Policy Brief

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Task Force 2: Energy, Climate and Sustainable Development

Maximising Resource Efficiency and Transitioning to a Circular Economy

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Abstract

While industrialisation, economic development, and quality of life have improved significantly over the last century, years of the traditional linear take-make-dispose economy have had adverse effects on natural capital and has pushed us closer to the triple planetary crisis – climate change, nature and biodiversity loss, and pollution. Decoupling economic development from environmental degradation will be critical moving forward and transitioning to a circular

economy (CE) can help to tackle this issue, especially as global population and urbanisation continue to rise. However, this requires a transformative systemic shift, involving both the public and private sectors, consumers, and society. The Group of Seven (G7) is in a unique position to lead on this front by collaborating with each other and the Global South through knowledge sharing of effective domestic CE policies and strategies, enhancing international frameworks, increasing public investments, and promoting public-private partnership initiatives to accelerate the transition to circularity and more resource efficient business practices, including the adoption of more renewable energy systems throughout the value chain.

Introduction

Rapid economic growth and industrialisation along with unsustainable extraction and utilisation of raw materials have resulted in the depletion of natural resources, ecosystem degradation, and pollution from chemicals, hazardous wastes, and inorganic non-biodegradable materials such as plastics. The traditional linear take-make-dispose model which has been characterised by these actions and unsustainable supply chains jeopardises future generations' resource requirements and wellbeing. Decoupling economic development from environmental degradation will be critical moving forward and transitioning to a CE can help to tackle this issue.

With urbanisation and global population projected to continue to rise, and as economies become more developed, patterns of production and consumption have also shown to increase, pushing us closer to the triple planetary crisis – climate change, nature and biodiversity loss, and pollution. Without any urgent or concerted global action, this demand could result in a 60 per cent increase in resource extraction by 2060 compared to 2020 levels (UNEP 2024). Currently, over half of greenhouse gas (GHG) emissions are attributed to the way in which raw materials are extracted and processed, including fossil fuels, minerals, non-metallic minerals and biomass (UNEP 2024). Unsustainable extraction and utilisation of raw materials is also responsible for the nature and biodiversity loss as growing and harvesting biomass (e.g., agricultural crops and forestry) account for more than 90 per cent of total land use related biodiversity loss and water stress. Additionally, the current linear economy combined with poor or non-existent solid waste management practices causes air pollution, and contamination to soil, water systems, and food sources. Uncollected and mismanaged waste and open and sanitary landfills also lead to greater risks of infection and transmission of waterborne diseases among others health issues.

More than half of global emissions is material-related, and approximately 70 per cent of material-related emissions comes from infrastructure materials, primarily from the production of iron and steel; cement, lime and plaster; and plastics and rubber, which are widely used in the construction industry (Hertwich 2021). Annually, nearly 400 million tons of plastic are produced, which is an energy intensive process, heavily dependent on fossil fuels and emitts GHGs throughout the different stages of a product's life cycle, including extraction, transport, refining, manufacturing,

and disposal. At the same time, only a mere 9 per cent of plastic is recycled, while 12 per cent is incinerated, with 22 per cent "mismanaged waste" in open dumps, openly burnt or leaked into the environment (OECD 2022).

The growing resource extraction is the main driver of this triple planetary crisis and it is imperative for governments to prioritise circular principles by designing solutions that minimise waste and the need for raw materials by extending the life cycle of products and keeping existing materials and assets in the production cycle.

Challenges

Transitioning to CE requires a multifaceted approach that addresses sustainability issues at every part of the life cycle of a product from the extraction of raw materials to the product's end of life, where it can be recycled, reused, or disposed. Integrating a life cycle approach into development policies are crucial as it calculates emissions at these different phases and identifies where there is potential for emissions reductions to achieve carbon neutrality. This approach also allows for making comparisons avoiding transferring burden from one energy system to another or from one life cycle phase into another. Yet, the current system lacks a systematic approach, with fragmented supply chains and markets for secondary raw materials. This section explores these challenges and other barriers to implementing CE in terms of material flows, adopting renewable energy systems, and examples of industries where there is significant potential to transition to circularity.

Material flows

Analysing material flows will help to better understand the environmental impacts of economic activities and how to effectively improve resource efficiency and solid waste management and reduce GHG emissions. It considers all the material and energy inputs throughout the extraction, transportation, processing, manufacturing, use and disposal phases of products and infrastructure in our economy.

With global extraction expected to grow by nearly 60 per cent from 100 billion tonnes in 2020 to 160 billion tonnes in 2060, driven by economic and population growth, construction materials (e.g., cement, lime and plaster; plastics and rubber; and other infrastructure materials) will see the highest increase in resource extraction, due in large part to infrastructure needs of both advanced economies and the Global South (UNEP 2024).

In 2020, the world generated 2.13 billion tonnes of municipal solid waste, which includes residential and commercial waste, and this is projected to grow to 3.78 billion tonnes by 2050 (UNEP 2024). Waste generation has a direct correlation with income, with waste generation

increasing with both increasing levels of economic development, industrialisation and urbanisation. 38 per cent of all waste generated was not collected, ending up in the environment, with such mismanagement levels for municipal solid waste higher than for plastic waste (UNEP 2024). 22 per cent of plastic waste generated is mismanaged and recycling levels for plastic was 9 per cent globally, due to inefficient collection systems and the vast majority of plastic remaining uncollected due to its low value for recycling (OECD 2022).

Transition to renewable energy

After the outbreak of the war in Ukraine, its massive implications on the international energy markets have set new patterns for the energy transition at the global level, speeding up the pace of change and transformation in many advanced economies. However, in emerging economies and the Global South, many governments are prioritising economic growth and access to low-cost energy over the renewable energy transition. The geopolitical crisis, coupled with the climate one, are highlighting the vulnerability of the traditional energy model, showing that an accelerated evolution towards an energy system powered by clean technologies will encompass a substantial revolution (IEA 2022a).

The massive deployment of clean energy technologies has the potential to reduce the energy system vulnerability of G7 countries, decoupling it from traditional commodities' availability and prices. However, to fully reap the socio-economic benefits of changes in progress, the G7 needs to properly develop the entire green energy value chain, reducing external technology dependence (IEA 2022b).

Achieving a fully decarbonised energy system will require the deployment of a wide range of technologies along the whole value chain. The bulk is represented by renewable generation, storage, energy transmission and distribution and final uses. Among these technologies, based on the growth perspective and the development level of the value chains at the global level, the G7 should focus on three key industrial sectors related to decarbonisation: photovoltaic, batteries and energy storage systems, and electric heat pumps (European House-Ambrosetti and Enel Foundation 2023). Given the massive deployment expected in the following years for these technologies, it may be appropriate to develop and boost the domestic production capacity, starting from the critical raw materials required to manufacture the final products.

Industries

The construction industry is known for its significant environmental footprint, marked by its major contribution to depletion of natural resources, extensive energy consumption, GHG emissions (Azhgaliyeva and Rahut 2022), air pollution, environmental degradation, and global warming. Addressing these challenges, the adoption of CE within the construction industry holds promise in mitigating these adverse impacts. CE represents a departure from the wastefulness inherent

in the current linear economic model, aiming to establish a closed-loop system across the value chain. The concept extends beyond technical aspects to foster circular feedback systems and connect stakeholders in the value chain. Collaborative efforts and interactions of stakeholders are crucial to achieving the objective of transitioning towards the realisation of CE. However, despite the acknowledged potential, stakeholders exhibit disparities in their perceptions of CE strategies' importance and their associated cost implications.

In a parallel study (Karaca et al. 2024), construction stakeholders' perspectives were measured on the costs and benefits of CE implementation in construction, employing waste hierarchy principles such as the 3Rs (Reduce, Reuse, Recycle). Policy recommendations in the last section are based on the referred research and focuses on regional disparities and addressing key cost factors like design for disassembly and off-site production.

The role of the G7

With its strong influence on international policies to tackle global and crosscutting issues and crises, the G7 is in a position to bring together countries at different stages of development serving as model to support their efforts towards sustainable and inclusive development. During the 2023 G7 Summit in Hiroshima, leaders of the G7 agreed to enhance resource efficiency and circularity along value chains to reduce extraction of primary resources, which would help to address climate and environmental crises. They also endorsed the Circular Economy and Resource Efficiency Principles (CEREP) and committed to ending plastic pollution by 2040. With discussions on a legally binding instrument to tackle plastic pollution ongoing, the G7 can take a pro-active, leadership role during the International Negotiation Committee (INC) meetings in bringing the different member states to align on the various measures. Furthermore, this aligns with discussions from the 2023 G20 in India where the Resource Efficiency Circular Economy Industry Coalition (RECEIC) was launched, highlighting the need to prioritise technological cooperation, partnership, and finance to scale-up circular initiatives.

The G7 agreed to commit to addressing industrial decarbonisation and recognises the significant role of sectoral efforts and circularity in construction of buildings. Ambitious and well-designed policies are vital for promoting circular construction practices. In the following section, we propose a policy toolbox for creating a level playing field for circular construction practices. With the current efforts, the sector is not on track to reach net zero emissions targets. Leadership from G7 members will provide an example to follow for global acceleration.

In 2023, leaders of the G7 agreed to support concerted efforts domestically and internationally to enhance sustainable and efficient recovery and recycling of critical minerals and raw materials while increasing adoption of circular principles along supply chains. With many of the barriers to circularity stemming from technology and capacity limitations, the G7 can support developing

countries to accelerate transition to CE through the sharing of digital innovations and technology. Leapfrogging is an important concept for realising circular principles in infrastructure in developing and emerging economies. The availability of advanced technologies and sharing these allows developing and emerging economies to leap over the resource-intensive path to development followed by advanced economies. The G7 should also compile a list of CE business case studies across all the G7 countries and showcase them to other countries around the world and create pathways for replicating the success.

It cannot be overstated that these commitments from the G7 towards transitioning to CE are advantageous on several fronts not only for the G7 but for the rest of the world. First, reusing and recycling products and materials reduces reliance on natural resources and raw material extraction, which will stop environmental degradation and biodiversity loss. Second, circular and more energy efficient supply chains and designing out waste will reduce GHG emissions. This can help countries to achieve their NDC targets since they complement existing GHG emission reduction efforts such as renewable energy and energy efficient strategies to raise ambition (GACERE 2021; UNEP et al. 2023). Third, CE will promote competitiveness among companies, stimulate innovation, and create more jobs across various sectors, boosting economic development. In the EU alone, it is estimated that CE would create 700,000 jobs by 2030 (Ellen MacArthur Foundation 2015). Since critical minerals will continue to play a vital role in renewable energy transition, the G7 must manage economic and security risks brought on by unsustainable supply chains. By designing effective policies and regulations, CE can promote more secure, diverse, traceable, and fair market-based trade for critical minerals, raw materials, and secondary raw materials, that enhance countries' resilience against market disruptions. Collaboration between countries and international trade will be key in ensuring that CE is inclusive and sustainable for all.

Recommendations to the G7

For plastics and materials circularity:

- *Building institutional capacity and linkages* through strong commitments from government leaders and key ministries.
- *Cross-ministerial, regional cooperation, and international frameworks* to promote circular transition.
- *Engaging the private sector* and mobilising public, private and philanthropic sources of finance – including through blue bonds, blended finance structures, and multi-donor funds.
- *Upgrading infrastructure and increasing access to technology and innovation* that promote new forms of economic production and consumption which maximise resource efficiency.
- *Incentivising supply chain engagement* to reduce environmental impacts and creating incentives to encourage the use of secondary materials such as bioplastics and other materials.

- *Promoting products-as-a-service to decouple economic growth from environmental degradations*. Products-as-a-service allow products to be used repeatedly to provide the same service that single-use products offer. Life cycle assessment studies have shown that such business models often reduce environmental impacts while still meeting customer demands (Kerdlap et al. 2021; Incubation Network et al. 2022).
- *Pushing for more products to be repairable*. Products often thrown away could have been repaired and the product's useful lifetime extended, which avoids the need to manufacture another product. The European Union has already adopted a Right to Repair law and such laws should be replicated in other countries, especially in places where there are a large number of informal workers who are skilled at repairing consumer products.
- *Making farming practices more sustainable* in developing countries that are aggressively developing a bioeconomy. Although bio-based products absorb carbon dioxide and use renewable materials from the biosphere, the growth of the feedstocks for bio-based products can have harmful effects on soil quality and water resources. This includes the overuse of fertilisers that runoff into freshwater bodies, degradation of soil health and biodiversity through monoculture farming, and particulate matter pollution from burning of agriculture waste. Taking a life cycle perspective of bio-based products is important to mitigate shifting of environmental and social impacts elsewhere in the supply chain.
- *Pushing for development and enforcement of mandatory Extended Producer Responsibility (EPR) laws globally*, taking into account the local market context and adjusting where necessary. Such a law is needed to secure revenue for dealing with the growing volumes of packaging and other types of waste. In developing countries, waste management or landfill fees are too low or are virtually non-existent. This has caused financial failures in technically well-designed waste management systems. The EPR law must be transparent in proving that the fees paid are being directly used for addressing waste management issues and not for other government expenses.
- *Mobilising development capital in the G7 and redirect that to businesses tackling plastic pollution in countries where capital is needed the most*. 89 per cent of all private investments in plastic circularity solutions were in Europe and North America while the top 20 countries where plastic emissions into the oceans occur have been identified as emerging economies (The Circulate Initiative 2023).
- *By creating a destination market for recycled materials from emerging economies, the G7 can promote transparency and improve human rights practices along the supply chain*. This could inter alia include initiatives holding brands and suppliers more accountable for ethical material procurement practices in the supply chain including fair remuneration practices, adherence to health and safety requirements, absence of child labour, and support for marginalised populations that are involved in the collection of plastic and other feedstock for recycling.

Reducing raw material extraction for renewable energy:

- *Essential to integrate the recycling value chain to secure feedstock, close the loop and benefit from lower supply costs and risks is crucial* as secondary raw materials play a crucial role in the deployment of clean energy technologies and are important to reduce external dependency. To this end, it is also important to consider the significant number of raw materials potentially coming from dismissed clean technologies in the coming years and reaching end-of-life (OECD 2023).
- *Recycling must be seen as a real mining activity* that can increase the circularity of the value chains, while ensuring less external dependence for the supply of strategic raw materials. The increased availability of materials would represent a significant starting point for the development of green industrial value chains in the G7, to be complemented with initiatives in favour of the construction of new production plants necessary to enable the significant expected growth.

For the construction industry:

This section aims to evaluate the economic impact of implementing a CE model from the perspectives of various stakeholders. This evaluation is based on a study conducted by Karaca et al. in 2024, where data was collected and analysed to gauge the opinions and preferences of different stakeholders. The section focuses on policy implementations while quantifying the costs and benefits of CE implementation. It provides a comprehensive analysis of the diverse perspectives of stakeholders from both European and non-European backgrounds.

- *CE strategies and overall costs*: To promote the implementation of CE strategies, policymakers should focus on adopting policies that prioritise the optimisation of reuse and designing for disassembly (DfD) in European countries. This should include policies that encourage the offsite production of structural elements and reuse of materials. Furthermore, policymakers should prioritise conducting cost-benefit analyses globally for offsite production to determine the most efficient methods. Policymakers should also encourage investment in research and development to make offsite production more cost-effective. Additionally, policymakers should foster and mainstream knowledge-sharing among stakeholders by creating collaboration platforms.
- *Influence of CE strategies on cost increase*: To promote the implementation of CE strategies in European countries, policymakers should prioritise raising awareness and motivation among workers and carefully planning for possible maintenance costs. They should also prioritise developing waste treatment infrastructure, qualitative employee training, and thoughtful planning of the most efficient logistics in non-European countries.
- *CE strategies and overall benefits*: To promote the implementation of CE strategies, policymakers should prioritise the optimisation of the amount of reuse and increasing storage capacity for such purposes in European countries. They should also encourage the offsite production of structural elements and materials reuse in non-European countries. Policymakers should ensure that there is a shared understanding of the importance of maximising storage for reuse across both countries' groups. Furthermore, policymakers

should prioritise regional contexts in prioritising practices such as reuse and recycling for European countries and disassembly for non-European countries, thus regional guidances on CE will be beneficial.

- *Impact of CE strategies on benefits increase*: To promote the implementation of CE strategies, policymakers should focus on waste reduction in European countries, aligned with their legislative acts and national strategies. They should also encourage the use of new resale markers, the collaborative approach of construction parties, and potential funding attained due to reduced environmental impacts in non-European countries.
- *Prioritisation of activities affecting the financial performance of companies*: To promote the implementation of CE strategies, policymakers should prioritise policies that support sustainable logistics and reduce transport expenses for European organisations. They should also prioritise policies that support skill development and workflow change for non-European organisations. This should include policies that limit the use of new materials, reduce expenses regarding employees' skills training, and promote workflow change.

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