Circular Economy

ELLEN MACARTHUR FOUNDATION

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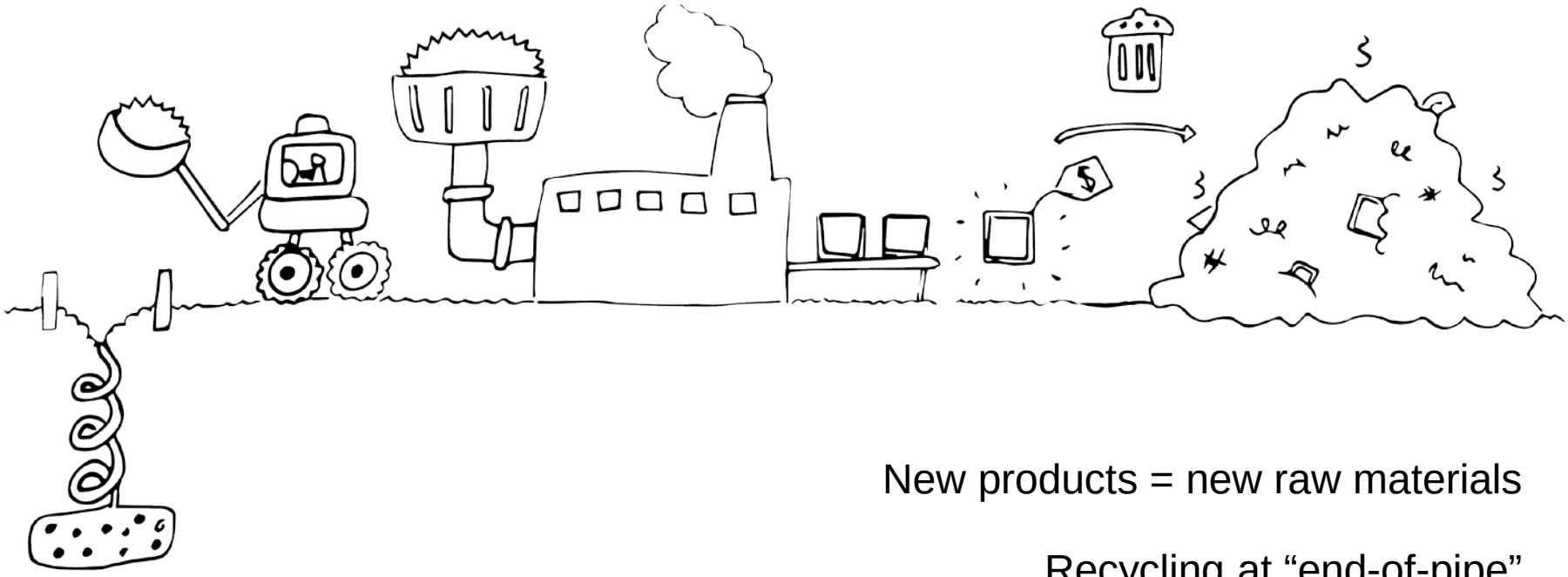
TODAY'S TAKE-MAKE-DISPOSE ECONOMY



New products = new raw materials

Recycling at "end-of-pipe"

Waste is chronically high

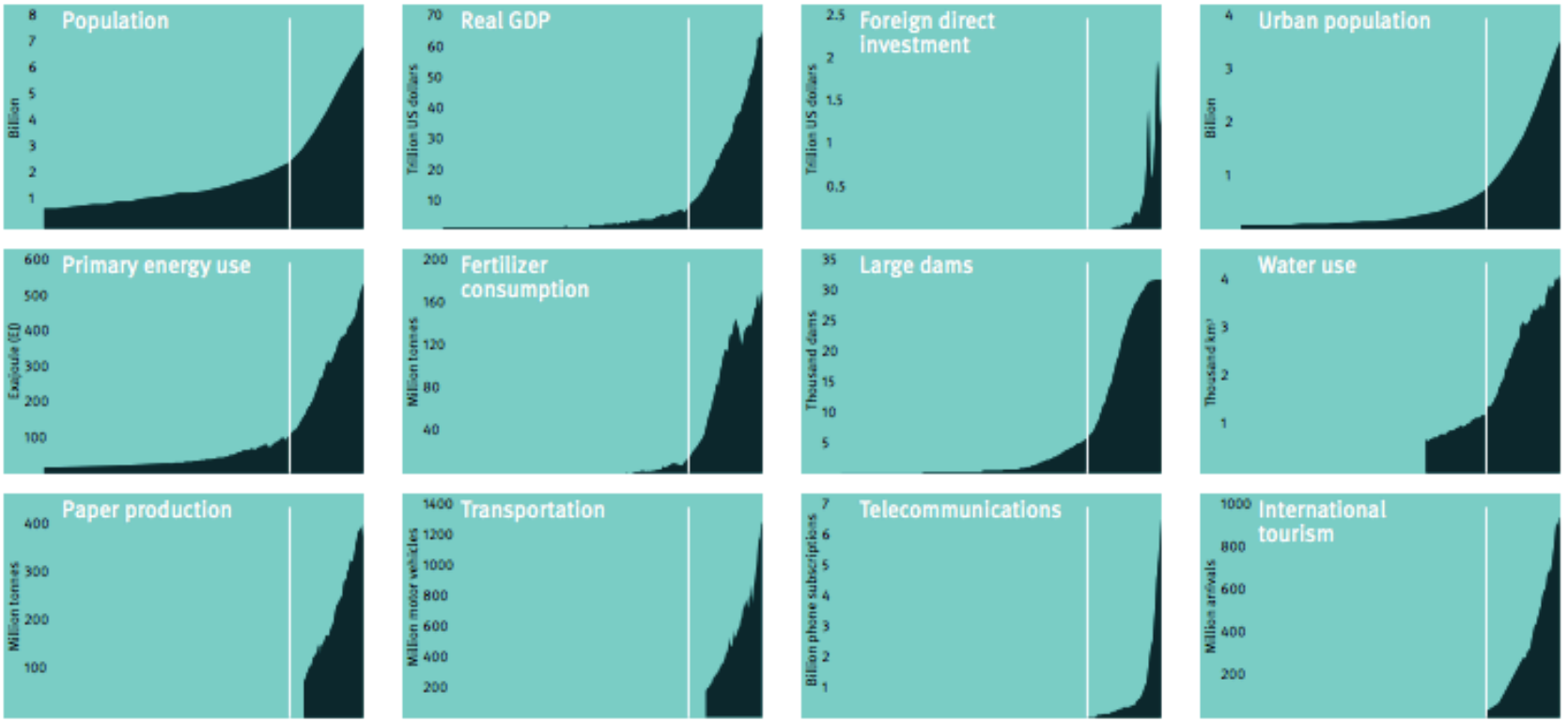
A COMBINATION OF RISKS AND OPPORTUNITIES

A further 3 billion middle-class consumers will enter the market by 2030 fuelling demand ...

A COMBINATION OF RISKS AND OPPORTUNITIES

Socioeconomic development

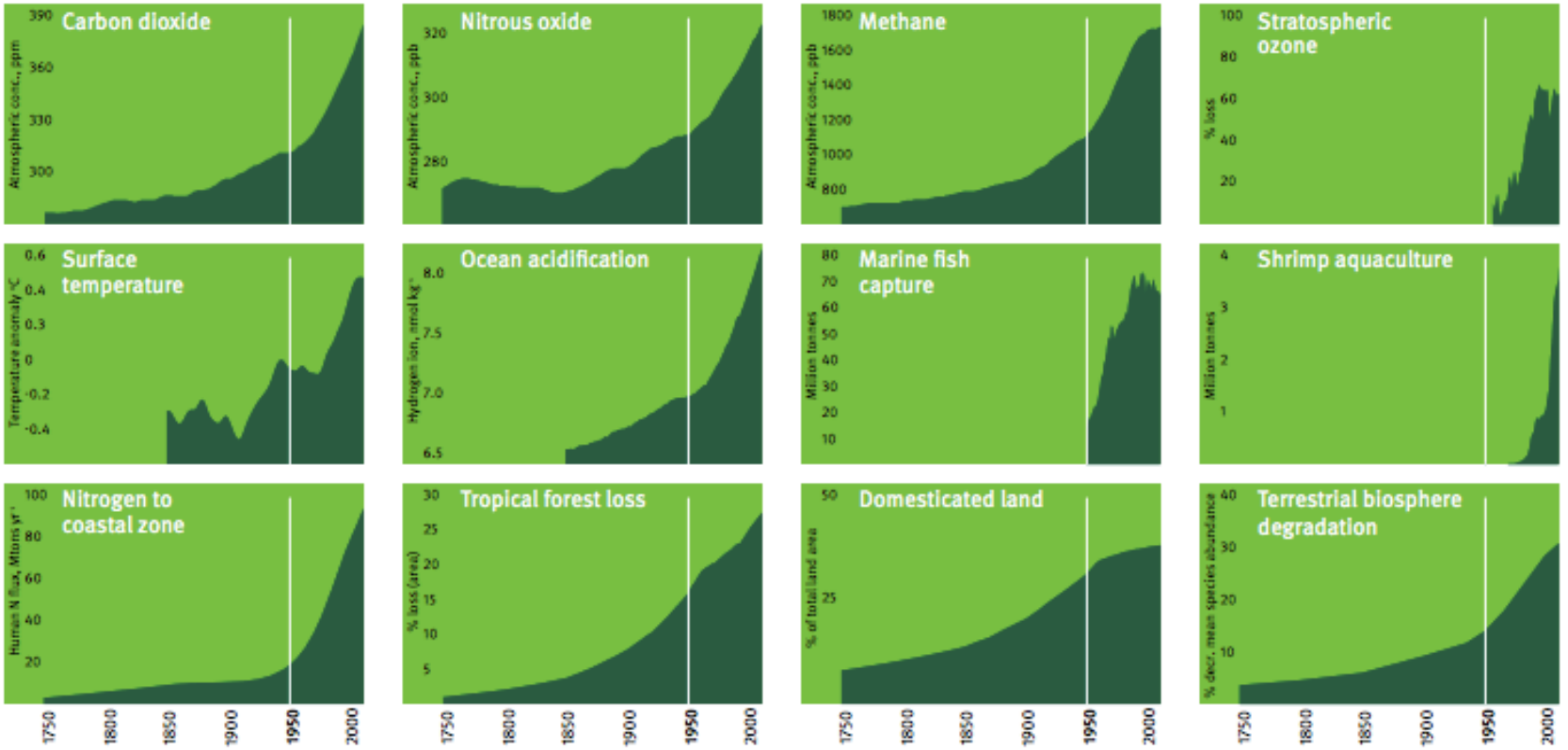
Trends from 1750 to 2010 in globally aggregated indicators for socioeconomic development



A COMBINATION OF RISKS AND OPPORTUNITIES

Living Systems

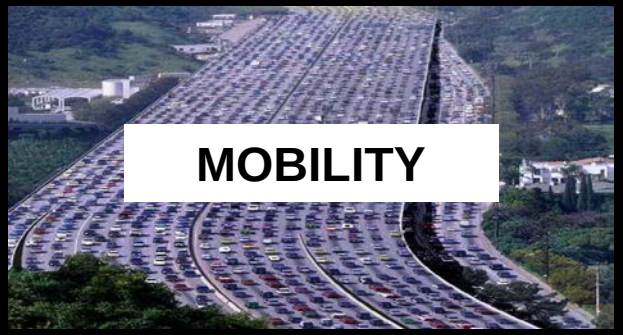
Trends from 1750 to 2010 in indicators for the structure and functioning of the Earth System



Images source: *The Anthropocene Review*, 2015

A MODEL WITH EMBEDDED STRUCTURAL LOSSES

Faults in the linear model means great economic losses and negative externalities



MOBILITY

- Cars remain parked **92%** of the time
- When moving, they usually carry **1,5** people at a time
- **30.000** lives are lost in accidents and, 1 out of 4 times, this results in irreversible lesions

BUILT ENVIRONMENT

- **30%** of waste sent to landfill in Europe originates from construction (in Brasil, approximately **50%**)
- Offices are occupied only **40-50%** of the day on a working day
- **11 million** empty homes in Europe

FOOD

- **>100Mi tonnes** of food lost annually in Europe
- **50%** lost along the production chain
- **97%** of global food residue is sent to landfill or **~USD 300 bn**
- Soil degradation is around **30-80%** in Europe

"Growth Within: A Circular Economy Vision for a Competitive Europe", Ellen MacArthur Foundation, SUN (Stiftungsfonds für Umweltökonomie und Nachhaltigkeit) and McKinsey Center for Business and Environment, 2015

Rethinking progress

https://www.youtube.com/watch?time_continue=4&v=zCRKvDyyHmI

RETHINKING VALUE CREATION

Three guiding principles to the circular economy

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

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

Foster system effectiveness by revealing and designing out negative externalities.

THE NEW PLASTICS ECONOMY

A structured approach

The New Plastics Economy is an ambitious, three-year initiative to build momentum towards a plastics system that works.

Applying the principles of the circular economy, the initiative brings together key stakeholders to re-think and re-design the future of plastics, starting with packaging.

With the aim to create an effective after-use plastics economy; drastically reduce leakage of plastics into natural systems and other negative externalities and decouple plastics from fossil feedstocks, the New Plastics Economy works with five interconnected blocks to create the necessary conditions for redesigning the system:

DIALOGUE MECHANISM

Cross-value chain collaboration is at the heart of the New Plastics Economy.

GLOBAL PLASTICS PROTOCOL

A common target state to innovate towards, to overcome existing fragmentation and enable the creation of effective markets.

INNOVATION MOONSHOTS

Mobilising innovations that can scale across the system, to re-define what's possible and create the conditions for a new economy.

EVIDENCE BASE

A robust evidence base to guide improvement and inform the global debate.

OUTREACH

Engaging stakeholders to learn, to inform, and to amplify what works.

FIGURE 3: PLASTIC PACKAGING MATERIAL VALUE LOSS AFTER ONE USE CYCLE

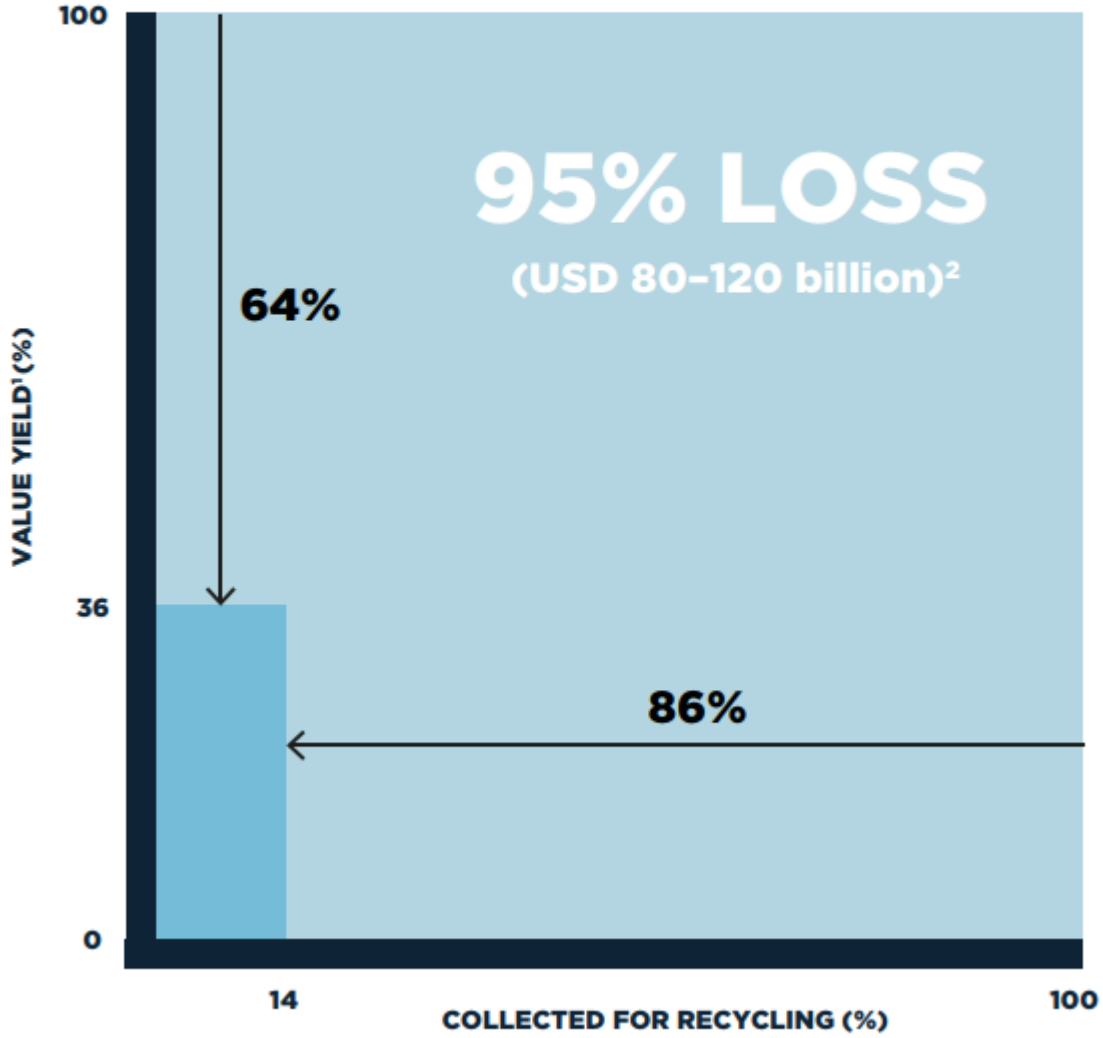
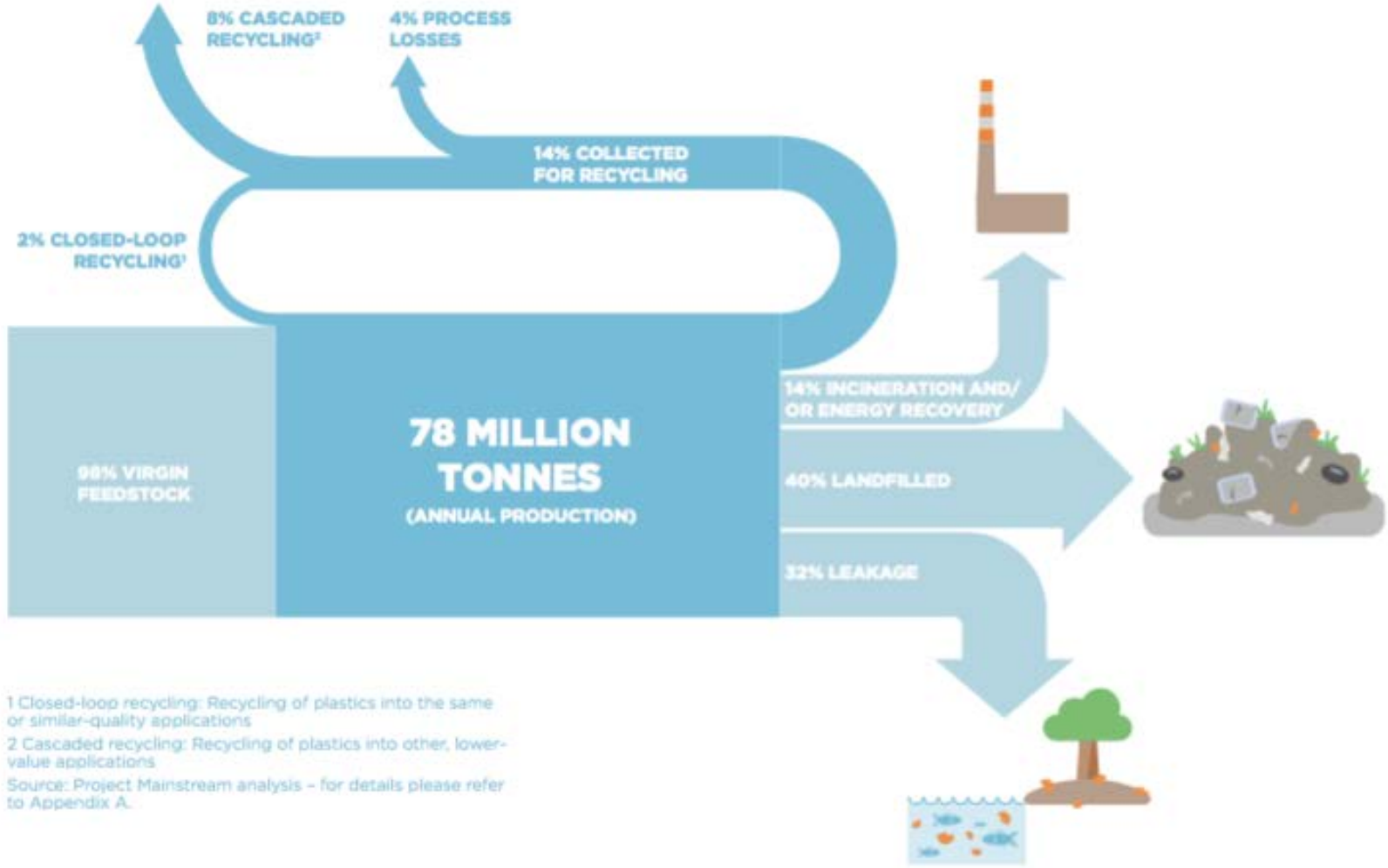


FIGURE 4: GLOBAL FLOWS OF PLASTIC PACKAGING MATERIALS IN 2013



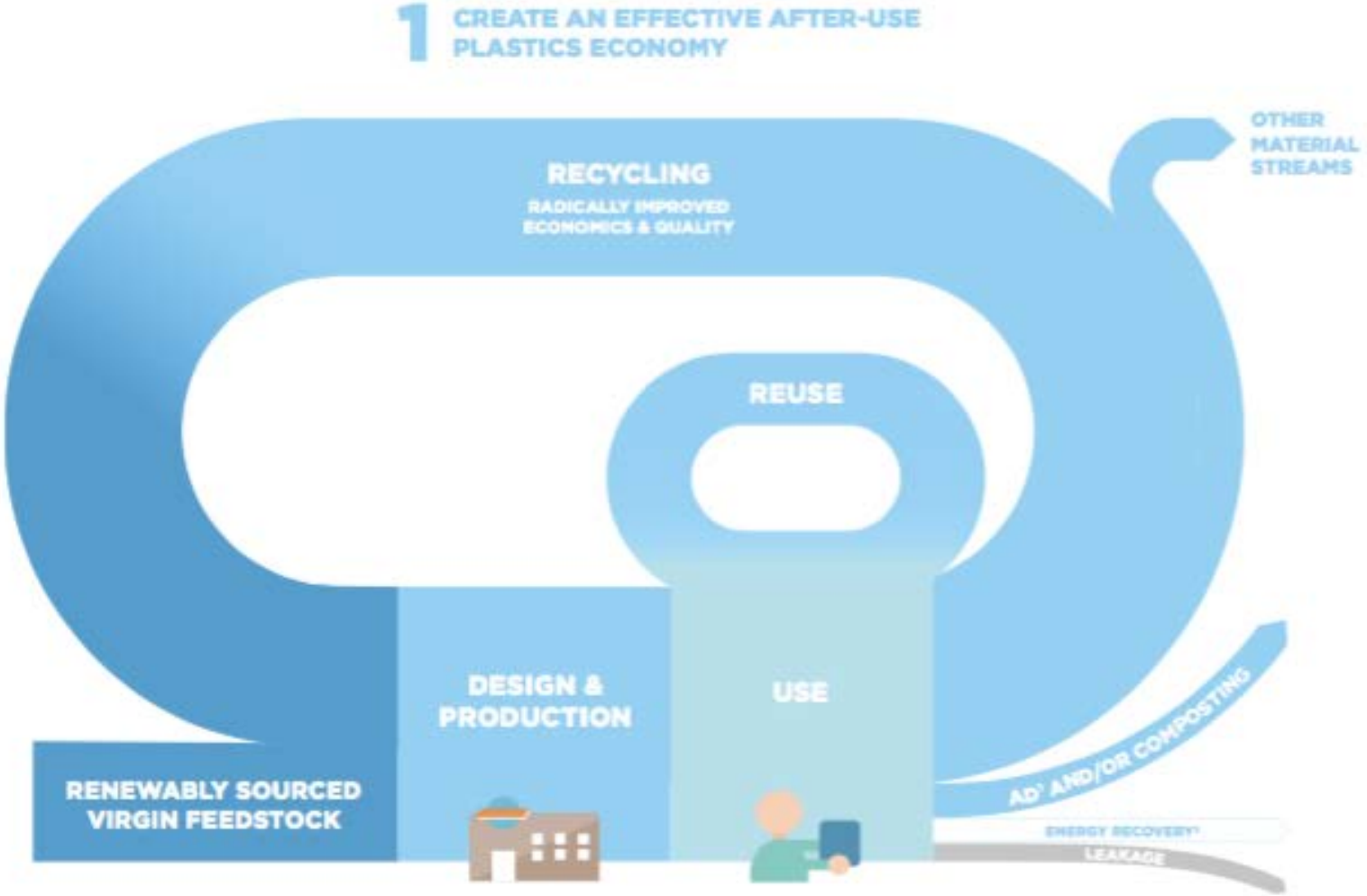
1 Closed-loop recycling: Recycling of plastics into the same or similar-quality applications

2 Cascaded recycling: Recycling of plastics into other, lower-value applications

Source: Project Mainstream analysis – for details please refer to Appendix A.

WORLD ECONOMIC FORUM, ELLEN MACARTHUR FOUNDATION, MCKINSEY & COMPANY, THE NEW PLASTICS ECONOMY
ELLENMACARTHURFOUNDATION.ORG/PUBLICATIONS

FIGURE 6: AMBITIONS OF THE NEW PLASTICS ECONOMY



1 Anaerobic digestion

2 The role of, and boundary conditions for, energy recovery in the New Plastics Economy need to be further investigated

Source: Project Mainstream analysis.

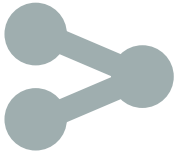
THE ReSOLVE FRAMEWORK

ReGENERATE

Regenerate and restore natural capital

EXCHANGE

Select appropriate resources and technologies



SHARE

Maximize asset utiisation

VIRTUALISE

Avoid resource use and deliver utility virtually

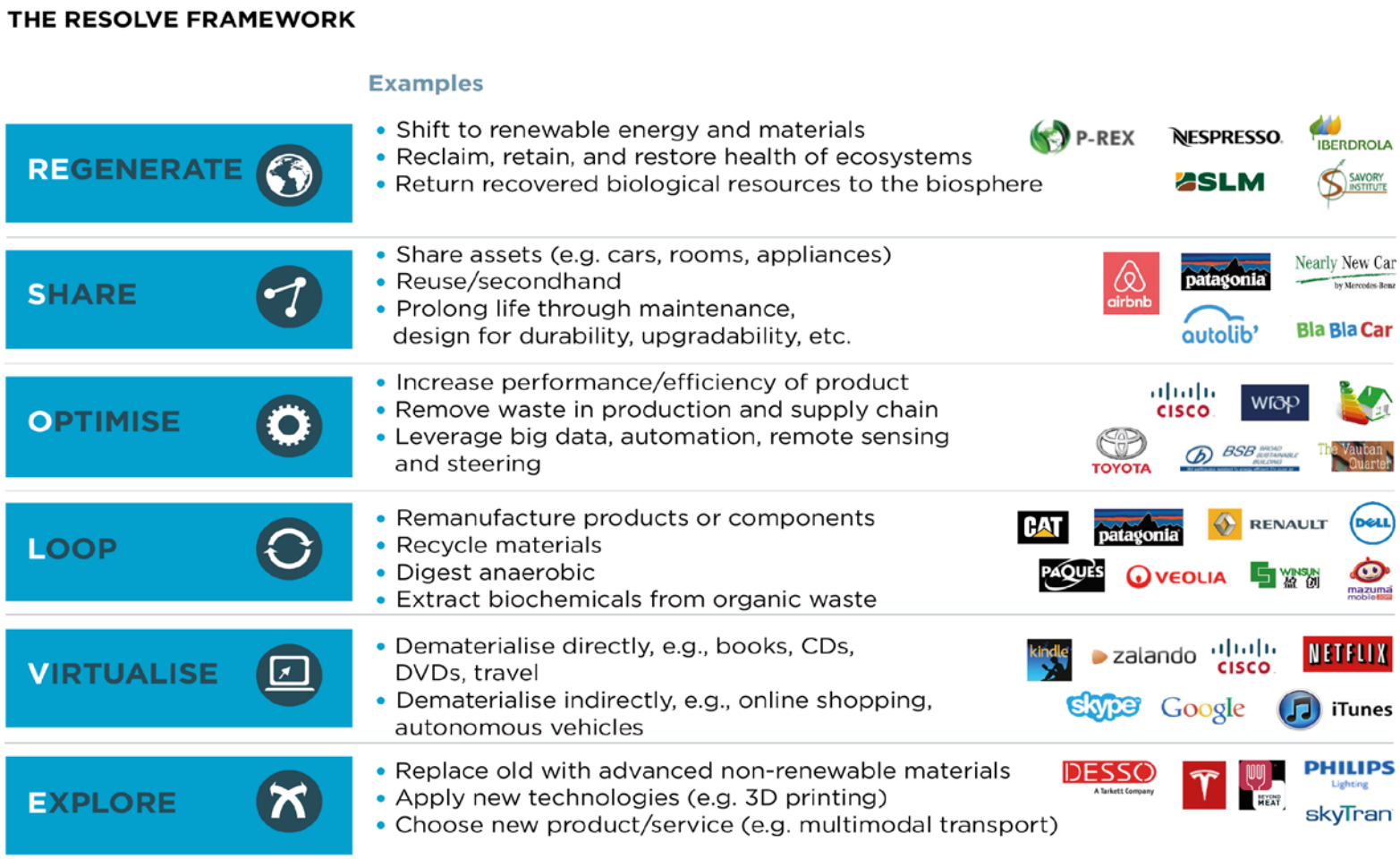
OPTIMISE

Optimise system performance

LOOP

Keep products and materials in productive cycles

THE ReSOLVE FRAMEWORK



In the world,
we used an

Eiffel tower

of metal

every 3 minutes.

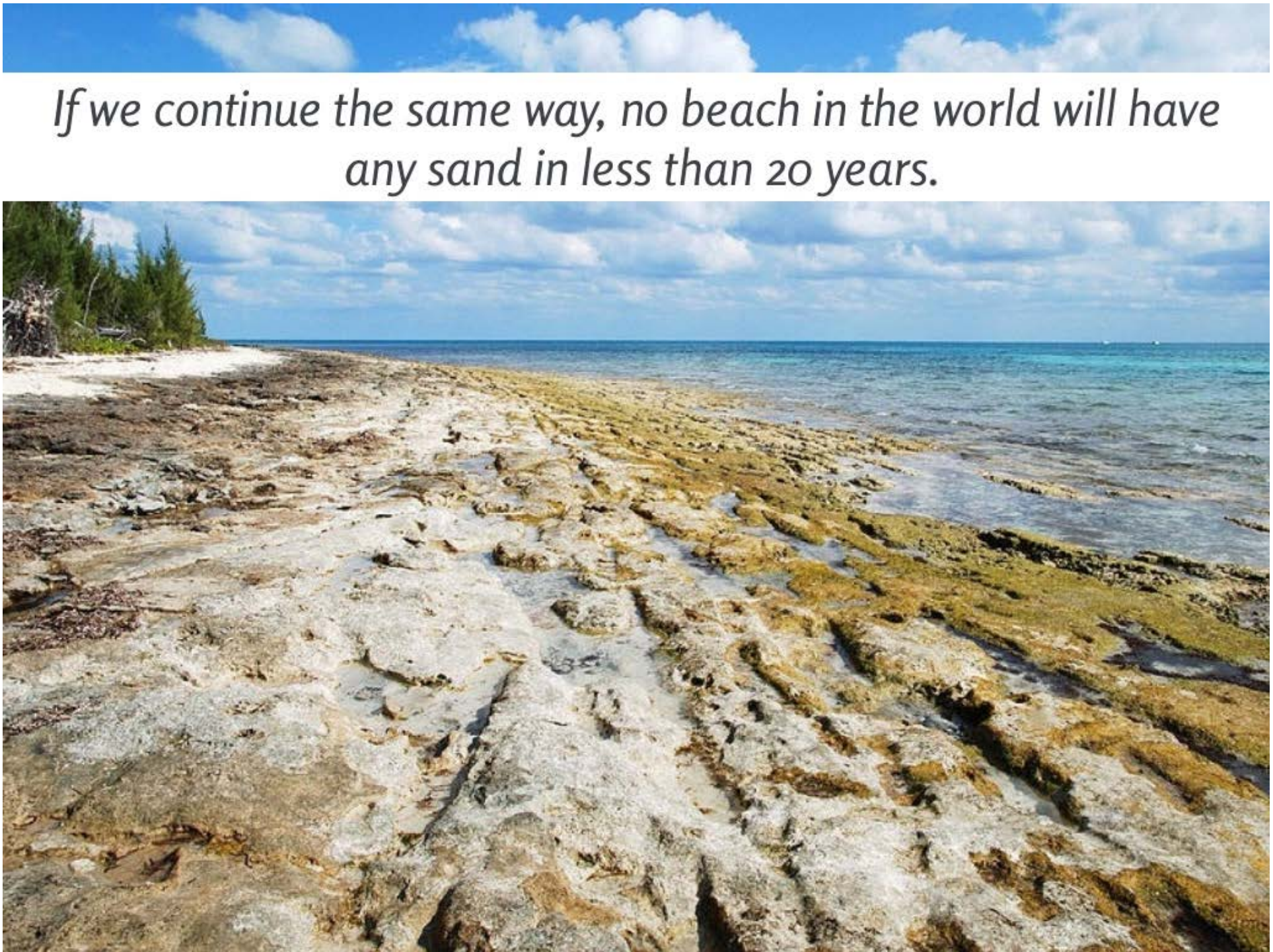
Source : P. Bihouix & B. de Quillebon, Quel avenir pour les métaux ? Éditions Sciences Paris 2013.

An Olympic pool of cement is used

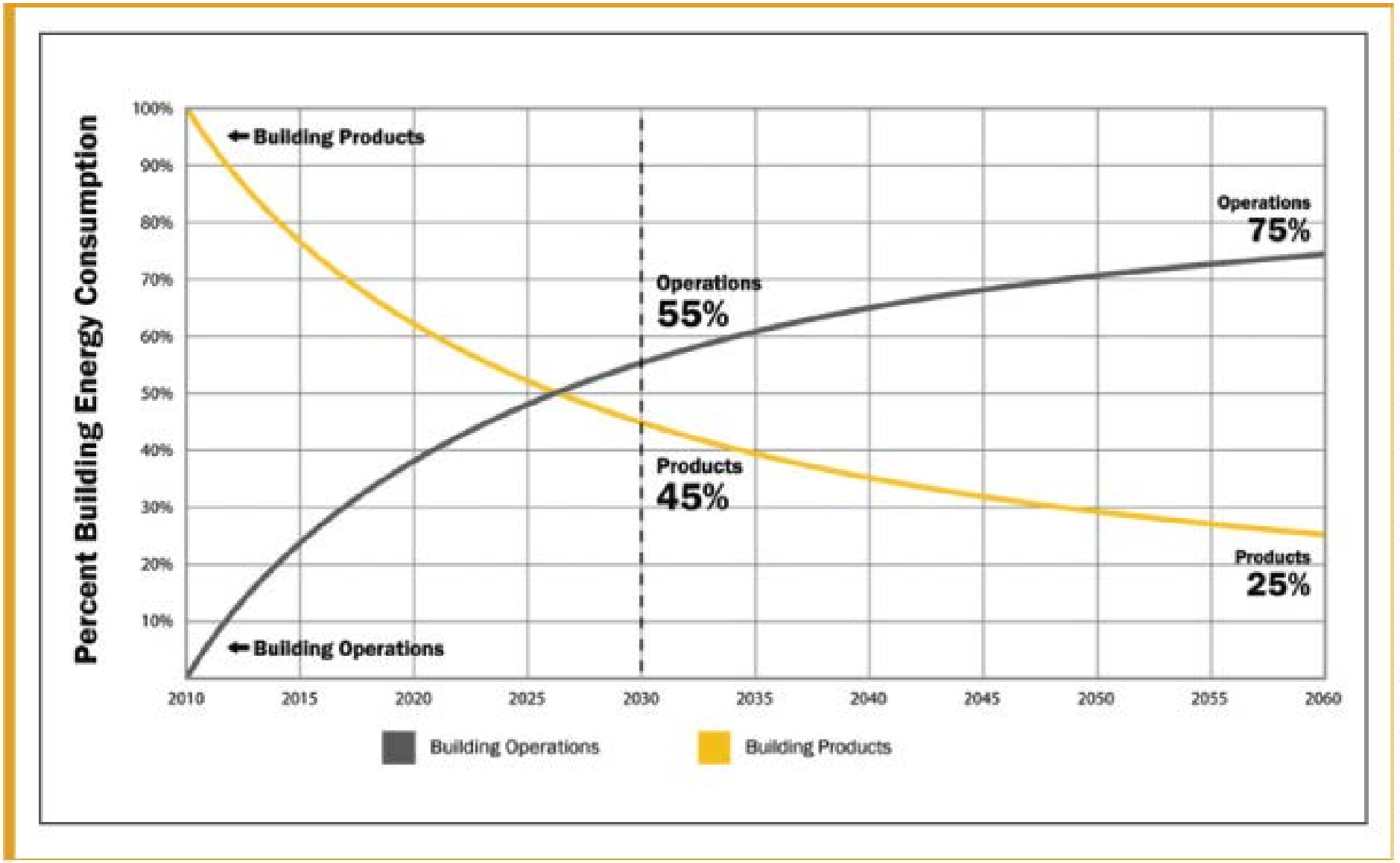
every 15 seconds.

Source : PC Alcin & S. Mindness, *Écostructures en béton, Comment diminuer l'emprunte carbone des bâtiments ?* Eyrolles Paris 2013.

CIRCULAR ECONOMY IN CONSTRUCTION
Trends



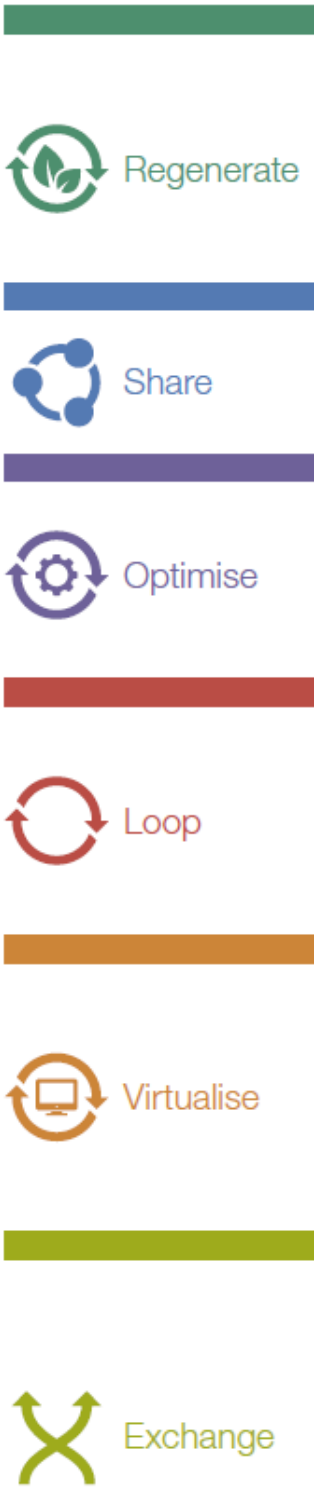
CIRCULAR ECONOMY IN CONSTRUCTION
Energy consumption of building over time



Data courtesy Architecture 2030, EIA 2011, Richard Stein

CIRCULAR ECONOMY IN CONSTRUCTION
Productivity in construction

CIRCULAR ECONOMY IN CONSTRUCTION
ReSolve Framework



CIRCULAR ECONOMY IN CONSTRUCTION
Regenerate

Regenerating and restoring natural capital

- Diverting waste from landfill (FA, GGBS in concrete)

Dartington Primary School, UK: reclaimed tyres act as planters in the school grounds

Safeguarding, restoring and increasing the resilience of ecosystems

Madrid + Natural tackling climate change through the greening of existing infrastructure to provide natural habitats for wildlife and spaces for human enjoyment

CIRCULAR ECONOMY IN CONSTRUCTION
Share

Maximising asset utilisation

- co-location
- co-living
- Airbnb -valued at around US$25bn. Airbnb guests use 63% less energy than hotel guests. In Europe, in just one year Airbnb saved water equivalent to the contents of 1,110 Olympic-sized swimming pools, and avoided GHG emissions equivalent to 220,000 cars.

Pooling the usage of asset

- WikiHouse
- 3D Hubs - over 32,000 printers in over 150 countries
- HeadBox

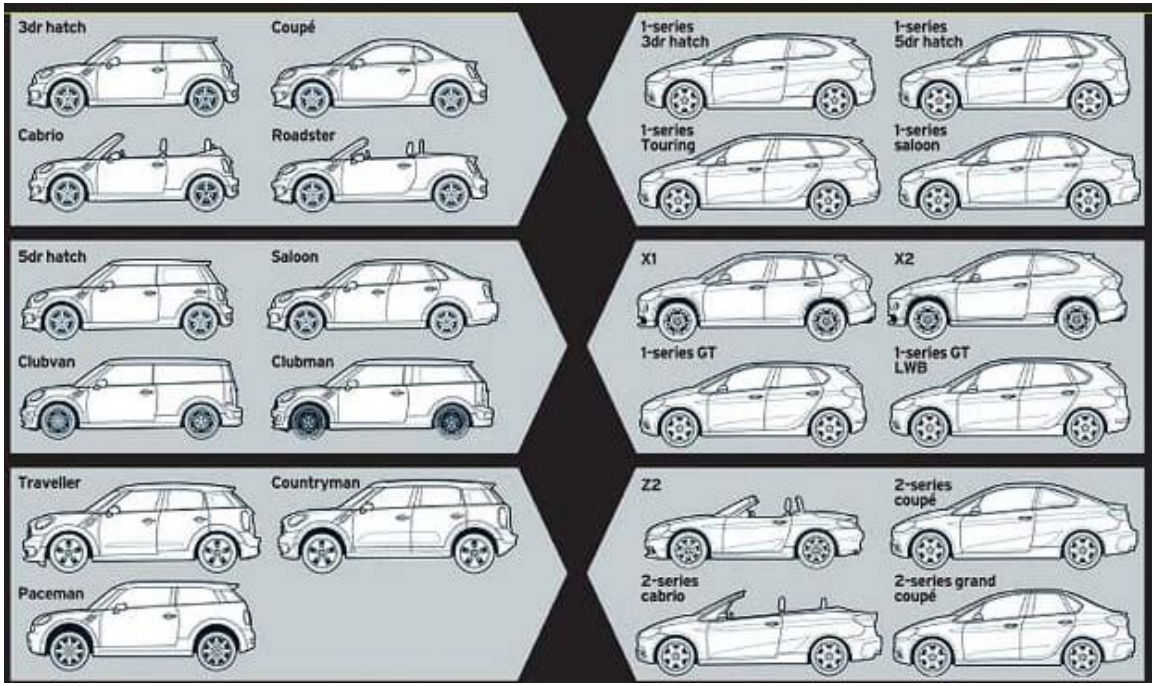
Reusing assets

- Globechain

CIRCULAR ECONOMY IN CONSTRUCTION
Optimise

Optimising system performance (maintaining materials and components at their highest value)/Decreasing resource usage

- Flexible design methodologies
- Off-site construction and modular components
- Reusing materials



Prolonging an asset's life

- Repurposing - designing flexible building cores

Decreasing resource usage

- 3D printing technology can reduce waste, promote material resource efficiency and minimise transport needs

Implementing reverse logistics

- Leasing phones
- Returning engine cores

3D Print Canal House, Amsterdam

CIRCULAR ECONOMY IN CONSTRUCTION
Loop

Keeping products and materials in cycles, prioritizing inner loops

- Focusing on disassembly during the design phase increases the chance of effective second use and reuse pathways

Remanufacturing and refurbishing products and components

Recycling materials

- Buildings and structures can be designed to allow component parts to be easily separated and recycled Standardisation of components will also facilitate this process and increase recyclability

Olympic Stadium, Stratford, London: 98% of demolition material was reused or recycled

CIRCULAR ECONOMY IN CONSTRUCTION
Virtualise

Displacing resource use with virtual use

- virtual marketplaces like Peerby and Streetbank connect users wanting to lend or borrow infrequently-used household

Replacing physical products and services with virtual services

- Building information modelling (BIM)

Replacing physical with virtual locations

- video conferencing
- real-time language translation

Delivering services remotely

- embedded sensors and smart monitoring devices that anticipate problems and carry out maintenance works can extend the life of built environment assets

Materials passports provide information on the value of materials and products

CIRCULAR ECONOMY IN CONSTRUCTION
Exchange

Replacing with renewable energy and material sources

- generating energy and heat through closed-loop systems such as anaerobic digestion, or using wind, solar and other renewables as part of a low- and zero-carbon

Using alternative material inputs

- sewage sludge into bio-plastic
- bricks made from microscopic, fibrous fungi bound to agricultural waste
- Bioreactive façades onto buildings to generate renewable energy from algal biomass and solar thermal heat

Replacing traditional solutions with advanced technology

- LED
- 3D printing (weight reduction by 40%)

Replacing product-centric delivery models with new service centric

- pay per lux

SolarLeaf's bio-reactive façade generates renewable energy from algal biomass and solar thermal heat

CIRCULAR ECONOMY IN CONSTRUCTION
Dubai Creek Tower

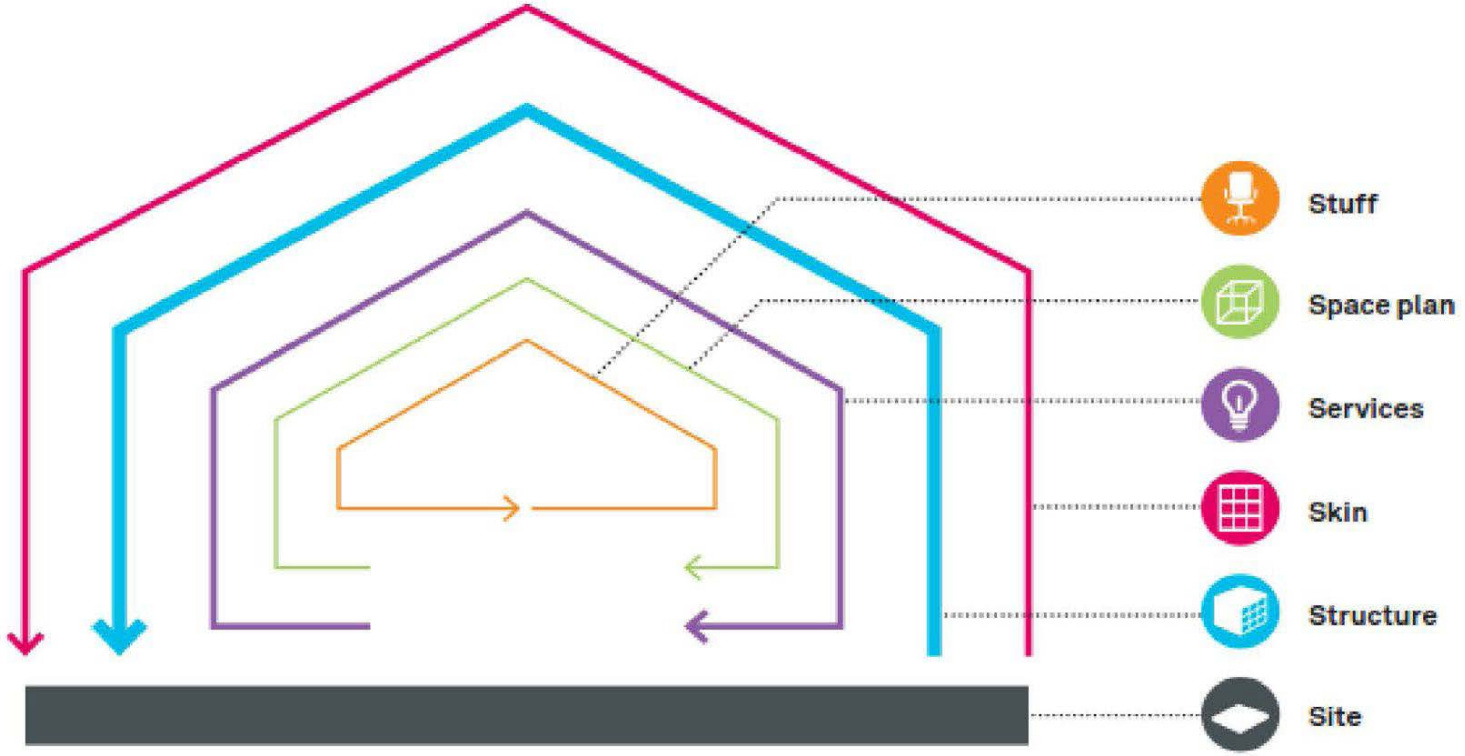
> 1km skyscraper

A highly efficient cooling system, where collected water from the system will be used to clean the façade of the building.

Green corridors across the structure will provide solar protection.

An integrated shading system will improve the energy-efficiency of the building.

CIRCULAR ECONOMY IN CONSTRUCTION
Building in Layers



- Building Shell (e.g. 50-75 years lifespan): generous floor to ceiling heights allow flexibility; Spacious cores and risers enable flexibility to adapt to changing expectations; Use bolted rather than welded connections
- Services (e.g. 15-20 years lifespan): ensure services are accessible and demountable for ease of repair or replacement; Look at modular systems that will allow simple upgrade to services without the whole system becoming obsolete; Consider leasing arrangements rather that outright purchase, as this passes responsibility onto the manufacturer for upgrades and changes
- Interiors (e.g. 5-10 years lifespan): Look for modular designs that enable partitions to be dismantled and relocated into different configurations, allowing a space to be easily modified to create new spaces
- Settings and Furniture: Think how consumables will be replaced e.g. carpet tiles can be replaced individually when damaged, instead of replacing a wall-to-wall carpet; Select products that can easily be recycled or broken down at the end of life

CIRCULAR ECONOMY IN CONSTRUCTION

……

"Adopting circular economy principles could significantly enhance global construction industry productivity, saving at least US$100bn a year."

World Economic Forum, 2016

300,000 cars

5,300,000 cars