SEVEN MESSAGES ABOUT THE CIRCULAR ECONOMY AND CLIMATE CHANGE
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 organisating 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.

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 intricably 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.

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 klimaatakkoord).

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 as 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 CO₂. 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.

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 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 CO₂ 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.

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 entwined.

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

1 VITO (2015), Energiebalans Vlaanderen 1990-2014, Referentiejaar i.o.v. de Vlaamse Regering.
Message 2: circular strategies contribute to the reduction of greenhouse gas emissions

The application of circular strategies ensures that less CO₂ 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 materials and energy-efficient economy.

Moreover, circular strategies also provide a perspective on an additional loco 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 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 CO₂ 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 CO₂ equivalents would be achieved.

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 fulfillment 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 CO₂ impact (e.g. a plane trip).

MORE INFORMATION

- OWM: 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 CO₂ uitstoot
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.

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

- Metabolisme van Antwerpen, Stad van Stromen

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.
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 temporary use into account. This also means remediating contaminated soil, groundwater, and the waterproof 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 CO₂ emissions) and of the opportunities to reuse materials locally.

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 (ELFM) 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 managed 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.

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 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 ILCAI.

MORE INFORMATION


• EEA (2016). Land recycling in Europe, Approaches to measuring extent and impacts.

1 EMA (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 de-localising production.

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

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 CO₂ equivalents versus 59 million tonnes of CO₂ equivalents). Over half of the carbon footprint of the Flemish consumption is generated by housing, passenger transport, and food.

We must follow the right course. We cannot look at the CO₂ emissions occurring in Flanders alone. What counts is the CO₂ that is emitted globally by Flemish consumption.

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 CO₂ 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 CO₂ equivalents per capita). To restrict the average global temperature increase to 2°C, 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 guidelines on reducing material footprints of approximately 7 kg per capita in 2050. This is a reduction by a factor of four compared to the current material consumption. Hence, 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.
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.

**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**

- Peter Styring et al. (2011). Carbon Capture and Utilization 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.

Capturing and using CO$_2$ in products contributes to a low-carbon economy.
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.

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 based on sharing and reusing products or offering product-service systems that result in less material consumption.

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.

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%;
- 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.
- The CO2 emissions decreased by 8.2% by 2020;
- In the year 2020, the average employment increases in the EU-27 by approximately 2.9% and the GDP increases by 2.0%;
- 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.

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.

MORE INFORMATION
