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Joint technical note by the UNFCCC and UNEP:

The reasons behind the differences in projected emissions totals for 2030 between the UNFCCC NDC Synthesis Report and the UNEP Emissions Gap Report 2021

Background: The UNFCCC NDC Synthesis Report (published on 17 September, updated on 25 October 2021) and the UNEP Emissions Gap Report (published on 26 October 2021) present projections of global GHG emissions to 2030, and to some extent beyond 2030. The projected trajectories of global GHG emissions somewhat differ in the two reports: for example, for global GHG emissions in 2030 the difference is about **6-7 Gt CO_2** equivalent. Overall, the range of UNEP GHG trajectories is lower than the range of UNFCCC trajectories.

Common messages:

Both reports are consistent in clearly indicating that currently the world is not on a path leading to limiting the increase in global temperature by 1.5 °C or below 2 °C by the end of the century.

Both reports indicate that the net-zero targets would bring the world a sizable step closer to limiting warming well below 2°C or 1.5°C, with the UNFCCC Synthesis report also showing that 2050 per-capita emission levels of the subset of countries with long-term targets are in line with global averages under 1.5°C-with-limited-overshoot and 2°C scenarios. Furthermore, the UNEP Emissions Gap Report 2021 indicates that achieving net-zero targets in addition to the current NDCs would lower future temperatures by a sizable 0.5°C compared to a world without such long-term targets. Both reports are consistent in terms of their temperature projections, as the upper end of the unconditional NDC emission ranges is shown to be in line with a scenario that leads to 2.7°C warming (UNFCCC, median warming estimate quoted from IPCC). The UNEP Gap report focuses on the warming that is avoided with 66% probability, and projects the unconditional NDCs to lead with 66% probability to warming below 2.7°C (range 2.2–3.2°C).

Reasons for differences in 2030 emissions:

The 6-7 Gt lower estimates of the UNEP report in the 2030 emissions are explained in the points below. Note that the impact of these points tends to add up to more than 6-7 Gt, but some differences affect more the lower or conditional ranges, whereas others the high end:

- **GWP-AR4 versus GWP-AR6 (around 1 Gt):** the UNEP report uses GWP values from the IPCC 4th Assessment Report (AR4)[1] of the IPCC (published in 2007) because countries and also the literature most often still uses these values, whereas the UNFCCC report uses the GWP values from the IPCC 6th Assessment Report.[2]
- **'Including announcements' versus 'NDCs-only' (around 1.2 Gt).** The UNFCCC report is based exclusively on all latest NDCs officially submitted to the UNFCCC secretariat and recorded in

[1] Some GWP values from AR4: CO2 = 1; CH4 = 24; N2O = 298.

[2] Some GWP values from AR6: CO2 = 1; CH4 = 27.2-29.8; N2O = 273.

the interim NDC registry as at 12 October 2021; the UNEP report uses, in addition to the information from NDCs, also an assessment of the impact of recent political statements with commitments to reduce or limit GHG emissions that have not yet been submitted as an official NDC.[3]

- **Overachievement versus stated NDCs (up to 2-4 Gt):** The UNEP report averages estimates for eight available studies, which mostly include current policies scenarios, and for the NDC scenarios they take the lower estimate of the NDC or the projected emissions under current policies. This assumption lowers the global GHG emissions projection of the UNEP report compared to an assessment based on NDCs only. The UNFCCC report in contrast aggregates emission estimates that are purely based on submitted NDCs.
- **Different representation of LULUCF (up to 2-3 Gt):** Individual studies use various sources for estimating emissions from LULUCF, which can differ in their definition[4]. The UNEP gap report averages across eight studies, many of which explicitly adjust for LULUCF definitions consistent with the IPCC scenarios , while for some others the approach is somewhat unclear in that respect. The UNFCCC report, on the other hand, consistently follows the same convention for LULUCF emissions that is taken in the global modelling studies in the SR1.5 database and to which 2030 emissions are compared to. Thus, the estimated emission gap by UNEP Gap report might be 2-3 Gt smaller, if all underlying studies had used the same approach[5].
- **Harmonisation to historical emissions (around 2-3 Gt):** The UNFCCC report global emission numbers are harmonised[6] to recent emissions that are also consistent with the scenarios used in the IPCC AR6 WG1 Report, to directly compare its NDC estimates with scenarios from AR6 and SR1.5. About half of the studies in the UNEP gap report also use a harmonisation; which is reported in the underlying studies. However, the stated numbers in the UNEP Gap report do not include the harmonisation adjustment of the individual studies because the UNEP gap report chooses not to collapse the uncertainty in historical emissions found in the different studies it assesses into a single value. The harmonised UNEP Gap report numbers would be 2-3 Gt higher (depending on lower/upper or conditional/unconditional range setting).[7]

The UNEP Emissions Gap Report includes several estimates of global aggregate emissions for current emissions. For example, chapter 2 of the UNEP Emissions Gap Report reports 58.1 Gt CO_2eq for 2019, while the data underlying the analysis in chapter 4 suggests around a level of about 53.5 Gt

[3] For example, for China and the Republic of Korea

[4] National Greenhouse Gas Inventories consider all CO_2 fluxes on managed land to be anthropogenic, while global modelling studies, including the scenarios in the SR1.5 scenario database, exclude the natural effects (e.g. because of CO_2 fertilization effects) from their anthropogenic LULUCF estimates. See Grassi et al (2021) for a discussion.

[5] That is, to account for anthropogenic fluxes on managed land, but not for natural ones.

[6] Harmonisation is dealing with a mismatch of historical emissions. Some scenario or bottom-up studies imply slightly lower or higher emissions of greenhouse gases compared to what climate models are calibrated against. The harmonisations process itself is adjusting (either by scaling or by applying an offset that diminishes over time) the original scenario or emission trajectory so that it matches an agreed historical 'best-estimate' reference point. It is usual practice for emission scenarios that they are 'harmonised' to the same historical emission level, with more details described in Gidden et al. (2019) (https://doi.org/10.5194/gmd-12-1443-2019)

[7] The different representation of LULUCF (previous point) and this harmonisation difference are overlapping, i.e., if one is higher, the other is lower.

(see also Figure 4.2, which implies roughly 55 Gt CO_2eq for 2019 emissions). This difference between chapter 2 and chapter 4 comes from the fact that in chapter 4 historical data from modeling teams are used, while in chapter 2 data from country reporting and international databases are used. This difference is similar to that in the last year's report, and it was explained in Box 3.1 in UNEP Emissions Gap Report 2020.

Conclusion:

The UNFCCC NDC Synthesis Report and the UNEP Emissions Gap Report present fully consistent messages despite some differences in approach and modelling choices. Estimates of how much global warming would result from the implementation of the current NDCs by the end of the century are consistent across the two reports. Both reports confirm that there is still a large emissions gap between what is pledged at present and what is required to limit warming to 1.5°C or well below 2°C.