

Circular economy: A key approach to addressing our Climate Goals

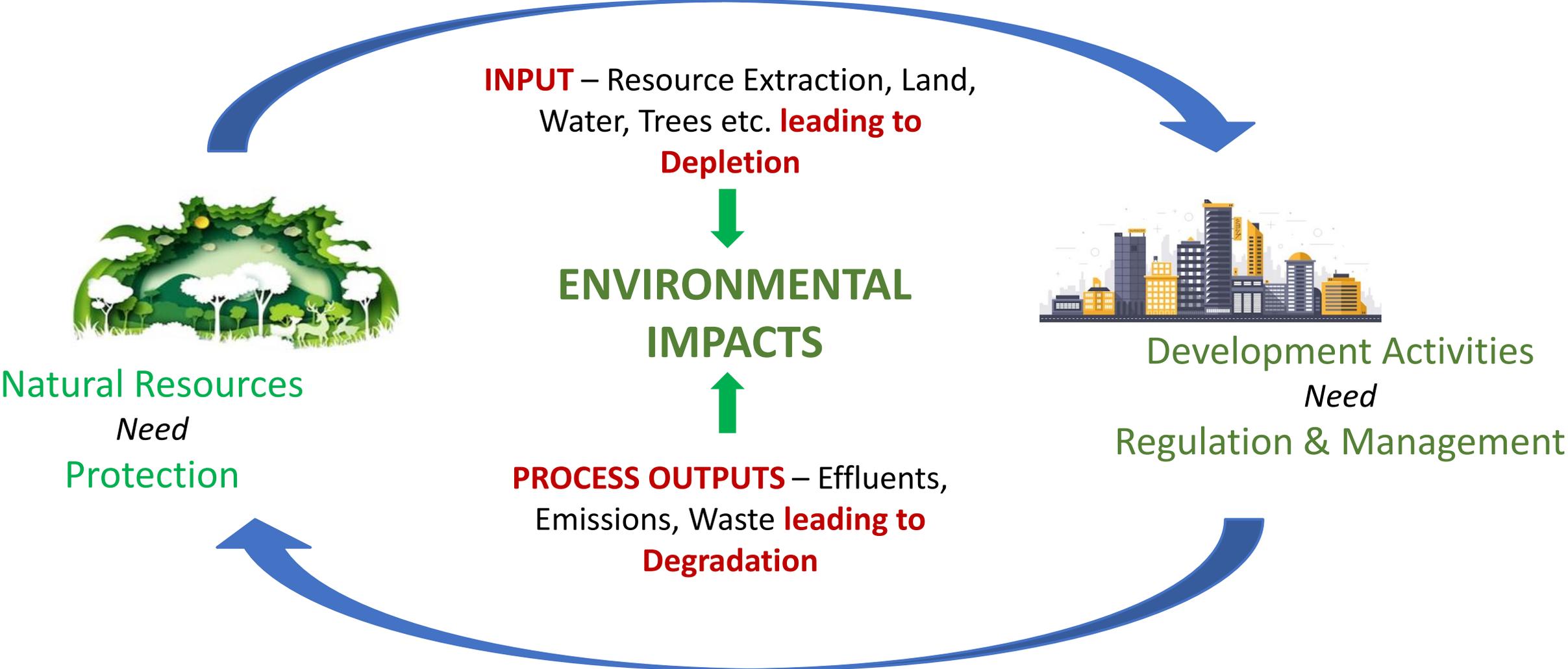
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Environmental Management Centre Pvt. Ltd (EMC)

14th February 2023



Setting the Context

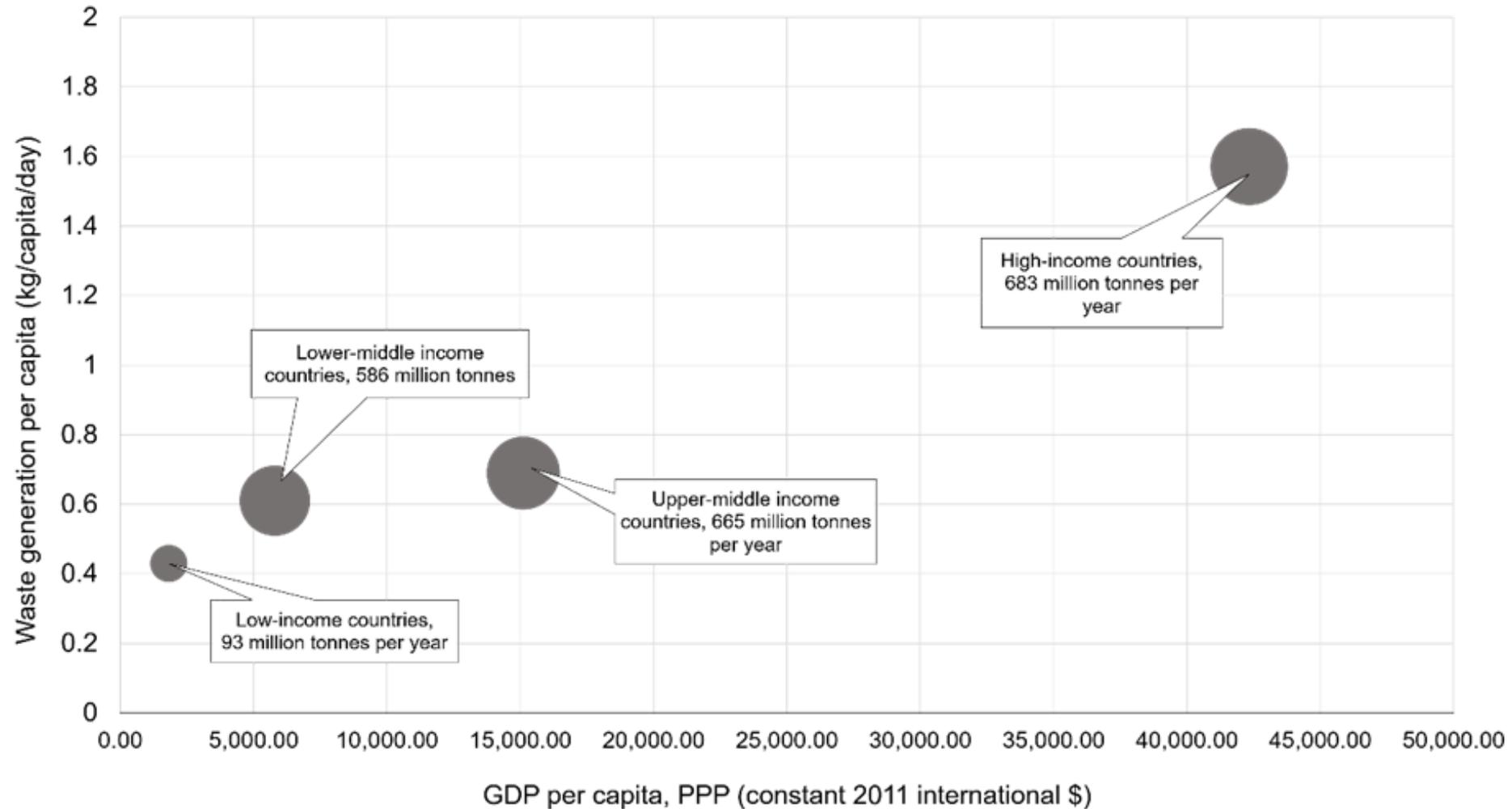
Environment and Development- Interaction and Impacts



Resource Security

- **Population** expected to **increase** by 1.4 times in 45 years from 6.5 billion in 2005 to 9.1 billion in 2050
- More than three quarters of world's population live in countries whose **national resource consumption has exceeded the nation's resource availability**
- The issue is not just **consumption of resources** but the **degradation of resources** due to **poor management of residues**
- **To compound we now have a looming threat of climate change**
- The **Global Resource Security** is therefore **at a risk** than never before

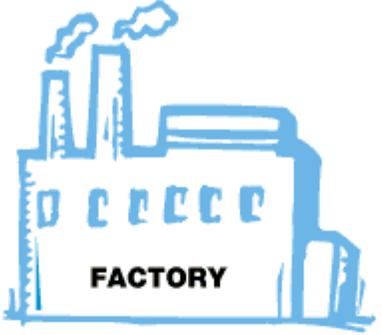
Waste generation per capita and GDP per capita



Coupling between waste generation per capita and Gross Domestic Product (GDP) per capita.

Emissions from Waste Sector

- When organic waste decomposes, carbon dioxide and methane gas is created. Methane is created when there is no air present, while carbon dioxide is the natural product when anything rots in air.
- The production and incineration of inorganic waste uses natural resources such as water, fuel, metal, timber in their production and this results in the emission of greenhouse gases, particularly carbon dioxide and other pollutants.
- Plastic waste produces greenhouse gas emissions during every stage of its lifecycle. The extraction and transportation of plastic is dependent on oil, gas, and coal. The production and disposal of plastics also release tons of carbon emissions.
- Waste management (transportation, incineration, etc.) is a huge contributor to greenhouse gas emissions.
 - Emissions of nitrous oxide during incineration of wastes;
 - Emissions of fossil-derived carbon dioxide from the collection, transportation and processing of wastes, from the fuel used in these operations



Increased GHG Emissions

Harvesting trees, extracting oil and ores, and transporting these raw materials emit greenhouse gases.

Decreased GHG Emissions

Waste prevention and recycling delay the need to extract some raw materials, lowering greenhouse gases emitted during extraction.

Increased GHG Emissions

Manufacturing products releases greenhouse gases during processing and as energy is expended.

Decreased GHG Emissions

Waste prevention means fewer products are made, and making products from recycled materials requires less energy. Both lower greenhouse gases emitted during manufacturing.

Increased GHG Emissions

Burning waste in an incinerator emits greenhouse gases.

Decreased GHG Emissions

Waste prevention and recycling reduce the amount of waste sent to incinerators, lowering the greenhouse gases emitted when waste burns.

Increased GHG Emissions

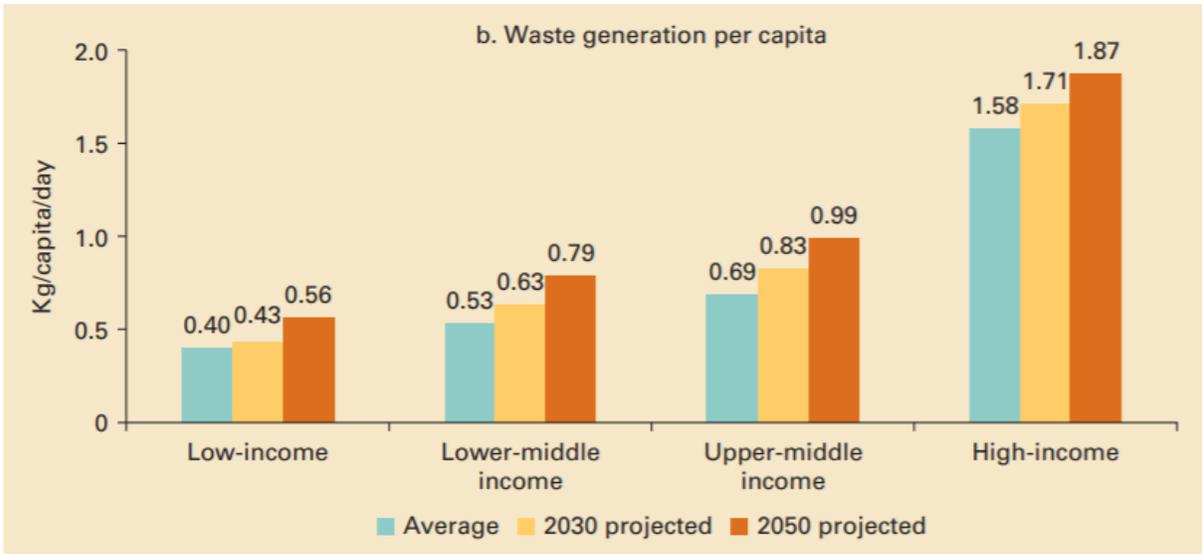
Greenhouse gases are emitted as waste decomposes in landfills.

Decreased GHG Emissions

Waste prevention and recycling reduce the amount of waste sent to landfills, lowering the greenhouse gases emitted as certain wastes decay.

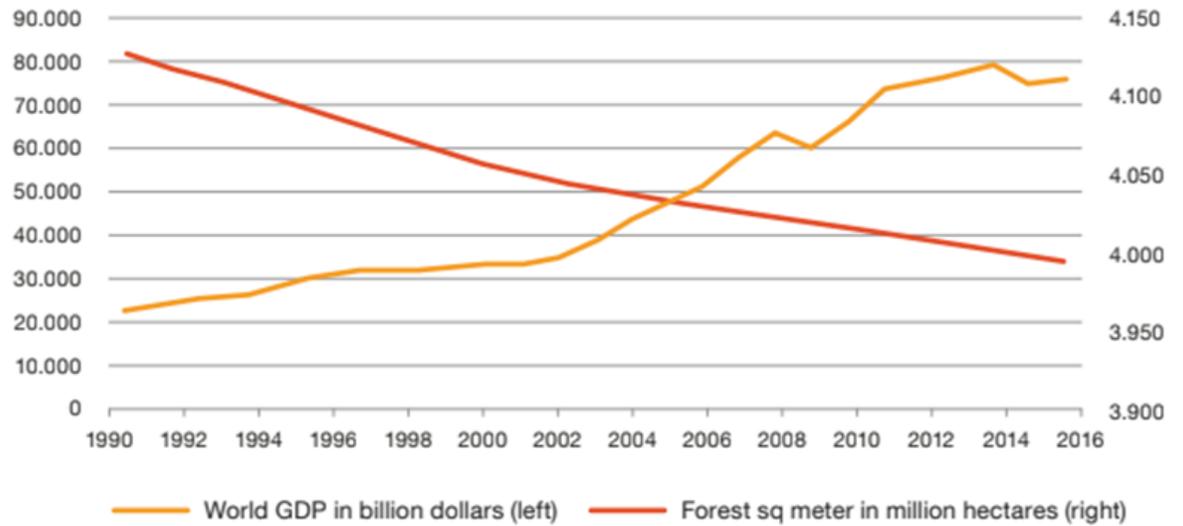
[Source: Climate Change and Municipal Solid Waste Fact Sheet | Pay-As-You-Throw | US EPA](#)

Need to decouple Economic growth from resource depletion and environmental degradation



Waste generation per capita

Source: World Bank



GDP Vs Forest Degradation

Source: The World Bank Food and Agriculture organization

Decoupling

Decoupling occurs when the growth rate of environmental pressure (for example, GHG emissions) is less than that of its economic driving force (for example, GDP per capita) over a given period

Highlights from OECD Report on Waste Generation and GDP Decoupling

- Most countries continue to generate increasing amounts of waste; only a few have managed to decouple total waste generation (i.e., all sources of waste) from population and economic growth (such as France, Hungary, Japan, Slovak Republic, Spain).
- The developments for municipal solid waste are more positive as their growth rate appears to have peaked after the year 2000. A person living in the OECD area generates, on average 525 kg of municipal waste per year; this is 20 kg more than in 1990, but 35 kg less than in 2000.
- Waste is increasingly being recycled, but landfilling remains the primary disposal method in many OECD countries.

Challenges of Decoupling

Decoupling is not easy to achieve.



Need for concerted policy packages, coordinated sustainability actions, particularly resource efficiency, sustainable consumption, product life extension, and integrated waste management that help recycle and recover used resources.



New business models and leapfrogging technologies.



Business models should involve multiple stakeholders e.g. both from formal and informal sectors and operate based on partnerships.

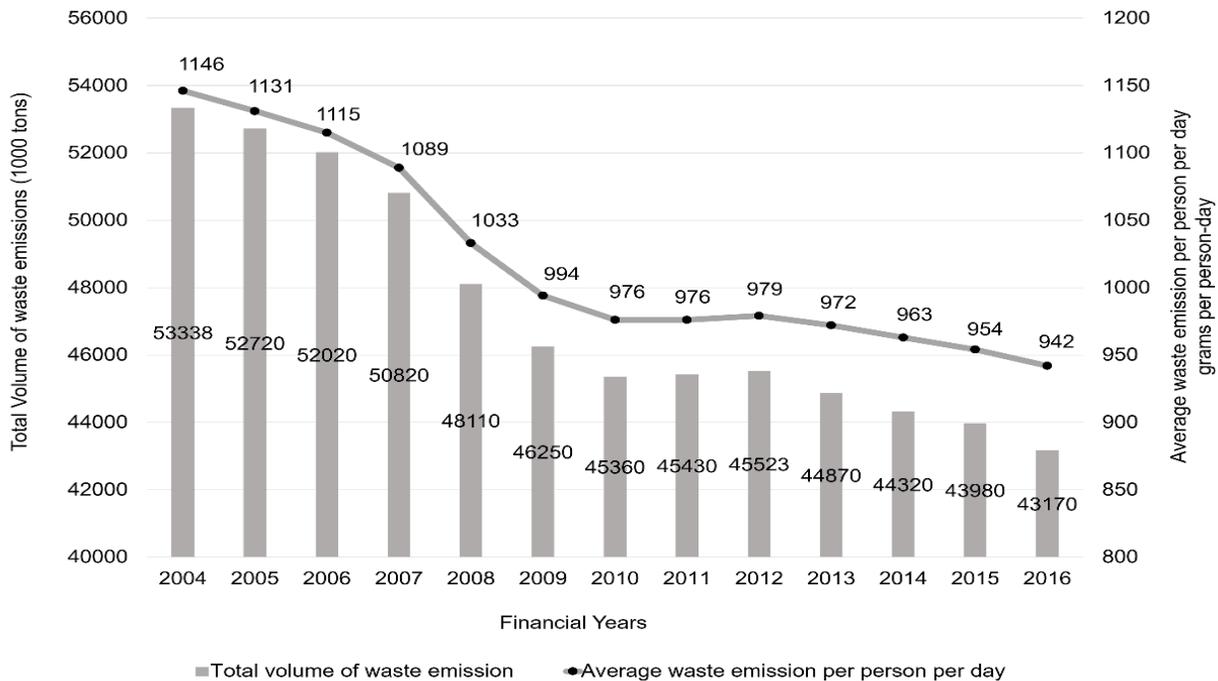


Economies often do not naturally adjust to these changes and can suffer from blocks to transition where current consumption and production patterns remain “locked-in”.



Circular economy shows a great promise to address the challenges described

Kityashu Case Study



Average waste emission per capita per day in Japan

- Kitakyushu (industrial city in Japan) pursued an environmentally sound approach rather than a disposal-focused waste management.
- Drivers cover all steps from the start to endpoints: sorting the waste at source, composting widely at the household level, recycling, and engaging citizens.
- Measures were complemented with financial incentives/disincentives. The waste handling user fees were based on volume rather than on flat fees per household.
- Kitakyushu built up an “Eco-Town” to increase environmental awareness and recover materials

South Korea Case Study

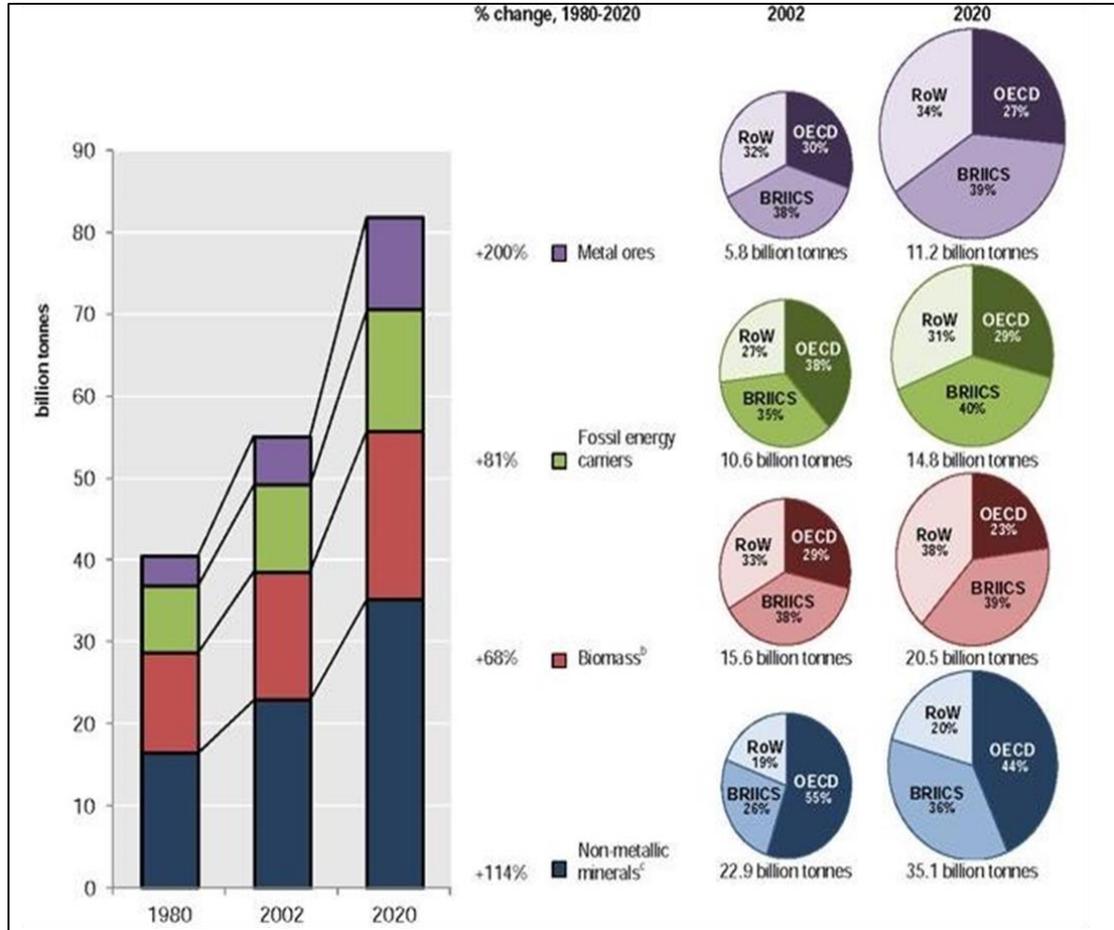


- In South Korea, solid waste generation rose rapidly due to rising incomes and changes in consumption.
- In 1995 the government introduced a system where people had to pay for bags to dispose of garbage. The price varied based on the municipality and reflected the local cost of disposal.
- Despite the charges levied not covering the full cost, waste generation fell from 1.3 kg per person per day in 1994 to 0.95 kg in 2014.
- The recycling rate rose from 15.4 percent to 59 percent over the same period.

About Circular Economy

Why Circular Economy?

Increasing resource consumption



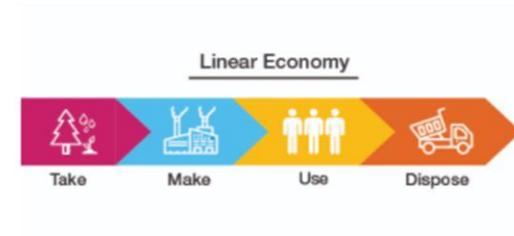
Source: Data from UNEP

Need for Changing the Course

Need for Changing the Course

Linear Economic growth

- Take-make-dispose model
- **Waste generated not put back in resources pool**



Circular Economic growth

- Product and materials are remained in circulation over long time
- Effectively put **back** into the resource pool



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The Transition

Throw away society



Linear economy

Responsible society



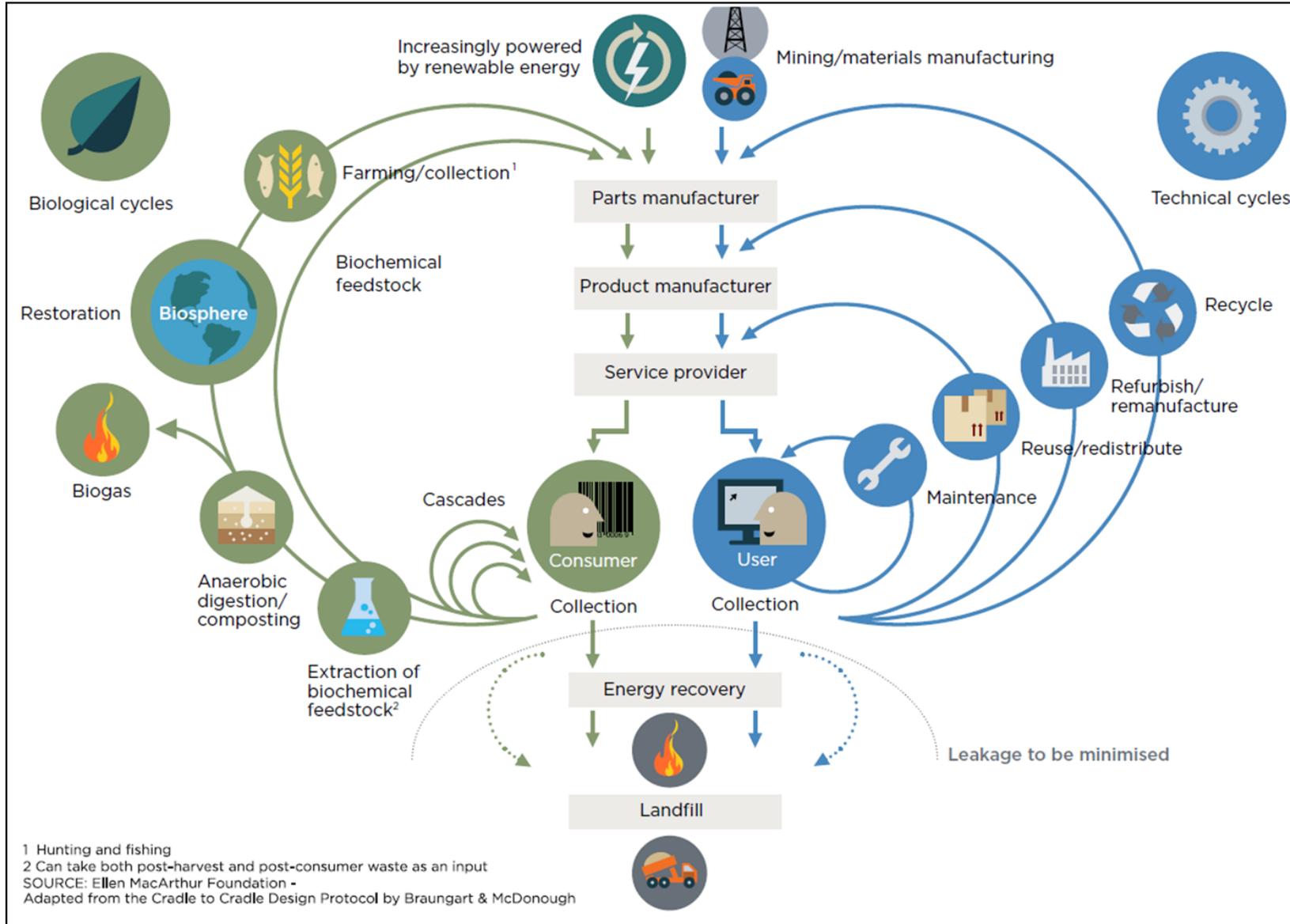
Circular economy

Circular Economy

- **Regenerative** and **restorative** economy that is **inclusive**
- Aims to **redesign the production and consumption systems**
- **Integrates social, environmental, economic and cultural aspects, especially behavioral change**

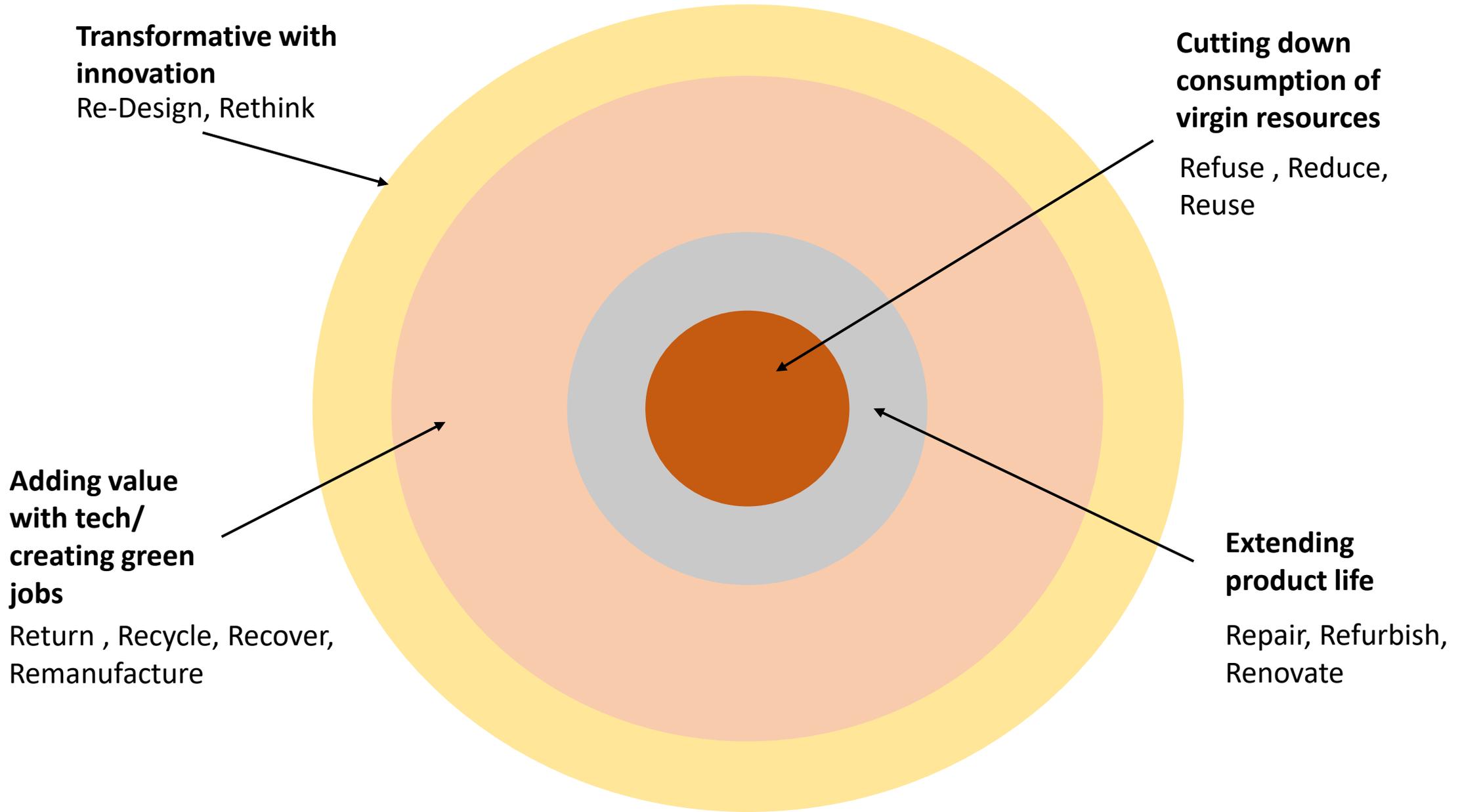
A paradigm shift

The Butterfly Diagram



[Source: Ellen MacArthur Foundation](https://www.ellenmacarthurfoundation.org/)

Four Circles of Circular Economy



Climate and Circularity

Climate and Circularity

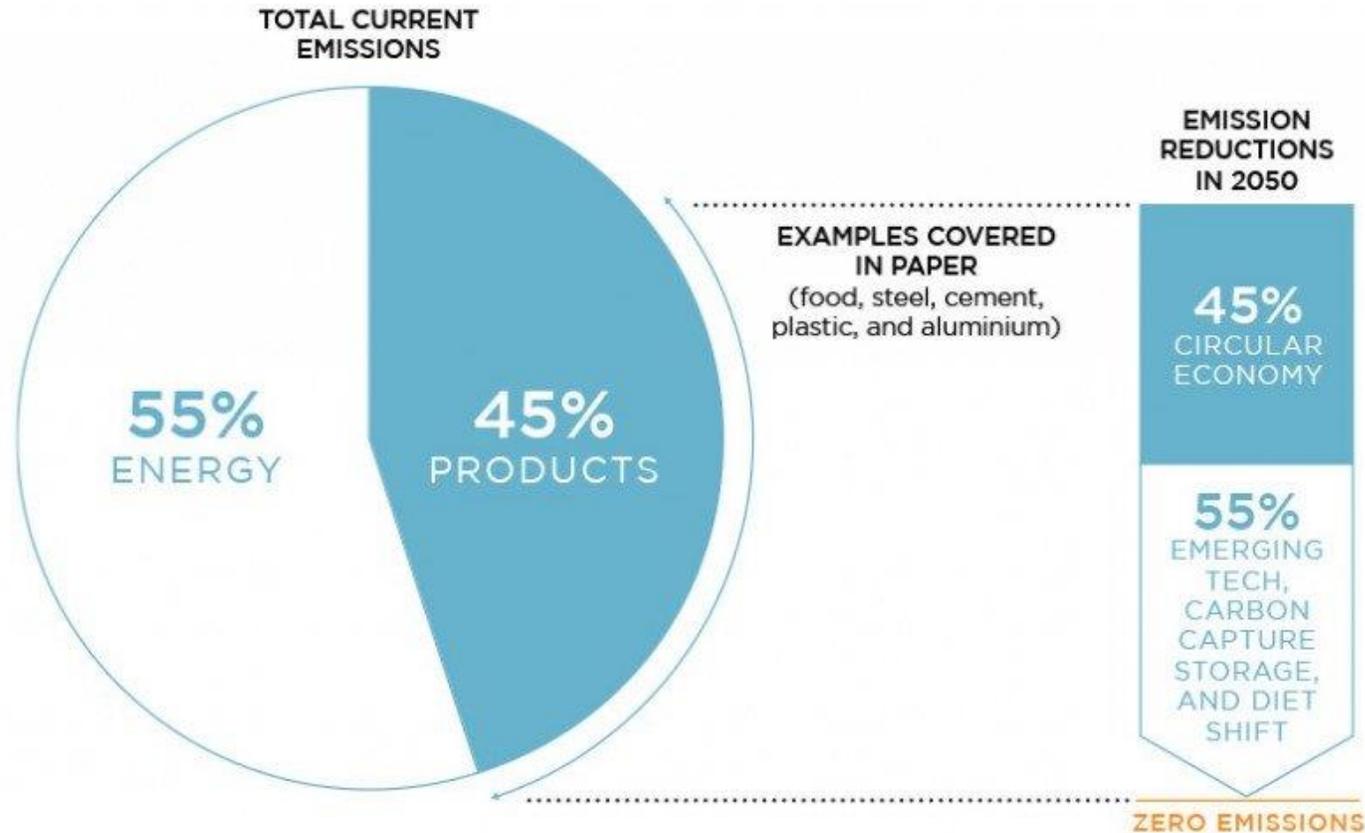
- Need for product cycles to become more efficient and closed in order to reach climate neutrality
- 62% of global GHG emissions (excluding those from land use and forestry) are released during the extraction, processing and manufacturing of goods to serve society's needs; only 38% emitted in the delivery and use of products and services

Source: The Circularity Gap Report 2019

Mainstreaming circularity in key sectors to reduce GHG emissions

- The Circularity Gap Report 2021 by Circle Economy highlighted that the majority (70%) of GHG emissions are associated with material handling and use.
 - *Housing, nutrition, mobility, communications, services, consumables and healthcare as the seven core societal needs with big potential to cut down attributed emissions and resource use once circular interventions are implemented*
- Research by Ellen MacArthur Foundation in the global context has shown that with existing technologies, transition to renewable energy will only address 55% of the emissions, and the remaining 45% decrease to achieve net zero goal will need to come through the transition to a circular economy.
 - *Focusing on five key sectors (cement, plastics, steel, aluminium, and food), the study illustrates how circular strategies can reduce GHG emissions while making the sectors resource efficient and competitive.*

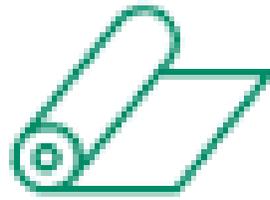
Circular economy –Critical role in Climate Mitigation Action



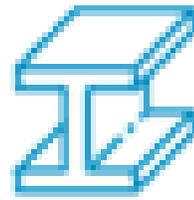
Creating a circular economy for **5 KEY SECTORS**



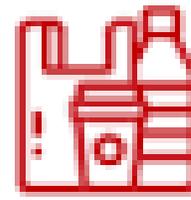
CEMENT



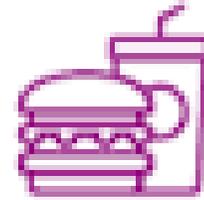
ALUMINUM



STEEL



PLASTICS



FOOD

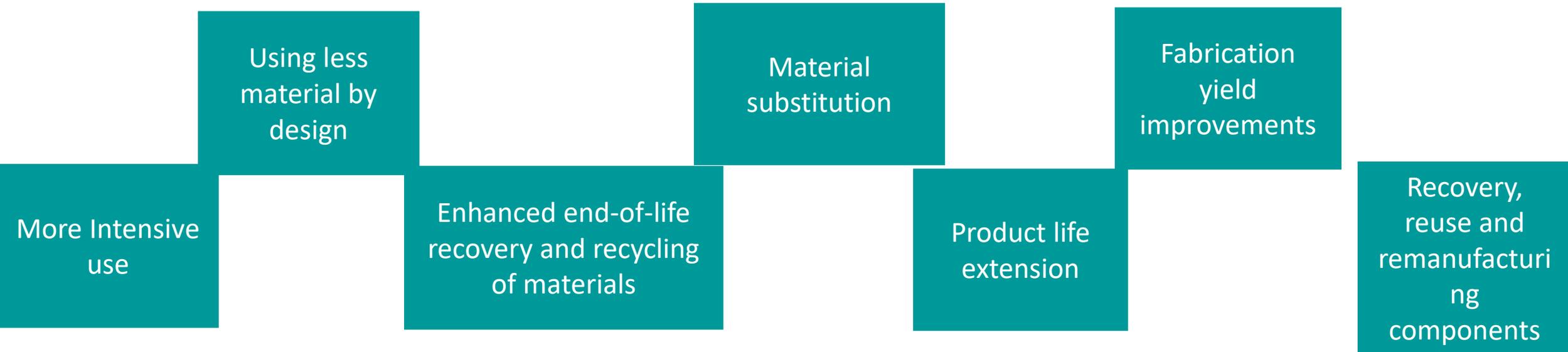
could cut CO2 emissions by **3.7 BILLION TONS IN 2050**

Source: The Ellen MacArthur Foundation
2019



WORLD RESOURCES INSTITUTE

Material Efficiency Strategies for Climate Action



Material efficiency is an **essential part of the circular economy**
Consists of **the preservation of materials by making products more durable and repairable and facilitating** recovery and recycling of material at the end of the product life

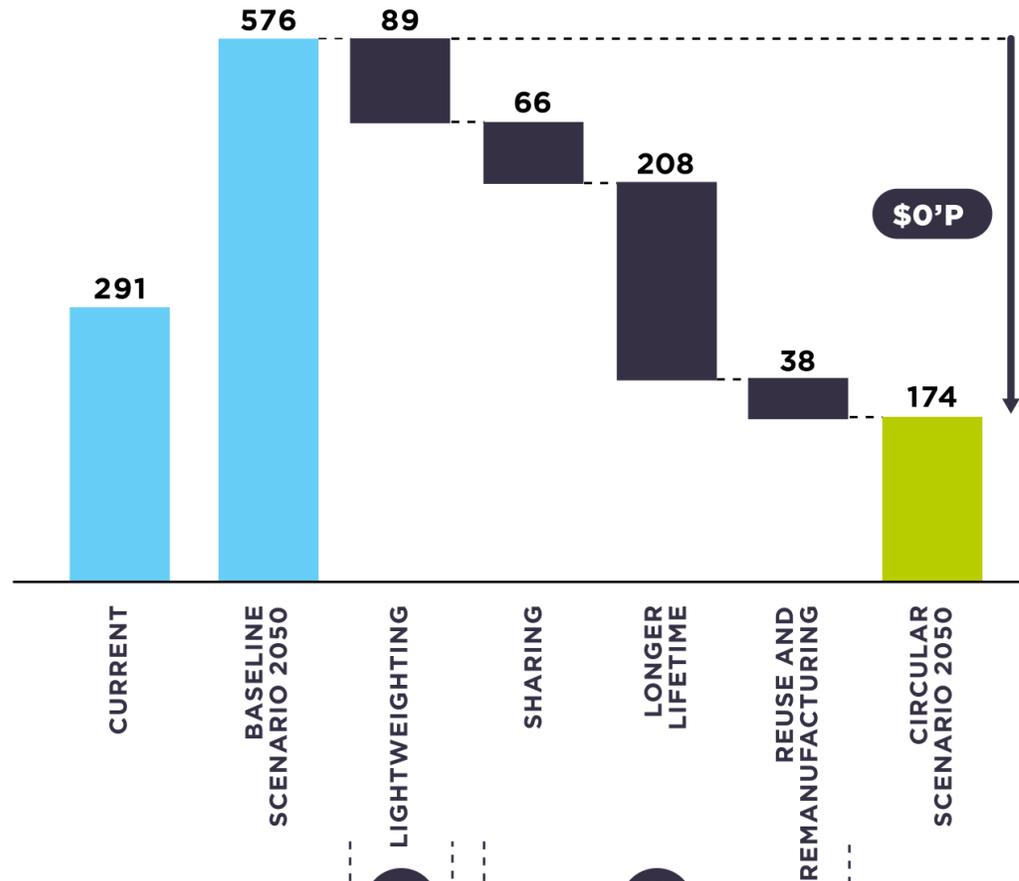
Sectoral Opportunities- Few Examples

Sectors	Opportunities
Built environment	<ul style="list-style-type: none">• Enhance building use and occupancy to reduce the overall demand for new buildings in the city,• Switching materials from traditional carbon-intensive materials to renewable and/or low-carbon materials such as timber or low-carbon concrete,• Using materials efficiently through design changes and improvement in fabrication yields, recover, reuse, repurpose materials to replace use of virgin materials• Extending life of materials and components through circular design <p><i>Prioritize a circular, zero-waste approach that is based on the use of reused and reusable materials, modular and off-site construction methods alongside design for maintenance and deconstruction to mitigate the carbon impact of buildings</i></p>
Automotive	<ul style="list-style-type: none">• Recovering material from vehicle scrap• Development of LIB technologies and supporting them through policy incentives thereby leading to the sustainability of this low carbon mobility option <p><i>Largest reductions of life-cycle emissions can be attained by changing patterns of vehicle use e.g. car-sharing</i></p>
Common circular Infrastructure	<p>Setting up waste recycling facilities, common material recovery facilities, sharing networks, reverse logistics and marketplaces for secondary raw materials/used goods.</p> <p><i>For example, the common infrastructure for waste management such as the Material Recycling Facilities (MRFs) can be a catalyst for decarbonization and the circular carbon economy by diverting waste from landfills to resource recovery</i></p>

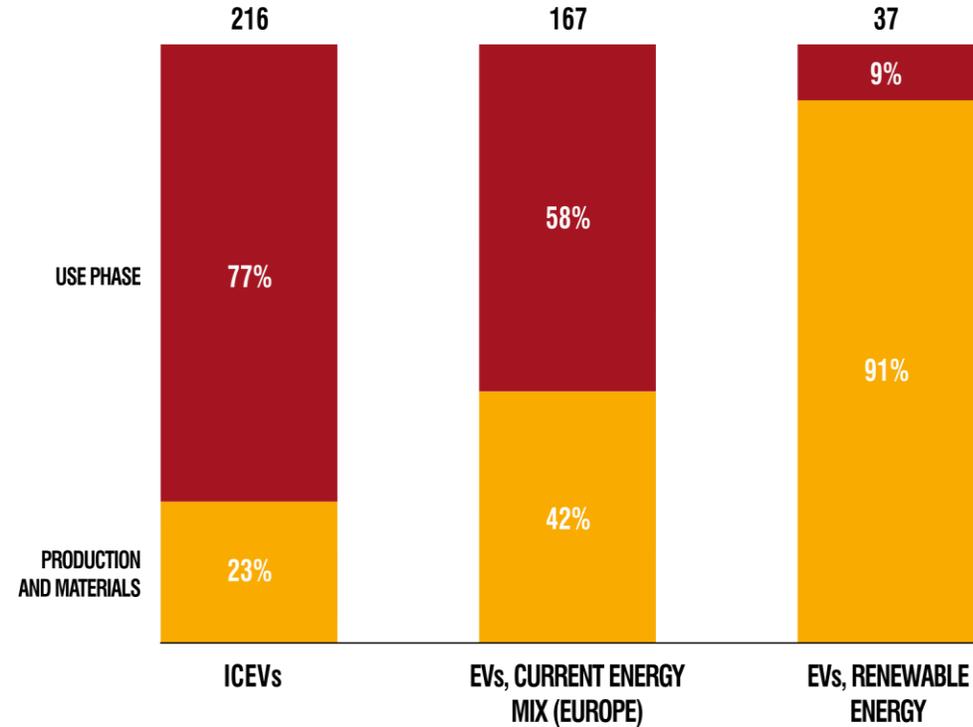
Circular economy leading to emission reduction: Potential for Mobility Sector

Circular scenario for passenger cars could reduce global CO₂e emissions by 70%

EMISSIONS FROM ALL MATERIALS USED IN PASSENGER CARS
MILLION TONNES OF CO₂e PER YEAR, GLOBALLY



Lifecycle CO₂ emissions from ICEVs versus EVs (g CO₂ per car km)



Source: Material Economics. The Circular Economy. A Powerful Force for Climate Mitigation

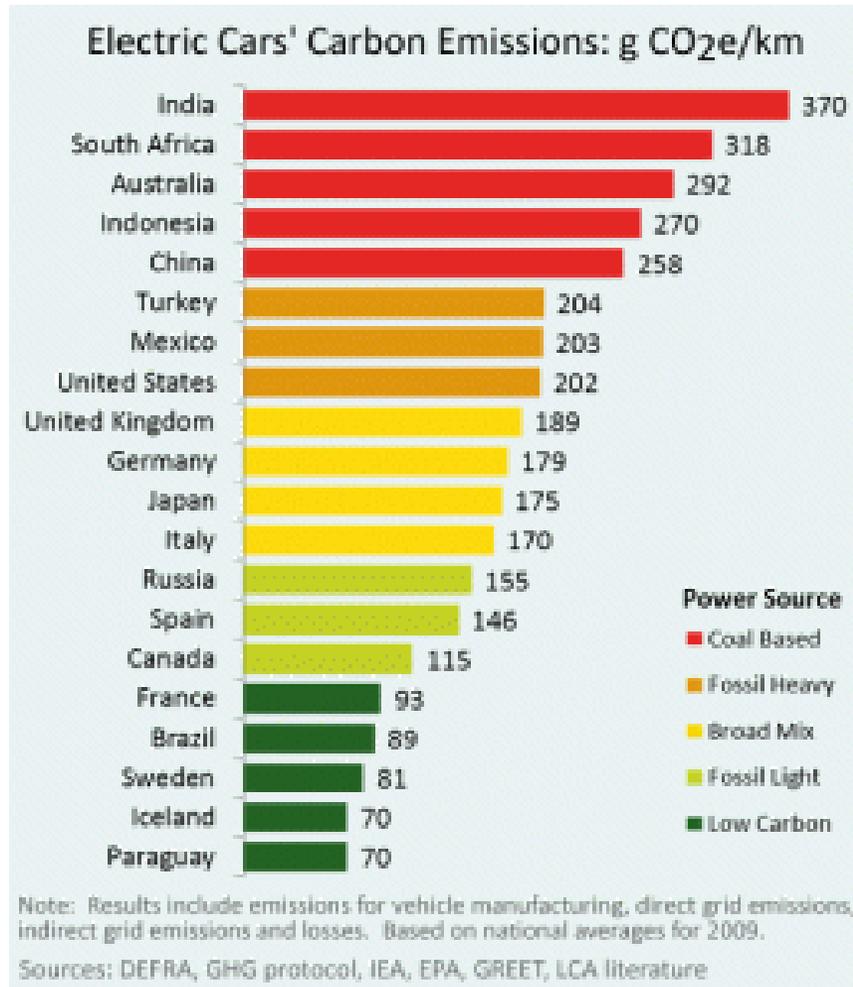
Source: Completing the Picture: How the Circular Economy Tackles Climate Change. Ellen MacArthur Foundation and Materials Economics.

<https://www.ellenmacarthurfoundation.org/publications/completing-the-picture-climate-change>

Circular strategies for decarbonization in Mobility

- **Incorporating the circular economy in electrification of transport**
 - Circular approaches can ensure that the dramatic increases in battery production required incorporate reuse and remanufacturing principles from the outset
- **Expanding shared mobility**
 - Emphasizing shared mobility (e.g. public transport)
 - Ensuring transport connectivity are central to promoting zero-emission urban transportation systems.

Put your thinking caps: Are electric Cars really greener?



- Variation across countries
- Country's energy mix affects the environmental advantage of EVs.
- Even dependence on time of the day for charging- night-time electricity is less dependent on coal
- Recycling of special materials and components- need technology and finance
 - Recycling EV batteries is an asset-intensive business in which high utilization is critical to operating efficiency

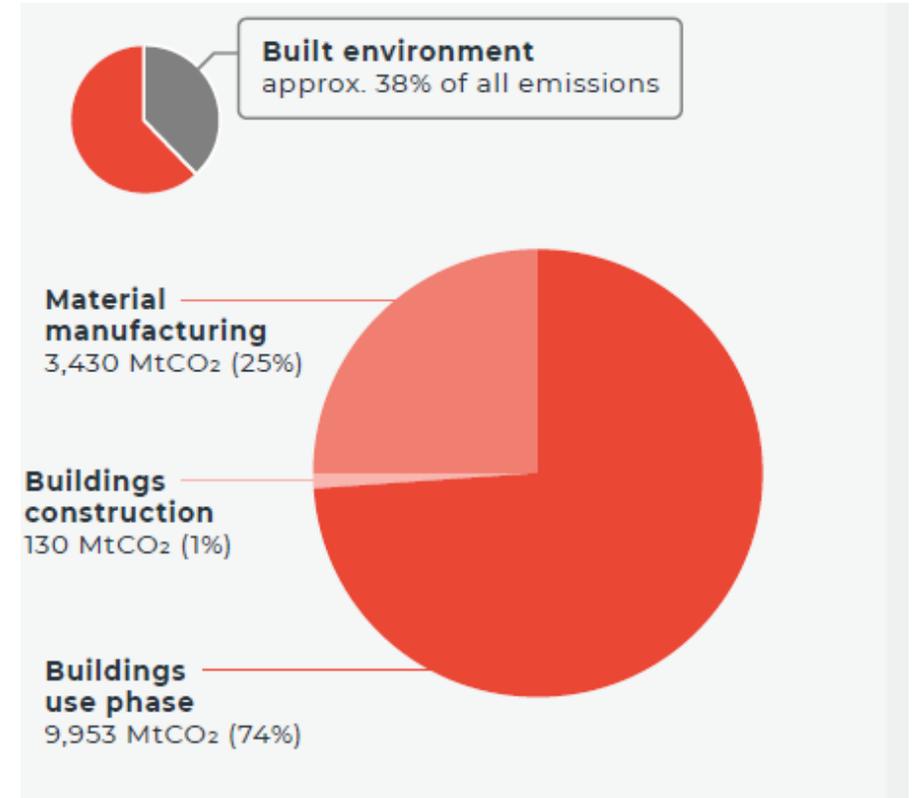
Should the focus be on development of a circular ecosystem for EVs?

Circular economy for Climate adaptation

- Urban planning - nature-based solutions integrating green infrastructure and ecosystem services into the built environment to further boost resilience
- Circular nature-based solutions is based on use of renewable resources, reuse or repurpose other resource streams and avoid unwanted by-products.
 - Nature-based solutions also make adaptation measures circular and smarter by promoting multifunctional areas in cities. For example, green spaces in Stockholm are used for both heatwave protection and recreational activities
- Supply chain management and raw material security
- Future proofs society and businesses

Circular strategies for Construction sector and opportunity for emission reduction

- Adoption of circular design principles - minimise waste, optimise buildings for energy efficiency and for usage, using regenerative materials and components (cross-laminated timber (CLT)), recycled (such as circular aggregates) or reused
- Maximize their utilization, improving their energy efficiency and preventing their demolition through adaptive reuse, circular refurbishment and retrofitting
- Circular construction and demolition criteria or green infrastructure—such as rainwater harvesting systems or green roofs—also present important opportunities both for material use reduction and to reach net-zero emissions.



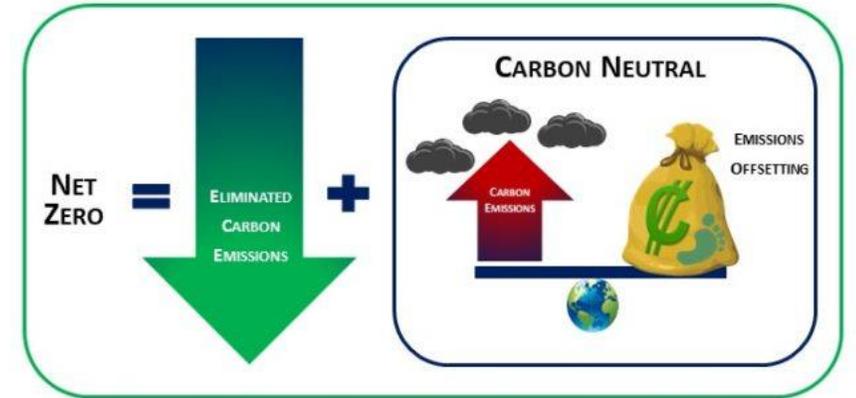
Carbon footprint of built environment globally

Enablers

Innovation	Regulation	Market instruments including Fiscal Measures	Procurement	Information	Partnerships and Collaborations	Infrastructure
<p>Partnership Innovation</p> <p>Process Innovation</p> <p>Product Innovation</p> <p>Packaging Innovation</p> <p>Proposition Innovation</p> <p>Digital Innovation</p> <p>Source: Supporting Net Zero Through a Circular Economy - Anthesis (anthesisgroup.com)</p>	<p>Extended Producer Responsibility with mandated recovery and recycling targets</p> <p>Regulation of pollution from recycling activities (for example in case of auto recycling)</p> <p>Regulations around right to repair</p> <p>Recycled content in product mandates</p>	<p>Incentives for sharing models of products and services</p> <p>Carbon tax</p> <p>Subsidies</p>	<p>Preferential purchasing by government departments and agencies of circular, and low embodied carbon content products</p> <p>Procurement of refurbished or remanufactured products</p> <p>Products as service model and extended warranties</p> <p>Responsible disposal</p>	<p>Labelling and Certification for reuse and remanufacturing</p> <p>Peer nudges to change behaviour</p> <p>Product information about carbon intensity</p>	<p>Voluntary commitments</p> <p>Sectoral strategies engaging key stakeholders</p>	<p>Common circular infrastructure</p> <p>Science, Research and Technology parks</p> <p>Infrastructure to support emerging/new technologies (for example, charging infrastructure for EVs)</p>

Circular Economy for Net Zero Targets

- Net zero – key emerging sustainability trend
- To meet net zero targets, circular economy approach can be part of the trajectory to meet net zero targets
- Can be included in company strategy and governance in the form of mission statements, commitments, targets and plans, city plans, tapping circular opportunities in rural areas
- Pilots, incubators and demonstration projects to test business solutions that address the twin objectives of circular economy and decarbonization
- One-third of NDCs updated and submitted this year, largely across Europe and some other G20 countries, include mention of a circular economy (the Netherlands, Finland and Chile are few examples).



[Circular economy, carbon neutrality and net zero : Yorkshire Circular Lab \(leeds.ac.uk\)](#)

Circular Economy and Just Transition

Challenges

- Impact on the informal sector dependent on conventional production processes
- Disruption in the value chain
- Job substitution

“Nobody should be left behind”

ILO led Just Transition Declaration in Glasgow

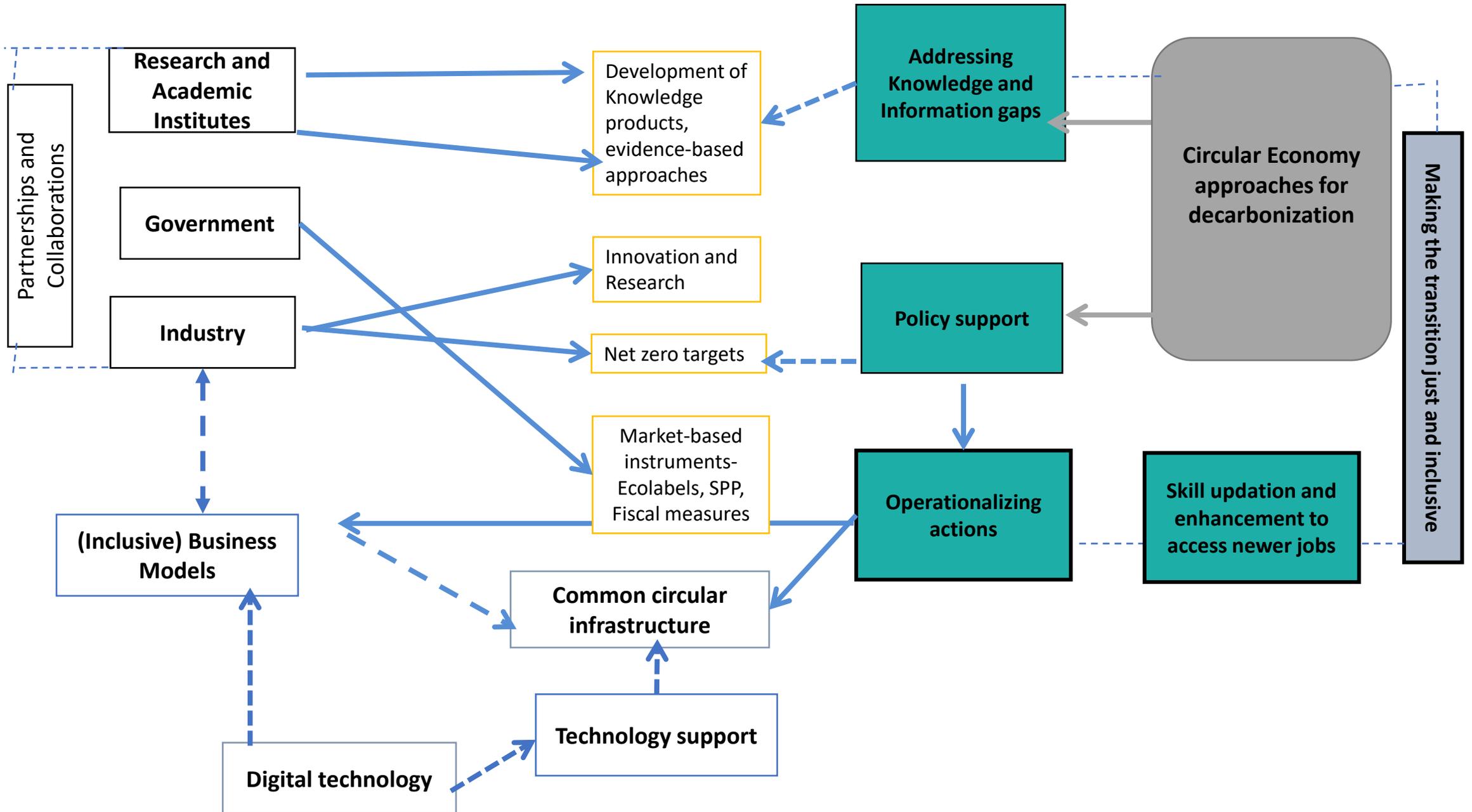
Circular investments

Skilling and Entrepreneurship development

Formalization of the informal sector

Inclusive circular economy helps in Just Transition by building a resilient Circular Economy

Integrated Approach towards Circular Economy and Decarbonization



Policy levers for CE and Decarbonization- Case of Steel Sector



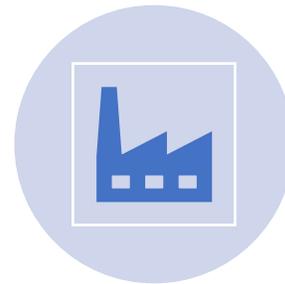
Production Linked
Incentive Schemes for
speciality steel



Vehicle scrappage



Sustainable public
procurement



Creating a business case
and market for green
steel production

Building climate resilience

- Implementing economic stimulus packages focused on green and circular investment,
- Developing policy frameworks to support the formation of a CE (e.g., phasing out single-used plastics),
- Adopting circular business models and promoting innovation to stimulate creativity and future solutions.
- The need for ‘green, circular, scalable, customizable technologies’ and increased interconnectivity for greater resilience and enhanced response capacity

Circular Economy related challenges

Lack of effective collection of scrap generated at production or after end-of-life stage

Lack of standards and benchmarks for recycled products

Lack of public awareness on recycling

R&D needs, popularizing best technologies that exists in the world.

Thank you

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