CIRCULAR ECONOMY
Challenges and Opportunities
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Middle East Clean Energy

معرض ومؤتمر الشرق الأوسط للطاقة النظيفة

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ENVIOREMENTAL INTRODUCTION

CLIMATE CHANGE

Net Zero Carbon by 2050 As per International COP' s

Mid term Control Target 2030 (Reduce emission by 45%)

Actual situation increases of 1.1 degree C since 1800, target to reach 1.5 degree C by 2050 Paris Agreement with amendments

GHG EMISSIONS

Industry 30%   Transport 21.8% Others 9.2 %

For the Construction 39%= Operational 28%+ embodied carbon 11%

ENVIOREMENTAL INTRODUCTION

Global Approach

55% From Running Energy

(Emerging technique & Carbon Capture storage)

45% from Product (target for reduction)

11.9 AFOLU (Agriculture, Forester, Land usae…) 10.2 % industry

3% Energy from Building,(6.7+17.2) transport & systems

ENVIOREMENTAL INTRODUCTION

Additional new Process for Emission Reduction by Changing underlying production process and feedstock.

Objective: Eliminate Fossil fuel, replaced by Renewable energy, Decarbonized Electricity, Hydrogen & Biomass

ENVIOREMENTAL INTRODUCTION

Challenge: Recycling & Reuse

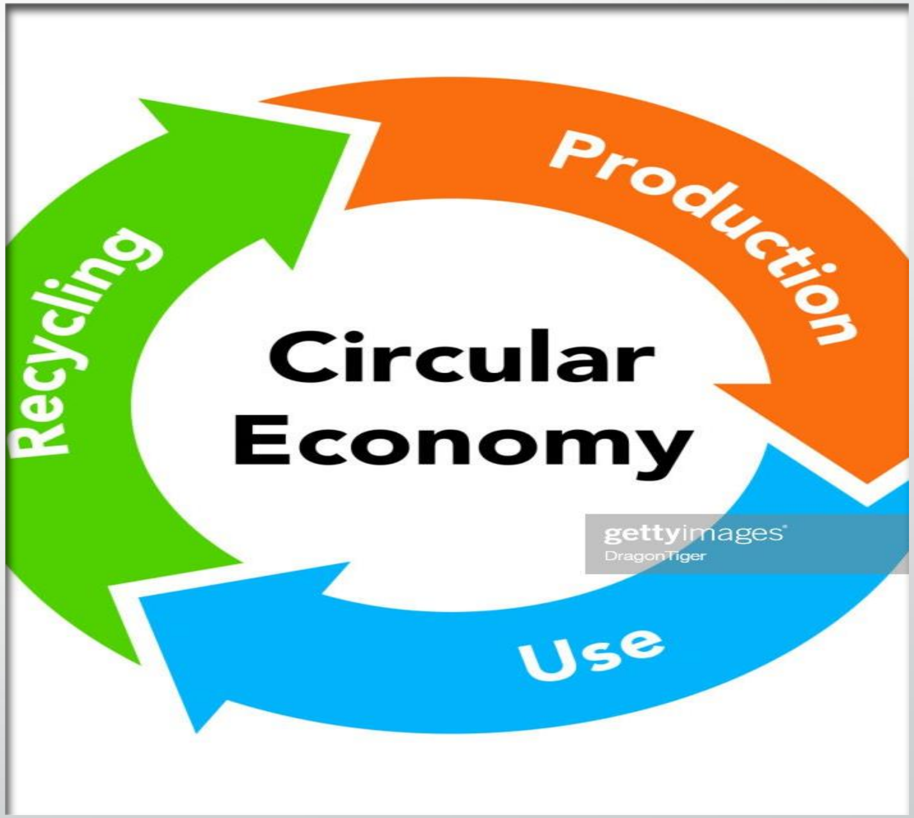
Isolating & Refining Individual Rare Earth Elements (REE) Plus

Diversify the ressources, Necessity for reducing energy of processing during the recycling

Metabolizing by Gluconabacter bacteria, producing acid to separate REE from Shreddered electronic waste

FRAMEWORK FOR THE CIRCULAR ECONOMY

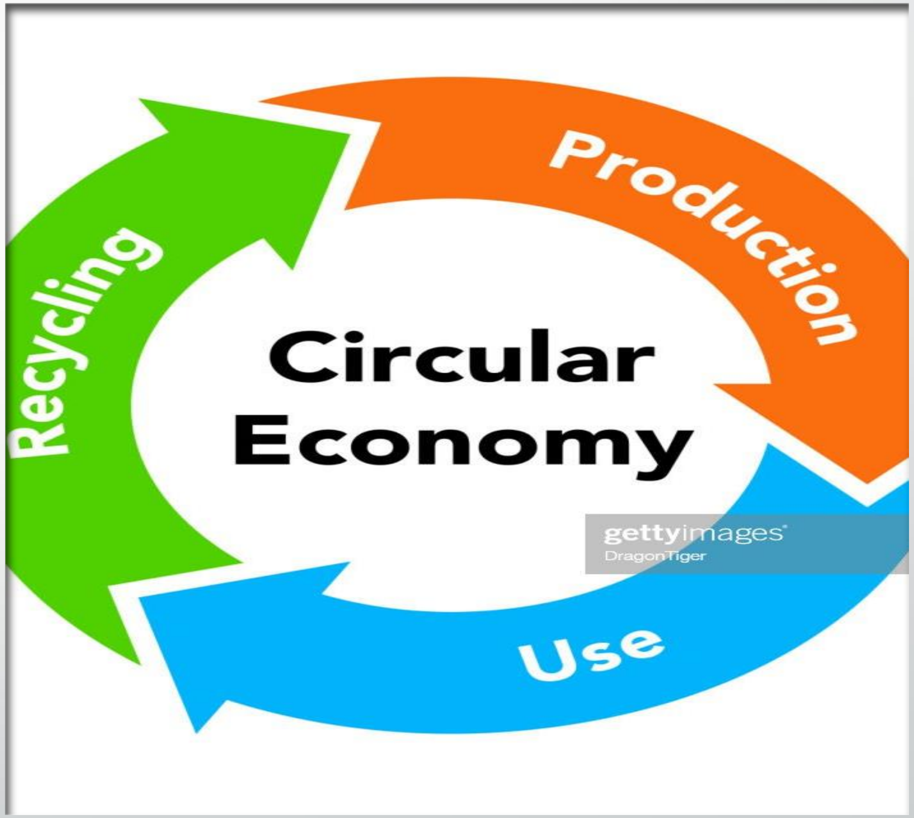
Circular economy (also referred to as circularity or CE) is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products for as long as possible.



CE aims to tackle global challenges such as climate change, biodiversity loss, waste, and pollution by emphasizing the design-based implementation of the three base principles of the model.

FRAMEWORK FOR THE CIRCULAR ECONOMY

The **three principles** required for the transformation to a circular economy are: **designing** out waste and pollution, **keeping** products and materials in use, and **regenerating** natural systems."



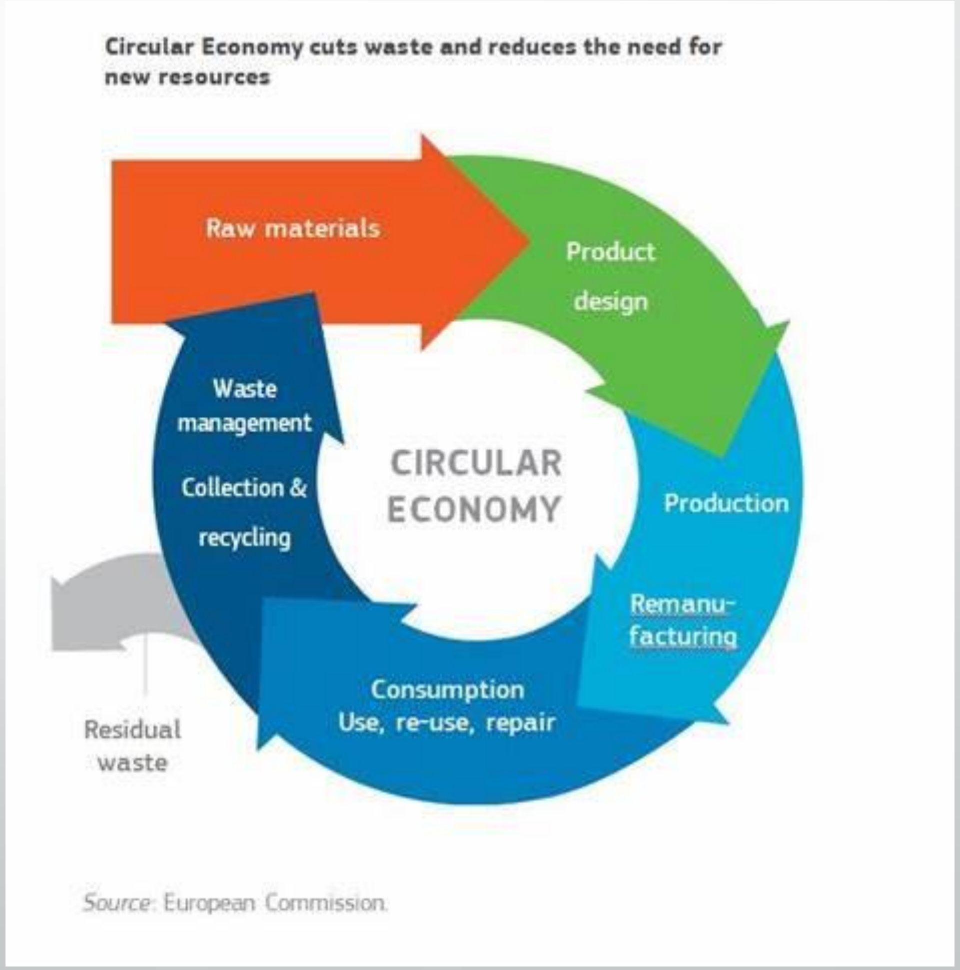
FRAMEWORK FOR THE CIRCULAR ECONOMY

CE has been gaining popularity because it helps to minimize emissions and consumption of raw materials, open up new market prospects and principally, increase the sustainability of consumption and improve resource efficiency.

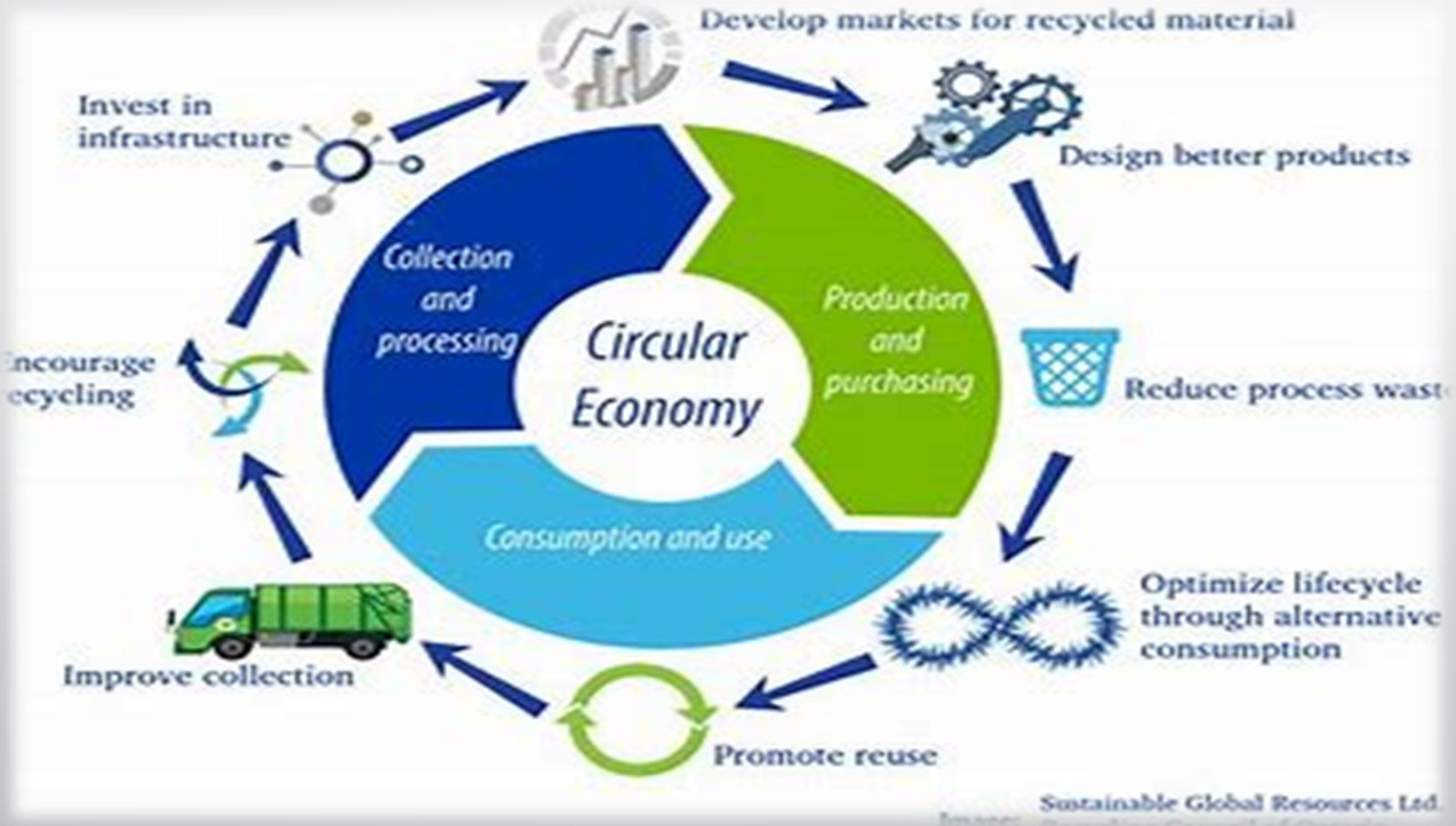
The circular economy is a framework of three principles, driven by design:

- Eliminate waste and pollution,
- Keeping products and materials in use and
- Regenerate natural systems.

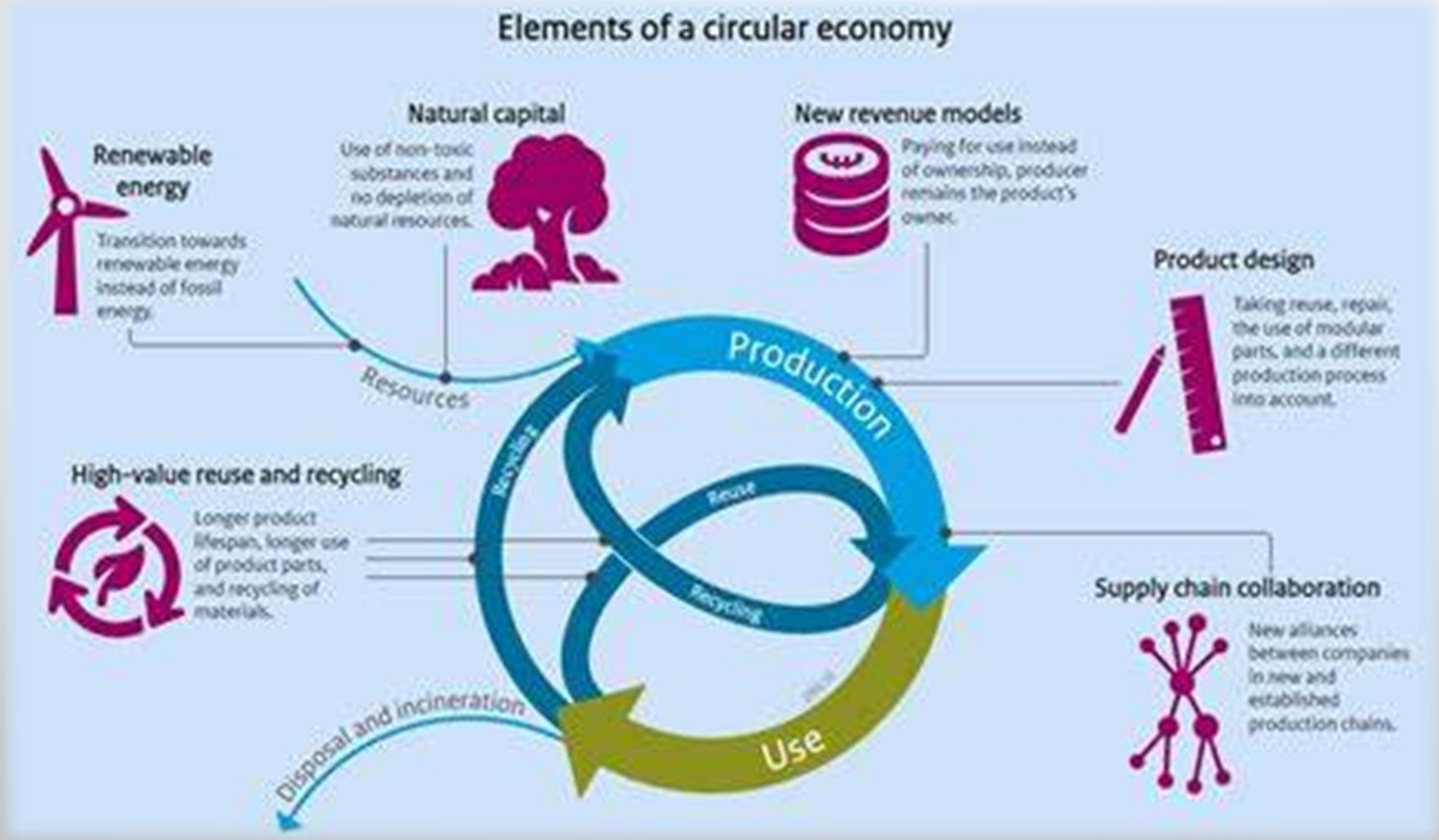
It is based increasingly on renewable energy and materials, and it is accelerated by digital innovation.



The circular economy is a framework of three principles, driven by design:

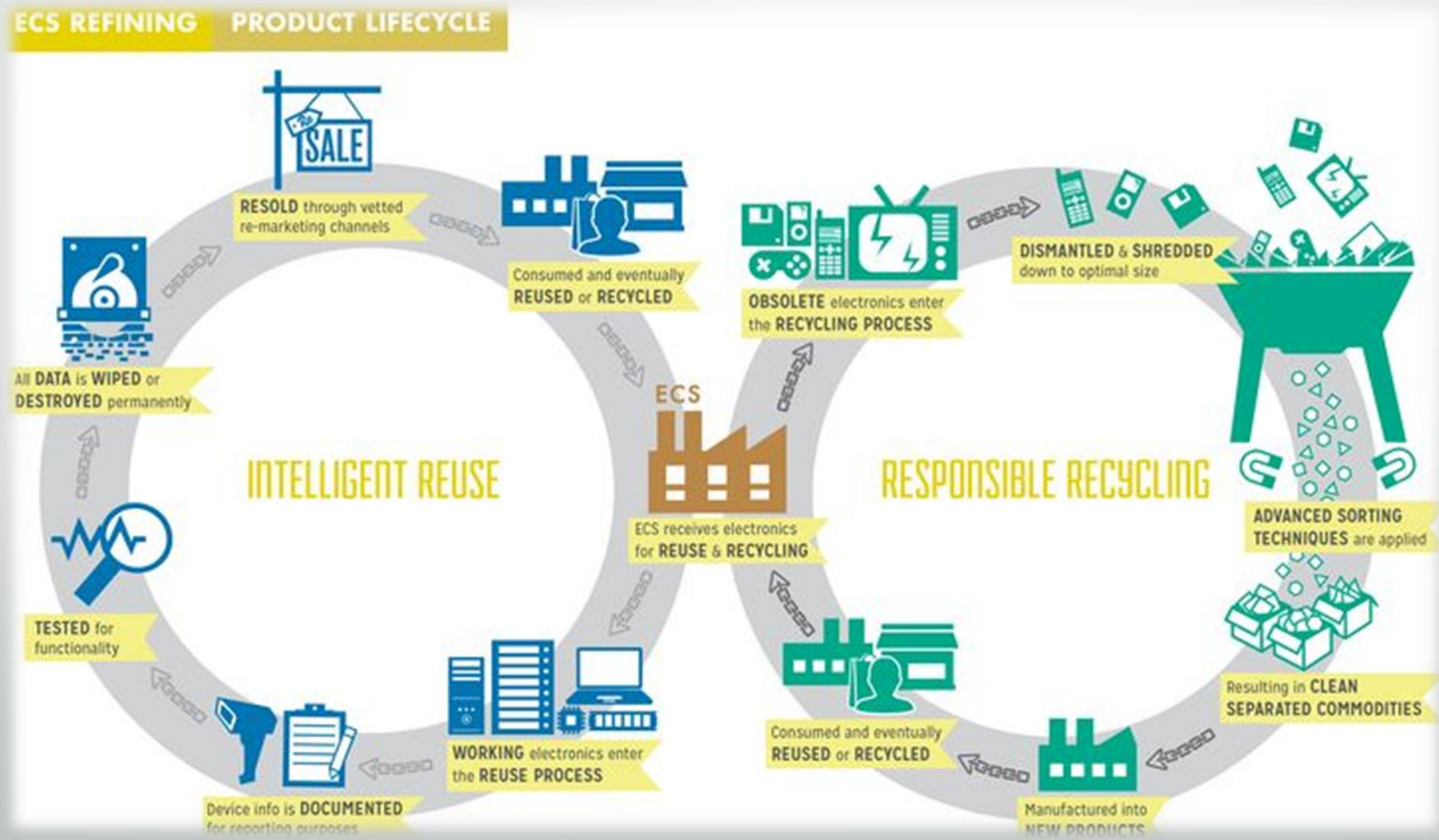


Elements of Circular Economy



Elements of Circular Economy

Circular Economy: Product life cycle



Life Cycle Assessment for the circular economy (LCA) "courtesy of WIKIPEDIA"

Life Cycle Assessment, also known as Life Cycle Analysis, (LCA) is a process for evaluating the environmental impacts of a product or service over the course of its entire life. It is often used to determine the best performing product, service, or other solution, at a given point in time, in terms of specific environmental impacts, such as carbon emissions.

However, like any tool, it has its limitations, and can give misleading or contradictory outcomes if not used carefully.

Reasons to be cautious with Life Cycle Analysis

1. It favours short term gain over systemic change, it is important to remember that while Life Cycle Assessment is good at pointing to the best option based on a specific metric at a specific time, it can sometimes lead us to seek short term, individual benefits at the expense of long term, collective ones.

Reasons to be cautious with Life Cycle Analysis

2. It ignores hard to measure impacts, can only measure metrics that we can quantify, such as carbon emissions, and therefore weighs decisions more heavily towards these metrics. LCA can often ignore impacts that are harder to measure or less well understood, such as plastic in the environment or the long term effects of landfill runoff.

Reasons to be cautious with Life Cycle Analysis

3. It only measures what you tell it to measure and relies on assumptions, LCA is limited in the sense that they will only measure the parts of the system or the metrics that you have asked them to look at. Anything that isn't defined within the boundaries of the LCA will not be accounted for. On top of all that, LCAs, just like all models, are dependent on the data you feed into them and the assumptions you make.

How to use Life Cycle Assessment for a circular economy transition

1. **Highlight areas of improvement, LCA** can be used to identify impact hotspots within the life cycle of a specific solution
2. **Test against changing external factors, LCA** can be used to investigate the impact of external factors that might vary between geographies or with time.

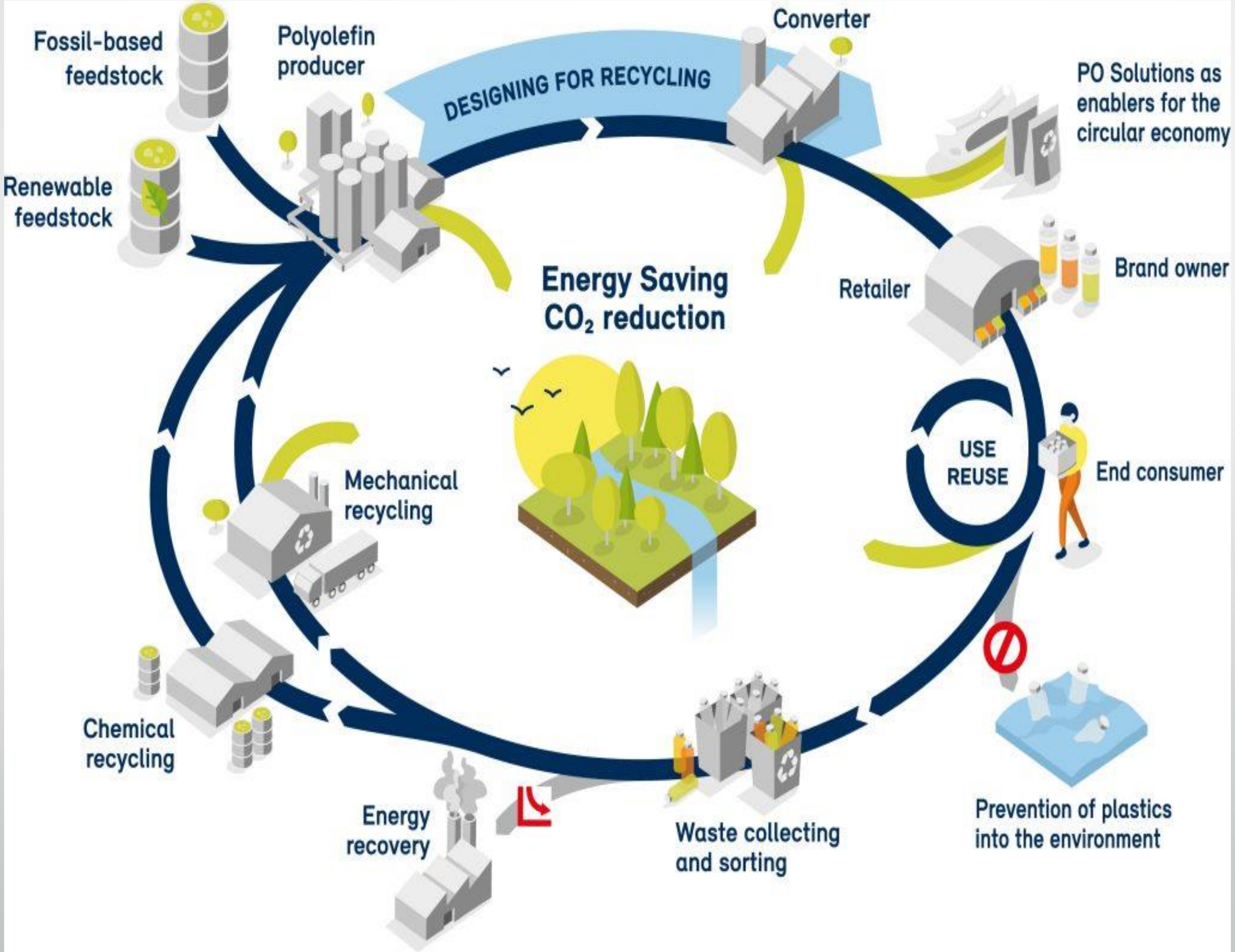
3. **Compare similar solutions, LCA** is most likely to be able to give a clear answer when most parts of the system remain the same.

4. **Use LCA in later stages of innovation,** An **LCA** is most useful when there is reliable input data and fewer unknowns. Once it is clear how materials and resources will flow through the system, an LCA can be more effective. The later stages of an innovation process, such as during scale up or when improving an existing system, therefore might be the best time to carry out LCAs. Care should be taken when using LCA in the early stages of an innovation process.

The butterfly diagram: Visualising the circular economy

It illustrates the continuous flow of materials in a circular economy. There are two main cycles – the technical cycle and the biological cycle. In the technical cycle, products and materials are kept in circulation through processes such as reuse, repair, remanufacture and recycling. In the biological cycle, the nutrients from biodegradable materials are returned to the Earth to regenerate nature.

Chemical recycling, a part of the solution for closing the loop



The circular cascade model. Source: Borealis

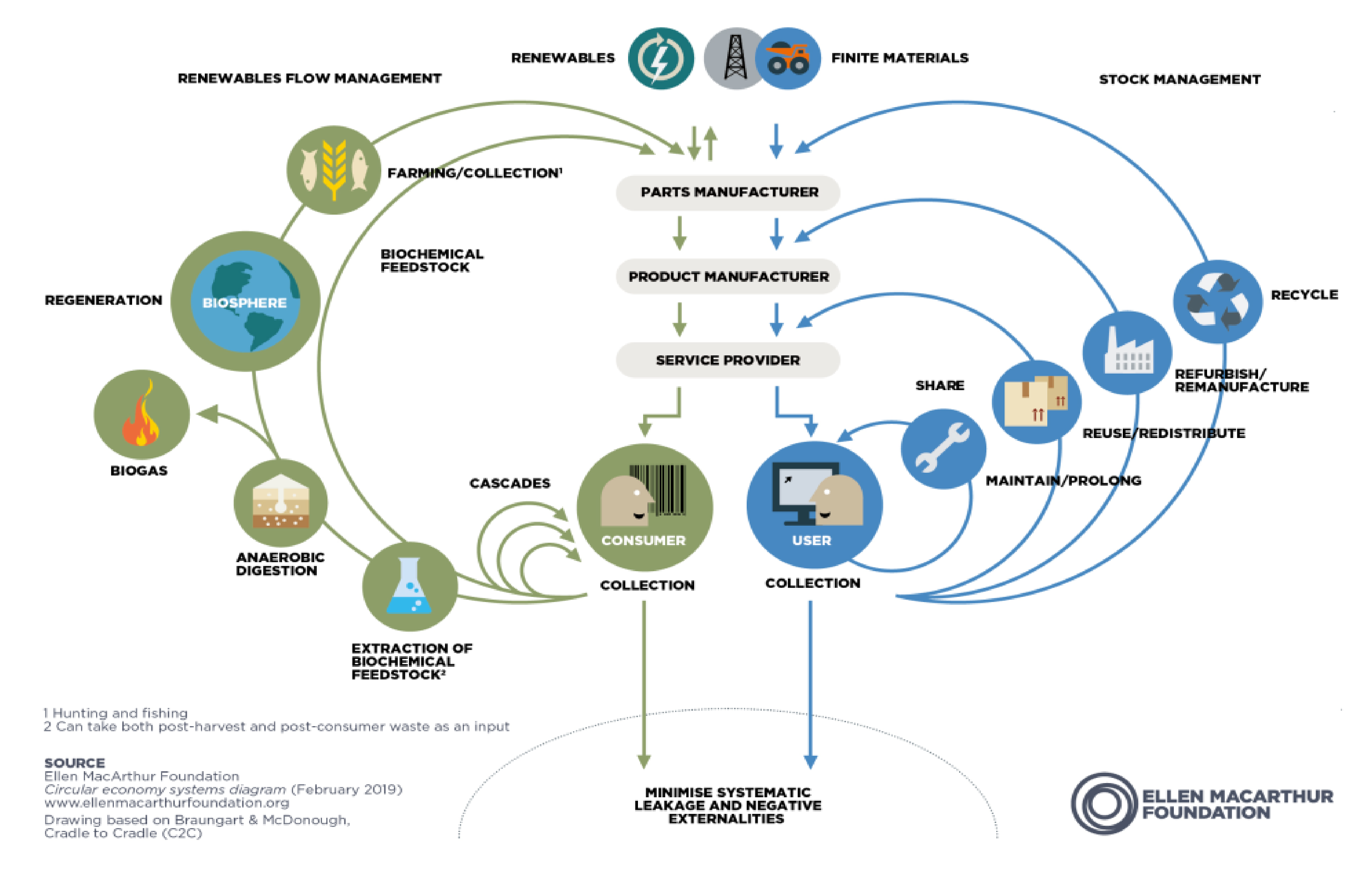
Chemical recycling, a part of the solution for closing the loop

As a leader in the polyolefins (PO) industry, Borealis is driving the transition from a linear to a circular economy. Borealis has developed a strategic framework to move its PO business stepwise towards a circular economy, developing 'Circular Economy Solutions' to cover all possible circular offerings for customers, from renewable-based feedstock to chemical recycling. In addition, the Borealis membership of the Ellen MacArthur Foundation's New Plastics Economy endorses this leading position.

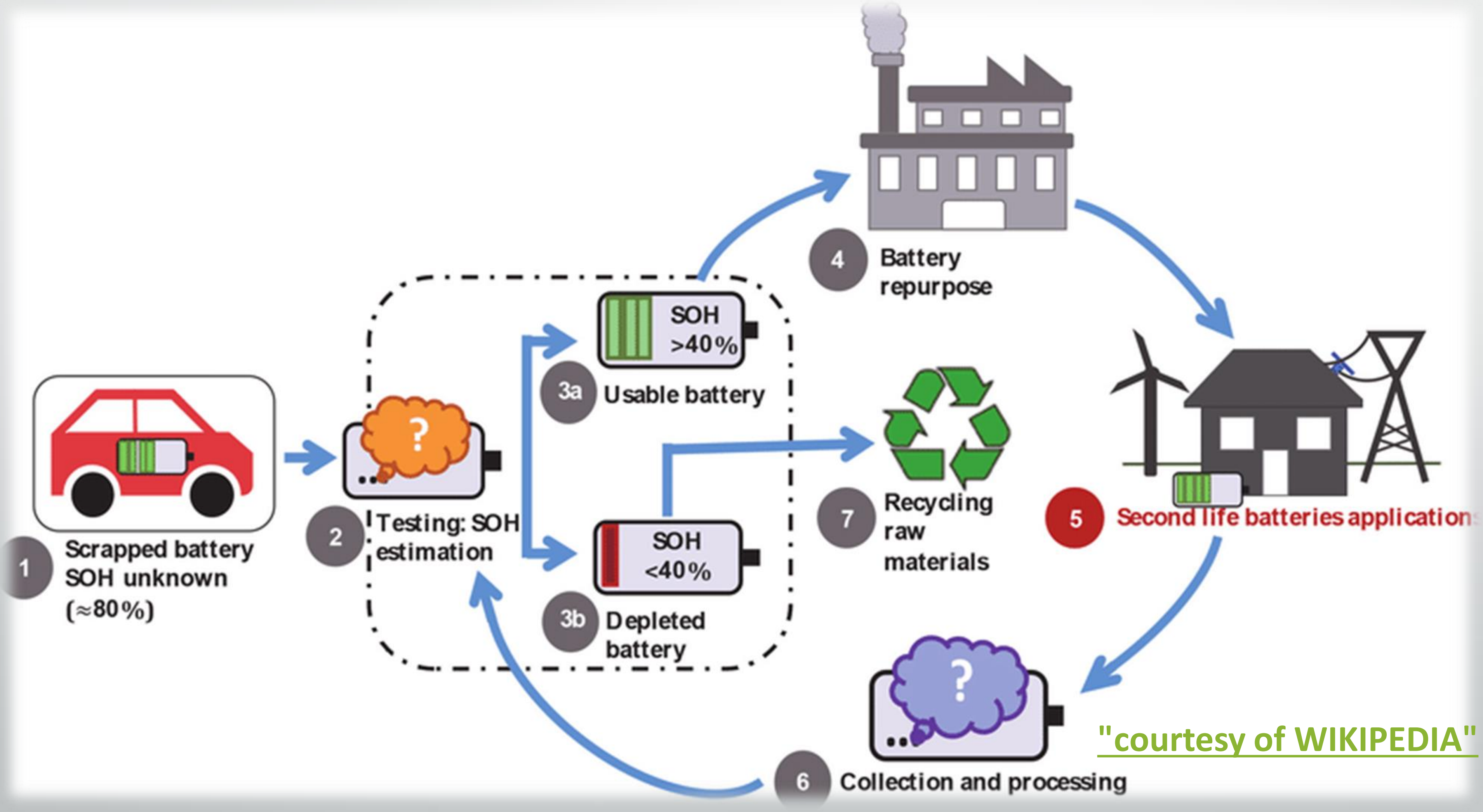
Chemical recycling, a part of the solution for closing the loop

Borealis PO products and solutions are designed for circularity with a primary focus on reusability, followed by mechanical recycling, then chemical recycling and finally energy recovery. When selecting these end-of-life options, the entire life cycle of a material is considered. In the case of chemical recycling technology, Borealis optimises and balances environmental, market and social expectations versus energy recovery from incineration.

THE BUTTERFLY DIAGRAM

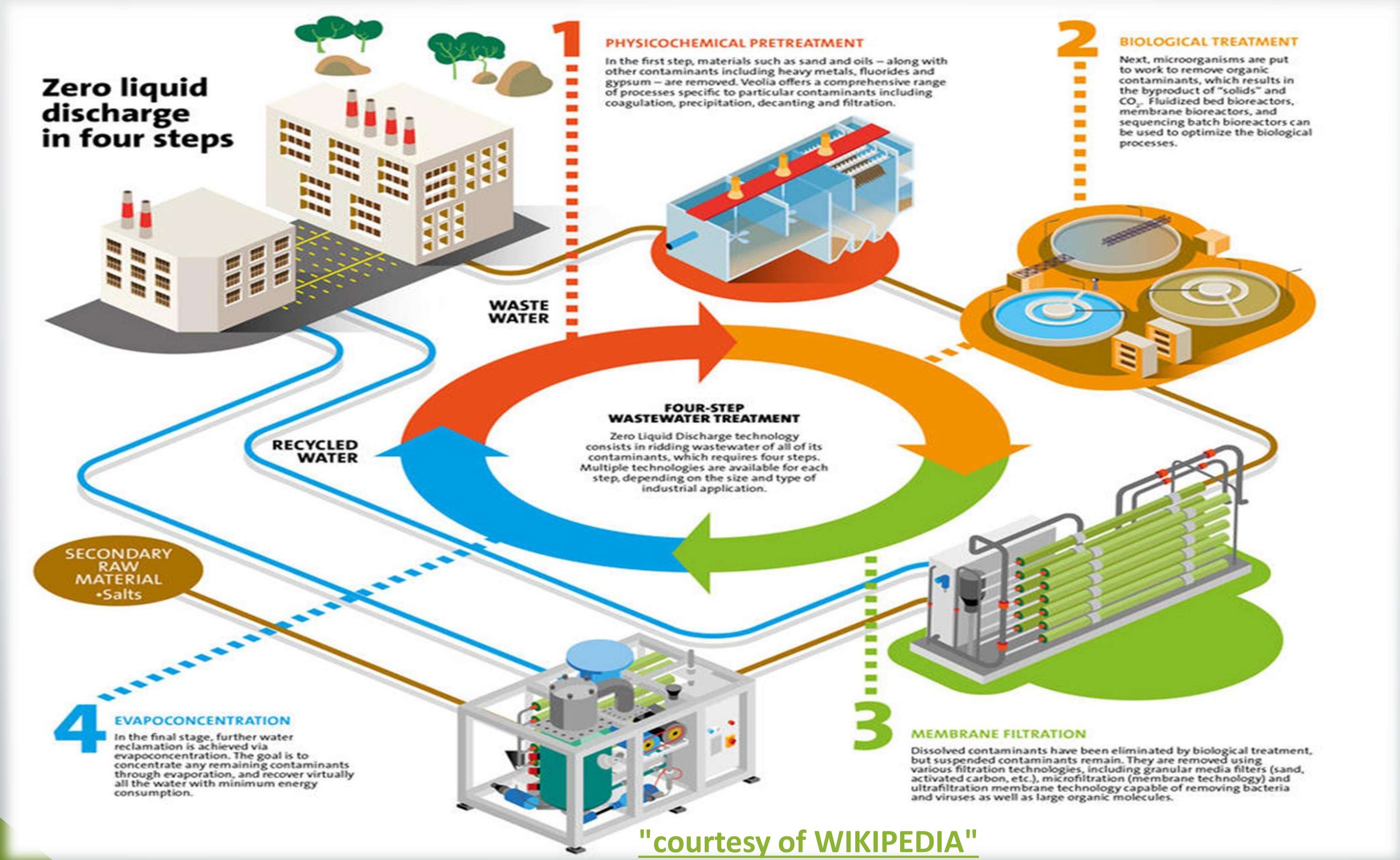


BATTERY RECYCLING



"courtesy of WIKIPEDIA"

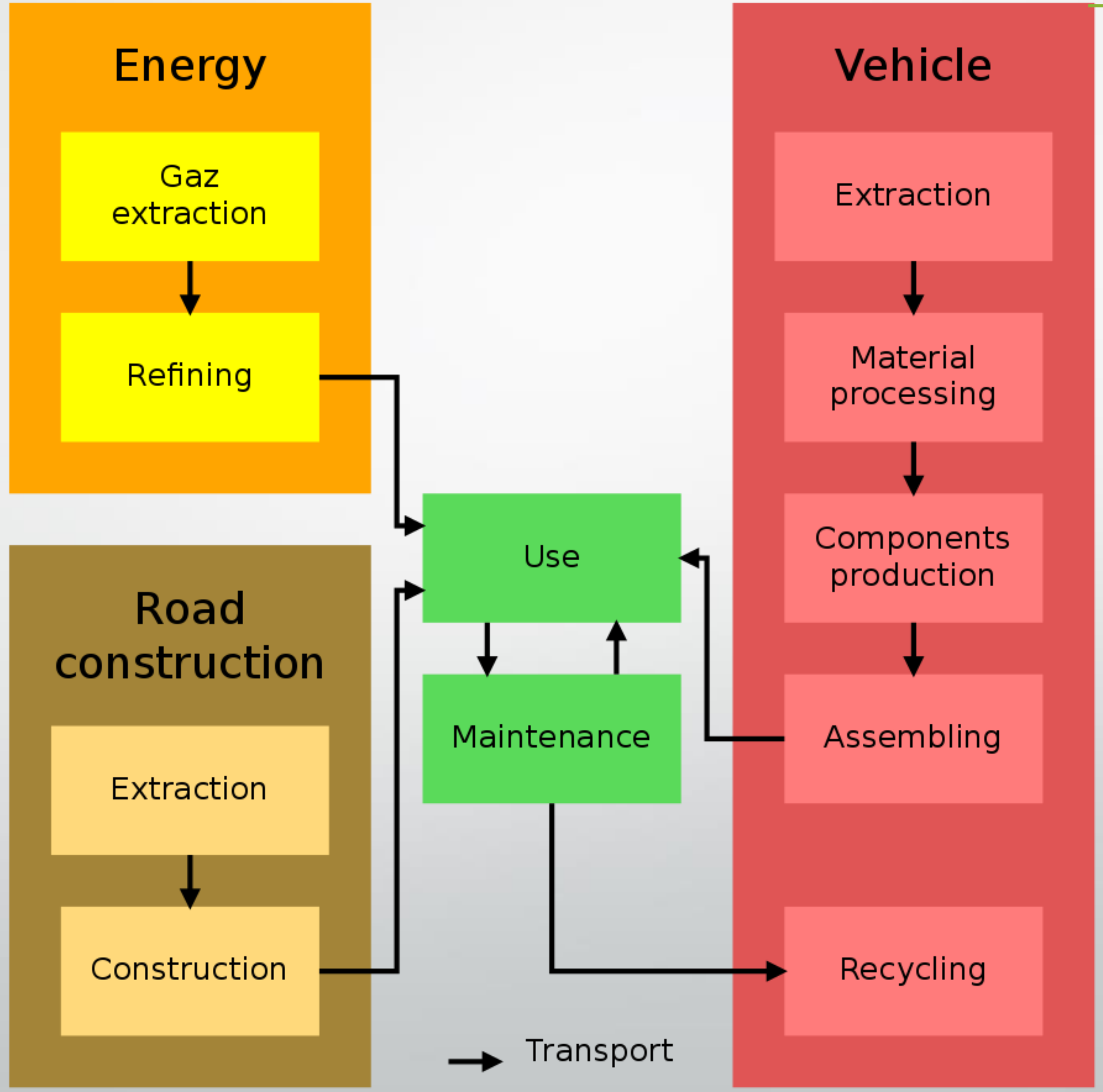
WASTE WATER RECYCLING



"courtesy of WIKIPEDIA"

SUSTAINABILITY AND RECYCLING

"courtesy of WIKIPEDIA"



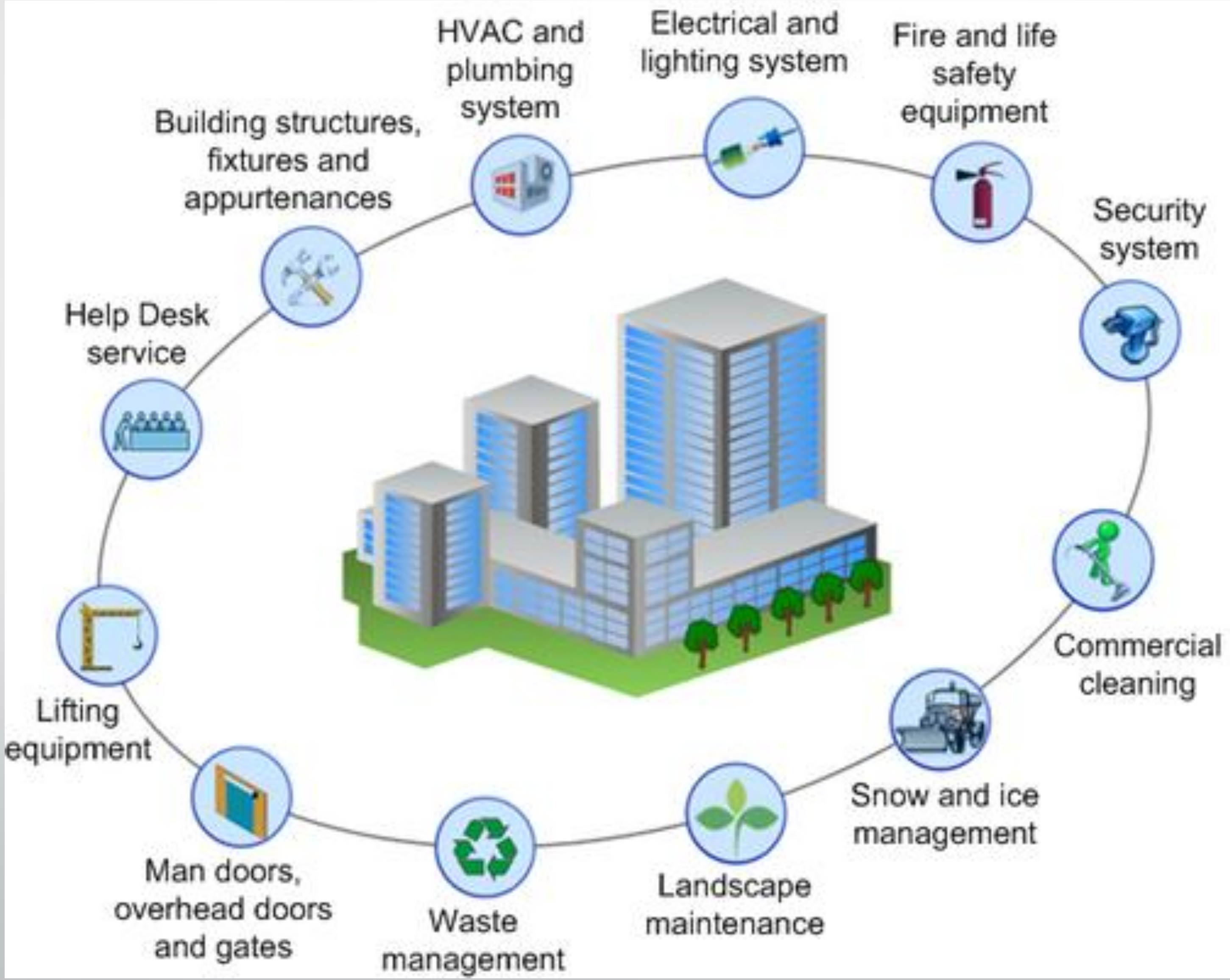
Car life cycle

SUSTAINABILITY AND RECYCLING

Intuitively, the circular economy would appear to be more sustainable than the current linear economic system. Reducing the resources used, and the waste and leakage created, conserves resources and helps to reduce environmental pollution. However, it is argued by some that these assumptions are simplistic; that they disregard the complexity of existing systems and their potential trade-offs.

"courtesy of WIKIPEDIA"

RECYCLING IN THE CONSTRUCTION FIELD-FULL LOOP "courtesy of WIKIPEDIA"

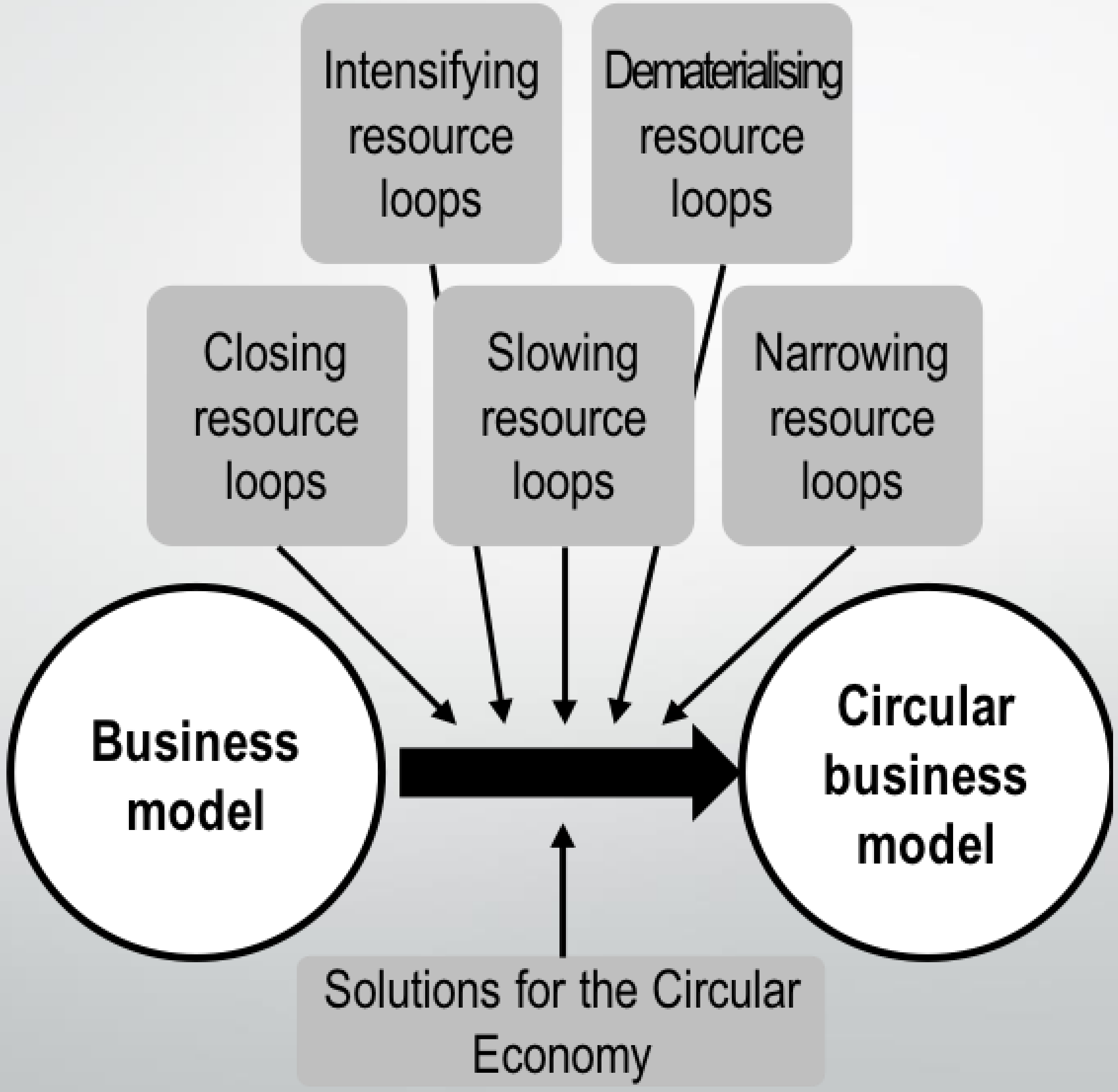


CHALLENGES

There are some obstacles during REE **recycling and reuse**. One big challenge is REE separation chemistry. Specifically, the process of isolating and refining individual rare earth elements (REE) presents a difficulty due to their similar chemical properties. In order to reduce the environmental pollution released during REE isolation and also diversify their sources, there is a clear necessity for the development of novel separation technologies that can lower the cost of large-scale REE separation and recycling. In this condition, the **Critical Materials Institute (CMI)** under the Department of Energy has devised a technique that involves utilizing Gluconobacter bacteria to metabolize sugars, producing acids that can dissolve and separate **rare earth elements** (REE) from **shredded electronic waste.**

courtesy of WIKIPEDIA

CIRCULAR BUSINESS MODEL



"courtesy of WIKIPEDIA"

CIRCULAR BUSINESS MODEL

Circular business models can be defined as business models that are

closing, narrowing, slowing, intensifying, and dematerializing loops,

to minimize the resource inputs into and the waste and emission leakage out of the organizational

system.

"courtesy of WIKIPEDIA"

CIRCULAR BUSINESS MODEL

This comprises:

1. recycling measures (closing),
2. efficiency improvements (narrowing),
3. use phase extensions (slowing),
4. a more intense use phase (intensifying),
5. and the substitution of products by service and software solutions (dematerializing)

STRATEGIC MANAGEMENT IN A CIRCULAR ECONOMY

The CE does not aim at changing the profit maximization paradigm of businesses. Rather, it suggests an alternative way of thinking how to attain a **sustained competitive advantage (SCA)**, while concurrently addressing the environmental and socio-economic concerns of the 21st century.

STRATEGIC MANAGEMENT IN A CIRCULAR ECONOMY

Indeed, **stepping away from linear forms of production** most often leads to the development of new core competencies along the value chain and **ultimately superior performance that cuts costs, improves efficiency, promote brand names, mitigate risks, develop new products**, and meets advanced government regulations and the expectations of green consumers.

"courtesy of WIKIPEDIA"

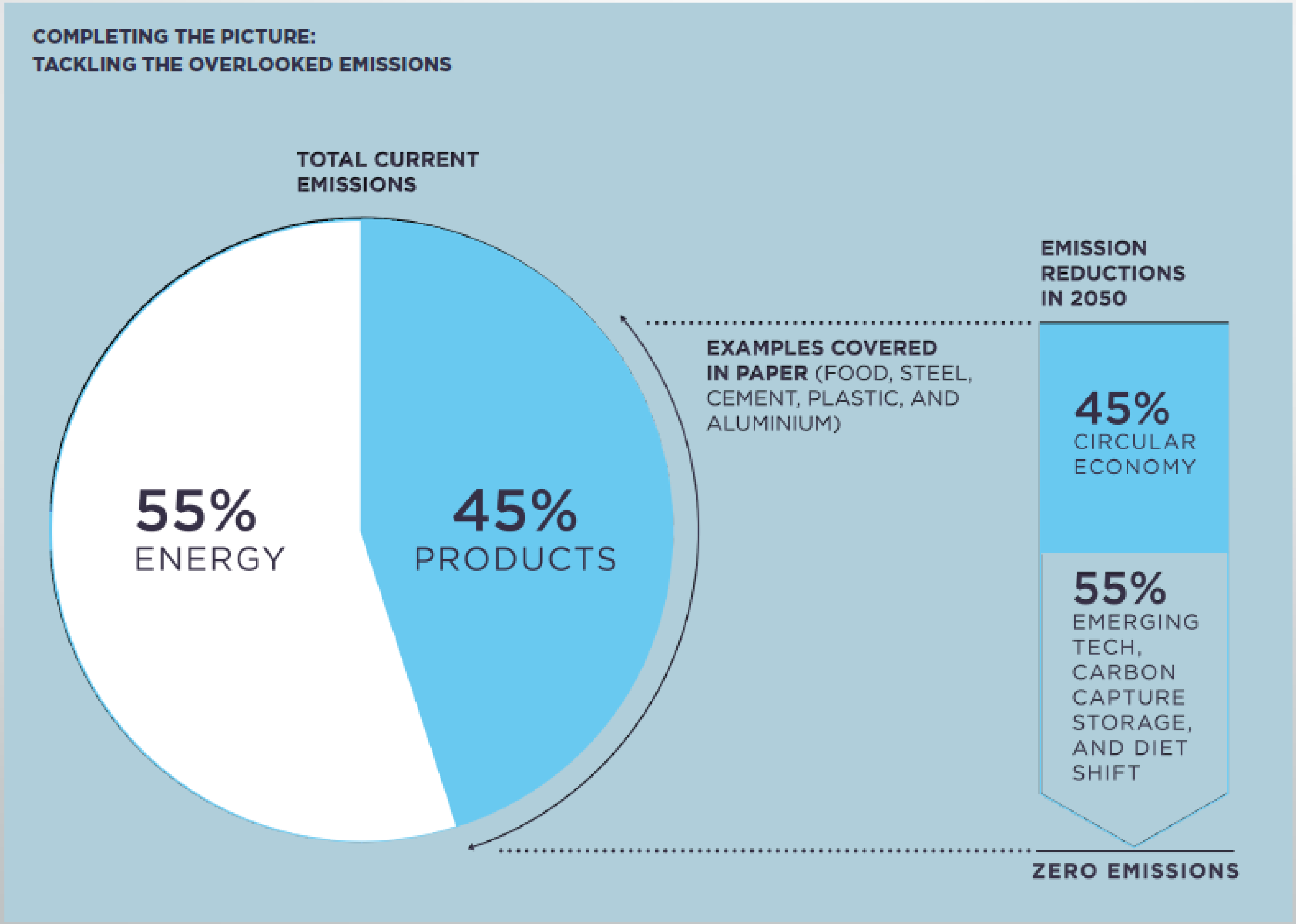
ACTUAL APPLICATION IN EUROPEAN COUNTRIES

The circular economy can reduce global CO2e emissions from cement, steel, plastic, and aluminum production by 40% or 3.7 billion tones in 2050, thereby achieving almost half of their net-zero emissions target. This opportunity comes from making better use of products and materials within key sectors such as built environment and mobility. These solutions are cost-effective and offer system-wide benefits. Industry is responsible for around 21% of global CO2e emissions.

ACTUAL APPLICATION IN EUROPEAN COUNTRIES

Additional interventions will be needed to further reduce industry emissions While a transition towards a circular economy for key industry materials could reduce global emissions by 40% in 2050, additional measures will be needed to close the remaining emissions gap. Innovative industrial processes will be crucial. For example, new low-emission industrial processes will contribute to emissions reduction by fundamentally changing the underlying production processes and feedstocks. The objective is to eliminate fossil fuels from the outset and replace them with renewable sources, e.g. decarbonised electricity, hydrogen, and biomass

ACTUAL APPLICATION IN EUROPEAN COUNTRIES

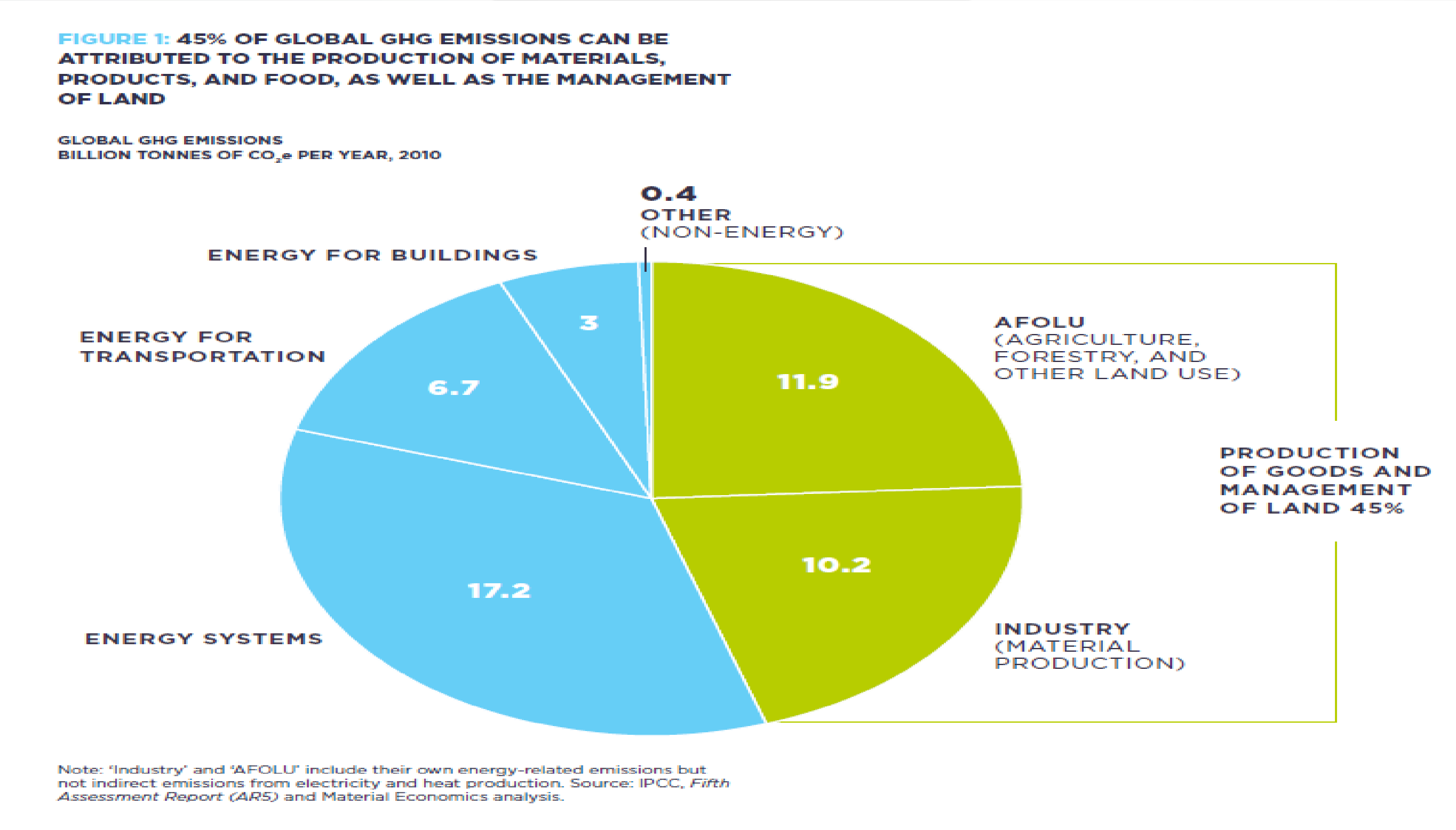


ACTUAL APPLICATION IN EUROPEAN COUNTRIES

45% OF GLOBAL GHG EMISSIONS CAN BE ATTRIBUTED TO THE PRODUCTION OF MATERIALS, PRODUCTS, AND FOOD, AS WELL AS THE MANAGEMENT OF LAND GLOBAL GHG EMISSIONS BILLION TONNES OF CO2E PER YEAR, 2010 NOTE: 'INDUSTRY' AND 'AFOLU' INCLUDE THEIR OWN ENERGY-RELATED EMISSIONS BUT NOT INDIRECT EMISSIONS FROM ELECTRICITY AND HEAT PRODUCTION. SOURCE: IPCC, FIFTH ASSESSMENT REPORT (AR5) AND MATERIAL ECONOMICS ANALYSIS. 11.9 AFOLU (AGRICULTURE, FORESTRY, AND OTHER LAND USE) 10.2 INDUSTRY (MATERIAL PRODUCTION) 17.2 ENERGY SYSTEMS 6.7 ENERGY FOR TRANSPORTATION 3 0.4 OTHER (NON-ENERGY) ENERGY FOR BUILDINGS PRODUCTION OF GOODS AND MANAGEMENT OF LAND 45

"courtesy of WIKIPEDIA"

ACTUAL APPLICATION IN EUROPEAN COUNTRIES

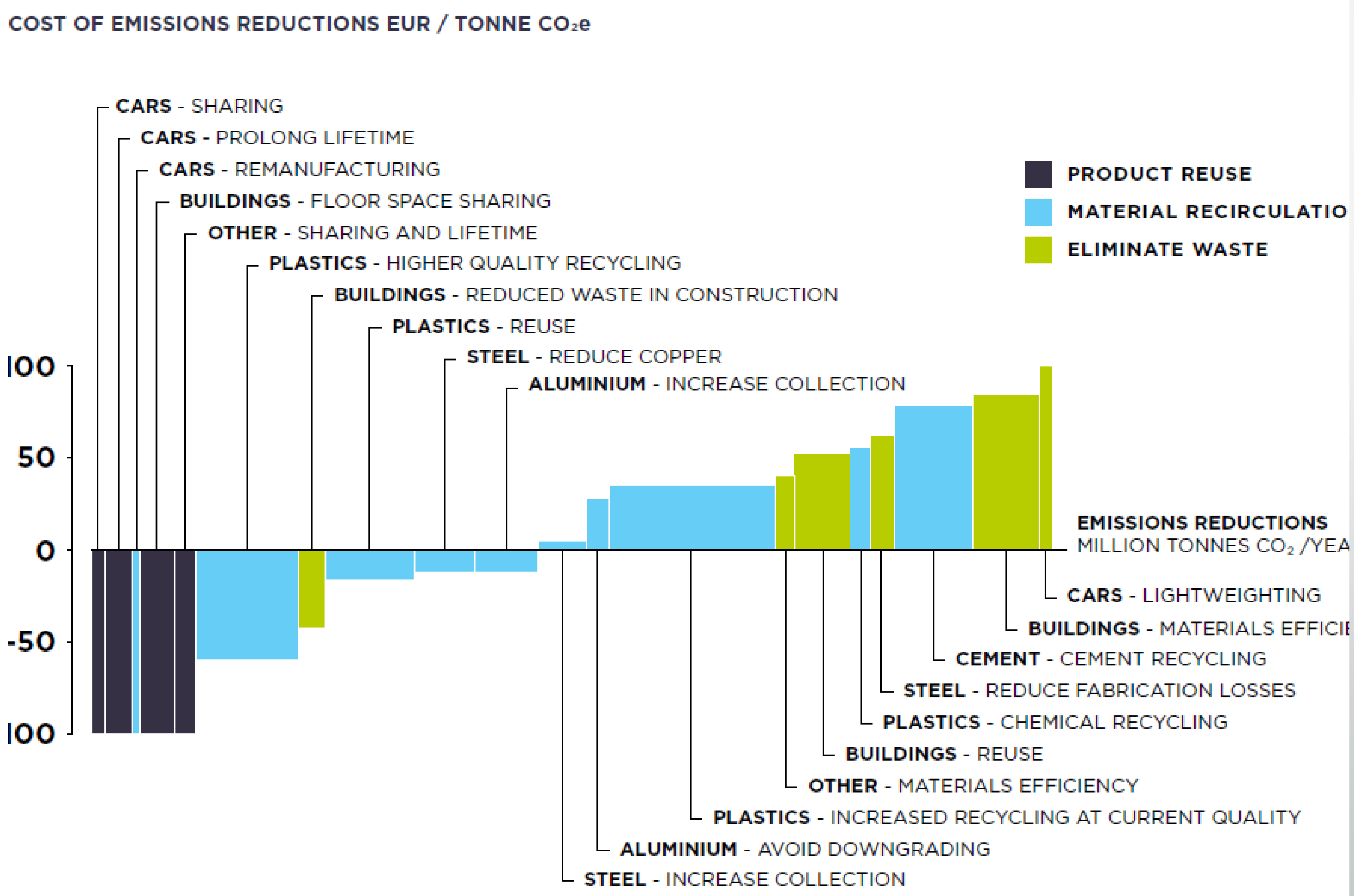


ACTUAL APPLICATION IN EUROPEAN COUNTRIES

The attached figure shows a CO_2 e abatement cost curve of a number of circular economy opportunities .some like sharing business models, durable designs and high quality recycling can be cost negative and others fall below USD 50/t CO_2 e. by comparison, many measures required for Zero Carbon materials production cost minor than USD 100/t CO_2 e

ACTUAL APPLICATION IN EUROPEAN COUNTRIES

FIGURE 5: EMISSIONS REDUCTION POTENTIAL FROM CIRCULAR ECONOMY BUSINESS MODELS[XV]



Source: Material Economics, *The Circular Economy – A Powerful Force for Climate Mitigation* (2018)

WRAPING THE ABOVE CIRCULAR ECONOMY INFORMATION

ELEMENTS OF CIRCULAR ECONOMY

RESOURCES PRODUCTION USE RECYCLING

Resources	**Production**	**Use**	**Recycling**
Natural Capital	New revenue model	share, maintain	reduce
natural	Rethink: Leasing, rent	reuse, repair	ressources,
Nontoxic, NonDepleting	New design sustainable	share, refurbish	biological &
Renewable Energy	Supply chain collaboration	remanufacture	
Mechanical			

EXAMPLES FOR THE BUSINESS APPLICATION OF CIRCULAR ECONOMY MODEL:

Based on using special Materials and Products

"Gispen, Circular Interior Design(extensive usage of products with possible return to factory)

"Mud Jeans", Organic Cotton recycled with no waste

"Auping", Bedding Matrass (Could be used and returned to factory after many years)

"Interface", Square Module Carpet (Could be used and return it to factory after many years)

"Bosh" Washing Machine (Repairing units and reselled again)

IMPACT AND TACKLE OF THE CIRCULAR ECONOMY

Climate Change   Biodiversity Loss   Waste   Pollution

RESULTS

Minimizing emissions &   Open up New Market Prospect & consumption of Raw Material   increase sustainability, Improve   resources efficiencies

CHALLENGE: RECYCLING & REUSE

Isolating & Refining Individual Rare Earth Elements (REE) Plus Diversify the ressources, Necessity for reducing energy of processing during the recycling.

Metabolizing by Gluconabacter bacteria, producing acid to separate REE from Shreddered electronic waste.

Q and A

Your Queries | Our Solutions

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