This brief document provides key information about ‘construction’ and suggested application of the air pollutant emission factors sets for SSP sccenarios produced by IAMs. We have tried to simplify the air pollution storylines a bit compared with Rao et al (2017) used for AR6 scenarios. Contrary to the previous set from 2017, the three datasets with air pollutant emission factors can be directly used for the whole time horizon for supported sectors and regions. Of course the users can also combine the sets and develop modified storylines if needed – can be discussed and finetuned if needed. The three datasets include

* Baseline SSPs and these can be used forrespective SSPx for high and medium (see Table 1)
* The SLE set can be used for selected variants (see Table 2)
* The MTFR set can be used for selected variants (see Table 2)

Here further details and some background:

Table 1 provides simplified overview of assumptions used in calculation of emission factors (EFs) for the baseline scenario across SSPs. The government capacity index (GCI) is used as a multiplier and so the CLE emission factors calculated in GAINS, which are year specific (provided in 5-year steps until 2050), are multiplied by the country, year and SSP specific GCI to produce the final set of factors. The GCI for SSP1,3,4,5 are calculated as relative change to the GCI for SSP2.

Note that the calculation of the implied CLE emission factors in GAINS are based on IEA World Energy Outlook stated policies scenario (STEPS) (IEA, 2023), FAO agricultural outlook to 2050 (FAO, 2018), and own assumptions as implemented in the GAINS model. The IEA STEPS scenario (WEO, 2023) has similar storyline as SSP2. After 2050, the2050‘s CLE and SSP specific GCI is used to calculate the emission factor up to 2100. All emission factor trajectories are provided for all key air pollutants relevant for the IAM work (SO2, NOx, BC, OC, CO, NH3, NMVOC) at IMAGE region level.

We suggest using emission factors trajectories as described in Table 1 for the high (H) and medium (M) variants, see also Figure 1.

Table 1: Air pollution policy and implementation effectiveness in high and medium scenarios.

|  |  |  |  |
| --- | --- | --- | --- |
| SSP (variant) | 2020 | 2025-2050 | 2050-2100 |
| 1,3,4,5 (H, M) | CLE(GAINS) | CLE(GAINS) \* GCI (SSPx/SSP2) | 2050 EF \* GCI (SSPx) |
| 2 (H, M) | CLE(GAINS) | CLE(GAINS) | 2050 EF \* GCI (SSP2) |

The narratives for further variants (Table 2) of the scenarios rely on the baseline (Table 1) and additional set of emission factors referred to as SLE (strong legislation) and MTFR (maximum technically feasible reduction), which are also developed at country/region level and aggregated to IMAGE regions.

The SLE set of emission factors (Table 2) evolves over time stating with the CLE until 2030 and then is adjusted in 25% reduction steps when given country moves from one income category to the other, i.e., Low (L) to Medium(M) and Medium (M) to High (H). The 25% reduction in EF is dependent on sector and region as it is 25% reduction of the ‘gap’ between CLE and MTFR value for a given sector/region in a given period.

The MTFR set (table 2) is also evolving linearly after 2050 to reach the minimum MTFR value in a given sector/region by 2100.

Table 2. Proposal for assumption on development of EFs for further variants…L/M/H

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variant | 2020-2030 | 2030-2050 | 2050-2100 | Description |
| Medium-Overshot (MOS) | As in Baseline | SLE (SSPx) | SLE (SSPx) | The gap between CLE and MTFR is reduced SSP specific pace dependent on income level development L/M/H |
| Low (L) | As in Baseline | SLE (SSPx) | SLE (SSPx) | The gap between CLE and MTFR is reduced SSP specific pace dependent on income level development L/M/H |
| Low Overshot (LOS) | As in Baseline | MTFR (GAINS) | MTFR (GAINS) -> min MTFR (GAINS) | qq |
| Very Low (VL) | As in Baseline | MTFR (GAINS) | MTFR (GAINS) -> min MTFR (GAINS) | Reducing sector/region MTFR EF in 2050 to the minimum MTFR value (most efficient GAINS technology in 2050) by 2100. Linear approach is used. |

The QUESTION is if there shall be a different definition/assumption on how the trajectory for the variants looks like dependent on the underlying SSP (beyond the already embedded differences in the SLE and MTFR factors); current proposal is to keep it independent and so use the below for all SSPs with respective variants.

Below, the stylized concept of the CMIP7 scenariso for reference in Table 2.

A diagram of a design

AI-generated content may be incorrect.Figure 1. Stylized, qualitative design for the CMIP7 ScenarioMIP scenarios; Source: <https://wcrp-cmip.org/wp-content/uploads/2024/04/24-04-15_ScenarioMIP-CMIP7-proposal_final.pdf>