SCIENCE FOR ENVIRONMENT POLICY

How to close the global circularity gap? In 2011, six gigatonnes of potentially recyclable material went to waste

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Living sustainably within our planet's boundaries is a matter of global concern, with some countries now focusing on the development of a circular economy (CE) — where materials are reused as much as possible. Much CE research has focused on the amount of waste being recycled; the focus of this study, however, is on quantifying the amount of material that is not being recycled but could be — a distinction known as the 'circularity gap' (CG).

In 2015, the European Commission adopted the Circular Economy Action Plan[1]. Legislative changes to waste management in Europe in 2018 also set clear objectives and targets for reducing waste, increasing reuse and increasing recycling; including recycling 70% of packaging waste by 2030. However, on a global scale, the 2019 Global Circularity Gap Report found that the economy is only 9% circular: just 9% of the 92.8 billion tonnes of minerals, fossil fuels, metals and biomass that entered the economy are re-used each year.

Over the last decade, numerous studies have estimated material circularity for a variety of different materials (e.g. paper, steel, aluminium), across a variety of countries, using a range of approaches. Previous studies mostly focused on how much waste is recovered as a share of raw material input, in which materials for energy use and in-use stocks (i.e. durable goods such as building, infrastructure, and transport machinery) are considered part of the circularity gap.

This study now distinguishes between materials that are added to in-use stocks, and materials dispersed in the environment as dissipative emissions or other combustion and biomass residues, allowing the researchers to identify the actual fraction of waste for material circularity in a specific period. The circularity gap of a nation is defined as waste generation (i.e. material disposed of by industries and households), plus stock depletion (i.e. waste flow from old in-use stocks (i.e. durable goods, such as cars) that does not necessarily end up in landfill[2]), minus recovered materials. This shows the amount of waste material

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How to close the global circularity gap? In 2011, six gigatonnes of potentially recyclable material went to waste (continued)

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theoretically available for circularity. This is the first study to take a global perspective on circularity gaps at the level of individual nation states and regions, offering a starting point for developing improved performance measures for CE activities.

The researchers calculated the circularity gap (CG) of 43 countries and five other world regions in 2011[3] using the global input-output database, 'EXIOBASE'. The CG result for a specific nation or region was then analysed to see which of four interventions categories — product lifetime extension, closing supply chain, resource efficiency and residual waste management — would best minimise the CG.

The analysis found that, worldwide, around six gigatonnes (Gt), or 0.8 tonnes per person, of waste could potentially be reintegrated into the global economy as secondary materials. Europe showed the highest circularity gap (1.2 Gt) and the fourth largest per-person gap. This was true even though the countries had the highest values of recovered waste; this is because of the high level of stock depletion, which is five times larger than the 2011 global average.

The researchers suggest that in the EU, stock is depleted at a slightly higher than waste is generated in Europe. The total waste generated in 2011 was 2.7 tonnes per capita (t/cap), of which 53% was stock depletion. The circularity gap was, therefore, 1.6 t/cap (2.7 t/cap of total waste minus 1.1 t/cap of recovered waste).

Similar trends were present in other high-income countries such as the USA, Russia, Canada, Japan and Australia, where there was high waste recovery but larger stock depletion. In Africa and the Asia-Pacific region, the typical CG showed a low degree of recovery and stock depletion but high levels of generated waste.

Interventions aiming to minimise CG for European and other high-income countries should be to decrease or delay waste from previous stocks by extending product lifetimes. This can be achieved by designing for longevity and maintaining durable goods. Closing supply chains could also contribute to delaying stock depletion if product and component reuse is applied to extend products' length of use.

The researchers suggest that major contributions to circularity potential can be developed by factors such as establishing a relationship between circularity, resource efficiency and decoupling (an economy which can grow without corresponding stress on the environment). The study suggests that these elements could be integrated into future research to create a better understanding of the potential of a global circular economy from a material-based perspective.

1. EU Circular Economy Action Plan: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN

2. Stock depletion is processed — as any other ordinary waste — by waste treatment sectors (where it can be recovered, incinerated or landfilled depending on the material type and regional technologies).

3. 2011 is the most recent year available in EXIOBASE, but these findings can be used in the CE debate, and the method can be applied to more recent years once data is available.