

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](#)



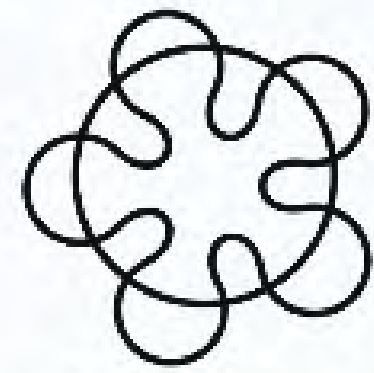


FAB CENTER

ER STREET

CITY HUB

REVIVE LANE



CITY OF
REBURG

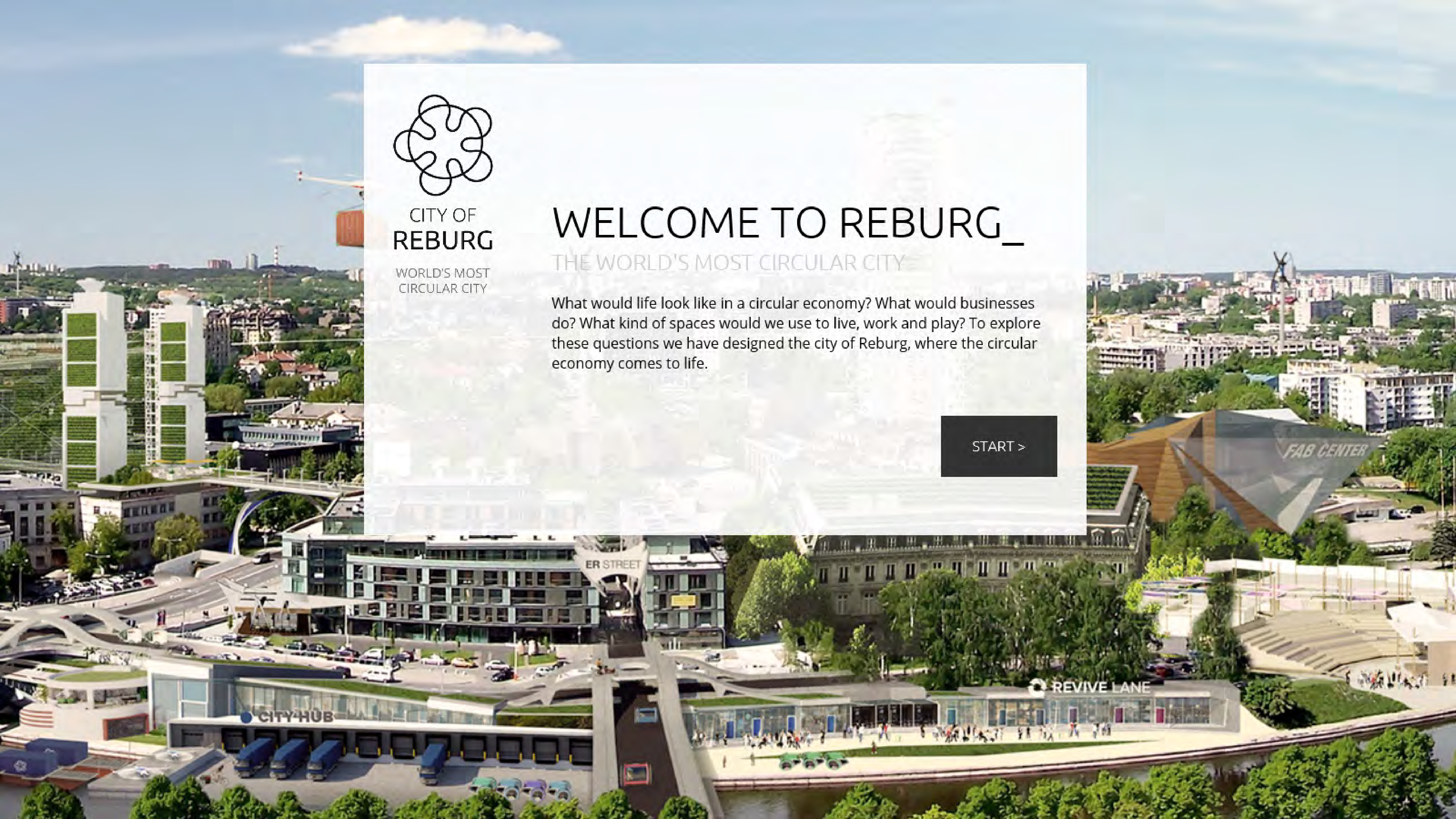
WORLD'S MOST
CIRCULAR CITY

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

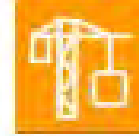
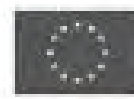
What would life look like in a circular economy? What would businesses do?
What kind of spaces would we use to live, work and play?
To explore these questions we designed the city of Reburg, where the circular economy comes to life.



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

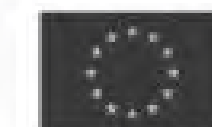
About smart cities and virtualization - The real, the augmented and the virtual reality are mixed into a seamless whole. Thus reducing material and logistic needs.



LET'S GO >

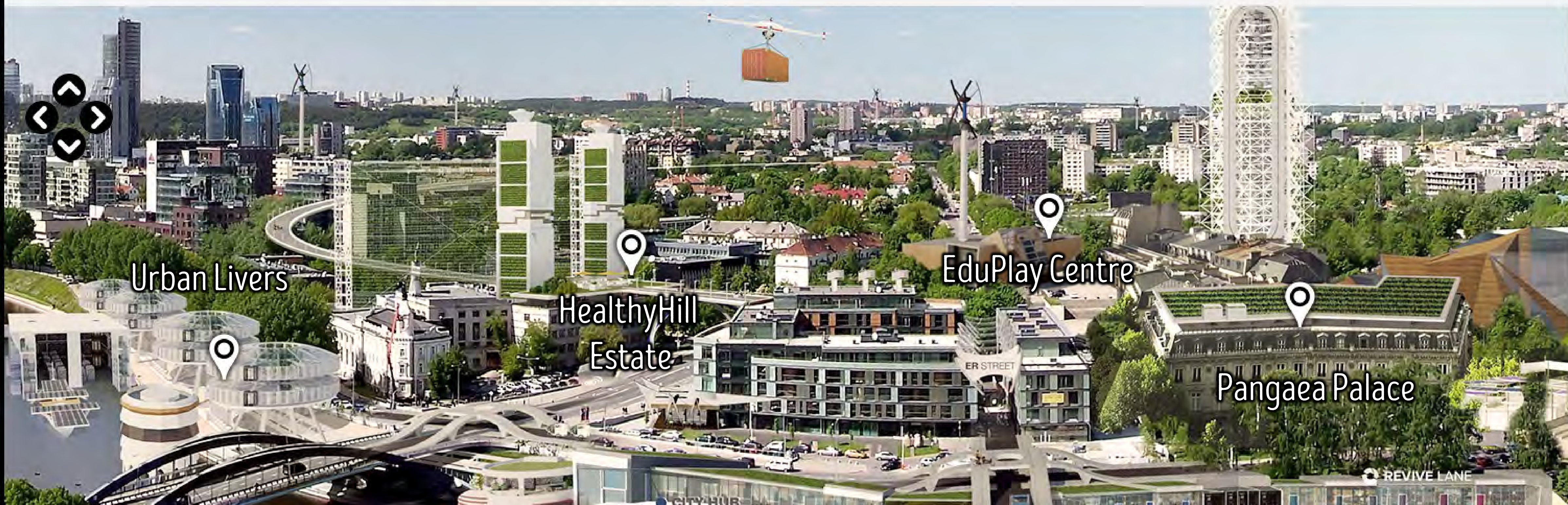
OUR PARTNERS

REBURG IS BUILT BY MANY HANDS_



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

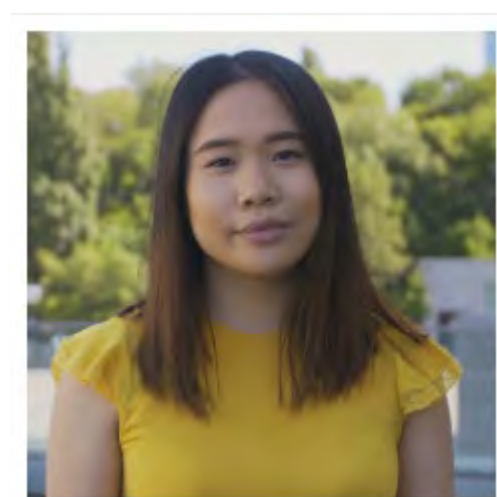
A vertical sidebar on the left side of the page. It contains several icons: a circular arrow icon at the top, followed by a magnifying glass, a house with a checkmark, a Wi-Fi signal, a Facebook 'f' logo with the number '258' below it, a Twitter bird logo, a printer icon, an envelope icon, and a red square with a white plus sign and the number '14' below it.



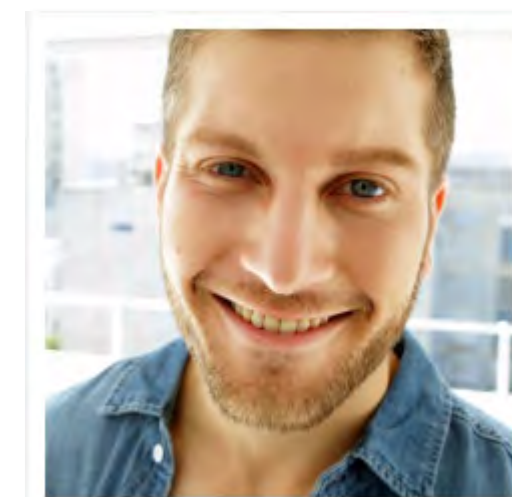
Erica Molano



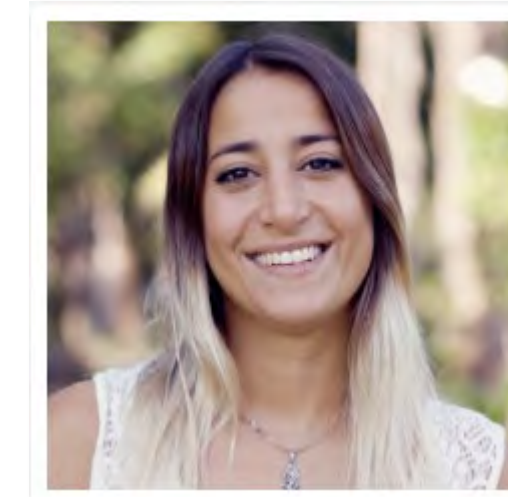
Elma Hobbs

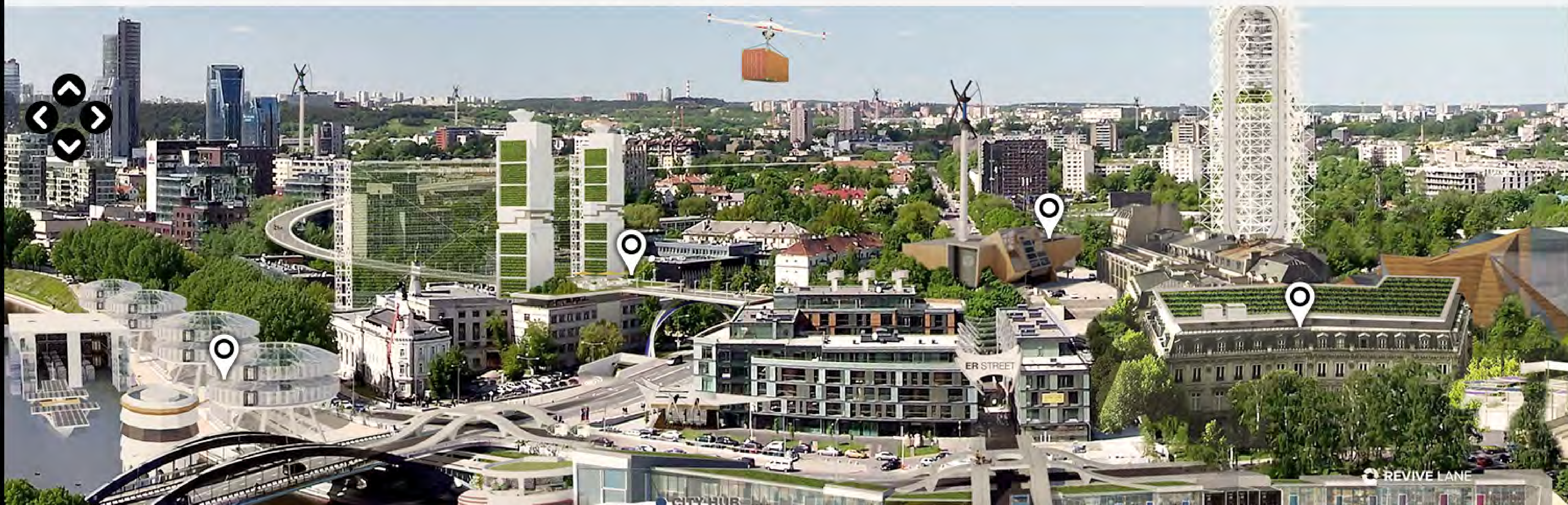
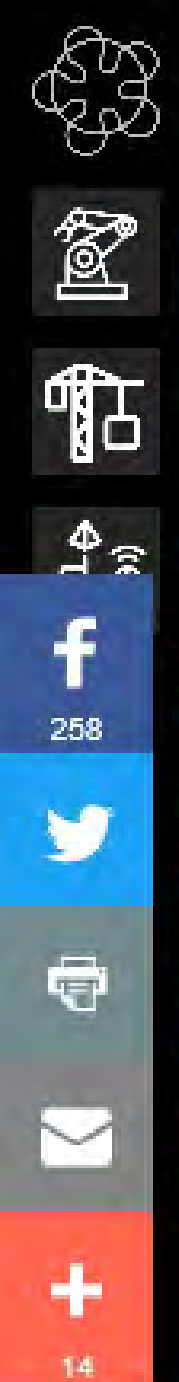


Rodrigo Madagani



Carmen Van Zandt

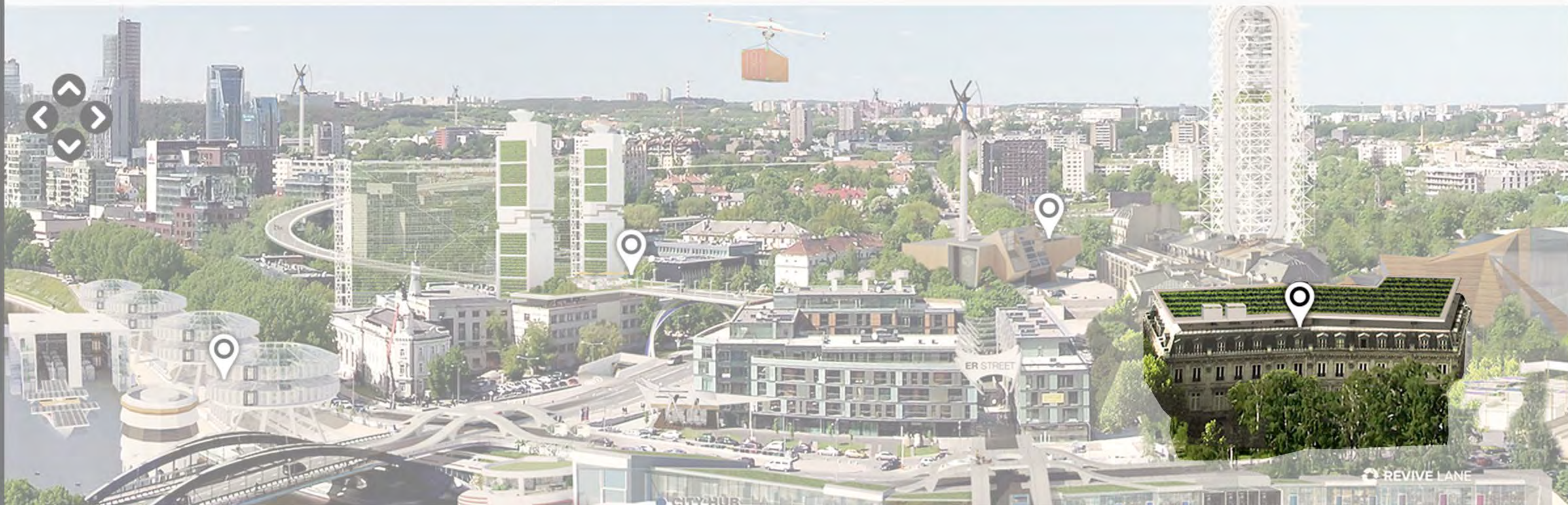




Erica Molano



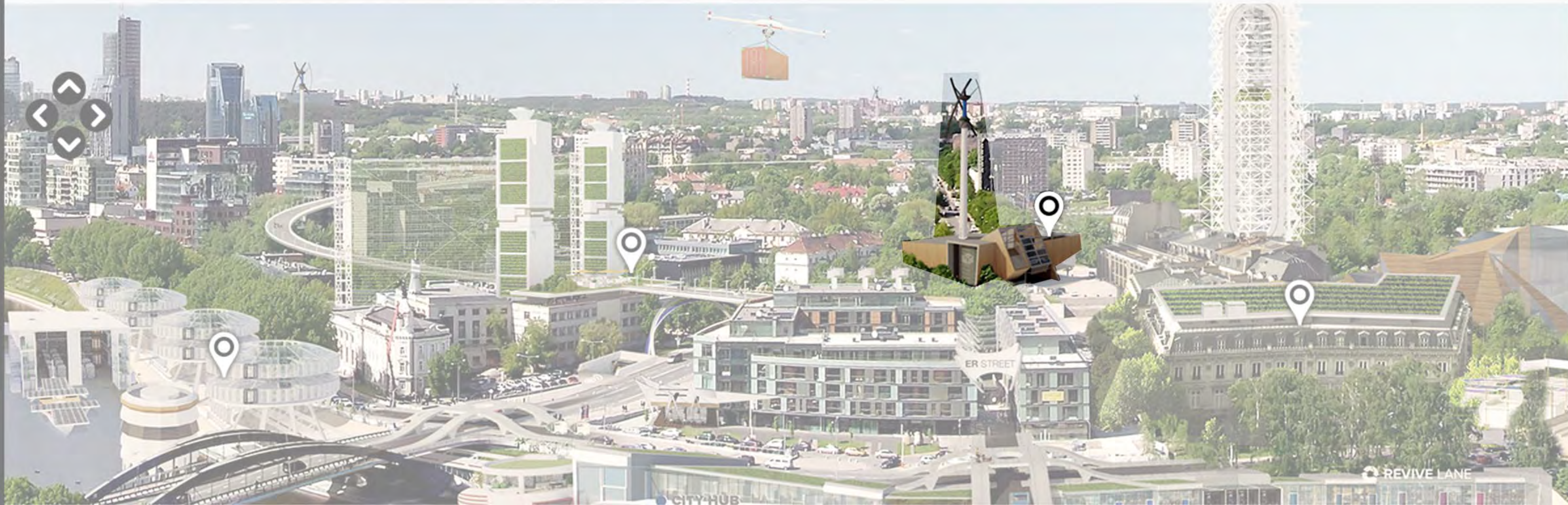
Resident at Pangaea Palace
President of the school council
Daughter of resident at Healthy Hill



Erica Molano



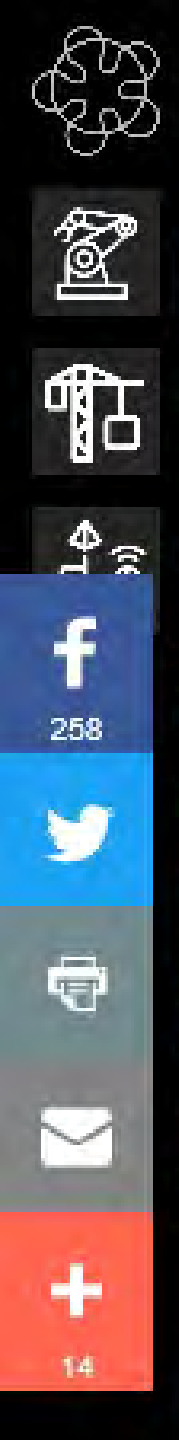
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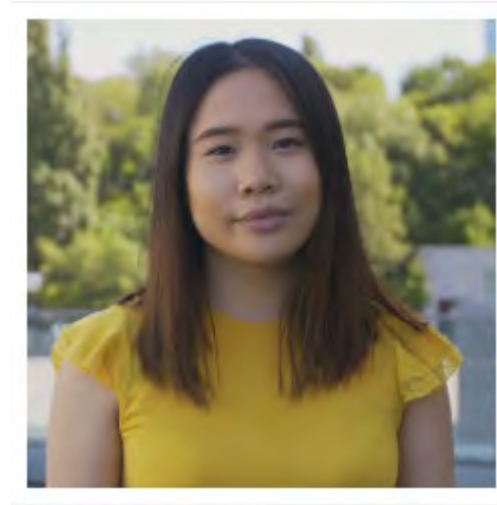
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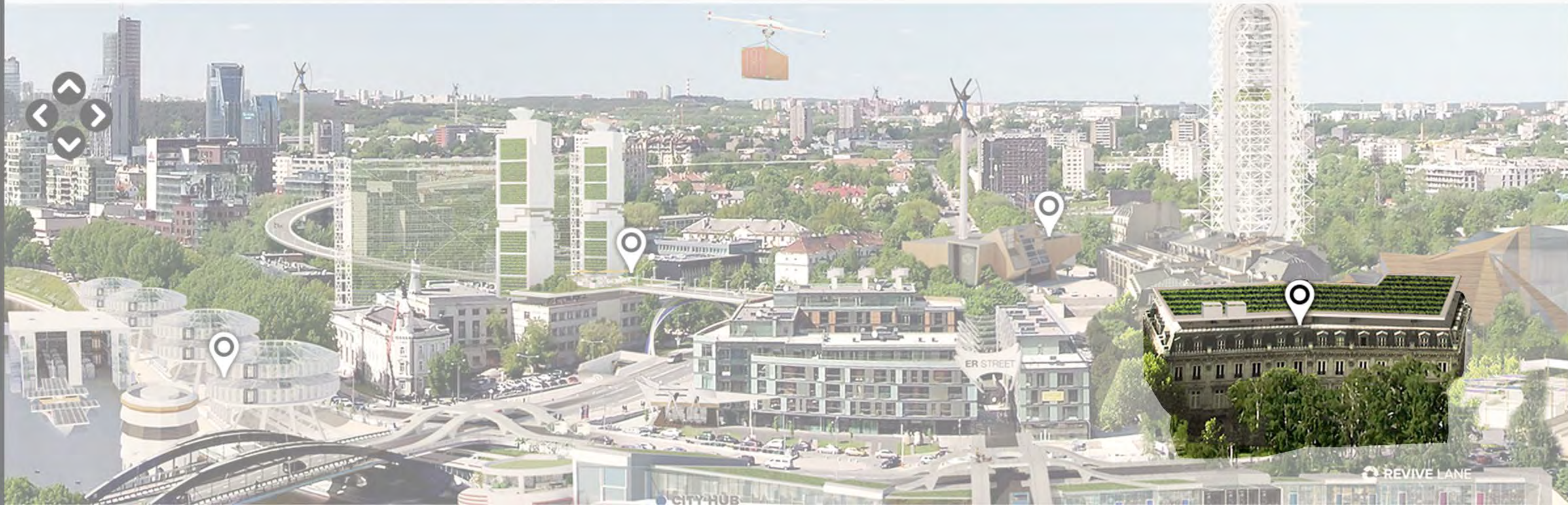
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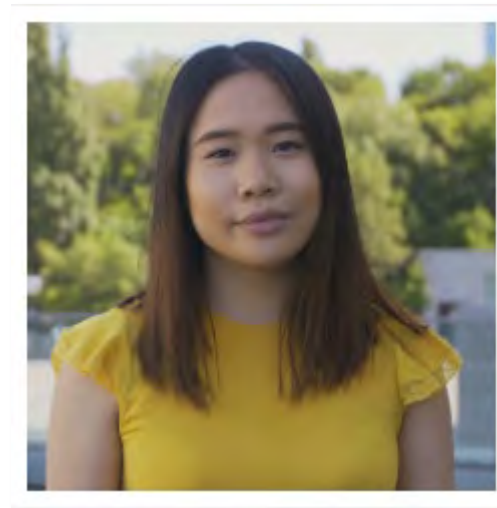
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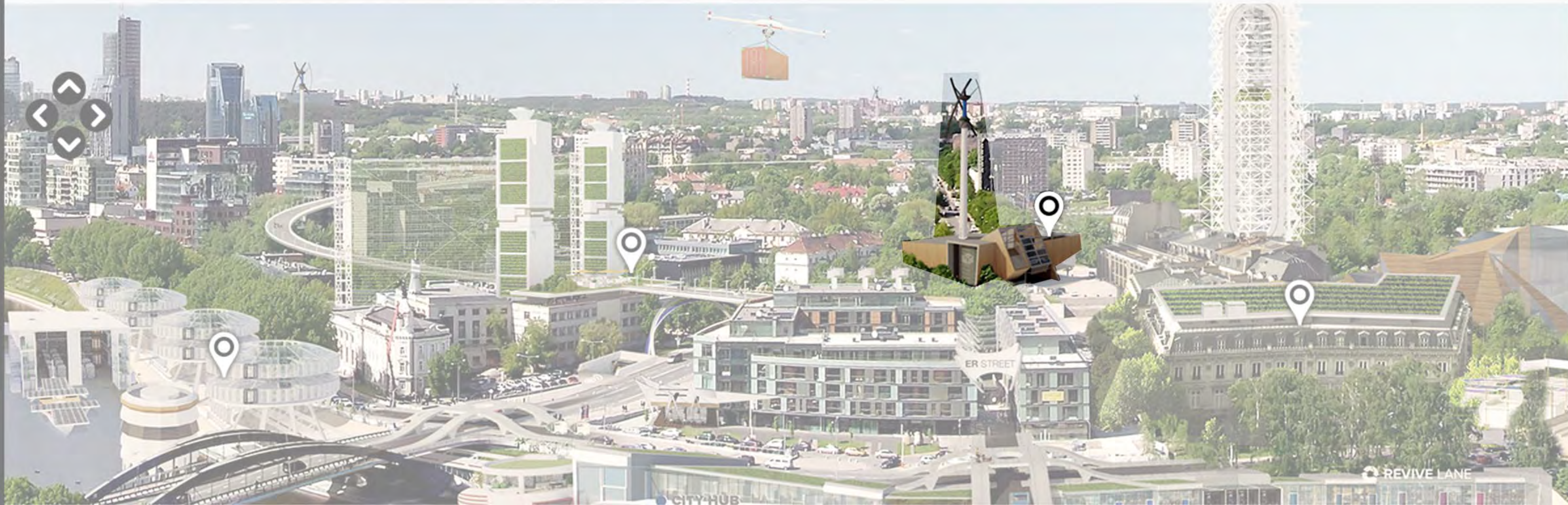
building system developer
at Meccalegos Ltd



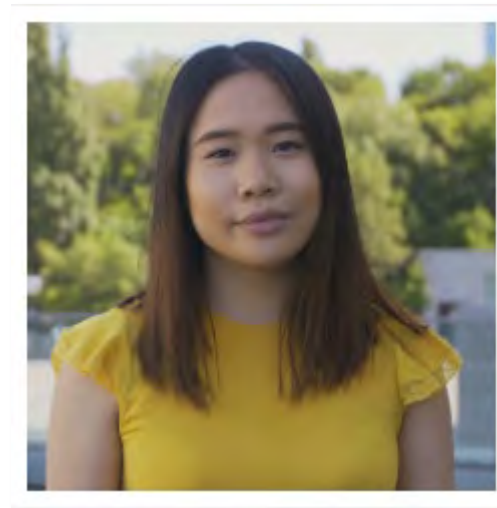
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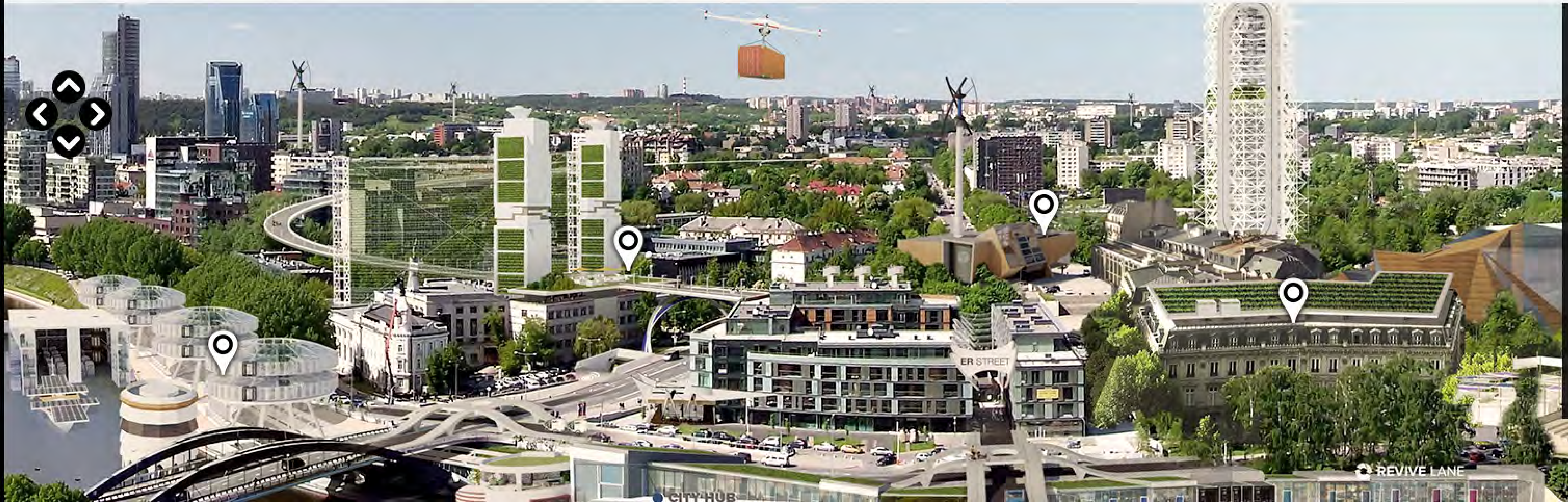
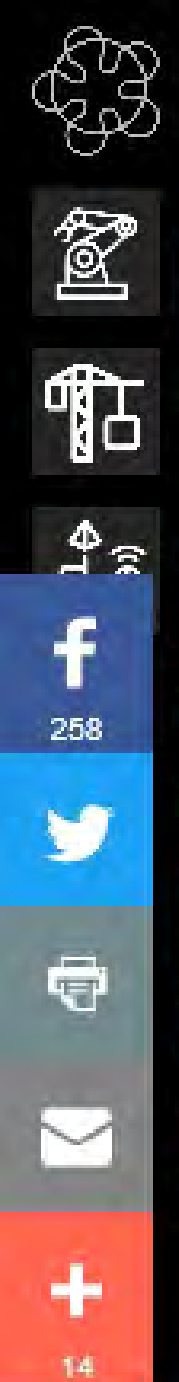
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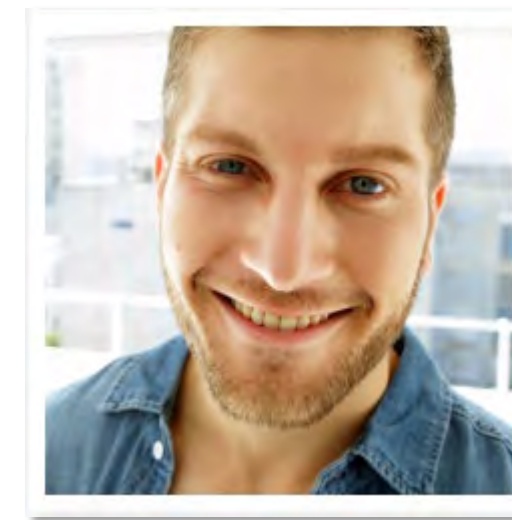
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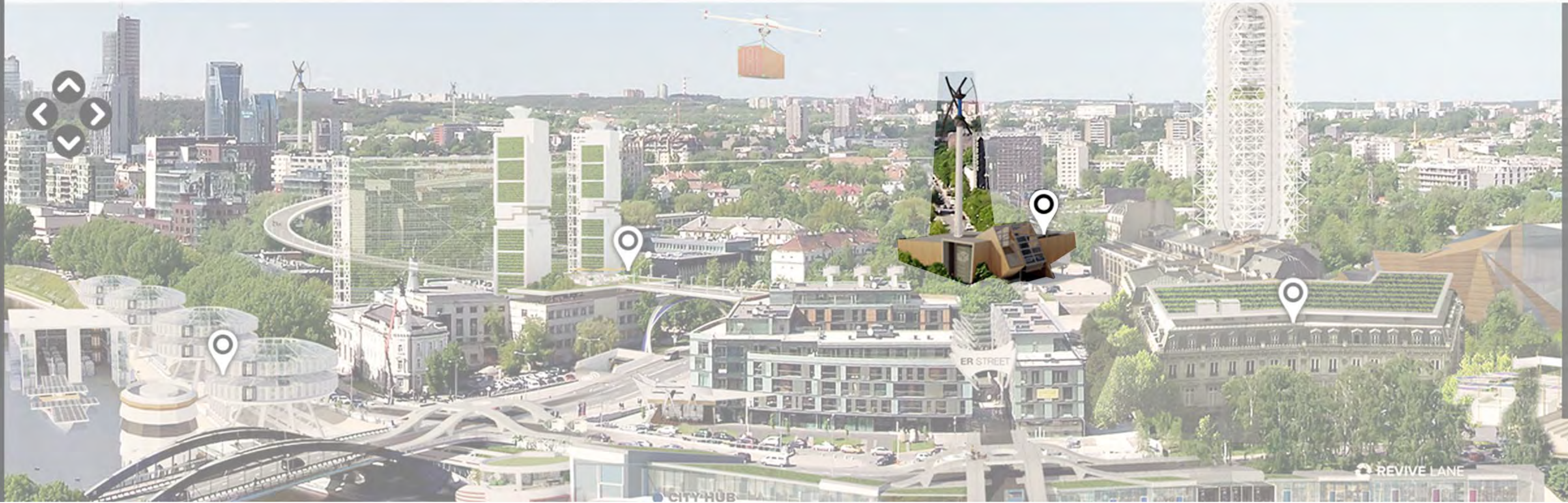
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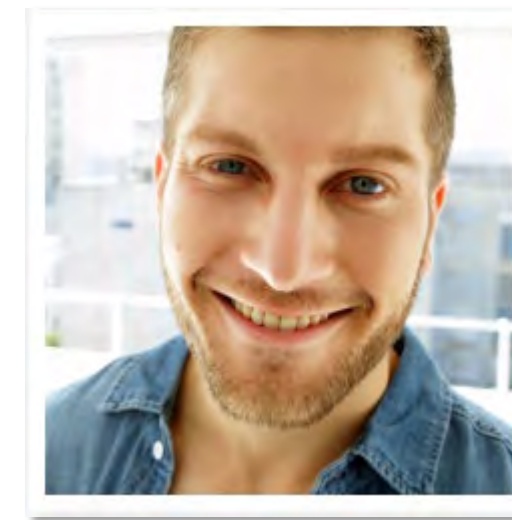
Rodrigo Madagani



building stock manager
at Facilitoutatis



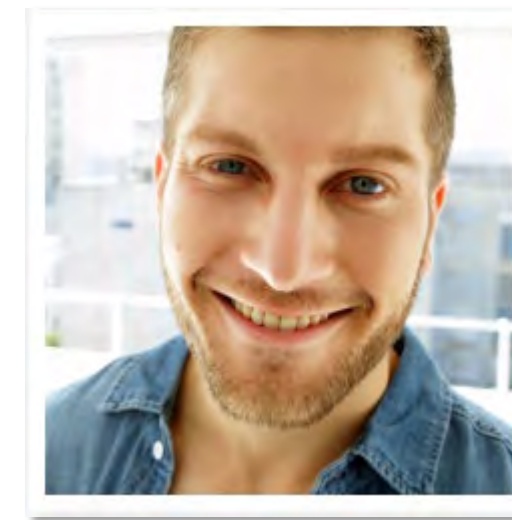
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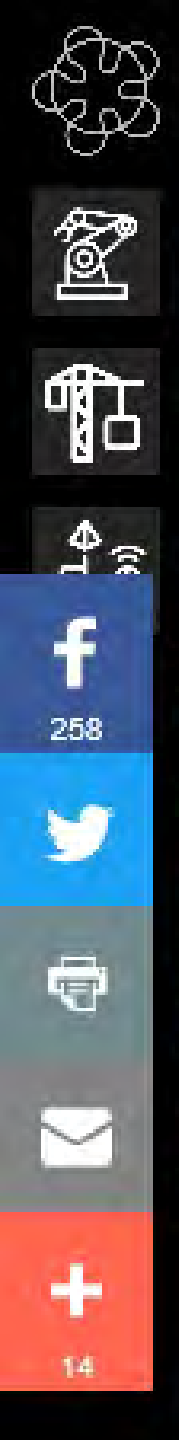
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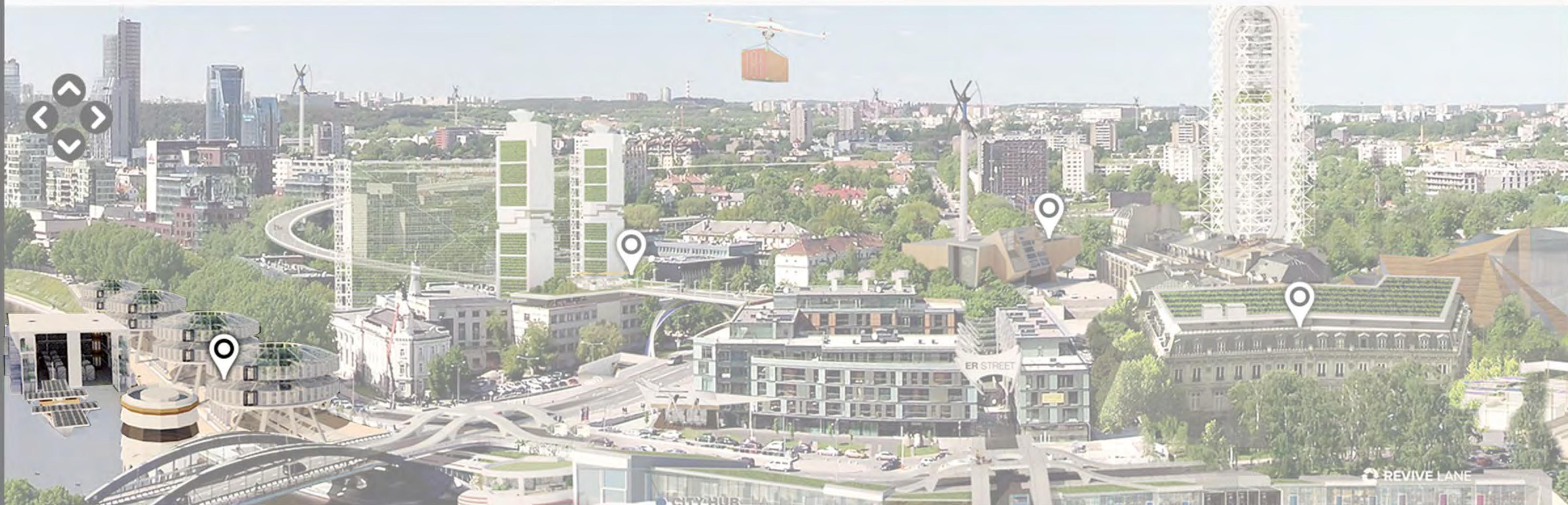
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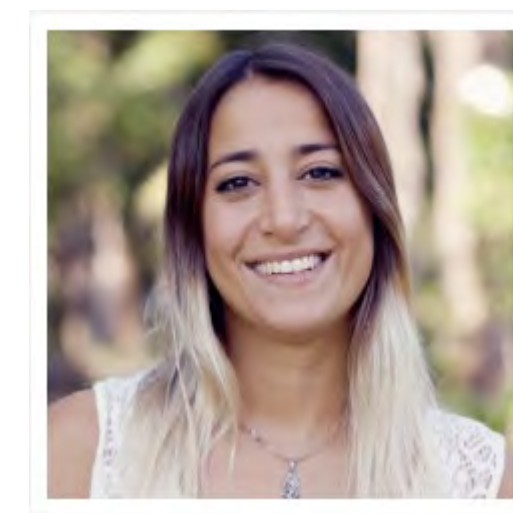
Carmen Van Zandt



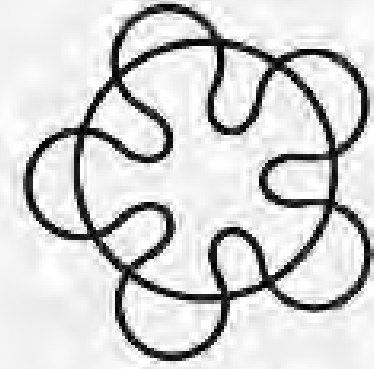
component wizard at
Urban Metabolism Ltd



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



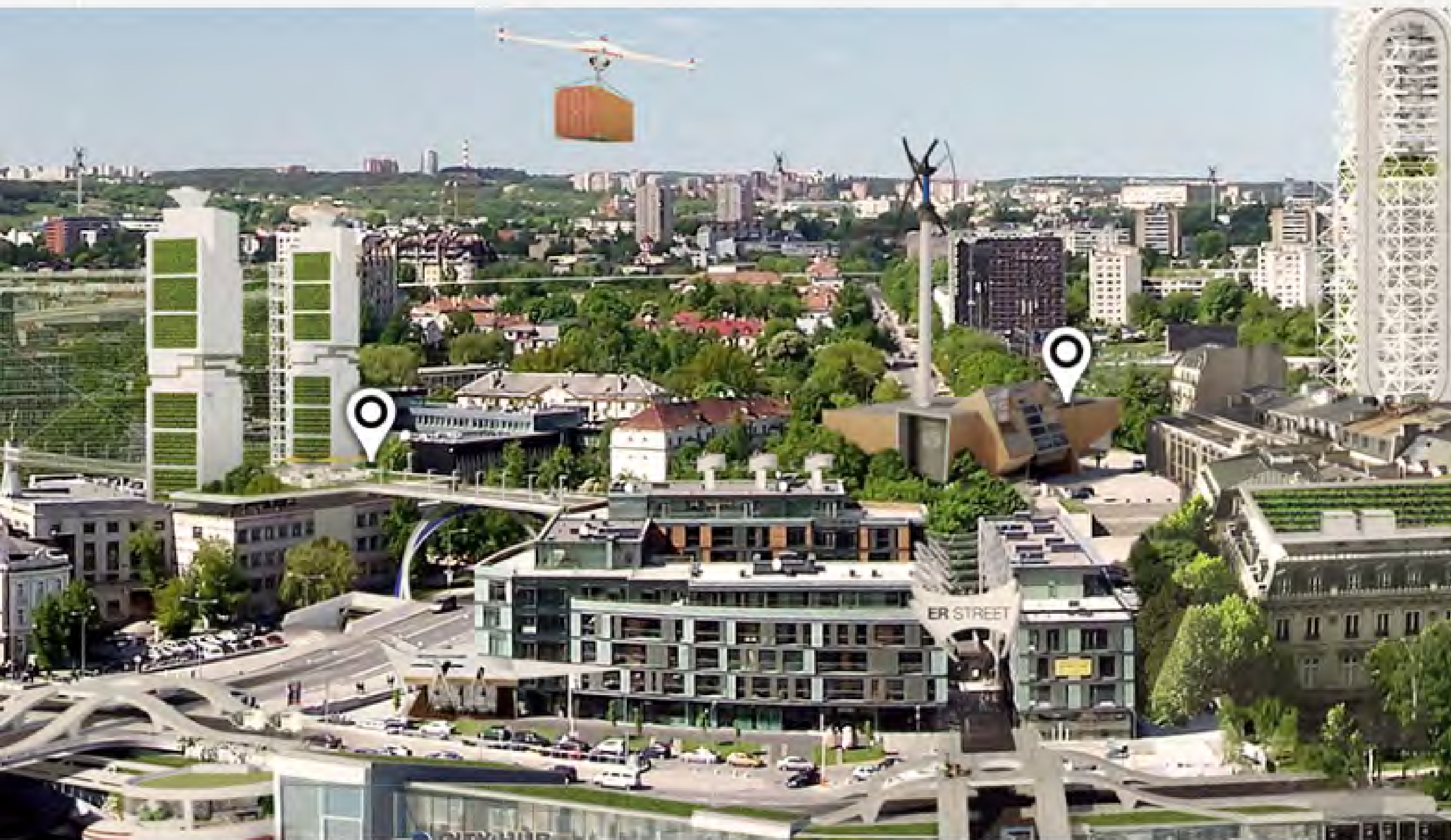
URBAN MINING COLLECTIVE

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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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**





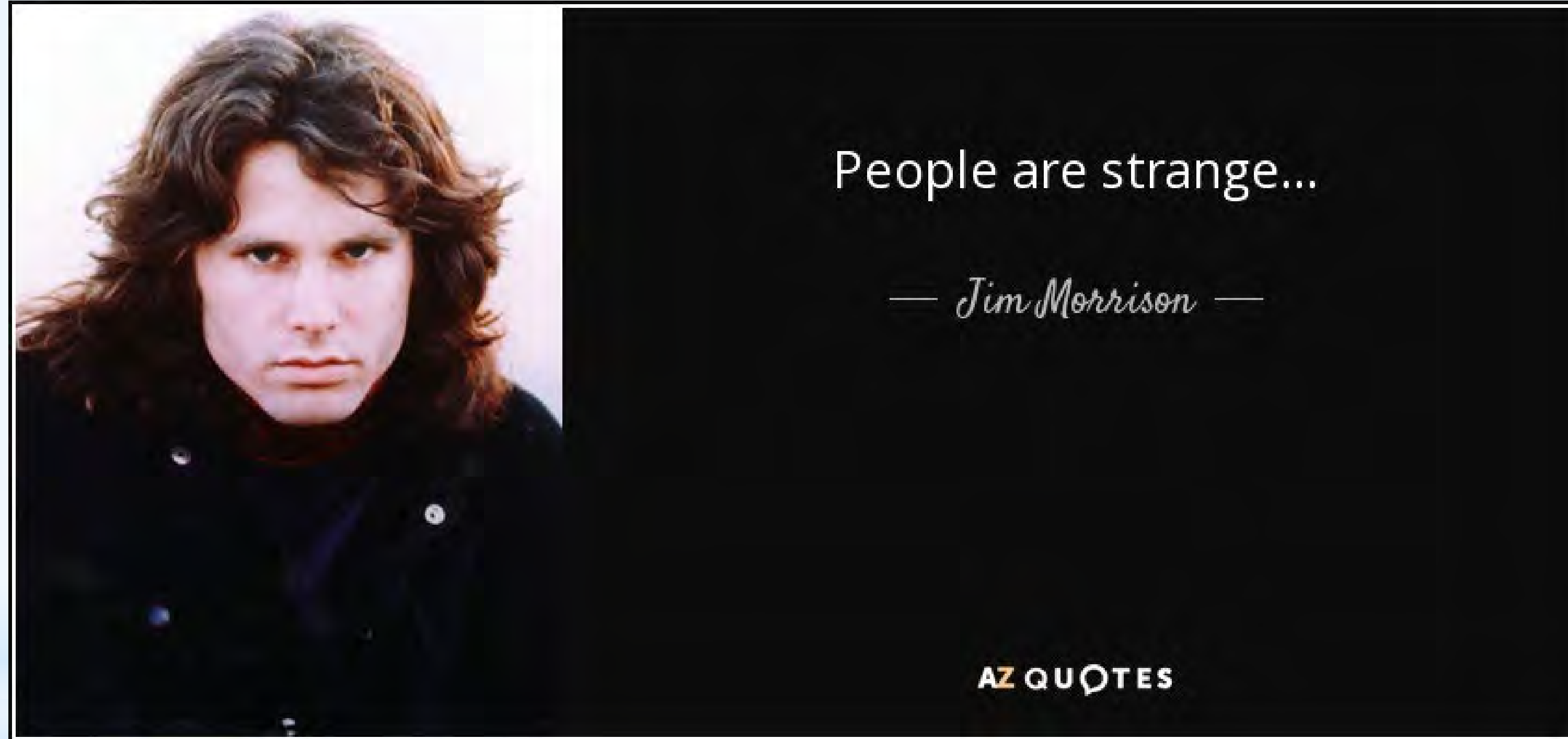
RESOURCES AND THE FUTURE

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

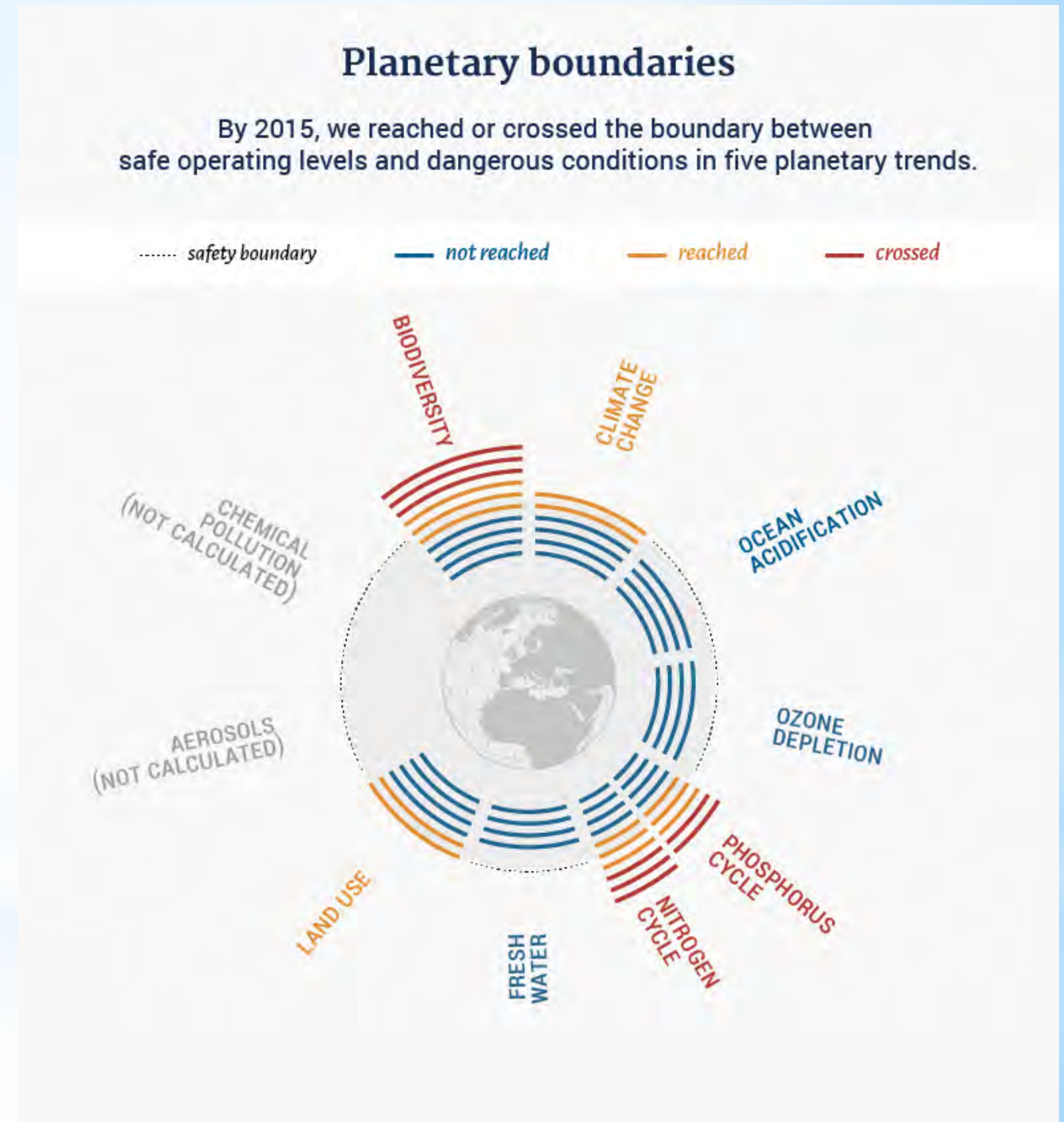
- Nearly half of all the *work* we do, will be able to be *automated* by mid of the century
- In 1997, DeepBlue beat Gary Kasparov - world Chess champion - using an algorithm conceived in the 1950s and lots of human data. In 2017, AlphaGo beat Ke Jie - world Go champion - discovering by itself the principles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



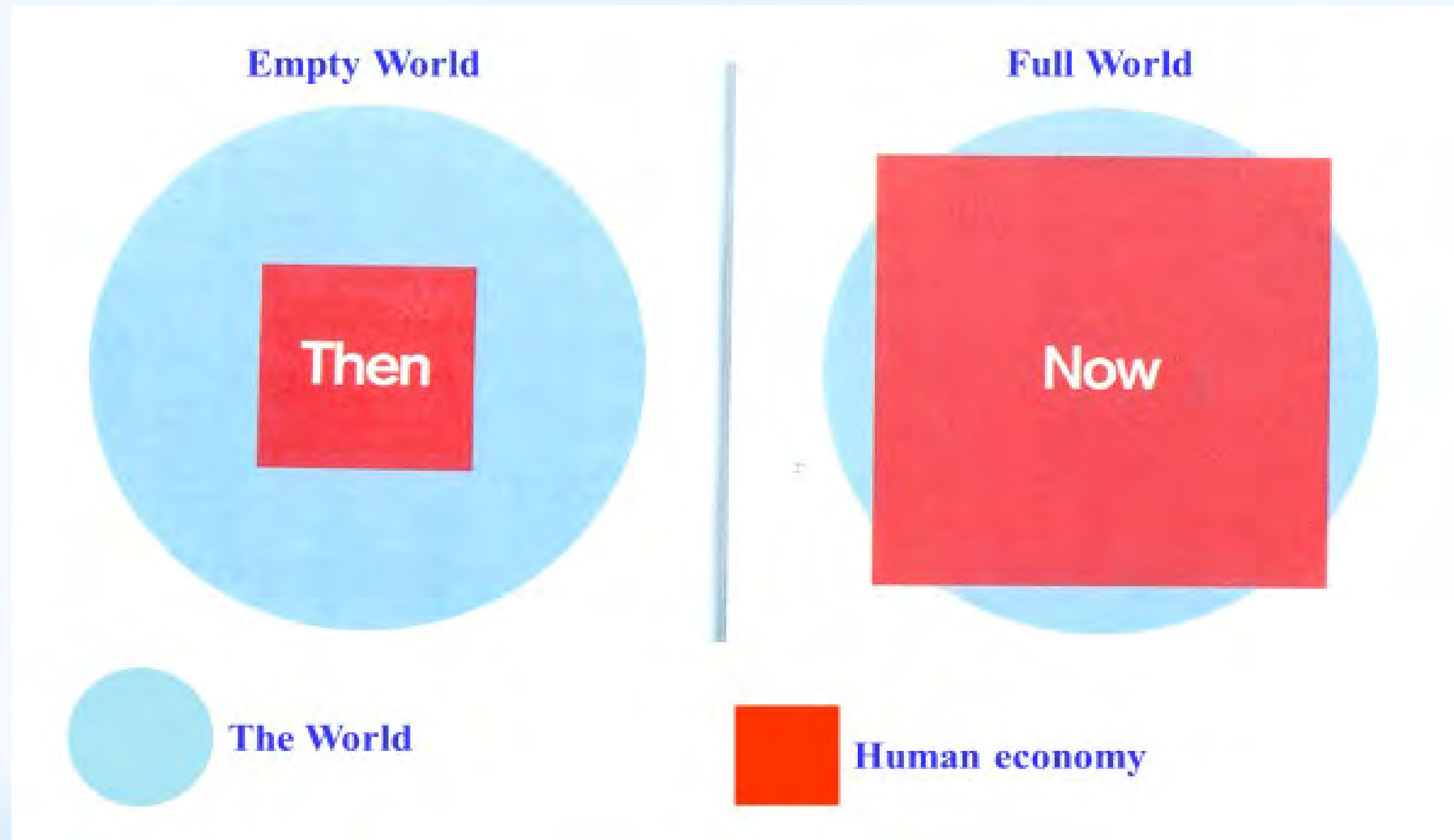
*For the first time in a human history we face the emergence of a **single, tightly coupled human social-ecological system of planetary scope.***

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

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

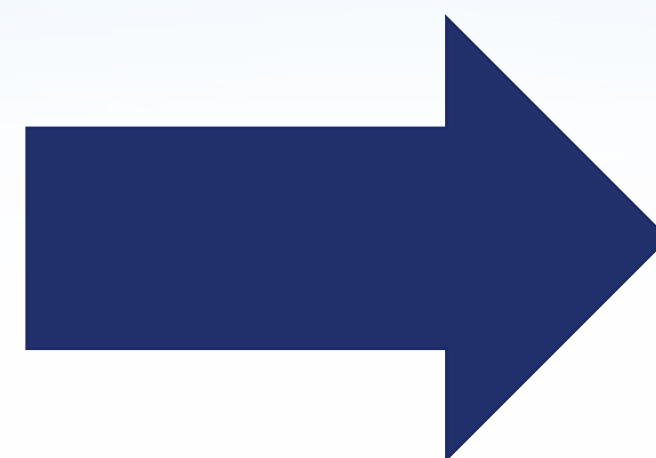


EMPTY WORLD AND THE FULL WORLD



Source: Club of Rome: Simplified after Herman Daly

*Labour and Infrastructure
limiting factors of human
wellbeing*

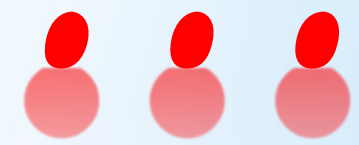


*Natural resources and
Environmental sinks limiting
factors of human wellbeing*

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



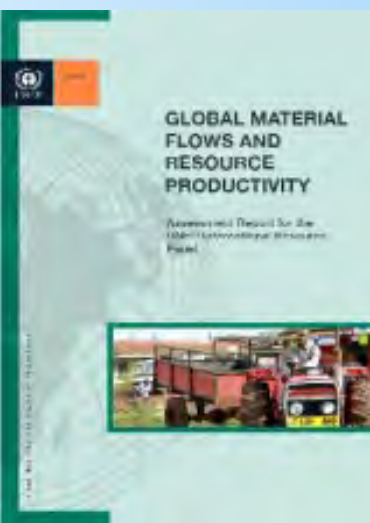
OUR ECONOMY





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*



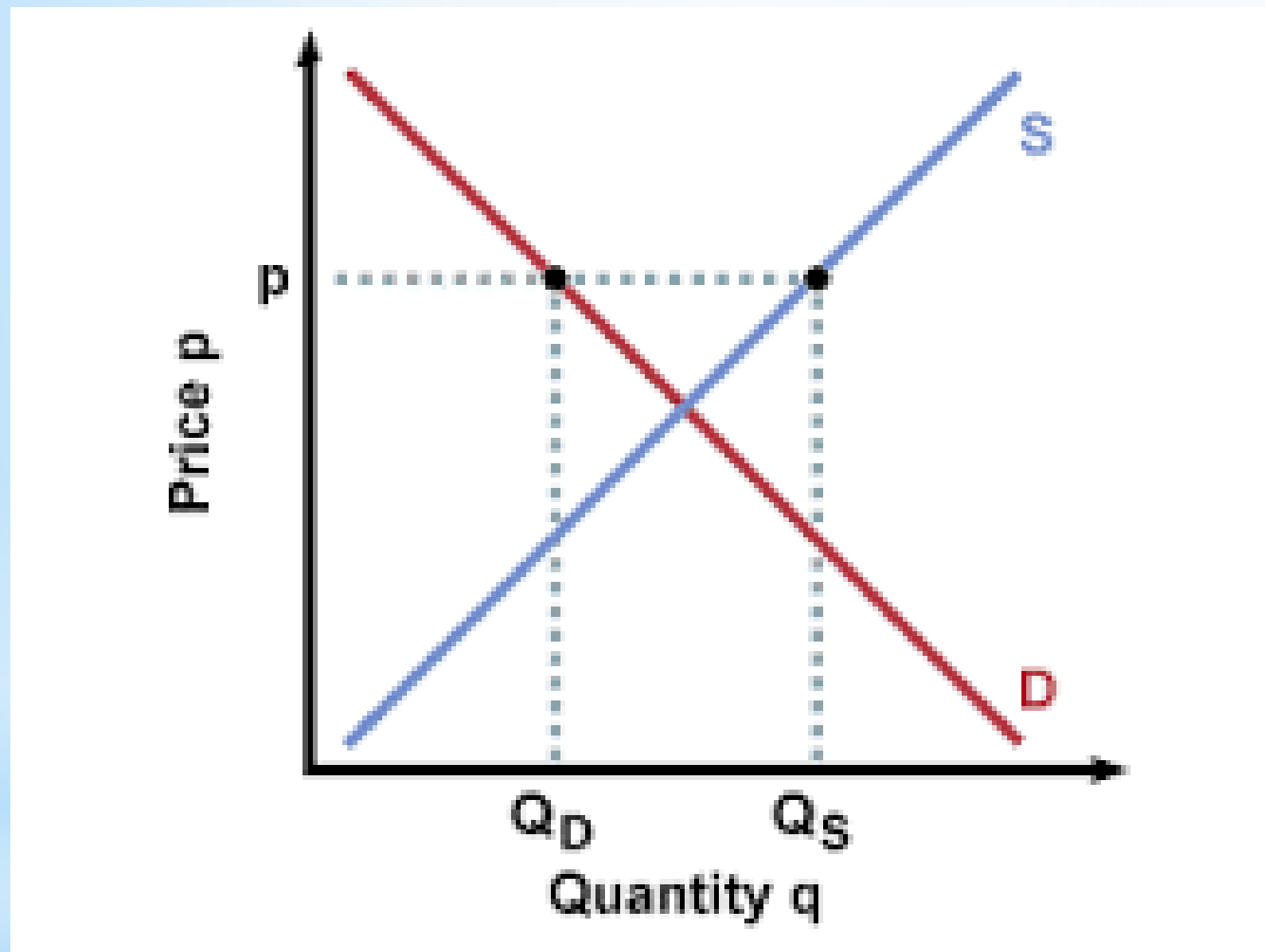
Market

*Producers/Consumers
Rational Behaviour*



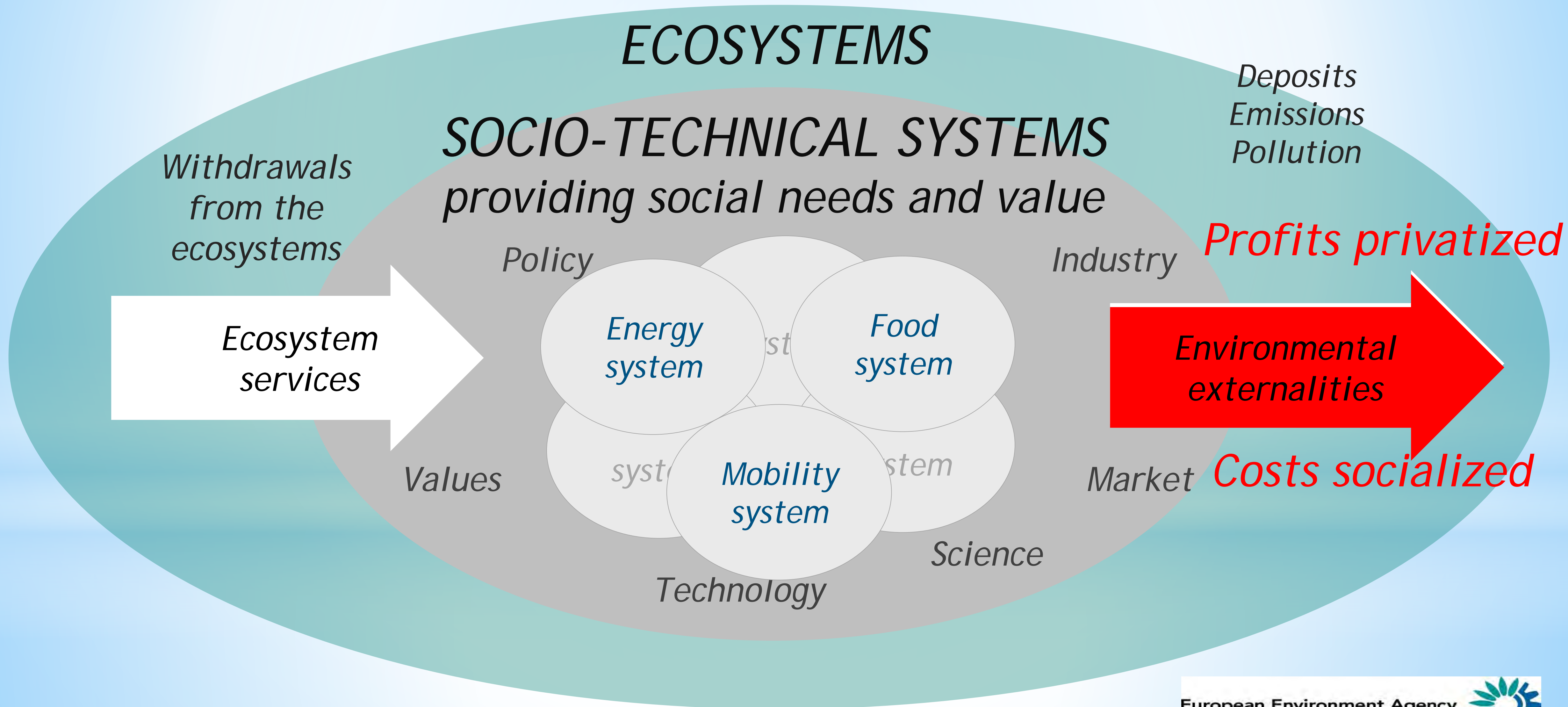
Economic model

Inbuilt Economic, Social, Environmental Imbalances



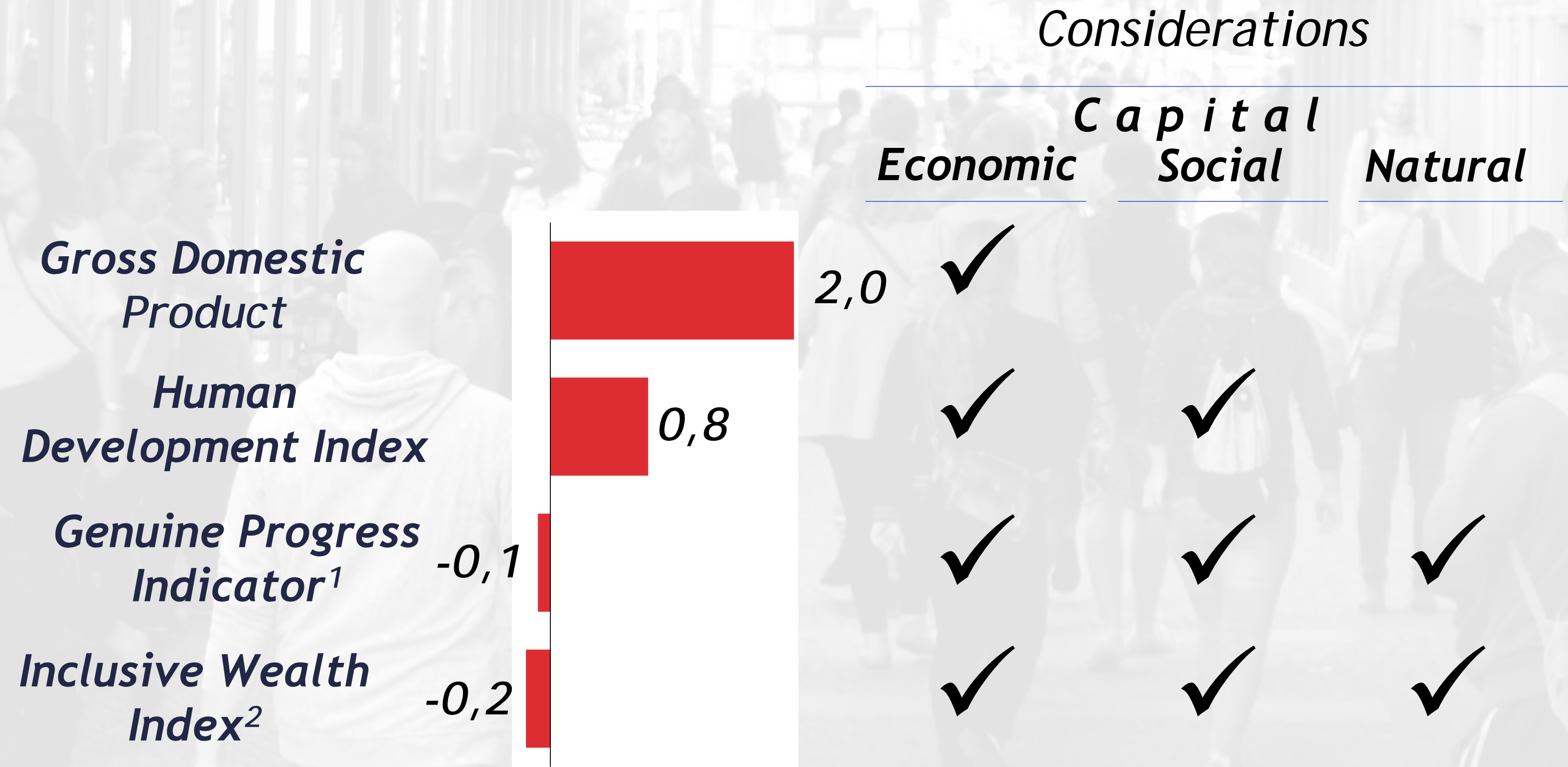
SAFE OPERATING SPACE

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

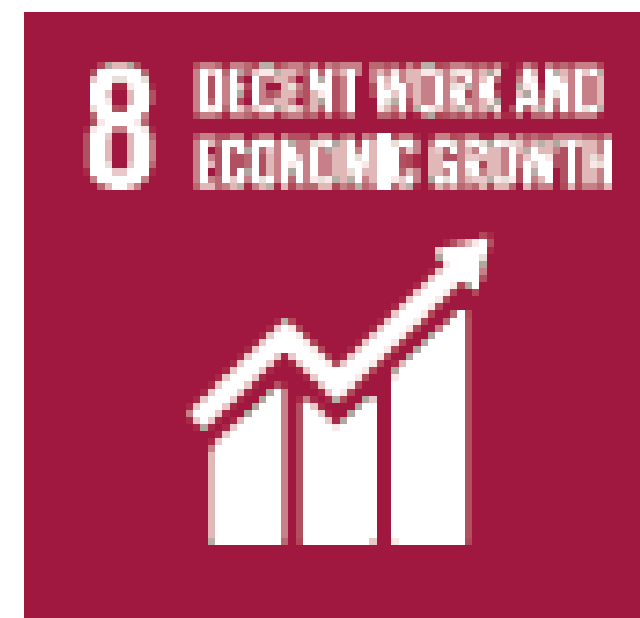


*Trade-offs among various SDGs are unavoidable. **Sustainable Consumption and Production** is the most efficient strategy to mitigate trade-offs and create synergies to resolve the development and environmental challenges articulated in the SDGs.*



International
Resource
Panel

SDGs DIRECTLY DEPENDENT ON NATURAL RESOURCES



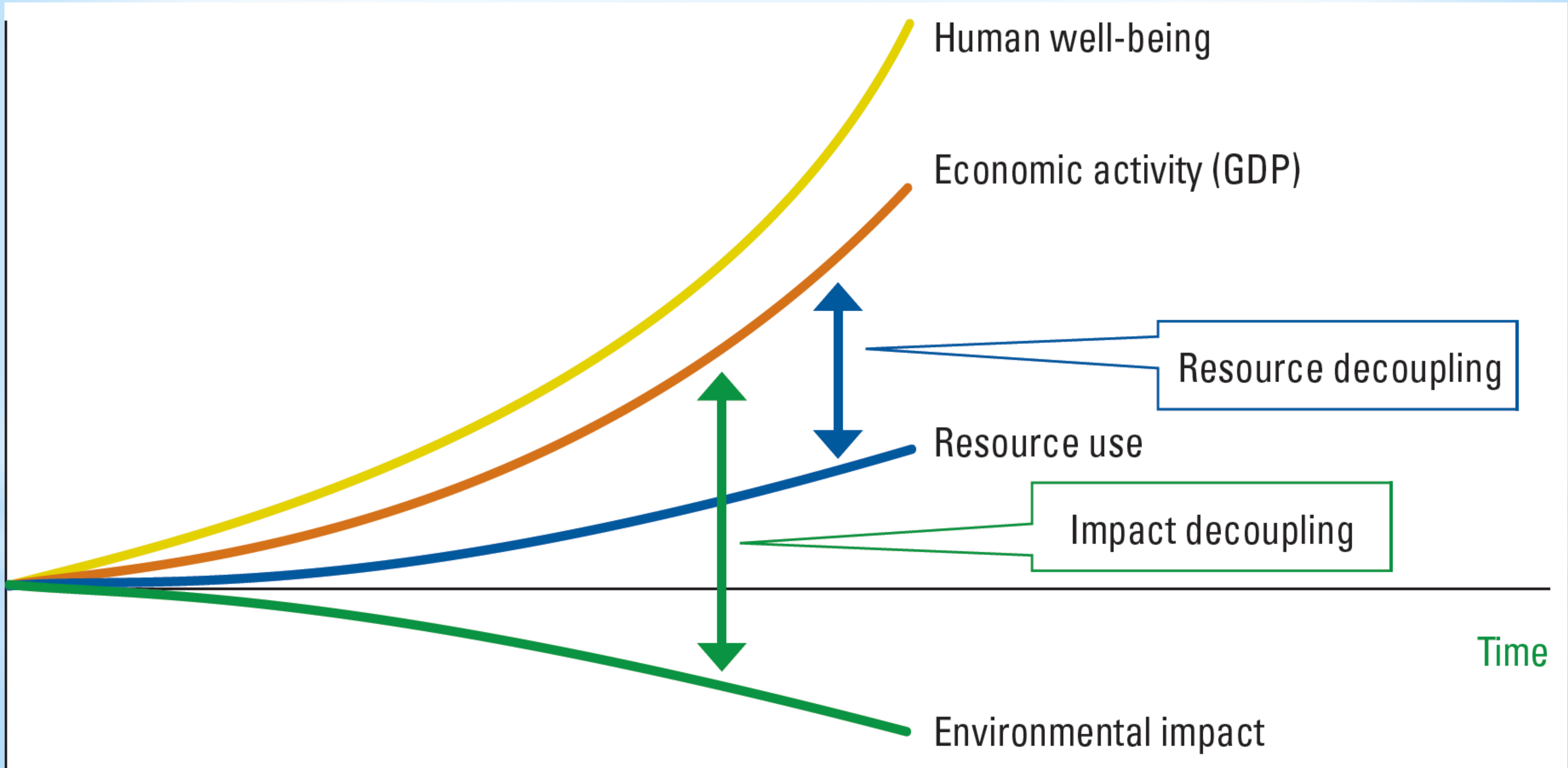
RESOURCES

THE MISSING LINK



International
Resource
Panel

DECOUPLING IS THE IMPERATIVE OF MODERN ENVIRONMENTAL AND ECONOMIC POLICY





International
Resource
Panel

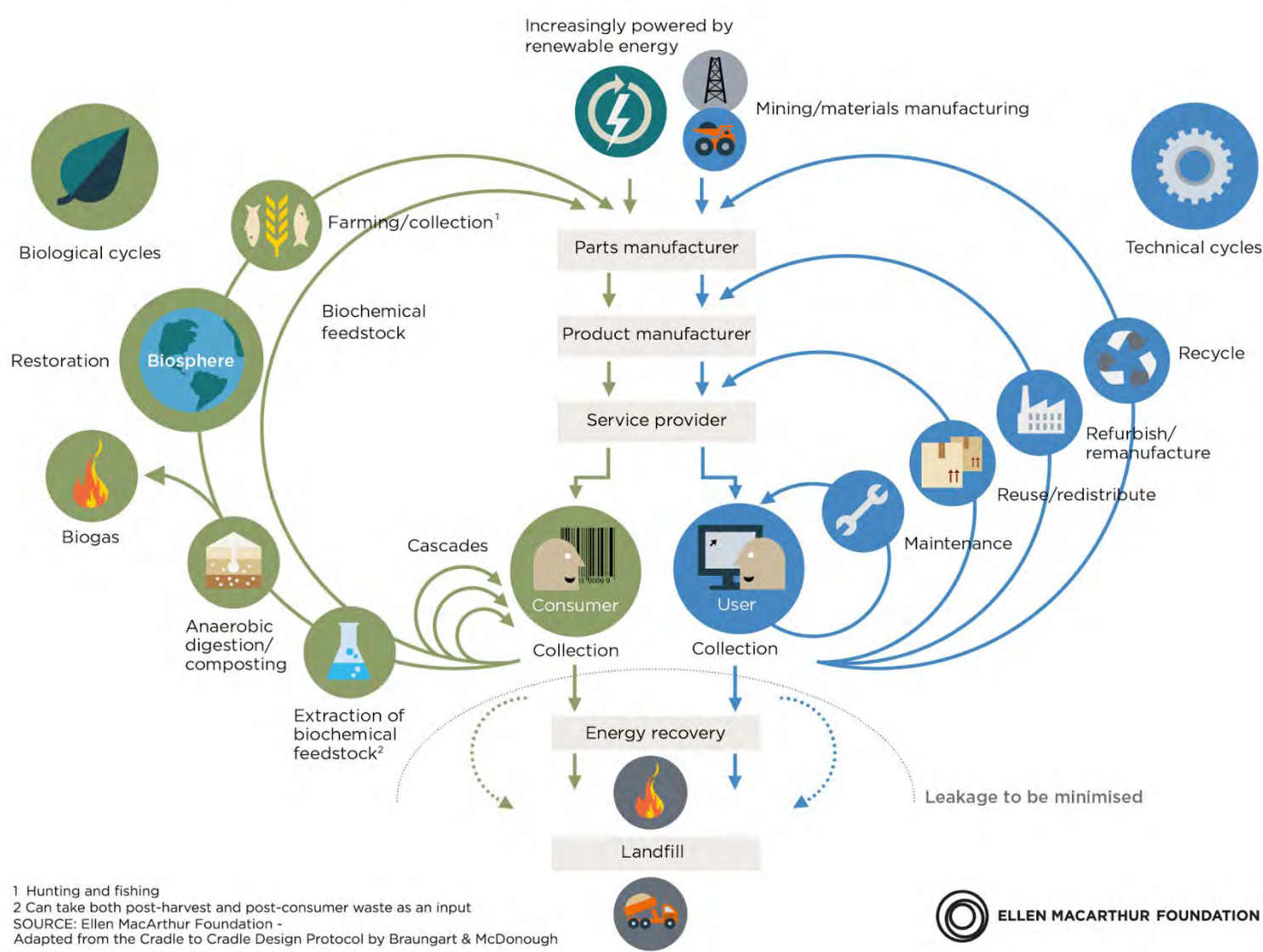


*In the mid-term, except in specific cases,
resource shortage will not be the core limiting
factor of our (economic) development ...
... but the environmental and health
consequences caused by this excessive and
irresponsible use of resources will be!*

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



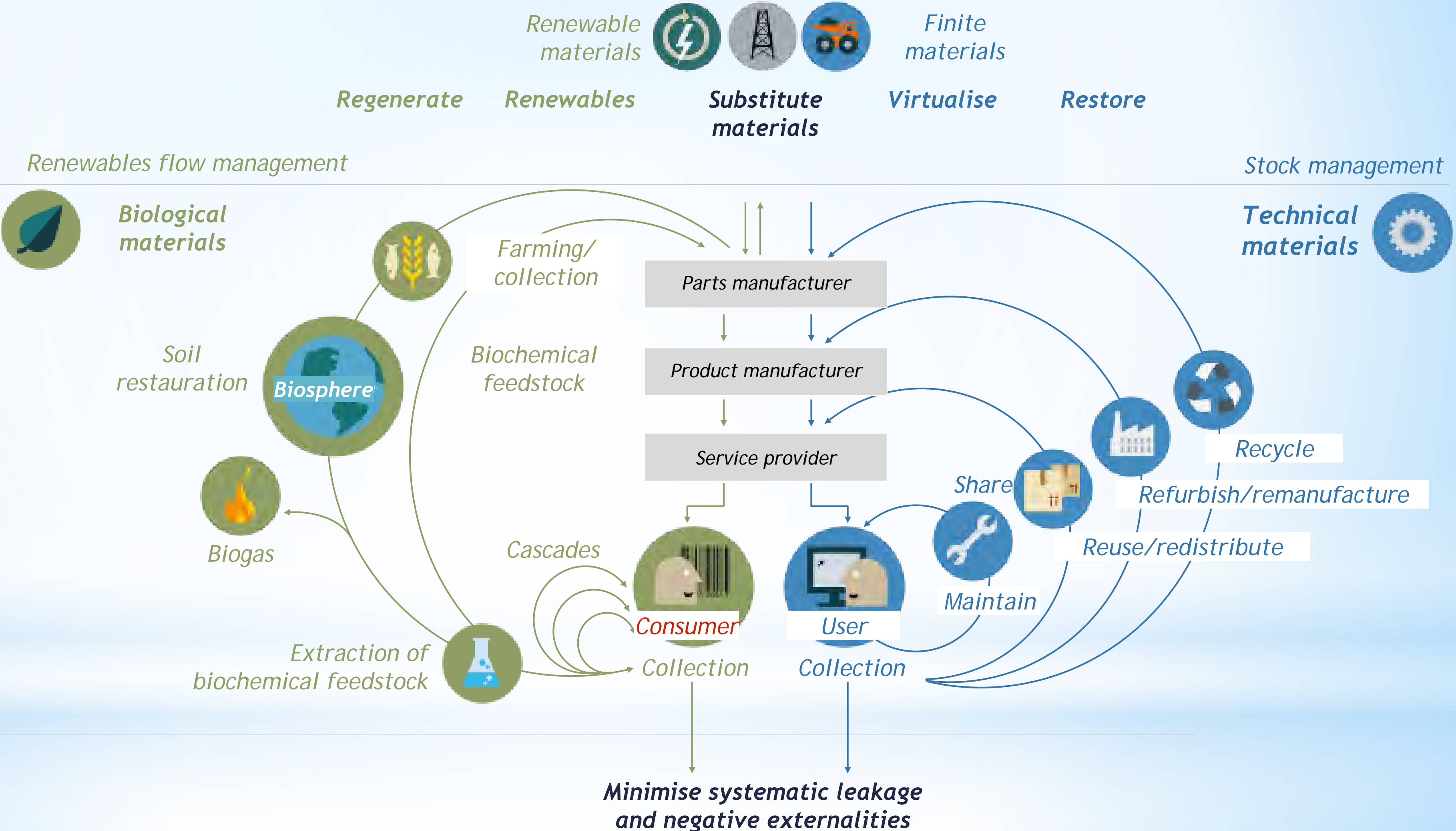
OUTLINE OF A CIRCULAR ECONOMY SYSTEM

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 EnvironmentStiftungsfonds 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 







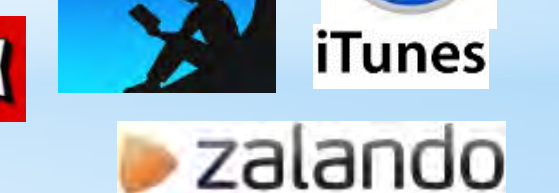
- Remanufacture products or components
- Recycle materials
- Digest anaerobic
- Extract biochemicals from organic waste








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)

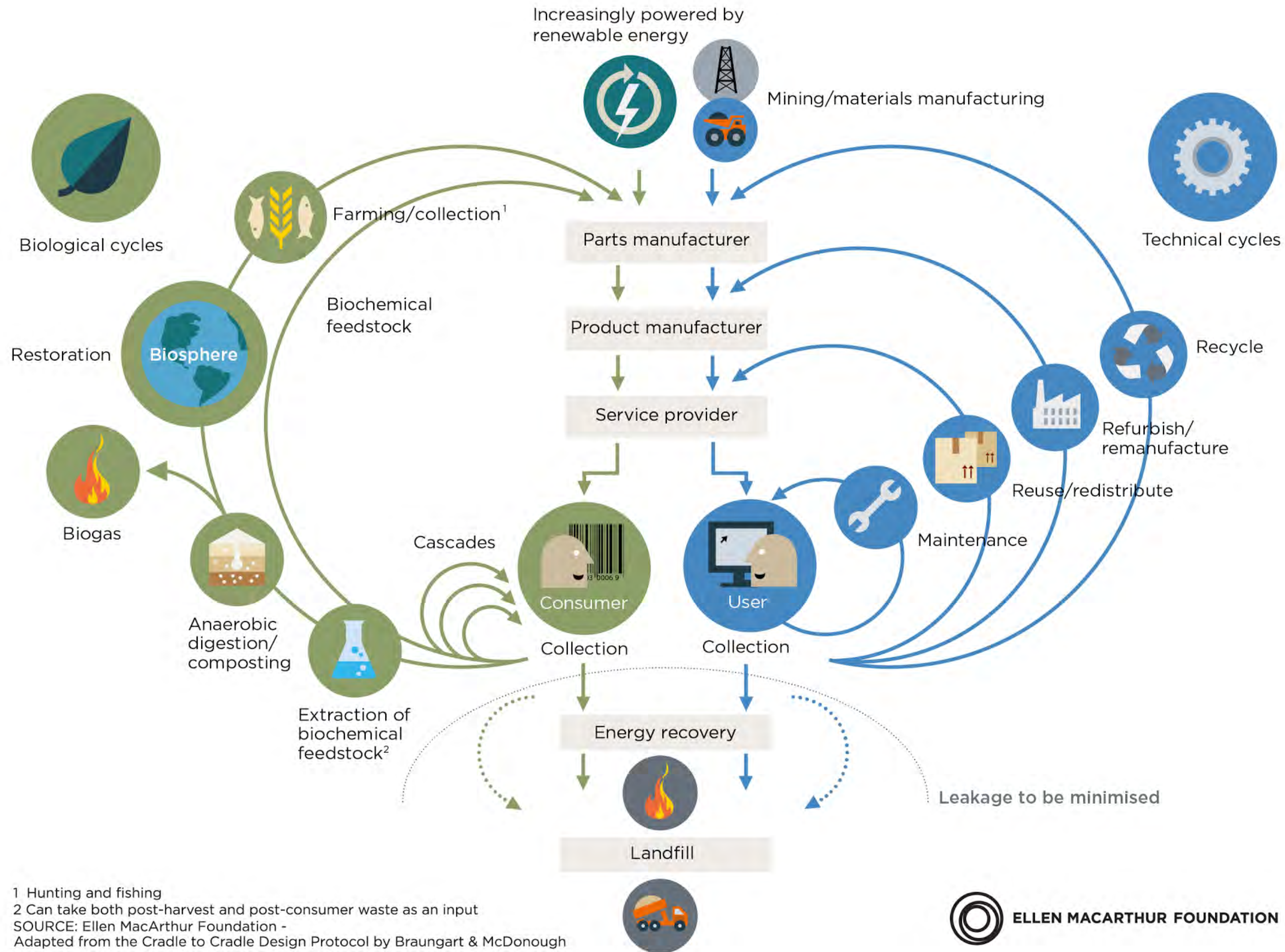
    



DESCRIPTION OF NEXT-WAVE CIRCULAR ECONOMY INVESTMENT THEMES

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 			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	Analytics	Material 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*

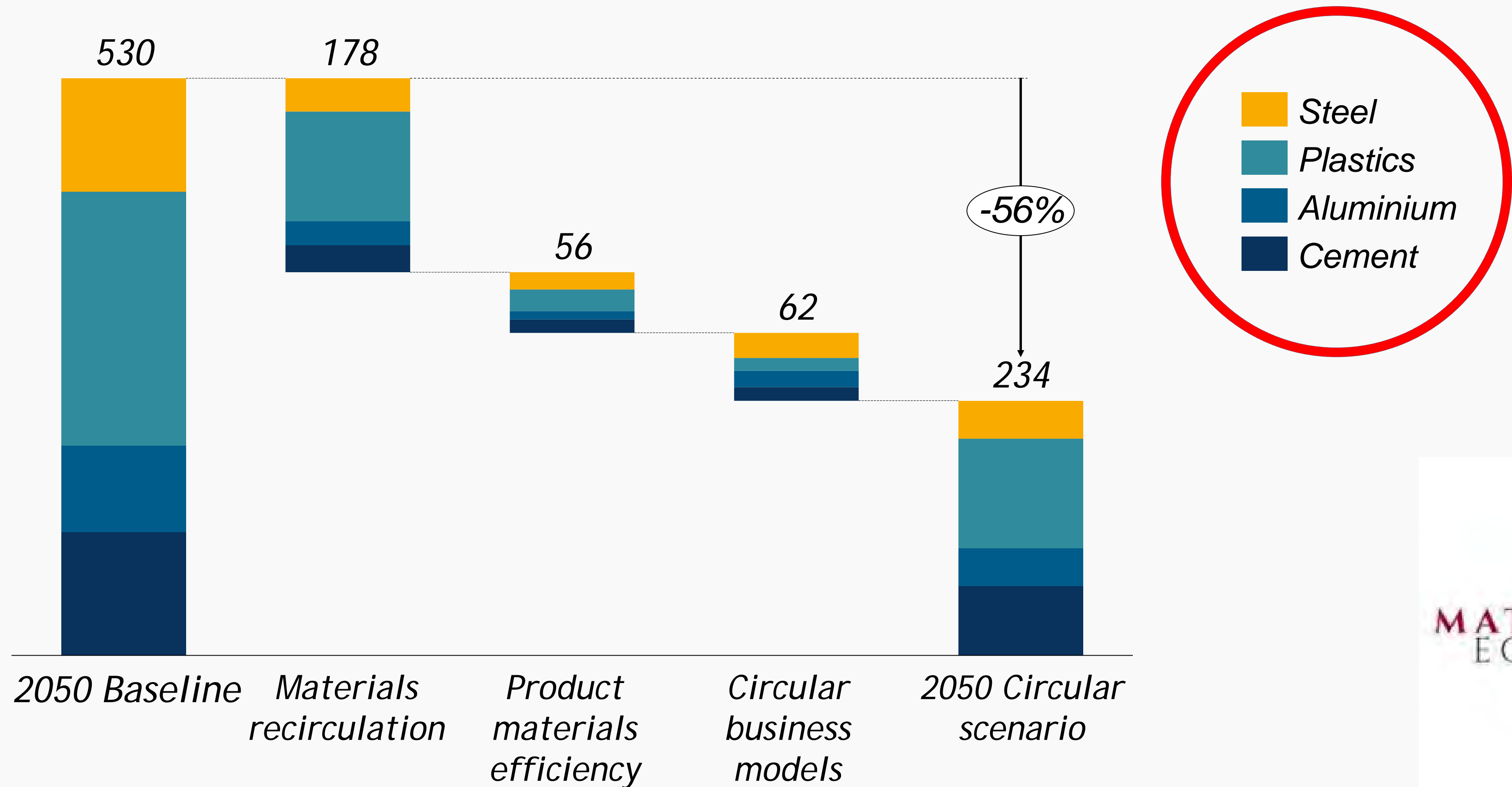
*Energy,
Carbon management*

*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

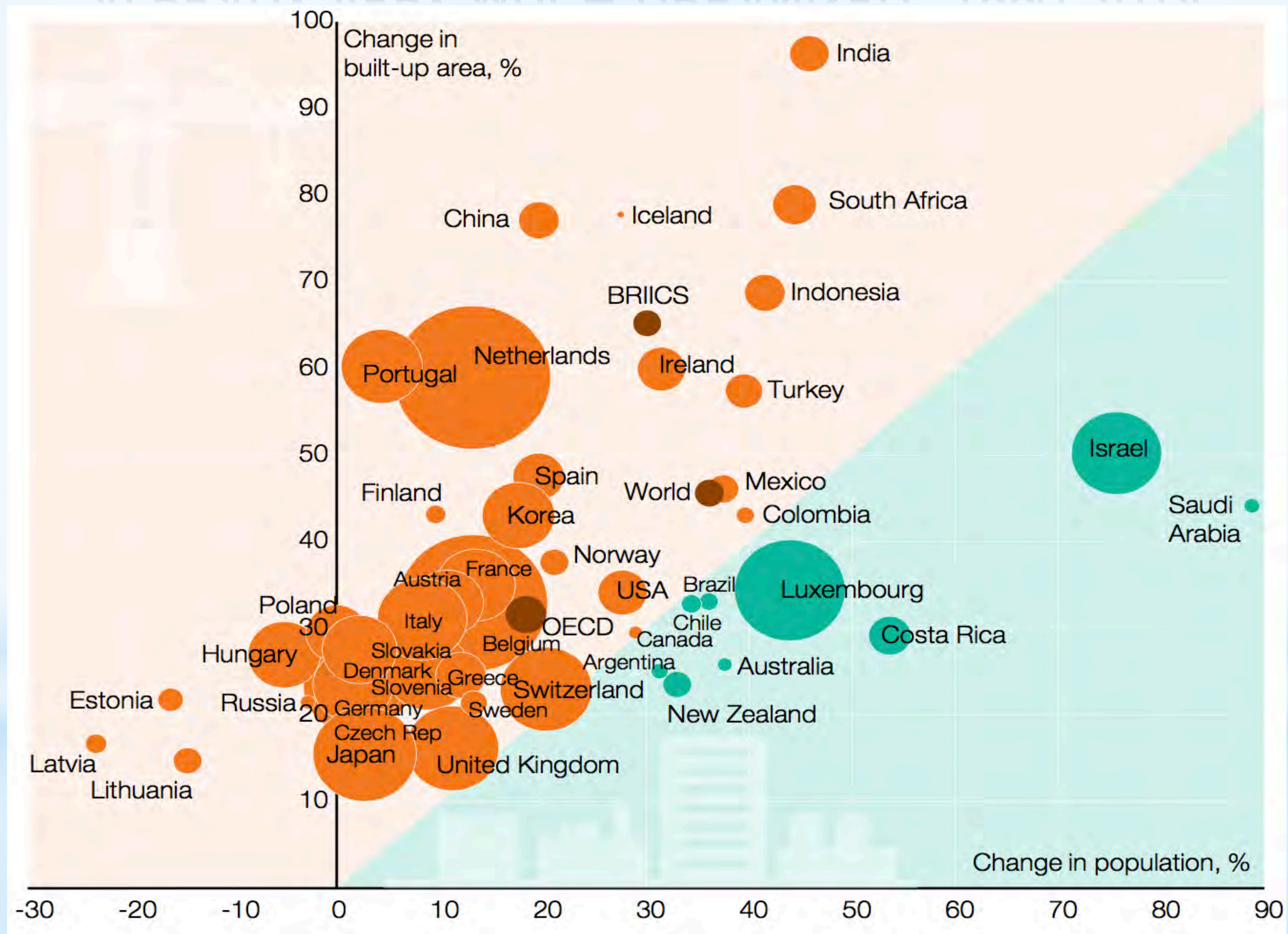


URBANISATION

- 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



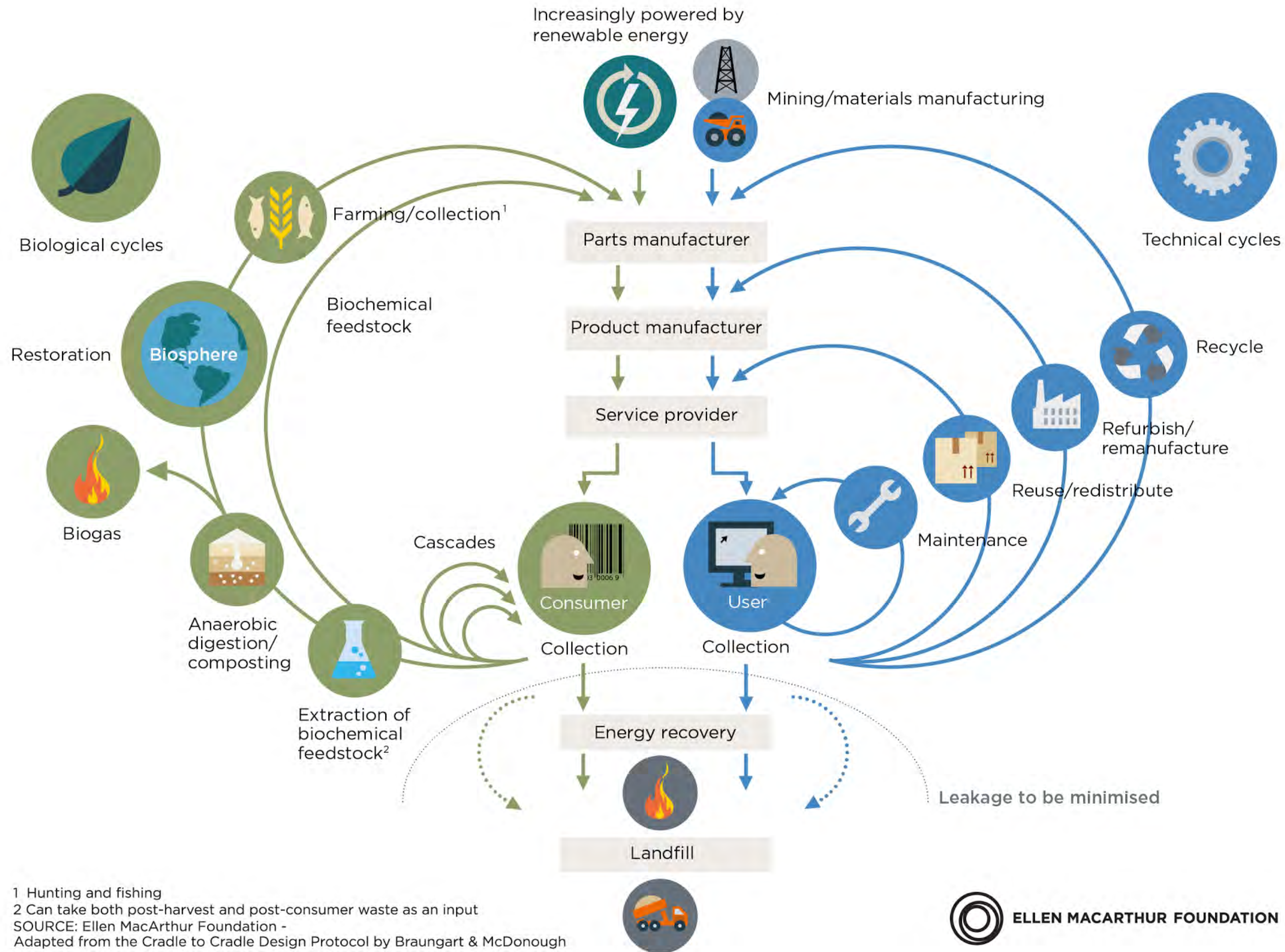
Source: OECD, Green Growth Indicators 2017

“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*

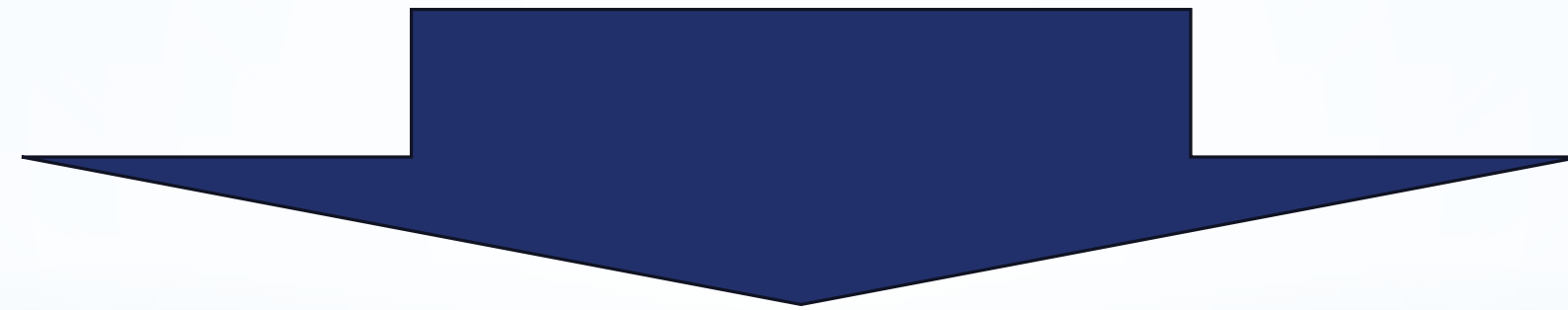
**Urban
Metabolism**

**Pathways of
Change**

Governance

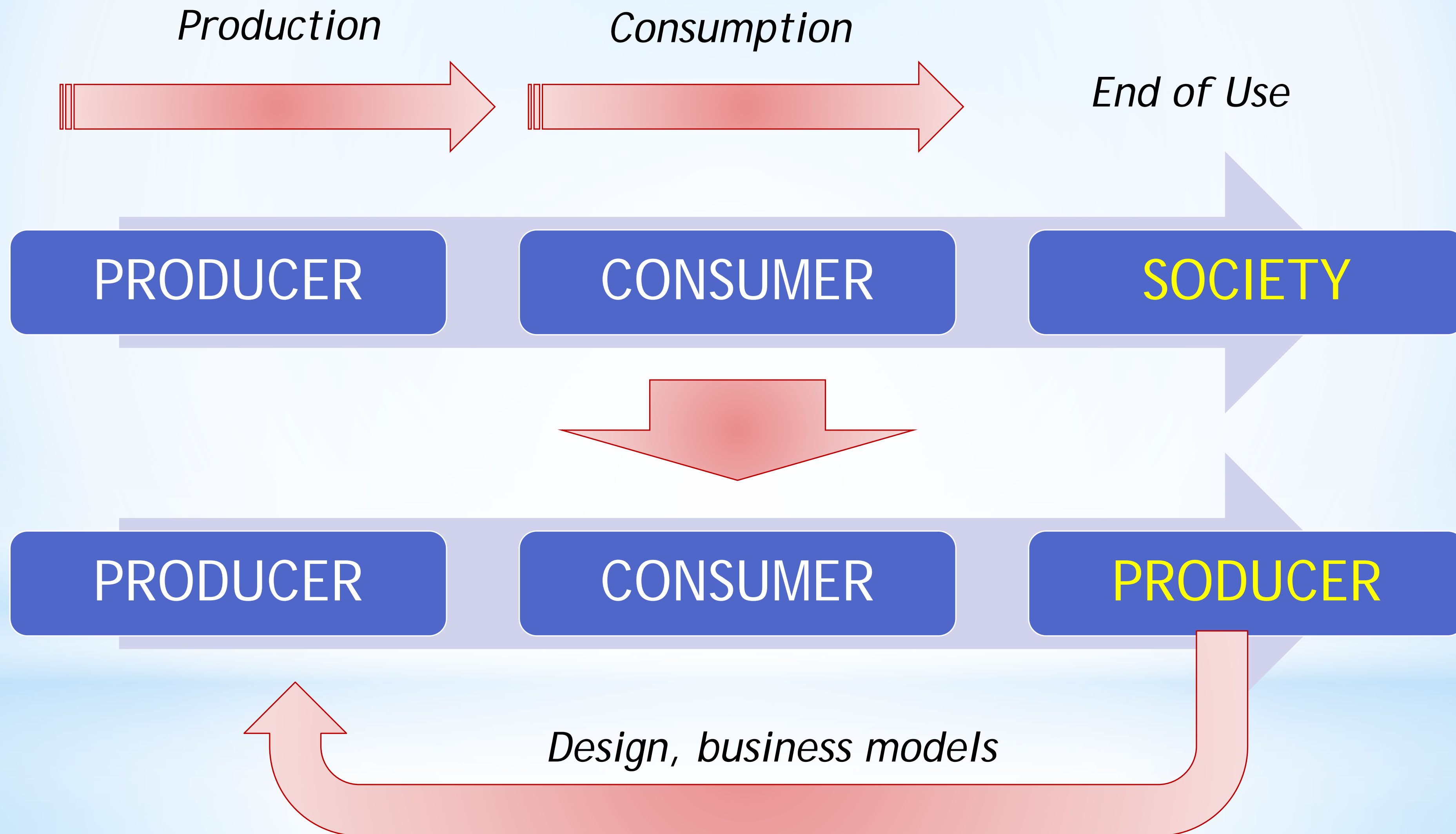
Redefining Risk Management To make it compliant to SDGs

*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!

