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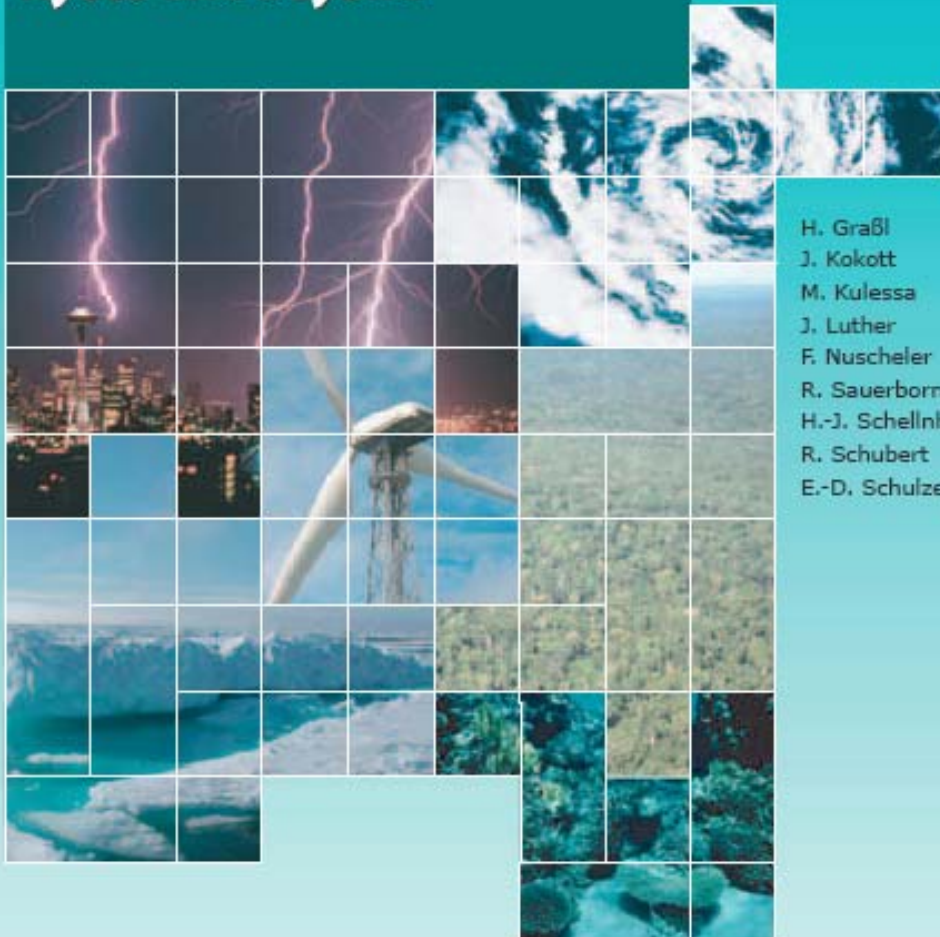
German Advisory Council on Global Change
(WBGU)



Climate Protection Strategies for the 21st Century: Kyoto and beyond

Special Report

Advocating "Contraction and Convergence" [C&C]



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Summary for policymakers

Global climate change is a threat that is already having initial tangible impacts upon humankind and nature today. Due to the inertia of the climate system, this development can no longer be prevented entirely. However, it is still possible, through cooperation among the international community and through national-level efforts, to stabilize the CO₂ concentration in the atmosphere and thus prevent the most severe changes. Shaping the international climate regime will continue to be an urgent policy task over the coming decades. With this special report, the German Advisory Council on Global Change (WBGU) provides recommendations for future negotiations within the context of the United Nations Framework Convention on Climate Change (UNFCCC), particularly relating to the Kyoto Protocol to the Convention. The report centres on three questions:

- What is 'dangerous climate change' within the meaning of Article 2 of the UNFCCC?
- Which socio-economically and technologically viable pathways are available to prevent such dangerous climate change?
- How can all countries be integrated equitably within a system of emissions reduction commitments?

To address these questions, we must lift our gaze far beyond the time horizon of the Kyoto Protocol's second commitment period (after 2012), as the stabilization of greenhouse gas concentrations at a tolerable level can only be achieved by means of a long-term, ambitious reduction of greenhouse gas emissions. The report concentrates on the potentials to reduce the emissions of carbon dioxide, this being the principal anthropogenic greenhouse gas. The analysis focuses, on the one hand, on the economic and technological potentials to reduce energy- and industry-related emissions and, on the other hand, on the relevance of biological sinks of carbon dioxide and the options to preserve them. Finally, based on this analysis, the report contains specific recommendations on ways to shape political and economic instruments in the second commitment period of the Kyoto Protocol.

1

Defining dangerous climate change

The key goal of the UNFCCC is to stabilize greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system. Article 2 of the Convention defines this in specific terms: Ecosystems are to be able to adapt naturally to climate change, food production is not to be threatened and economic development is to be able to proceed in a sustainable manner. The Council has examined each of these three criteria with regard to the threshold from which climate impacts would no longer be tolerable. The present state of science does not yet make it possible to derive these 'guard rails' stringently and quantitatively from the climate impacts that must be prevented. The WBGU was thus limited to providing a qualitative assessment, based on its own expertise and on commissioned external reports and study of the literature.

With regard to ecosystems, the effects of climate changes are already apparent today. The threshold from which damage to the global natural heritage is no longer acceptable cannot be determined precisely. However, the WBGU estimates it to be in the range of 2°C global warming relative to pre-industrial values. For worldwide food security, too, the threshold appears to be in this range, as above this global warming level worldwide climate-related losses in agricultural production must be expected, as well as a steep rise in the number of people threatened by water scarcity. Concerning health impacts, no tolerance threshold can currently be appraised due to poor data availability and a lack of mature methodologies. However, it can be assumed that for some regions the effects of climate change would already lead to intolerable impacts at 2°C mean global warming. Moreover, climate change has the potential to trigger singular, catastrophic changes in the Earth System, such as a shift in worldwide ocean circulation, the melting of major ice sheets (West Antarctic, Greenland) or the sudden release of huge methane

reserves. Quantitative assessments of the threshold values for these effects are beset with great uncertainty.

THE WBGU'S RECOMMENDATION: A MAXIMUM OF 2°C WARMING IS ACCEPTABLE

The WBGU reaffirms its conviction that in order to avert dangerous climatic changes, it is essential to comply with a 'climate guard rail' defined by a maximum warming of 2°C relative to pre-industrial values. As the global mean temperature has already risen by 0.6°C since the onset of industrialization, only a further warming by 1.4°C is tolerable. A global mean long-term warming rate of at most 0.2°C per decade should not be exceeded.

This climate window should be agreed as a global objective within the context of the UNFCCC process. The European Union should seek to adopt a leading role on this matter.

2

Acceptable emissions

The WBGU has developed tolerable emission paths for energy- and industry-related greenhouse gases that remain within the WBGU climate window. However, major uncertainty still attaches to the estimate of climate sensitivity, meaning the rise in temperature that follows a doubling of CO₂ concentration. Similarly, the role of the biosphere in the carbon cycle cannot yet be appraised with sufficient accuracy. It is also hard to assess to what extent other greenhouse gases can also be reduced.

THE WBGU'S RECOMMENDATION: ADOPT AMBITIOUS EMISSIONS REDUCTION TARGETS

In view of the major uncertainties concerning the climate system, the WBGU recommends a hedging strategy in which initially a CO₂ concentration target below 450 ppm is aimed at. This will only be possible if by 2050 global energy-related CO₂ emissions can be reduced by about 45–60% from 1990 levels. Furthermore, it will be essential to achieve substantial reductions of the other greenhouse gases (notably methane and nitrous oxide, but also the fluorinated compounds) and of further indirectly radiatively active substances (e.g. soot). Therefore, industrialized countries must reduce their greenhouse gas emissions by at least 20% by 2020.

3

Stabilization paths: Climate protection and sustainable development

Within the context set by the WBGU's hedging strategy, this report examines emissions profiles as to their technological and economic viability, comparing trajectories across regions and over time by means of scenario computations. For this purpose the Council has developed, in cooperation with the International Institute for Applied Systems Analysis (IIASA, Laxenburg, Austria) CO₂ stabilization scenarios based upon the scenario families used by the Intergovernmental Panel on Climate Change (IPCC). The present report examines emissions reduction paths in scenario worlds characterized by global convergence and rapid technological development (scenarios A1T and B1), and compares these with an emissions reduction path in a 'business-as-usual' world (B2). The A1T scenario presupposes rapid technological development, while the B1 scenario assumes that environmental aspects gain high prominence. Additional conditions are set in both scenarios in order to ensure compliance with sustainability criteria.

Building upon these scenarios and further assumptions on the reduction of other greenhouse gases, the WBGU's climate protection goal is attainable for climate sensitivity values of up to 2.0°C (at a stabilization level of 450 ppm) or, respectively, 2.4–2.9°C (stabilization at 400 ppm, depending upon assumptions regarding other emissions). If it should emerge that climate sensitivity is in fact higher than these values (the IPCC estimates climate sensitivity to be in the range of 1.5–4.5°C), even lower CO₂ concentrations would need to be aimed at in order not to move outside of the WBGU climate window.

The necessary measures to reduce energy- and industry-related CO₂ emissions can be organized in three groups: intensified energy saving, structural changes (in particular the use of renewable forms of energy and low-carbon conventional technologies) and geological CO₂ storage as a bridging technology. In the scenarios characterized by sustainable energy supply systems and dynamic technology development (A1T, B1), the assumption concerning structural change is that by the end of the century energy supply is based essentially upon solar electricity and solar hydrogen.

When assessing the costs of climate change mitigation paths, the costs of CO₂ reduction need to be compared to the damage and adaptation costs arising due to the climate change that will take place if no mitigation activities are undertaken. The comparison also needs to take into account the other forms of

avoided damage (such as damage resulting from air pollution). Very high uncertainties attach to the currently available assessments. The overall damage that will result if no climate policy action is taken is generally underestimated because damage to goods not traded on markets is usually neglected or undervalued. Moreover, assessments regularly fail to consider the damage resulting from singular changes or from the increasing frequency of extreme events.

THE WBGU'S RECOMMENDATION: ALIGN FINANCIAL AND CAPITAL TRANSFERS TO DEVELOPING COUNTRIES WITH SUSTAINABILITY CRITERIA

It is essential for efficiency reasons to link climate policy consistently with global governance and development policy. This means that development cooperation activities must focus more firmly on sustainability, markets should be opened to the greatest degree to products from developing countries, and official development assistance funding should be clearly raised.

The Council refers to its recommendations on global energy policy (WBGU, 2004) for further supporting measures in this field. These include the adoption of a Multilateral Energy Subsidization Agreement (MESA) ensuring the internationally coordinated removal of subsidies, as well as international commitments to substantially raise the proportion of renewable energy sources in energy supply.

THE WBGU'S RECOMMENDATION: INCREASE INVESTMENT IN RESEARCH AND DEVELOPMENT

The WBGU reaffirms its recommendation to achieve a ten-fold increase in investment in researching and developing sustainable technologies by 2020. Focal areas should include, in particular, energy efficiency and renewable energies, but also R&D on the use of sustainable potentials to store carbon dioxide in geological repositories (WBGU, 2004).

4

Reduction of emissions caused by fossil fuels use

Compliance with a target path for stabilizing CO₂ concentrations entails a specific global emissions budget. The WBGU considers that the allocation of the emission rights available within this budget to individual countries should be oriented above all to the egalitarian principle and to targetedness in terms of CO₂ emissions. Abrupt changes in the permissible emissions of individual countries should be avoided.

THE COUNCIL'S RECOMMENDATION: AIM TOWARDS EQUAL PER-CAPITA EMISSION RIGHTS AND LINEAR HARMONIZATION OF EMISSIONS SHARES

The WBGU recommends that emission rights for the greenhouse gases covered by the Kyoto Protocol be allocated according to the 'contraction and convergence' approach, taking 2050 as convergence year.

This means that global emissions would need to be reduced substantially over the long term (contraction). In a further step, it would be agreed that the per-capita emissions of all states must reach equal levels in a continuous process extending until 2050 (convergence). In particular, this means that the per-capita emissions of industrialized countries, which are still comparatively high at present, must be reduced, while some developing countries can initially increase their per-capita emissions. The principle of constancy requires that there be no sudden switch to equal per-capita emissions, because of the resulting stresses on the global economy. The approach further presupposes a functioning global emissions trading scheme, in order to reduce the costs of the transformation process.

THE WBGU'S RECOMMENDATION: PROVIDE OPT-OUT CLAUSE FOR THE POOREST DEVELOPING COUNTRIES AS A COMPROMISE

In the event that various developing countries are initially unable or unwilling to accept absolute emissions caps from the second commitment period onwards, an opt-out clause could be considered for countries with low levels of economic capacity and relatively low per-capita emissions. Such an approach requires criteria for mandatory participation in the contraction and convergence process. In such a scheme, the opt-out clause could not be made use of once a threshold value has been exceeded, which could be oriented, for example, to per-capita emissions and per-capita income. The reduction burden of developing countries making use of the opt-out clause would be distributed among the participating countries in order to safeguard attainment of the stabilization target and thus compliance with the climate window.

5

Conservation of carbon stocks of terrestrial ecosystems

The terrestrial biosphere plays a major role in the carbon cycle. Near-natural forests, wetlands and grasslands are important carbon reservoirs as long as they are not cleared, drained or ploughed. Thus deforestation, above all in the tropics, is currently the cause of 10–30% of present anthropogenic carbon

dioxide emissions. Nonetheless, the biosphere is currently a net carbon dioxide sink. The present way in which biological sources and sinks are accounted under the Kyoto Protocol is not suitable, however, to provide incentives to conserve these natural stocks (WBGU, 1998).

THE WBGU'S RECOMMENDATION: ENGAGE IN FULL CARBON ACCOUNTING

From the principle of 'moderate anthropocentrism' and the precautionary principle, the Council derives the recommendation to give greater consideration in climate policy to terrestrial biological carbon stocks and sinks. All carbon fluxes and stocks should be accounted fully ('full carbon accounting'). However, at the present time the Council advises against seeking to regulate the conservation of biological terrestrial carbon stocks within the same system, with the same allocation procedure and with the same instruments as reduction commitments for fossil carbon stocks. Such an approach could cause an unacceptable delay of the entire climate protection process.

THE WBGU'S RECOMMENDATION: TAKE THE ROLE OF THE BIOSPHERE INTO ACCOUNT THROUGH A SPECIAL AGREEMENT

The WBGU recommends agreeing a special inter-governmental commitment to preserve the carbon stocks of terrestrial ecosystems. Such an agreement could be implemented as a 'protocol for the conservation of carbon stocks' to the UNFCCC. This approach should not distinguish, as the Kyoto Protocol has done until now, between direct and indirect human impacts (such as CO₂ fertilization or climate change) or natural factors (such as natural climate variability). Rather, it should involve measurement and accounting of the full carbon balance of the terrestrial biosphere.

The WBGU recommends for the conservation of natural ecosystems, which are major carbon reservoirs (e.g. primary forests, wetlands, grasslands), an international system of tradable non-utilization commitments similar to that already presented by the Council for the global biodiversity policy (WBGU, 2002).

6 Reviewing and enhancing instruments

In recent years, the international community has devised a range of instruments for global climate protection. These have partly been tested in pilot phases, and in some cases the practical deployment of these instruments has begun. Building upon past experience, the WBGU recommends further developing

these instruments, in order to be able to attain the climate protection goal more efficiently and effectively.

THE WBGU'S RECOMMENDATION: HARNESS THE OPPORTUNITIES OF EMISSIONS TRADING AND MINIMIZE UNCERTAINTIES

In order to preclude uncertainties relating to global emissions trading, the Council recommends establishing a Climate Central Bank, hosted by the UNFCCC Secretariat. The primary task of the bank would be to smooth price surges on the certificates market. An automatic mechanism would need to ensure that only extreme price fluctuations, but not longer-term price trends, are prevented. Furthermore, the introduction of a variable bottom price limit for certificates merits consideration.

In order to generate permanent innovation pressure to develop new mitigation technologies, the scope for purchasing emission rights to meet national reduction commitments should be limited. Intensified and continuous innovation activity is essential in order to attain the climate change mitigation goal.

The WBGU further considers it urgent to integrate the emissions of international aviation and shipping into global emissions trading. Alternatively, charges could be levied on the use of airspace or oceans at a global or at least European level (WBGU, 2002).

THE WBGU'S RECOMMENDATION: NO EMISSIONS TRADING WITHOUT RELIABLE INVENTORIES

The environmental targetedness of the climate protection regime should not be jeopardized through trade with possibly incorrectly assessed emission rights. In order to ensure the integrity of the regime, the WBGU recommends making participation in emissions trading conditional upon the compilation of high-quality inventories. Developing countries should therefore receive greater support than in the past in compiling inventories with a high information content.

THE WBGU'S RECOMMENDATION: USE THE CDM AS A TRANSITIONAL INSTRUMENT

Countries that do not possess sufficiently high-quality inventories or do not participate in 'contraction and convergence' can be integrated into emissions reduction efforts through the Clean Development Mechanism (CDM). To this end, special incentives should be created for CDM projects in the least developed countries, and the investment additionality approach should be made mandatory for large-scale projects. In view of the dubious effects of past projects in the field of biological sinks, and building upon the Council's recommendation to establish a special protocol on the conservation of the carbon

stocks of terrestrial ecosystems, sink projects should be excluded from the CDM in the future. Nuclear projects should not be supported by the CDM as a matter of principle. With regard to Joint Implementation (JI), the WBGU recommends reviewing to what extent JI should be subsumed fully within emissions trading, or whether it can be merged with the CDM. The CDM should not be the sole instrument to be burdened by a tax for the financing of the Adaptation Fund. Instead, the WBGU argues that charges should be levied on all transactions within the context of the flexible mechanisms, but only to the amount of the administrative costs incurred by handling emissions trading or the CDM and JI.

**THE COUNCIL'S RECOMMENDATION: FINANCE
ADAPTATION AND COMPENSATION FUNDS
ACCORDING TO GLOBAL WARMING
RESPONSIBILITIES**

Neither is the financing of the Adaptation Fund through a charge raised on CDM projects purposeful, nor will replenishment of the LDC Fund and the Special Climate Change Fund by means of voluntary ad-hoc contributions suffice. The resources available to these climate protection funds created under the GEF umbrella need to be expanded substantially and fund design needs to be improved in order that the deployment of resources contributes in a targeted manner to sustainable development in the recipient states. Furthermore, an additional Compensation Fund should be set up for the second commitment period, from which payments providing compensation for climate damage would be financed.

The contributions of individual states – specially their contribution to compensation and adaptation funds – should be oriented to their respective contributions to global warming (cumulative emissions). However, only emissions from 1990 onwards should be taken into account, as the publication of the IPCC first assessment report was the point at which the international community clearly recognized the problem and the severity of its consequences.

**THE WBGU'S RECOMMENDATION: DISCUSS
SANCTIONS AGAINST FREE RIDERS**

The Council does not consider it an urgent priority at the present time to reform the mechanisms envisaged for imposing sanctions on countries that fail to meet their commitments. However, there should be debate early on about the incentives and sanctions to be applied against countries that refuse to join the climate protection regime on principle. The WBGU recommends that the international community retain from the outset the option of imposing hard political and economic sanctions, particularly on large-scale emitters.

7

Key strategic decisions lie ahead

In the coming years, the international community will need to take key strategic decisions in international climate policy, if dangerous climate change is to be prevented. With every further delay of consistent climate protection policy, the scope for action narrows. The UNFCCC provides an indispensable framework for upcoming negotiations.