Let the Market Decide

by Hans-Holger Rogner

Markets should be allowed to decide whether nuclear power is as economical as it is green.

The ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC) is to achieve the stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a timeframe that would allow ecosystems to adapt naturally to climate change. This would ensure that food production is not threatened and that economic development proceeds in a sustainable manner.

The scientific findings of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) published in 2007 can be summarized as follows:

✦ Global atmospheric GHG concentrations have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values. Carbon dioxide (CO_2) — a result of the production and use of fossil fuels such as coal, gas and oil and land-use change — is the most important anthropogenic GHG. Its atmospheric concentration has increased from a pre-industrial value of about 280 parts per million (ppm) to 381 ppm today;

✦ Global temperatures are rising, 0.56°C to 0.92°C since 1905. Higher global temperatures — on balance — adversely affect ecosystems, human health, food supply and access to fresh water;

✦ With current climate change mitigation policies and related sustainable development practices, global GHG emissions will continue to grow over the next few decades (25-90% between 2000 and 2030); and

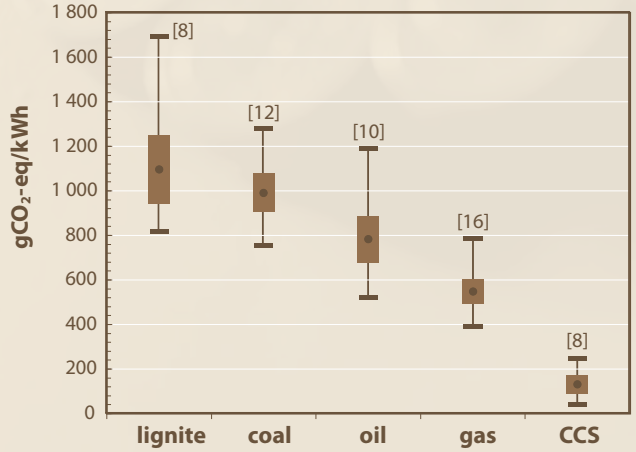
✦ Measures and technologies for an effective mitigation of climate change already exist and the economic potential for GHG emission reduction is large enough to offset projected emission growth or even to lower GHG emissions below current levels over the coming decades without undue constraints to economic development prospects.

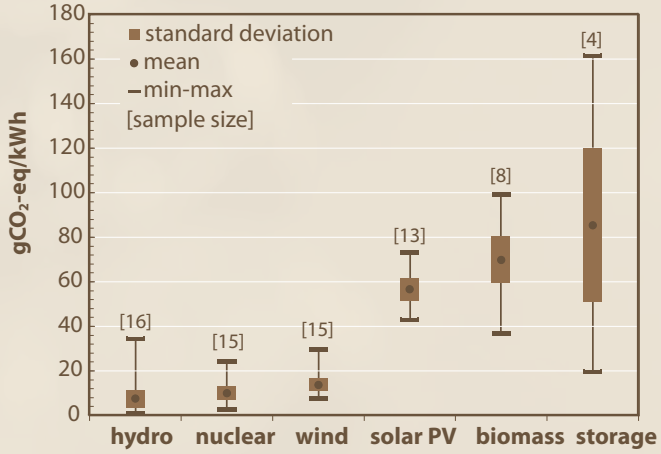
The decision taken by the European Union, Canada and Japan to define 'dangerous anthropogenic interference with the climate system' as a mean global temperature increase (from pre-industrial times) of 2°C implies capping atmospheric CO_2 concentrations at about 450 ppm. This requires a drastic reversal of current emission trends, i.e., a decrease of annual CO_2 releases to the atmosphere by 45-50% from current levels by mid-21st century.

The agreement on climate change reached at the 2007 G8 Meeting in Heiligendam reflects the 2°C temperature limit and sets a goal of at least halving global emissions by 2050.

As climate change is a global problem, it clearly needs to be addressed through a comprehensive international policy framework, specifically for post 2012 GHG emission

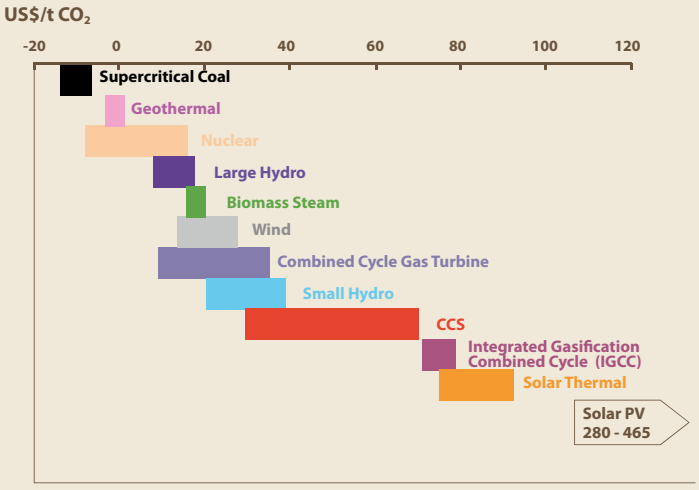
Life Cycle Emissions of Greenhouse Gases from Different Electricity Generating Options





Source: Weisser, 2007

Range of Carbon Dioxide Reduction Costs for Electricity Technologies



The figure illustrates the range of incremental CO_2 reduction costs for grid-based electricity generation technologies. The graph is for illustrative purpopses only, actual costs are site-specific.

Source: World Bank 2006

reductions. Such a framework must address not only climate change but also energy security, economic growth and sustainable development, as well as comply with the UNFCCC principle of 'common but differentiated responsibilities and respective capabilities'. This principle assigns a leadership role to the developed economies in future efforts to reduce global GHG emissions. However, actions by developed economies alone will not be sufficient to stabilize GHG concentrations. Eventually, all countries will need to undertake effective climate commitments tailored to their particular situations, essentially by controlling the national carbon intensity of their economic development.

Effective and efficient mitigation of climate change in developing countries depends on the rate of global diffusion and transfer of climate friendly technologies. One way of fostering technology transfer is the Clean Development Mechanism (CDM) under the Kyoto Protocol. The CDM allows countries obliged to emission reductions under the Protocol to obtain emission credits achieved by investments in GHG mitigation outside their national borders, e.g. in developing countries.

Reducing GHG emissions

It is generally accepted that the UNFCCC is the appropriate platform for negotiating future global action on climate change, i.e., a comprehensive post-2012 agreement (post-Kyoto) that would include all major GHG emitting countries.

Today, numerous technology options for GHG emission reductions already exist. These range from energy efficiency improvements, to switching from coal to natural gas and to more use of nuclear power and renewables. Other options expected to be commercially available in the near term include CO_2 capture and storage (CCS), e.g., coal combustion with the removal of CO_2 from flue gases and storage of the captured CO_2 in suitable geological repositories.

Each one of these mitigation options has different costs and benefits, reflecting the difference in their climate effectiveness (emissions per unit of energy), capital and operating costs (see figure, which shows the life-cycle GHG emissions for one kilowatt-hour (kWh) of electricity from different generating options). The complete nuclear power chain — from mining the uranium and manufacturing the fuel to constructing and operating the reactor and disposing of the waste — emits only 4-22 grams of CO_2-eq per kWh. This is about the same negligible emission rate as wind and hydropower, less than solar photovoltaic and bioenergy, and many times less than coal, oil and natural gas.

Having low life-cycle emissions is a necessary but not sufficient prerequisite for climate change mitigation: the technology must also meet cost and other performance criteria. Together, costs, performance and climate effectiveness determine the true mitigation potential of a particular technology.

In 2004, some 17400 TWh of global electricity generation contributed about 11 $GtCO_2$ to total GHG emissions (see figure). The 16% share of nuclear power in electricity generation avoided the emission of approximately 2.0-2.2 $GtCO_2$-eq, depending on what would have replaced nuclear power in today's electricity mix. Regardless, nuclear power today avoids more GHG emissions than what a fully implemented Kyoto Protocol would deliver. In the context of climate change, and thus in the context of the UNFCCC, nuclear energy is exclusively positive. It has no adverse impacts on the climate and the more it is used the more GHG emissions are avoided.

A more level playing field

But what about the economics of nuclear power? Some skeptics say that while it may be a low GHG-emitting technology, its high capital costs make it too costly a mitigation option. This proposition can only be answered by comparing the climate change characteristics and costs of alternative mitigation options, through the metric life-cycle cost per tonne of CO_2 emission avoided. It is possible to illustrate the typical ranges of CO_2 reduction costs for different grid-based electricity generating technologies (see figure).

Nuclear power's mitigation costs are among the cheapest. At the low end, costs are even negative, indicating a growing market potential even without climate change benefits. Recent fossil fuel price volatility in the face of burgeoning demand, concerns about energy supply security and the recognition that renewables cannot be expected to provide cost-

effective and reliable baseload electricity, have rekindled an interest in nuclear power in many countries. Climate change is seen as an added benefit at no costs. At the high end of its mitigation costs, nuclear power competes with low-end cost ranges of most alternatives.

Yet nuclear power now is excluded from joint implementation projects under the Kyoto Protocol and from the CDM. Proposals continue to be made to further exclude nuclear power from the menu of climate change mitigation options. This is happening not because nuclear power is bad for the climate, since nuclear power is undeniably benign to it. Indeed, countries with high shares of nuclear electricity have the lowest GHG emissions per capita. In reality, those who oppose nuclear power do so for other reasons. Naturally, that is their prerogative, but their arguments against the nuclear option must be examined carefully and independently, and the question of whether nuclear power, or any technology, should be excluded from international climate change agreements must be answered objectively.

The stated non-climate-related concerns about nuclear power are that it is too expensive, too dangerous, or too conducive to weapons production and terrorist attacks. Besides, it is often mentioned that a solution to the accumulation of high-level wastes is still to come. However, these issues should not be addressed when international agreements on climate change are being negotiated.

If reactor safety is the worry, the focus should be on those few old-style reactors that fall short of current standards, rather than summarily precluding new, state-of-the-art reactors from future carbon markets.

If proliferation is the concern, legislators should consider the near-universal adherence to the Non-Proliferation Treaty (NPT), and devote efforts to advancing the additional protocol, to further strengthen safeguards agreements under this Treaty. Efforts to better address proliferation and waste management concerns could also include restrictions on the use of weapon-usable material in civilian nuclear programmes, limiting the processing of nuclear fuel to international centres under appropriate rules of transparency, control and assurance of supply. Such an approach would go a long way towards strengthening the non-proliferation regime.

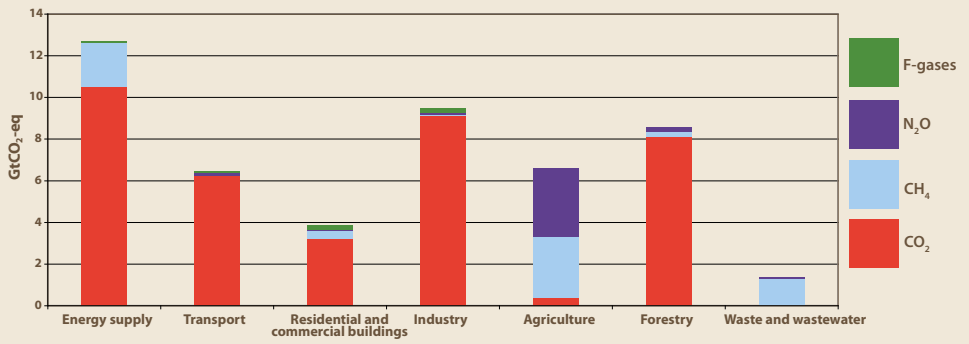
In addition, as national waste strategies continue to evolve, it may also be of benefit to consider multinational approaches to the management and disposal of spent fuel and other radioactive waste. Not all countries have the appropriate conditions for geologic disposal, while for many countries with small nuclear power programmes, the financial and human resources required for the research, construction and operation of a geologic disposal facility are intimidating.

Considerable economic, safety, security and non-proliferation advantages may accrue from the creation of international waste repositories.

All these efforts to strengthen non-proliferation safeguards and make further progress on waste disposal are valuable and important whatever the politics of climate change. And they are not advanced by efforts to prohibit nuclear power from expanding its contribution to reducing climate change.

The argument that climate change agreements should legislate against nuclear energy because it is too expensive makes no sense. A more logical approach to concerns about high nuclear capital costs would be to liberalize energy markets and let market players decide. If nuclear power proves to be more expensive than alternative sources, quite simply it will not be built in a competitive market. Cost-effectiveness should be promoted by making it easier for markets to operate freely rather than centrally plan their development for the next 100 years.

Emissions of Greenhouse Gases by Sector in 2004



Source: Adapted from Olivier et al., 2005, 2006.

Exclusion from climate change agreements of any technology with clear climate benefits can only limit options, flexibility and cost-effectiveness. The best chance for sustainable development, i.e., for meeting the needs of the present without compromising the ability of future generations to meet their needs, lies in allowing those future generations to make their own decisions about energy options, and allowing all options to compete on a level playing field on the basis of cost-effectiveness, GHG reductions, environmental considerations, security and safety.

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