Extended abstract

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Fossil fuels:
Technical and economic issues on the horizon 2030-2050
"Physical realities and policy challenges "

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Carbon dioxide concentrations in the atmosphere have increased substantially since the industrial revolution, mainly due to the combustion of fossil fuels. Increasing concentrations of greenhouse gases, carbon dioxide as the most important among them, can be associated with increasing global average temperatures, like the small increases observed in the 20th century. The growing number of extreme weather event in recent years can also be associated with climate change. More severe climate change impacts have been predicted for the 21st century if the rise in greenhouse gas concentrations cannot be stopped. Especially the developing world is at great risk. Stabilizing CO_2 concentrations to prevent the most serious impacts (e.g. at a level between 450 and 650 ppmv) will require global emissions to peak soon and start to decline thereafter.

How can the future energy needs be satisfied while reducing carbon emissions substantially? Reducing CO_2 emission from energy is key to bringing down global greenhouse gas emissions. The world economy follows a history of gradually reducing carbon intensity since the start of industrialization. This is due to fuel switching and increasing energy efficiency. Different trends in different parts of the world reflect different local situations, but also show some of the remaining potential improvement with present technologies.

Carbon-intensities have to decline further and at an increasing rate if CO_2 concentrations are to be stabilized at levels that may be acceptable. Scenarios developed by different institutions demonstrate that the necessary changes are feasible through further improvements in energy efficiency, continued switch to natural gas (including in transport) and a rapidly increasing share of renewables. The scenarios suggest that energy systems would have to undergo substantial changes in the period between 2030 and 2050. They differ in their projections for the oil sector and, in particular, on when, if ever, gas would overtake oil as the most important fossil fuel.

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Clear policy signals are needed at the international level to set the necessary changes in motion. The ultimate objective ("[…] stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system", Art. 2) of the United Nations Framework Convention on Climate Change sets the overall direction. The Kyoto Protocol defines the first step. Parties now need to agree on the pace of further steps to limit CO_2 emissions. Full involvement of energy ministries in reaching agreement and evaluating the consequences of targets is important. There is a need for clear policy signals soon to influence the upcoming investment decisions, both on investment into new power generation capacity and on investment into research and development efforts for the new technologies that are to take over in the second half of the 21st century.

National legislative measures have to be taken to address the consequences of constraining carbon. A framework is needed to help develop low-carbon energy systems in a way that is appropriate for national circumstances. This includes getting the prices right and attaching a price to carbon (through taxation and/or trading schemes). Subsidies for fossil fuels, largest for coal and smallest for natural gas will hardly be tenable in such a framework. The Kyoto Protocol shows the way forward by its flexible mechanisms (the clean development mechanism, joint implementation and emission trading). Such emission trading initiatives are widely gaining support. Large oil companies have taken a lead by setting up company-internal trading schemes.

There may be a need for accompanying measures including the possible use of carbon sequestration for the interim period, when the share of fossil fuel is still large. However, only if storage technologies become environmentally acceptable and economically feasible will carbon sequestration help to prolong the future of fossil fuels. If successful by 2020-2030, the development of the hydrogen economy will help tackle the transport sector and facilitate a larger share of intermittent renewables.

As the risks for developing countries to suffer the impacts of climate change are most serious, these countries also have many opportunities to take measures to increase energy efficiency and they have the potential to lead the way in renewable energy use. The large co-benefits associated with such steps (reduced air pollution, greater energy security and reduced dependence on imports) should make such policies worthwhile, independent of the objective of reducing carbon emissions. The challenge will be to finance the necessary investments.

Climate change is a long-term and a global problem, which requires forward-looking decision-making at the international level. Energy systems have been evolving and the underlying markets have historically shown the ability to adapt to new conditions. For some of the changes, however, long lead times are necessary and early signals are required to change course. Many actors in the oil sector have demonstrated that they are ready to face the challenge of a carbon-constrained future. Maybe it is useful to remind those, who are less inclined to adapt, of what Dmitry Mendeleev (inventor of the periodic table of elements) said about burning oil for heating purposes back in the 1880s: "One can heat by burning banknotes, too."

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