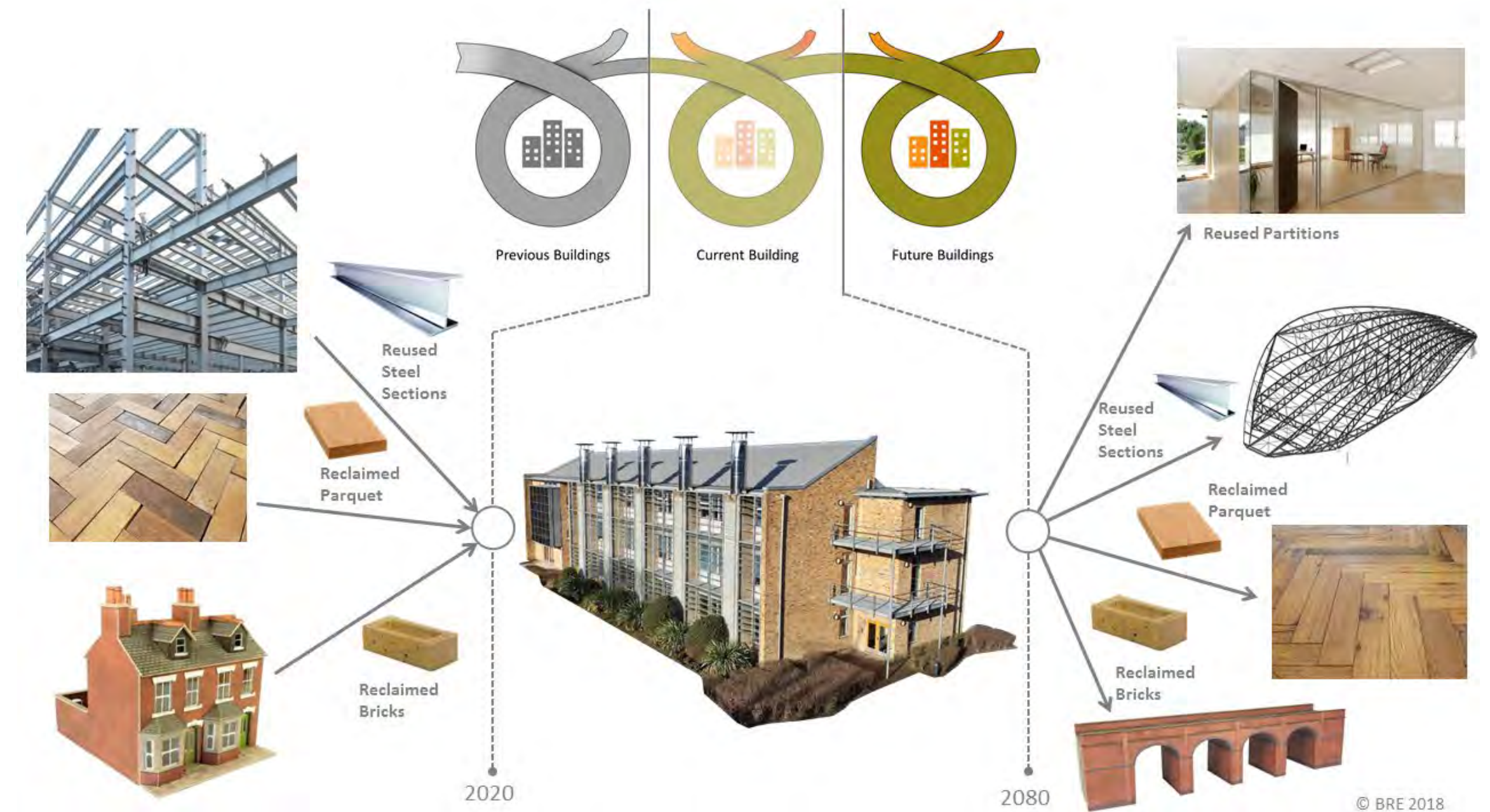
Social



Environmental

FIND OUT MORE & JOIN THE CONVERSATION...

- Client view - Heathrow Expansion
- Designer view - BRIC & BRE Env bdg
- New assessment methods
- BIM data integration
- CBA platform proof of concept
- User experience
- Further developments





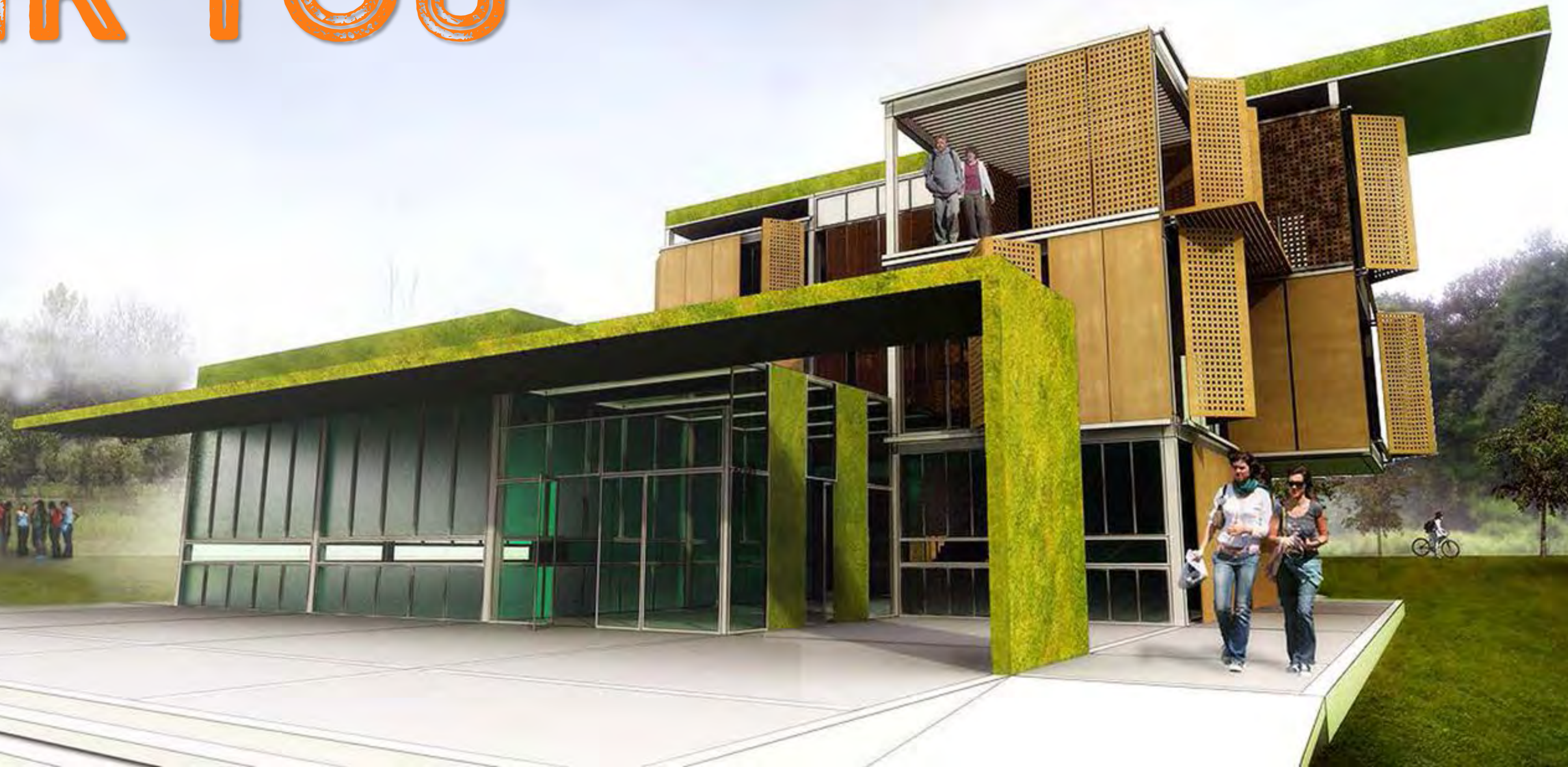
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Gilli.hobbs@bre.co.uk

Gilli Hobbs | BRE





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MATERIALS PASSPORTS

Making data on materials value for recovery
and reuse available

Lars Luscuere - EPEA

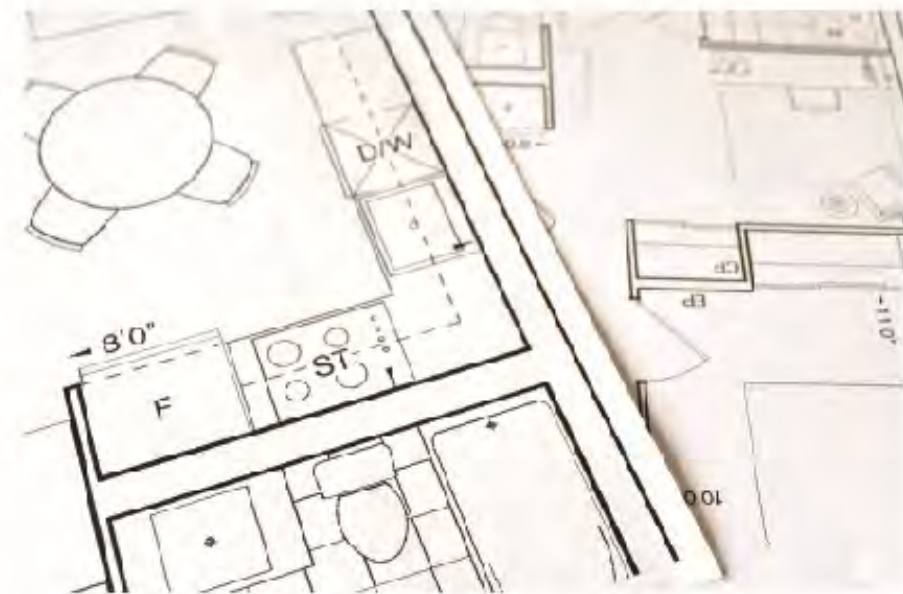




COMPANY
EPEA Nederland
PRODUCT
REMs
Reversible Experience Modules

Product features

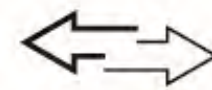
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- + Dolor sit amet
- + Consectetur adipiscing elit



MATERIAL HEALTH ASSESSED



REVERSE LOGISTICS IN PLACE



(PARTS) DESIGNED FOR BIOSPHERE



(PARTS) DESIGNED FOR TECHNOSPHERE



CONTAINS RENEWABLE CONTENT

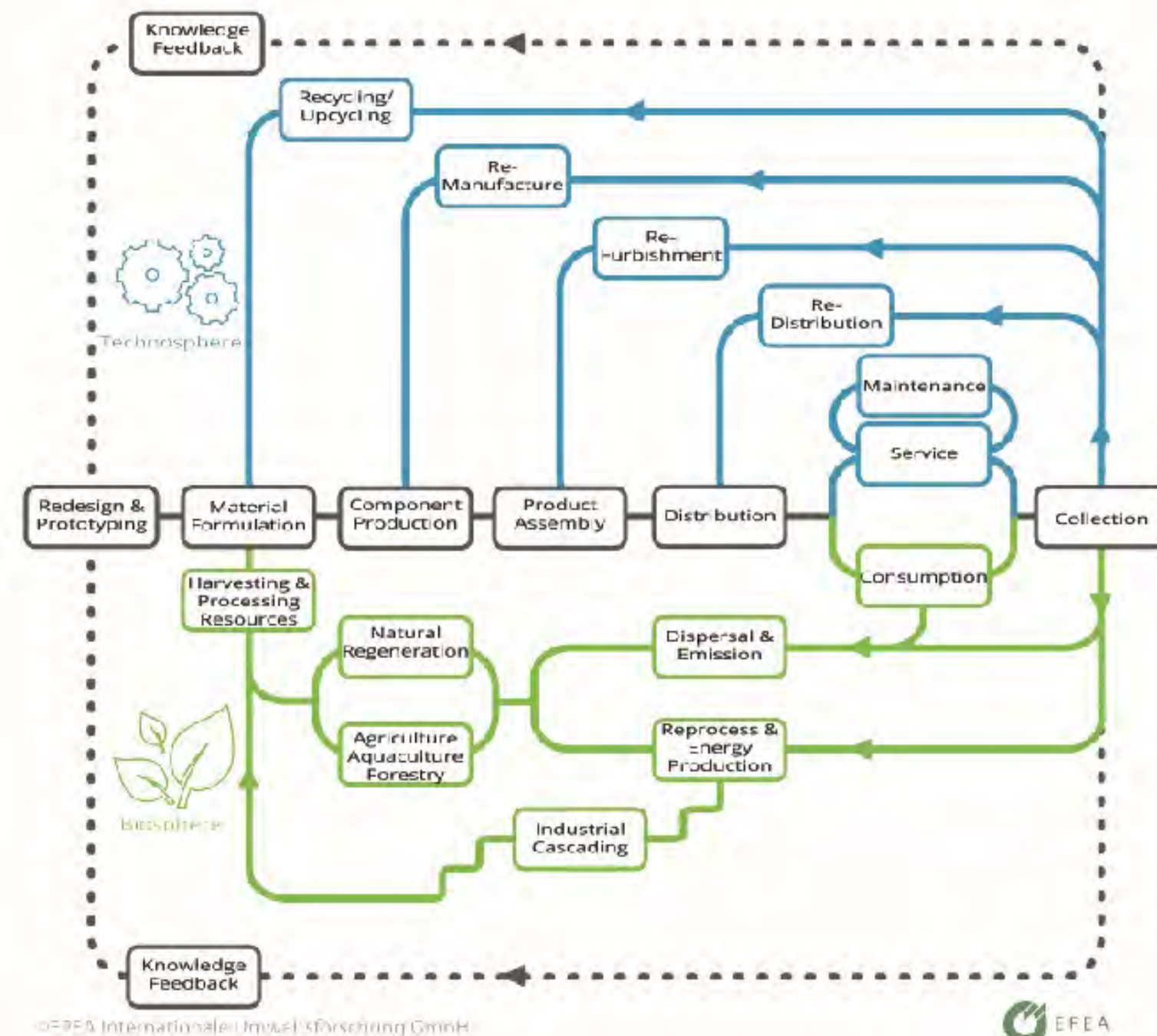


CONTAINS RECYCLED CONTENT



Reuse Potentials

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Product story

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Lars.Luscuere@epea.com

Lars Luscuere - EPEA





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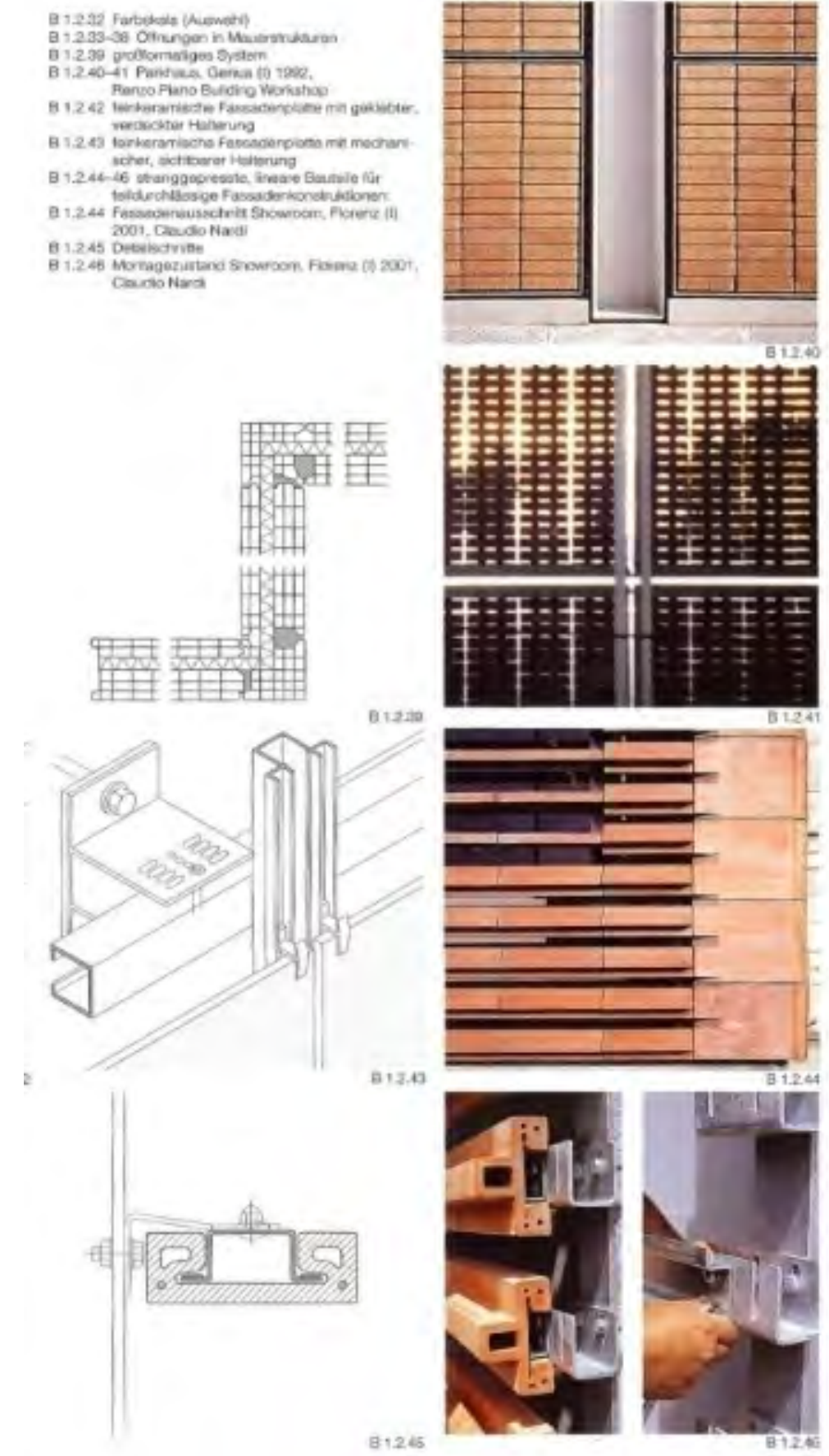
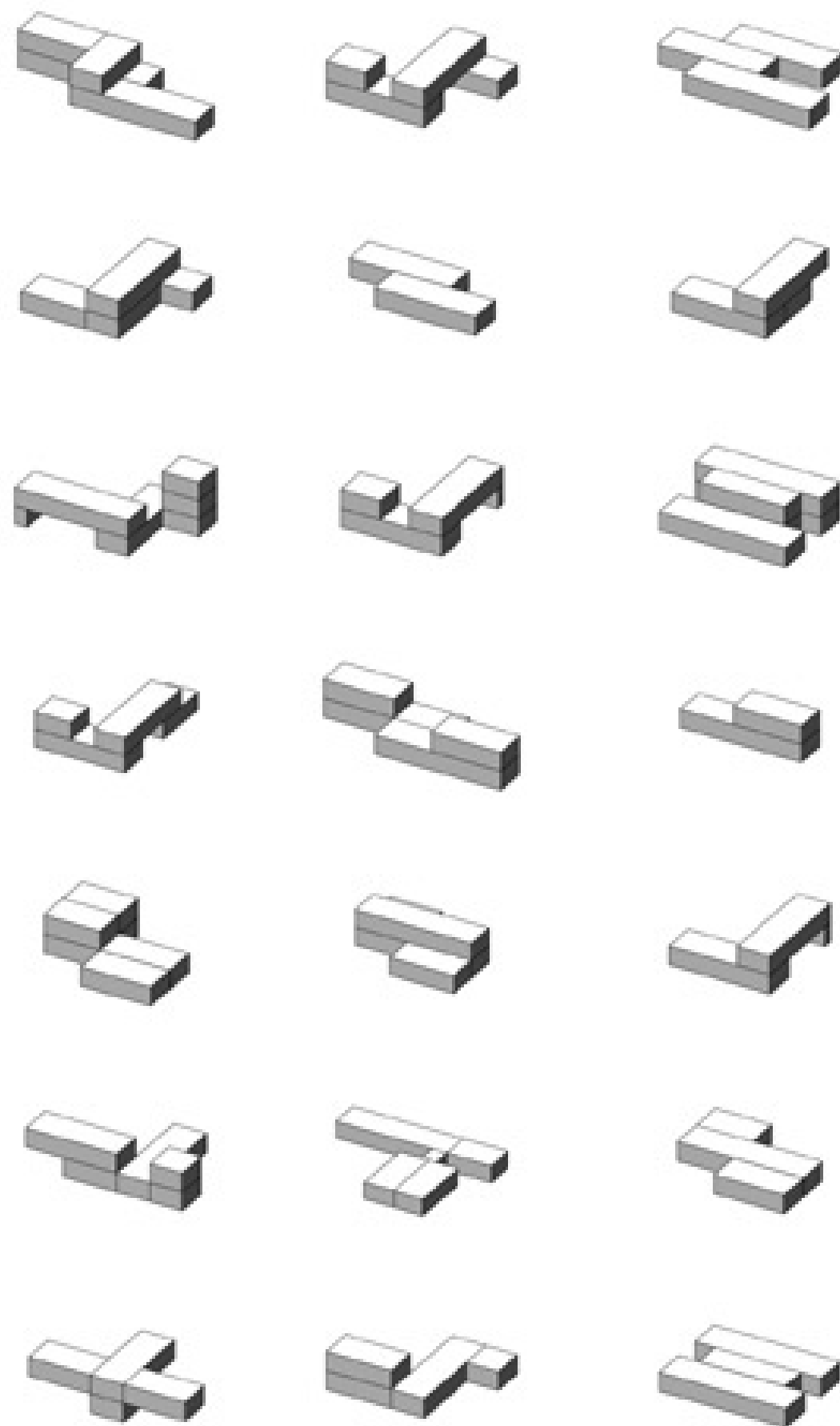
REVERSIBLE BUILDING DESIGN TOOLS AND PROTOCOLS

Opening the door to circular construction

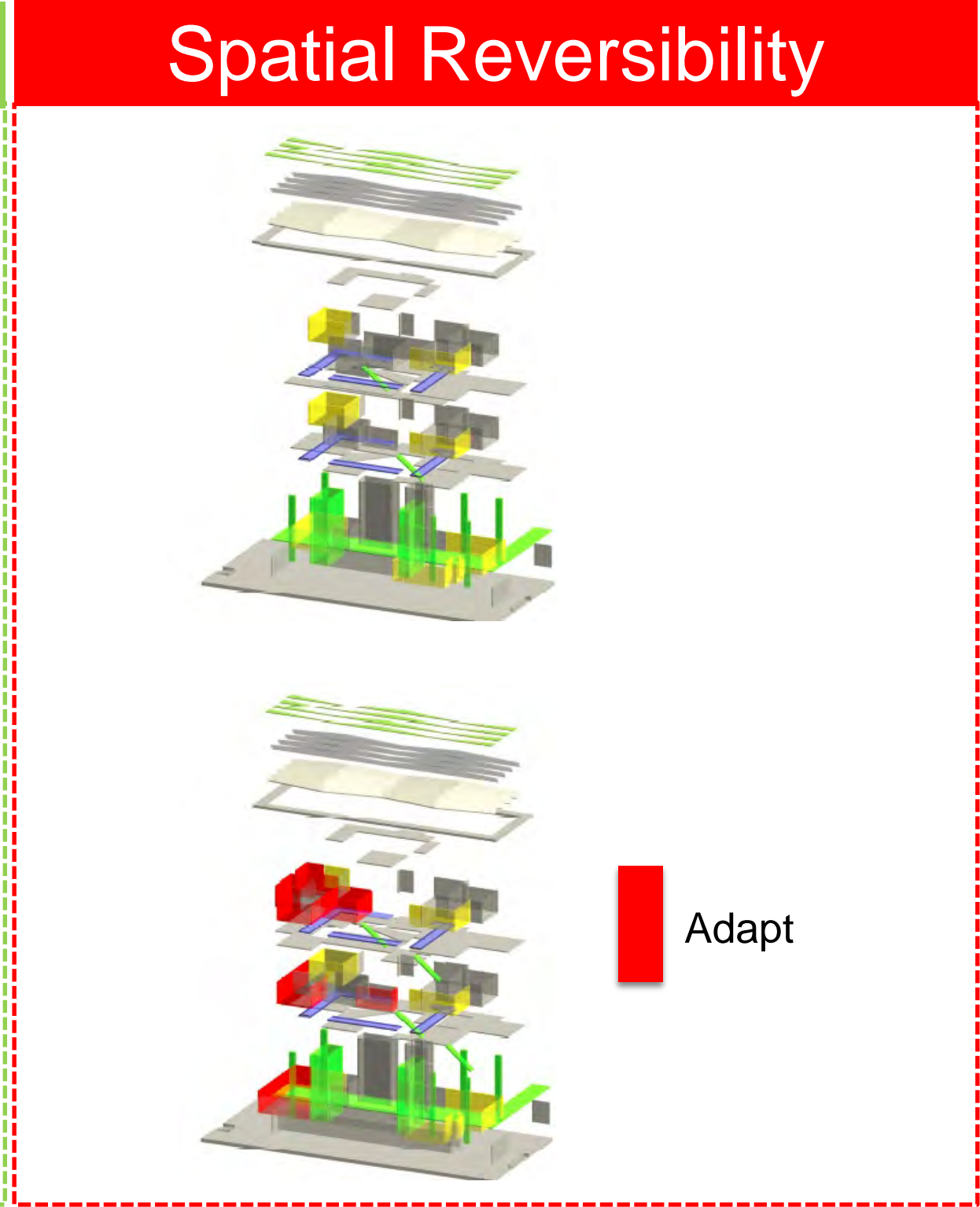
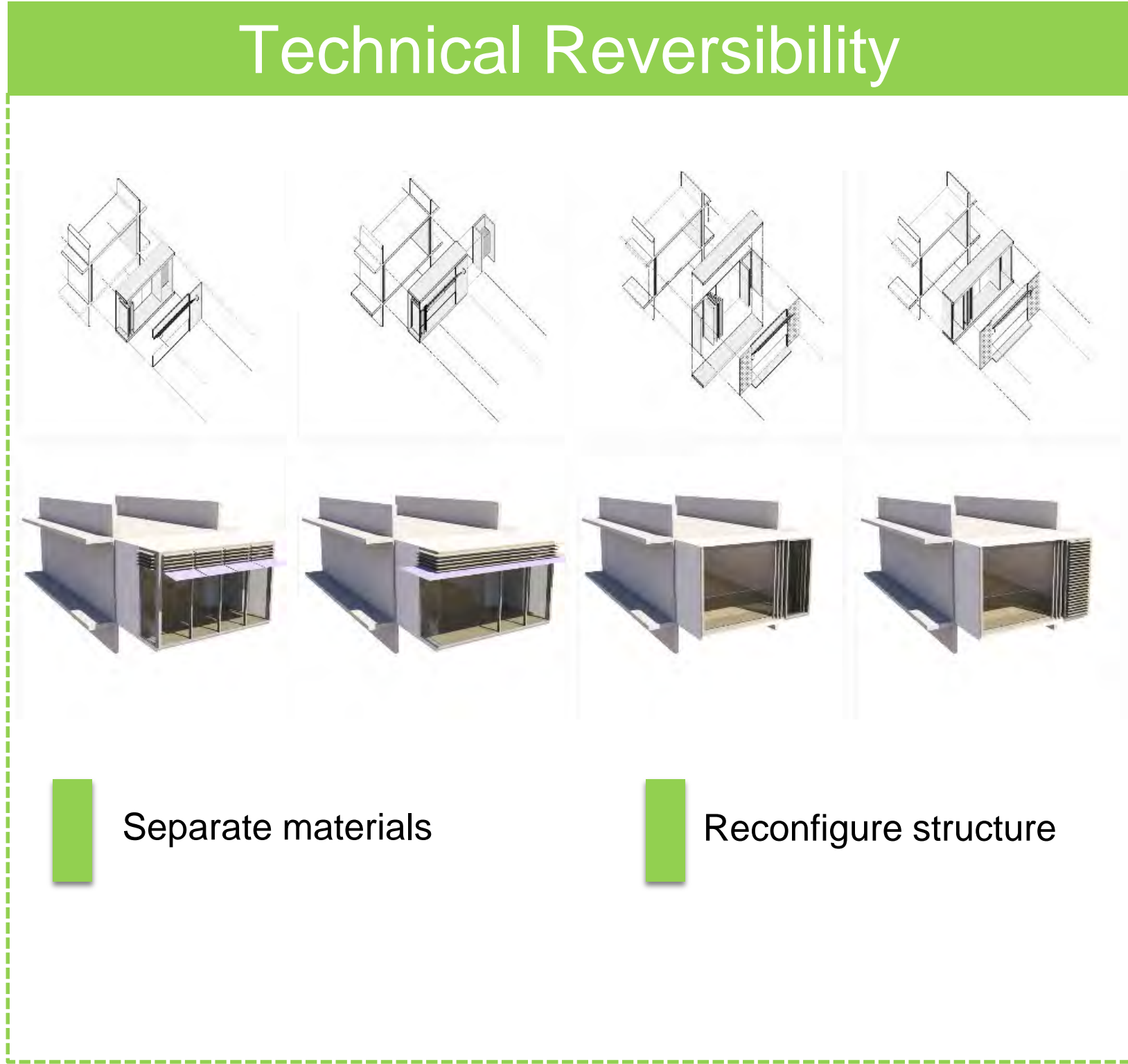
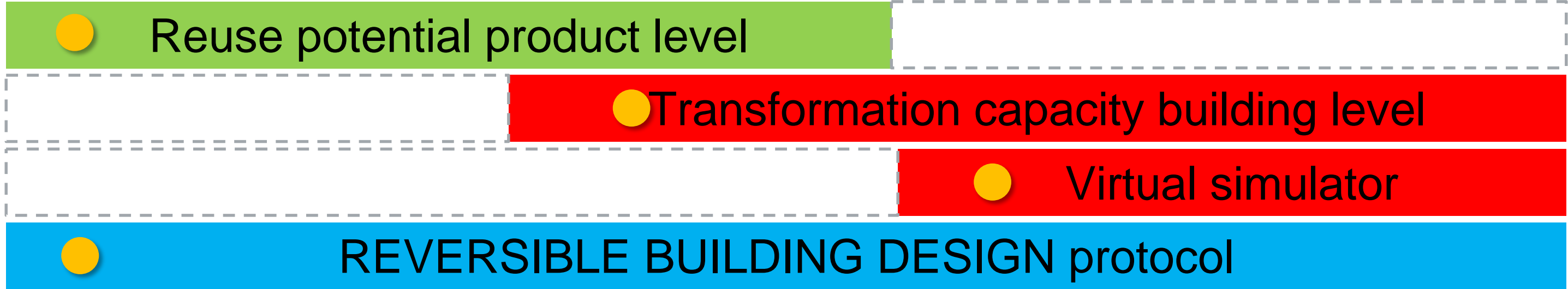
Dr. Elma Durmisevic, University of Twente, 4D architects



REVERSIBLE BUILDINGS



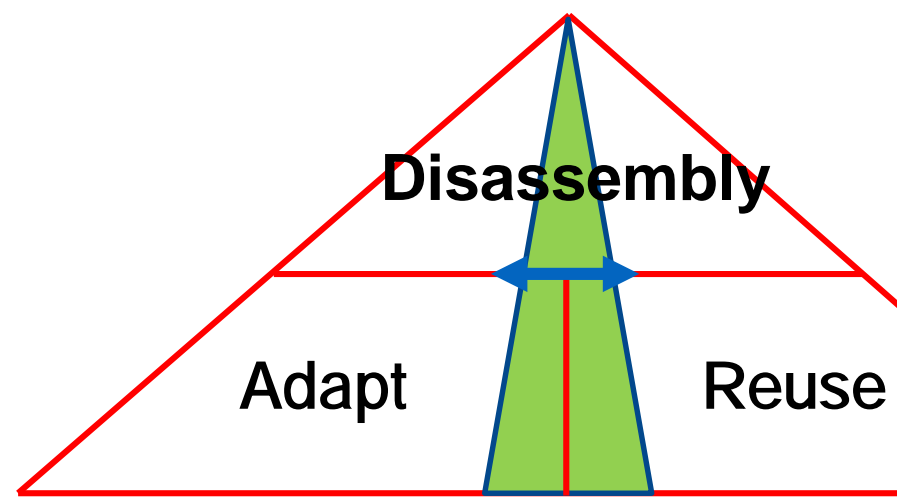
Reversible Building Design Toolkit



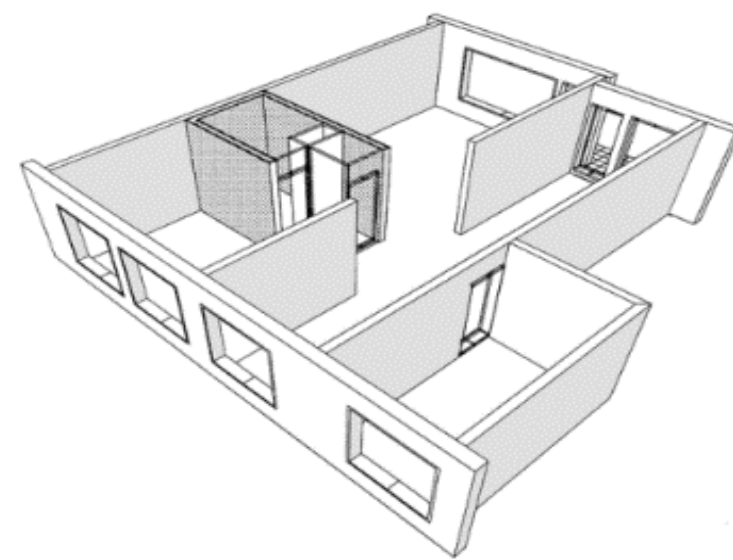
REVERSIBLE BUILDING DESIGN/FRAMEWORK

Reversible Building Reuse Potential

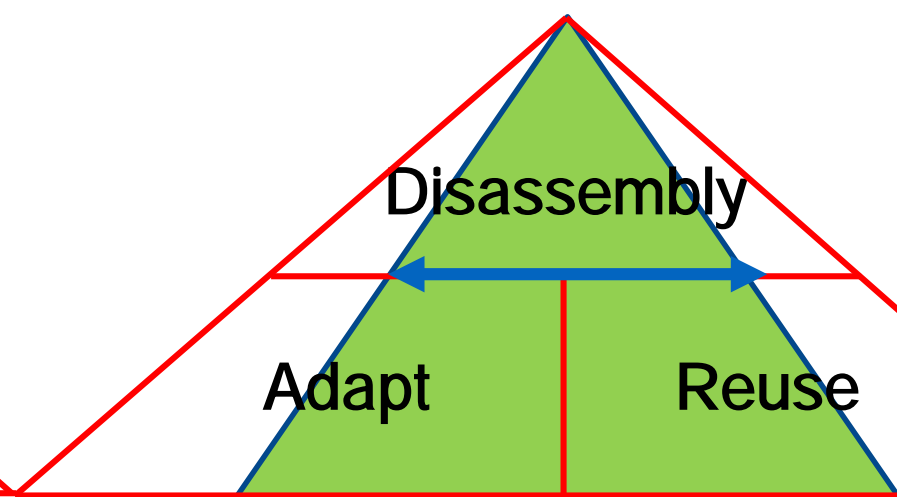
Low reversibility



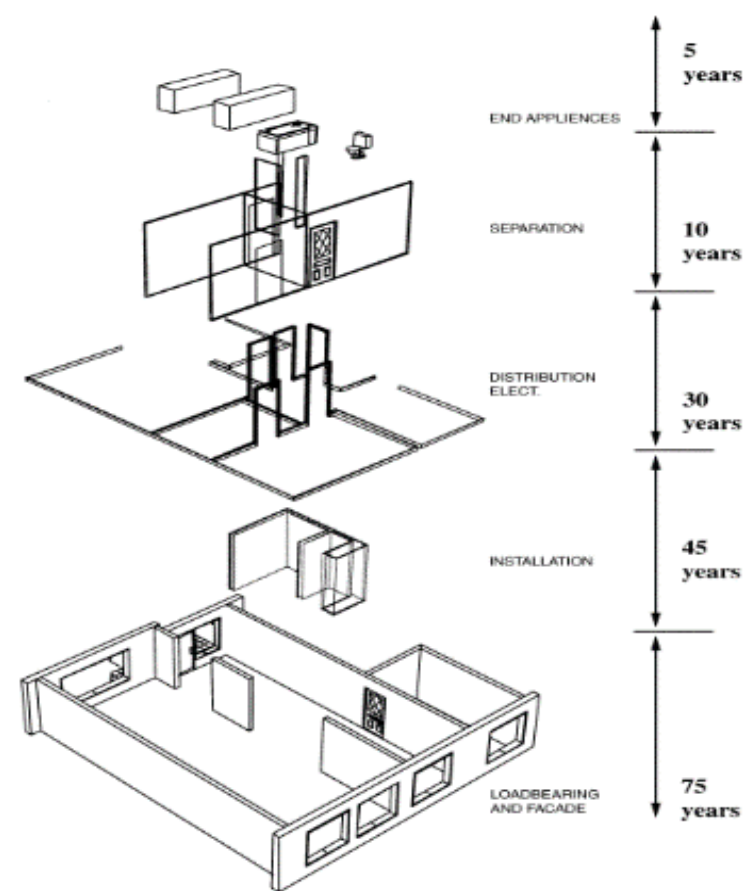
1 Irreversible structure



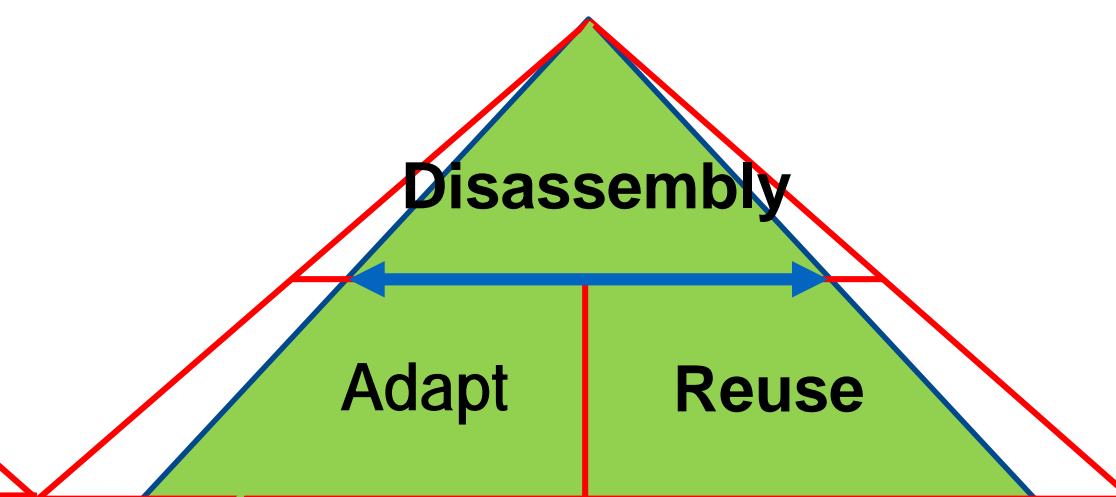
Medium reversibility



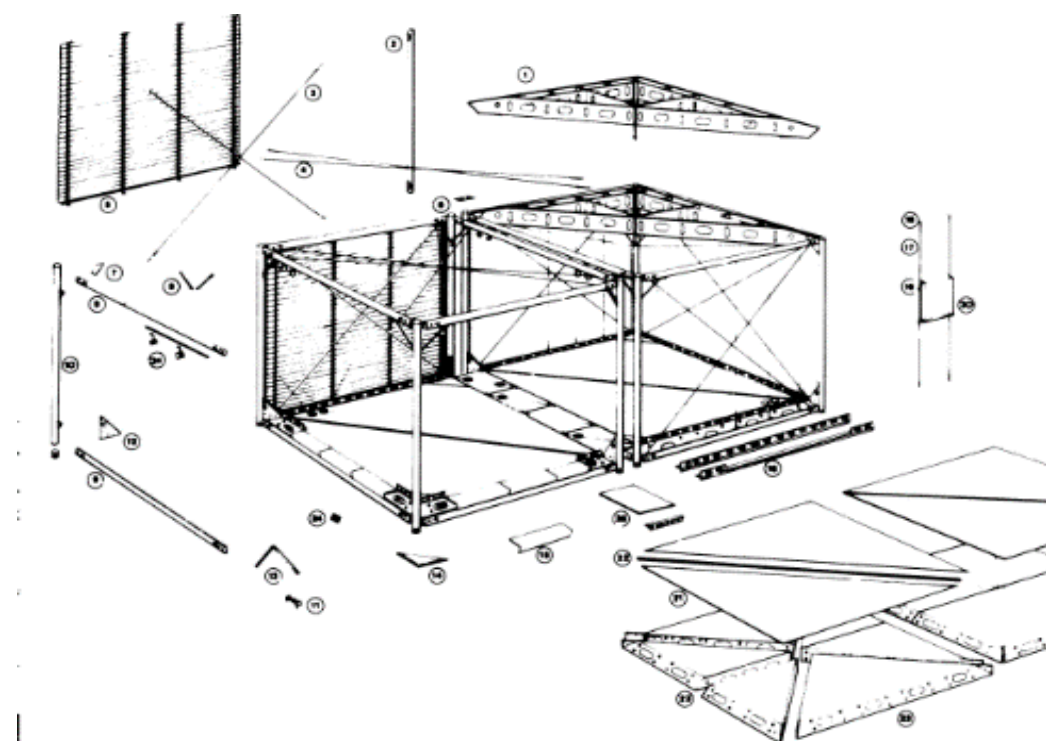
2 Partly reversible



High reversibility



3 Reversible structure



CATEGORIES OF REVERSIBLE STRUCTURES

in relation to the type of material composition:



- IREVERSIBLE**
 if RP indicates that a system has **RP < than 0,3** these systems will be characterised as irreversible and the end of life options = **RECYCLING/DOWN CYCLING**.

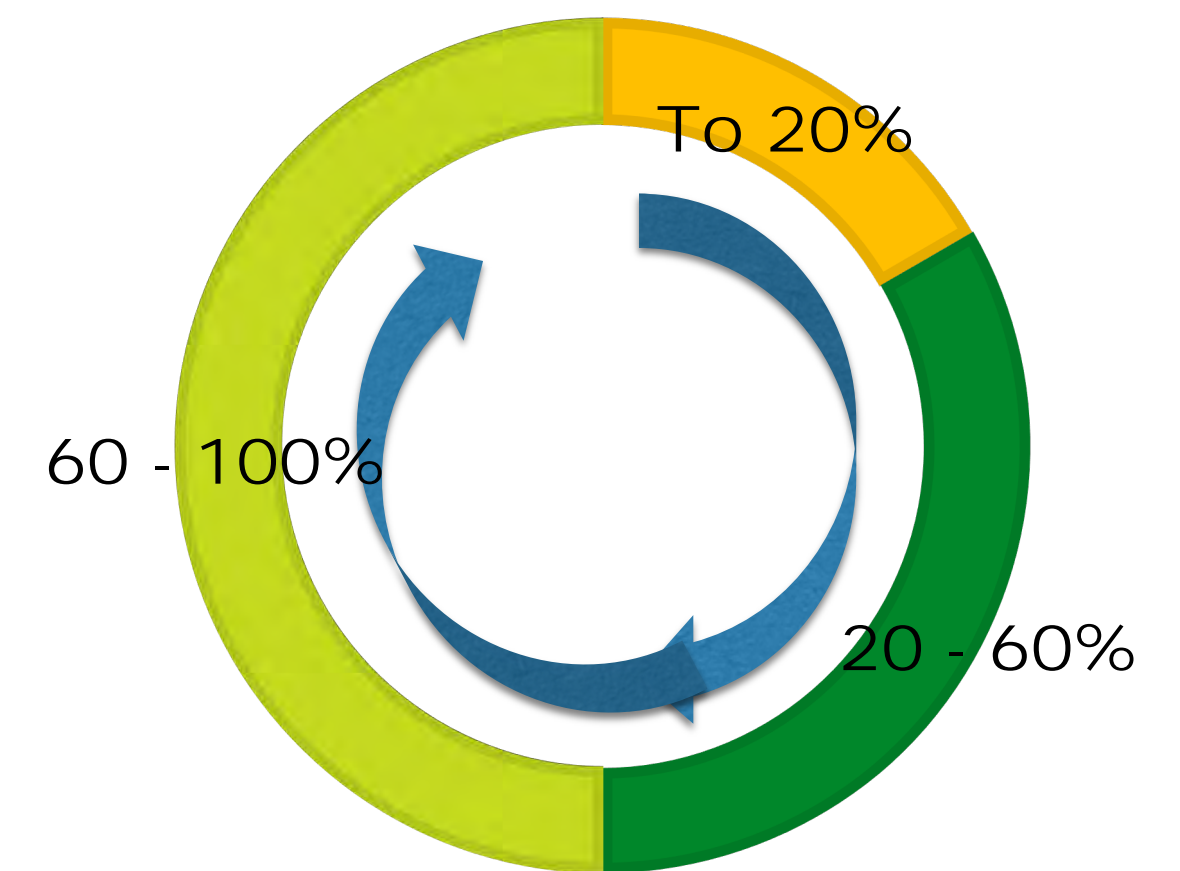


- PARTLY REVERSIBLE**
 If system has **RP > 0,3 and RP < 0,6** end of life options = **REPAIR, DIRECT REUSE, REMANUFACTURING**.



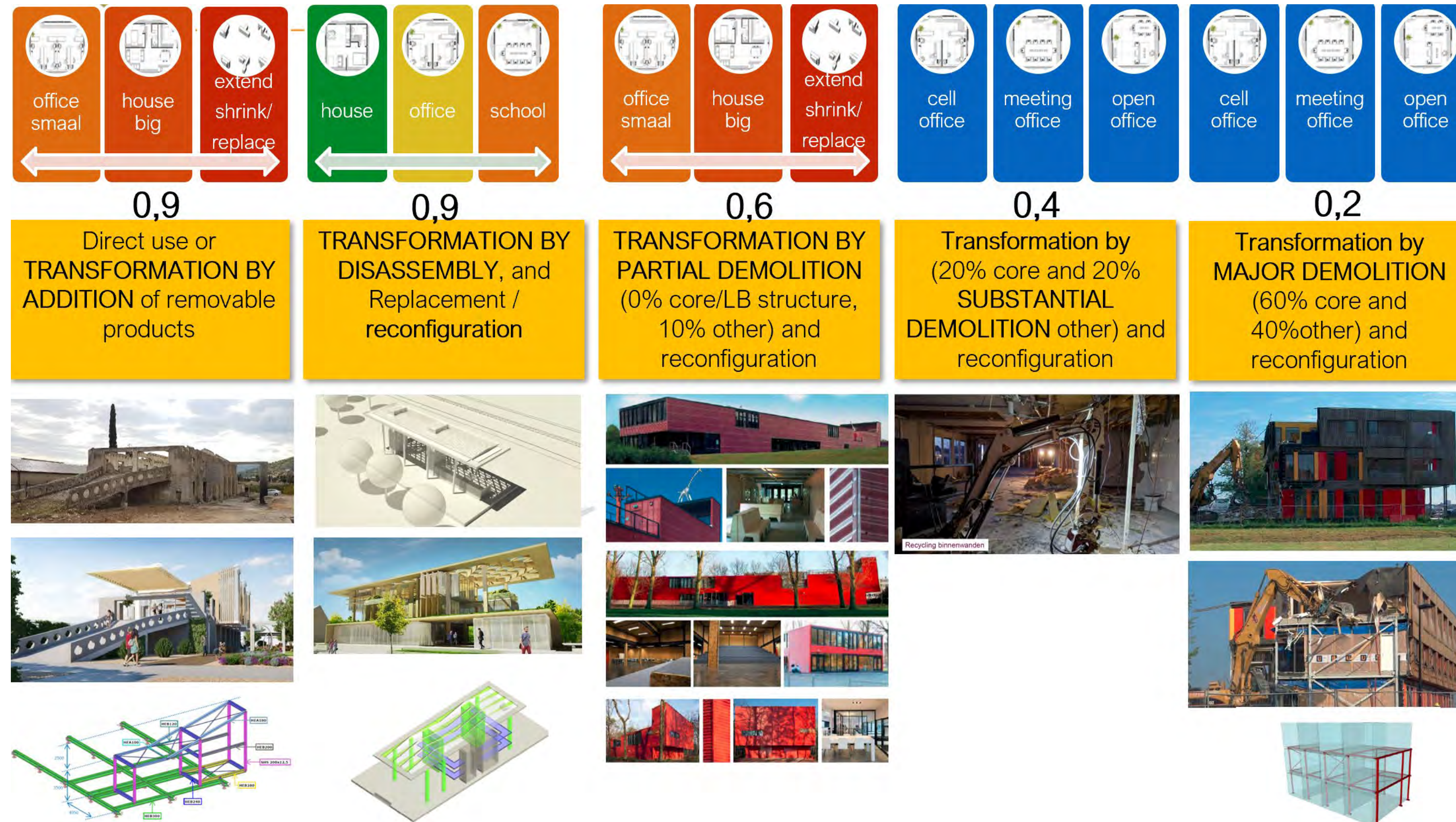
- REVERSIBLE**
 If system has **RP > 0,6** this would mean that besides **DIRECT REUSE AND REPAIR** of its parts the system can be **RECONFIGURED AND UPGRADED** and its dimensions adjusted to fit new requirement.

REUSE %
 ■ irreversible ■ partly reversible ■ reversible



REVERSIBLE BUILDING INTEGRATED VIEW

Building level transformation + material composition:





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CONTACT US!

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e.durmisevic@4darchitects.nl

Dr. Elma Durmisevic, University of Twente, 4D architects





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TURNING BAMB SOLUTIONS INTO VALUE FOR YOUR BUSINESS

IBM & VITO workshop

Martijn Peters | IBM



APPLYING REVERSIBLE BUILDING DESIGN PRINCIPLES FOR COMMERCIAL BUILDINGS

*“WHY INVEST IN A REVERSIBLE
BUILDING DESIGN?”*

MATERIAL PASSPORTS APPLIED FOR REUSING STEEL STRUCTURES (UK)

*“CAN MATERIAL PASSPORTS LOWER
FINANCIAL BARRIERS FOR STRUCTURAL STEEL RE-USE?”*



..... next use?

MARKET SIZE OPPORTUNITY FOR REUSE

“WHAT IS OR WILL BE THE SIZE OF THE PIE”



disclaimer - unfortunately we will only talk about it

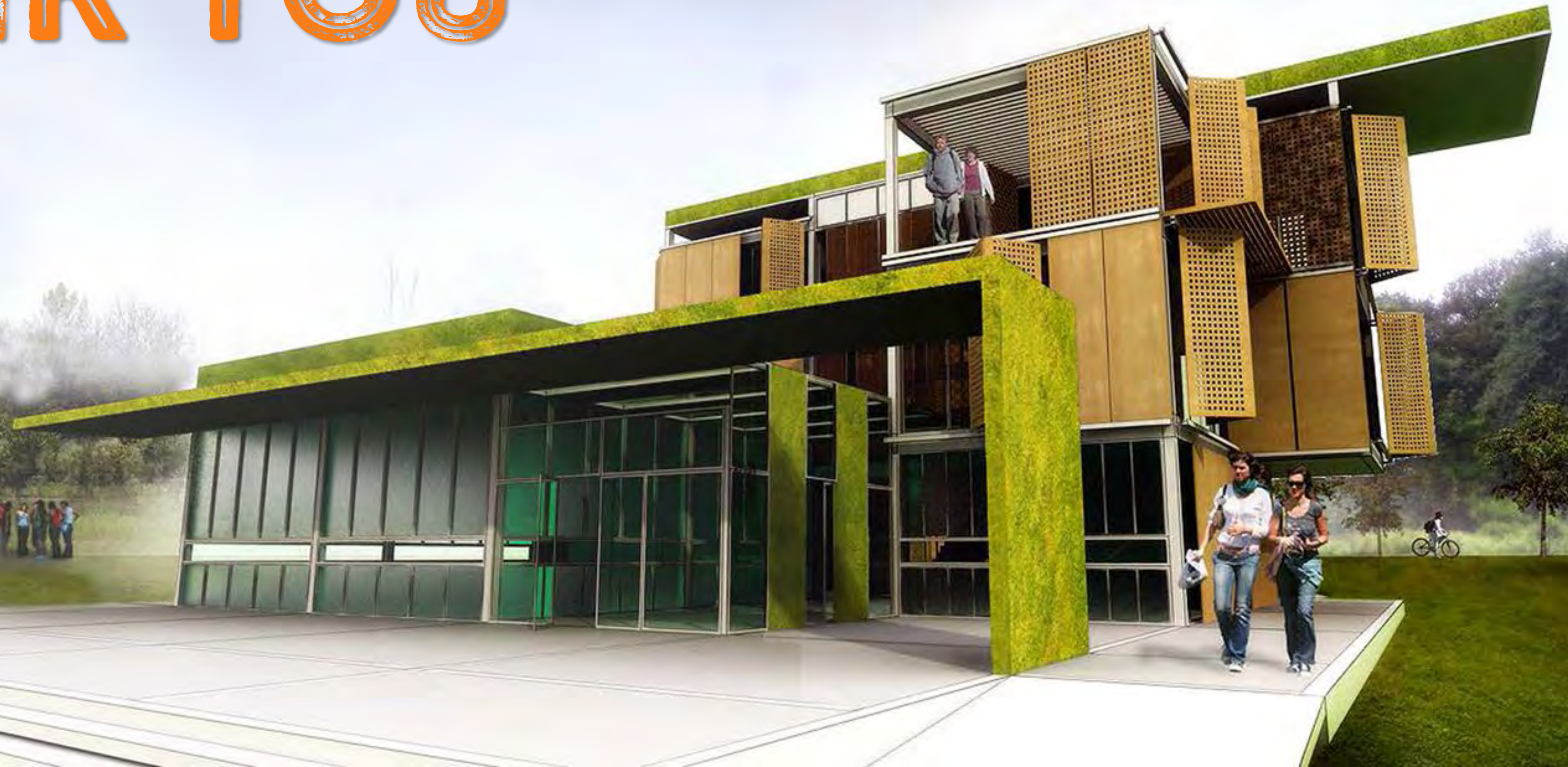


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THANK YOU

Martijn Peters | IBM





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POLICY RECOMMENDATIONS

Supporting the sector through policy in order to make circularity business as usual

Molly Steinlage - Brussels Environment













- Josefina Lindblom, DG Environment - *Level(s)*
- Philippe Van de Velde, Public Waste Agency of Flanders (OVAM) - *Tracimat*
- Mervyn Jones, Rijkswaterstaat, Netherlands - *Purchasing and Procurement Rules*
- Matti Kuittinen, Ministry of the Environment of Finland - *Finish Roadmap to a Circular Economy*





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msteinlage@environnement.brussels

Molly Steinlage - Brussels Environment





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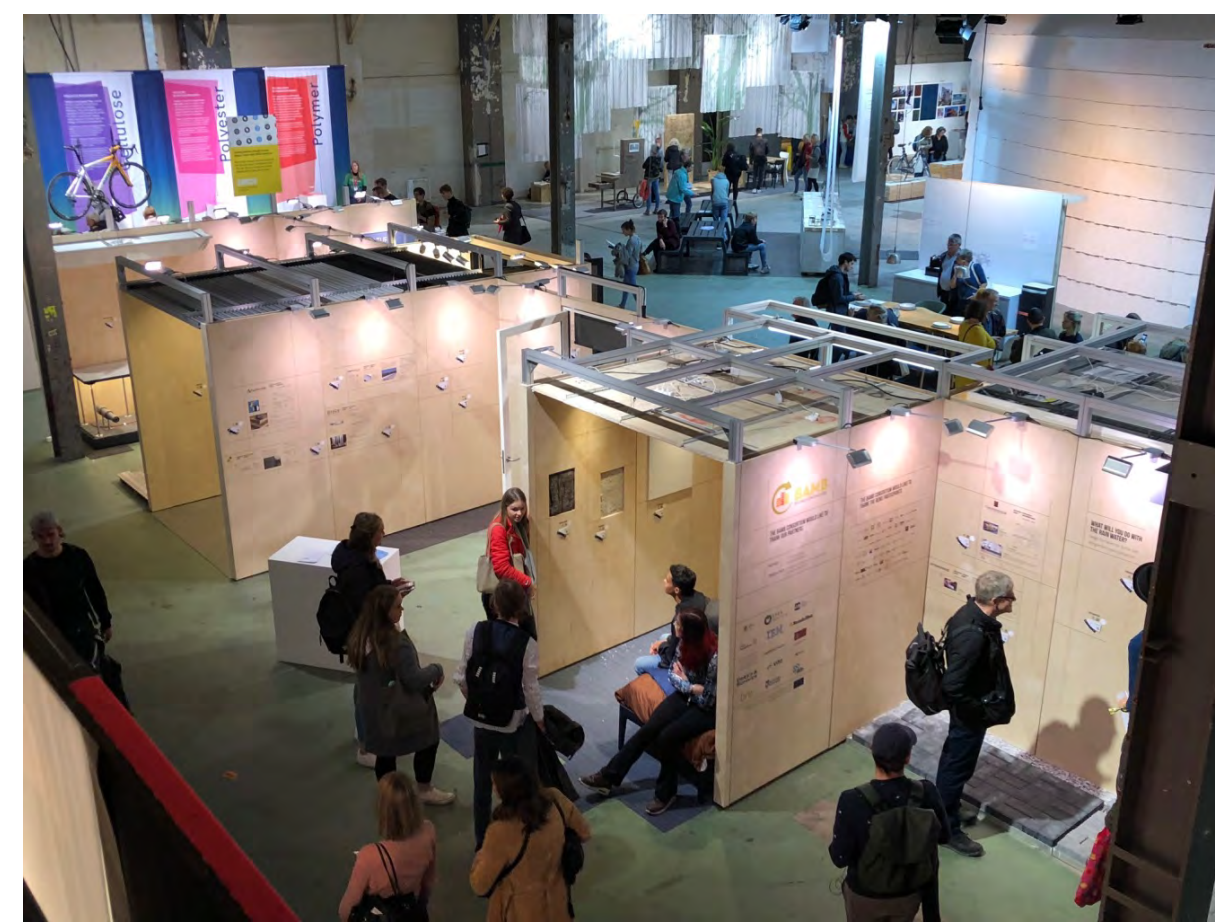


BAMB PILOT PROJECTS

Learning by doing - circular architecture tested at
real scale" at BAMB's final event
SBE19 Brussels - BAMB-CIRCPATH

Teodora Capelle | [Bruxelles Environnement](#)





**BUILD REVERSIBLE IN
CONCEPTION (BRIC)
BRUSSELS**

**CIRCULAR RETROFIT LAB
(CRL)
BRUSSELS**

**REVERSIBLE EXPERIENCE
MODULES (REM)
TRAVELLING**

**GREEN TRANSFORMABLE
BUILDING LAB (GTB LAB)
NETHERLAND**











**INCREASE AND
EXTEND VALUE
OF MATERIALS**



**RESHAPE
THE DESIGN
APPROACH**



**REDISTRIBUTION
OF ROLES**



**SHARE
INFORMATION
ACROSS PROCESSES,
TIME**

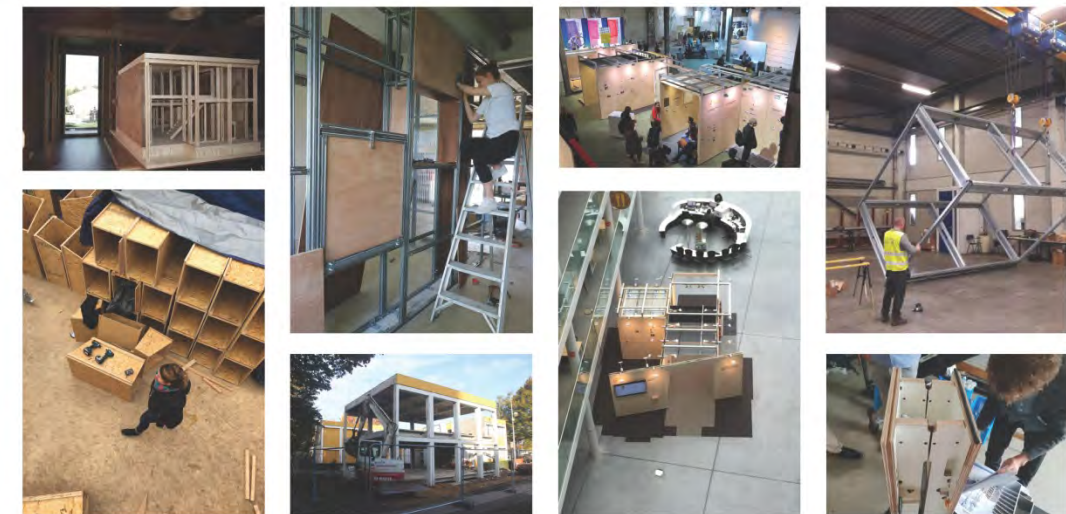


**GATHER
INFORMATION
FOR FUTURE
ASSESSMENT
TOOL**



BUILDINGS AS MATERIAL BANKS

D14 – 4 pilots built + Feedback report 28.02.2019
TESTING BAMB RESULTS THROUGH PROTOTYPING AND PILOT PROJECTS



1. BUILDINGS AS MATERIAL BANKS

1.1. A SYSTEMIC APPROACH

Designing buildings as repositories of valuable materials is a concrete contribution towards the development of a circular construction industry. The "Buildings as Material Banks" H2020 innovation project has provided practical answers for the preservation of raw materials and the implementation of waste reduction strategies and solutions. The project has identified actions along the construction industry processes and given in-depth insights into the necessary changes within the value chains to support the circular economy transition.

The Buildings as Material Banks project has contributed to the creation of a new culture of "recovery, re-use, and upcycling". The team developed protocols for reversible building design, addressing different layers ranging from materials through components to buildings.

The project seizes the opportunities offered by digitalization through the development of more than 300 material passports and by creating a Circular Building Assessment tool.

Materials Passports are electronic and inter-operable data sets that collect characteristics of materials and assemblies. They enable building stakeholders to better capture the value of products they use by extending their life span.

The Circular Building Assessment tool assesses the transformation capacity, and reuse potential of buildings. It allows efficient data management at project level to generate optimal decision-making models for the stakeholders.

The research process developed during the project has provided insights into how policies and standards can shape the systemic shift. It helped identify new needs and opportunities for emerging businesses in the industry.

1.2. PILOT PROJECTS

In order to maximize BAMB's innovation potential, dissemination impact and stakeholder involvement, six pilot projects tested and demonstrated the project outputs in various settings.

The pilot projects investigate and demonstrate new design approaches to making buildings more flexible throughout their life. From the first phase, they focus on manufacturing to increase the quality of materials and products, on construction and maintenance, as well as on the re-design potential of the building.

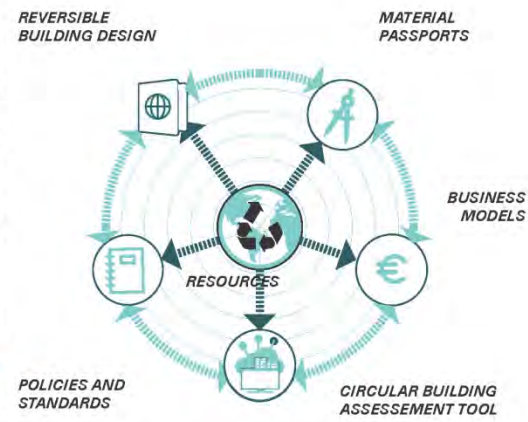


Figure 1: Towards a circular construction ecosystem Building as Material Banks Horizon2020 Innovation project

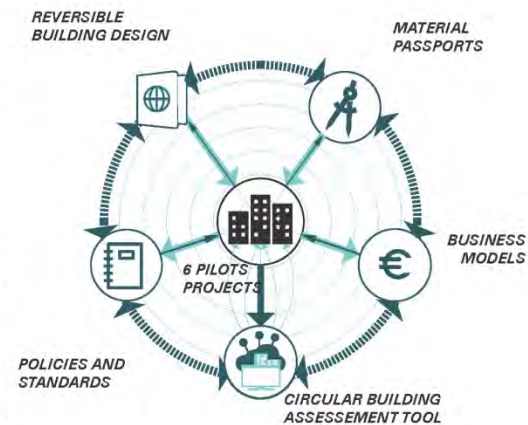


Figure 2: Articulation of the pilots projects around the Building as Material Banks Horizon2020 Innovation project major topics

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.



BRIC 4.4. BUILD REVERSIBLE IN CONCEPTION (BRIC)

CONSTRUCTION DRAWINGS: AS BUILT PLANS (OF EACH TRANSFORMATION/RELOCATION).

4.4.1. DESIGN APPROACH

REVERSIBILITY

Constructed during the 2017-2018 academic year, the first version of BRIC building has been deconstructed in winter 2018. Designed for two successive re-assemblies and dis-assemblies, the project included transformation scenarios for BRIC2 and some incipient idea about BRIC3. Several key strategic criteria were identified:

- each construction has different volume and function
- all the successive buildings use the same materials and maximize their reuse potential
- screwed together or interlocked connections create the opportunity to recuperate, sell, re-use materials after the end of the project
- circularity has been addressed at various levels: building, spatial, system, element and material level

SUSTAINABLE BUILDING

The project combines building circular solutions for reducing waste and minimising environmental impacts, with the aim to close energy and material loops. It challenges the entire value chain. The project tackles topics such as local supply, energy efficiency, and closing urban hydrologic cycles.

WOOD AS AN INTRINSICLY CIRCULAR RESOURCE

The BRIC project used bio-based and renewable materials with a focus on wood and wooden derivatives. Characterized by its specific "texture, structure, flexibility, and tension", the wood take multiple shapes, provide re-usable and upgradable products, etc. Timber and wood-based products were used to replace petrochemical and mineral-based construction materials. This reduces natural resource depletion. Within the production phase, the wood demands little energy consumption compared with other products. Moreover, wooden materials sequester carbon, contributing to the long-term storage of atmospheric carbon dioxide. Hence, they offer an additional measure to mitigate Greenhouse Gases Emissions. Light and resistant, with insulating properties and the ability to regulate humidity, timber is an important resource for circularity.

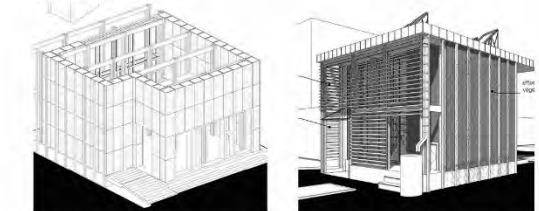


Figure 14: projet BRIC 2, axonometric views (insulation boxes and finishing), ground floor plan and second floor plan

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.



BRIC 1

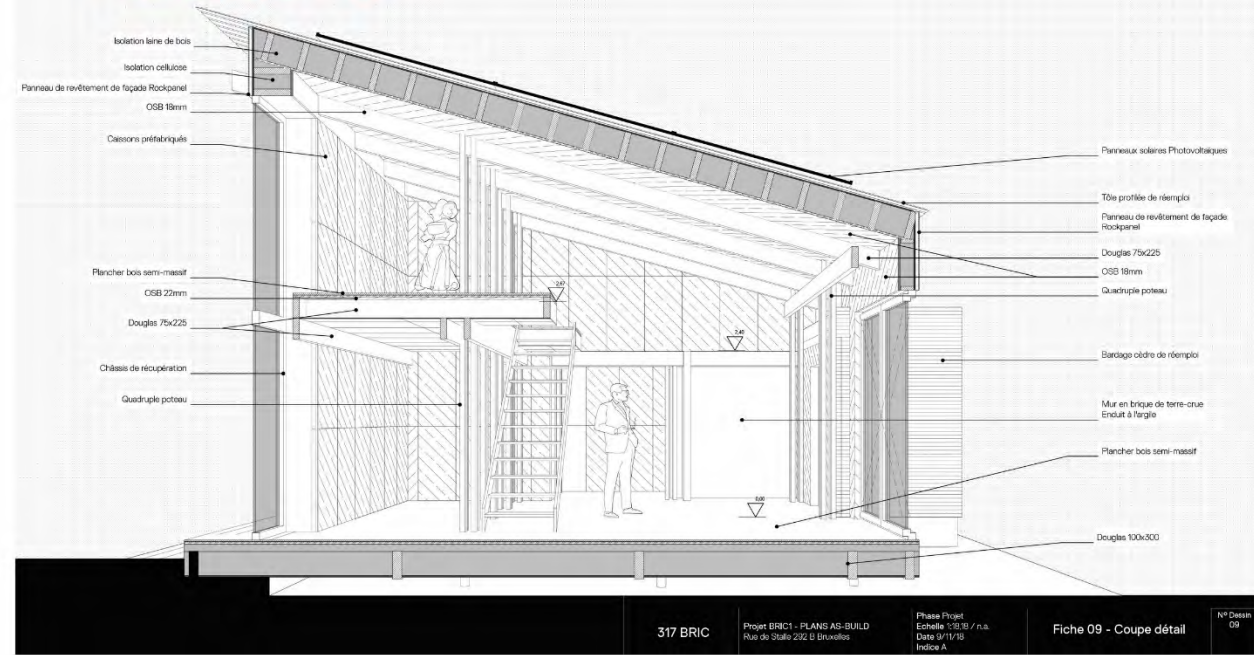


Figure 15: BRIC 1, facades

Figure 16: BRIC 1 plans

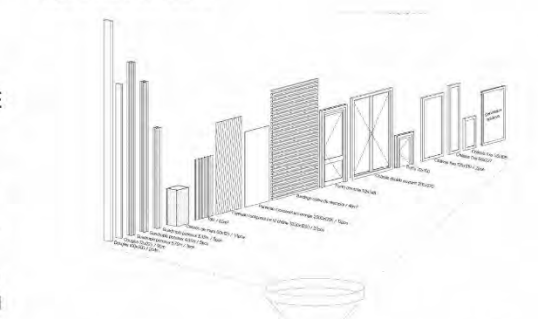


Figure 17: Inventories and reuse strategy for BRIC 2

BRIC 2



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.



TESTING BAMB RESULTS THROUGH PROTOTYPING AND PILOT PROJECTS REPORT 28.02.2019



BAMB
BUILDINGS AS MATERIAL BANKS

Co-funded by the Horizon 2020
Framework Programme
of the European Union



Teodora Capelle | [Bruxelles Environnement](#)



Coffee Break



Parallel sessions – PART I : Explore the BAMB tools and results for your business and industry



Lunch



Parallel sessions – PART II : Explore the BAMB tools and results for your business and industry



Coffee Break



What did you say?



Welcome to Reburg – the world's most circular city!

Wim Debacker, VITO





Co-funded by the Horizon 2020
Framework Programme
of the European Union



WELCOME TO REBURG

WORLD'S MOST CIRCULAR CITY

@ INDUSTRY DAY, FINAL BAMB EVENT
BRUSSELS, 5TH OF FEBRUARY 2019

Wim Debacker | [VITO](#)



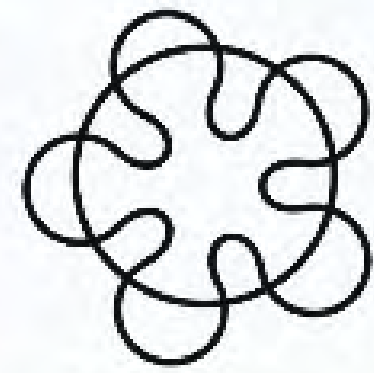


ER STREET

CITY HUB

REVIVE LANE

FAB CENTER



CITY OF
REBURG

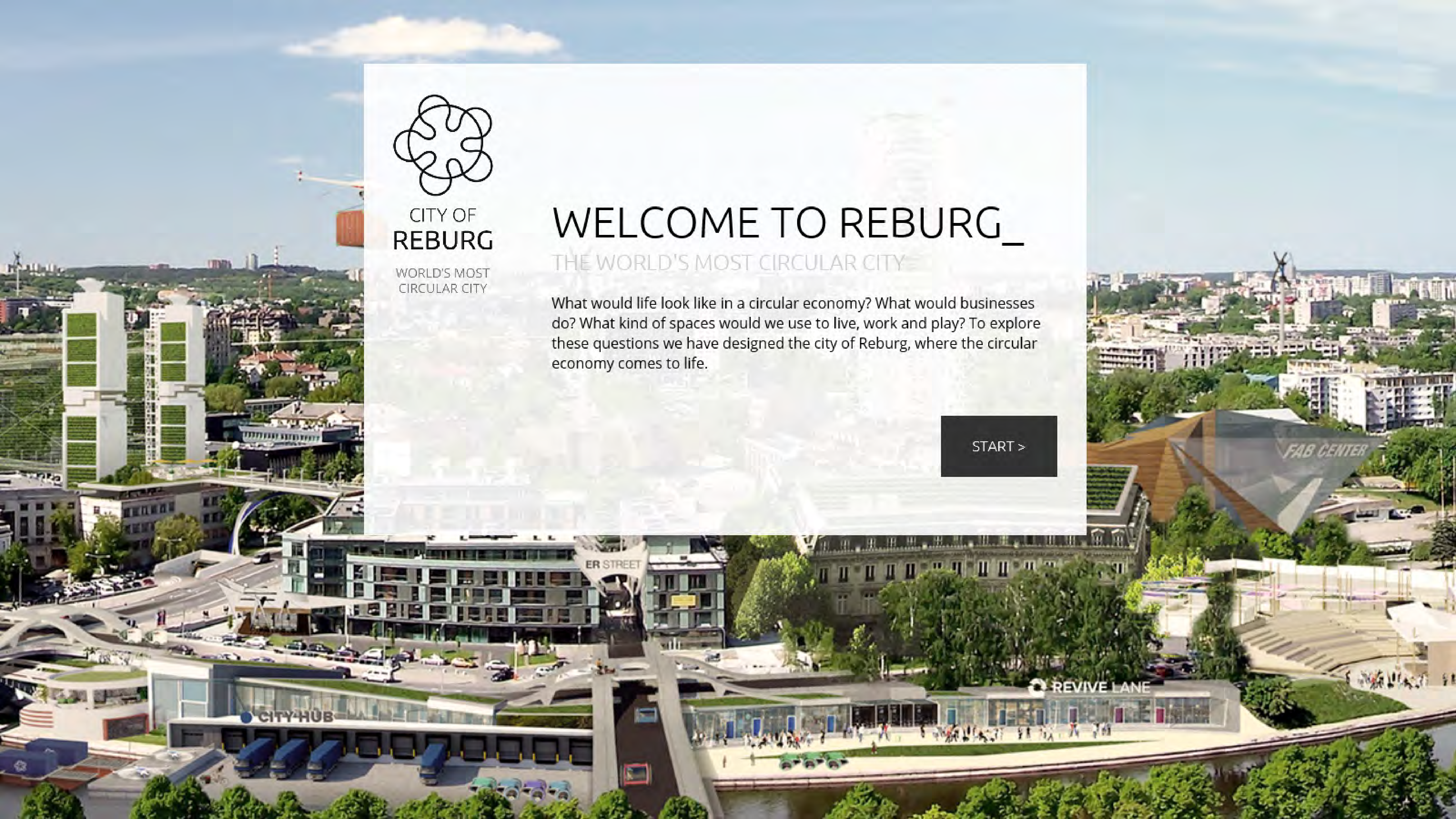
WORLD'S MOST
CIRCULAR CITY

WELCOME TO REBURG_

THE WORLD'S MOST CIRCULAR CITY

What would life look like in a circular economy? What would businesses do? What kind of spaces would we use to live, work and play? To explore these questions we have designed the city of Reburg, where the circular economy comes to life.

START >





WELCOME TO REBURG_

THE WORLD'S MOST CIRCULAR CITY

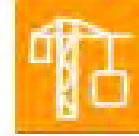
What would life look like in a circular economy? What would businesses do?
What kind of spaces would we use to live, work and play?
To explore these questions we designed the city of Reburg, where the circular economy comes to life.



CONSTRUCTION

BUILDINGS AS MATERIAL BANKS

About the future of building - Smart and versatile buildings adjust to the needs of their users. Unfit building parts are repurposed, upgraded or reprocessed into new materials.



LET'S GO >



MANUFACTURING

FABCITIES

About making, materials and resource loops - Hyperlocal fabcities with local co-working and comanufacturing spaces make for local circularity.



LET'S GO >



DEMATERIALIZATION

ENTANGLED REALITIES

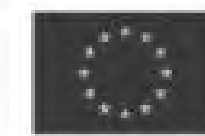
About smart cities and virtualization - The real, the augmented and the virtual reality are mixed into a seamless whole. Thus reducing material and logistic needs.



LET'S GO >

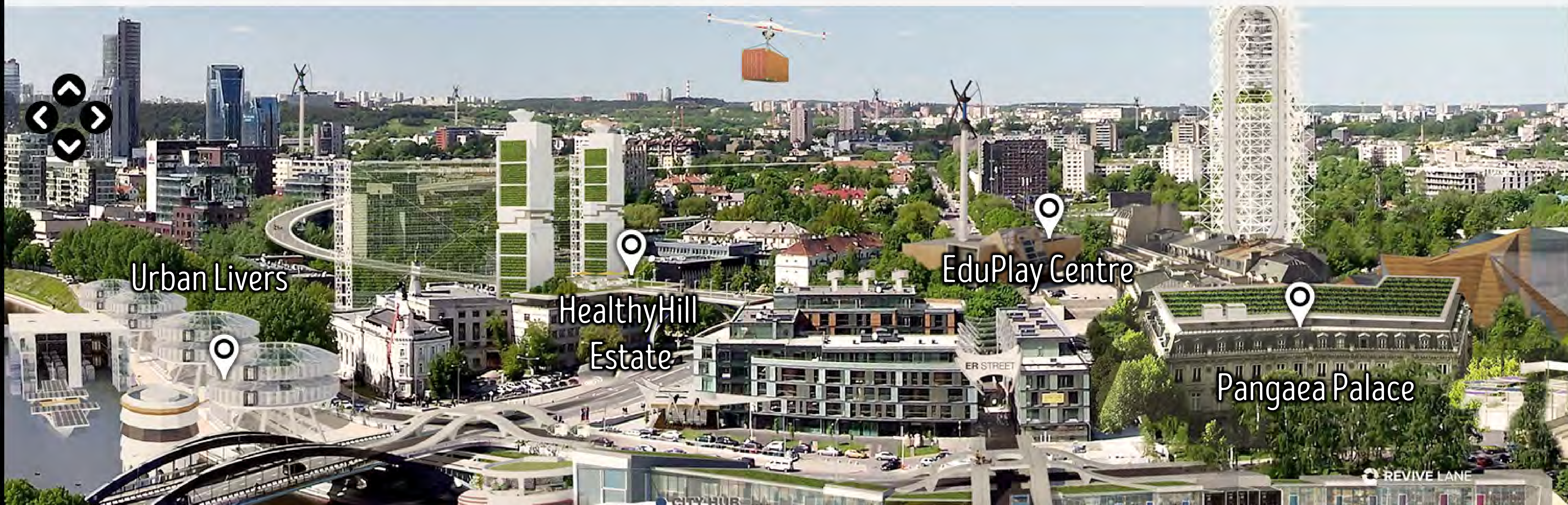
OUR PARTNERS

REBURG IS BUILT BY MANY HANDS_



This project has received funding from the European Union's Horizon 2020 research and innovation programme

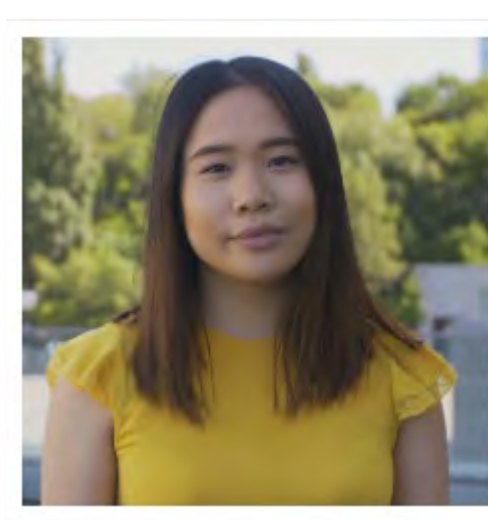
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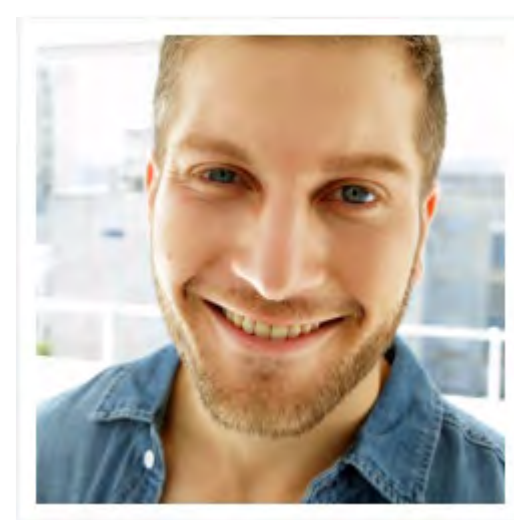
Erica Molano



Elma Hobbs

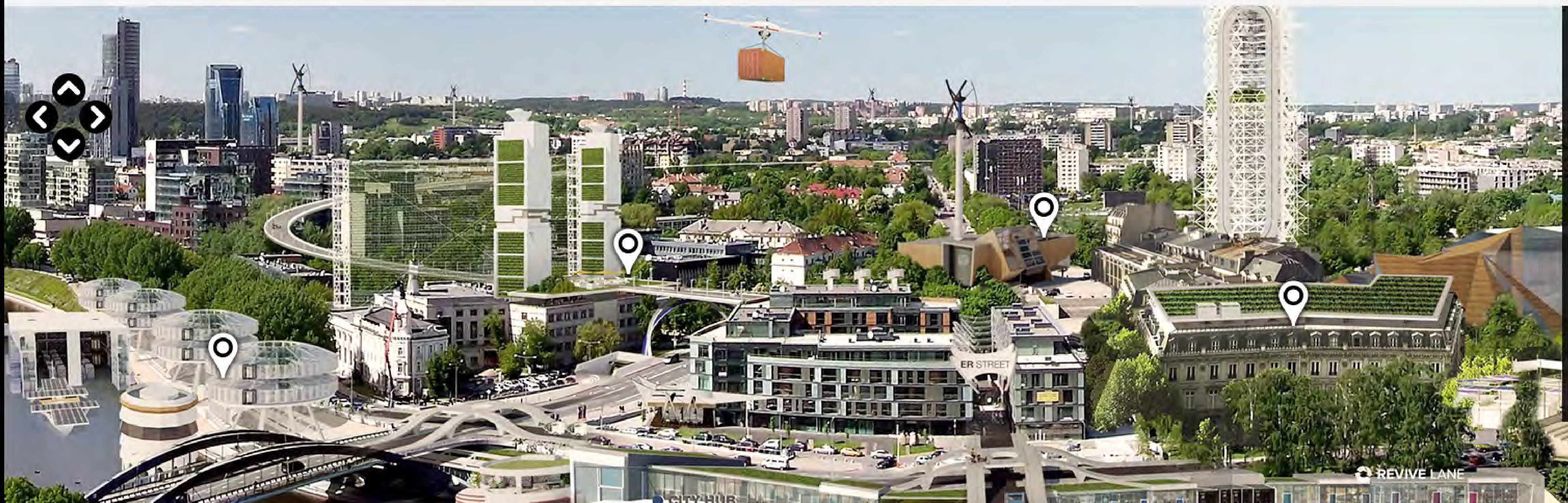
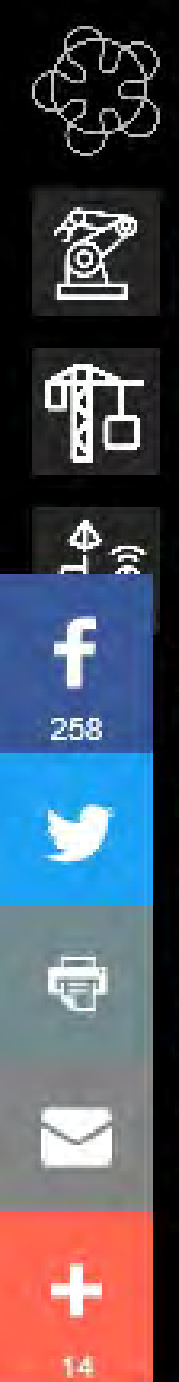


Rodrigo Madagani



Carmen Van Zandt

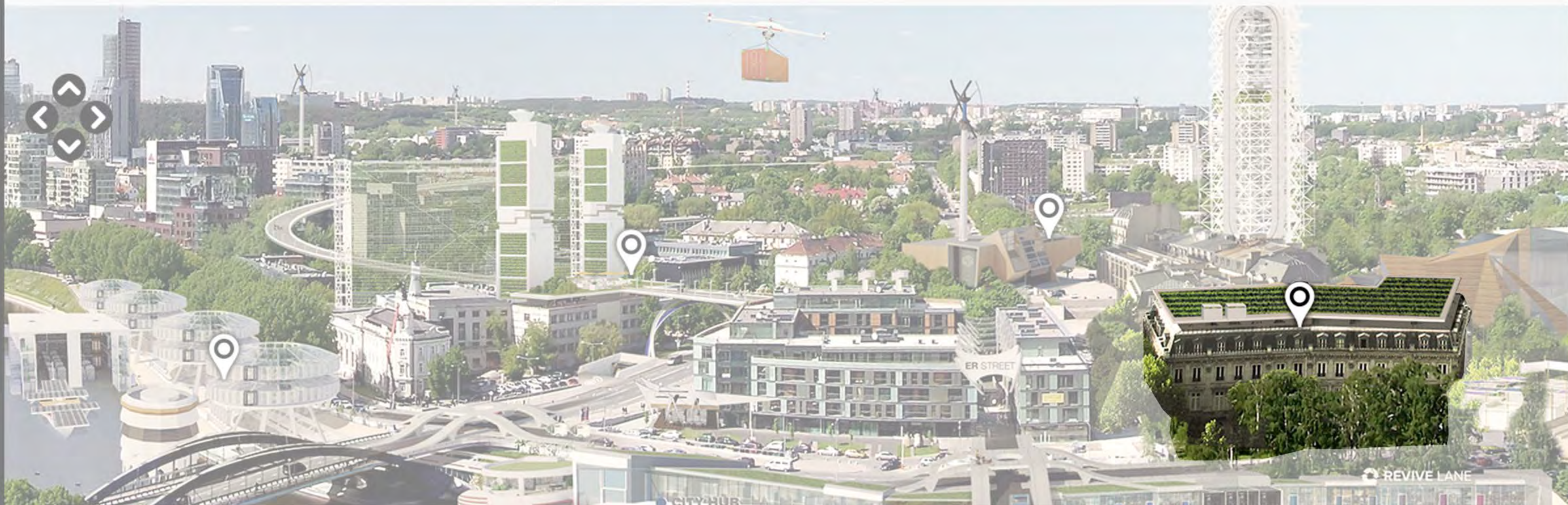




Erica Molano



Resident at Pangaea Palace
President of the school council
Daughter of resident at Healthy Hill



Erica Molano



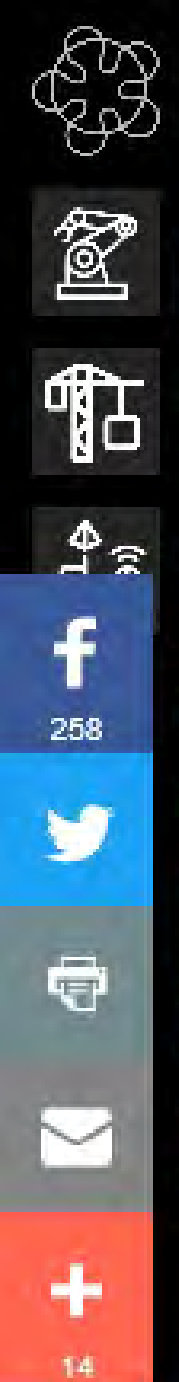
Resident at Pangaea Palace
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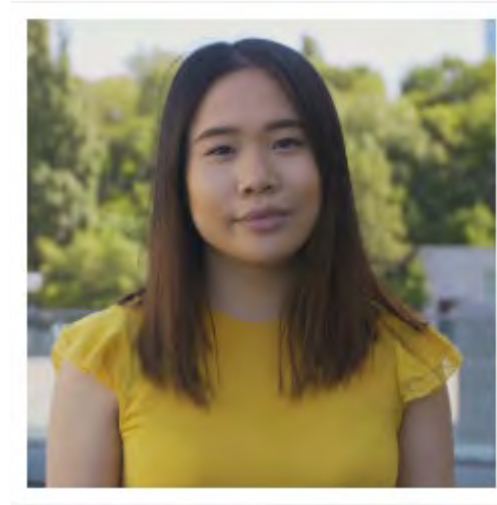
Erica Molano



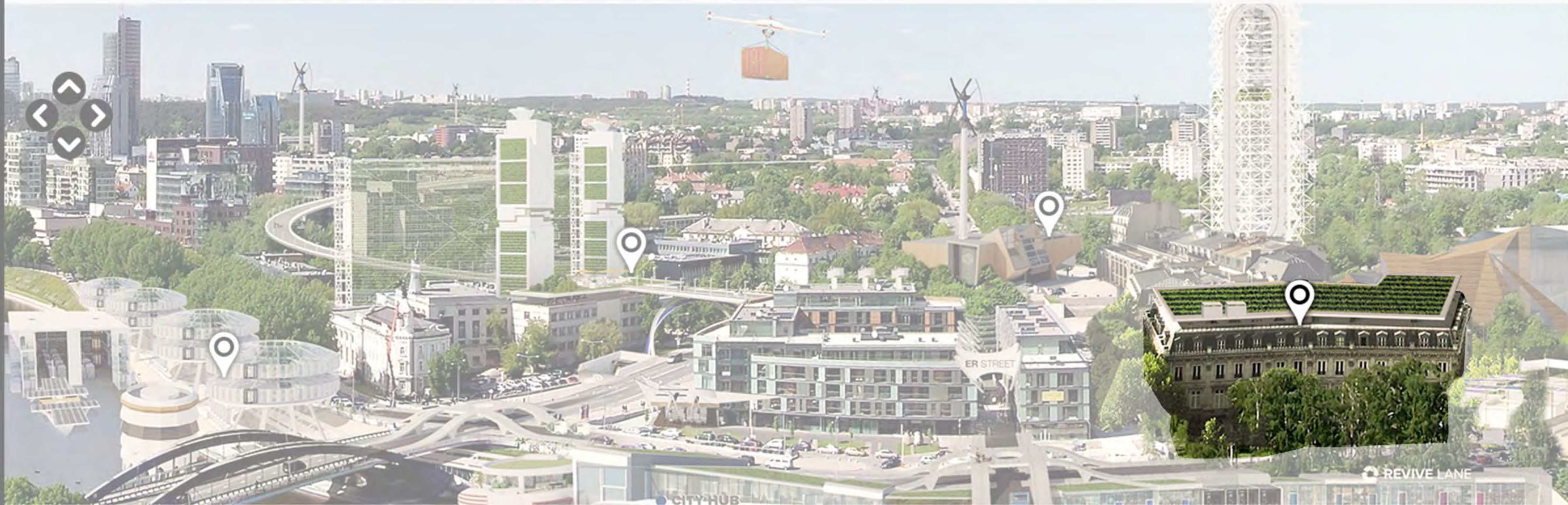
Resident at Pangaea Palace
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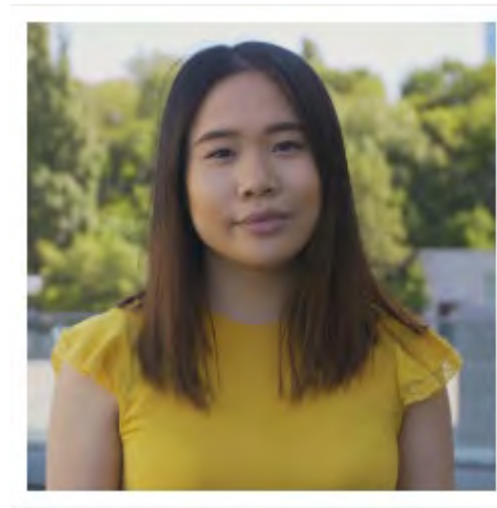
Elma Hobbs



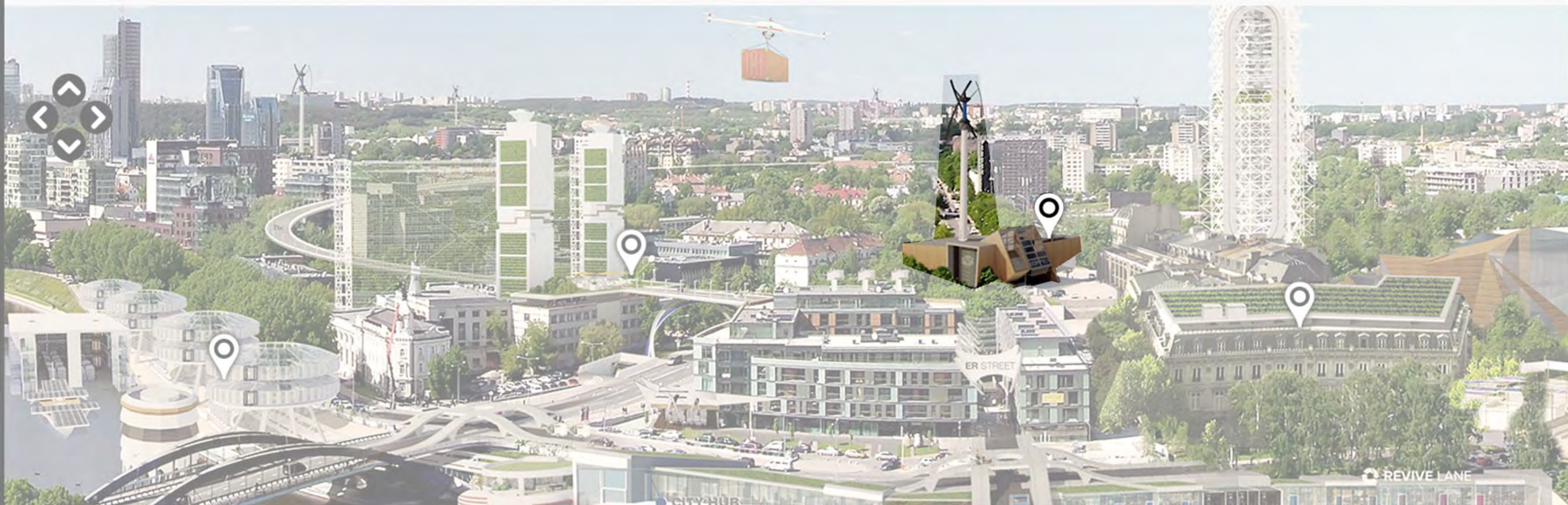
building system developer
at Meccalegos Ltd



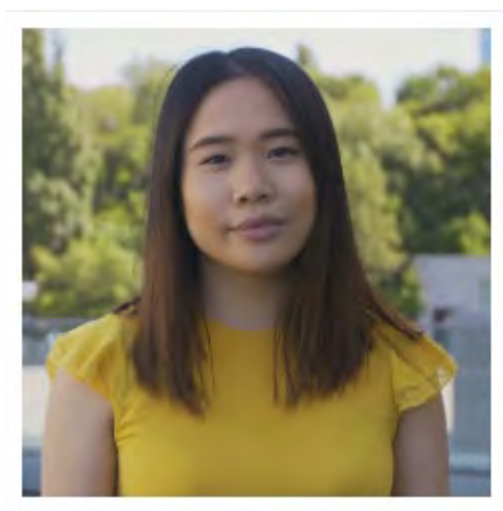
Elma Hobbs



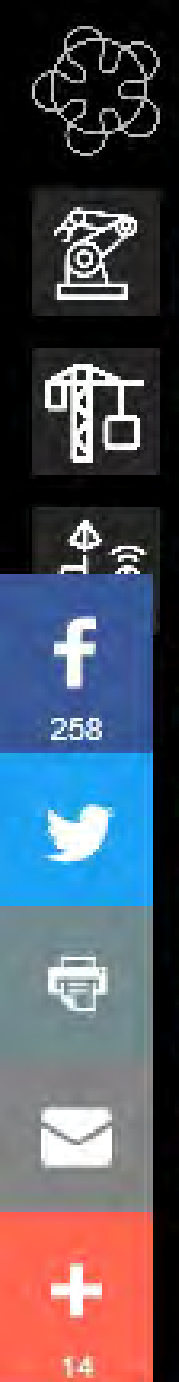
building system developer
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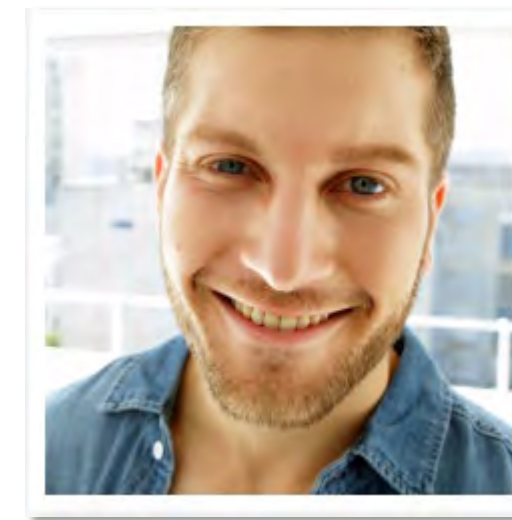
Elma Hobbs



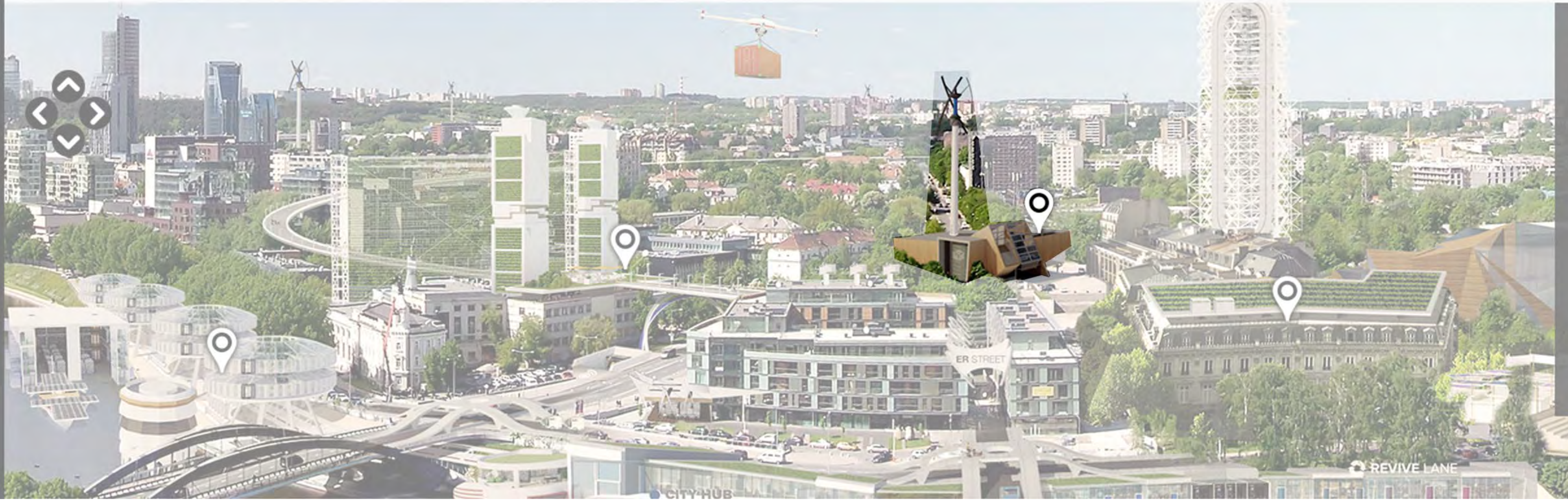
building system developer
at Meccalegos Ltd



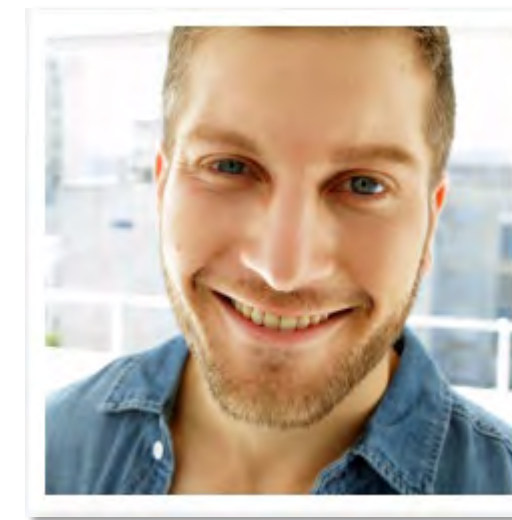
Rodrigo Madagani



building stock manager
at Facilitoutatis



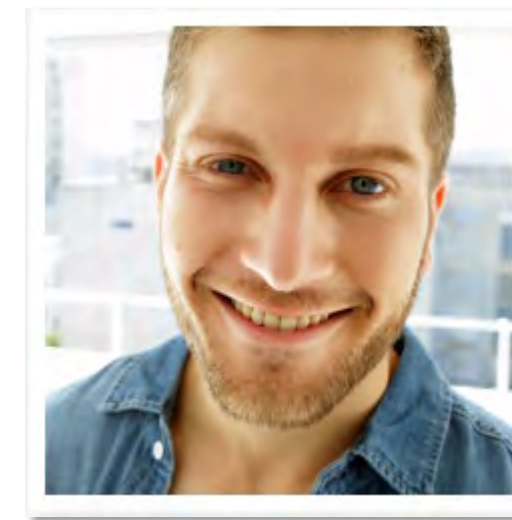
Rodrigo Madagani



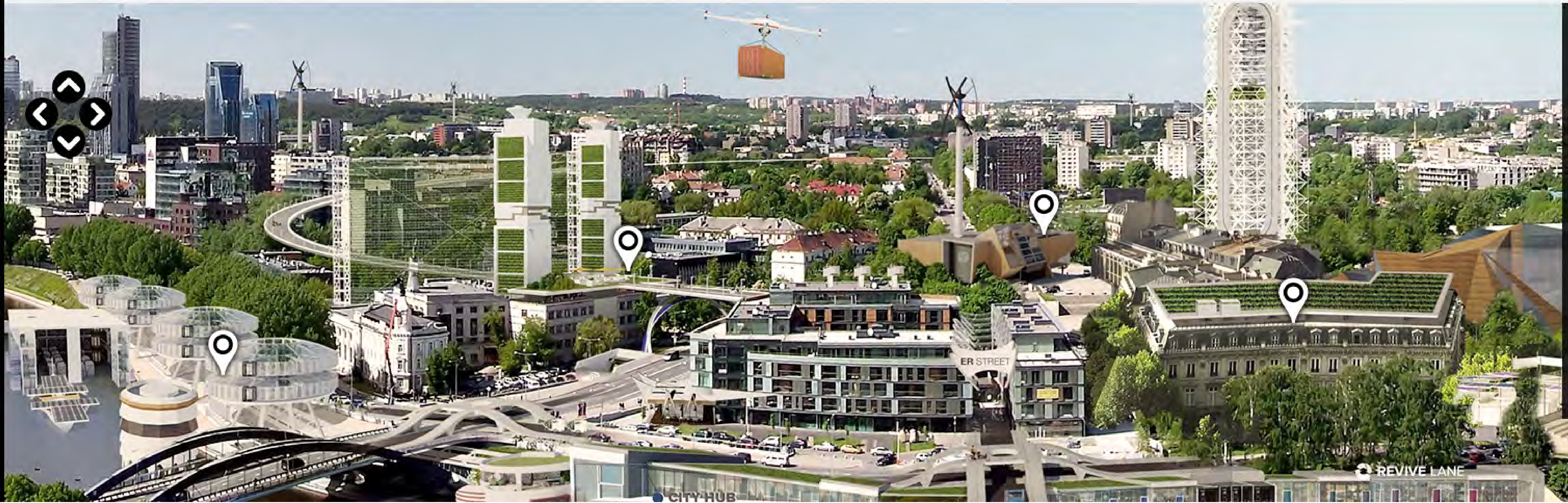
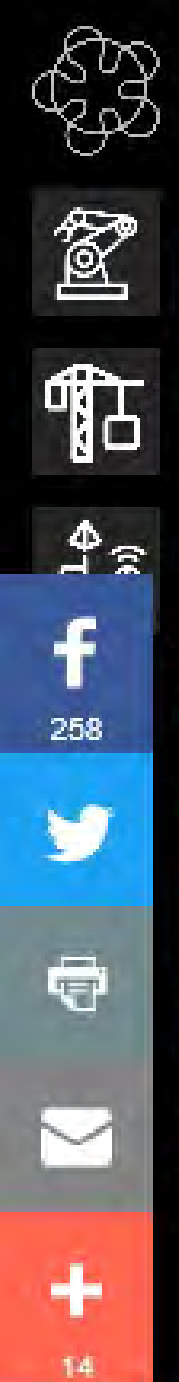
building stock manager
at Facilitoutatis



Rodrigo Madagani



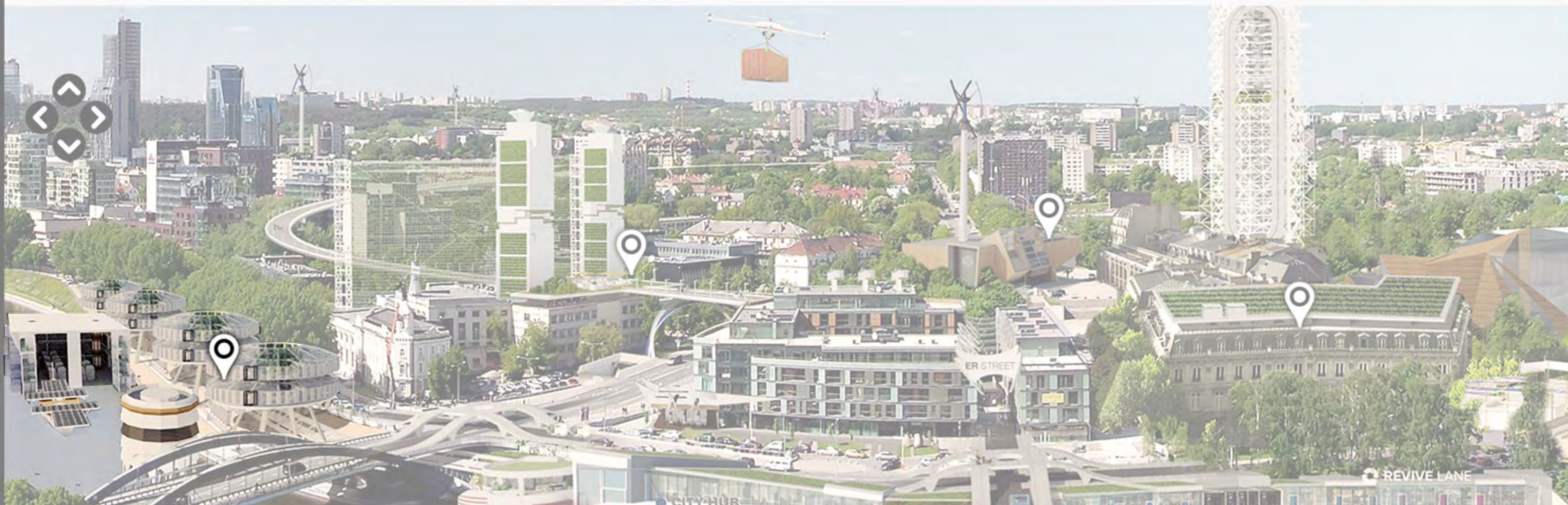
building stock manager
at Facilitoutatis



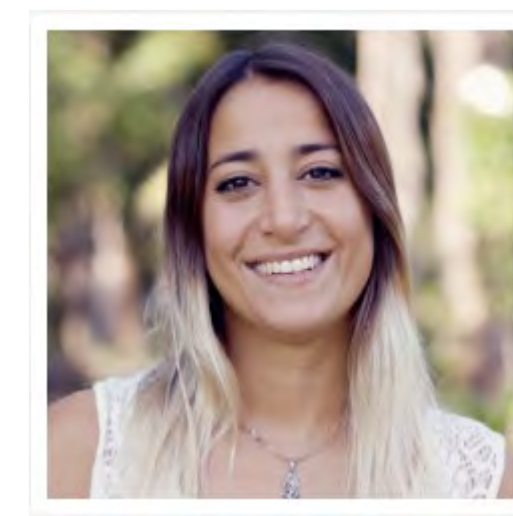
Carmen Van Zandt



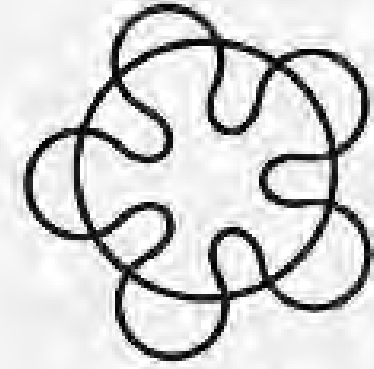
component wizard at
Urban Metabolism Ltd



Carmen Van Zandt



component wizard at
Urban Metabolism Ltd



CITY OF
REBURG

WORLD'S MOST
CIRCULAR CITY

← Back

MATERIAL BANKS

In the beginning of the 21st century, Reburg, like many cities, suffered from wasteful construction and demolition works. More than 30% of all waste generated within Reburg originated from construction and demolition works. Nowadays, Reburg has adopted a circular building practice, which is aimed at getting resources back in such a way that they can be used again for other applications. Two strategies can be put forward to achieve this:

- **Urban Mining**, by recovering building materials and building components from existing buildings for low- or high value recycling/reuse, even though these buildings were initially not designed to be easily deconstructed.
- **Urban Metabolism**, by designing, installing and re-installing building components in such a way that they are used over and over again.

In both strategies, buildings are considered as materials banks, temporary repositories of valuable building products that can be recovered for other applications as well. Only a limited amount of primary resources have to be imported to keep the cycle running and only a limited amount of materials end up as waste that needs to be disposed.



IT'S HAPPENING TODAY_

SIGNALS OF CHANGE



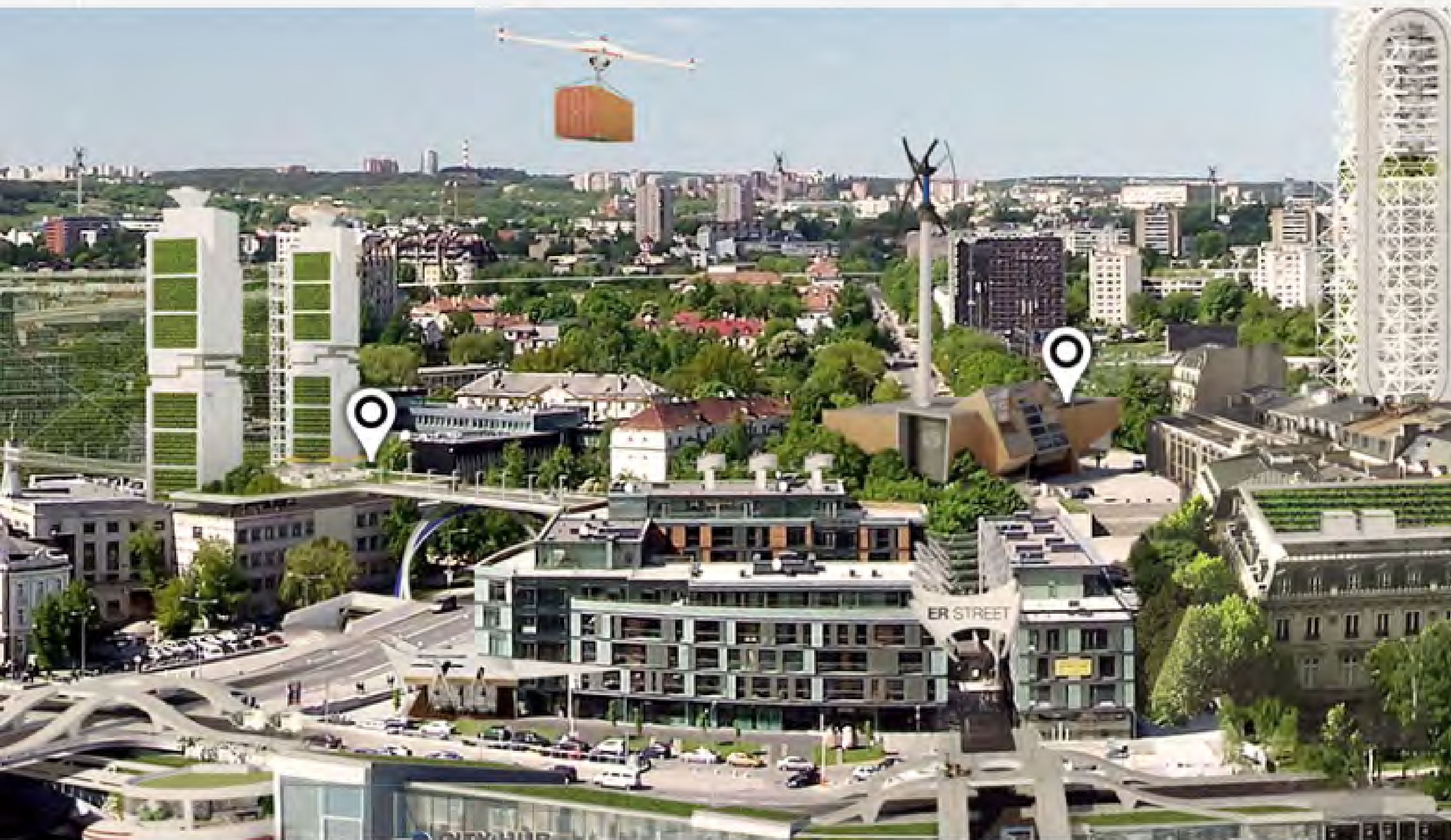
URBAN MINING COLLECTIVE

Urban mining as a thriving
business




ROTOR DECONSTRUCTION

Pooling of reclaimed building
components



CONSTRUCTION JOBS IN REBURG

 INDUSTRIES

 Building configurator

INTERMODULAR

 Building assembler

Facilitoutatis

 Building stock manager

Digital Brick

 Building system developer

 EduPlay Centre

 Urban Livers

WWW.REBURG.WORLD/



interviewer



Saskia



City portal administrator



Sam





BAMB
BUILDINGS AS MATERIAL BANKS

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Wim Debacker | [VITO](#)





BEL-EVENT

Password: Bamb2019



slido

#BAMBImpact

The voice of the Industry: panel



Panel



- **James Drinkwater**, Director of World GBC's Europe Regional Network
- **Mark Edwards**, Environmental Assessment Manager - Resources & Construction, Heathrow Airport
- **Sébastien Garnier**, Innovation and Project Manager, Housing Europe
- **Didier Leon**, Senior Relationship Manager Real Estate & Infrastructures, Triodos Bank
- **Josefina Lindblom**, Level(s) framework, DG Environment, European Commission
- **Stefania Rocca**, Executive Agency for Small and Medium-Sized Enterprises (EASME)

Closing keynote - 'Resources and the future'

**Janez Potočnik, Co-Chair of the International
Resource Panel and former EU Commissioner for the
Environment**





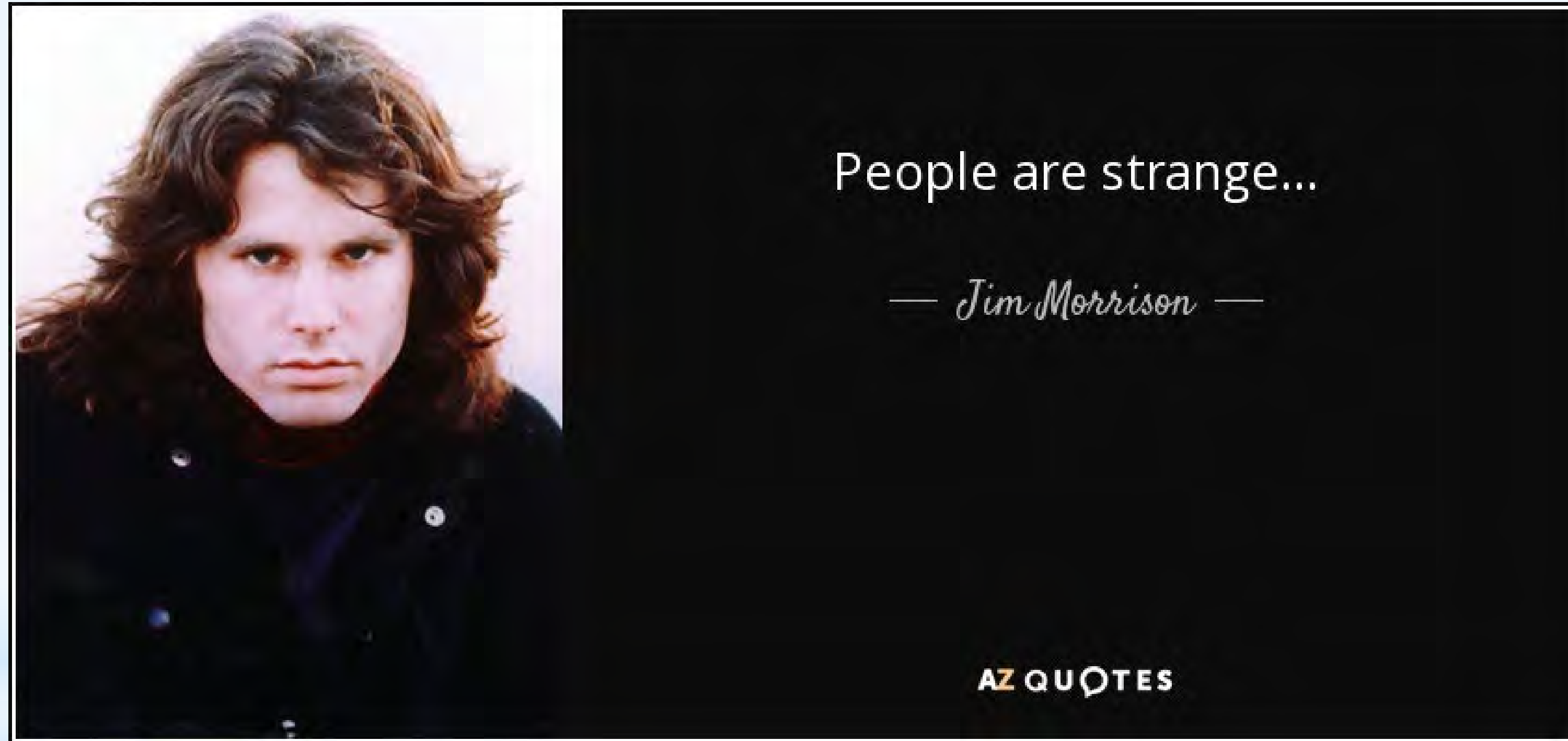
RESOURCES AND THE FUTURE

5th February 2019

JANEZ POTOČNIK

Co-chair UNEP International Resource Panel (IRP)

Partner SYSTEMIQ



WE WANT CHANGES ...

BUT WE DO NOT WANT TO CHANGE



International
Resource
Panel

20th CENTURY

THE GREAT ACCELERATION



- *Growth of population by a factor **3.7***
- *Annual extraction of construction materials grew by a factor of **34**, ores and minerals by a factor of **27**, fossil fuels by a factor of **12**, biomass by a factor of **3.6***
- *Total material extraction grew by a factor of **8***
- *GHG emissions grew by a factor of **13***

THE TASTE OF 21ST CENTURY

- *Population* growth (2050 - 9.7 billion)
- *Per capita consumption* growth (consumers moving from low to middle class consumption till 2030)
- 8 people own the same as the poorest half of the world and the richest 1% is more *wealthy* than the rest of the world)
- 800 million people are *hungry*, over 2 billion suffer from micronutrient deficiencies, over 2 billion people are *obese*
- We *throw away* one third of the *food* we produce



THE TASTE OF 21ST CENTURY

- There is increasing evidence of the *climate change* threat
- 60% of *ecosystems* already degraded or used unsustainably
- *Biodiversity*: Living Planet Index - 60% fall in just 40 years
- 85 % of the world's *fisheries* are at (beyond) biological limits
- 33% of *soils* is degraded or used unsustainably due to various reasons
- 7 millions premature deaths yearly globally and almost half a million in Europe *due to air pollution*
- A million of *plastic* bottles are bought every minute. 9% of plastic recycled, 12% incinerated, 79% landfills or environment



THE TASTE OF 21ST CENTURY

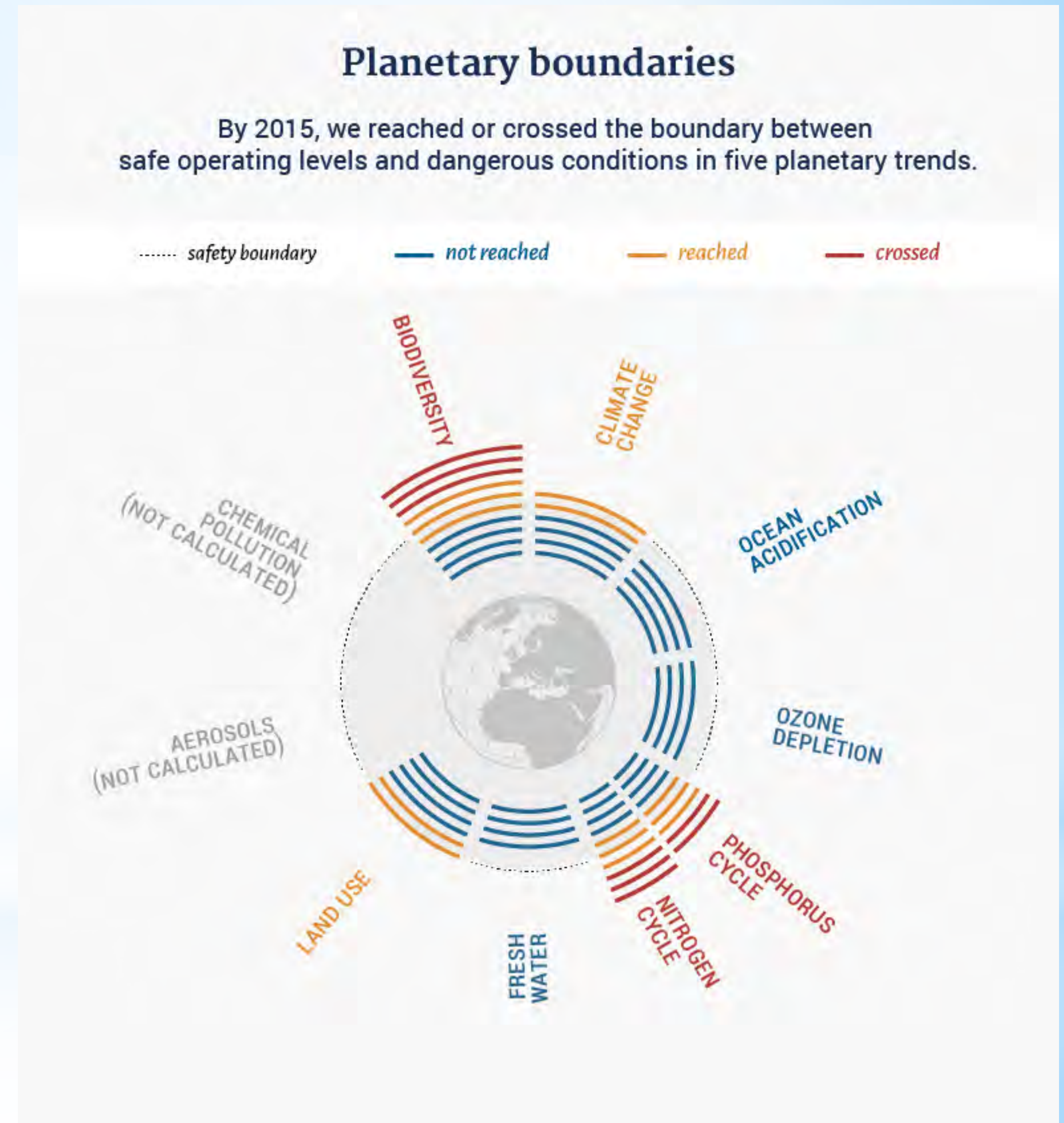
- Nearly half of all the *work* we do, will be able to be *automated* by mid of the century
- In 1997, DeepBlue beat Gary Kasparov - world Chess champion - using an algorithm conceived in the 1950s and lots of human data. In 2017, AlphaGo beat Ke Jie - world Go champion - discovering by itself the principles of the game and how to play it - *Era of artificial intelligence*



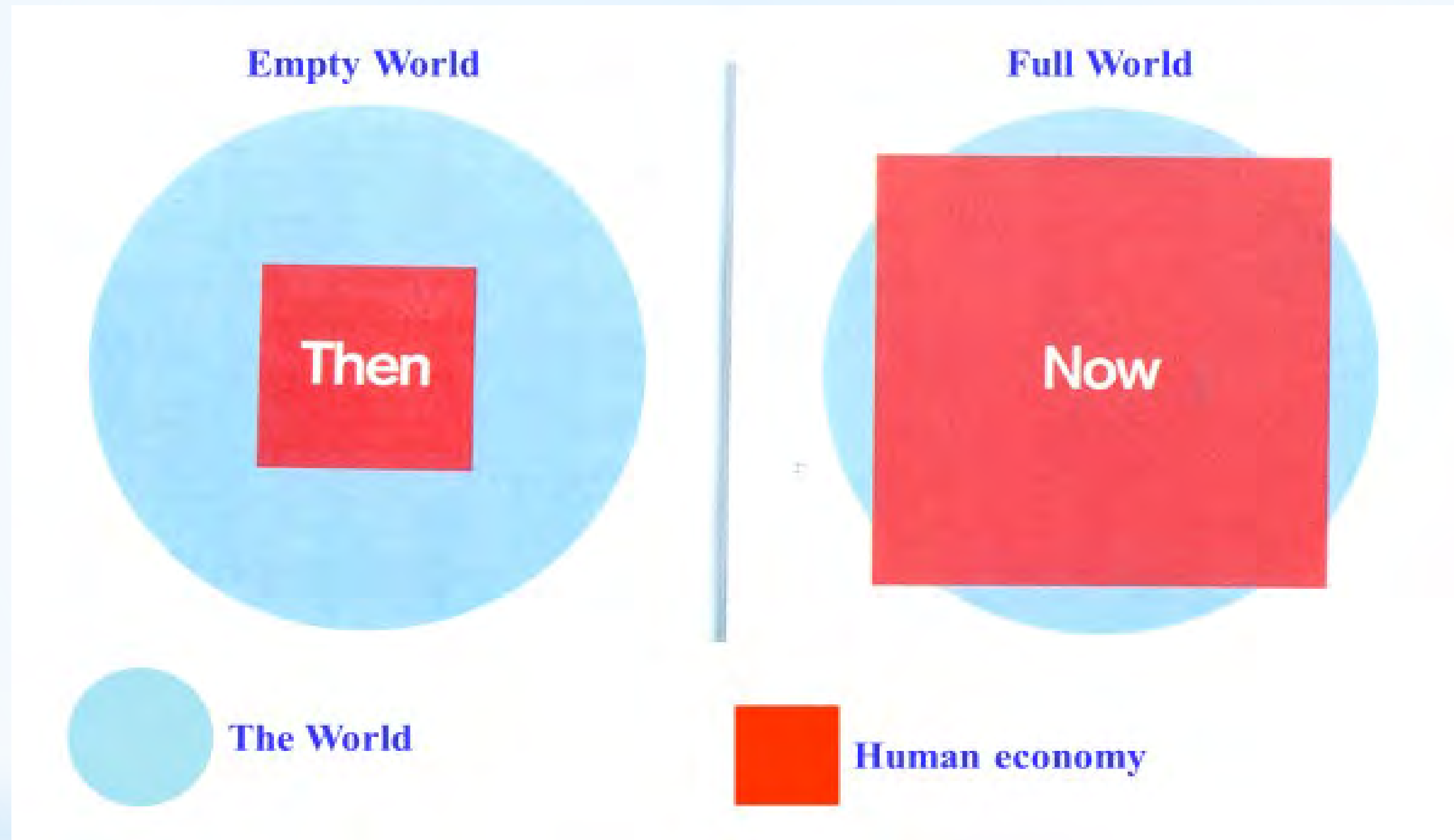
*For the first time in a human history we face the emergence of a **single, tightly coupled human social-ecological system of planetary scope.***

*We are more **interconnected and interdependent** than ever.*

*Our individual and collective **responsibility** has enormously increased.*

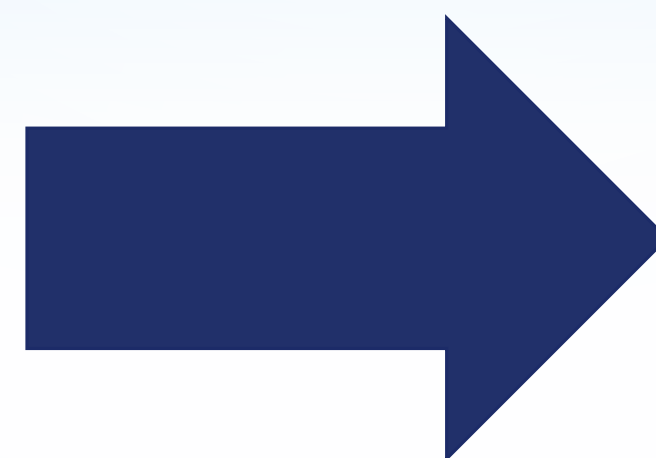


EMPTY WORLD AND THE FULL WORLD



Source: Club of Rome: Simplified after Herman Daly

Labour and Infrastructure
limiting factors of human
wellbeing

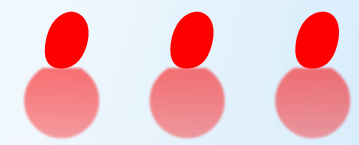


Natural resources and
Environmental sinks limiting
factors of human wellbeing

In the 21st Century we do not have any more the luxury of thinking and acting based on short term logic and interests



OUR ECONOMY



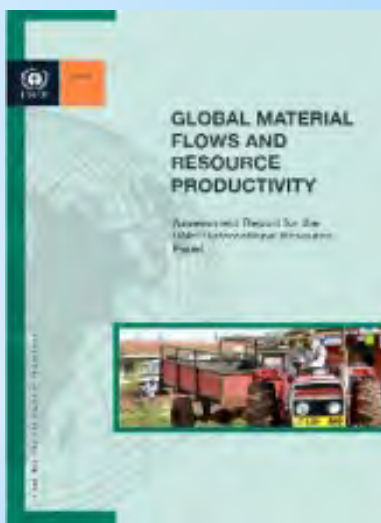


International
Resource
Panel

GLOBAL MATERIAL FLOWS AND RESOURCE PRODUCTIVITY (1970-2017)



- **Consumption** has been stronger driver of growth in than population growth
- **High-income countries** are currently consuming **10 times more** per person than low-income countries
- **Global material productivity** - USD per kg - started to decline around the year 2000. The decline is attributable to a shift in the share of global output from highly material productive economies to less productive economies.
- **Global material resource** use is expected to reach nearly 90 billion tonnes in 2017 and may more than double from 2015 to 2050. The level of wellbeing achieved in wealthy industrial countries **cannot be generalised globally based on the same system of production and consumption**



*Price Signals:
Financial Capital Overvalued
Human Capital Undervalued
Natural Capital not Valued*



Market

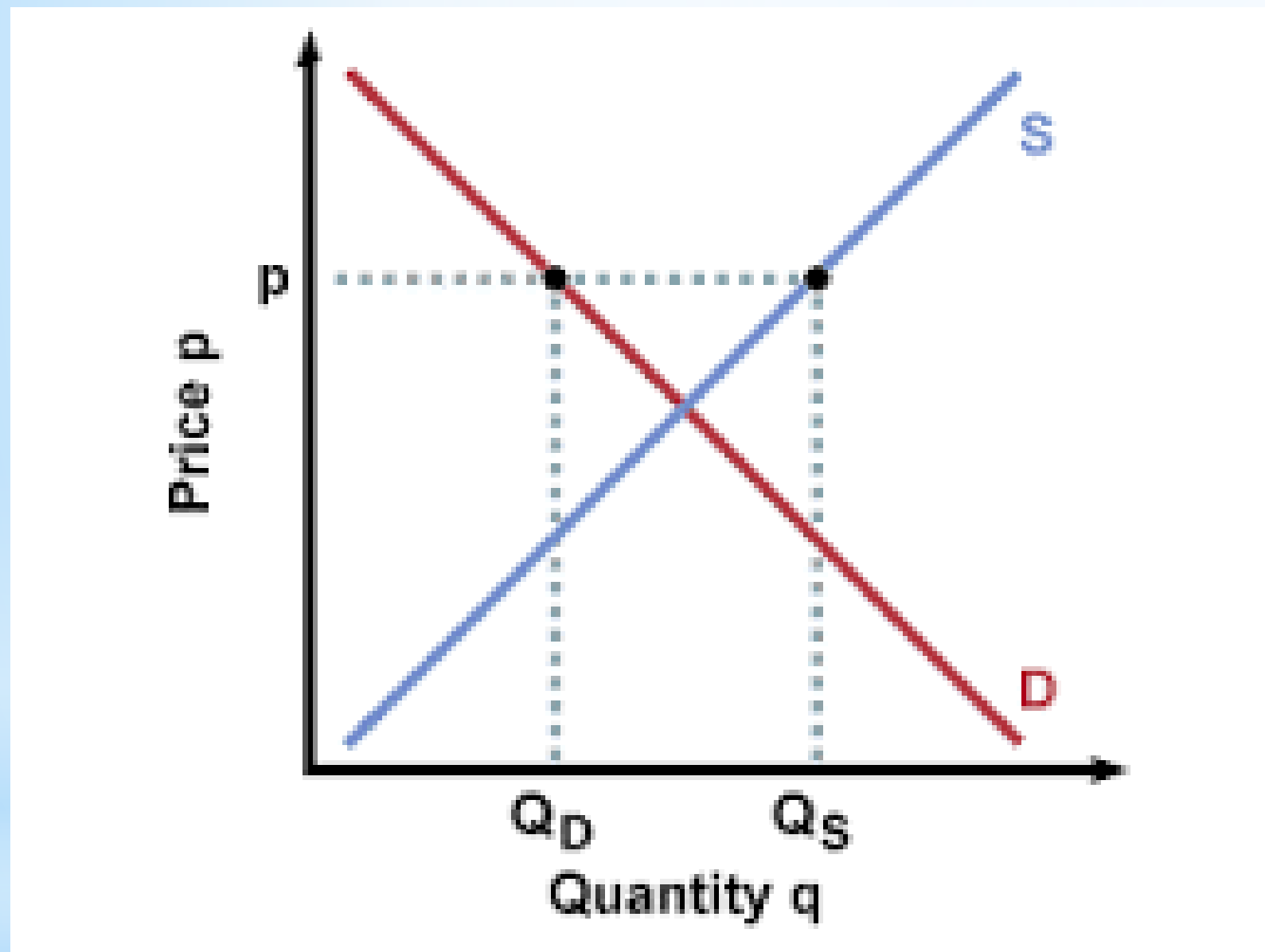
Producers/Consumers

Rational Behaviour



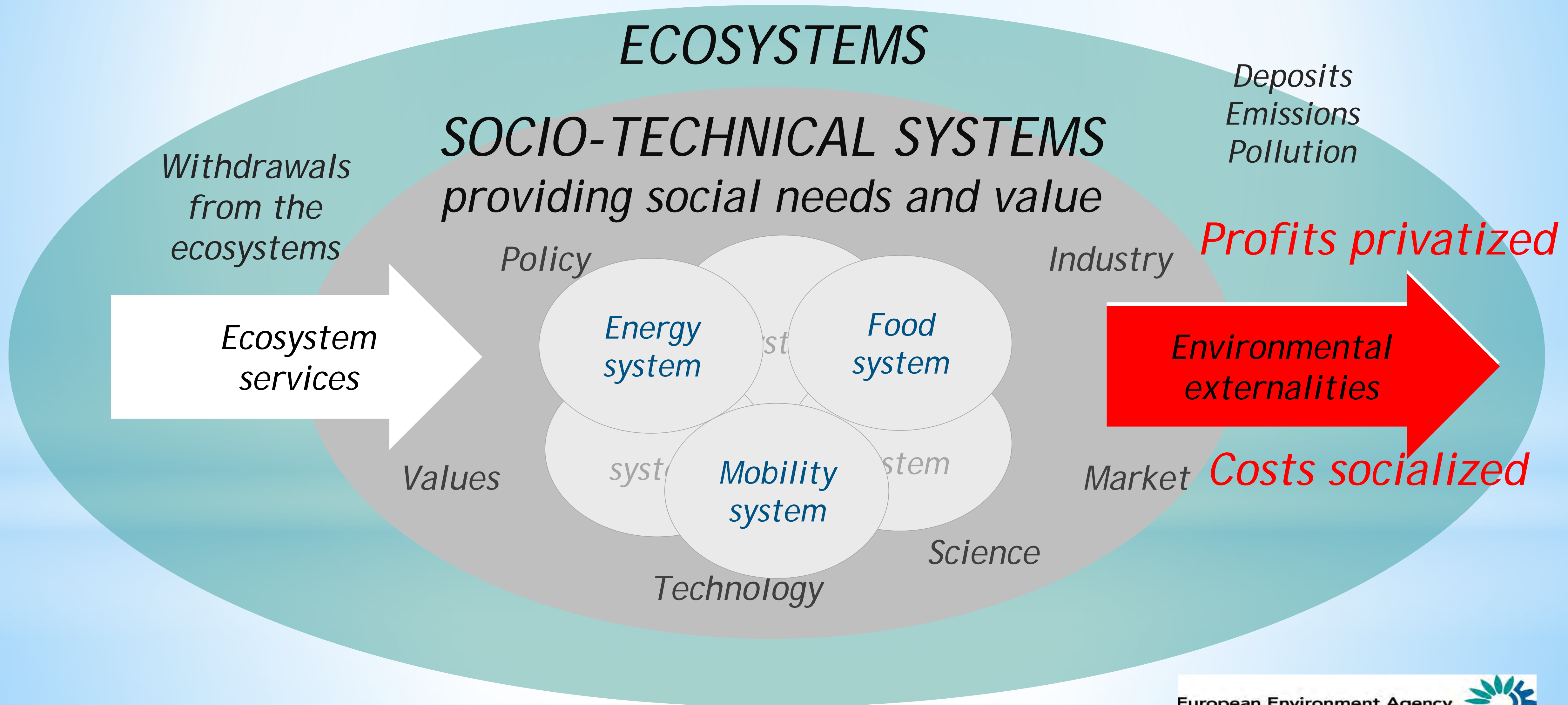
Economic model

Inbuilt Economic, Social, Environmental Imbalances



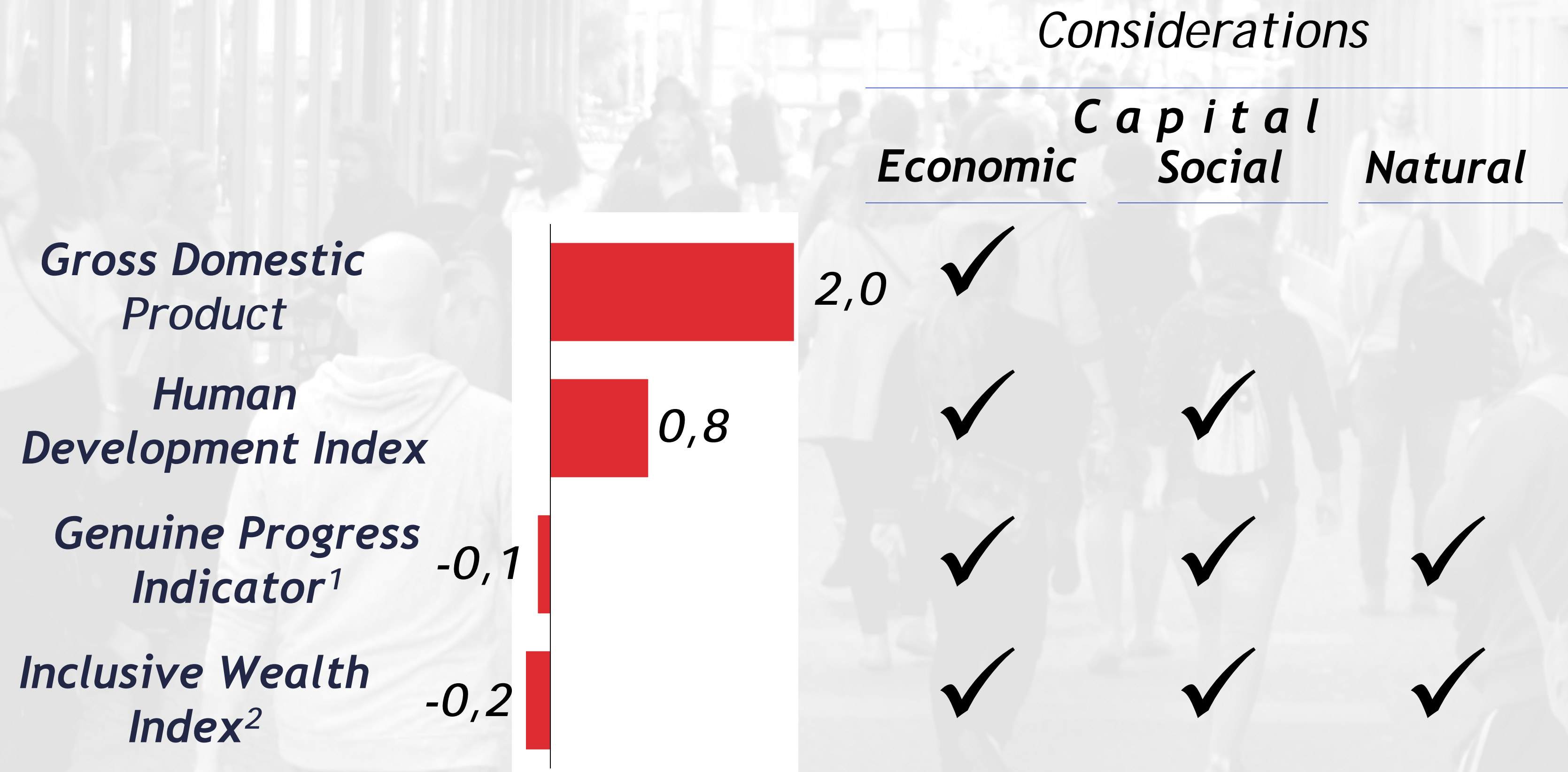
SAFE OPERATING SPACE

ECONOMIC SYSTEM FUNCTION OF ECOSYSTEM



MEASURES OF SOCIETAL DEVELOPMENT THAT INCLUDE NATURAL CAPITAL DEPLETION GROW MUCH SLOWER THAN GDP

Progress per capita³, globally, 1990-2010, real terms



1 1990-2005, as later data not available globally,

2 IWI exists in two versions, one unadjusted, and one where adjustments are made for environmental damage, oil capital gains, and total factor productivity. The adjusted version is shown here,

3 Global population growth was 1.6 percent per year during the period

SOURCE: UNEP (2014a), Kubiszewski et al. (2013)





*It is not helping if you
are walking faster,
if you are walking in
the wrong direction!*

AND

OUR COMMITMENT

OUR OBLIGATION

THE GLOBAL GOALS

For Sustainable Development





International
Resource
Panel

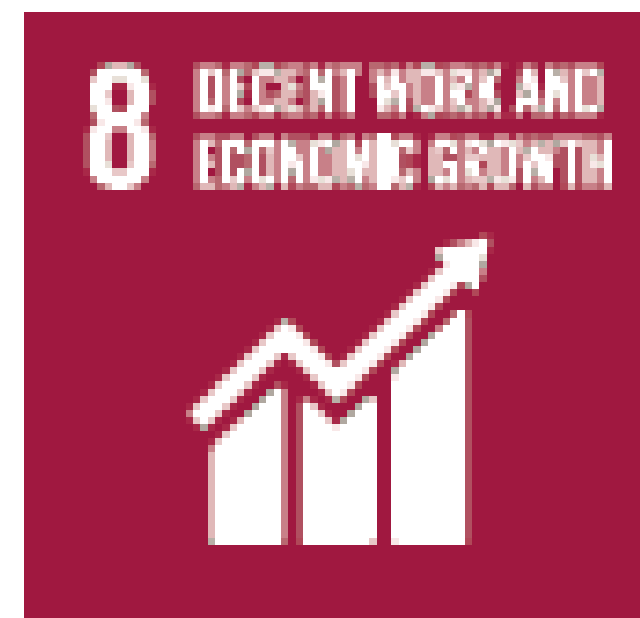


*Trade-offs among various SDGs are unavoidable. **Sustainable Consumption and Production** is the most efficient strategy to mitigate trade-offs and create synergies to resolve the development and environmental challenges articulated in the SDGs.*



International
Resource
Panel

SDGs DIRECTLY DEPENDENT ON NATURAL RESOURCES



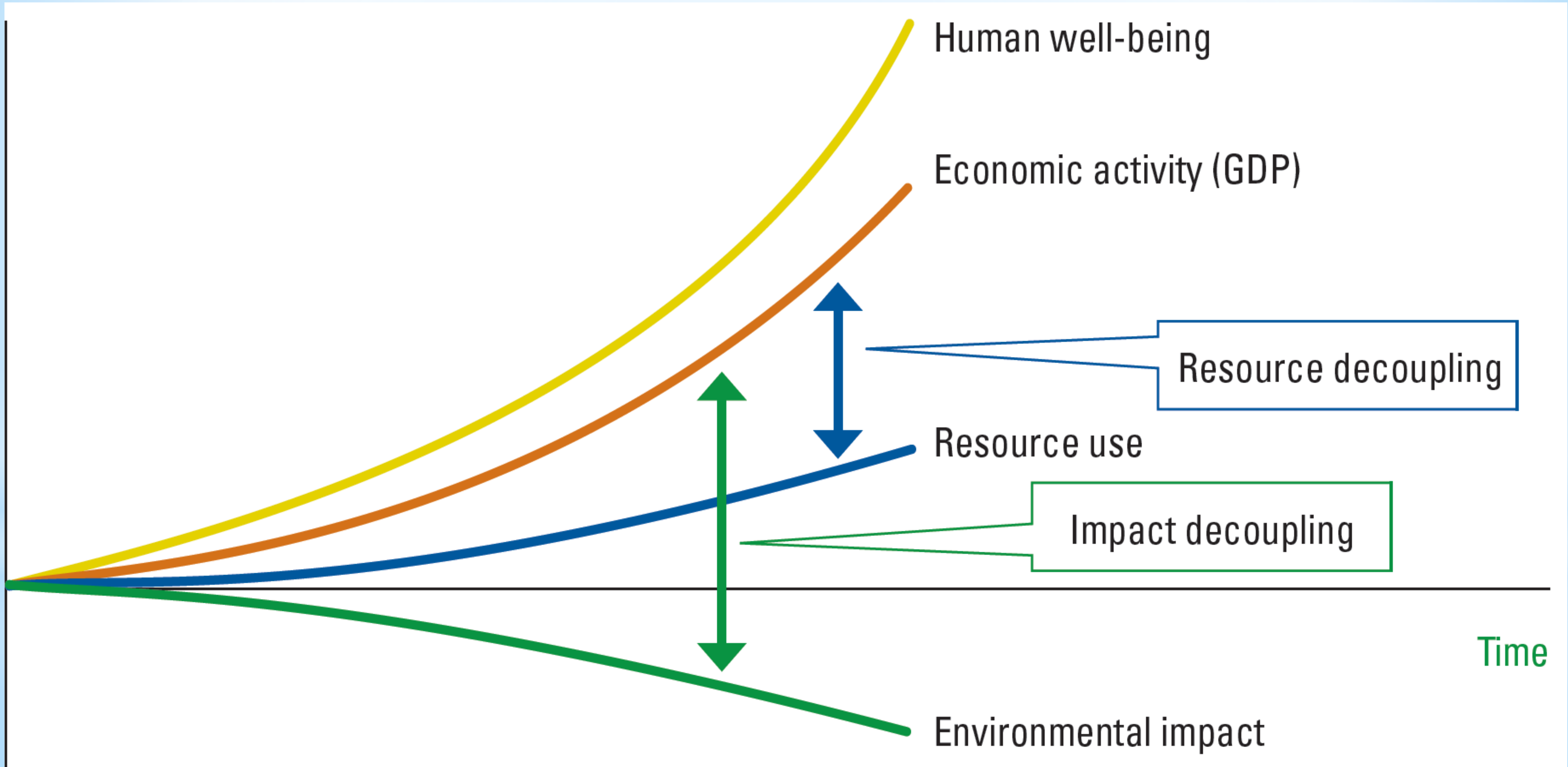
RESOURCES

THE MISSING LINK



International
Resource
Panel

DECOUPLING IS THE IMPERATIVE OF MODERN ENVIRONMENTAL AND ECONOMIC POLICY





International
Resource
Panel

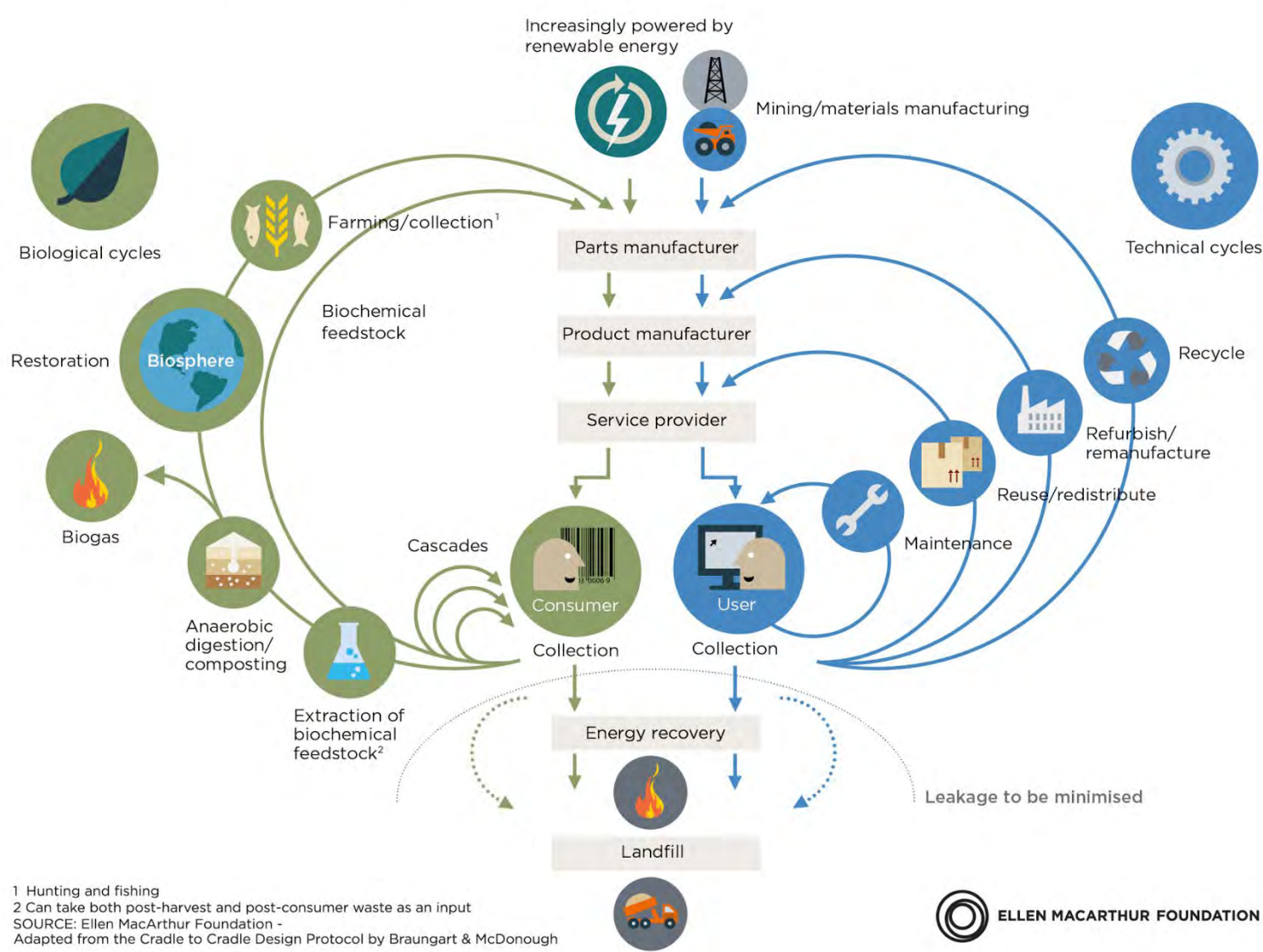


*In the mid-term, except in specific cases,
resource shortage will not be the core limiting
factor of our (economic) development ...
... but the environmental and health
consequences caused by this excessive and
irresponsible use of resources will be!*

CIRCULAR ECONOMY

- Started as an *environmental initiative*
- In two years it was *transformed to an economic based initiative* with positive environmental and health consequences
- In reality it should be seen as a *part of the bigger picture of societal and cultural transformation* needed to sustain the humanity and its prosperity.

CIRCULAR ECONOMY - an industrial system that is restorative by design



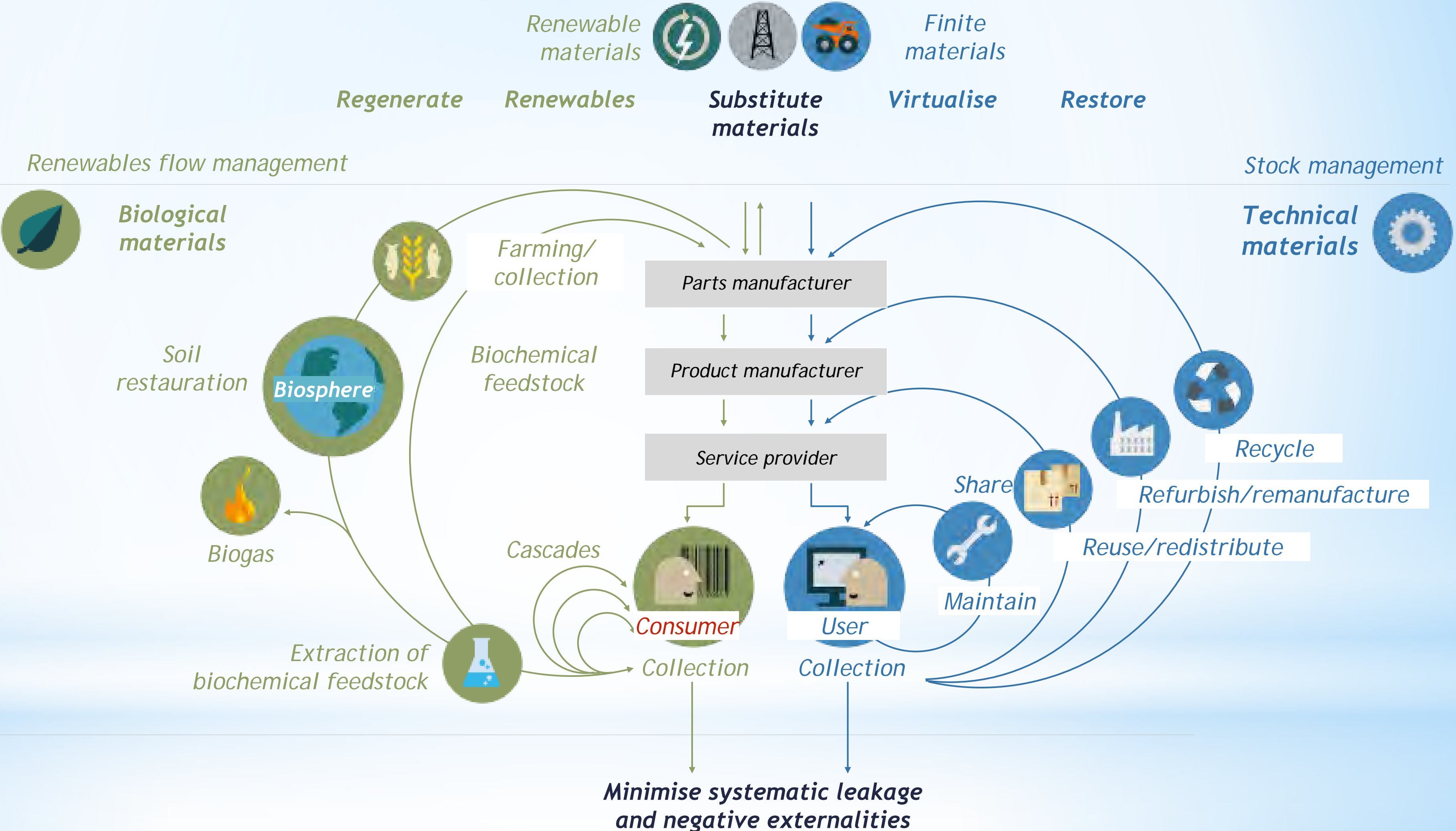
OUTLINE OF A CIRCULAR ECONOMY SYSTEM

Principles

1 **Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows**

2 **Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles**

3 **Foster system effectiveness by revealing and designing out negative externalities**



Source: Ellen MacArthur Foundation; McKinsey Center for Business and Environment; Stiftungsfonds für Umweltökonomie und Nachhaltigkeit;



ReSOLVE – A MENU OF BUSINESS ACTIONS FOR A BETTER ECONOMY

Examples

REgenerate 

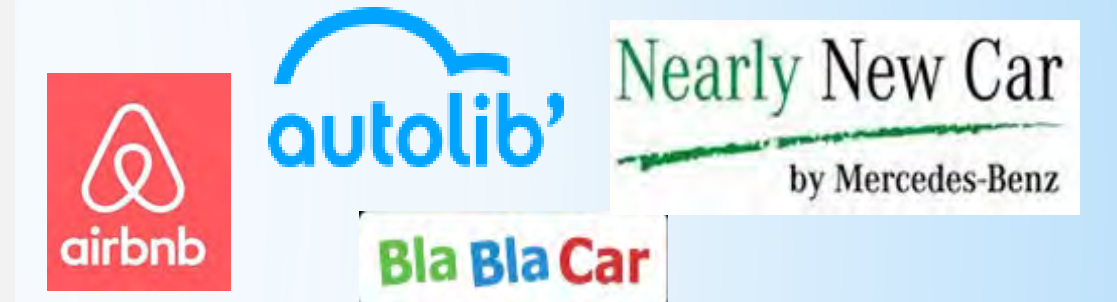
- Shift to renewable energy and materials
- Reclaim, retain, and restore health of ecosystems
- Return recovered biological resources to the biosphere





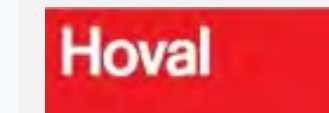
Share 

- Share assets (e.g. cars, rooms, appliances)
- Reuse/secondhand
- Prolong life through maintenance, design for durability, upgradability, etc.



Optimise 

- Increase performance/efficiency of product
- Remove waste in production and supply chain
- Leverage big data, automation, remote sensing and steering







Loop 

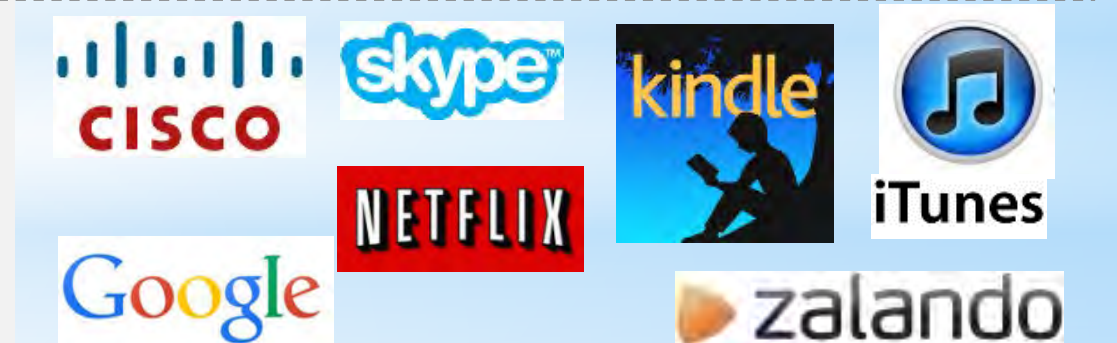
- Remanufacture products or components
- Recycle materials
- Digest anaerobic
- Extract biochemicals from organic waste





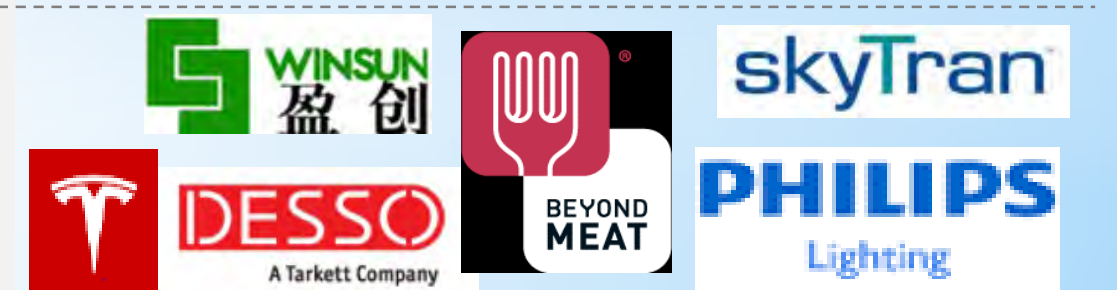
Virtualise 

- Books, music, travel, online shopping, autonomous vehicles etc.



Exchange 

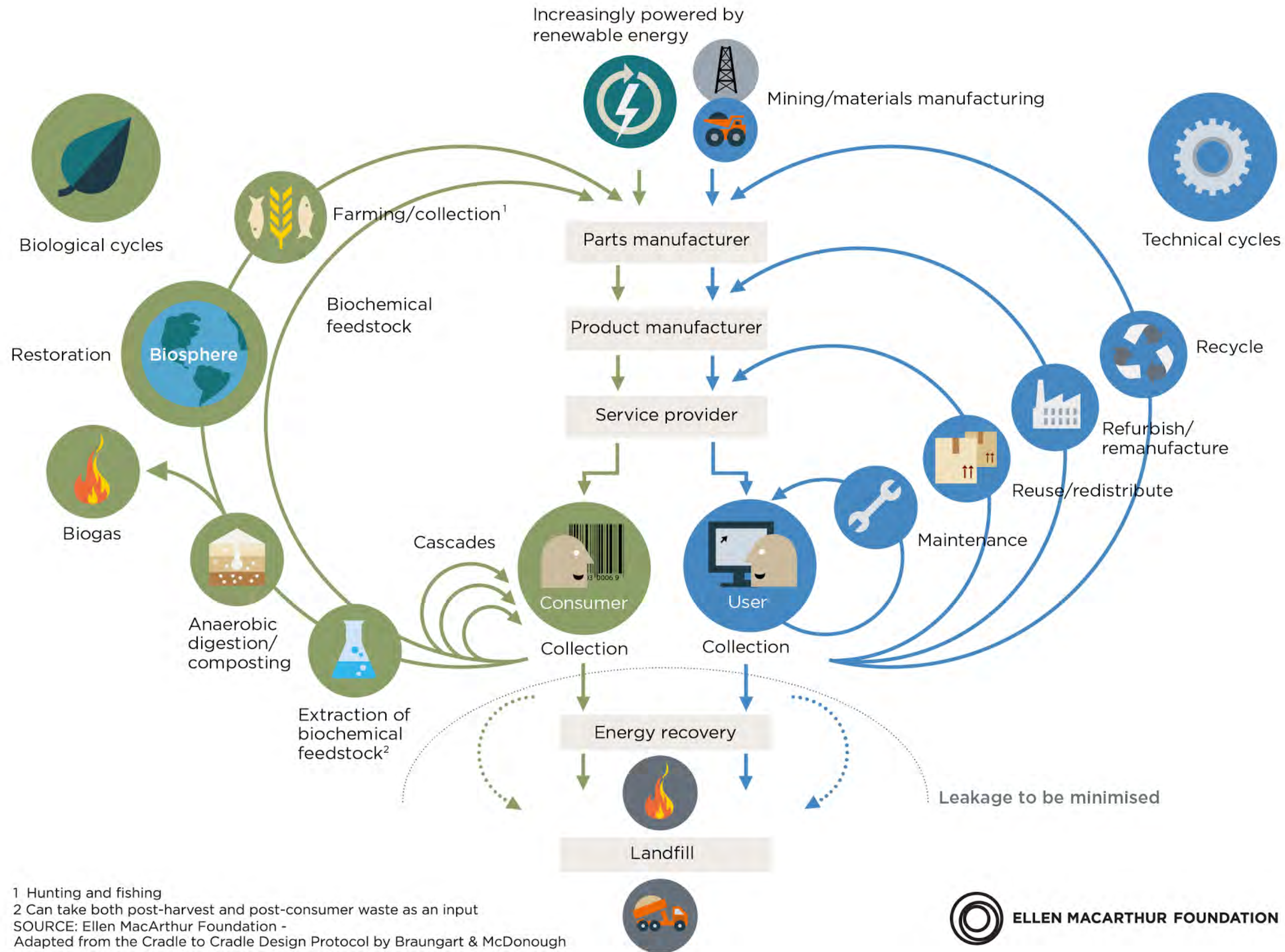
- Replace old with advanced non-renewable materials
- Apply new technologies (e.g. 3D printing)
- Choose new product/service (e.g. multimodal transport)



DESCRIPTION OF NEXT-WAVE CIRCULAR ECONOMY INVESTMENT THEMES

Cross-cutting opportunity

			Investments up to 2025 ¹ € billion	Case examples				
		Description						
Mobility	Integrating mobility systems	<ul style="list-style-type: none"> Fully integrate the public transport system with shared vehicles 	100	DriveNow	MAAS GLOBAL SOLUTIONS	switchh Hamburg verbunden	Digital innovations (IoT, applications)	Material tracking system through secondary market
	Designing and producing circular cars	<ul style="list-style-type: none"> Design and produce clean cars made for looping with durable materials 	35	BMW	ZOX	UBER		
	Remanufacturing car parts	<ul style="list-style-type: none"> Rollout remanufacturing of car parts at scale 	1	RENAULT	AUTOCRAFT Drivetrain Solutions	Li BALANCE		
Food	Deploying regenerative agricultural practices	<ul style="list-style-type: none"> Shift towards an EU agricultural system that regenerates the soil and revitalises ecosystems 			ASLM	MilkFlex		
	Closing nutrient loops	<ul style="list-style-type: none"> Scale nutrient and energy recovery from various waste streams using anaerobic digestion or biorefineries 		CONSORZIO ITALIANO COMPOSTATORI	HARVEST	CSS		
	Farming through indoor urban farms	<ul style="list-style-type: none"> Scale hydroponic, aquaponics, and aeroponic farms in urban areas 		AeroFarms	AGRICOOOL	UF		
	Developing next-wave	<ul style="list-style-type: none"> Develop new and efficient sources of protein 						
Built Environment	Designing and producing circular buildings	<ul style="list-style-type: none"> Design and produce multi-usage highly modular and energy-positive buildings made of durable non-toxic materials 	105	LIVING BUILDING CHALLENGE	PARK 20 20	Ministry of Environment and Food of Denmark Environmental Protection Agency	Digital innovations (IoT, applications)	Material tracking system through secondary market
	Closing buildings loops	<ul style="list-style-type: none"> Ramp-up recycling and re-use of building materials 	2	GYPSUM RECYCLING	danogips			
	Developing circular cities	<ul style="list-style-type: none"> Integrate circularity into urban developments through innovative business models 	10	U.S. GREEN BUILDING COUNCIL MEMBER	EcoDistricts			



1 Hunting and fishing
 2 Can take both post-harvest and post-consumer waste as an input
 SOURCE: Ellen MacArthur Foundation -
 Adapted from the Cradle to Cradle Design Protocol by Braungart & McDonough

CIRCULAR ECONOMY AND CLIMATE CHANGE



CLIMATE

CARBON MANAGEMENT

LAND

WATER

ENERGY

MATERIALS

DECOUPLING

RESOURCES

PILLARS FOR EFFICIENT CLIMATE CHANGE POLICY

*SUPPLY SIDE
SOLUTIONS*

*DEMAND SIDE
SOLUTIONS*

*NATURE BASED
SOLUTIONS*

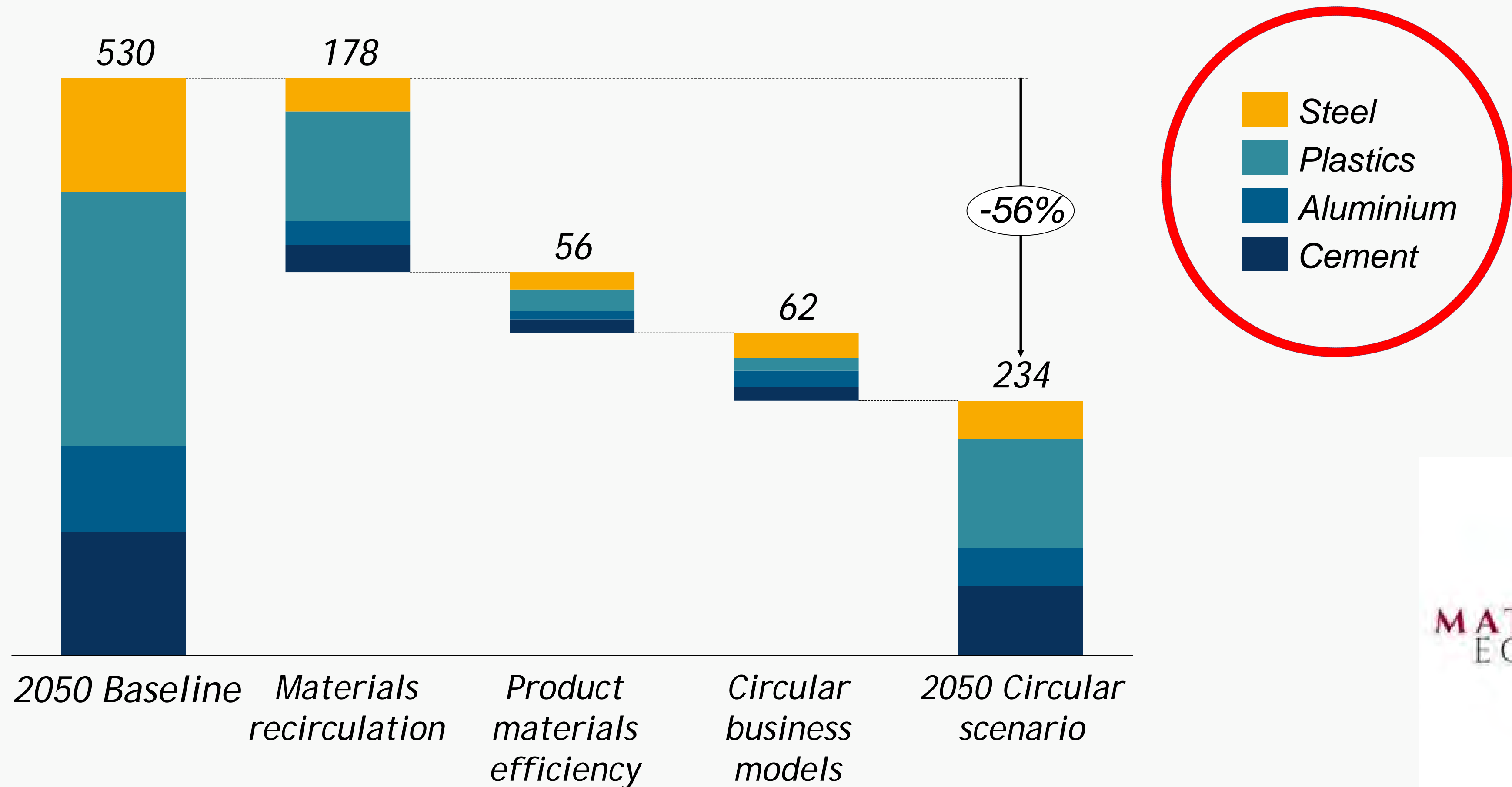
*Energy,
Carbon management*

*Circular Economy,
Land, Water,
Materials
Management*

*Eco-system services
Environmental sinks*

A MORE CIRCULAR ECONOMY CAN REDUCE EU EMISSIONS FROM MATERIALS BY 56%

EU emissions reductions potential from a more circular economy, 2050
Mt CO₂ per year



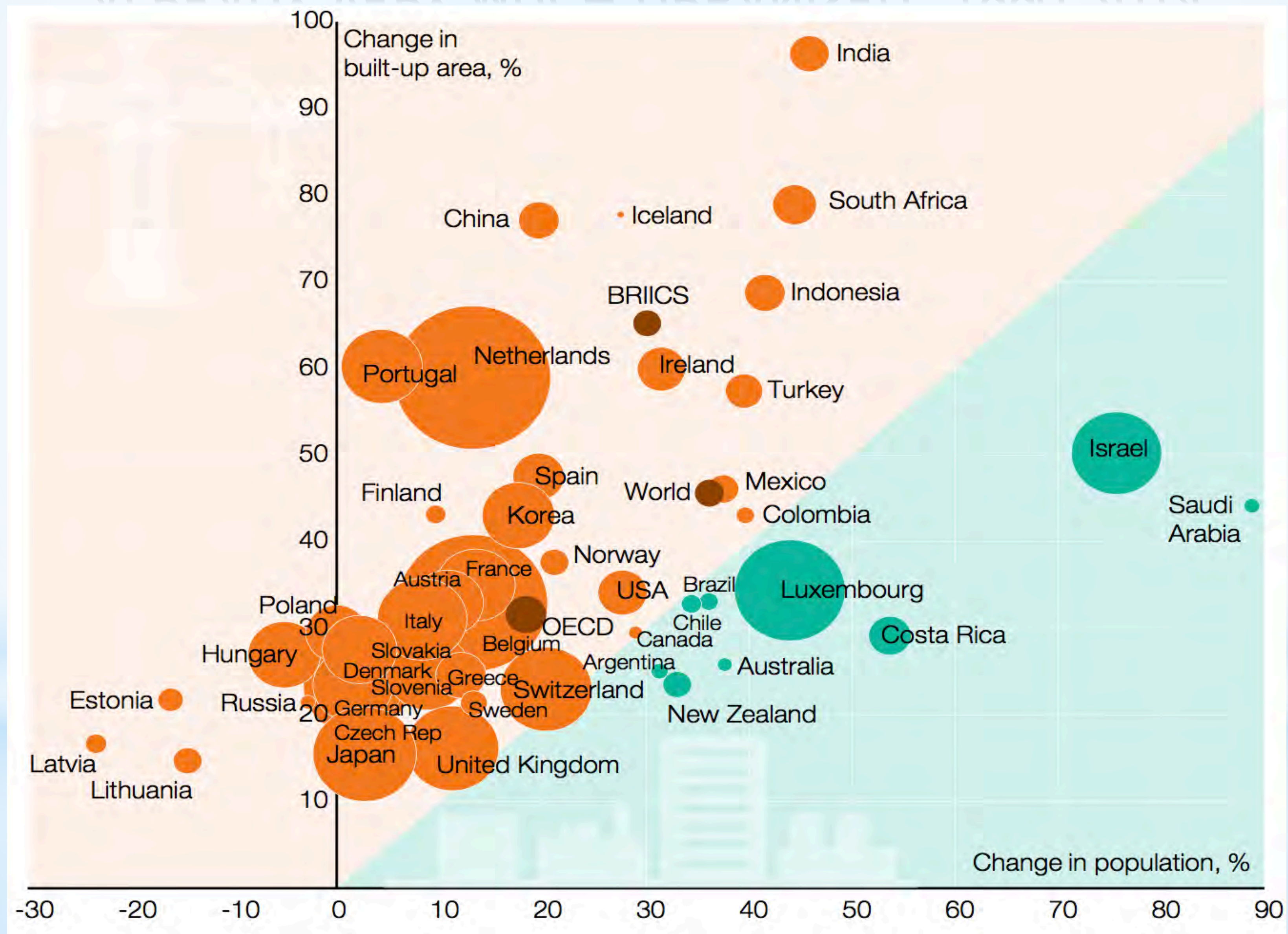
CIRCULAR ECONOMY
AND CITIES

URBANISATION

- Globally, an area of the size of the UK has been *converted to buildings* since 1990 (OECD GG Indicators 2017)
- *More than 50% of urban fabric* expected to exist by 2050 still needs to be constructed
- In the three years period (2011-2013), *China* has used more *cement* than the *USA* during the entire 20th century



BUILT-UP AREA PER CAPITA IS INCREASING, INCLUDING IN COUNTRIES THAT ARE ALREADY VERY MUCH URBANISED, 1990-2014



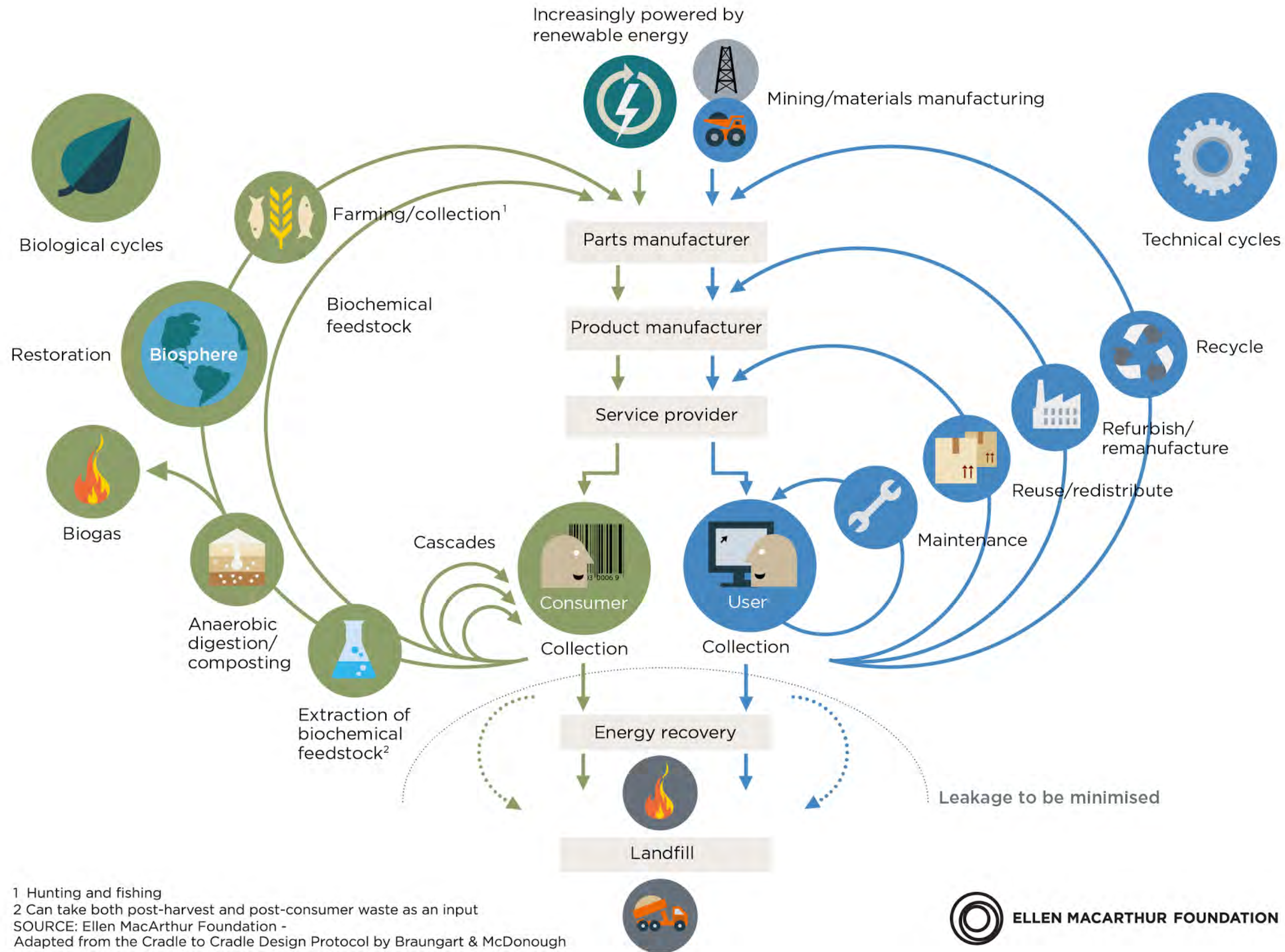
Source: OECD, Green Growth Indicators 2017

“NEW URBAN AGENDA”

QUITO 2016

Roadmap for sustainable urbanization with its three transformative commitments

- *leave no one behind*
- *sustainable and inclusive economies*
- *environmental sustainability*
- *and references to resource efficiency, alongside low-emission and resilience, of housing, infrastructure and basic services.*



1 Hunting and fishing
 2 Can take both post-harvest and post-consumer waste as an input
 SOURCE: Ellen MacArthur Foundation -
 Adapted from the Cradle to Cradle Design Protocol by Braungart & McDonough

URBAN SYSTEMS AND CIRCULAR ECONOMY

- SHARING MODELS
- MOBILITY SYSTEMS
- WASTE RECYCLING
- SUSTAINABLE BUILDINGS
- ENERGY EFFICIENCY
- ...



“THE WEIGHT OF THE CITIES” - RESOURCE REQUIREMENTS OF FUTURE URBANISATION 2050

*Urbanization is expected to be more or less
completed in 50 years.*

*We have a once-in-a-lifetime opportunity to
shift the expected urbanization onto a more
environmentally sustainable and socially just
path.*

RECOMMENDATIONS

1. *Shift from 'linear' to 'circular' metabolisms*
2. *Urban metabolisms must be monitored to inform strategic planning*
3. *Relationships between GDP, population and land/material/energy use must be measured and targets developed by city types*
4. *Change city planning 'defaults' toward 5D framework*
5. *Use urban infrastructure investments as catalysts for change*
6. *Link infrastructure & land use policy (regional and neighborhood)*
7. *Promote appealing mixed-income mixed-use city cores; prevent suburbanization*
8. *Attractive business propositions to support infrastructure transformation*
9. *Leverage the power of 'experimentation' to re-imagine futures in practice*
10. *Foster inter-city learning networks*
11. *Support from higher levels of government*

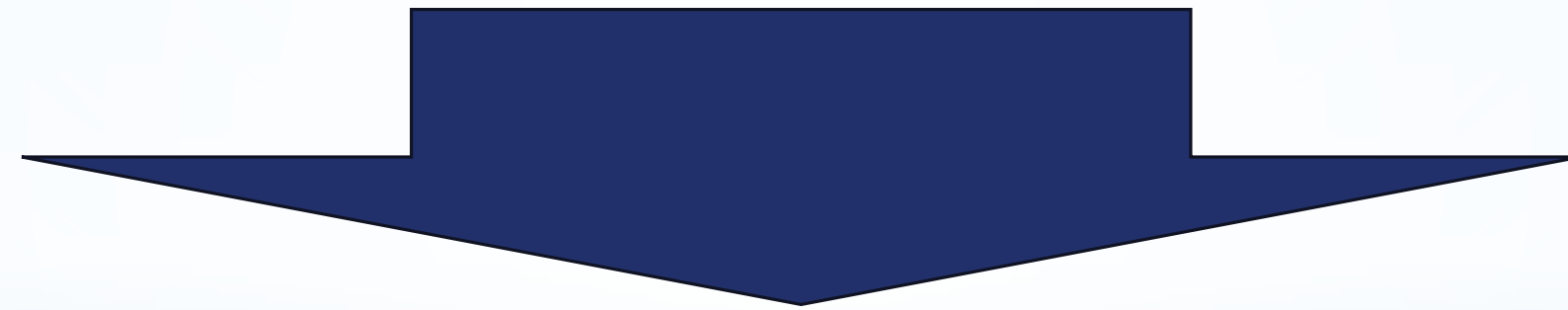
**Urban
Metabolism**

**Pathways of
Change**

Governance

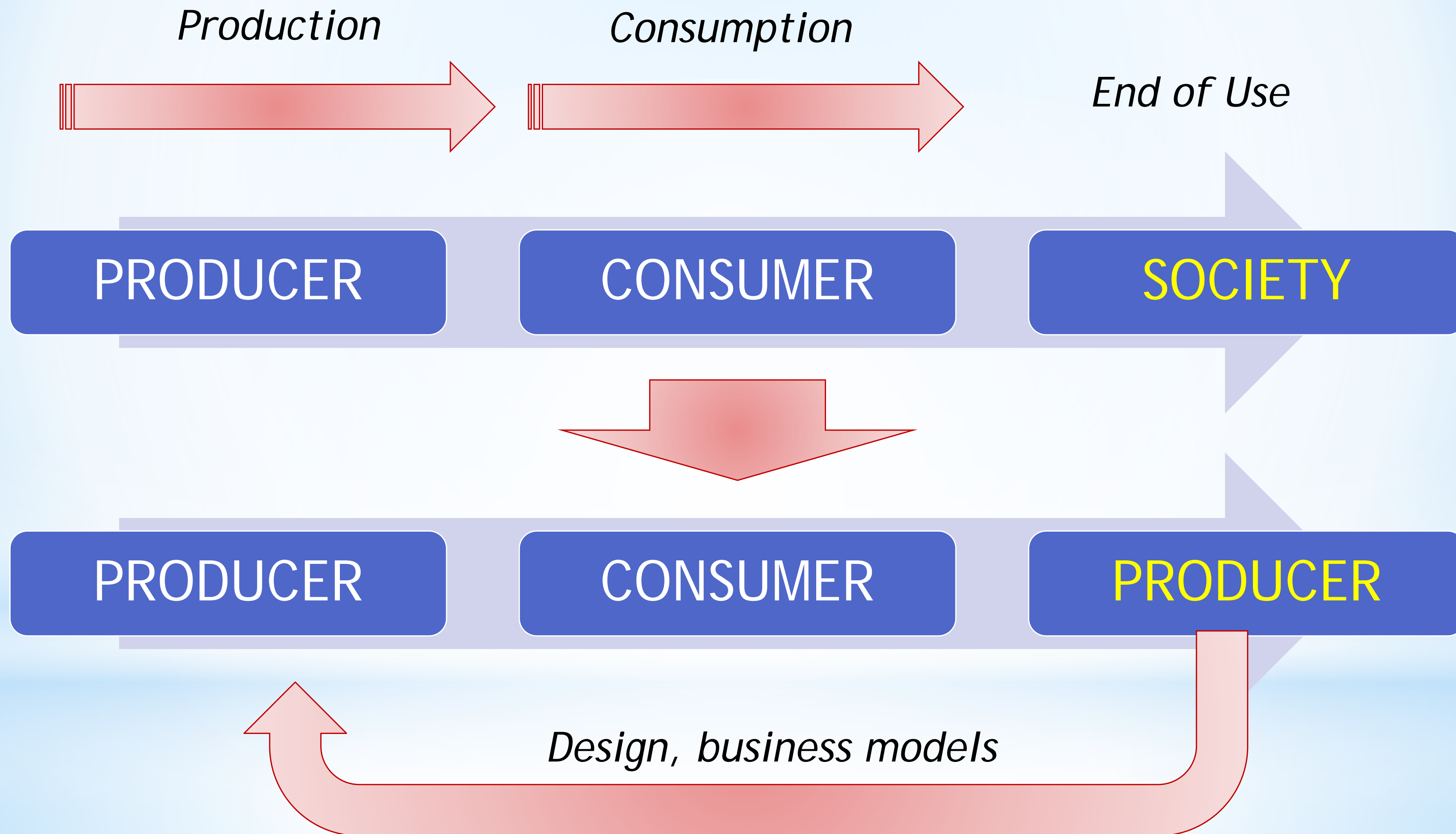
Redefining Risk Management To make it compliant to SDGs

*From being a pure product or service providers
managing the risks of the company, farm, bank
through profit maximisation*



*To socially responsible companies, farmers, bankers ...
managing also the risks of the society*

EXTENDED PRODUCER RESPONSIBILITY



TO CONCLUDE

SYSTEM INITIATIVE ON ENVIRONMENT AND NATURAL RESOURCE SECURITY

World Economic Forum - Annual Meeting 2018



Complexity and scale of these challenges requires a space that allows actors with responsibility for those environmental governance mechanisms to be able to consider and experiment with both new forms of collaboration and more „systemic“ approaches ... through promoting multi stakeholder cooperation, more agile governance (including sub-state actors, such as cities, states and provinces), the use of new technologies, and enhanced accountability and transparency.

SYSTEM INITIATIVE ON ENVIRONMENT AND NATURAL RESOURCE SECURITY

World Economic Forum - Annual Meeting 2018



- *The challenge seems to not be one of not inadequate scientific evidence anymore; rather it is one of **cooperation and implementation**.*
- *There is a deepening perception of a lack of **synchronicity between economic and environmental policy** responses to global risks.*

CIRCULARITY AND GLOBAL GOVERNANCE



*INTRODUCING MORE OF THE SHARING
SOVEREIGNTY INSTEAD OF OWING SOVEREIGNTY*

Why it is important to keep materials in the economy and make it circular?

- *We have to fix a broken **compass!** In essence this means the **development of new economic model** based on sustainable consumption and production integrating all pillars of sustainability.*
- *To **avoid globally extensive and inter-systemic crisis and frequent conflicts** and to show that we are committed to implement what we have agreed in SDGs. Changes are **unavoidable** and humans are supposed to be intelligent. It is high time to prove it.*
- *To prove that we understand our challenges and we are serious about efforts to improve European **competitiveness** on a global level.*

And how?

*Change will not appear by waiting for the leadership of others, **be the leaders** on your level of governance and authority ... in politics, in business, academia, civil society, in making your investment decisions ...*

Recommended policy strategies

- 1. Set targets and measure progress*
- 2. Develop a national plan and act on key leverage points across all levels of governance*
- 3. Take advantage of leapfrogging opportunities*
- 4. Implement a policy mix that builds incentives and corrects market failures*
- 5. Promote innovations toward a circular economy*
- 6. Enable people to develop resource efficient solutions*
- 7. Unlock the resistance to change*
- 8. Strengthen cooperation and reach a consensus for coordinated global actions*

WORK ON ALL LEVELS OF GOVERNANCE

Cities



*A lot could be done on that level due to **relative autonomy** of the governance and many **concentrated CE related problems and opportunities***



Guy McPherson:

"If you think the economy is more important than the environment (and health), try holding your breath while counting your money".



International
Resource
Panel



THANK YOU

For more information

Contact IRP Secretariat at resourcepanel@un.org

Visit our website at <http://resourcepanel.org/>

Closing of the day



Thank you for your attention!

