Sustainable Indicators for a Resource Conscious Europe

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INTRODUCTION

All economic activity depends on the consumption of energy and natural resources. This relationship between the economy and the natural environment (or ecosystem) is at the root of all global environmental problems, including climate change, biodiversity loss, marine pollution and more broadly ecosystem degradation.

QUANTITY OF MATERIAL INPUTS DETERMINES AMOUNT OF WASTE AND EMISSIONS

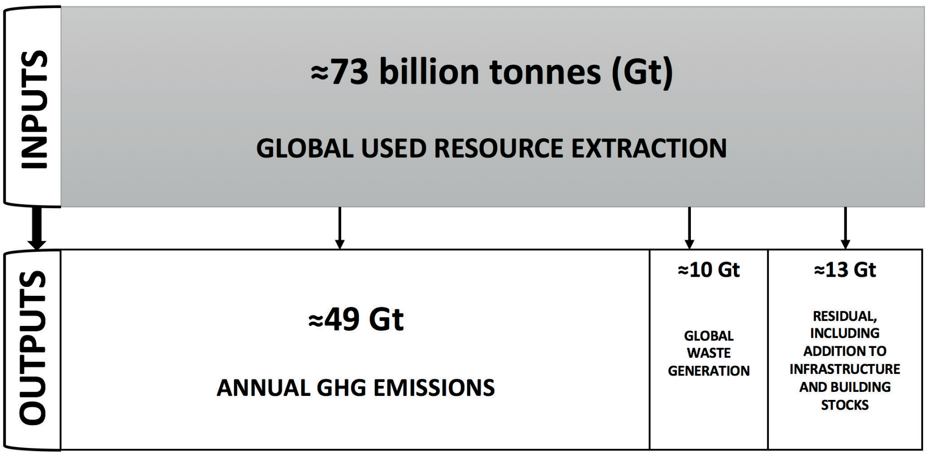
The link between the consumption of natural resources and environmental impacts becomes evident when considering the economy as a subsystem of a much larger, finite and non-growing ecosystem. Similar to living beings, this subsystem requires a constant throughput of materials and energy to function. The relationship between these two systems is mandated by the laws of thermodynamics: Total material inputs to the economy must eventually equal its total outputs back into the ecosystem. Given that the outputs occur in the form of emissions and waste, it follows that an overall reduction of material consumption in the European Union and globally will be key to combatting climate change and ecosystem degradation.

DIRECT LINK BETWEEN RESOURCE USE AND CLIMATE CHANGE

There is a direct link between the use of natural resources and greenhouse gas (GHG) emissions. **Figure 1** illustrates this link.

FIGURE 1

Estimates of material inputs and outputs of the global economy, 2010



Source: Author's own calculations based on data from WU Vienna (2016), IPCC (2014), World Bank (2012) and Frost & Sullivan (2012).

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Regarding the material inputs to the global economy, an estimated 73 billion tonnes of resources were extracted and used in economic activities worldwide in 2010. By definition, global inputs must equal global outputs. Regarding the latter, global GHG emissions stood at about 49 billion tonnes[1] while global (industrial and municipal) waste amounted to roughly 10 billion tonnes. An additional 13 billion tonnes are attributed to a residual mainly consisting of 'additions to the stock' of the global economy in the form of buildings, infrastructure and others. These figures underline the importance of emissions in the physical output of the global economy: GHG emissions accounted for almost 70% by weight of material outputs in 2010, thereby making the atmosphere by far the largest disposal site for global waste.

ALL MATERIAL CATEGORIES CONTRIBUTE TO CLIMATE CHANGE

Addressing the climate change impacts of material use requires an assessment based on different material categories. Behrens et al. (2007) established four aggregated material categories, including fossil fuels, biomass, industrial and construction minerals, and metal ores. Each of these categories contributes directly and/or indirectly to energy use and global GHG emissions (see also Behrens, 2016).

Fossil fuels alone contributed to some 65% of global GHG emissions in 2010. The link with climate change is thus evident. Biomass, on the other hand, is often considered carbon-neutral, based on the assumption that its use releases more or less the same amount of CO_2 as was absorbed during the growth phase. However, agricultural activities contribute to GHG emissions mainly through land-use changes and through the use of fossil fuels in production, processing and transport. For example, the Global Forest Resources Assessment 2015 (FAO, 2015) reports that carbon stocks held in forests decreased by over 11 Gt since 1990, mainly due to the conversion of forests to agricultural and residential land, as well as due to the degradation of forest land.

Construction minerals can be indirectly linked to GHG emissions mainly through housing, energy and transport infrastructure. The cement sector alone was responsible for about three percent of total EU GHG emissions in 2016 (EUTL, 2017). The building sector is the largest energy end-use sector in the EU, responsible for almost 41% of final energy consumption in 2013 and with similar contributions to CO_2 emissions (European Commission, 2015).

Finally, metals have the highest supply chain carbon intensity of all the commodities used in an economy (Aldersgate Group, 2010). Mining, processing, extracting and refining are estimated to account for seven to eight percent of the world's total energy consumption (UNEP, 2013). Iron and steel production alone accounted for some four percent of EU GHG emissions in 2016 (EUTL, 2017). With the increasing need to access less productive sites with lower-grade ores (e.g. for gold, copper and nickel), future energy requirements and related GHG emissions from the production of primary metals is likely to increase.

A SHIFT OF THE POLICY FOCUS IS NEEDED

Reducing global GHG emissions by at least 60% by 2050 compared to 2010 to limit global warming to 'well below 2°C above pre-industrial levels' (as stipulated in Art. 2 of the Paris Agreement) will thus require more than a shift to low-carbon and renewable energy sources. Improved resource efficiency, greater recycling and re-use, as well as an absolute reduction of raw material use must become key elements of environmental and climate policies in the context of a resource efficient and circular economy.

The advantages of focussing on restricting input into the economy in the long run over limiting output for reducing generic pressure on the environment are manifold. Most importantly, input oriented environmental policies act on the cause of ecological problems rather than on the symptoms. The reduction of inputs reduces potential consequences of economic activity on the environment and thus potential external effects. Similarly, there are (potential) economic incentives for adopting more resource efficient technologies and practices, which could ease the introduction of input related policies. In addition, input orientation is generally better suited for dealing with the complex links between population, poverty, growth, resources and the environment.

([1]) It should be noted that GHG emissions data is presented in CO2-equivalents. This means that the physical mass of total global GHG emissions as presented in Figure 1 changes when aggregating the actual mass of all non-CO2 greenhouse gases (incl. CH4, N2O and F-gases). However, given that CO2 alone accounted for 76% of total anthropogenic GHG emissions in 2010 (IPCC, 2014), this change in the physical mass of GHG emissions would not impact the overall message of Figure 1, i.e. that GHG emissions are the major part of the global economy's physical outputs.

MULTIPLE BENEFITS FROM REDUCED NATURAL RESOURCE USE

The benefits of reducing resource use obviously go far beyond combatting global warming. Other environmental benefits include biodiversity protection through reduced pressures on habitats, both due to less extractive activities and less pollution, emissions and waste. Similarly, the pollution of the world's oceans can be significantly reduced. According to the World Economic Forum et al. (2016), a third of all plastics packaging escapes collection systems into the environment, with 8 million tonnes of plastics leaking into oceans each year. The prevention of plastics waste and more circular business models in the plastics industry can thus help reduce significant environmental externalities.

Apart from environmental benefits, there are also economic benefits of reduced resource use. While the overall effects on growth and employment are still subject to debate, there are clear benefits for the EU and its industries to become less dependent on imports of natural resources. In fact, many natural resources required to maintain and expand economic activities are subject to increasing geological scarcity (e.g. antimony and gold, see Henckens et al., 2016) or economic scarcity (e.g. due to geographical concentration). These resources may be subject to increasing price fluctuations thus jeopardising future economic development if no substitutes can be found.

In addition, there is also a social dimension. On the one hand, the global poor are over-proportionately affected by the consequences of global resource use as their incomes and livelihoods largely depend on natural resources and services such as land, water and forests (see, e.g., Young/Goldman, 2015). On the other hand, the extraction of natural resources can have negative impacts on local populations, often associated with social unrest and conflict in some developing countries.

DELIVERING ON THE SUSTAINABLE DEVELOPMENT GOALS (SDGS)

It is therefore not surprising that resource efficiency is considered as a main enabler for the achievement of the Sustainable Development Goals (SDGs) in the context of the United Nation's 2030 Agenda for Sustainable Development. In fact, one of the 17 SDGs aims to 'ensure sustainable consumption and production patterns' (Goal 12). However, the importance of resource efficiency for the SDGs goes beyond SDG 12. The International Resource Panel (IRP, 2015) found that 12 out of the 17 SDGs promote human well-being through the sustainable use of natural resources. In addition, 10 SDGs are only achievable with higher levels of efficiencies in the use of land, water, energy, materials and other finite resources.

With ongoing global population growth and the justified aspirations of developing countries to reach standards of living comparable to high-income countries, global resource use could increase by over 50% until 2050 (compared with 2013 levels).[2] Breaking the link between economic growth and resource use will thus be essential to avoid irreversible environmental damage and thus to stay within the 'planetary boundaries' (see Steffen et al., 2015).

WHAT DOES THIS ALL MEAN FOR INDICATORS?

Indicators play a crucial role in improving resource consciousness among policy makers and citizens. They are required for the identification of potentially worrying trends and priority issues for policy, but they are also indispensable for the formulation, assessment, monitoring and evaluation of resource efficiency and circular economy policies in Europe and elsewhere. However, the question remains: Which (set of) indicators are the most useful to measure progress towards a green and more resource efficient economy?

POLICIES REQUIRE A VISION, INDICATORS CAN PROVIDE SCIENTIFIC EVIDENCE

A lack of data and indicators is often used as a pretext for no action or delayed action on the policy level. A multitude of indicators exist, but resource efficiency policies will only be successful if they are linked to attractive visions for change, e.g. in the context of the SDGs. Indicators can be used to underpin this vision, providing scientific evidence for the benefits (and costs) that

(2) Own calculations based on WU Wien et al. (2017), Eurostat (2017a) and UN DESA (2015). This number is for illustration purposes only. It assumes that all projected 9.7 billion human beings living on this planet in 2050 will have the same per capita resource consumption (measured in Domestic Material Consumption – DMC) as EU citizens did in 2015.

resource efficiency can bring. Eventually, and as indicators mature, they can also be used to set voluntary and/or binding resource use reduction targets.

THE IMPORTANCE OF CHOOSING THE RIGHT HEADLINE INDICATOR

Of particular importance for political accountability and communication is the choice of headline indicator. The current Resource Efficiency Scoreboard uses a single such headline indicator called 'resource productivity', which is expressed as the ratio between GDP and Domestic Material Consumption (DMC).[3] It thus measures how efficient an economy uses material resources to produce wealth.

This indicator has three shortcomings. First, the DMC indicator does not take into account indirect materials of imported and exported products. DMC is thus not robust against outsourcing material intensive industries or processes to third countries and substituting domestic extraction by imports. Second, GDP-linked indicators mask the substantial structural differences between EU economies. Countries with larger shares of the service sector will naturally perform better in terms of resource efficiency. Third, improved resource productivity can derive from an increase in GDP, a decrease in DMC, or both. However, the GDP/DMC indicator does not show whether resource use has actually decreased or even increased.

To overcome some of these issues, the use of Raw Material Consumption (RMC)[4] as the headline indicator should be considered. This would solve the issue of outsourcing production abroad and of varying economic structures across EU member states. Instead of measuring progress against GDP, the use of RMC would allow for identifying trends, thus giving a clear indication of where a society is headed in terms of resource use. Once fully mature, the RMC indicator would allow focus on environmental policy and targets solely on reducing material consumption as a proxy for environmental impact, costs and security (similar to CO2 emissions as a proxy for climate change in energy policy). This indicator would also need to be included in the EU SDG indicator set under Goal 12.[5]

TIMELY PUBLICATION OF INDICATORS[6]

While data for GDP and its components are published by Eurostat on a quarterly basis and with a delay of only a few weeks, resource use related data is published much less frequently and with a delay of several years. For example, the most recent data available in mid-June 2017 for GDP was 2017Q1, while for DMC it was 2015. This also means that the Resource Efficiency Scoreboard's headline indicator (GDP/DMC) is only published with a delay of about two years. In order to be useful for policy-making, sustainability related indicators need to be readily available on a more frequent and timely basis. This will require more political will and emphasis on timely indicator development.

INCLUSION IN THE EUROPEAN SEMESTER

The European Semester is the EU's annual cycle of economic policy guidance and surveillance. Its main focus is on economic policies for growth, jobs and investment. All these three areas are closely related to the transition towards a low carbon, resource efficient and more circular economy. It is thus evident that the European Semester's evidence base will need to be expanded to areas of raw material use and resource efficiency, once timely and robust indicators are available[7] Eventually, the European Semester could be expanded to report on national strategies implementing the 2030 Agenda for Sustainable Development and progress towards the SDGs.

MORE HARMONISATION OF INDICATORS NEEDED ON ALL LEVELS…

The development of methodologically sound indicators based on complete and robust data is a prerequisite for EU action on resource efficiency. However, corresponding data will also be required on the member state, regional

(3) DMC measures the total amount of materials (in tonnes) used by an economy. It is defined as the annual quantity of raw materials extracted from the domestic territory, plus all physical imports minus all physical exports (Eurostat, 2017b).

(4) According to Eurostat (2017b), RMC "measures the total amount of raw materials required to produce the goods used by the economy (also called 'material footprint')." Contrary to DMC, RMC therefore also includes all raw material required to produce the goods imported into the economy.

(5) In its current form, the EU SDG indicator set includes the following indicators under Goal 12: waste generation, recycling and landfill rate, consumption of toxic materials, resource productivity, CO2 emissions from passenger cars, and volume of freight transport relative to GDP. See http://ec.europa.eu/eurostat/documents/276524/7736915/EU-SDG-indicator-set-with-cover-note-170531.pdf

(6) The author is thankful to Mr Enrico Giovannini for his inspirations to this recommendation.

(7) The EU-funded H2020 project „CIRCULAR IMPACTS" looks at possibilities for better integrating the circular economy in the European Semester. See www.circular-impacts.eu for more information.

and local levels. To ensure transparency and comparability, there is a need for harmonised methodologies and data requirements across different levels.

On the regional level, Flanders, Belgium, is a good example of the development of regional indicators, based on specific local needs. While the development of such indicators should be supported, there is also a need for more harmonisation – also to avoid duplication of efforts.

…ALSO ON THE COMPANY LEVEL

Improving resource efficiency in the EU will require a strong engagement of the private sector. Policy-makers and business leaders will need to marry political commitments with business opportunities. However, there is currently no common framework or methodology to measure resource efficiency and circular economy activities in companies. There is therefore a need to identify operational 'key performance indicators' (KPIs) based on the inventory of available circular economy indicators and on an assessment of indicators already in use in companies in other areas (e.g. greenhouse gas emissions reporting etc.). The non-binding guidelines on the methodology for reporting non-financial information (NFI) published by the European Commission in June 2017[8] contain examples of environmental KPIs for companies. This is a step in the right direction, however, in order to ensure comparability of indicators and methodologies across companies from different member states, a more detailed and technical approach will be required.

Existing economy-wide circular economy measuring frameworks may serve as an inspiration for circular economy indicators for companies. For example, a KPI similar to the Resource Efficiency Scoreboard's 'resource efficiency' headline indicator could be constructed for companies, by putting the turnover (or a similar economic indicator) in relation to the company's raw material consumption.

Eventually, harmonised resource use/efficiency indicators – as part of the KPIs – need to become part of standard accounting practices and (compulsory) reporting requirements of companies. These harmonised indicators could then also play a role in the assessment of the creditworthiness of companies, improving transparency about exposure to carbon and other environmental risks. As always, the specific requirements and limitations of SMEs need to be taken into account.

TAKING THE ENTIRE SUPPLY CHAIN INTO ACCOUNT

In order to understand the full environmental impact of consumption, indicators should not only take into account the direct resource inputs but also the indirect material flows along the (global) supply chain of goods and services consumed in a country. This includes the indirect flows associated with processing products and with trade flows.

(8) http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017XC0705(01)&from=EN

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