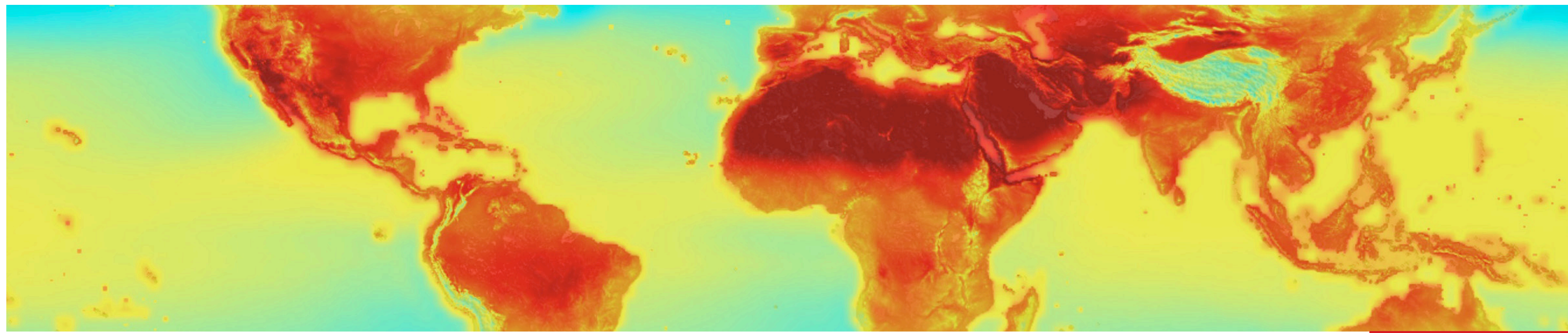

via their national budgets and 'conditional targets' where additional sources of financing will be needed for example through private sector investment and/or international support.

Against this background, the process of developing a national resource efficiency agenda should therefore consider from the beginnings prerequisites necessary for later NDC integration. This requires, amongst others, conducting detailed appraisals of priority actions for key sectors and developing a resource use related greenhouse gas inventory, together with a specific system for measurement, reporting and verification (MRV). Defining GHG abatement effects of resource efficiency measures along the value chain is a relatively new discipline requiring still more investigation. International exchange of experience gained in this field can therefore help to shorten the learning curve.

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Resource Efficiency for Climate Protection

Improving resource efficiency is a key contribution to climate protection. The efficient and sustainable use of natural resources bears many potentials for climate protection. These opportunities could be used more effectively. According to the International Resource Panel, resource efficiency is indispensable to meet the targets of the Paris Agreement cost effectively.

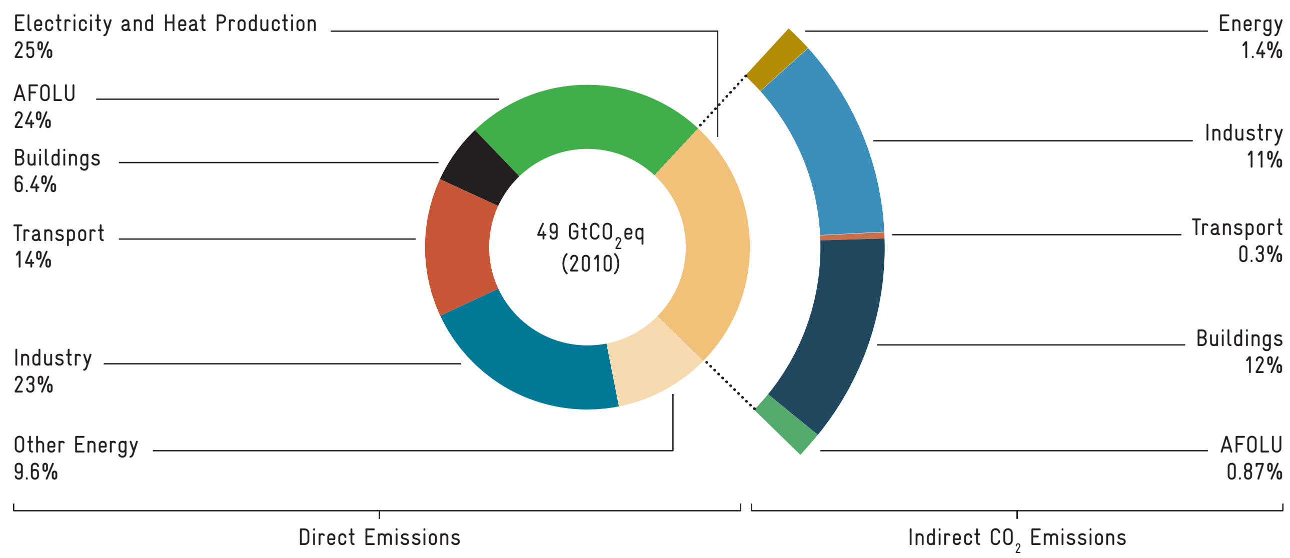
1 Population and economic growth driving resource use and global climate change

Since the beginnings of industrialization, anthropogenic greenhouse gas emissions have led to a 40% higher CO_2 concentration in the atmosphere. As a result, the global mean temperature is today 1.2°C higher than in pre-industrial times.

In 2015, the G20 countries had a share of 80% of global economic output, accounting for more than 86% of global greenhouse gas (GHG) emissions.[1] In spite of the progress made to reduce energy and carbon intensity of their economies, this has not been sufficient to compensate for economic and population growth.

Considering direct and indirect emissions, the industrial sector is worldwide the largest emitter, accounting for more than thirty percent of global GHG emissions. About a third of these emissions can be attributed to the extraction and processing of metals and minerals. If current trends concerning population growth, urbanization, carbon intensive production and consumption persist until 2050, demand for metal ores will increase by 96% and for non-metallic minerals even by 168%, going hand in hand with a plus of 41% in GHG emissions.[2] This would lead to a 3°C increase in global mean temperature by the end of the century.

Figure 1: Total anthropogenic GHG emissions (Gt CO_2eq per year) by economic sector: energy, industry, transport, buildings, and agriculture, forestry and other land use (AFOLU). Source: IPCC (2014)



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BOX 1

Paris Agreement

Mitigation goals	To keep a global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C.
Signatories	176 out of 197 Parties to the Convention have ratified so far (May 2018[3]) the Paris Agreement and confirmed to the UNFCCC their Nationally Determined Contributions (NDC).
Main mitigation actions	Nearly all countries address in their NDCs mitigation actions in the energy sector, followed by energy supply, transport and waste.
Emission gap	If all NDCs were implemented, only 45% of the necessary emission reductions would be reached in 2030[4] for a two degrees pathway. Global warming would therefore still increase between 2.9°C and 3.4°C by the end of this century, relative to pre-industrial levels.
Update of NDCs	Countries need to identify further options for closing the gap, raising the level of ambition of the updated NDCs to be submitted to the UNFCCC by 2020. Resource efficiency provides an opportunity to raise the ambition of NDCs.

These interactions illustrate the close nexus between resource use and GHG emissions. They underpin at the same time the huge potential a more efficient and effective use of natural resources can have not only for mitigating negative climate impacts but also for increasing competitiveness of industry and employment opportunities.

2 Potentials for linking resource efficiency with climate protection

To assess the impacts of global resource use on GHG emissions to 2050, the International Resource Panel (IRP)[5] modelled different scenarios: Following existing trends, resource use would increase until 2050 by 119%. This increase could be reduced by one third if effective resource efficiency strategies were implemented. These should for example combine technical resource innovation and improvements, fiscal instruments, and shifts reducing resource demand through regulations, planning and procurement policies. Combining these resource efficiency strategies with ambitious GHG abatement policies in line with the 2°C target – defined in the Paris Agreement- this would even allow halving resource use and reducing GHG emissions by 63% compared to 2015. In all scenarios, the economic benefits would offset the necessary investments. With annual economic benefits of $2 trillion by 2050, a smarter and more efficient use of the world's natural resources would even offset the costs of ambitious climate change action for keeping global warming below 2°C.

As resource use and GHG emissions go hand in hand, resource efficiency potentials coupled with GHG emissions reductions exist in all countries, with different sectors as possible entry points. Increasing resource efficiency in the iron and steel industry for example would potentially achieve a GHG emission reduction of 9 to 30 percent, and resource efficiency measures in the cement production between 20 and 25 percent reduction.[6]

Example 1: Closing the loop for aluminium chips[7]

Companies producing aluminium profiles generally have to deal with metal waste. In one case, a company was generating about 50 tons of aluminium chips per year. Due to the mixture with cooling lubricants, these aluminium chips could not be easily smelted and thus not to be used as secondary raw material. As costs for collection and removal of the waste material exceeded its value, the company purchased a briquetting press to turn the aluminium chips into briquettes. This not only reduced significantly the bulk volume but also allowed pressing out the cooling lubricants almost completely. Such briquettes are suitable for smelting, allowing the company to close the loop, saving in logistics and material purchasing. The investme paid for itself after about two years, reducing simultan ously the GHG footprint of the company: The sourcir and processing of 50 tons of aluminium from primary sources corresponds to about 640 tons of CO_2 equivalents, using recycled aluminium for the quantity has a carbon-footprint of about 90 tons.

Example 2: Metallic additive manufacturing of lightweight components[8]

Taking a small series of 12 wheel carriers suitable for lightweight vehicles as example, Fraunhofer Institute for High-Speed Dynamics at the Ernst Mach Institute (EMI) in Germany analysed the relevance of 3D printing of metal components for resource efficiency and climate protection. The design of a wheel carrier offering maximum performance for the defined load scenarios turned out to be a challenge for conventional production processes such as turning or milling. Therefore, additive manufacturing was chosen as alternative. Thanks to the lightweight design, 28% less material was used per component. The additive production of the lightweight model required 10 kilowatt hours per piece, compared to 12 kilowatt hours required for the traditional design. CO_2 emissions were 19% lower. In addition, the lightweight construction also reduced production time by 14%.

3 Recommendations

While renewable energies and energy efficiency are widely recognized as relevant for mitigating climate change, the potentials of resource efficiency appear to be still underestimated. Yet, resource efficiency becomes more and more relevant as a key contribution to climate protection. Against this background, initiating national processes – ideally multi-stakeholder – for raising awareness of these potentials and existing gaps and to link resource efficiency and climate policy, as well as sharing good practice from national and international level is an important step. It can help to identify priority fields of action, paving the way towards a roadmap on resource efficiency with common goals, indicators, activities for implementation and strategies for communication.

Following the Paris Agreement Ambition Mechanism, by 2020 countries will have to take stock of progress and - informed by this stocktake - submit a climate action plan that is progressively more ambitious than the last. Given the existing emission gap, countries could use this process for linking their Nationally Determined Contributions with their resource efficiency agenda. The NDCs differentiate between 'unconditional targets' countries can meet

BOX 2

Carbon intensity of metals and secondary raw materials

Turning metals into products requires large amounts of energy in the upstream value chain to extract, refine, process and transport the initially mined ores and concentrates. In 2012, iron and steel alone accounted for 6.2% of global GHG emissions.[9] The carbon-footprint of primary and secondary raw materials differ considerably, illustrating the relevance of the use of secondary raw materials in industry and infrastructure for climate action.[10, 11]