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Framing the ambition of carbon neutrality

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I. Defining carbon neutrality

1. How to understand the terms 'decarbonization' and 'carbon neutrality'? It is not about removing carbon itself – it is the combination of carbon and oxygen (carbon-dioxide) which yields harmful consequences for the global climate. Carbon-dioxide (CO_2) accumulates in the atmosphere through natural and anthropogenic processes. In the atmosphere, CO_2 absorbs heat and thus causes the atmosphere to heat up.

2. There are, CO_2 aside, other substances which have a similar effect on the atmosphere, hence they are also regarded as advancing global warming, i.e. greenhouse gases (GHG) or CO_2-equivalents.

3. Does carbon neutrality include these emissions, as well? What does carbon neutrality mean? Do we aim for CO_2-neutrality? Is simply moving towards CO_2-neutrality sufficient for attaining the goals as agreed on in the Paris Climate Agreement? Or does this require including CO_2-equivalents? Does a full removal of GHG equal climate neutrality? And, what is the actual difference between climate neutrality and environmental neutrality?

4. Moreover, is 'neutrality', defined as absolute neutrality (no emissions remaining), or is 'net neutrality' the goal, defined as neutrality after summing up all positively and negatively contributing factors (remaining emissions are cancelled out through compensatory measures, i.e. planting trees or purchase of emission certificates)?

5. Conceptualizing this is essential in order to set climate goals and implement respective policies. If not properly defined, misconceptions will inherently lead to inefficient approaches and disputes during implementation. With regard to this, capabilities and characteristics of each actor – and especially on a macro level societal, geopolitical and strategical considerations of nation-states – need to be included before setting terms and recommendations.

6. Actions to attaining different levels of neutrality may be considered as follows:

(a) Carbon neutrality:
  (i) reducing CO_2 emissions;
  (ii) CO_2 compensation measures;

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(b) Climate neutrality:

(i) reduction and compensation of further GHG[2] with global-warming potential (GWP[3][4]): CO_2-equivalents[5];

(ii) non-fluorinated: methane (CH_4), nitrous oxide (N_2O);

(iii) fluorinated: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6),

nitrogen trifluoride (NF_3).

(c) Environmental neutrality:

(i) avoidance and compensation of any other means negatively impacting on the environment and health (i.e. pesticides, nitrogen oxides (NO_x), soot, sulphur dioxide (SO_2), particulates, etc.).

II. Necessity of establishing clarity on the target variable

7. How will decision makers be able to make good decisions if the issue to decide or act upon itself is not sufficiently clear: If for instance carbon neutrality is the proclaimed goal, is the intended goal neutralising all CO_2-emissions or does the goal extend to CO_2-equivalents as well, changing the actual goal to climate neutrality?

8. Clarity on the target variable is hence essential to make good decisions, the presence or absence of an 'CO_2-e'-suffix changes the scope and corresponding strategy significantly. The challenge in this in particular is that usually – at least it should be like this – decision makers believe that the context is clear. Unambiguity therefore requires all stakeholders involved to be conscious of the clear definition(s) of the issue discussed, as well as having clear communication with one another.

9. The commonly used response to the question 'do you know what I mean' – 'yes I understand' emulates a perceived common understanding of the matter in question whilst in reality this means 'I believe I know what you mean' and can significantly harm, delay or prevent succeeding in achieving the (actually intended) goal set, respectively wasting time and resources. This calls for ensuring mutual understanding on targets and definitions rather than well intended assumptions (i.e. 'let us do something good for the environment' or in a personal context 'let us do something nice together' –> likelihood that something 'good' or 'nice' is considered to be something very different is high): hence, (order) clarification, where the involved parties define each element part of or excluded for target achievement is critical.

10. In context of this document: are CO_2-equivalents considered (hence GHG with the corresponding target of 'climate neutrality') or not?

11. Target-setting aside, measuring progress on the set target must be against statistics of the very same definition consistently and in the same manner. If it is not an absolute goal such as net-zero or incorporates milestones, the definition of base-figures is essential (i.e. certain percentage of reduction by 2030; this frequently is based on 1990 figures, but it cannot be assumed unless clearly stated). Less important in the long run, but critical during the starting period, is whether early milestones aim at, i.e., have strategies derived or contracts ready to be

[2] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Greenhouse_gas_(GHG)

[3] https://unfccc.int/process/transparency-and-reporting/greenhouse-gas-data/greenhouse-gas-data-unfccc/global-warming-potentials

[4] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Global-warming_potential_(GWP)

[5] https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Carbon_dioxide_equivalent

tendered or the strategies approved, and the contracts awarded and signed. Here only absolute clarity will allow feasibility of schedules and successful progress. In practice, however, climate and environmental neutrality are often confused among another, as are carbon and climate neutrality.

III. The hidden long-term relevance of industry

12. Noting fluctuations depending on country, industry accounted for approximately 18 percent of global GHG emissions in 2018, including energy, process and use-related emissions.[6] Depending on the set-up of manufacturing in a country the share of process emissions amongst total emissions varies. In Germany, industry accounted for around 23 percent of the country's GHG emissions, with one-third of these attributed to process-related emissions and two-thirds to energy-related emissions.[7] Looking at this from a status quo perspective, working on all sectors generating GHG emissions is an impediment and equally important. For the long-term perspective, however, it is the manufacturing sector that determines the majority of future emissions and, consequentially, whether or not carbon, climate, or environmental neutrality can be achieved.

13. Whilst it is necessary to improve 'the existing' across all sectors, decisions on the design, the sourcing and choice of materials, the lifetime energy consumption, the durability, as well as the energy and resources consumed during the manufacturing process are taken in those companies manufacturing future goods (i.e. ships, power-generating technologies, components for buildings). It is these determining the environmental performance.

14. As seen, regulative measures such as phasing out traditional light bulbs, can guide or accelerate process to longer lasting or more energy efficient goods. Similarly, in regions where a price on emissions is in place, there is a cost incentive encouraging decision reducing the footprint of manufacturing-related emissions.

15. Considering the long-lasting nature of many types of machinery, vehicles, building components, there is an urgency in encouraging and facilitating rapid transition. The products that are being designed now, will be manufactured in the future, and will in use for many years to come.

IV. Carbon neutrality in industry

16. Working towards carbon (or climate) neutrality requires an effective assessment of the status quo. Awareness on the macro level is not sufficient in this instance as the manufacturing sector in particular is very diverse: company size determines, for instance, whether or not a dedicated person can take care of the issue, or whether the level of investment or cost per tonne of carbon emissions avoided is of higher relevance, the manufacturing sector determines through the specific mix of processes applied in that sector how emissions can be reduced and the energy intensity determines the associated cost lever.

17. In order to tailor fitting solutions understanding realities on the micro level, notably assessment of the topic and intentions to act on a company level, there is a necessity to understand:

(a) How effective are current policies considered to facilitate an increase in energy efficiency in industry?

(b) What measures, if any, are being taken by companies to reduce their carbon footprint?

[6] See UNFCCC_GHG_EMISSIONS_1990-2018_ANNEX1, by sector: 1.A.2 and 2 as share of GHG emissions without LULUCF

[7] See https://www.umweltbundesamt.de/daten/klima/treibhausgas-emissionen-in-deutschland#emissionsentwicklung-1990-bis-2018

(c) Are energy, resource and carbon footprint being considered during product development? In terms of the manufacturing process, or in terms of the whole life cycle? Which of these has the highest priority?

(d) Do companies aim at net-carbon or net-climate neutrality? If so, where do they stand in this effort. By when? If not, what is or are reasons for it?

(e) What factors motivate companies to reduce their GHG emissions?

(f) What GHG reduction do companies aim for within the next 5 years? How much of this do they associate with which type of measure?

(g) Which factors are most decisive in determining the aforementioned mix of measures?

(h) In what way does the COVID-19 pandemic affect companies energy efficiency and decarbonisation strategy?

18. On a policymaker level, the answers to these questions matter significantly, as they give an indication as to whether planned decarbonisation progress by industry is in line with the degree of progress intended by policymakers. Not only the progress itself matters, but also the method chosen: if, for instance, companies aim to decarbonise by largely switching to renewable electricity, this may lead to a demand overshoot: the increase in the supply of renewable electricity is not sufficiently high to satisfy the increase in demand for renewable electricity. Similarly, if a majority of measures is to take place on site, are there sufficient capacities among planning authorities, etc.

19. From a system perspective, it therefore makes sense (1) to reduce energy and resource consumption and then (2) to substitute with renewable sources, before (3) compensating what is left. From an infrastructure perspective, it is beneficial to aim for local substitution first (i.e. micro generation, such as photovoltaic, micro hydro, etc.). Not only does such sequence increase a company's resilience to supply and price shocks, but also places the ability and responsibility to act to companies rather the country. This is important as the general energy and (green) generation infrastructure undergoes at times long planning and building times, besides from being often unpopular. To increase transparency on a planning level, it makes sense to determine the 'decarbonisability-factor', the share of a company's emissions it is able to take care of locally, respectively the remaining share that needs to be taken care off 'by the system' (energy infrastructure and compensatory measures).

20. It should to be noted that the ability to decarbonise differs significantly between companies whose business model is based on releasing emissions (coal companies for example), to companies whose business model is by nature carbon negative (for example lumber). Between companies that release in majority process emissions, to companies whose emissions are solely energy-related. Between companies where the majority of emissions are under their direct control to those, often larger ones, that assemble pre-products without releasing a significant share of the product's total emissions (like car manufacturers).

21. Over the next months and in a collective effort, the 'Energy Efficiency Barometer of Industry' (www.eep.uni-stuttgart.de/eeei), aims to gather answers to the aforementioned questions from manufacturing companies across the UNECE region. Sufficient responses permitted, this undertaking will shed light on the current realities in manufacturing across all company sizes, all 27 manufacturing sectors and different energy intensities across the region, and ideally as many individual UNECE member countries as possible. Whilst technical aspects will be similar, other aspects influencing responses to the questions raised are likely to differ across countries.

V. Conclusion

22. A clear definition and mutual understanding of the target variable, the goal aimed for and the associated timeframe, are a prerequisite to its achievement (for instance climate neutrality by 2050).

23. The industrial sector is varied in different dimensions. The sector has a pivotal role in enabling us to achieve the goal set.

24. Therefore, understanding the sectors' actions, plans and ambitions – as well as the differences across company size, subsector and energy intensity - is essential to shape, suitable support mechanisms, regulatory frameworks, infrastructure, and local authorities' planning capacity to avoid bottlenecks and ensure achieving the goal on time.