

# Calculation of Paris-compatible Emission Paths with the ESPM

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## Political decisions necessary

Important framework data for deriving Paris-compatible NDCs must ultimately be decided politically.

The following agenda is therefore proposed:

- ▶ Concretization of framework data such as the **global CO<sub>2</sub> budget** and the role of net negative emissions based on current scientific knowledge.
- ▶ Establishment of a **national CO<sub>2</sub> budget** that does justice to a fair and economically sensible distribution of a global CO<sub>2</sub> budget.
- ▶ Regarding reduction targets: Orientation on compliance with the national CO<sub>2</sub> budget and a **meaningful course** of the **annual change rates**.
- ▶ **Regular adjustment** of framework data and reduction targets based on scientific knowledge and new developments.

## Extended Smooth Pathway Model (ESPM)

The ESPM provides a framework for operationalizing this political agenda (cf. [1], [2], [3], [4]).

The ESPM consists of two steps:

- (1) Determination of a national CO<sub>2</sub> budget.
- (2) Deriving national emission paths that comply with the national CO<sub>2</sub> budget. A temporary overshoot can be taken into account.

## National budgets

In order to derive national budgets from a global budget, an allocation key is needed. The ESPM offers a weighted distribution key that incorporates a country's share of global emissions and its share of the global population in a base year. With this two-dimensional distribution key, the current emissions reflect the **current reality** and the population shares address the issue of **climate justice**. This leads to the following weighting formula:

$$B^i = \left( C * \frac{P_{BY}^i}{P_{BY}} + (1 - C) * \frac{E_{BY}^i}{E_{BY}} \right) * B$$

where

$E_{BY}$  or  $E_{BY}^i$     global emissions or emissions of country  $i$  in the base year  
 $P_{BY}$  or  $P_{BY}^i$     global population or population of country  $i$  in the base year  
 $B$  or  $B^i$         global CO<sub>2</sub> budget or national CO<sub>2</sub> budget of the country  $i$   
 $C$                 weighting of population

However, the national budgets can also be determined with other distribution keys.

## National paths

The ESPM offers the Regensburg Model Scenario Types RM 1 – 6 to derive national emission paths that meet the given budget [5]. The scenario types cover the range of plausible possibilities well. These scenario types are plausible in the sense that the courses of the annual change rates do not show any arbitrary changes in direction.

Which type of scenario makes sense must be judged from an overall climate policy perspective. The following questions can play a role:

- (1) Do initially low reduction rates imply an unacceptable burden for the future, since these later require extremely high reduction rates?
- (2) Or do high later reduction rates even make sense because they give you a longer lead time for the necessary investments? However, this requires a very credible climate policy.
- (3) Do rapidly increasing reduction rates lead to a more credible climate policy right from the start, which creates planning security for public and private investments in a fossil-free future?

## Tools

- Web apps:
  - National CO<sub>2</sub> budgets for all countries in the world: <http://short.national-budgets.climate-calculator.info>
  - Budgets and emission paths for the EU: <https://eu.climate-calculator.info>
  - Emission paths that comply with a predetermined budget: <https://paths.climate-calculator.info>
  - Overview apps: <https://www.climate-calculator.info>
- Excel tools:
  - ‘[ESPM](#)’: This tool contains a database with the emissions data of all countries in the world. Therefore, Paris-compatible emission paths can be calculated for all countries [6].
  - ‘[Paths\\_RM\\_ST](#)’: With this tool, RM scenario types can be used to calculate emission paths that adhere to a predefined budget [7].
  - [National CO<sub>2</sub> budgets](#) for all countries in the world [8].

## References

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