THE CLIMATE MITIGATION POTENTIAL OF THE CIRCULAR ECONOMY

Environmental Defense Fund | BUSINESS

Trinomics

KEY MESSAGES 01

390-550 Million tonnes

The potential for the circular economy to contribute to climate mitigation is undeniable

All sources identified climate change mitigation benefits from the circular economy. EU-wide adoption of circular measures in major industrial sectors could deliver 13-18% annual greenhouse gases (GHG) emission savings – roughly 390-550 million tonnes (Mt) CO_2e each year – more than the annual carbon footprint of France or Italy.

It will only be possible to reach our net zero goals by shifting to a more circular economy

Shifting to renewable energy and improving energy efficiency will only take us so far – estimates suggest around 55% of global emissions – so product and circular economy measures will be essential to reach net zero.

The mitigation potential of circular actions varies across different sectors. Buildings, transport and agriculture are the most significant.

The literature currently points to the greatest potential in the building, agrifood, and transportation (especially automotive) sectors, where circular measures could reduce emissions by 85%, 60% and 55% respectively.

The circular economy offers particular opportunities to decarbonise traditionally 'hard to abate' sectors

In sectors such as steel, cement and chemicals, technical and physical constraints mean full decarbonisation is impossible; measures aimed at reducing demand for these materials – such as repair, remanufacturing and recycling – are therefore critical.

Circular actions can be among the most cost-effective for businesses, offering potential to save costs, open new revenue streams and bolster supply chain resilience.

Reducing dependence on international raw material commodity markets can insure companies against price fluctuations and supply chain shocks. At the same time, new circular business models offering repair, remanufacturing, resale and rental services present an opportunity for business value creation.

For the above reasons, companies with net zero goals must include circular economy measures in their action plans.

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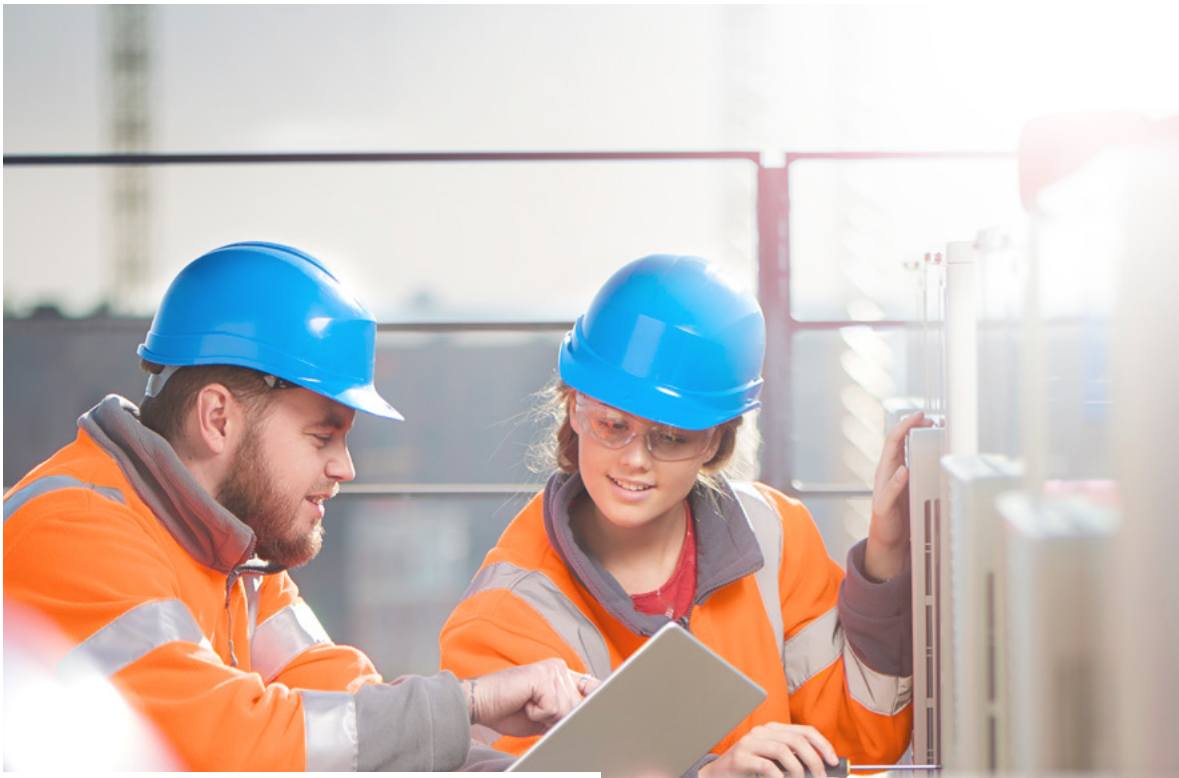

SCENE-SETTING

The circular economy constitutes a novel economic paradigm that goes far beyond improved waste management and increased recycling rates. A circular economy model implements material efficiency strategies applied throughout the value chain, from improved product design for longevity and durability to mechanisms that enable proper separation of materials at the end-of-life phase, allowing for re-circulation. More 'circular' products, materials and processes reduce the need for extraction of virgin materials or carbon-intensive production processes, with a strong potential for cost savings and other benefits for business. As a result, CE is increasingly viewed by governments and businesses as a means to mitigate the negative impacts of the linear economy – including GHG emissions and biodiversity destruction – and to build supply chain resilience in light of recent geopolitical crises.

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SECTORS 03

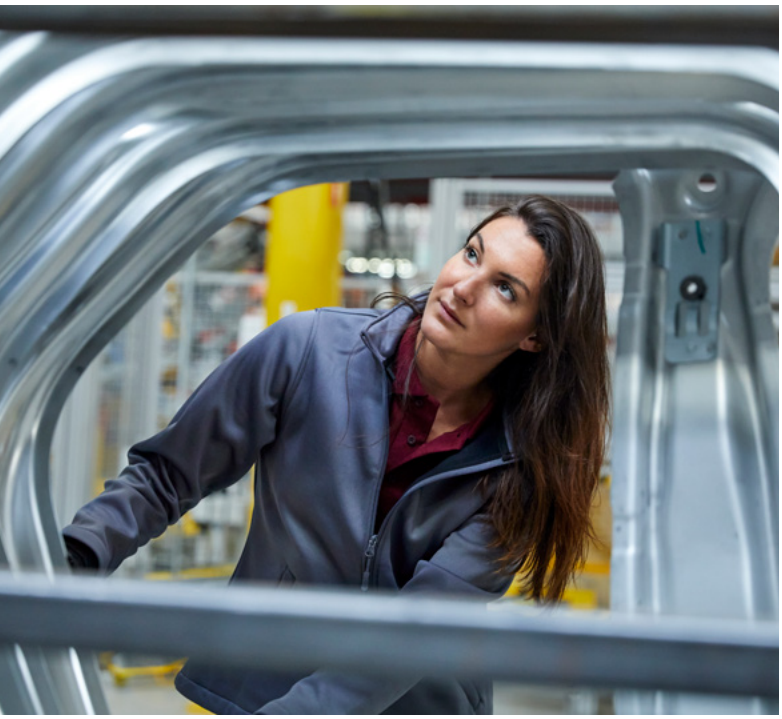
BUILDINGS AND CONSTRUCTION

A circular built environment in the EU could deliver 34% emissions reductions by 2050, which roughly translates to savings of 80-123 Mt CO_2e per year (equivalent to the carbon footprint of Czechia).[1]

The circular economy measures identified with the highest potential are:

1. **increasing material efficiency through improved design and construction of buildings**
2. **prolonging the lifespan of buildings**
3. **increasing recycling of building materials**

A fully circular EU building sector could generate benefits of more than €1 trillion by 2030 compared to 2015 and reduce household expenditure on housing by as much as 50%.



AUTOMOTIVE

Increasing the circularity of the automotive sector offers potential for up to 70% reduction in GHG emissions from materials used in passenger cars in the EU by 2050, which equals to 43 Mt CO_2e emissions per year. (Note that the actual emissions reductions will be even higher due to improved energy efficiency from lighter weight vehicles.)[2]

Those circular measures identified as having the greatest abatement potential are:

1. **designing for durability and extending vehicles' lifetime (-36% emissions from passenger cars by 2050 or 22 Mt CO2e per year)**
2. **improving material efficiency through 'lightweighting' (i.e. reducing vehicle mass) (- 16% by 2050 or 10 Mt CO2e per year)**
3. **increasing usage intensity through ride- and car-sharing (-15% by 2050 or 9 Mt CO2e per year).**

Introducing circular measures such as light-weighting, remanufacturing and ride sharing - alongside electrification of passenger cars and modal shift – could generate total benefits of approximately €370 billion by 2030 and reduce household expenditure for transport by as much as 70%.

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[1] These estimates do not include energy-related emissions from heating, cooling, lighting of buildings etc., which if included could lead to about 85% reduction of GHG emissions by 2050, totaling around 374 Mt CO_2e emissions.

[2] This estimate does not include emission savings from the energy used to power vehicles (i.e. shifting from fossil fuel-based transport to electricity-based generated by renewables would generate significantly higher benefits, but this constitutes a green energy transition measure rather than circular economy). Incorporating these emission savings could lead to about 95% reduction of GHG emissions by 2050, totaling around 600 Mt CO_2e emissions

PACKAGING

Improving circularity in the EU packaging sector could deliver up to 74 Mt of CO_2 savings every year (close to the carbon footprint of Belgium).

Reuse of packaging eclipses other circular measures in terms of GHG mitigation potential, with 90% of estimated savings attributed to this.

Increasing the share of secondary materials (e.g. closed loop PET bottle recycling) could generate additional profits of €330-€540 per tonne of PET bottle produced; 'lightweighting' through reducing packaging material by 10% reduces packaging costs by the same percentage.

The packaging sector is the biggest contributor to plastic waste in Europe, accounting for about 60% of post-consumer plastic waste. The food industry is responsible for over half of all packaging use.

FOOD AND AGRICULTURE

Transitioning to a fully circular and regenerative agrifood system in the EU could deliver very significant GHG emissions reductions from the sector.

Most emissions in agriculture come from the livestock sector, including from enteric fermentation (48%) and manure management (17%). The latter is especially relevant from a circular economy point of view. However, the estimation of specific potentials in this area was out of the scope of this report.

Other circular economy measures identified in the literature as having the highest climate change mitigation potential are:

1. **the shift to regenerative crop production[3] and agroforestry[4]**
2. **food waste reduction**
3. **nutrient recovery from agricultural and forest residues**

[3] Regenerative crop production includes (1) perennial staple crops, (2) regenerative annual cropping, (3) tree intercropping and (4) abandoned farmland restoration

[4] Agroforestry includes (1) Silvopasture and (2) multistrata agroforestry

TEXTILES

Conservative estimates suggest moving to a more circular EU textile sector could reduce the sector's GHG emissions by 15%, or 18 Mt (similar to the annual emissions of Lithuania) CO_2e per year. Measures with the greatest impact:

1. Initiatives to promote product durability

The combination of product design for longer-lasting, repairable items, alongside the promotion of resale, rental and sharing platforms extends the number of times an item is worn.

If on average consumers doubled the number of times they wore a garment, it would reduce GHG emissions associated with the garment by 44%.

2. Recycling

Mechanically recycled polyester and cotton have an estimated 70% lower carbon footprint than their respective fossil-based and virgin counterparts. However, textile recycling technologies remain limited, so the full mitigation potential from recycling is difficult to estimate for the sector as a whole.

EU citizens consume on average 26kg textiles each per year.

Producing one tonne of textiles emits around 15-35 tonnes CO_2e.

50% of the sector's impact comes from clothing, 20% from footwear and 30% from household textiles

About 80% of the textile sector's climate impact occurs during the production phase.

ELECTRICAL AND ELECTRONIC EQUIPMENT (EEE)

The diversity of EEE product groups, a lack of clarity on the required recycling technologies for all components and materials, and limited quantification methodologies means drawing definitive conclusions and recommendations is not easy.

However, the circular economy measures identified in the literature as offering the greatest climate mitigation potential are:

1. **Increasing usage intensity and product lifespan through improved product design.**

   Extending the life of all European smartphones by 1 year would save over 2 Mt CO_2e per year by 2030 and reduce life cycle costs for consumers by 14%; including laptops, washing machines and vacuum cleaners would save an additional 2 Mt CO_2 equivalent.

2. **Promoting greater use of secondary raw materials in product manufacturing.**

   Replacing primary aluminium with domestically-recycled aluminium could save 95% of the energy and around 39 Mt CO_2e annually, whilst generating €6 billion per year for the European economy.

Over 20kg of EEE products are sold per person annually in the EU. The EU's EEE market is expected to grow by 8% annually until 2027.

The production phase of smartphones accounts for 35–92% of their total GHG emissions.

Remanufacturing of EEE uses 85% less energy than manufacturing.

LOOKING AHEAD 04

There is **a strong business case to be made** for embedding circular economy measures and initiatives into companies' net zero plans.

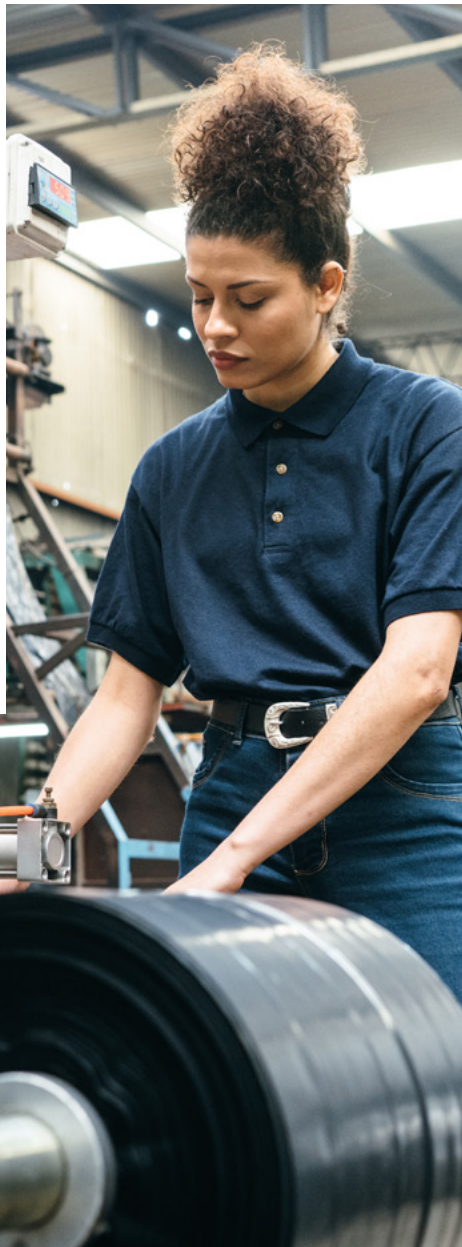
Implementing energy efficiency strategies and switching to renewable energy will only take us so far – as much as 45% of global emissions will need to be addressed by, inter alia, circular economy measures.

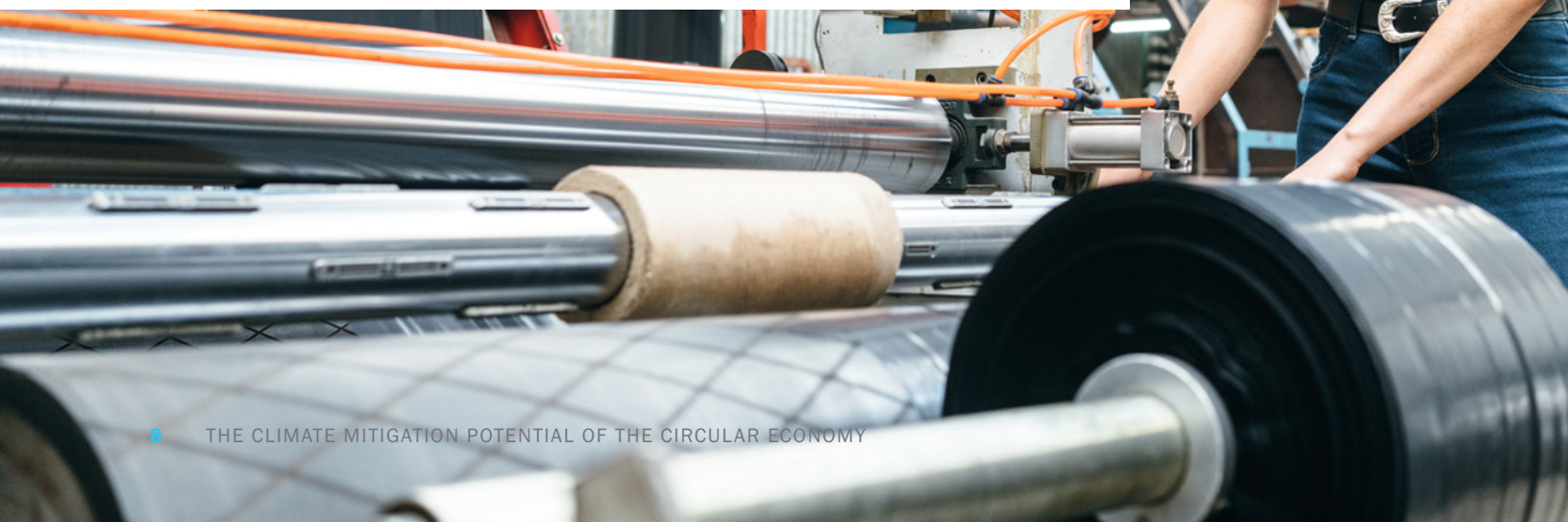
At the same time, **circular measures can deliver co-benefits** to help future-proof business models: reducing costs, opening new revenue streams and value creation opportunities, and de-risking against financial system and supply chain shocks.

But what is also clear is that **there is no single 'circular solution'**. The literature identifies a range of different measures, which can deliver different emissions reductions at different life cycle phases for different product value chains.

It will be for **individual companies to identify, map, evaluate and prioritise the most appropriate circular measures** for their own operations and value chains, and to include these in their climate transition action plans. Environmental Defense Fund stands ready to engage with companies on these next steps.

> **"Environmental Defense Fund stands ready to engage with companies in their climate transition action plans.**





ANNEX/BACKGROUND 05

THE PROJECT

These findings are based on a literature review and synthesis of studies to date which seek to identify and quantify the climate mitigation potential of circular economy measures – bringing together two policy areas often treated separately by regulators and businesses. The report includes a thorough description of findings – including outlining the most promising and impactful interventions across different sectors, quantification of the emissions reduction potential of different measures (where possible), an assessment of the financial impacts of such measures, and a description of the methodological and measurement gaps.

THE ANALYSIS/METHODOLOGY

Assessing the circular economy potential of different sectors requires taking a full lifecycle approach – i.e. a holistic view of all economic activities across the entire value chain – and measures which can deliver emissions reductions naturally take place at different life cycle phases for different product value chains, with varying potential magnitudes. Life cycle-based analyses are thus crucial for designing product value chains towards lower carbon emissions.

CONTACT

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