Adapt, Mitigate, or Die? The Fallacy of a False Trade-off

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When looking at the current pace and progress of international climate negotiations, option 3 ('die') seems humankind's most likely fate. But hopefully that only is a false perception. False is also the trade-off implied by the heading above. There is no doubt that we have to invest in both adaptation and mitigation. Nevertheless, the question is legitimate as it deals with the emphasis of our efforts. Ultimately, managing the problem of climate change will require the weighing of different kinds of risks arising from climate change, adaptation and mitigation.

The climate challenge

Climate change poses a permanent and serious threat to human development and prosperity. With rising temperatures, climate change is likely to become unmanageable and catastrophic, pushing Earth's complex ecology past known and as yet unknown tipping points, which may fundamentally and irreversibly alter the way our planet functions. Summer minima of the Arctic Sea ice have been decreasing at alarming rates in recent years. The Greenland ice sheet, which stores enough ice to raise global sea levels by seven meters, has become a highly sensitive tipping point. Other potential tipping points include the West Antarctic ice sheet, boreal forests, the Amazon rainforest and the Indian summer monsoon. Key impacts of climate change include flooding of coastal areas and river deltas, more intense droughts and desertification, increased occurrence of extreme weather events, and water scarcity due to melting glaciers and changing precipitation patterns. The impacts of climate change can threaten basic human needs, in particular food and safe shelter. Climatic risks can destroy the livelihoods of many, triggering large-scale migrations and inducing or exacerbating national and international conflicts. Climate change is a major obstacle to poverty reduction objectives and achievement of the Millennium Development Goals (Parry et al. 2007).

In light of these dangers, the European Union has formulated the objective of limiting global warming to 2°C above pre-industrial levels. While no level of climate change is inherently 'safe', estimates of the temperature thresholds suggest that the 2°C target will be sufficient to avoid triggering intermediately sensitive tipping elements such as the West Antarctic ice sheet, El Niño/Southern oscillation, Indian summer monsoon circulation, Amazon rainforest and boreal forests (Lenton et al. 2008). The 2°C target, however, bears the risk of being insufficient for avoiding a melting of the Greenland ice sheet. For the highly sensitive Arctic sea ice, the tipping point may have even been already passed. In fact, new research indicates that the risks from any given global temperature increase have been underestimated (Smith et al. 2009). Scientists also misjudged the difficulty of limiting temperature increases because the climate system already contains more warming potential than previously assumed. Greenhouse gas (GHG) emissions are increasing at a faster pace (Raupach et al. 2007), the oceans' capacity to sequester carbon is decreasing (Canadell et al. 2007) and the temporary cooling effects of aerosols in the atmosphere are likely to diminish as more stringent clean air policies are applied (Ramanathan and Feng 2008). Thus the likelihood of global warming in the 21st century even beyond the threshold of a 2.4°C increase is dangerously high (Schellnhuber 2008).

2 degrees – 2 tasks

No matter at which temperature level governments finally manage to 'land' the planet, human settlements will need to adapt to residual climate change.

Keeping the 2°C threshold, an extremely ambitious target, implies global warming three times as much as has been observed in the past 200 years. Managing the unavoidable and avoiding the unmanageable are two sides of the same coin. Yet, adaptation and mitigation are sometimes seen as alternative policy options, suggesting that it suffices to implement either of them. This view, however, neglects some fundamental differences between mitigation and adaptation in terms of their spatial and temporal dimension. Mitigation of climate change can reduce the impacts of climate change on all systems across the globe and it is certain to be effective. Many mitigation activities have immediate side benefits such as reducing air pollution or protecting biodiversity. But the climatic benefits of mitigation take several decades to fully manifest themselves because of the inertia of the global climate system.

Adaptation, in contrast, is the only option to reduce climate impacts in the near future. It can be implemented locally or regionally, and it can generate valuable synergies with the reduction of current climate-sensitive risks. Unlike mitigation, the benefits of adaptation accrue locally in the targeted regions and sectors. Its scope is limited (e.g. it is hard to imagine how to protect the Maldives against a 5m sea-level rise) and its effectiveness uncertain (e.g. dykes and levees can break). Last but not least, it puts the burden on those most vulnerable to climate change, which stands in stark contrast to the polluter-pays principle. Ultimately, managing the problem of climate change will require the weighing of different kinds of costs and benefits arising from adaptation and mitigation.

Managing the unavoidable

Limiting global warming to 2°C is likely to defend critical tipping points in the earth system but significant impacts on human life will still occur. These include, among others, more and stronger extreme weather events, heat waves, water stress, failing harvests and a widespread loss of biodiversity.

Most adaptation actions yield short- to mid-term benefits for those implementing them and, as a result, they often occur autonomously. Insurance companies adjust their premiums in response to changing weather risks, farmers change their practices in response to failing harvests, water managers invest in additional water storage capacity due to decreasing precipitation, and health managers update vaccination recommendations in line with changing disease patterns. Nevertheless, it would be wrong to conclude that adaptation can largely be left to market-driven actions of self-interested agents. There are three main reasons why governments and international organizations have an important role to play here.

First, adaptation by self-interested actors pays no attention to equity issues such as differential responsibility for climate change and capacity to adapt. If adaptation was left to the markets, wealthy communities would be able to prepare themselves against the detrimental impacts of climate change. Poor societies would have to bear the unmitigated impacts of climate change that was largely caused by others. This outcome, denoted as 'climate apartheid' by Nobel Peace Laureate Bishop Desmond Tutu, is unacceptable from a moral point of view.

Second, effective adaptation at global, regional and local levels often depends on the accessible information about current and future climate change and its likely impacts; on guidelines for the inclusion of climate change risks into current decision procedures; and on the availability of technologies that are robust against a wide range of climatic conditions. Much of this knowledge is most effectively supplied by governments or international organizations. One example for a provider of this kind of information is the Intergovernmental Panel on Climate Change (IPCC), whose reports and main datasets are freely available.

Third, governments are engaged in many climate-sensitive activities. They build and operate transport and water-related infrastructure, they run weather services and agricultural outreach agencies, they establish poverty reduction strategies, building norms and water-allocation rules, they regulate food processing and insurance industries and run national parks, public health services and disaster preparedness agencies, and they provide international development assistance. These climate-sensitive activities are generally governed by direct regulation rather than by market forces. In the end, decision-making bodies and executive agencies need to explicitly assess and consider the significance of climate change in all their activities.

Avoiding the unmanageable

Is it possible to stabilize the global climate system at reasonable economic cost? If the past 200 years of human development may serve as an indicator, climate change cannot be halted without sacrificing world economic growth. In the past, the accumulation of physical capital stocks and the accumulation of carbon emissions in the atmosphere have gone hand in hand. The combustion of fossil fuels has been at the heart of wealth creation ever since the industrial revolution changed the face of our planet. This is why many economies in transition feel that they are not only challenged by dangerous climate change but also by 'dangerous emission reductions'. The mitigation challenge lies in developing an economy that decouples growth in capital stocks from that in emissions. Overcoming the tragic trade-off between economic growth and climate protection is the ultimate goal. This is especially important for developing countries who cannot afford to forego economic growth for the sake of climate protection. A precondition for a new, low-carbon growth path for the world economy is massive investments in new energy technologies.

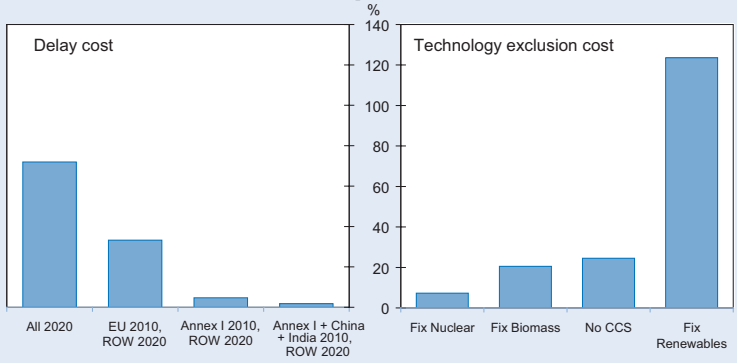
In recent years, modeling exercises (with integrated economy-energy-climate models that feature an improved formulation of endogenous technological change) have shown that the cost of climate stabilization can be indeed modest. In a comparison of several leading integrated assessment models, the Report on Energy and Climate Policy in Europe (RECIPE)[1] found that the 'gross' cost of stabilizing atmospheric concentrations of CO_2 at 450ppm (parts per million) do not exceed 1.4 percent of global GDP upto 2100.[2] REMIND, an integrated economy-energy-climate model developed at the Potsdam Institute for Climate Impact Research, shows costs of less than 0.6 percent of global GDP for the same time horizon. These relatively moderate mitigation costs are based on the assumption that the world community immediately starts a comprehensive transition towards a low-carbon economy. Figure 1 presents how costs escalate if action is not immediate (i.e. certain countries delay participation) or comprehensive (i.e. certain technological options are excluded). Delaying global action until 2020 boosts mitigation cost by 72 percent compared to the reference scenario. If Annex I countries along with China and India start mitigation in 2010 and the rest of the world (ROW) follows a business-as-usual path until 2020, costs increase by only 2 percent. Similarly, costs will rise by 124 percent if the expansion of renewable energy sources is not pushed beyond business-as-usual expansion rates. Abstaining from a 'renaissance' in nuclear power, in contrast, will not substantially increase global mitigation costs (+ 7 percent).

Another energy-economy model comparison exercise suggests that the costs of an ambitious low-stabilization scenario of 400ppm CO_2 equivalent lie below 2.5 percent of GDP upto 2100 (Knopf et al. 2008). This low-stabilization scenario is believed to have a relatively high chance of safeguarding the 2°C target. Overall, this suggests that costs of limiting the rise of global mean temperature to 2°C can be relatively moderate if effective policies and technologies are put into place on a global scale. Given that major impacts of climate change regarding tipping elements and ecosystem changes may be avoided when limiting global warming to 2°C, this appears to be a reasonable target for an international climate policy framework.

Figure 1

ADDITIONAL COST DUE TO MITIGATION DELAY OR TECHNOLOGY EXCLUSION[a)]

Cost increase as compared to reference scenario



a) As compared to a 450 CO_2 ppm reference scenario (REMIND results). Costs are cumulated upto 2100 and discounted by 3%.

Source: Potsdam Institute for Climate Impact Research.

[1] RECIPE is an in-depth international comparison of energy-economy models carried out at the Potsdam Institute for Climate Impact Research (Germany) together with Centro Euro-Mediterraneo per i Cambiamenti Climatici (Italy) and Centre International pour l'Environnement et le Développement (France). The project assesses global mitigation options and costs on regional and sectoral levels. First results will be made available in Autumn 2009.

[2] The gross costs of climate stabilization are calculated as the difference between the path of GDP without climate policy (business-as-usual) and the GDP path with climate policy. This ignores the benefits of climate protection in form of damages avoided; hence 'gross' cost. Costs are discounted with 3 percent per year.

A Global Contract[3]

Achieving the 2°C target will require an institutional framework that can deliver on the criteria of environmental effectiveness (reducing emissions in accordance with the 2°C limit), economic efficiency (doing so at least costs), and equity (taking into account different responsibilities and capabilities in mitigating and responding to climate change). Along these lines, we propose a Global Contract on Climate Change that focuses on four major issues: establishing a global carbon market, fostering the development and sharing of low carbon technologies, reducing emissions from deforestation and land degradation (REDD), and setting up a framework for addressing adaptation. Such a Global Contract represents a guiding vision that can be implemented via a set of policy roadmaps that eventually merge into an integrated climate policy architecture.

First, a *global carbon market* based on tradable emission permits internalizes the social costs of emitting greenhouse gases. As the debate on the Green Paradox has shown, even an optimal carbon tax cannot ensure a socially optimal extraction pathway for fossil fuels (Sinn 2008; Edenhofer and Kalkuhl 2009). A comprehensive cap-and-trade system is necessary to guide private investment into a socially desirable direction. At the same time, the auctioning of emission permits provides governments with funds for public investments in infrastructure, education, research and development.

For maximum efficiency, the emerging price should stretch across all sectors and countries. A global trading system may be implemented via UNFCCC negotiations or bottom-up by the linking of regional schemes in the context of the International Carbon Action Partnership. Ideally, these approaches will complement each other. But bottom-up linking can be a fallback option if a more comprehensive approach turns out to be politically infeasible during the December 2009 Copenhagen negotiations. The precise institutional requirements for a global carbon market are challenging and deserve further exploration (see Flachsland et al. 2009).

[3] The blue print for a Global Contract has been developed at Potsdam Institute for Climate Impact Research (Edenhofer et al. 2008) and was launched during a conference hosted by the European Parliament in November 2008. More information is available under www.global-contract.eu.

Second, *low-carbon technologies* help to de-carbonize our energy systems. However, market failures related to the specific circumstances of technological innovation exist which prevent the large-scale uptake of sustainable energy sources. For this reason, it is important to understand that even a well-designed carbon market is not sufficient on its own to encourage the fundamental energy system transformation we aim for. Although many renewable energy technologies or carbon capture and storage (CCS), given stringent carbon constraints, are likely to be profitable in the mid-to long-term, most of them fail to attract funding because their realization requires large investments in infrastructure. Additional policies such as enhanced funding for developing low-carbon technologies, pilot projects for complex technologies such as CCS and market introduction programs for renewable energy sources need to be put in place.

The investment requirements are significant and benefit all countries. Therefore, industrialized countries should shoulder the research and development effort together by agreeing on a burden sharing for the introduction of low-carbon technologies. In addition, a sustainable energy provision for developing countries is of key importance for a long-term and global solution of the climate problem and comes with numerous ancillary local and regional benefits. Mainstreaming low-carbon development into development policy, promoting sharing of technologies and setting up a low-carbon fund for least developed countries and regions could help poor countries to leapfrog directly into a modern low-carbon economy.

Third, *deforestation and forest degradation* accounts for roughly 20 percent of global anthropogenic greenhouse gas emissions. According to most estimates, these emissions can be reduced at low costs. Also, REDD comes with significant ancillary economic benefits due to the preservation of ecosystems and their services. Important challenges in establishing an environmentally effective REDD regime lie in ensuring permanence of forest conservation and limiting leakage. Funding for forest preservation would stimulate the economies of developing countries and ensure that local populations do not respond to the downturn by accelerating the present overexploitation of their natural resources.

Fourth, even if the most ambitious mitigation target can be realized, *adaptation* to unavoidable climate change will be required. The funding necessary to finance adaptation is significant, especially in the developing world. As the adaptation fund set up under the Kyoto Protocol is inadequate in meeting these needs, a broadened funding mechanism needs to be installed in order to provide a sufficient and reliable financial basis for adaptation activities in developing countries.

As a conclusion, the Global Contract should define the rights and responsibilities of all nations and allocate the burden of mitigation and adaptation in an effective, efficient and equitable manner. The contract must be effective in addressing climate change and bringing down greenhouse gas emissions. It must be efficient so that scarce resources are used to the greatest benefit. And it must be equitable by acknowledging the common but differentiated responsibility among rich and poor countries and by advancing economic prosperity and adaptive capacity in the underdeveloped world. After all, we do not have the luxury to choose between adaptation and mitigation; we have to do both.

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