WBGU
Wissenschaftlicher Beirat Globale Umweltveränderungen
German Advisory Council on Global Change

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The WBGU Budget Approach

The German Advisory Council on Global Change (WBGU) has developed an innovative approach to tackling the problem of climate change. A key component is an agreement between the community of states regarding a cap, in the form of a global budget, for the total amount of carbon dioxide that may be emitted from fossil-fuel sources until the year 2050, in order to avoid dangerous climate change. As the global budget would be distributed among all countries in line with fundamental principles of equity, the budget approach can serve as the basis for a new global climate treaty.

Key elements of the budget approach

- The 2°C guard rail is adopted as legally binding in international law.
- For carbon dioxide (CO_2) from fossil sources, a global emission budget that is compatible with the 2°C guard rail is adopted.
- The global CO_2 budget is subdivided into national CO_2 budgets among all countries on an equal per-capita basis.
- Global CO_2 emissions must start to decrease between 2015 and 2020.
- Each country is committed to producing verifiable decarbonization road maps.
- An international emissions trading system is established, with all countries participating.
- The extent and institutional arrangements for financial and technology transfers are agreed.
- A decision is taken to establish a world climate bank.
- For CO_2 emissions resulting from land-use changes, especially deforestation, a separate legally binding regime is agreed.
- Specific agreements are reached on other greenhouse gases and climate-relevant substances.

The 2°C guard rail

As a result of anthropogenic greenhouse gas emissions, globally averaged surface temperatures have increased by 0.8°C since the Industrial Revolution. Unless emissions are reduced, a further temperature rise of between 2 and 6°C could occur by the end of the century. The consequences would include irreversible sea-level rise and more frequent droughts. The worst effects of climate change could be averted if global warming is kept below 2°C through comprehensive climate protection measures. More than 100 countries have recognized the significance of this 2°C guard rail. While it is a scientific benchmark for climate change mitigation, it certainly does not guarantee impact-free climate change. Even warming of 2°C will have a lasting effect on the climate.

The global CO_2 budget

In order to avoid dangerous climate change, the international community must limit the total amount of CO_2 emitted from fossil-fuel sources by setting a global budget. This budget should not exceed 750 billion tonnes (Gt).

In order to limit global warming to 2°C, a cap must be set on the total amount of CO_2 emitted globally from fossil-fuel sources. Due to their sheer quantity and immense longevity in the atmosphere, CO_2 emissions must be the key focus of climate change mitigation. WBGU therefore proposes the introduction of a mandatory global cap in the form of a global CO_2 budget that may be emitted until the year 2050. The higher the desired probability of limiting warming to 2°C, the smaller the available budget is to be set. WBGU proposes a global budget of 750 Gt CO_2 for the period 2010–2050. With this amount, there is a two-thirds probability that climate warming can be kept within the 2°C guard rail.

Limits and leeway: National emissions budgets

Once the global budget has been determined, it needs to be distributed among all countries. An appropriate solution is to allocate emissions on an equal per-capita basis. Reduction targets can be derived from the national budgets, which ensures the compatibility with current climate negotiations.

The principle of equality is a good starting point for the fair distribution of the global budget. This principle cannot directly be used to derive an individually enforceable right to equal per-capita emissions, but it does imply that equal per-capita emissions should be the basis for the allocation of national emissions budgets.

Per-capita emissions are calculated from the global budget and the world's population in a given reference year, to be determined at political level. A world's population of 6.9 billion in the year 2010 and a global budget of 750 Gt CO_2, would allow for average annual per-capita emissions of 2.7 t CO_2 until 2050. For this calculation, population growth is not taken into account.

National emissions budgets are based on the size of the national population. With an estimated population of 82.2 million for 2010, Germany would have a national CO_2 budget of 9 Gt. How quickly a country exhausts its national budget will depend on its emissions and hence its mitigation efforts. If Germany's annual CO_2 emissions of around 0.9 Gt remain unchanged at the current level and no flexible mechanisms are deployed, the German budget would be exhausted within 10 years (Table 1).

National budgets thus create a framework for national climate strategies and allow for short-term reduction to be derived. The budget approach could establish a systematic basis for negotiations of national reduction targets up to 2020 and thus offers guidance for the ongoing international climate negotiations. It puts an end to the current protracted method of negotiating individual countries' reduction targets at international level.

Table 1: National budgets for compliance with the 2°C guard rail with a 67% probability. Source: WBGU. 2009

	Estimated share of world population in 2010 [%]	Budget 2010–2050 [Mrd. t CO_2]	Estimated emissions in 2008 [Gt CO_2]	Reach of the budget lifetime. assuming annual emissions as in 2008 [years]
Germany	1.2	9.0	0.91	10
USA	4.6	35	6.1	6
China	20	148	6.2	24
India	18	133	1.5	88
Burkina Faso	0.24	1.8	0.00062	2.892
World	**100**	**750**	**30**	**25**

A race against time

The decarbonization process must be launched as soon as possible. Unless total global emissions start to decrease between 2015 and 2020, it will be almost impossible to achieve compliance with the 2°C guard rail.

The national budgets show that is is extremely urgent to take action. A rapid switch to a decarbonization pathway is unavoidable. Any delay or half-heartedness by countries in initiating the requisite climate protection measures will result in very substantial CO_2 emissions reductions having to be achieved within a very short period of time.

As the restructuring of energy, production and transport systems takes time and is often a controversial issue at both political and societal level, it is unrealistic to expect substantial emissions reductions to be achieved within a few years. If total annual global emissions only start to fall after 2015, this would lead to annual global emissions reduction requirements of up to 5% in order to ensure compliance with the global budget in 2050. The world would then have to achieve in every single year the same emissions reductions for which the Kyoto protocol has allowed the industrialized countries full two decades.

To achieve an early reversal of the emissions trend, governments need to agree on the requisite emissions reductions and commence restructuring towards low-carbon economies without delay. The course towards a climate-compatible future must be set now, for the window of opportunity is starting to close.

Flexibility in the budget approach: Emissions trading

Flexible mechanisms like emissions trading are crucial components of the budget approach. Ideally, it offers every country sufficient leeway to reduce its emissions, thus facilitating compliance with the 2°C guard rail.

Countries can be classified broadly in three groups according to the number of years their allocated budget would last at the present level of emissions (excluding emissions trading). Group 1 comprises approximately 60 countries whose budget – at their current rate of emissions – would be exceeded in less than 20 years. It mainly includes industrialized countries, but also oil-exporting countries such as Saudi Arabia and Venezuela, as well as a small number of emerging economies, e.g. Malaysia and South Africa. Group 2 consists of around 30 countries whose budget would last for 20–40 years. This group includes China, Mexico and Thailand. Group 3 comprises around 95 countries whose budget would last for more than 40 years. It mainly includes developing countries, as well as some emerging economies such as India and Brazil.

By engaging in emissions trading, countries in Groups 1 and 2 will gain extra leeway: their emissions could thus decrease at a slower rate, and they would delay the exhaustion of their budgets (Fig. 1). Group 3 countries thus generate revenue, which should mainly be invested in a low-carbon development. Because their national budgets shrink by selling emission allowances, their emissions would have to increase more slowly, and they would need to start reducing their emissions at an earlier stage, than would be the case without emissions trading.

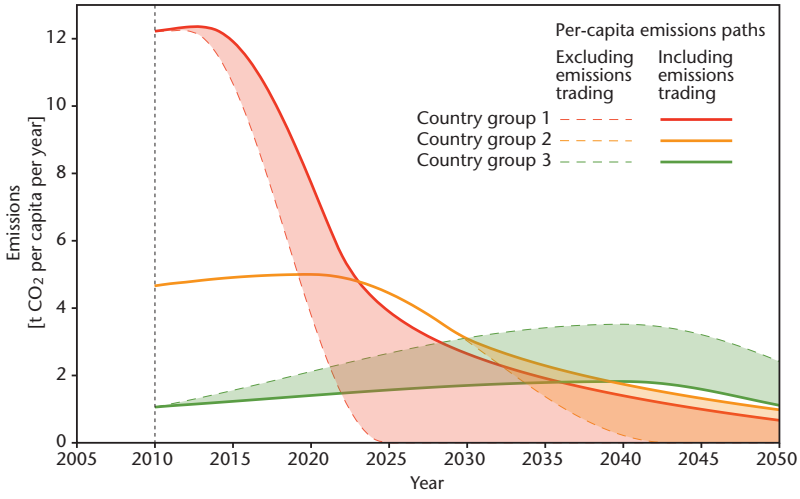

Figure 1: Examples of per-capita CO_2 emissions trajectories without (broken curves) and with (unbroken curves) emissions trading. It is assumed that Group 1 countries increase their budget by purchasing emission allowances for 122 Gt CO_2, at a cost of €10–30 per t CO_2, equivalent to €20–60 per capita per year on average. Total annual costs would amount to €30–90 billion. Group 2 countries purchase emission allowances totalling 41 Gt CO_2. The suppliers of the sum total, i.e. 163 Gt CO_2, are the Group 3 countries.
Source: WBGU, 2009

Institutional requirements: Road maps and interim targets

A national budget allows a high level of national autonomy in emissions reductions. Nonetheless, some international rules and external coordination are essential in order to ensure compliance with the 2°C guard rail.

In order to avoid delays, the budget approach envisages the establishment of mandatory, plausible national decarbonization road maps which should be based on national emissions reduction potentials and include interim targets. However, the budget approach also allows for substantial temporal flexibility.

WBGU recommends that an independent world climate bank be established, which would be responsible for scrutinizing the national decarbonization road maps. In the event of failure to meet the interim targets, the world climate bank – in cooperation with the countries concerned – would set new targets and impose sanctions. The world climate bank would have several other tasks, including the monitoring of the actual emissions of countries or country groups and the granting of loans for mitigation measures. In addition, as a global interim target, it is important to ensure that global CO_2 emissions start to decrease during the period from 2015 to 2020 and reach very low levels towards the year 2050.

Adopting 2010–2050 as the national emission budget period, as proposed by WBGU, would not take account of emissions already produced by the countries. As a compensatory measure, WBGU proposes that the high emission countries make mandatory payments, in line with their historical emissions since 1990, into funds that would provide financial support for mitigation and adaptation measures in the emerging economies and developing countries.

International cooperation towards 2°C: New prospects for partnerships

The adoption of emissions budgets offers the opportunity for international cooperation on establishing low-carbon economies. Emissions trading and Joint Implementation allow industrialized countries to increase their budgets, while developing countries receive support to fund their transition towards sustainable development.

International cooperation via global emissions trading and Joint Implementation is a key prerequisite for the successful application of the budget approach. These two mechanisms allow countries with high emissions to increase their budgets, while low-emission countries receive funding and technology for a low-carbon development.

High-emission countries will have no option but to participate in these two mechanisms, for otherwise, they will be unable to reduce their emissions quickly enough to remain within budget. The USA's budget, for example, would last for just six years at the present rate of emissions, i.e. around 6.1 Gt CO_2 per year. As the USA cannot possibly reduce its emissions to zero within just six years, it will have to purchase substantial quantities of emissions allowances or invest in mitigation measures in other countries. This offers an opportunity to put relations between the industrialized and the developing countries on a new footing.

Every country – including the emerging economies and the developing countries – must make the switch to a low-carbon economy as soon as possible. Industrialized countries with narrow emissions budgets have the financial resources, technology and know-how that are urgently needed in less developed countries with larger budgets. These countries, in turn, could generate substantial revenue from the sale of CO_2 emission allowances, which could be invested in their low-carbon development. These complementary interests can create incentives for bilateral, multilateral and regional cooperation on climate change mitigation and decarbonization between partners of equal standing.

Conclusion: Building blocks for a low-carbon economy

The WBGU budget approach offers a framework to facilitate the transition to a global low-carbon economy. The further development and implementation of the budget approach are now tasks for the international community.

The budget approach creates major transparency worldwide concerning the global and national emissions budgets still available. By capping CO_2 emissions from fossil-fuel sources at both global and national levels, clear incentives are created for the transition to a low-carbon economy and the efficient use of fossil resources. Under the budget approach, every success in reducing emissions is rewarded, regardless of the country in which it is achieved. For the private sector, transparent budgets create stability and planning certainty. Climate protection and carbon efficiency become key factors in increasing competitiveness.

Decarbonization road maps establish the framework for the planning and international coordination of national climate protection programmes. Emissions trading and Joint Implementation allow a flexible approach to be adopted to budget management, and facilitate access to the technologies and financial resources that are required for the transition to a low-carbon economy. Efficiency incentives and emissions trading encourage the development of the necessary innovations.

Administrative, monitoring and sanctioning functions will be the responsibility of the proposed world climate bank. The bank will also channel the additional support required by the developing countries through its management of the compensation funds for historical emissions and the granting of loans.

In terms of the basic institutional architecture, the WBGU budget approach provides the framework for the transition to a low-carbon world economy. It is now up to the world's governments to further develop and implement the approach.

WBGU
The German Advisory Council on Global Change (WBGU) was established by the German federal government as an independent, scientific advisory body in 1992 in the run-up to the Rio Earth Summit. WBGU is an interdisciplinary body which provides in-depth scientific analyses and derives recommendations for policy action and research.

WBGU's 2009 Special Report, entitled 'Solving the climate dilemma: The budget approach', is available for download at www.wbgu.de.

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