Flanders
is circular

SEVEN MESSAGES ABOUT THE CIRCULAR ECONOMY AND CLIMATE CHANGE

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Seven messages about the circular economy and climate change

The circular economy is a concept that first appeared from within the waste and materials policy. The traditional waste policy was targeted at processing waste materials in a way that was as environmentally friendly as possible. This was converted into a materials policy that was targeted at designing and organising material cycles that can continue running for centuries, in principle, in order to meet our needs. Waste materials become new raw materials and products are designed in such a way that they can be recycled and/or are made of recycled materials.

A circular economy is about more than just recycling. It concerns the fundamental review of products and the systems in which they are applied: longer lifecycle, reduced materials impact, reusability, ease of disassembly for repair and replacement, introduction of new revenue models, such as product-service systems, and supporting other consumption models based on shared use.

Below are **seven messages** about the circular economy and climate change that demonstrate that the transition to a circular economy and to a low-carbon economy are challenges which are inextricably entwined. Both challenges must also be faced jointly in order to achieve the ultimate goal: a low-carbon, low-materials, and circular economy by 2050.

A circular economy is about more than just recycling. It concerns the fundamental review of products and the systems in which they are applied.

The way in which we interact with materials has a major impact on the climate. A very large part of our energy consumption (and therefore the related greenhouse gas emissions) is very closely linked to the extraction, processing, transportation, use, and discarding of materials. Circular strategies such as circular design, material-efficient production, reuse, repair, and recycling lead to both savings in material consumption and greenhouse gas emissions. By focusing on maximum retention of value and closing the (local) material cycles, the circular economy possesses a robustness that will also serve well when dealing with the drastic changes caused by climate change.

For **more information** on the link between the circular economy and climate change, we refer you to the detailed background report (OVAM, 2018, De bijdrage van de circulaire economie aan het klimaatbeleid).

[1] Materials here are used in the sense as defined in the Materials Decree, 'each substance that was or is reclaimed, extracted, cultivated, processed, produced, distributed, used, discarded, or reprocessed, or any object that is produced, distributed, used, discarded, or reused, including the waste materials originating from these'. Therefore, materials can be raw materials, finished products, or waste materials.

Message 1:

the way we deal with materials determines a large part of the greenhouse gas emissions

The climate challenge is primarily referred to **an energy problem.** Solutions are first sought in renewable energy generation (energy transition) and the implementation of energy-efficiency measures (energy savings through optimisation). This perspective must be supplemented with a focus on the underlying driver of the high energy demand: a high material consumption that is the consequence of a linear economy.

The additional framing of the climate problem as a materials problem offers new solution-based approaches. Indeed, the concept of the circular economy offers a concrete perspective on how we can organise our production and consumption so that it emits less CO_2. The transition to a circular economy begs reflection on the question of how we can meet our needs (e.g. living, mobility, food) with less material consumption and how the materials that are truly needed can continue to circulate through the value chain in closed cycles with as little impact on the environment as possible.

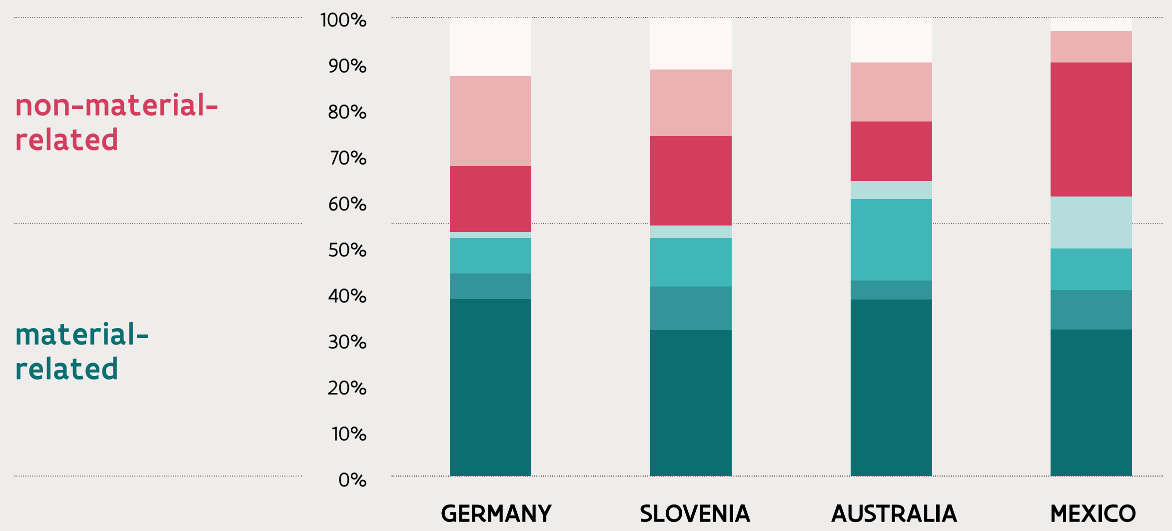
The way we deal with materials determines a large part of the greenhouse gas emissions

EXAMPLE

The figure demonstrates the link between greenhouse gas emissions and **material-related** processes in four countries. The activities related to materials management (production of goods and fuel, transport of goods, food production and storage, waste processing) for the four countries studied total over **50 to 65% of the total greenhouse gas emissions.** This is even a conservative estimate. For example, the residential energy consumption is determined by, among others, the way in which our houses are currently built (e.g. building insulation) and is therefore actually also (partly) material-related. Passenger transport is done mainly using cars that weigh an average of 1.5 tonnes. Reducing the material intensity of our transport system by increased usage of public transport, bicycles, carsharing, and carpooling result in fewer CO_2 emissions.

The first exploratory calculations based on data from the Flemish energy balance sheet showed that the total energy consumption in Flanders, in order of importance, is comparable to that in the case studies in the OECD study. According to an initial estimate, some two thirds of gross domestic energy consumption in Flanders in 2014 can be attributed to material-related activities.

[2] VITO (2015), Energiebalans Vlaanderen 1990-2014, Referentietaak i.o.v. de Vlaamse Regering.



	GERMANY	SLOVENIA	AUSTRALIA	MEXICO
non-residential energy consumption	12%	11%	10%	2%
residential energy consumption	20%	14%	13%	8%
passenger transport	14%	20%	13%	28%
waste removal	1%	3%	3%	12%
food production & storage	9%	11%	18%	10%
cargo transport	5%	9%	4%	7%
production of goods & fuels	39%	32%	40%	33%

Figure 1: National greenhouse gas emissions for four countries categorised by activity. Source: OECD (2012), Greenhouse gas emissions and the potential for mitigation from materials management within OECD countries.

POLICY IMPLICATIONS

It follows from the observation that over half of the greenhouse gas emissions are material-related that the transition to a circular economy and to a low-carbon economy are challenges which are **inextricably entwinted.**

The realisation of a circular economy is a necessary precondition for a successful climate policy because the climate impact of material consumption throughout the various phases in the value chain (e.g. extraction, production, transport) is incredibly high. Therefore, we must develop a policy that is focused on adapting these chains via circular production and consumption models.

MORE INFORMATION

- Ecofys & Circle Economy (2016), Implementing Circular Economy globally makes Paris targets achievable
- OECD (2012), Greenhouse gas emissions and the potential for mitigation from materials management within OECD countries

Message 2:
circular strategies contribute to the reduction of greenhouse gas emissions

The application of circular strategies ensures that **less CO_2** is emitted globally. This can be done in a direct manner (e.g. avoiding transport) or because the strategy requires fewer materials and/ or **products** to meet the same needs. For example, a strategy that can extend the lifecycle of a product leads to fewer products required globally to satisfy a **specific need**. This then creates CO_2 gains in the extraction, production, transport, and waste processing phase of these (avoided) products.

Moreover, circular strategies also provide a perspective on additional (local) **job creation** (e.g. repair, recycling, remanufacturing).

At the same time, we know that **extra materials** (e.g. metals for batteries) will be required for certain paths within a low-carbon and energy-efficient economy. If this demand is not dealt with in a circular manner, this will lead to higher greenhouse gas emissions, which will increase climate change once again.

Products that last longer, that are designed for reuse and recycling, that are shared, and that circulate through takeback systems are essential elements for a low-carbon economy.

EXAMPLE

The use of recycled copper in products results in a net gain of 4.6 tonnes of CO_2 equivalents per tonne of copper compared to the use of raw copper extracted from ores. 18% of the copper used in the world consists of recycled copper. And yet, this quantity represents a mere 3% of the greenhouse gases linked to the use of copper. If all the discarded copper in the world were to be recycled, then a saving of 41 million tonnes of CO_2 equivalents would be achieved.

Sources: World Copper Factbook 2015, international Copper Study Group.; Glöseret al., Dynamic analysis of global copper flows. Environ. Sci. Technol. 2013; VITO, copper model, 2016; Ecoinvent 3, ReCiPe Midpoint (H) V1.10" method, 1994

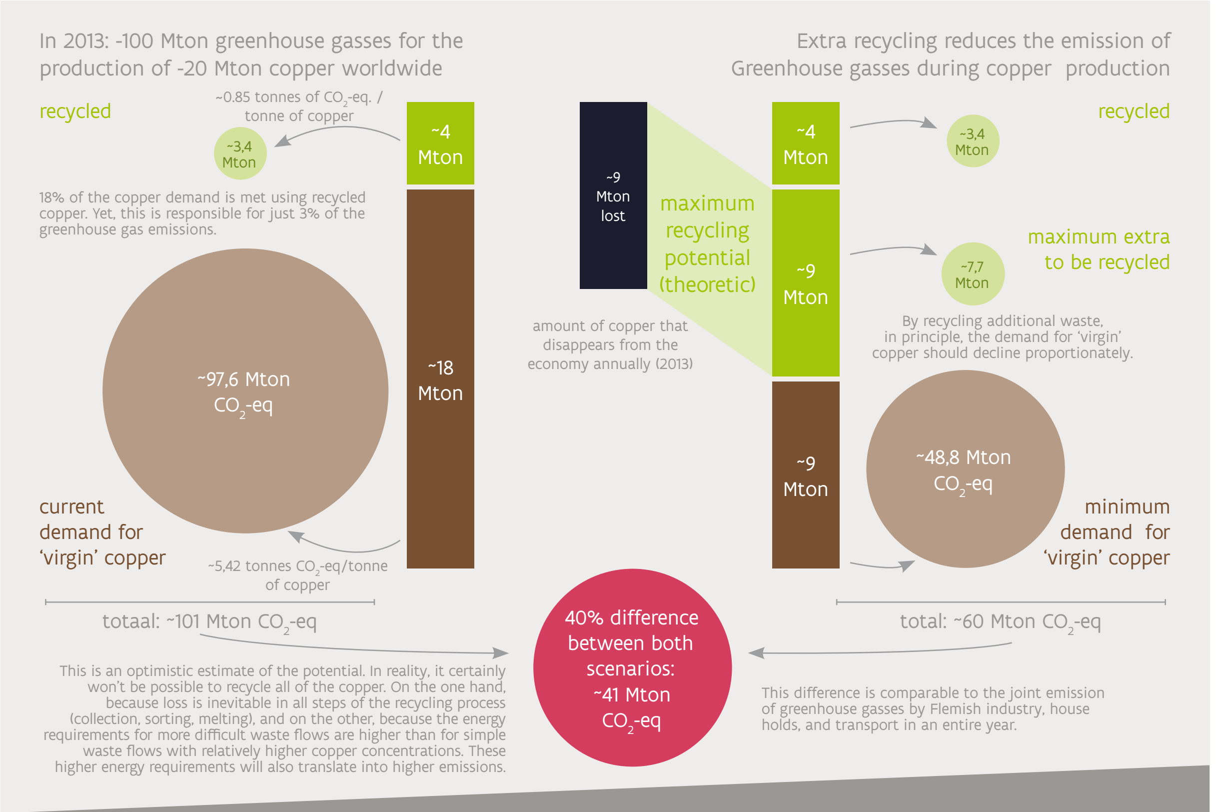


Figure 2: Reduction of global greenhouse gas emissions through maximum copper recycling.
Source: http://www.ovam.be/het-koper-model

POLICY IMPLICATIONS

The start memorandum for the Flemish climate vision 2050 proposes to reduce the Flemish greenhouse gas emissions by at least 80 to 95% by 2050, compared to 1990 as a **mitigating objective,** with a view to complete climate neutrality in the second half of this century.

Circular strategies form **mitigating measures** that can contribute to combatting climate change. Measures that strengthen one another (e.g. more efficient design and production, shorter transport distances, shared use, more recycling) are needed in each step of the value chain. For example, the **combination** of various circular strategies for the fulfilment of a certain need (e.g. mobility) can have a much greater effect than the sum of the separate strategies. This will then set a true **system change** to a circular, low-carbon economy in motion.

However, **rebound effects** could occur with all circular strategies that, depending on the size of these effects, could (partly) undo the climate gains. An example of this is that people who save money via a peer-to-peer sharing system, spend this money on additional consumption with the related CO_2 impact (e.g. a plane trip).

MORE INFORMATION

- OVAM metals stock management
- European Environmental Bureau (EEB), (2015), Delivering resource efficient products. How ecodesign can drive a circular economy in Europe
- PBL (2015), Effecten van autodelen op mobiliteit en CO_2 uitstoot
- IRP (2017): Green Technology Choices: The Environmental and Resource Implications of Low-Carbon Technologies
- Eunomia (2015), The potential contribution of waste management to a low carbon economy, Report commissioned by Zero Waste Europe in partnership with Zero WasteFrance and ACR+

Message 3:

a circular economy is a resilient and climate-resistant economy

The contribution of the circular economy to the climate policy goes beyond just helping to reduce greenhouse gas emissions. Circularity, in all its aspects, can contribute to making our society more **climate-resistant.**

A circular economy that deals with materials, energy, space, water, and food intelligently is also a **resilient** and **adaptive** economy, and one which can better adapt to external trends. Examples of external developments are, of course, climate change as well as demographic developments and technological breakthroughs. By focusing on maximum retention of value of the materials and closing the (local) material cycles, the circular economy possesses a **robustness** that will also serve well when adjusting to a changing climate. The application of circular principles also makes an economy more robust on a socio-economic level.

A circular economy that deals with materials, energy, water, food, and space intelligently is better able to withstand changes that are due to climate change.

EXAMPLE

The risks of climate change are often linked to buildings and infrastructure. Flanders has been focusing on **material-conscious** and **change-oriented** design and renovation/construction for some time now. Change-oriented concepts not only play a key role in reducing the environmental impact of the construction sector, but also flexibly take advantage of technological innovations, strategies for spatial efficiency, and socio-economic and demographic developments.

A change-oriented building can also be **disassembled** so that all components can be reused, maintained, or repaired. In this way, people can utilise the value of the construction materials throughout their entire lifecycles, instead of demolishing the building and losing the construction materials as waste. This also generates savings in greenhouse gas emissions. Buildings that are constructed today must be able to take advantage of a socially, economically, and physically changing environment in 2060. An example of the latter is a warmer climate with more storms and heavy rainfall. A building that can be disassembled can also be moved if necessary (e.g. flooding). The needs and expectations of both the users (e.g. changing family compositions) and the policy (e.g. energy performance, accessibility, etc.) mean that buildings will have to satisfy these new demands.

POLICY IMPLICATIONS

In a circular economy, there is cooperation throughout the entire value chain, knowledge is shared, and solutions are developed in **co-creation** with the partners involved. Just as with the climate problem, the transition to a circular economy is a deep-rooted project, in which the **long-term vision** must be kept in sight, be translated into a **needs-system perspective** (i.e. how can we meet a need (e.g. living) with a minimum consumption of materials) and take into account the various interests. Circular strategies that focus on **reviewing** the concept of property and shared ownership can offer inspiration for dealing with the challenges within the climate policy.

In addition, the circular economy also offers opportunities for local **job creation** in the services sector (repair, maintenance), the manufacturing industry (local production, remanufacturing, 3D production), and the recycling industry.

MORE INFORMATION

- Boelens et al. (2017), Adapt for life, Rapport van de Denktank Klimaat Adaptatie Vlaanderen 2015-2017
- Metabolisme van Antwerpen, Stad van Stromen

Message 4:
circular regional development contributes to climate policy

Circular spatial development results in climate gains through the **reuse** and **more intensive** use of space that is already in use, rather than taking up new open space. This supposes design and construction practices that take easy **adaptability**, **multifunctional** use, and **tempory use** into account. This also means remediating contaminated soil, groundwater, and the waterbed and/or managing risks so that the functions of these spaces can be restored and the space made reusable.

Circular regional development also supposes the organisation of the **location** of activities in a different way, taking better account of the material flows that are generated by localising an activity somewhere else (this generates transport and therefore CO_2 emissions) and of the opportunities to reuse materials locally.

Space is a scarce resource, especially in the heavily built-up region of Flanders. Condensing and the smart location of activities generates climate gains.

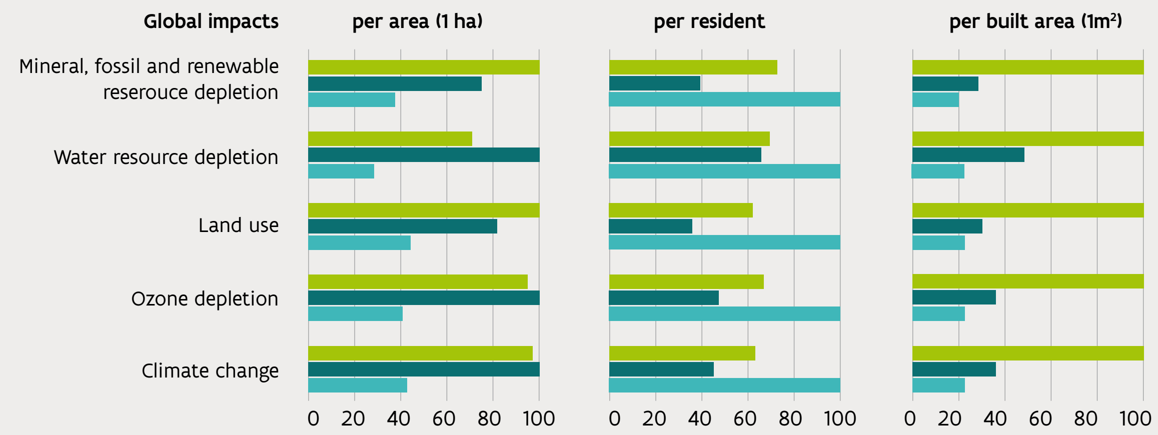
EXAMPLE

A specific tool that focuses on the remediation and redevelopment of polluted locations are the **brownfield covenants,** which the Government of Flanders concludes with project developers and investors. Brownfields are abandoned or underutilised sites in old industrial zones that are difficult to redevelop due to various factors (e.g. complexity, high development costs). An EMA study[3] demonstrated that the environmental impact (including as measured by the impact on climate change and exhaustion of resources) of reusing a brownfield site is lower than cutting into a greenfield.

The figure demonstrates that the greenfield site (cutting into new, open space) has the greatest environmental impact per built m² for all parameters. The **functional unit** of built area is most suited for comparing various approaches to urban development. The choice of functional unit (per surface, per capita, or per built area) is important for the interpretation of the results of the lifecycle analysis (LCA).

[3] EMA (2016), Land recycling in Europe, Approaches to measuring extent and impacts.

Comparison of global environmental impacts (relative importance, maximum 100) across life cycle stages and activities of the three test cases (20 year use scenarios)



Site characteristic	GF_Spain	BF_Spain	GF_UK
Total surface (ha)	47,5	3	7,7
Residents	13 356	1 269	700
Built survace (m²)	130 641	22 638	40 000

Figure 3: Comparison of the global impact of three spatial cases. Source: EMA (2016), Land recycling in Europe, Approaches to measuring extent and impacts.

POLICY IMPLICATIONS

The Government of Flanders' 2050 vision expands the concept of a circular economy to include **spatial use.** The circular strategies of **value retention** can also be applied to space. In accordance with the White Paper on the Flemish Spatial Policy Plan, the additional appropriation of space in Flanders must gradually decrease to 0 ha per day in 2040. There are various strategies possible to do more with less space.

Reusing space means re-utilising existing sites, constructions, and buildings that are no longer being used. An example of this is **remediation and redevelopment** of contaminated locations. Other strategies are **mixed use** (combining various activities in the same space), **intensification** (increasing the number of activities in the same area), and **temporary** use (allowing activities to be carried out in a space that is intended for other purposes at a different time).

Sustainable stock management of **landfill sites** can also contribute to an economic, circular use of space. Enhanced Landfill Management & Mining (ELFM²) is an innovative management concept that ties in with the transition to a circular economy. Flanders is the first region in the world where landfill sites are entirely approached as **stock**, with a view to optimal spatial integration, possible valorisation of the contents, and protection of the surrounding area from the negative impact of these landfill sites.

MORE INFORMATION

- Roe, S., Streck, C., Weiner, P.H., Obersteiner, M., Frank, S. (2017). How Improved Land Use Can Contribute to the 1.5°C Goal of the Paris Agreement. Working Paper prepared by Climate Focus and the International Institute for Applied Systems Analysis
- EEA (2016), Land recycling in Europe, Approaches to measuring extent and impacts

Message 5: taking the footprint of Flemish consumption into account

Footprint indicators map out the impact of Flemish consumption in terms of greenhouse gas emissions **(carbon footprint)** and material consumption **(material footprint)** globally.

The power of these footprint indicators is that they provide direction in terms of where the major impacts are and can prevent problems from being solved by **shifting** them abroad or by delocalising production.

These indicators also take the impact throughout the **entire value chain** into account, which is essential for monitoring a circular economy.

We must follow the right course. We cannot look at the CO_2 emissions occurring in Flanders alone. What counts is the CO_2 that is emitted globally by Flemish consumption.

EXAMPLE

The carbon footprint of the Flemish consumption is calculated as the greenhouse gas emissions that are linked to the **consumption of goods within Flanders**. This footprint not only takes the emissions that occur as a result of the use of products within Flanders into account, but also the emissions that occur during extraction, production, and transport of these goods **outside** of Flanders. The emissions in Flanders that occur during the production of goods intended for export are **not** included in the calculation of the carbon of the Flemish consumption.

The figure demonstrates that the **largest part (88%)** of the carbon footprint of the Flemish consumption **is located abroad** and is **twice as high as** the Flemish territorial emissions (128 million tonnes of CO_2 equivalents versus 59 million tonnes of CO_2 equivalents). Over half of the carbon footprint of the Flemish consumption is generated by housing, passenger transport, and food.

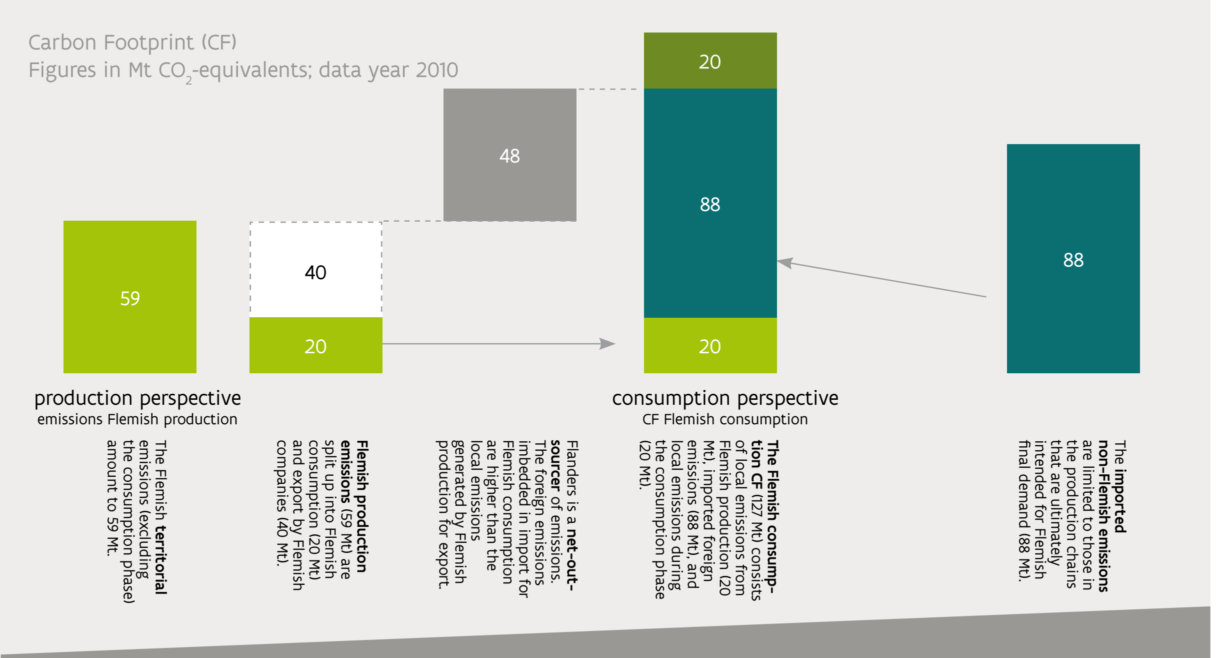


Figure 4: Greenhouse gas emissions caused by Flemish production and consumption. Source: Vercalsteren A., Boonen K., Christis M., Dams Y., Dils E., Geerken T. & Van der Linden A. (VITO), Vander Putten E. (VMM) (2017), Koolstofvoetafdruk van de Vlaamse consumptie.

POLICY IMPLICATIONS

The greenhouse gases accounting based on territorial emissions and the related formulation of objectives must be **supplemented** with an approach based on the **carbon footprint** of the Flemish consumption. In this way, measures that intervene at the level of purchasing behaviour, consumption, reuse, and recycling (by companies, governments, and citizens) can be made visible and lead to **new solution-based approaches.**

With 20 tonnes of CO_2 equivalents per capita, the carbon footprint appears to be significantly higher than the total greenhouse gas emissions at the Flemish territorial level (i.e. approximately 9 tonnes of CO_2 equivalents per capita). To restrict the average global temperature increase to 2ºC, the global greenhouse gas emissions must be reduced to an average of two tonnes per capita by 2050. Therefore, the carbon footprint of the Flemish consumption is **too high by a factor of 10** and we must look for other, more sustainable production and consumption patterns in order to reduce the carbon footprint.

A low-carbon and climate-resistant economy will be a **low-materials** economy. Therefore, climate objectives must not only be translated into energy objectives, but also into **materials objectives**. These materials objectives indicate the amount of materials that an economy can use in order to achieve a sustainable level of raw material consumption. An example of this is the UNEP Resource Panel's guideline to achieve a material footprint of approximately 7 kg per capita in 2050. This is a reduction by a factor of four compared to the current material consumption (the material footprint of the Flemish consumption currently amounts to 29 tonnes per capita). The use of materials objectives as guidelines for the policy is an important step towards achieving a circular economy that no longer unbalances the climate.

MORE INFORMATION

- Vercalsteren A., Boonen K., Christis M., Dams Y., Dils E., Geerken T. & Van der Linden A. (VITO), Vander Putten E. (VMM) (2017), Koolstofvoetafdruk van de Vlaamse consumptie
- IRP (2014), Managing and conserving the natural resource base for sustained economic and social development, A reflection from the International Resource Panel on the establishment of Sustainable Development Goals aimed at decoupling economic growth from escalating resource use and environmental degradation

Message 6:
carbon as a resource in a circular economy

For several years now, techniques have been developed in which the CO_2 that is released by industrial processes is captured and converted into valuable applications (e.g. construction materials, raw materials for the chemical industry, etc.). This use of CO_2 as a raw material for products is known as **Carbon Capture and Utilisation** (CCU). Some CCU technologies make use of other **residual flows** (e.g. leftover materials from metal slags), which makes it possible to recycle these waste flows. This way, CCU can contribute to a circular economy for carbon-based materials.

Capturing and using CO_2 in products contributes to a low-carbon economy.

EXAMPLE

VITO and DNV-GL were commissioned by the Department of Environment and Spatial Development to study the potential of applications for CO_2 capture and use in Flanders. A total of six knowledge institutions follow ten research paths. The processes studied are primarily in the laboratory phase and need at least 5 to 15 years before commercialisation. Four Flemish companies (Avecom, Carbstone Innovation, Organic Waste Systems, and Proviron) have developed their own, specific technologies. Two companies (ArcelorMittal and Havenbedrijf Antwerpen) are planning to implement existing technologies.

The study delves deeper into four CCU cases that are ready for the market, technically speaking, and can be demonstrated in an operational environment:

- ethanol production from waste gasses from the steel industry (ArcelorMittal)
- methanol production using green energy (power-to-methanol) (Havenbedrijf Antwerpen)
- algal biomass production to feed larvae (Proviron)
- construction material production from steel slags (Carbstone Innovation)

The production of construction materials and algal biomass are profitable under the assumptions made in the study. It is primarily the production of fuels, such as ethanol and methanol, which have high potential to reduce CO_2 emissions, if renewable energy is utilised.

Another example are the applications linked to biogas. The conversion of biogas into biomethane generates CO_2 that can be used in natural cooling systems or that can be recombined with hydrogen (e.g. from power-to-gas (energy storage) systems) to biomethane ('synthetic biomethane'), which can be used as a building block in the chemical industry instead of fossil fuels.

POLICY IMPLICATIONS

Thanks to CCU, CO_2 can (after capturing it at point sources) be used as a **raw material,** thus closing the carbon cycle. But CCU alone can never solve the climate problem given the magnitude of the current CO_2 emissions (> 35 gigatons/year) compared to the potential demand for products made from CO_2. But CCU can make a valuable contribution to the transition to a low-carbon economy. New production processes and **innovation** should make us capable of capturing carbon and using it in materials applications.

MORE INFORMATION

- Linsey Garcia-Gonzalez, Guinevere Thomassen, Mieke Quaghebeur, Stella Vanassche, Miet Van Dael, Heleen De Wever (VITO), Vanden Berghe Joost (DNV-GL Belgium), (2016), Onderzoek naar mogelijk ondersteuningsbeleid m.b.t. nieuwe toepassingsmogelijkheden van CO_2 als grondstof/feedstock, In opdracht van LNE
- Peter Styring et al. (2011), Carbon Capture and Utilisation in the green economy, Using CO_2 to manufacture fuel, chemicals and materials
- In the context of the Enabling CO2 Re-Use (EnCO2re) project, all CCU initiatives have been mapped out

Message 7:
a new fiscal and legal framework is necessary for the transition to a circular and low-carbon economy

The transition to a circular and low-carbon economy requires a **fiscal** transition (a thorough shift from taxing labour to taxing (raw) materials, waste, and energy) and adapting the **legal** and **legislative** frameworks.

In addition to this, the government must make room for jointly managed **commons** as a third pillar of society, in addition to the market and the government. Commons are what are shared and maintained without organisation by a governmental authority or via traditional commercial transactions. Citizens and companies organise themselves into platforms or associations that are focused on the shared use, maintenance, or further development of commons (e.g. open knowledge, shared goods and buildings, infrastructure, land, neighbourhood parks, material flows, energy, etc.).

Shifting taxes from labour to (raw) materials, waste, and energy boosts the circular economy and the climate policy.

EXAMPLE

The Ex'tax project proposes to increase taxes on **natural resources** and decrease taxes on labour. This will thus create stimuli for avoiding the use of natural resources. The figure shows several results of the tax shift scenario from the Ex'tax project:

- In 2020, the average employment increases in the EU-27 by approximately 2.9% and the GDP increases by 2.0%;
- The CO2 emissions decrease by 8.2% by 2020;
- In the period from 2016 to 2020, the scenario saves 219 billion cubic metres of water and 194 million tonnes of oil equivalents (a combination of 12 different energy sources) compared to the reference scenario.

Key modelling results (EU-27, 2015-2020, % difference from baseline)

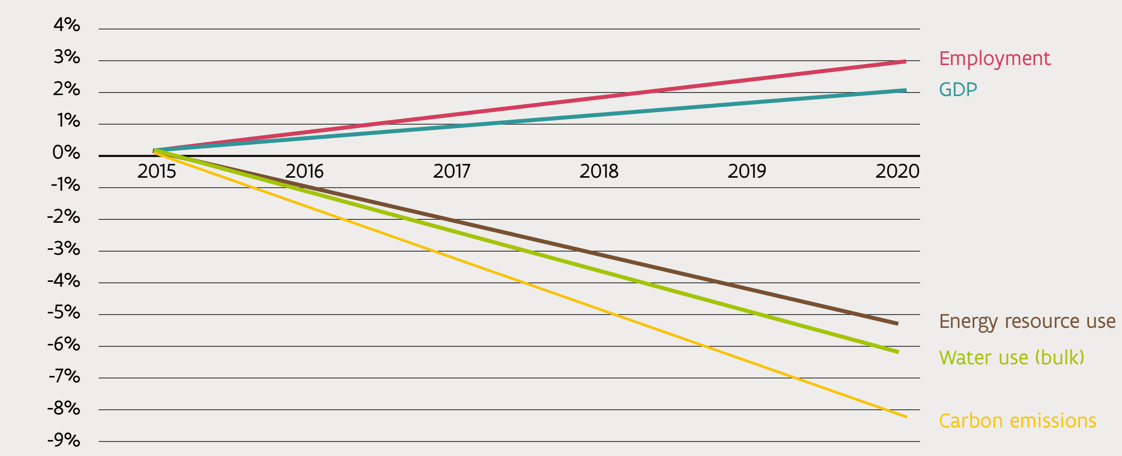


Figure 5: Results of the tax shift scenario in the EU-27 for the 2016-2020 period. Source: The Ex'tax Project et al., (2016) New era, new plan. Europe. A fiscal strategy for an inclusive, circular economy.

POLICY IMPLICATIONS

The current fiscal system in which the tax pressure is much higher on labour than on raw materials and energy consumption, as well as the general environmental pressure, poses an obstacle to circular economy activities. Reforms in the tax law must make activities that focus on **value retention** such as repair, reuse, shared use, and service provision more economically interesting. Activities that result in a **loss of quality or a loss of materials,** on the other hand, must be made unprofitable via fiscal measures. By shifting the tax pressure from labour to raw materials consumption, it will then become more interesting to make **local, high-quality products** that will last a long time, which can be maintained, adapted, and reused or recycled.

In a circular economy, manufacturers will be significantly financially and operationally **responsible** for closing the material cycle. Changes to the legislative framework must ensure that products are only put on the market once a system and techniques are available for their return and recycling. The legislation must also make room for **circular business models** that are based on sharing and reusing products or offering product-service systems that result in less material consumption.

Parallel to this, the government authorises transaction systems to allow **commons** to work as the third pillar of society, in addition to the government and the market. Citizens and companies can organise themselves into **platforms** or **associations** that are focused on the shared use, maintenance, or further development of commons (e.g. shared goods and buildings, infrastructure, energy, etc.). The underlying idea is that jointly maintained commons contribute to returns for the whole of society. The current initiatives (e.g. in the context of the sharing economy) must be assessed on their merits and those that actually result in **reduced material consumption** and stronger communities must be supported by policy.

MORE INFORMATION

- Planbureau voor de Leefomgeving, (2017), Fiscale vergroening: belastingverschuiving van arbeid naar grondstoffen, materialen en afval
- The Ex'tax Project et al., (2016) New era, new plan. Europe. A fiscal strategy for an inclusive, circular economy.

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